Amendment to Change of Zone Ordinance 02 131

Applicant: Kona Three, LLC

Requests:

<u>Condition I</u> — Time extension to secure Final Plan Approval and Complete Construction of First Increment of RM-zoned area

<u>Condition N</u>—Clarify improvements to subdivision roads

Tax Map Keys: (3) 7-6-021:016 and 017
Holualoa, North Kona District
Hawai'i Island

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May 2022

REQUESTS FOR TIME EXTENSIONS TO SECURE FINAL PLAN APPROVAL AND COMPLETION OF MULTIPLE FAMILY RESIDENTIAL COMPONENT OF PROJECT AND TO CLARIFY REQUIRED DEDICABLE ROADWAYS FOR DEVELOPMENT FORMERLY KNOWN AS KONA VISTAS AS SUPPORTED BY CHANGE OF ZONE ORDINANCE NO. 02 131 (REZ 470)
APPLICANT: KONA THREE, LLC (formerly GAMREX, Inc.)
PROPOSED PROJECT: ROYAL VISTAS
HŌLUALOA 1st and 2nd, NORTH KONA, HAWAIʻI, TMK: 7-6-021: 016 and 017

I. INTRODUCTION

Kona Three, LLC ("Applicant"), is the owner of two (2) properties identified by TMKs: 7-6-021 016 and 017 ("subject properties"), consisting of a total of 68.837 acres situated within a larger 173.66-acre project area that was subject to a State Land Use District Boundary amendment to the Urban District in 1984 (Exhibit A–A83-549) which was then subsequently rezoned later in the same year into the Single Family Residential (RS-15) and Multiple Family Residential (RM-5) zoning districts (Exhibit B–Ordinance 84-23) in support of a proposed 500-unit single- and multiple-family residential development, with the single family residential component being completed as the Kona Vistas subdivision.

Over the course of the next 23 years or so, the original Applicant, GAMREX, Inc., proceeded with the initial increment of development of the 103.3 acres of RS-15 zoned lands into 215 single-family residential units that is now known as Kona Vistas subdivision, which also included the construction of the mauka section of Lako Street that now serves this subdivision.

GAMREX, Inc., and its subsequent development entity Kona Vistas LLC, was successful in securing from the Hawaiʻi County Council a series of amendments to the original zoning (Ordinance 84-23) to provide additional time to complete the proposed development, the last extension was approved in 2002 (Exhibit C-Ordinance 02-131), that granted a time extension until November 27, 2007 to secure Final Plan Approval for the first increment of the multiple-family residential component within the RM-5 zoned area with its planned completion no later than November 27, 2011.

Upon completion of the last phase of the single-family residential component of Kona Vista subdivision on or around 2007, the next increment proposed was the RM-5 zoned lands to the north of the existing Kona Vista subdivision. Work on this phase never progressed.

In December of 2015, the current Applicant, Kona Three, LLC, acquired the 68.837 acres comprising the RM-5 zoned lands (Parcels 016 and 017) with the intention of developing a 450-unit multiple family rental and for sale housing project to be known as "Royal Vistas". In the years since its acquisition of the subject properties, the Applicant has made efforts to satisfy the various procedural and regulatory requirements that would support these requested time extensions to Ordinance 02 131, which includes the preparation of an environmental assessment as well complying with the affordable housing obligations for both the existing Kona Vistas subdivision developed by the original developer, GAMLON Corp., as well as the proposed multiple family project proposed by the current Applicant, Kona Three LLC.

II. <u>APPLICANT'S REQUEST</u>

A. <u>Time extensions to Condition I of Ordinance 02 131</u> – effective November 27, 2003

Condition I of Ordinance 02 131 requires that plans for the first increment of the multiple family residential component of the project be submitted and Final Plan Approval secured no later than five (5) years from the effective date of the ordinance, or <u>November 27, 2008</u>, with construction commencing within one (1) year thereafter and completion of this multiple family residential component no later than three (3) years thereafter, or no later than <u>November 27, 2012</u>. Both respective conditions within Ordinance 02 131 are recited for your convenience below:

I) plans for the development within the first increment of the RM zoned area shall be submitted to the Planning Department and final plan approval secured within five years from the effective date of this sixth amendment. Construction shall commence within one year from the date of receipt of final plan approval and be completed within three years thereafter;

U) an initial extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances:

1) the non-performance is the result of conditions that could not have been foreseen or are beyond the control of the applicants, successors or assigns, and that are not the result of their fault or negligence;
2) granting of the time extension would not be contrary to the general plan or zoning code;
3) granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;
4) the time extension granted shall be for a period not to exceed the period originally granted for performance (i.e., a condition to be performed within one year may be extended for up to one additional year); and

5) if the applicant should require an additional extension of time, the Planning Director shall submit the applicant's request to the County Council for appropriate action. Further, should any of the conditions not be met or substantially complied with in a timely fashion, the Director *[sic]* initiate rezoning of the area to its original or more appropriate designation.

The Applicant purchased the subject properties in late 2015, 3 years after construction of the first increment of the multiple family residential project was intended to be completed as originally afforded by Condition I of the change of zone ordinance. Regardless, a significant amount of planning, design, regulatory approvals, permitting and construction have already been done as witnessed by the completion of the 215-unit Kona Vista subdivision and the construction of Lako Street as well as in anticipation of the final residential component, the 450-unit multiple family project to be known as "Royal Vistas".

Regrettably, as explained further below, the concerted and diligent efforts of both the original and current Applicants to meet all deadlines prescribed by Ordinance 02 131, were unsuccessful. As such, and pursuant to Condition I and Condition U of Ordinance 02 131 and on behalf of Kona Three, LLC, ("Applicant"), we respectfully request an extension of time of **ten (10) years** from the effective date of this amendment request by which to complete construction of the first increment of the 450-unit multiple family residential project upon the RM-5 zoned subject properties as originally set forth in Condition I.

B. <u>Amendment to Condition N of Ordinance 02 131</u>

Condition N, as recited in full below, obligates the Applicant to provide for dedicable roadways with curb, gutter and sidewalk improvements within the proposed development, which the Applicant has every intention of providing. For the sake of anticipating the extent of these dedicable-standard roadways as it affects the overall design of the proposed project, the Applicant is requesting that Condition N be clarified to provide such dedicable-standard roadways only as it pertains to its extension of Paulehia and Hoʻomana Streets within Pualani Estates to the north and Kekuanaʻoa Place and Leilani Streets within Kona Vistas subdivision to the south, along with an interconnecting road between these two extensions and to the Queen Kaʻahumanu Highway, all of which will be constructed as minor collector roadways as identified within the Kona Community Development Plan (KCDP) and further defined on the Conceptual Master Plan for Royal Vistas identified as <u>Figure 3 – Conceptual Building Layout</u> in the Final Environmental Assessment dated September 2021.

Regarding that portion of Condition N referencing roadway improvements that cross or is divided by a zone line and its extension to the nearest intersection, the Applicant recommends that this section be deleted in its entirely since Figure 3-

Conceptual Building Layout within the FEA defines the roadway segments that will be constructed with curb, gutter and sidewalk improvements. The requested amendment as shown below will also clarify that the existing section of Kekuanaʻoa Place with Kona Vistas subdivision can be maintained with its current paved shoulders and swale, which has been expressed as the preference of residents within the Kona Vistas Subdivision.

N) the roadways and stubout within the RM zoned area, as shown on "Figure 3- Conceptual Building Layout" in the Final Environmental Assessment-Royal Vistas Housing Project dated September 2021, shall be constructed to dedicable standards with curbs, gutters, and sidewalks meeting with the approval of the Department of Public Works and shall be dedicated to the County of Hawaii upon completion.[~~ Where a roadway crosses a zone line or if a zone line should divide a roadway, the curbs, gutters, and sidewalks shall be provided for the entire right-of-way and shall continue to the nearest intersection in order to avoid telescoping and to provide consistent improvement;~~]

(added material is underscored, deleted material is bracketed & struck-out)

The reason for these requests and other associated information are outline in the pages that follow.

III. PROGRESS OF DEVELOPMENT

Since the approval of both the State Land Use District Boundary amendment and change of zone in 1984, the former and current Applicants have made significant progress towards completion of the overall single- and multiple-family residential project, as demonstrated by its accomplishment of the following milestones:

1. Lako Street extension (SUB 5738)
Creation of right-of-way between Kuakini Highway and the Kailua-Keauhou Middle Road to accommodate initial segment of the proposed extension of Lako Street, approved on May 17, 1990.

2. Kona Vistas Subdivision – Unit 1-A (SUB 6140)
Phase 1 of initial increment of 39 single family residential lots of at least 15,000 square feet in size, approved on May 27, 1992. Includes the construction of the initial segment of the extension of Lako Street from its intersection with Kuakini Highway and extending mauka to Leilani Street.

3. Kona Vistas Subdivision – Unit 1-B (SUB 6140a)
Phase 2 of initial increment of 51 single family residential lots and 4 bulk lots, approved on January 21, 1993. Includes the second segment of the extension of Lako Street between Leilani Street and Kinau Street.

4. Kona Vistas Subdivision – Unit 1-C (SUB 6140b)
   Phase 3 of initial increment of 20 single family residential lots and 1 bulk lot (subsequently condominiumized), approved on July 8, 1997.

5. Kona Vistas Subdivision – Unit 1-D (SUB 6140b)
   Phase 4 of initial increment of 10 single family residential lots, approved on December 22, 1997. Note that this subdivision covers portion of same area as Unit 1-C.

6. Kona Vistas Subdivision – Unit 1-E (SUB 6140b)
   Phase 5 of initial increment of 6 single family residential lots, approved on December 22, 1997. Note that this subdivision covers portion of same area as Unit 1-C.

7. Kona Vistas Subdivision – Unit 2-A (SUB 7578)
   Phase 1 of second increment of 8 single family residential lots, approved on September 9, 2002.

8. Kona Vistas Subdivision – Unit 2-B (SUB 03-000022)
   Phase 2 of second increment of 39 single family residential lots, approved on July 23, 2003. Includes the third and final segment of the extension of Lako Street, extending it mauka from Kinau Street to the adjoining Iolani Subdivision.

9. 12-acre County Affordable Housing site
   Located along the makai side of Kuakini Highway across of the subject properties, this 12-acre property was selected as the potential site of an affordable housing project in satisfaction of the affordable housing obligations required by the State Land Use District Boundary amendment and change of zone ordinance. An environmental assessment was prepared and a FONSI was issued in 1996. However, before the site could be developed for affordable housing, improvements to the Horseshoe Bend and Holualoa drainageways were required that would connect with the existing County drainageway between Alii Kai and Kamani Tree subdivisions. Gamrex prepared and successfully secured the issuance of SMA Use Permit No. 430 on April 4, 2003 to allow for these drainageway improvements to occur within the Special Management Area. Note that this effort also involved the acquisition of properties by Gamrex in the vicinity of Royal Poinciana Drive and Kupuna Street to accommodate both the 12-acre affordable housing site and the mentioned drainageways.

10. Kona Vistas Subdivision – Unit 4 (SUB 05-000227)
    Third increment of 26 lots, each consisting of a minimum of 15,000 square feet, approved on May 8, 2005.

11. Kona Vistas Subdivision – Unit 3 (SUB 05-000226)
    Fourth increment of 20 single family residential lots, approved on May 4, 2006.

12. Plan Approval Application
    On November 23, 2007, Final Plan Approval was issued by the Planning Department for the proposed construction of 150 multiple-family residential units on approximately 17 acres of land within a portion of Parcel 016 in satisfaction of Condition I of Ordinance 02 131. Per Condition I, construction should have commenced no later than November 23, 2009 with completion no later than November 23, 2012. By letter dated September 1, 2017, the Planning Department notified the Applicant that this Final Plan Approval is no longer valid since the original applicant, GAMREX Inc. was not able to commence construction of the initial phase of the 150 multiple family residential units within the RM-5 zoned area within the two-year period ending November 23, 2009, thereby necessitating this request for a 10-year time extension to complete the proposed multiple-family residential project.

13. Kona Vistas Subdivision – Unit 4 (SUB 20-001973
    Subdivided large remnant lot in Unit 4 into 3 single family residential lots, approved on January 25, 2021.

14. Kona Vistas Subdivision – Unit 4 (SUB 20-001988)
    Subdivided large remnant lot in Unit 4 into 2 single family residential lots, approved on March 30, 2021.

Upon purchase of the subject properties at the end of 2015, Kona Three LLC has placed a significant financial commitment and many years of consultation, negotiation, environmental review, preliminary design work and regulatory compliance in order to be able to support this request for an extension of time by which to complete the project. These efforts included the following:

1. Drainage Improvements within Holualoa Drainageway
   In coordination with the Department of Public Works, Planning Department and the Office of the Corporation Counsel, completed improvements within and adjacent to the Holualoa Drainageway in accordance with the recommendations of the Department of Public Works.

2. Dedication of roadways within Kona Vista subdivision
   In coordination with the Department of Public Works and the Office of the Corporation Counsel, performed all necessary road work and completed dedication of three (3) remaining roadway lots within the adjacent Kona Vistas subdivision, namely Kekuanaʻoa Place, Liholiho Place and Kamamalu Place.

3. 12-acre County Affordable Housing site makai of Kuakini Highway
   With the issuance of SMA Use Permit No. 430 on April 4, 2003 to allow for improvements to the Horseshoe Bend and Holualoa drainageways within this proposed affordable housing site, the Applicant retained the services of a hydrological engineer to prepare and submit a Conditional Letter of Map Revision ("CLOMR") application to the Federal Emergency Management Agency (FEMA) in 2018. The CLOMR was issued 1-10-22 as Case No. 21-09-1757R, so the necessary drainage improvements can now be built and the property then developed for affordable housing. However, despite the Applicant's efforts, the County no longer wishes to proceed with the development of the 12-acre property for affordable housing in favor of the affordable housing agreement discussed further below.

4. Final Environmental Assessment and Finding of No Significant Impact (FONSI)
   By letter dated September 13, 2021, the Hawaiʻi County Planning Department issued a FONSI for the proposed 450-unit Royal Vistas housing project that accompanies and supports these amendment requests to Ordinance 02 131 as Exhibit D. The Final Environmental Assessment included an updated traffic impact analysis report, biological survey, cultural impact assessment, archaeological inventory and preservation plan. Also included within this process were consultations with area residents, specifically from the adjoining Kona Vistas subdivision. Work on the environmental assessments and its related studies began in 2018 until its acceptance by the Planning Department in September 2021, covering more than 3 years of studies and project design revisions based on agencies and public review and comments upon the draft environmental assessment.

5. Environmental flora study commissioned by Applicant and performed on all of Parcel 16; 17; the County-owned 18 & 19, plus the 12-acre site.

6. Environmental faunal study commissioned by Applicant and performed on all of Parcel 16; 17; the County-owned 18 & 19, plus the 12-acre site.

7. Affordable Housing Agreement
   Applicant Kona Three, LLC and the County of Hawaiʻi entered into an agreement on January 10, 2022 to satisfy the affordable housing obligations (Condition J of Ordinance 02 131) for the development of the entire 173.66 acres of land encumbered by both the State Land Use District Boundary amendment and change of zone ordinance approved in 1984. As allowed by Section 11-5(a)(7) of Chapter 11 of the Hawaiʻi County Code regarding Affordable Housing, the Applicant acquired 67 excess housing credits via an exchange for land for a new project to satisfy the affordable housing obligations for both the 215 single family residential units within the existing Kona Vistas subdivision as well as the 450 multiple family housing units within the proposed Royal Vistas project.

As such, the Applicant is requesting an extension of time of **ten (10) years** to secure Final Plan Approval for the first increment of the proposed 450-unit multiple family housing project as well as to complete its construction as originally intended by Condition I of Ordinance 02 131.

And with approval of the requested amendment to Condition U of Ordinance 02 131 to provide clarity and certainty regarding the extent of required County-dedicable roadways to be constructed within the proposed development, the overall design can be facilitated so that plans for engineering and construction can commence promptly after the requested amendments are approved by the Hawaiʻi County Council.

IV. NATURE OF REQUEST

GAMREX, Inc./Kona Vistas, LLC (the original landowners and Petitioners) were owned by a Japan-based development group, whose majority owner and President spearheaded the Kona Vistas project development until his passing some years ago. The development group eventually lost interest as well as its ability to continue to develop the project after 37 years of progress as demonstrated above.

In December of 2015, Kona Vistas LLC sold their remaining land holdings to two Hawaiʻi-based development entities: KV3, LLC and Kona Three LLC. These remaining landholdings that were transferred included about thirteen lots in Unit 3 and Unit 4 of the Kona Vistas subdivision together with three roadway lots and some remnant lots in Unit 4 and Unit 1 transferred to KV3 LLC; and the multi-family (RM-5) zoned subject properties totaling about 68.837 acres identified as TMKs: 7-6-21:016 & 017 were transferred to Kona Three LLC.

Also included in the transfer were about 12 acres located makai of Kuakini Highway and mauka of Royal Poinciana Drive (TMK's 3/7-6-24:25; 112 & 113). These 12 acres contain the confluence of the Holualoa and Horseshoe Bend drainageways, and were originally planned by the County to fulfill the affordable housing requirements of both the existing Kona Vista subdivision and the proposed Royal Vistas multiple family residential projects.

KV3, after building some drainage improvements adjacent to County-owned Holualoa drainageway, worked with the Department of Public Works (DPW) and the Planning Department (CPD) along with County of Hawaii Corporation Counsel ("Corp Counsel") to dedicate the 3 remaining roadways that had not been dedicated, completing the roadway dedications in 2019.

The current Applicant, Kona Three LLC, has retained a hydrological engineer and other advisors and is working on a new drainage study and flood zone analysis in anticipation of moving forward with the planning and development of the RM-5-zoned lands, which is impacted by two floodways: the Horseshoe Bend and Holualoa drainageways. The Applicant anticipates that a new CLOMR will be needed during the development of Phase I of the Project for the Horseshoe Bend drainageway.

The Applicant also came to agreement with Hawaiʻi Preparatory Academy's 5-acre interest in the multi-family zoned lands situated within the extreme southeastern corner of Parcel 017. Hawaiʻi Preparatory Academy decided they no longer wished to build a new school in Kona, and Kona Three LLC was able to purchase their undivided interest in the 5-acres. A new AIS was then prepared on the 5-acres as this land was not previously included in the original AIS. This recent AIS found a previously unknown historic burial site underground in a lava tube within this included 5-acre area. The Applicant then commissioned a Burial Treatment Plan which has been approved by the SHPD and the Hawaiʻi Island Burial Council.

In addition, the Applicant was instructed to prepare a new AIS for the remaining 65 acres of RM-5 zoned lands within the subject properties due to the age of the original AIS report. This new AIS has been completed and approved by SHPD and made a part of the 2021 environmental assessment report.

The Applicant has also contracted with a local construction firm, under approvals issued by the Department of Water Supply, and subsequently installed in 2018 an off-site water meter box that will provide fire flow and potable water to the proposed 450-unit multiple family residential project.

Finally, at the request of the County, the Applicant submitted an application for a CLOMR for the 12 acres located makai of Kuakini Highway that was formerly intended as an affordable housing site, with the CLOMR being issued on January 10, 2022 as Case No. 21-09-1757R.

As demonstrated above, much "soft work" has been undertaken by the Applicant after its purchase of the remaining land assets from the original landowner in 2015, in order to update and align the various studies and previous obligations of the original landowner in order to be in a position to make this request for additional time in which to complete the last remaining major residential development component that was envisioned by both the State Land Use Commission and the Hawaiʻi County Council when it originally approved the State Land Use Boundary amendment and change of zone in 1984.

The Applicant found itself in a difficult position where it could not responsibly approach the Hawaiʻi County Council for additional time in which to complete the final residential component within the RM-5 zoned lands without first addressing the many project-related supporting elements that will inform decision-makers in making the proper decision to support the approval of the time extension as it will be consistent with the original reasons for approving the land use entitlements back in 1984 while conforming to current land use policies and adequately addressing project-related impacts in a responsible manner.

V. PROJECT LOCATION

The subject properties, consisting of combined 68.837 acres and identified by TMK: 7-6-021:016 and 017, is located along the east (mauka) side of the Queen Kaʻahumanu Highway at its junction with Kuakini Highway in the vicinity of Lako Street. The subject properties are situated between some vacant ranch land and Pualani Estates subdivision to the north and Kona Vistas subdivision and a church to the south, in the ahupuaʻa of Hōlualoa 1st and 2nd, North Kona, Hawaiʻi (Figure 1-Location Map and Figure 2 – Vicinity Map).

The current General Plan, State Land Use District and zoning district boundaries relative to the subject properties are reflected on Figure 3 – LUPAG Map, Figure 4 – State Land Use and Figure 5 – Zoning.

VI. PROPOSED DEVELOPMENT

Proposed Multiple Family Residential Housing Component

The Applicant proposes to construct "Royal Vistas" as a 450-unit multi-family residential housing project with both rentals and For Sale product to be developed in clusters of two- and three-story buildings throughout the 68.837-acres that comprises both Parcels 016 and 017. A conceptual drawing of the layout of the buildings is shown below as Figure 6 – Conceptual Master Plan for Royal Vistas.

Royal Vistas will be comprised of multiple family residential units "For Rent" and "For Sale". While the final distribution of these units may be adjusted during final design and permitting, the Applicant anticipates that the project will consist of:

- 174 "For Rent" units consisting of:
  - 122 two-bedroom/two-bath units
  - 52 three-bedroom/two-bath units plus a resident manager's unit
  - All units within two-story buildings situated within the *makai* portion of the 68.837-acre project site.

- 274 "For Sale" units consisting of:
  - 147 two bedroom/two-bath units
  - 137 three-bedroom/two-bath units plus a resident manager's unit.
  - All units would be located in 10 two-story buildings and 39 three-story buildings, with the two-story buildings being four units each and the three-story buildings being six units each. Parking would consist of a mix of covered and open spaces for residents and guests.

To address housing shortages in Kona, the Kona Community Development Plan (CDP) identifies Objective HSG-4: Build More Units and Policy HSG-4.2: Workforce Housing. The workforce gap group (up to 180% of median income) includes the part of the population that earns too much to qualify for affordable housing programs, yet too little to buy or rent decent housing close to their jobs. The Project would build units that offer a variety of housing types for both the rental and buyer segments of the mid-market which includes the workforce group. Although the Project is not specifically a workforce project, it would provide a housing option for the workforce gap group.

The Project would be developed in two or more phases, with Phase I having a maximum of 258 units to be constructed on no more than 42 acres within the makai portion of the project site, and Phase II having the balance of 192 units within the mauka portion. Phase I would include all the “For Rent” units and some “For Sale” units. Both “For Rent” and “For Sale” units would target local renters and buyers in the “mid-market” price points. These are residents who earn too much to qualify for “affordable housing” but not enough to buy the expensive single-family homes located nearby.

Phase I is expected to be completed by 2024, and Phase II is expected to be completed by 2029, although processing of these amendment requests will probably push its completion to the Fall of 2030. There would be two Community Centers, each of which includes a neighborhood park; one for the “For Rent” units and one for the “For Sale” units. Each community center will have a pool and facilities for use by the residents.

Proposed Roadways

The proposed roadway system within Royal Vistas will assist in implementing the roadway network within this project area as defined by the “Official Transportation Network Map-Nani Kailua Area” within the Kona Community Development Plan (KCDP), as part of the County’s plan to expand the road grid to help alleviate traffic and provide safer driving conditions (see Figure 7-KCDP Official Transportation Network Map-Nani Kailua Area).

These KCDP-defined roadway segments as it affects the proposed project include:

- to provide the opportunity in the long-term to connect County-owned Leilani Street (in the Kona Vistas project) to County-owned Hoʻomama Street (in the Pualani Estates project);

- to provide the opportunity in the long-term to connect County-owned Kekuanaʻoa Place (in the Kona Vistas project) to County-owned Paulehia Street (in the Pualani Estates project); and

- to connect these new roads to each other within the Project area. Kona Three, LLC is required to build and dedicate these roads by Ordinance.

More specifically, the proposed Royal Vistas project would construct the following minor collector roadway segments as shown in Figure 6–Conceptual Master Plan for Royal Vistas.

- In Phase I, construct Royal Vistas roadway as a direct, fully channelized entrance from the Queen Kaʻahumanu Highway.
- In Phase I, construct that segment of the Leilani Street extension situated within the project site. This segment will stub-out the Leilani Street extension on the southern project site boundary and will not connect it across the private adjoining parcel (TMK 7-6-021:014) owned by the Calvary Community Church of Kona.
- In Phase II, extend Kekuanaʻoa Place northward through the project site from its existing terminus in Kona Vistas subdivision.
- Construct a mauka-makai roadway connecting both the Leilani Street and Kekuanaʻoa Place extensions.
- None of the roads proposed for the project will connect to Hoʻomama Street and Paulehia Street in Pualani Estates due to an intervening privately-owned parcel (TMK 7-6-013:004).
- These roadways will be constructed to as minor collector roadways meeting County-dedicable standards with curbs, gutters, and sidewalks, all of which will be dedicated to the County of Hawaiʻi upon completion.

Proposed Drainage Improvements

The alignments of most of the Horseshoe Bend (TMK: 7-6-021:018) and Holualoa (TMK: 7-6-021:019) drainageways are both owned and managed by the County of Hawaiʻi Department of Public Works (DPW) as drainageways. A portion of the Horseshoe Bend drainageway sheet flows from the County-owned ditch at Parcel 18 down to the existing culvert system under Queen Kaʻahumanu Highway at the northwest corner of Parcel 16. As shown on Figure 2-Vicinity Map, Horseshoe Bend drainageway partially bisects the project site in a northeast to southwest direction, while the Holualoa drainageway runs along the entire southern boundary of the project site.

Phase II of the proposed project will include the installation of a culvert system across the Holualoa drainageway to extend Kekuanaʻoa Street, which will be gated off and used for emergency access only until Phase II is completed. Phase II will add utilities and roadway improvements which would then be dedicated to the County in compliance with both Ordinance 02 131 and the KCDP "Official Transportation Map."

The mauka section of the Horseshoe Bend drainageway, consisting of approximately 3 acres that runs between the subject properties that collectively make up the 68.837-acre project site, will be improved and partially realigned to maintain its separation from the Holualoa drainageway, along with infrastructure for channelizing a portion of the drainageway to accommodate road and utility crossings associated with the construction of the two north-south minor collector roadway alignments through the project site as defined by the KCDP "Official Transportation Map.

The makai portion of the Horseshoe Bend drainageway will be channelized where it is primarily sheet flow and moved closer to the northern boundary of the project site to make room for the planned roadway intersection at Queen Kaʻahumanu Highway at the location to be approved by the State Department of Transportation Highways Division. Aside from the Department of Public Works-approved drainage improvements, utilities, and roadways, the Applicant is not proposing to construct any additional drainage structures or improvements within these County-owned drainageways.

Utilities and Services

Electrical and sewer service would be extended from nearby public grid terminus and water commitments have already been purchased and secured for the Project. The project site is situated within the Kona Urban Area between Kona Vista and Pualani Estates subdivisions and is in close proximity to major roadways, recreational opportunities, and essential services, including grocery and wholesale stores, employment, hospital/clinics, public transit, schools, financial institutions, government agencies/services, and the airport.

VII. PROJECT TIMETABLE AND COST

Should the requests be approved, the Applicant intends to submit plans for plan approval review within one (1) year. Anticipated completion of the first increment of the 450-unit Royal Vistas project is expected within ten (10) years from the date of approval of the requested amendments to Ordinance 02 131.

Assuming there are no additional cost-related conditions beyond those improvements required by Ordinance 02 131, the current estimated development cost of this project is $170 million in 2022 dollars. This includes County exactions and fees.

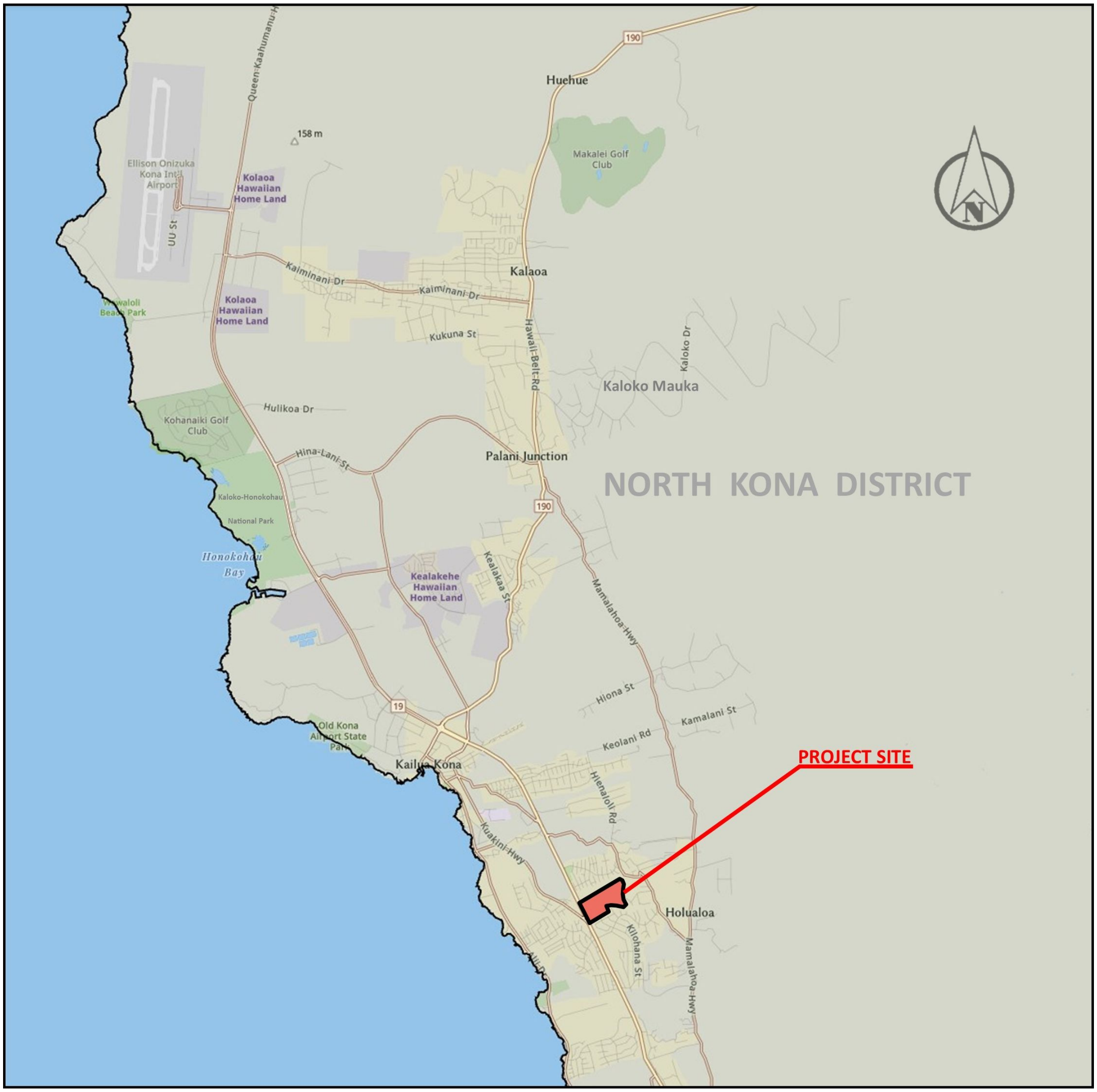

Figure 1 – Location Map

Figure 2 - Vicinity Map

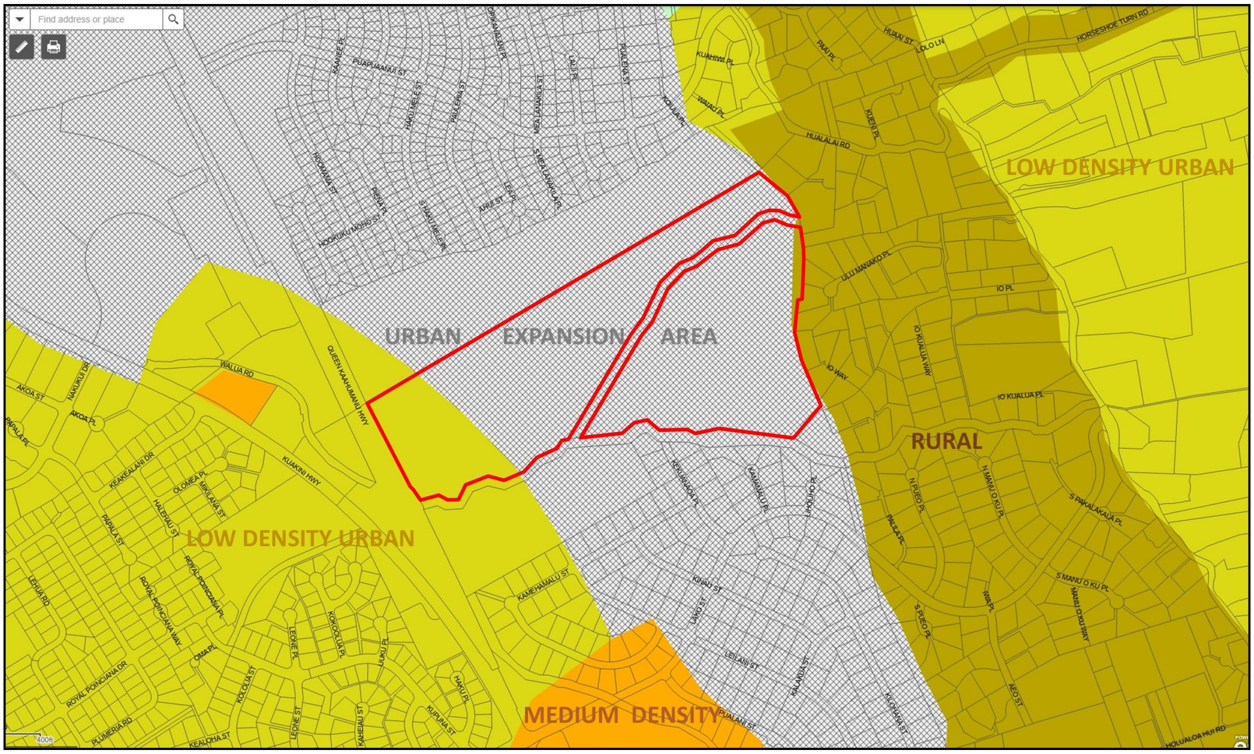

Figure 3 – LUPAG Map

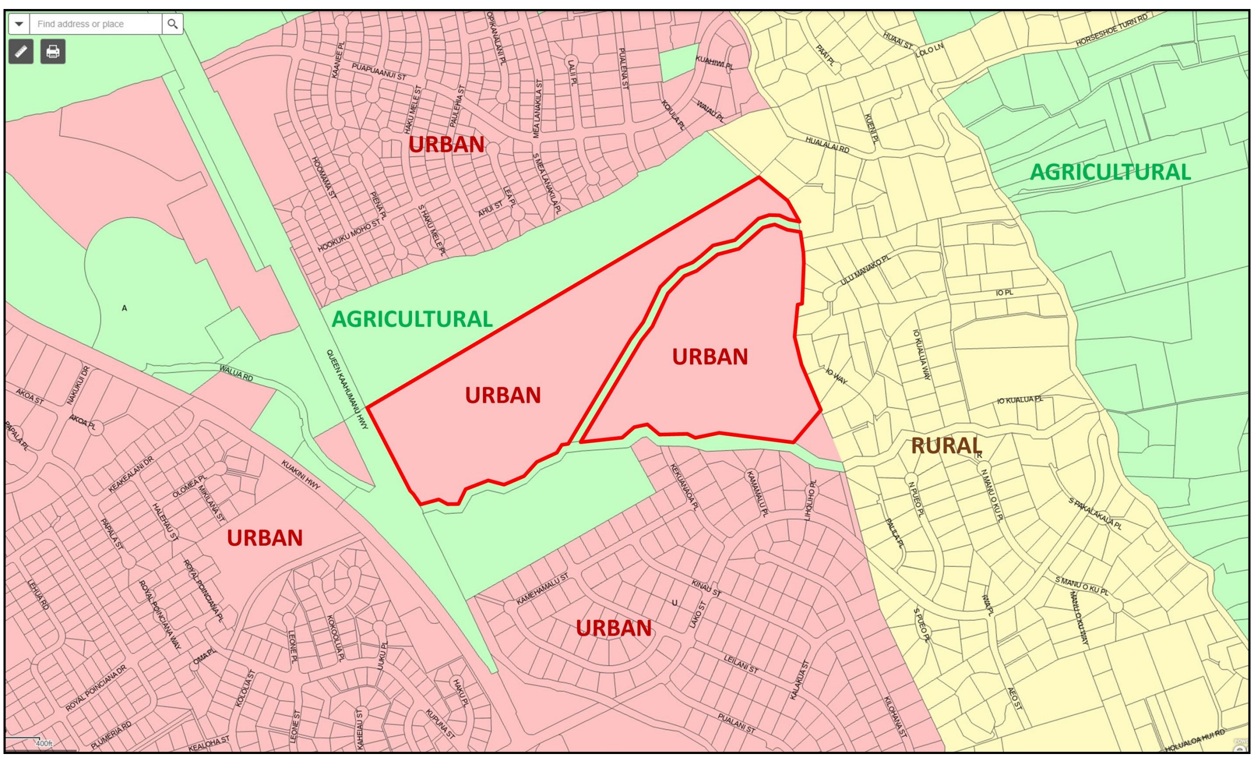

Figure 4 – State Land Use

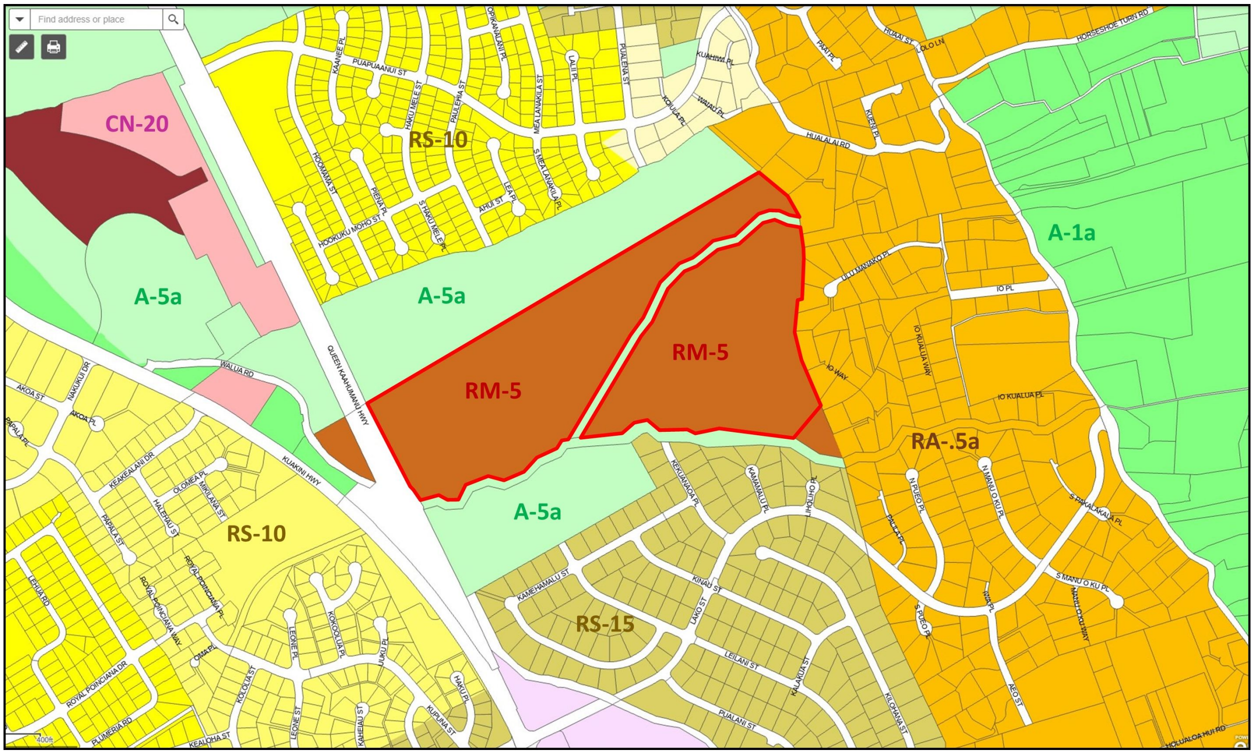

Figure 5 – Zoning

Figure 6 – Conceptual Master Plan for Royal Vistas

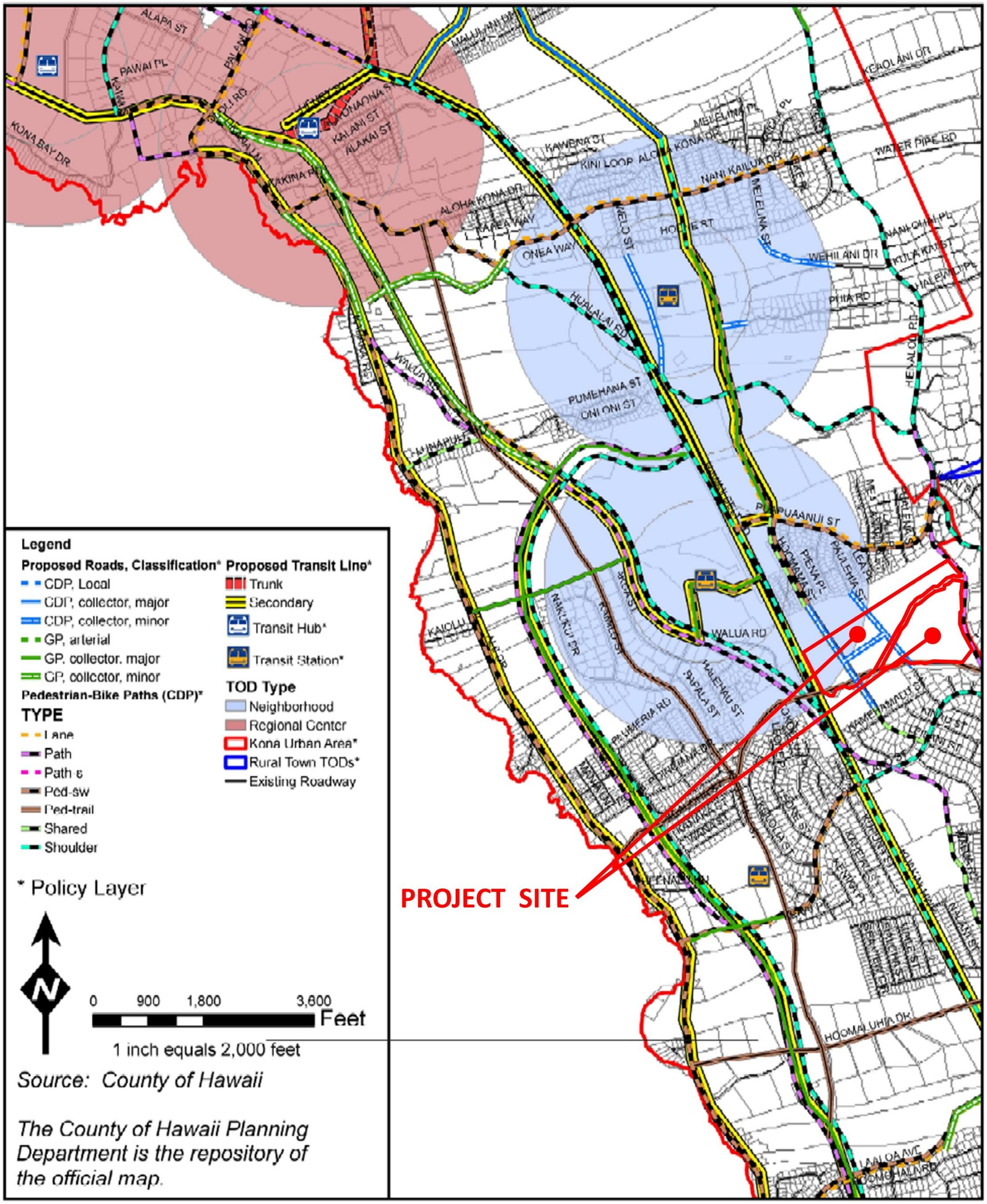

Figure 7 – KCDP Official Transportation Network Map-Nani Kailua Area
(with project site highlighted)

VIII. ORDINANCE 02 131 CONDITIONS AND STATUS OF ITS COMPLIANCE

Rezoning time extensions require compliance with applicable prevailing codes, particularly the concurrency provision of the Zoning Code. Further, project's compliance with the conditions of the rezoning ordinance also needs to be discussed. As such, this section addresses those requirements.

Change of Zone Ordinance 02 131

(A) the zoning for the property shall be effective only after: (1) there are assurances satisfactory to the Departments of Water Supply and Planning, upon consultation with the State Department of Health, and the Division of Water and Land Development of the State Department of Land and Natural Resources, that a water source of sufficient quality and quantity has been established within two years from the effective date of this ordinance; provided that a maximum one-year extension to the two-year time limit may be granted by the Planning Director with reasonable and sufficient justification; and (2) an agreement, accompanied by an appropriate surety bond or other acceptable security, is executed with the Department of Water Supply for the actual development of a proven water source and its water transmission and distribution system within one year from the official date of compliance with condition A (1); provided that a one-year extension to the one-year time limit may be granted by the Planning Director with reasonable and sufficient justification; or (3) the Department of Water Supply issues a water commitment for the proposed development;

- *The Applicant has secured and fully paid the required facilities charge fees for 450 water units that will support the proposed 450 multiple family residential unit within the Royal Vistas project. In 2018, an off-site water meter box was installed that will provide the necessary potable water and fire flow to service this project.*

(B) no subdivision or development of any portion of the land shall occur unless and until condition A has been complied with;

- *As mentioned above, the Applicant has fully paid for the necessary water units to support the proposed project in satisfaction of the requirements of Condition A.*

(C) the Planning Director shall be mandated to initiate action for the repeal of this ordinance if conditions A or B have not been complied with;

- *As both Conditions A and B were deemed satisfied by the Planning Director, the Director was never compelled to initiate an action to repeal the RS-15 and RM-5 zoning (Ordinance 84 23). This is further supported by the many subsequent amendments to this ordinance that was approved by the Hawai ʻi County Council to allow for additional time in which to complete the proposed project, the most recent being Ordinance 02 131.*

(D) the petitioner, its assigns or successors, shall be responsible for complying with all conditions of approval;

- *The Applicant acknowledges its continuing responsibility to comply with the conditions of approval, along with its assigns or successors.*

(E) the zoning for the 49+ acres designated by the State Land Use Commission as its second zoning increment shall not become effective until that land is certified by that commission to be within the Urban District;

- *By its Decision and Order dated May 10, 1993, the State Land Use Commission certified that the second zoning increment of 49+ acres is within the State Land Use Urban District.*

(F) the RS zoned area shall be developed in two increments. The first increment shall consist of a maximum of 59.5± contiguous acres, and the second, the remaining area. The effective date of zoning for the second increment shall be after development has occurred in the first increment, as determined by the Planning Director. "Development" means the applicant has completed the on-site and off-site improvements within the first increment of the RS zoned area and has dedicated the roadway to the County;

- *This condition has been satisfied with the completion of all phases associated with the RS-15 zoned portions of the project area now known as Kona Vistas subdivision, with the last phase being completed in 2006.*
- *As Condition F has been satisfied, the Applicant has no objection to the deletion of this condition should it be recommended by the Planning Director.*

(G) subdivision plans for the first increment of the RS zoned area shall be submitted within one year from the effective date of the zoning. Final subdivision approval shall be secured within two years from the effective date of this amendment;

- *This condition has been satisfied with the submittal to the Planning Department of Kona Vistas Subdivision–Unit 1-A (SUB 6140), consisting of the initial increment of 39 single family residential lots, which secured final subdivision approval on May 27, 1992. This increment also includes the construction of the initial segment of the extension of Lako Street from its intersection with Kuakini Highway and extending mauka to Leilani Street.*
- *As Condition G has been satisfied, the Applicant has no objection to the deletion of this condition should it be recommended by the Planning Director.*

(H) the RM zoned area shall be developed in two increments. The first increment shall consist of a maximum of 42 acres of the Multiple Family Residential zoned land and the second increment, the remaining area. The effective date of zoning for the second increment shall be after the applicant has completed the on-site and off-site improvements of the first increment of the RM zoned area and has dedicated the improvements to the County;

- *The Applicant will comply with this condition, developing the 450-unit Royal Vistas project in two increments, as discussed in Section VI of this report.*

(I) plans for the development within the first increment of the RM zoned area shall be submitted to the Planning Department and final plan approval secured within five years from the effective date of this sixth amendment. Construction shall commence within one year from the date of receipt of final plan approval and be completed within three years thereafter;

- *The Applicant is requesting an amendment to Condition I that will allow for the submittal of plans and Final Plan Approval for the first increment of the RM-zoned area secured within five (5) years from the effected date of the amended ordinance with completion of the first increment of the 450-unit project within five (5) years thereafter.*

(J) should the Council adopt a Unified Impact Fees Ordinance setting forth criteria for the imposition of exactions or the assessment of impact fees, conditions included herein shall be credited towards the requirements of the Unified Impact Fees Ordinance;

- *The Applicant acknowledges this condition and will comply upon the adoption of a Unified Impact Fees ordinance.*

(K) housing opportunities for Hawaii residents shall be provided in accordance with the condition imposed by the State Land Use Commission. The number of units and manner in which they are to be provided shall meet with the approval of the Hawaii County Housing Agency;

- *Attempts by the Applicant, in coordination with the Office of Housing and Community Development (OHCD), to satisfy this affordable housing requirement initially began with an Agreement, along with seven (7) subsequent amendments, regarding the conveyance of approximately 12 acres of land located between Kuakini Highway and Royal Poinciana Drive and zoned RS-10 to the County or their designated affordable housing developer. These 12 acres were purchased at the direction of the County, along with the need for the Applicant to address some drainage issues in the area. At the request of OHCD, the Applicant prepared and then submitted an application for a Conditional Letter of Map Revision ("CLOMR") to the Federal Emergency Management Agency ("FEMA"), to allow the flood-zone designated portion of the 12 acres to be channelized and developed. The CLOMR (Case No. 21-09-1757R) was subsequently issued on January 10, 2022.*
- *Despite the Applicant's efforts, the OHCD recently decided that this proposed 12-acre affordable housing site was not suitable to meet their goals for affordable housing, prompting the Applicant to offer an alternative to satisfy the affordable housing obligations for both the existing 215-unit Kona Vistas subdivision and the proposed 450-unit multi-family residential project through the acquisition of 67 affordable housing credits via land exchange for land associated with the creation of a new 100-unit affordable rental project above Lowes on land that the Applicant will donate to a qualified affordable housing developer. This most recent affordable housing Agreement, attached as <u>Exhibit D-Affordable Housing Agreement</u>, between the Applicant and OHCD was executed on January 10, 2022 in satisfaction of Condition K of Ordinance 02 131.*

(L) improvements to the intersections with Kuakini Highway and the Kuakini Highway Extension shall be constructed meeting with the approval of the State Department of Transportation, Highways Division. The intersection improvements shall be constructed concurrently with the development of the first increment of the RS or RM zoned areas, whichever occurs first;

- *This condition was satisfied with the completion of intersection improvements along the Kuakini Highway at its intersection with the mauka extension of Lako Street that serves all of the existing Kona Vistas subdivision.*
- *As Condition L has been satisfied with the completion of the intersection along Kuakini Highway (this segment is now referred to as "Queen Kaʻahumanu Highway) at its intersection with Lako Street, the Applicant has*

no objection to the deletion of this condition should it be recommended by the Hawai'i County Council.

(M) no direct access shall be provided for the lots within the RS zoned area from the mauka-makai collector road;

- *The development of the existing single family residential lots within the existing Kona Vistas subdivision adheres to this condition by restricting any direct access onto Lako Street, the mauka-makai connector road.*
- *As Condition M has been satisfied with the completion of Kona Vistas subdivision, the Applicant has no objection to the deletion of this condition should it be recommended by the Planning Director*.

(N) the roadways and stubout within the RM zoned area shall be constructed to dedicable standards with curbs, gutters, and sidewalks meeting with the approval of the Department of Public Works and shall be dedicated to the County of Hawaii upon completion. Where a roadway crosses a zone line or if a zone line should divide a roadway, the curbs, gutters, and sidewalks shall be provided for the entire right-of-way-and-shall continue to the nearest intersection in order to avoid telescoping and to provide consistent improvement;

- *As presented in Section II-B of this report, the Applicant is requesting that Condition N be clarified to provide such dedicable-standard roadways only as it pertains to its extension of Paulehia and Ho'omama Streets within Pualani Estates to the north and Kekuana'oa Place and Leilani Streets within Kona Vistas subdivision to the south, along with an interconnecting road between these two extensions and to Route 11, all of which will be constructed as minor collector roadways as identified within the Kona Community Development Plan (KCDP) and further defined on the Conceptual Master Plan for Royal Vistas identified as <u>Figure 3-Conceptual Building Layout</u> in the Final Environmental Assessment dated September 2021.*

(O) at a minimum, roadways and stubouts within the RS zoned area shall be provided with paved shoulders and paved swales meeting with the approval of the Department of Public Works and shall be dedicated to the County of Hawaii upon completion;

- *The development of the existing single family residential lots within the existing Kona Vistas subdivision adheres to this condition by providing paved shoulders and swales along all interior subdivision roadways in a manner meeting with the approval of the Department of Public Works, as well as the dedication of all such roads to the County of Hawai'i.*

- *As Condition O has been satisfied with the completion of Kona Vistas subdivision and dedication of all interior subdivision roads, the Applicant has no objection to the deletion of this condition should it be recommended by the Planning Director.*

(P) the method of sewage disposal shall meet with the approval of the appropriate governmental agencies;

- *The proposed Royal Vistas project will comply with this condition through the extension of and connection with the existing County sewer system that currently services all of Pualani Estates subdivision located to the north of the project site.*

(Q) a drainage master plan shall be submitted to the Department of Public Works for review and approval prior to issuance of any subdivision or plan approvals. The plan shall include, as a minimum, hydrological and hydraulic calculations for all components of the drainage system, a construction timetable for all elements of the system, and an analysis of downstream impacts. Further, mitigating measures as approved by the Department of Public Works shall be taken to eliminate any downstream impacts;

- *This condition has been satisfied as it pertains to the RS-15 zoned lands that has been fully developed as Kona Vistas subdivision, which included the preparation and approval of a drainage master plan by the Department of Public Works and the completion of all required drainage improvements.*
- *A new drainage master plan that will provide for appropriate mitigating measures to eliminate any downstream impact that may be directly caused by the proposed 68.837-acre Royal Vistas project site, will be prepared and submitted to the Department of Public Works for review and approval should this requested time extension request be approved*.

(R) an intensive archaeological survey shall be conducted for the entire property and a report shall be submitted to the Planning Department prior to issuance of any subdivision or plan approvals;

- *An archaeological inventory survey (AIS) was conducted in 1984 for the original 171±-acre project except for a 5-acre portion in the southeastern corner originally intended to be developed by the Hawaii Preparatory Academy. As requested by the State Historic Preservation Division, a new archaeological survey to identify all archaeological historic properties present in the Project Site and an update of the previous archaeological documentation to include site plans for each site with site boundaries and areas impacted by bulldozing, photographs of all sites and features, an assessment of their integrity, and site significance were performed. These* *additional survey reports for both the previously excluded 5-acre site and the remainder of the project site including the existing County-owned drainageways were completed in 2018 and 2020, respectively, and included within the 2021 final environmental assessment for the Royal Vistas project.*

(S) should any unanticipated archaeological sites be found during land preparation activities, work shall immediately stop and the Planning Department notified. Work shall not resume in the affected area until clearance is given by the Planning Department;

- *The Applicant acknowledges and will comply with this condition. The Applicant also notes that it is not aware of any "inadvertent finds" that were encountered during the development of the existing Kona Vistas subdivision.*

(T) prior to the Final Approval of the second increment, the applicant, its successors of assigns shall pay for any additional real property taxes owed for the new residential assessed value of the subject property which was previously taxed at the agricultural rate; and

- *The Applicant understands that Gamrex Corporation, development predecessor in interest, complied with this condition many years ago. The Applicant believes this condition is no longer relevant as the remaining lands are assessed and taxed at RS and RM zoning valuations. Therefore, the Applicant has no objection to the deletion of this condition should it be recommended by the Planning Director*.

(U) an initial extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances:

1) the non-performance is the result of conditions that could have been foreseen or are beyond the control of the applicants, successors or assigns, and that are not the result of their fault or negligence;
2) granting of the time extension would not be contrary to the general plan or zoning code;
3) granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;
4) the time extension granted shall be for a period not to exceed the period originally granted for performance (i.e., a condition to be performed within one year may be extended for up to one additional year); and
5) if the applicant should require an additional extension of time, the Planning Director shall submit the applicant's request to the County Council for appropriate action. Further, should any of the conditions not be met or substantially complied with in a timely fashion, the Director initiate rezoning of the area to its original or more appropriate designation.

- *The Applicant is requesting an additional ten (10) years to complete the first increment of the proposed multiple family residential project within the RM-5 zoned properties as required by Condition I of Ordinance 02 131.*

VII. JUSTIFICATION OF REQUEST

Condition U of the Ordinance 02 131 (Exhibit C-Ordinance 02-131) outlined three (3) circumstances under which the Planning Director could consider an initial time extension request. These circumstances presumably also apply to an extension to be considered by the Hawaiʻi County Council and Leeward Planning Commission, with the recommendations of the Planning Director. As such, these circumstances and their justification follow.

A. *The non-performance is the result of conditions that could not have been foreseen or are beyond the control of the applicant, its successors or assigns, and that are not the result of their fault or negligence.*

As noted in Sections II, III and IV of this report, upon acquiring the subject properties at the end of 2015, the Applicant took immediate steps to address the various conditions and associated requirements imposed upon the development that included:

1. working with the OHCD to satisfy the affordable housing obligations for both the existing 215-unit Kona Vistas subdivision as well as for the proposed 450-unit Royal Vistas multiple family residential project, that included the abandonment of many years of effort by the Applicant to provide a 12-acre affordable housing site just makai of the project site,

2. working with the County and the Federal Emergency Management Agency (FEMA) regarding the management, design and improvements to both the Horseshoe Bend and Holualoa drainageways that borders and bisects the 68.837-acre project site,

3. updating the archaeological, cultural impact, biological, drainage and traffic impact studies that would inform the development of an environmental assessment for the Royal Vistas project,

4. prepared a final environmental assessment and secured a FONSI for the Royal Vistas project (Exhibit D-Royal Vistas Housing Project FEA-FONSI) due to anticipated improvements to these drainageways that are owned by the County, which alone took over 3 years to complete, and

5. worked with the State, County and surrounding community to address the proposed roadway system that will address anticipated traffic volumes and movements generated by the proposed Royal Vistas project while conforming to the roadway connectivity requirements of the Kona CDP.

As presented within this report, both the original and current Applicants have made significant progress towards the completion of the single and multiple family residential project over the course of past 37 years, with the completion of the 215-unit Kona Vistas subdivision in 2006 and the construction of the extension of Lako Street that serves both this subdivision as well as the adjoining Iolani subdivision. The current Applicant, Kona Three, LLC, has spent much of its time and resources since its purchase of the subject properties at the end of 2015 to perform extensive studies, planning, permitting and design work that is still necessary to proceed with the construction of the 450-unit multiple-family residential component to be called Royal Vistas. Part of this effort has been towards satisfying its affordable housing obligations, including those affordable housing obligations of the former landowner and applicant.

Please note that this time period also included the economic struggles associated with the Great Recession that began at the end of 2007 and extended through mid-2009, and the accompanying burst of the "housing bubble" and the subprime mortgage crisis that has taken years for both industries to recover.

Therefore, the Applicant's inability to complete the multiple-family residential project within the RM-5 zoned portion of the overall 171±-acre project area encumbered by Ordinance 02 131 are the result of conditions that could not have been foreseen or are beyond the control of the Applicant and are not the result of their fault or negligence.

B. *Granting of the time extension would not be contrary to the General Plan or Zoning Code.*

It should be noted that since the site was rezoned in 1984, there have been no changes to the County General Plan, which designates most of the project site as Urban Expansion with a section of Low Density Urban along the makai portion fronting the Queen Kaʻahumanu Highway, as shown on Figure 3-LUPAG Map.

Where the land use regulatory environment has changed is with the adoption of the Kona Community Development Plan (KCDP), which became effective on September 10, 2008 (Ordinance No. 08 116) and was not considered during the course of review of this rezoning action by the Planning Department, Planning Commission and Hawaiʻi County Council due to the filing of the change of zone request in early 1984.

Subsequent to these approvals, however, the County Council approved a slate of interim amendments to the CDP on September 18, 2019 that emphasized the CDP as providing a framework of guidance policies towards future development within the North Kona district rather than a series of mandates that actually hindered development in specific locations rather than promoting reasonable approaches to such development that in the end, accomplishes the very intent of what the CDP was attempting to achieve in the first place.

Regardless, the Applicant offers the following discussion that demonstrates consistency of its time extension and roadway condition amendment requests with the KCDP:

- <u>Consistency with the General Plan LUPAG map of Urban Expansion and Low Density Urban</u>.

  The LUPAG map identifies the subject properties and its immediately adjacent area as "*Urban Expansion Area"* and "*Low Density Urban*".

  "Urban Expansion Area" allows for a mix of high density, medium density, low density, industrial, industrial-commercial and/or open designations in areas where new settlements may be desirable, but where the specific settlement pattern and mix of uses have not yet been determined. "Low Density Urban" allows for residential, with ancillary community and public uses, and neighborhood and convenience-type commercial uses with an overall residential density of up to six units per acre. The existing RM-5 zoning of the subject properties and the proposed 450-unit Royal Vistas multiple family residential project, if allowed to proceed, will establish a land use pattern consistent with the both the urban expansion and low density pattern recommended by the General Plan as well as with the residential neighborhoods that characterize this part of North Kona along the Queen Kaʻahumanu Highway and Kuakini Highway.

  Speaking practically, the RM-5 zoning of the subject properties is appropriate given the design constraints of both the Horseshoe Bend and Holualoa drainage ways that borders and bisects the 68.837-acre project site. Placing residential units within multiple family residential structures allows for better siting opportunities while reducing the overall extent of land altering activities typically associated with single family residential lots.

- <u>Consistency with the General Plan goals, policies, and standards relative to the land use and housing elements</u>.

  The approved RM-5 zoning, and the proposed development of the 450-unit Royal Vistas multiple family housing project, would also be consistent with the goals, policies, and standards of the Housing and Land Use Elements of the General Plan, as it was determined in 1984 with the approval of the zoning by the Hawaiʻi County Council. The proposed project will increase the overall housing stock adjacent to established residential communities along with appropriate infrastructure that both support and facilitate the housing and transportation needs for this particular area.

More specifically to the Housing element, the more pertinent goals and policies follow:

Housing

Goals

- *Attain a diversity of socio-economic housing mix throughout the different parts of the County.*
- *Maintain a housing supply which allows a variety of choice.*
- *Develop better places to live in Hawaii County by creating viable communities with decent housing and suitable living environments for our people.*
- *Improve and maintain the quality and affordability of the existing housing stock.*
- *Seek sufficient production of new affordable rental and fee-simple housing in the County in a variety of sizes to satisfactorily accommodate the needs and desires of families and individuals.*

Policies

- *Increase rental opportunities and choices in terms of quality, cost, amenity, style and size of housing, especially for low and moderate income households.*

- Appropriate infrastructure such as water, wastewater, and access are available or will be constructed by the Applicant to support the proposed 450-unit multiple family housing project.

  As noted earlier, County water has already been paid for and is available for the project; the project will connect to the County's sewer system; and access to the site and adjoining residential communities will eventually be enhanced as two north-south minor collector alignments within the project site, as identified within the KCDP, will be constructed, leaving relatively small undeveloped segments between the project site and Pualani Estates to the north and Kona Vistas subdivision to the south. Within the project site, a new fully-channelized access point at Queen Kaahumanu Highway will be constructed to provide primary access to Phase I, with an eventual connection of Phase II with Kekuana'oa Street within Kona Vistas subdivision to provide access to Lako Street.

Kona Community Development Plan

The Kona Community Development Plan ("KCDP") became effective on September 10, 2008 (Ordinance No. 08 116) and was not considered during the course of review of this rezoning action by the Planning Department, the Planning Commission and Hawaiʻi County Council due to the filing of the request in 1984.

Subsequent to these approvals, however, the County Council approved a slate of interim amendments to the KCDP on September 18, 2019 that emphasized the KCDP as providing a framework of guidance policies towards future development within the North Kona district rather than a series of mandates that actually hindered development in specific locations rather than promoting reasonable approaches to such development that will satisfy some of the guiding principles of the KCDP to:

- Provide connectivity and transportation choices;
- Provide housing choices;
- Provide infrastructure and essential facilities concurrent with growth; and to
- Promote effective governance.

Regardless, the Applicant offers the following discussion that demonstrates consistency of its time extension and roadway condition amendment requests with the KCDP.

The subject properties are situated within the Kona Urban Area ("KUA") but is not situated within any Transit Oriented Development (TOD) area as shown on Figure 7 – KCDP Official Transportation Network Map-Nani Kailua Area. Furthermore, the subject properties are not situated within a Concurrency Zone. These findings were confirmed and accepted by the Planning Department as the accepting authority for the Final Environmental Assessment - Royal Vistas Housing Project dated September 2021.

The subject properties with their current RM-5 zoning, as well as this request for a time extension to complete the proposed multiple family housing project that has been a part of a much larger residential project covering more than 171 acres and underway for more than 37 years, should be functionally classified as "Infill" pursuant to Policy LU-2.8 that provides guidelines for rezoning actions and time extensions for properties outside of a TOD area but within the KUA. The guidelines and their relationship to the subject site/request are:

a. *Consistency with the LUPAG map*. The project site's existing RM-5 zoning, and its request for an extension of time to complete the proposed 450-unit multiple family housing project, will continue to fall within the area designated for *Urban Expansion* and *Low Density Urban* uses.

b. *Infill.* The project site is designated *Urban* on the State Land Use map. The subject property is situated adjacent to the north of the established 215-unit Kona Vistas subdivision, which is part of the original land use entitlements issued in 1984 that supported the residential development of this part of North Kona. Just one lot away to the north is Pualani Estates, a subdivision of more than 360 homes. Iolani subdivision and other smaller subdivisions lie immediately to the east (mauka) of the proposed Royal Vistas project site. As such, this area satisfies the concept of "infill" by linking together the established residential communities adjacent to the north, south and east of the subject properties. This can be no better demonstrated than the proposed extension of Kekuanaʻoa Place within Kona Vistas through the project site as well as the construction of the Leilani Street alignment, both of which will help to facilitate the interconnection of roadways within Pualani Estates to the north and Kona Vistas subdivision to the south, which clearly justifies the existing RM-5 zoning of the subject property, and its continued development through the approval of the requested time extensions as "infill".

c. *Greenfields Rezoning*. This is not applicable, as by virtue of the previous RM-5 zoning action prior to the adoption of the Kona CDP as well as the comments noted in "b" above, the subject site should not trigger a need to amend the KCDP.

By its letter dated September 1, 2017, the Planning Director confirmed that the proposed Royal Vistas multiple family housing project is consistent with the subject property's RM-5 zoning. The Planning Director also noted that according to the Official Kona Land Use Map (Figure 4-7) in the KCDP, the western portion of the project site is situated in the Puaʻa-Waiʻaha Village Transit Oriented Development (TOD) Floating Zone. The Director confirmed that location of this TOD has not yet become fixed by a master plan and project district zoning; however, it is likely that the future TOD will be located makai of Queen Kaʻahumanu Highway and mauka of Kuakini Highway. Therefore, the Planning Director determined that the subject properties are not located in the TOD.

The requested amendments to Ordinance 02 131, in continued support of the proposed 450-unit Royal Vistas multiple family housing project, will be developed in accordance with Policy LU-2.8(1)(b) of the KCDP, which indicates the project may be developed in accordance with the existing zoning, subject to the following requirements:

Policy LU-2.8: Development Outside Transit-Oriented Developments (TODs), but within the Kona Urban Area. Development outside the TODs, but within the Kona UA, may occur as follows:

1. Existing Zoning
   a. TND Overlay. Any project greater than 20 acres on land zoned Single-family residential (RS), Multiple residential (RM), Residential-Commercial Mixed Use (RCX), General Commercial (CG), Village Commercial (CV), or Neighborhood Commercial (CN), shall be permitted to develop as a neighborhood TND following the procedures for a PUD and the Village Design Guidelines.

   b. Non-TND Projects. Any project may be developed in accordance with the existing zoning, subject to the following requirements:
      i. Parks (see Policy PUB-6.2.)
      ii. Affordable Housing. Resale restrictions on affordable units built in compliance with HCC Chapter 11 (see Policy HSG-5.2).
      iii. Street Standards. Connectivity standards (see Policy TRAN-2.1), street standards (see Policy TRAN-3.1), and traffic calming standards (see Policy TRAN-3.7).
      iv. Wastewater. Priority sewer area (see Policy PUB-4.4).
      v. Sensitive Resources. Survey of potential sensitive resources (see Policy ENV-1.5).

   Applicant's response: As confirmed by the Planning Director by its letter dated September 1, 2017, the proposed Royal Vistas multiple family housing project may be developed as a non-TND project in accordance with its existing zoning, subject to the requirements of Policy LU-2.8, which the Applicant discusses in further detail below.

Policy PUB–6.2: Active Recreation Opportunities. A range of recreational opportunities should be provided to encourage physical activity and interaction among toddlers, youth, teens, adults, and seniors, including, without limitation the following:

(a) Regional park (minimum 50 acres)—New regional park at Kealakehe as shown on the Public Facilities Plan to include playfields, multi-purpose building (e.g., gymnasium)
(b) Kona Civic Auditorium or Performing Arts Center. Facility to provide a venue for major entertainment, social, cultural, and performing arts opportunities.
(c) District park (10-30 acres)—Upgrade the Old Airport Park to enhance the playfields, swimming pool, multi-purpose building, courts (basketball, tennis, volleyball), tot lots, fitness area, pet area, and skateboard area; locate a district park to service South Kona to include playfields, multi-purpose use building (e.g., community/senior center, gym), and a tot lot.

(d) Community parks (4-8 acres)—A community park should be located 2 miles apart within the Urban Area to include, at a minimum, playfields and a restroom, as designated in the Public Facilities Plan to provide adequate playfields for youth leagues; multi-purpose use of school playgrounds should be candidates for these types of parks.
(e) Neighborhood parks (up to 4 acres) – A neighborhood park (including community gardens, community centers, pocket parks, and pet parks) should be located ½ mile apart [for] subdivisions within the Urban Area. Subdividers shall provide for private maintenance or pay a fee pursuant to HCC Chapter 8 when required to provide neighborhood parks.

Applicant's response: The project site is situated within the Kona Urban Area, which contains a number of regional, district and community recreational facilities that are able to provide for the recreational needs of residents within the proposed project. Such existing recreational facilities within the Kailua-Kona area include:

Active Recreational facilities:
- *Old Kona Airport Park complex,*
- *Kekuaokalani Gym-Park complex*
- *Community park at Pualani Estates*

Beach Park facilities
- *Waiʻaha (Honls) Beach Park*
- *Kahaluʻu Beach Park*
- *Magic Sands (Laʻaloa) Beach Park*
- *Pāhoehoe Beach Park*

Camping Sites
- *Kohanaiki Beach Park*

Two neighborhood parks, each containing a swimming pool, will be included as part of the two community centers that will be provided for the residents of this proposed community.

Policy HSG-5.2: Privately-Constructed Affordable Units. For private projects subject to affordable housing requirements, the Kona Housing Non-Profit or other non-profit shall have a first right of refusal to 10% of the required affordable units. All affordable units shall remain affordable for 40 years. No restrictions may apply after 40 years based on the rationale that newer homes will replace these older homes in the affordable housing stock. During the resale-restricted period, the level of restriction shall meet the following minimum requirements:

- 1st 20 years: The affordable units shall have a minimum 20-year controlled appreciation restriction (cost of improvements plus appreciation based on the Honolulu Consumer Price Index;
- After 20 years: The owner may sell the property at market value with a shared appreciation with the County or Kona Housing Non-Profit at 50%;
- Right of First Refusal: After 20-years, the Kona Housing Non-Profit shall have the right of first refusal to purchase the unit;
- Owner-occupancy: During the resale-restricted period, affordable units shall remain owner occupied or rented out by the owner at an affordable rate as certified by the County real property tax division pursuant to the affordable rent provisions in HCC Chapter 19.

Applicant's response: The Applicant has acquired 67 affordable housing credits via an exchange for land associated with the creation of a new 100-unit affordable rental project above Lowes on land that the Applicant will donate to a qualified affordable housing developer. This most recent affordable housing Agreement, attached as Exhibit D-Affordable Housing Agreement, between the Applicant and OHCD was executed on January 10, 2022 in satisfaction of Condition K of Ordinance 02 131 and Policy HSG-5.2.

Policy TRAN-2.1: Connectivity Standards. Connectivity refers to the directness of links and the density of connections that make up the transportation network. Within the Kona Urban Area (UA) new development shall contribute to this interconnected transportation network of streets, pedestrian, and bicycle access that work to disperse traffic and connect and integrate new development with the existing fabric of the community. Proposals for new development or redevelopment within Kona's UA should meet the following connectivity standards:

2. Connection to Adjoining Development. The road system for new development shall contribute to the local transportation network. To supplement HCC Section 23-40, at a minimum, new subdivisions shall incorporate and continue all collector streets, and selected local streets to adjoining property. If a portion of the stub-out is not improved, the current developer shall improve the stub-out portion, where practicable. Connection to adjoining properties may not be required if seriously constrained by topography or other physical hindrances, or in cases where through travel cannot occur because the property is bounded by development with private streets previously allowed.

Applicant's response: The Applicant will satisfy the requirements of Policy TRAN-2.1 via the construction of alignments within the project site that will provide for the future connectivity between the proposed Royal Vistas multiple family housing project and the existing Kona Vistas and Pualani Estates subdivisions as *shown on <u>Figure 6 – Conceptual Master Plan for Royal Vistas. The proposed interconnecting road alignments include:</u>*

- *In Phase I, construct that segment of the Leilani Street extension situated within the project site. This segment will stub-out the Leilani Street extension on the southern project site boundary and will not connect it across the private adjoining parcel (TMK 7-6-021:014) owned by the Calvary Community Church of Kona.*

- *In Phase I, construct that segment of Kekuanaʻoa Place extension situated within the project site.*

- *In Phase I, construct a mauka-makai roadway connecting both the Leilani Street and Kekuanaʻoa Place extensions.*

- *In Phase II, extend Kekuanaʻoa Place from its existing terminus in Kona Vistas subdivision northward to connect with the Kekuanaʻoa Place alignment within the project site constructed in Phase I.*

- *None of the roads proposed for the project will connect to Hoʻomama Street or Paulehia Street in Pualani Estates due to an intervening privately-owned parcel (TMK 7-6-013:004).*

<u>Policy TRAN–3.1: Street Standards</u>. County street standards should be pedestrian-friendly, safely accommodate bicycles, accessible to the disabled, and appropriate for its surrounding land use context.

<u>Applicant's response</u>: The Applicant will satisfy the requirements of Policy TRAN-3.1 by constructing all connector roadways within the project to County-dedicable standards that will include the construction of sidewalks along these roadways, as shown on <u>Figure 6 – Conceptual Master Plan for Royal Vistas</u>, in compliance with Condition N of Ordinance 02 131, as requested to be amended.

<u>Policy TRAN–3.7: Traffic Calming Standards</u>. In order to slow traffic for pedestrian safety or comfort, standards for traffic calming should be included, as part of the County of Hawaiʻi Street Standards.

<u>Applicant's response</u>: Per Condition N, the Applicant must construct all minor collector roadways within the proposed project to County-dedicable standards. The only permissible traffic-calming device that could be considered within the dedicable roadways could be speed humps, which have been utilized within County roads in selected locations throughout the island.

However, the uses of internal driveways providing direct access from these minor collector roadways to the individual multiple family residential housing units do, *but its inherent narrow design, already provides for traffic calming throughout most of the project site.*

Objective TRAN-2 Street Network Connectivity.

With the proposed construction of roadway extensions through the project site that will help to facilitate the interconnection of roadway networks within Kona Vistas and Pualani Estates subdivision that lie on either side of the project site, the proposed subdivision adheres to an objective of the CDP to develop a system of interconnected roads within Kona that will provide alternative transportation routes that will disperse automobile trips and reduce their length, while not compromising the through functions of arterials and major collectors with excessive intersections. Such interconnections will also serve to:

- *(a) provide safe choices for drivers, bicyclists, and pedestrians;*
- *(b) promote walking and bicycling;*
- *(c) connect neighborhoods to each other and to popular destinations, such as parks, among others;*
- *(d) provide opportunities for residents to increase their level of physical activity each day by creating walkable neighborhoods with adequate connections to destinations;*
- *(e) reduce vehicle miles traveled and travel time, thus improving air quality and mitigating the effects of auto emissions on the health of residents and the environment;*
- *(f) reduce emergency response times;*
- *(g) increase effectiveness of municipal service delivery;*
- *(h) restores arterial street capacity to better serve regional long-distance travel needs; and*
- *(i) provide increased emergency evacuation opportunities.*

Policy PUB–4.4: Sewer Priorities. In order to protect the nearshore water quality, the requirement to hookup to the County sewer system (HCC Section 21-5) shall be strictly enforced. The highest priority in expanding the sewer system within the Kona Urban Area shall be to service any shoreline properties that do not have access to a public sewer system and then to service lots within approximately 1 mile of the shoreline. Any new subdivision within 1 mile of shoreline within the Kona Urban Area shall either hookup to the public sewer system, or provide a private treatment system, and/or install dry sewers (see Figure 4-10c Official Public Facilities and Services Map-Waste Management). Private wastewater collection systems within the 1 mile zone shall be designed and constructed to County standards to enable potential connection to County sewer system. The County shall ensure that TODs can be served by the public sewer system in a timely manner.

Applicant's response: The entire 450-unit Royal Vistas multiple family housing project will be connected to the County's sewer system.

Policy ENV–1.5: Sensitive Resources. In the context of Kona's ecology and history, the following natural and cultural resources shall be considered sensitive and therefore shall be inventoried, as part of any permit application to the County Planning Department (see Figures 4-8a to 4-8d):

- Critical habitat areas as identified by the U.S. Fish & Wildlife or County General Plan;
- Predominantly native ecosystems, which may not be considered endangered but are valued because of their nearly pristine condition;
- Anchialine ponds subject to a management Program addressed in Policy ENV-1.10: Non-Degradation of Anchialine Ponds;
- High-level groundwater recharge area which shall initially be defined as all lands mauka of the 1,500 foot elevation and which may be refined by the Kona Mauka Watershed Management Program;
- Historic trails;
- Archaeological and historic sites subject to protection under HRS Chapter 6E; and,
- Enhanced Shoreline Setback (see Policy LU-1.5).

Any permit application that encompasses any of the above resources shall incorporate these resources as assets. If a proposed project will have significant, unavoidable, adverse impacts to any of the above resources, the presumption shall be denial of the application and the applicant will have the burden of explaining any overriding considerations. The presence of any of these resources shall qualify for density transfers through a planned unit development based on potential gross density allowed by the prevailing zoning. The protection or restoration of any of these resources should qualify for funding from the Kona Treasures Fund (see Policy ENV-3.3).

Applicant's response: The subject properties are not situated within an area identified as the Kona Mauka Watershed Planning Area (Figure 4-8a) due to its location within the Kona Urban Area. Regardless, the proposed project will be connected to the County's sewer system to avoid direct impacts upon the County's groundwater resources. Also due to its location within the Kona Urban Area and below the 1,500-foot elevation, as well as supported by the biological survey, the subject properties are not situated within a critical habitat area nor does it consist of predominantly native or endangered ecosystem.

The subject properties are located about 4,200 feet from the shoreline, and will not have any direct effect upon the shoreline or coastal processes.

The Final Environmental Assessment for the Royal Vistas Housing Project (Exhibit D-Royal Vistas Housing Project FEA-FONSI) found that, "no threatened or endangered plant species as listed by the USFWS appear to be present in the Project Site, nor are there uniquely valuable habitats. No existing or proposed *federally designated critical plant (or animal) habitat is present in the Project Site. There appears to be no potential to adversely affect rare, threatened, or endangered plant species. Royal Vistas Housing Project Environmental Assessment 33 Although existing vegetation would be cleared during Project construction activities including grading, the plants that would be removed are all non-native. Landscaping is an important aspect for housing developments both for residents' experience and property value. The Proposed Project would plant new vegetation as part of landscaping following Project construction. As requested in an early consultation letter from DLNR, Kona Three would plant native or noninvasive trees as part of landscaping for the Proposed Project." Cumulatively, its findings also noted that "Past, present, and reasonably foreseeable future projects in the vicinity have impacted biological resources through alteration of the landscape through introduction of weeds, removal of native vegetation, and loss of habitat for native wildlife species. Impacts to biological resources from the Proposed Project would be minor, due to the limited number of native species present at the Project Site and the protection measures outlined to avoid impacts to Federally-listed species and prevent spread of non-native weeds. Therefore, the cumulative impacts of the Proposed Project in combination with past, present, and reasonably foreseeable future actions are expected to be minor."*

<u>Concurrency</u>

The subject properties are not situated within a concurrency zone as depicted in Figure 4-3–Official Concurrency Map of the KCDP. However, the Applicant commissioned SSFM International to prepare an updated Traffic Impact Analysis Report (TIAR) dated November 2021 for the proposed 450-unit multiple family housing project that is included as Appendix 2 of the FEA, and updated on November 30, 2021 in conformance with Section 25-2-46 of the Zoning Code regarding Concurrency and included with this report as <u>Exhibit G – Royal Vistas Updated TIAR</u>.

In response to comments from residents of the existing single-family residential communities of Kona Vistas and Pualani Estates, the Applicant moved the access for Phase I from Kekuanaʻoa Place to the Queen Kaʻahumanu Highway via a new un-signalized intersection in an effort to reduce and delay traffic impacts on the Lako Street/Queen Kaʻahumanu Highway intersection as well as traffic on Kekuanaʻoa Place. This direct access for Phase I onto the Queen Kaʻahumanu Highway was analyzed by the TIAR.

In summary, the study assumes that Phase I of the Royal Vistas multiple family housing project will be completed by 2024, with all trips generated by the 258 units within this phase entering and exiting at the proposed Royal Vistas roadway and distributed onto the Queen Kaʻahumanu Highway (Route 11) via an unsignalized and channelized intersection.

The study further assumes that the development of Phase II, consisting of the remaining 192 units, will be completed by 2029 along with the connection of Phase II through Kekuanaʻoa Place to Lako Street.

At anticipated build-out of Phase II in 2029, along with its connection to Kekuanaʻoa Place, the segment of Queen Kaʻahumanu Highway between Lako Street and Hualalai Road is anticipated to operate at Level of Service (LOS) C in the northbound direction and LOS C in the southbound direction during both AM and PM peak hours, and found to be providing an "acceptable level of service" according to the concurrency requirements of the Zoning Code.

The study then analyzed each project phase build-out during peak AM and PM hours and its effects on forty-seven (47) turning movements at eight (8) intersections along the Queen Kaʻahumanu Highway-Kuakini Highway (Route 11) alignment extending from Palani Road to the north to Kamehameha III Road to the south of the project site plus the effect on the main road segment "Route 11". Five of these existing intersections are signalized, and three of them are Two Way Stop Controlled ("TWSC") intersections. Overall, the proposed project is not anticipated to have a significant adverse impact to the existing level of service at these various intersections above the background rate.

Each transportation facility (State and County highways, roads, and public transportation facilities) uses defined performance measures for assessing capacity and levels of service, and for each facility type, one or more of the stated performance measures serves as the primary determinant of level of service ("LOS"). This LOS-determining parameter is called the Measure of Effectiveness ("MOE") for each facility type.

LOS is defined in HCC Section 25-2-46(c) as "Level of Service, or "LOS", means a qualitative measure describing operational conditions within a traffic stream, and shall be determined using the procedures in the latest edition of the "Highway Capacity Manual, Transportation Research Board."

For signalized intersections, the MOE procedure used is the Overall LOS, which measures "delay". The Overall LOS is determined by calculating the average control delay per vehicle. Once delays have been estimated for each lane group and aggregated for each approach and the intersection as a whole, then the appropriate LOS is determined using the Signalized Intersections Delay Chart, which specifies the time delay as letters A-F, with increasing time delays associated with each letter.

For TWSC intersections, the MOE procedure used includes both LOS and v/c measures. LOS for a TWSC intersection is determined by the measured control delay (see “LOS Criteria for Unsignalized Intersections” in Manual) and is defined for each movement, expressed as A through F. LOS is not defined for the intersection as a whole for TWSC intersections.

Vehicles travelling along the major, free flow road (Route 11 in this case) of a TWSC intersection proceed with minimal or no delay at all. Those vehicles approaching the intersection along the minor movement are controlled by a stop sign and thus experience delay attributable to the volume of vehicles passing along the free-flow road and the traffic gaps available. A traffic movement can have a poor LOS but low v/c, which suggests the traffic volumes along that movement are low but must wait a long time to make the movement. These movements affect fewer vehicles and are on the minor movements.

As stated in the manual “In evaluating the overall performance of TWSC intersections it is important to consider measures of effectiveness in addition to delay, such as v/c ratios---” and “By focusing on a single measure of effectiveness for the worst movement only, such as delay for the minor-street left turn, users may make less effective traffic control decisions.”

The v/c MOE measures the volume (v) to capacity (c), and expresses the ratio of the volume of traffic utilizing the TWSC intersection to the maximum volume of vehicles that can be accommodated by the intersection during a specific period. A v/c ratio under 0.85 means the intersection is operating under capacity and excessive delays are not experienced. An intersection is operating near its capacity when v/c ratios range from 0.85-0.95. Unstable flows are expected when the v/c ratio is between 0.95 and 1.0.

The study concluded that two of the TWSC traffic movements are problematic. Hualalai Road (N)’s East Bound Left turn movement currently operates at LOS “F” for both the LOS and the v/c MOE’s during the AM study period, and will continue to do so during the five-year study period.

Route 11 at Kuakini Highway’s North Bound left turn PM movement currently is LOS “E” and will stay LOS “E” for both the LOS and the v/c MOE’s during the five-year study period.

Nevertheless, with or without the proposed project, certain turning movements at the following intersections are or will be experiencing unacceptable levels of service (LOS E and F) upon completion of Phase I anticipated in 2024:

1. Queen Kaʻahumanu Highway and Henry Street signalized intersection
    a. Westbound left turn movement onto highway at LOS E due to signal timing, which can be adjusted to reduce approach delay.

2. Queen Kaʻahumanu Highway and Hualalai Road (North) unsignalized intersection
   a. Eastbound left turn movement onto highway at LOS F during both AM and PM peak hours to due high traffic volume on Queen Kaʻahumanu Highway.

3. Queen Kaʻahumanu Highway and Hualalai Road (South) unsignalized intersection
   a. Westbound left turning movement at LOS F during both AM and PM peak hours to due high traffic volume on Queen Kaʻahumanu Highway.

4. Queen Kaʻahumanu Highway at Royal Vistas roadway unsignalized intersection
   a. Westbound left turn onto highway at LOS F during AM peak hour due to high volumes along the Queen Kaʻahumanu Highway.

5. Queen Kaʻahumanu Highway and Kuakini Highway unsignalized intersection
   a. Northbound left onto Kuakini Highway at LOS E during peak PM hour.

6. Queen Kaʻahumanu Highway and Lako Street signalized intersection
   a. Eastbound left turn onto highway at LOS F during AM peak hour and LOS E at PM peak hour.
   b. Westbound left turn onto highway at LOS E during both AM and PM peak hours due to traffic volumes and split phasing for the Lako Street approaches.

The study concludes that none of the unsignalized intersections satisfy the Peak Hour Warrant for a traffic signal. The Queen Kaʻahumanu Highway and Kuakini Highway intersection will satisfy the Peak Hour Warrant in 2024. The satisfaction of a traffic warrant does not require the installation of a traffic control signal and none is recommended by the study.

Widening of Queen Kaʻahumanu Highway in the vicinity of Lako Street is needed in 2024 to provide for 4 lanes and a permissive left-turn phasing onto Lako Street.

Upon completion of Phase II anticipated in 2029, the increase in background traffic and traffic generated by the proposed project will further reduce the LOS at several of the intersections described above, with the addition of the Queen Kaʻahumanu Highway and Puapuaʻanui Street intersection that will experience LOS E for left turns during both the AM and PM peak hours due to cycle length. Left turn volumes at this intersection are low, however, and should clear every cycle.

The TIAR recommended that based on the existing traffic volumes and future projections of Royal Vistas on the surrounding roadways, the Queen Kaʻahumanu Highway and Lako Street intersection and some individual movements at other intersections are expected to deteriorate to LOS E or worse. The widening of Queen

Kaʻahumanu Highway to 4-lanes, and the completion of Aliʻi Highway is needed to increase the north-south regional capacity. In the interim, the following system-wide intersection improvements are recommended for consideration by Hawaii County and HDOT:

1. Queen Kaʻahumanu Highway and Palani Road
   Existing and future analysis indicate this intersection will operate at an acceptable LOS. Improvements to this intersection are not recommended at this time.

2. Queen Kaʻahumanu Highway and Henry Street
   Existing and future analysis indicate this intersection will operate at an acceptable LOS. Improvements to this intersection are not recommended at this time.

3. Queen Kaʻahumanu Highway and Hualalai Road (North)
   This intersection does not pass the Four-Hour warrant or peak hour warrant for any condition. The high delay is due to the high volume on the Queen Kaʻahumanu Highway. There are 44 vehicles and 10 vehicles making the westbound left turn in the AM and PM peak hours, respectively. When the delay experienced by drivers reaches this level, the eastbound drivers are likely to find alternative routes. A single lane roundabout will improve traffic operations at this intersection for the existing condition but worsen to LOS F after 2024. A roundabout is not recommended at this intersection.

4. Queen Kaʻahumanu Highway and Hualalai Road (South)
   As the westbound left turn delay gets worse, drivers may decide to use Puapuaʻanui Street to access the Queen Kaʻahumanu Highway in the southbound direction. This intersection did not pass the Four-Hour warrant or the Peak-Hour warrant for the existing or future conditions. Based on existing traffic operations, it is recommended an acceleration lane be installed for the westbound right turn onto the Queen Kaʻahumanu Highway. A single-lane roundabout will improve traffic operations at this intersection for the existing condition but worsen to LOS F after 2024. A roundabout is not recommended at this intersection.

5. Queen Kaʻahumanu Highway and Puapuaanui Street
   Signal timing should be monitored and adjusted as needed to increase the probability that queues on Queen Kaʻahumanu Highway can clear the intersection in 1 cycle.

6. Queen Kaʻahumanu Highway and Royal Vistas Roadway
   This intersection will function acceptably through the full Phase 1 buildout. Before any Phase 2 residences are occupied, it is recommended that the connection to Kekuanao'a Place is completed so that Royal Vistas Phase 2 'left out' traffic can access the Lako Street traffic signal.

7. Queen Kaʻahumanu Highway and Kuakini Highway
   This intersection passes the Peak-Hour warrant during all peak hours for all conditions. The satisfaction of a traffic signal does not mean a traffic signal needs to be installed. There are other factors that should be analyzed when installing a traffic signal, such as roadway geometry, added delay to a traffic network, and the impact of rear-end accidents that occur at new traffic signals. Analysis of this intersection with various phasing showed that the overall delay at the intersection would increase, while the northbound left turn will still operate at LOS E or worse. A traffic signal should not be installed at this intersection. Royal Vistas traffic has very little effect on this intersection. A single-lane roundabout will operate at LOS F for the existing AM peak hour condition, and LOS F for all future conditions. A roundabout is not recommended at this intersection.

8. Queen Kaʻahumanu Highway and Lako Street
   The Lako Street intersection operates at LOS E/D (AM/PM) with or without the Royal Vistas project in the 2039 condition. Lako Street currently has split phasing (sequential rather than concurrent) on the Lako Street approaches. Changing the phasing from split would help lower the delay, although several movements will still operate at LOS E or worse. This intersection would also improve significantly with more north-south regional capacity provided by the completion of the widening of Queen Kaʻahumanu Highway from Henry Street to Kamehameha III Road and the construction of Aliʻi Highway.

9. Queen Kaʻahumanu Highway and Kamehameha III Road
   Existing and future analysis indicate this intersection will operate at an acceptable LOS. Improvements to this intersection are not recommended at this time.

Section 25-2-46 of the Zoning Code regarding Concurrency Requirements states the following:

(e) Mitigation required.
   (1) If the LOS for any transportation facility in the project area is (A) currently worse than the acceptable level of service, or (B) projected to become worse than the acceptable level of service during the five year period of the TIAR, any rezoning of the property, if approved, shall contain conditions that require mitigation of adverse traffic effects before occupancy of the project is permitted, or that occupancy be delayed until the level of service has reached the acceptable level and is no longer projected to be worse than the acceptable level.

   (2) Where the LOS deficiency is due to roadway or intersection deficiencies in the immediate vicinity of the project, the conditions of zoning shall require local mitigation. Where the deficiency in LOS is due to

insufficient capacity in the transportation facilities serving the project area, the conditions of zoning shall require area mitigation.

As no transportation facility in the Project area is currently worse than the acceptable level of service, nor is projected to become worse than the acceptable level of service during the five-year period of the TIAR, no mitigation is required.

The Final Environmental Assessment (FEA) for the Royal Vistas Housing Project dated September 2021 and the Planning Department's issuance of a Finding of No Significant Impact (FONSI) supports the conclusion that the "*Potential impacts to the Kona Vistas subdivision would be alleviated by constructing the Royal Vistas Roadway intersection with Queen Kaʻahumanu Highway. Also, the traffic impact analysis shows no impacts to LOS from the Project above the background rate to the intersection of Queen Kaʻahumanu Highway and Lako Street which is the main entrance to the neighboring Kona Vistas subdivision.*"

Both the FEA and FONSI also recognizes "…*the extension of Kekuanaʻoa Street, and the construction of that portion of the Leilani Street extension within the project site to be stubbed-out on the south boundary at the Calvary Church property between the Project and Kona Vistas, and one new road would be constructed (Royal Vistas Roadway). All would be dedicated to the County as part of the Proposed Project. Based on comments received on the Draft EA on potential impacts to traffic from the connector roads (Appendix 1b), Figure 3 shows the location and phasing of these connector roads. While Figure 11 from the Kona CDP shows connector roads connecting County-owned Leilani Street (in the Kona Vistas project) to County-owned Hoʻomama Street (in the Pualani Estates project) and Kekuanaʻoa Place (in the Kona Vistas project) to County-owned Paulehia Street (in the Pualani Estates project), these connections would not be built as part of the Proposed Project. Additionally, no mauka-makai connector roads from Hualalai Road to Queen Kaʻahumanu Highway are proposed as part of the Proposed Project. <u>Therefore, the Proposed Project would have no effect to neighbors in adjacent subdivisions from Phase I, and only minimal impacts after Phase II.</u>"* (emphasis added)

County water for the project is still available, and the Applicant has maintained its current commitment deposit. The proposed project will also connect to the County's wastewater system that services the Kailua-Kona area. Attempts to contact the Hawaiʻi Emergency Management Agency (HIEMA) to confirm the location of existing operational civil defense sirens within the immediate area of the project site were unsuccessful. Should HIEMA or Hawaiʻi County Civil Defense Agency require an additional siren to be situated within the proposed project to provide for adequate coverage, the Applicant will comply.

C. ***Granting of the time extension would not be contrary to the original reasons for the granting of the change of zone.***

Approval of the requested time extensions to secure Final Plan Approval for the proposed 450-unit multiple family housing project and to commence and complete its construction within a period of ten (10) years will remain consistent with the original reasons for its approval in 1984, as well as demonstrated in discussions throughout this report as it pertains to consistency with the KCDP. In summary, the Applicant finds that approval of its amendment requests will be:

- Consistent with the General Plan LUPAG map of Urban Expansion Area and Low Density Urban.
- Consistency with the General Plan goals, policies, and standards relative to the housing and land use elements.
- Appropriate infrastructure such as water, wastewater, and access are or will be made available.
- No irresolvable issues relating to drainage, botanical, or avifaunal.
- Having appropriate archaeological/cultural safeguards or completing appropriate mitigation measures.

It is thus maintained that the reasons used to support the existing zoning back in 1984 still apply to the requested time extensions and amendment. It should be noted, however, that since the RM-5 zoning was approved in 1984, there have been two (2) substantive changes to the Zoning Code that relate to project of this nature.

One was the adoption of the Kona Community Development Plan in 2008, for which compliance has been extensively discussed earlier in this report.

The other was the adoption of the concurrency provision, Section 25-2-46. That provision requires that all rezoning, including time extension, address traffic, potable water, and civil defense siren concerns. And as discussed earlier, the project meets these tests.

The other provision relates to allowance and management of Short-Term Vacation Rental ("STVR") in certain areas as outlined in Section 25-4-16 of the Zoning Code. The subject properties are not situated within an area designated for Resort uses or as a Resort Node. Therefore, STVRs may be permitted within the "For Sale" units within the proposed 450-unit multiple family housing project provided that these "For Sale" units are part of a condominium property regime as defined and governed by Chapters 514A or 514B, Hawaii Revised Statutes.

Coastal Zone Management

Due to the location of the subject properties outside of the Special Management Area (SMA) and about 4,400 feet from the nearest shoreline, and the improvements and mitigation measures to be undertaken during the development of the project, the Applicant finds that granting of the requested time extensions and requested clarification regarding roadway improvements will not have any substantial adverse impacts on coastal processes or conditions, nor will its approval be contrary to the objectives and polices of Chapter 205A, HRS relating to Coastal Zone Management.

The proposed action will not create significant adverse impacts upon nearby and immediately adjacent properties nor the important coastal resources within this part of North Kona. The proposed 450-unit Royal Vistas multiple family housing project is the final component of a 171±-acre single- and multiple-family residential community that was approved by both the State Land Use Commission and Hawaiʻi County Council in 1984. The project site is situated within the Kona Urban Area that is specifically designated to direct future growth and to promote infill of areas adjacent to existing developments. As mentioned, the project site is situated immediately adjacent to or just one lot away from the existing single family residential communities of Kona Vistas, Pualani Estates and Iolani subdivisions. As traffic is frequently the prevailing concern of any proposed development, the project will assist in facilitating the interconnection of these existing communities through the construction of north-south and mauka-makai roadway segments within the project site that will align with existing roadways within both Kona Vistas and Pualani Estate subdivision. The development of Kona Vistas subdivision and Lako Street now provides an important mauka-makai link between Iolani Subdivision and Kuakini Highway. This same form of roadway networking, as promoted by the KCDP, will be facilitated by the approval of the requested time extensions.

While the subject properties are currently vacant, it was part of the Kona Field System and was likely used for commercial and subsistence agriculture as well as for cattle pasture until the mid-1800. There appears to be evidence that the subject properties were bulldozed sometime around the 1950s through the 1970s in preparation for commercial agriculture.

Based on the historical use and biological environment of the subject properties, for which studies were prepared and included as part of the FEA, no threatened or endangered plant species as listed by the USFWS appear to be present in the Project Site, nor are there uniquely valuable habitats. No existing or proposed federally designated critical plant (or animal) habitat is present. Therefore, there appears to be no potential to adversely affect rare, threatened, or endangered plant species

The project will connect to the County wastewater system. Any impacts from soil erosion and runoff during site preparation and construction phases can be adequately mitigated through compliance with existing regulations and proper construction practices. Air emissions generated during the construction phase for the proposed project will be mitigated by existing construction regulations. With these precautionary measures in place, the proposed development is not anticipated to have any substantial adverse effects upon nearby coastal resources or the surrounding environment. The Applicant continues to adhere to and implement conditions of approval for the project that will ensure that impacts on coastal resources, if any, are minimized.

An archaeological inventory survey (AIS) was conducted in 1984 for the original 171±-acre project except for a 5-acre portion in the southeastern corner originally intended to be developed by the Hawaii Preparatory Academy. As requested by the State Historic Preservation Division, a new archaeological inventory survey to identify all archaeological historic properties present in the Project Site and an update of the previous archaeological documentation to include site plans for each site with site boundaries and areas impacted by bulldozing, photographs of all sites and features, an assessment of their integrity, and site significance were completed on behalf of the Applicant. These additional survey reports for both the previously excluded 5-acre site and the remainder of the project site including the existing County-owned drainageways were completed in 2018 and 2020, respectively, and included within the 2021 final environmental assessment for the Royal Vistas project. These studies found 18 archaeological sites within the original survey area of the project site, of which 6 sites were determined to be pre-Contact era, 3 sites associated with habitation, 1 with agriculture, a single petroglyph site, and one single feature site (Site 10012) contained two burials. The remaining 12 sites were determined to be historic era, with many of the sites associated with coffee agriculture and cattle ranching, as well as two historic era habitation sites. The other AIS for the 5-acre site found 22 newly identified sites, which were determined to be primarily agricultural terraces associated with pre-Contact area to Historic era agriculture. A pre-Contact era to later post-Contact era lava tube burial and a portion of the old railroad berm were recorded as part of this separate survey.

The two burials (Site 10012) described in the 1984 AIS were removed and reinterred off-project prior to 1984. The site was further excavated to ensure that all *iwi* had been removed, then back-filled and leveled by bulldozer. The preservation plan for the railroad berm and petroglyph sites has been prepared and submitted to the DLNR for review and approval. A burial treatment plan for the lava tube burial within the 5-acre site has already been prepared by the Applicant and approved.

Following implementation of an archaeological preservation plan, there are not expected to be any impacts to historic or archaeological resources from the proposed project. Therefore, no cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions are anticipated to historic or archaeological resources.

A cultural impact assessment (CIA) was prepared in 2020 as made a part of the FEA. The study noted that the region of Hōlualoa was developed into a royal center in the late 1600s to early 1700s under the reigns of Keakamahana (reigned 1680-1700) and Keakealaniwahine (reigned 1700-1720), with many ʻaliʻi and konohiki residences and numerous religious sites known to have existed here. The majority of the heiau and royal residences were constructed along or near the coast, most notably at Kamoa Point south of the project area. The study further noted that this royal center at Hōlualoa was eclipsed in the second half of the 1700s by the royal center in the Kahaluʻu and Keauhou region.

The project area was also a part of the Kona Field System that extends north at least to Kau ahupuaʻa and south to Hōnaunau, west from the coastline and east to the forested slopes of Hualālai. In the post-contact era, the Kona Field System hosted the planting of coffee, sugar, sisal, citrus, and cotton until eventually the land was used for cattle pasture.

As part of the CIA, personal interviews were sought in an effort to provide ethnographic and oral history of the project area. Based on the interviews conducted, the report concludes that "*An analysis of the potential effect of the proposed construction of residences on cultural resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place is a requirement of the OEQC (No. 10, 1997). Based on historical research and responses from the above listed contacts, it is reasonable to conclude that, there would be no traditional cultural practices affected and there would be no direct adverse effect upon cultural practices or beliefs in the broader project area region.*"

In view of the Hawaii State Supreme Court's "PASH" and *"Ka Pa'akai 0 Ka 'Aina"* decisions, the issue relative to native Hawaiian gathering and fishing rights must be addressed. These rights must be addressed in terms of the cultural, historical, and natural resources and the associated traditional and customary practices of the site. Studies prepared in support of the proposed project and the amendment requests found no valuable cultural, historical and natural resources within the subject properties that would support traditional or customary Native Hawaiian rights being practiced on the subject properties. Thus, it is believed that the proposed project would have no adverse impact relative to the cultural and historical resources of the area.

Based on the above findings, the Applicant maintains that allowing for the development of the 450-unit Royal Vistas multiple family housing project and related improvements will not have any substantial adverse impacts on the surrounding area, nor will its approval be contrary to the objectives and policies of Chapter 205A, HRS, relating to Coastal Zone Management.

VIII. SUMMARY OF FINDINGS IN JUSTIFICATION OF REQUESTS

As extensively outlined within this report, the Applicant finds that it has made a substantial commitment of time and resources to comply with all of the conditions of approval of both Ordinance 02 131 immediately upon its purchase of the subject properties at the end of 2015. The scope of the Applicant's requests is limited to an extension of time of ten (10) years to secure Final Plan Approval and to commence and complete construction of the first increment of the proposed project and to amend Condition N to provide clarity on the extent of dedicable roads required to be constructed.

Since its acquisition of the subject properties in late 2015, the Applicant has diligently pursued the development of the 450-unit Royal Vistas mid-market, multiple family housing project as approved by the Hawaiʻi County Council to the extent that the original reasons for granting of Ordinance 02 131 is still relevant and appropriate.

from : LUC

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BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of GAMLON CORP. For Amendment of District Boundary and Reclassification of Certain Lands Situated at North Kona, County, Island and State of Hawaii.	)	DOCKET NO. A83-549

This is to certify that this is a true and correct copy of the Decision and Order on file in the office of the State Land Use Commission, Honolulu Hawaii.

1/26/84 by [signature]

Date Executive Officer

FINDINGS OF FACT, CONCLUSIONS OF LAW AND DECISION AND ORDER

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of GAMLON CORP. For Amendment of District Boundary and Reclassification of Certain Lands Situated at North Kona, County, Island and State of Hawaii.	)	DOCKET NO. A83-549

FINDINGS OF FACT, CONCLUSIONS OF LAW
AND DECISION AND ORDER

Petitioner, GAMLON CORP., a Hawaii corporation, filed the Petition in the above-captioned matter pursuant to Chapter 205, Hawaii Revised Statutes, and the Rules of Practice and Procedure of the Land Use Commission, State of Hawaii, to amend the land use district boundary of certain lands consisting of approximately 173.66 acres, identified as Tax Map Key Nos. 7-6-21:4, 9, 10, 11, 12, 13, 15, 16 and 17 (hereinafter referred to as "subject property") situated in the ahupua'a of Holualoa First and Second, North Kona, County, Island and State of Hawaii, from the Agricultural to the Urban District. The Land Use Commission, having heard and examined the testimony and evidence during the public hearing held on September 8, 1983, in Kailua-Kona, Hawaii, and having considered the entire record filed in this docket, hereby makes the following findings of fact and conclusions of law.

FINDINGS OF FACT

PROCEDURAL MATTERS

1. On May 9, 1983, Gamlon Corp. (hereinafter referred to as "Petitioner") filed this Petition to amend the Agricultural District boundary at Holualoa First and Second, North Kona, County, Island and State of Hawaii, to reclassify the subject property into the Urban District.

2. The Land Use Commission (hereinafter referred to as "Commission") held a public hearing on this Petition on September 8, 1983, in the Resolution Room, Kona Hilton Hotel, Kailua-Kona, Hawaii, pursuant to notice of hearing published in the Honolulu Advertiser and the Hawaii Tribune Herald on August 3, 1983.

3. The Commission received one timely request for intervention on July 20, 1983 from Elizabeth Ann Stone on behalf of the Honest Environmental Citizen's Against Progress, and denied the request in the absence of Ms. Stone at the hearing. The Commission received two untimely requests to appear as public witnesses from James Sogi representing Mr. and Mrs. Roy Nagle, property owners in the area, Maile Akimeseu, representing the Friends of Kamoa Point, Inc., and permitted them to testify as public witnesses.

DESCRIPTION OF SUBJECT PROPERTY

4. The subject property is located mauka of Kuakini Highway approximately 2.6 miles south of the Palani Road - Kuakini

Highway intersection in Kailua-Kona, Hawaii. The subject property is bordered by vacant, undeveloped lands to the north and generally to the east, by the Kalani Sunset, Leilani Sunset, and Kainana Subdivisions to the south, and by the old Kailua-Keauhou Middle Road to the west.

5. With the exception of an undivided interest in five acres of Tax Map Key No. 7-6-21: 17, which is owned in fee simple by Hawaii Preparatory Academy, Kalott Properties N.V., a Netherland-Antilles corporation, a wholly-owned subsidiary of Petitioner, owns all of the subject property. Petitioner holds an option to purchase the subject property from Kalott Properties N.V. Hawaii Preparatory Academy and Kalott Properties N.V. have authorized Petitioner to file this Petition.

6. Hawaii Tax Map Keys Nos. 7-6-21: 14, 18 and 19 are within the general boundary of the subject property but are not being considered for reclassification as a part of this Petition. Parcel 18, owned by the County of Hawaii and the Dillingham Investment Corporation, and Parcel 19, owned by the County of Hawaii, are an existing and proposed drainage way for the Holualoa School and Horseshoe Bend streams. Parcel 14 is owned by John P. Ellbogen.

7. On August 23, 1982, the State of Hawaii instituted an eminent domain action against Kalott Properties, N.V. to condemn a portion of Tax Map Key Nos. 7-6-21, parcels 13 (.578 acres) and 16 (2.202 acres) for the Kuakini Highway realignment

project. As of the date of the public hearing, final judgment had not been entered in this action.

8. The subject property is currently leased to and utilized by the Palani Ranch for cattle grazing under a month-to-month lease.

9. The United States Department of Agriculture's 1973 Soil Conservation Service Soil Survey Map of Island of Hawaii, classifies the soil of the subject property as being in the Punaluu series and an extremely rocky peat. Permeability is moderately rapid, runoff is slow, and erosion hazard is slight.

10. The elevation of the subject property ranges from 350 feet to 700 feet at its mauka boundary. The slope generally ranges from 6% to 20%.

11. Vegetation on the subject property is composed of almost entirely exotic specimens, with Koa-haole the dominant species. The subject property does not support any plant life considered rare, threatened or endangered. Several native species and exotic species common to Kona and found throughout the State also grow on the subject property.

12. Approximately 75% of the subject property is located within the defined boundaries of the Holualoa drainage basin. The Federal Insurance Administration has designated two portions of the subject property adjacent to the both sides of the

Horseshoe Bend and Holualoa School intermittent streams in Flood Zone "A," which is defined as areas susceptible to a 100-year flood, in the Flood Insurance Rate Maps for the Island of Hawaii.

PROPOSAL FOR DEVELOPMENT

13. With the exception of the five acres owned by the Hawaii Preparatory Academy, Petitioner proposes to develop a single-family and multi-family residential subdivision on the subject property. Petitioner intends to develop approximately 500 residential units of which 215 would be single-family residential units and 285 would be multi-family residential units.

14. Petitioner proposes to build the single-family residential units on approximately 103 acres, with each unit having a minimum lot size of approximately 15,000 sq. ft. The Petitioner estimates that single-family density will be at approximately 2.1 units per acre.

15. Petitioner proposes to build multi-family townhouse residential units on approximately 65 acres at an estimated density of RM-8.0 (1 unit per 8,000 feet of land area) or 4.4 units per acre.

16. Petitioner proposes to use the Holualoa School Stream as a boundary between the single-family units (to the south) and the multi-family units (to the north).

17. Petitioner intends to market 25% to 50% of the single-family units as house/lot packages and 50% to 75% as lot-only sales. Petitioner intends to market the multi-family units as residential, as opposed to resort, townhouse, condominiums. Pursuant to the County of Hawaii's incremental zoning requirements, Petitioner is required to construct dwellings on at least 25% of the lots in its first phase proposed residential subdivision in order to obtain rezoning of second phase.

18. Petitioner estimates that it will sell the vacant house lots for approximately $70,000 (1983 dollar) and three- and four-bedroom house/lot packages for $150,000 (1983 dollar). The multi-family units will range in price from $90,000 to $180,000 (1983 dollar).

19. Petitioner has agreed in principle to work jointly to provide housing opportunties for low- and medium-income residents. Petitioner proposes to cooperate with State and County housing agencies in order to offer ten percent of the lots and house and lot packages at prices that will enable residents to quality for Federal- or State-assisted housing loan programs.

20. Hawaii Housing Authority (HHA) feels that approximately 10% of the housing units should be affordable by low and moderate income families.

21. HHA recommends that a condition be included to assure that 10% of the units will be affordable to low and

moderate income families, as determined by the County of Hawaii and HHA.

22. The Draft Kona Regional Plan estimates that approximately 40% of the households in Kona are currently facing some kind of housing problem which ranges from the household paying too large a percentage of its income for housing, living in substandard or unsafe housing, living in a crowded household or combinations thereof.

23. Petitioner estimates construction costs for on-site and off-site improvements to be approximately $35 million (1983 dollar). This estimate includes major drainage improvements, road construction, site preparation, and labor and materials.

24. Petitioner estimates that Phase 1 and 2 can be completed within 8 1/2 years from the date of the Commission's approval of this Petition.

25. Petitioner is a wholly-owned subsidiary of Blue Chip Corporation, a Japan corporation. Petitioner holds approximately $14 million of investment property free of any mortgages and can use said property to finance the proposed project. If necessary, Blue Chip Corporation will provide any additional funds needed to complete the project.

STATE AND COUNTY PLANS

26. The subject property is situated within the State Land Use Agricultural District. It is contiguous to urban classified lands to the south which have been developed for low density

residential uses (Kalani Sunset, Leilani Sunset, and Kainana Subdivisions). To the west, the Kailua-Keauhou Middle Road (40 foot right-of-way), which is in the Agricultural District, separates the subject property from adjoining Agricultural and Urban Districts. Lands to the north are designated Agricultural. Lands to the east are designated Rural.

27. The County of Hawaii General Plan Land Use Pattern Allocation Guide (LUPAG) map designates most of the subject property as "Alternate Urban Expansion" and a small area as "Low Density Urban." The two stream beds and adjacent areas are designated as "Flood Plains."

28. The draft Kona Regional Plan prepared by the County of Hawaii's Planning Department recommends that the subject property be developed for low density residential (RES-4, 4 units per acre), and moderate density residential (RES-10, 10 units per acre) uses. Petitioner's proposed project is consistent with the draft Kona Regional Plan.

29. The Kailua-Honalo Urban Zone Map (Ordinance No. 74, 1967) zones the entire subject property as "Unplanned" with a minimum lot size of five acres. Petitioner must obtain a rezoning of the subject property.

30. The subject property is not situated within either the Special Managment Area or the boundaries of the Kailua Village Special District.

NEED FOR GROWTH AND DEVELOPMENT

31. The draft Kona Regional Plan poses three growth alternatives for Kona with corresponding population forecasts for the period 1980-2000. The population projections to the year 2000 are as follows: Alternative I: 33,200; Alternative II: 39,400; and Alternative III: 46,300.

32. Using these population projections and the anticipated decline in household size, the draft Kona Regional Plan indicates future new housing requirements at between 5,240 to 9,915 units or a production rate of 262 to 496 units per annum for Kona.

33. In addition, 1,580 units will reach obsolescence by the year 2000 and will need to be replaced. Petitioner's consultant assumes 40% of the above enumerated housing units reaching obsolescence will not be repaired.

34. Using the draft Kona Regional Plan's estimates of new housing units required and the obsolescence factor developed by Petitioner's consultant, the total number of new housing units needed for Kona ranges from 5,872 to 10,547 units.

35. Petitioner's market study of 32 existing residential subdivisions of ten or more units in the North Kona area (as defined geographically by the market study) identified a total of 4,580 existing residential lots. Of that total, 2,352 or 51% of the lots have houses built on them and contribute to the existing

housing stock. The balance of 2,228 lots or 49% are vacant. In addition, only 345 vacant lots are for sale.

36. If all the existing vacant lots counted in the market study become available for housing by the year 2000, the current available inventory of finished lots represents between 21% and 38% of the projected need.

37. Petitioner's market study estimates that 80% of the housing units needed for Kona will be built in the area studied by Petitioner (hereinafter referred to as "study area"), which encompasses the Kailua-Kona-Keauhou segement of the draft Kona Regional Plan prepared by the County of Hawaii's Planning Department. This amounts to between 4,698 to 8,437 units.

IMPACTS ON THE RESOURCES OF THE AREA

Agricultural Resources

38. The State Department of Agriculture does not place the subject property in any of its important agricultural land categories in its ALISH Maps for North Kona.

39. The Land Study Bureau's Detailed Land Classification Map for the Island of Hawaii indicates that two land types, D293 and E295, are distributed across the subject property. The D and E ratings indicate that the land is poorly or very poorly suited for agricultural activities.

40. Although the subject property is currently used for cattle grazing, it does not have a high capacity for intensive

agricultural use. Approximately 24 to 30 head of cattle are located on the subject property.

41. The draft Kona Regional Plan, which was developed in consultation with farmers and governmental agencies concerned with agricultural activities, recommends that the subject property be used for residential purposes.

Archaeological Resources

42. Cultural Surveys Hawaii conducted an archaeological reconnaissance in January of 1983. It discovered 47 archaeological sites on the subject property, some of which are merely remnants.

43. Based on preliminary observations, none of the sites discovered are historically significant except for research purposes. Petitioner will conduct further archaeological work as recommended by Cultural Surveys Hawaii, the State of Hawaii and the County of Hawaii.

Recreational Resources

44. Petitioner intends to develop a private recreation area for residents of the proposed development.

PUBLIC SERVICES AND FACILITIES

Fire Fighting and Police Services

45. The County of Hawaii will provide police service from the Kona District Headquarters located in Captain Cook. Fire protection service will be provided by the County from its Kailua Fire Station located on Palani Road.

Schools

46. Students from the proposed project will attend the Kealakehe Elementary and Intermediate School (Grades K-8) and the Konawaena High School (Grades 9-12). The opening of the Kahakai Elementary School in September, 1982, which has a capacity of 670 students, alleviates the overcrowding at Kealakehe Elementary and Intermediate School. The Kealakehe and Kahakai school facilities are expected to meet the needs of the growing North Kona population for the next seven (7) years. The DOE plans to construct additional school facilities at the Kealakehe Intermediate School and the Konawaena High School during the late 1980's in order to meet the needs of the residents of Petitioner's and other developments during the next 10-year period.

Electrical Utilities Services

47. Hawaii Electric & Light Company, Inc. and Hawaiian Telephone Company lines serve the area. Petitioner will provide all necessary service connection and transmission lines necessary to transmit electricity and other utilities to the development as may be required by applicable state and county regulations.

Water

48. Petitioner does not have a water commitment from the Board of Water Supply for this project, but Petitioner is a participant in the Kona Source Agreement I with the County development of Water Supply and other developers for development of new

domestic water sources in Kona. Petitioner has paid $125,000 as a contribution for its prorata share for 500 water units.

49. Should the exploratory activities conducted pursuant to the water agreement prove successful, Petitioner will execute a subsequent water source development agreement II and the Board of Water Supply will issue water commitments issued to participating developers, including Petitioner.

Drainage

50. Although approximately 75% of the subject property lies in the defined boundaries of the Holualoa Drainage Basin, intermittent flooding is limited to the Horseshoe Bend and the Holualoa School Streams. Petitioner will build and dedicate to the County of Hawaii all drainage facilities recommended in the Drainage Master Plan for the North Kona Flood Control Project within the boundaries of the subject property.

51. Properties located makai of the subject property (below Kuakini Highway) to the coastline have received various development approvals conditioned on the requirement that development of these projects may not commence unless the developers implement their portion of the drainage facilities recommended in the Drainage Master Plan for the North Kona Flood Control Project.

52. The development of the subject property and properties located makai of the subject property will result in a

continuous drainage system from the mauka boundary of the subject property to the ocean.

Sewage Treatment and Disposal Services

53. Petitioner proposes to dispose of sewage waste generated by the single-family residential area by individual cesspools. Petitioner proposes that the multi-family residential area will be served by private treatment plants.

54. Petitioner shall design and construct all sewage treatment facilities to satisfy the requirements specified in Chapter 38, Public Health Regulations, State of Hawaii.

Solid Waste Disposal Services

55. The County of Hawaii does not provide refuse collection service. Petitioner will require purchasers to haul refuse to the Kona Sanitary Land Fill or make arrangements with commercial disposal services. The landfill, which serves the North and South Kona districts, is located about four miles north of Kailua Village off of Queen Kaahumanu Highway.

56. The existing land fill has a life expectancy of approximately 10 years. The County of Hawaii is planning to install a refuse shredding facility to alleviate problems.

Roadway and Highway Services

57. The State Department of Transportation has approved two accesses from the proposed project to Kuakini Highway. Petitioner proposes to connect present north/south lateral road

system, specifically Kilohana, Leilani, and Pualani Streets to the proposed internal roadway system for the development. The lateral connections and intersection improvements would provide safer and more convenient ingress and egress to Kuakini Highway for residents of these adjacent subdivisions.

58. Petitioner anticipates that traffic generated by the proposed project should be mitigated by the completion of the Kuakini Highway realignment project which is already under construction by the State of Hawaii and which State expects to complete before the proposed project is completed.

CONTIGUITY OF DEVELOPMENT

59. The subject property is contiguous to an Urban District to the south which has been developed for low density residential uses (Kalani Sunset, Leilani Sunset, and Kainana Subdivisions). The Kailua-Keauhou Middle Road (40 foot right-of-way) separates the subject property from an existing Urban District along part of the subject property's makai (west) boundary.

COMPLIANCE WITH STANDARDS FOR DETERMINING DISTRICT BOUNDARIES

60. The character of the area is "city like" due to the adjacent residential subdivisions located to the south of the subject property. In addition, proposed commercial development by Dillingham Investment Corporation on lands between Kuakini Highway and the subject property further amplify the "city like" character of the area.

61. The subject property is centrally located to established employment centers. It is only 2 1/2 miles south of Kailua Village and 4 miles north of the Keauhou resort community. Dillingham Investment Corporation has proposed to construct a shopping center and medical center on nearby land already designated for commercial use.

62. Although the development of the subject property for residential use will not create permanent employment opportunities, the development of this project at a cost of $35 million will provide short-term employment opportunities for persons associated with the construction and real estate industries.

63. Reclassification of the subject property is reasonably necessary to accommodate urban growth projected for the North Kona area.

64. The subject property does not have any adverse geographic or topographic constraints which will hinder or endanger the proposed development. The proposed project will be designed and constructed to be reasonably free from the danger of floods, tsunami, unstable soil conditions, and other adverse environmental effects.

65. The proposed development will not result in "spot" urban development because an existing Urban District which has been developed for low-density residential uses is located adjacent

to the subject property on the south and a Rural District, which permits the development of residential housing on half acre lots, is contiguous to the subject property on its east (mauka) boundary.

66. Petitioner will install all on-site utility lines, roads, sewage disposal, and water systems at no cost to the state or county governments. Petitioner will also construct and dedicate to the County of Hawaii a major drainage facility within the boundaries of its property.

COMPLIANCE WITH THE HAWAII STATE PLAN

67. Petitioner's proposed project is consistent with the Hawaii State Plan's objectives and policies relating to population, the economy (general), and housing.

INCREMENTAL DISTRICTING

68. Petitioner cannot complete full urban development of the subject property within five years from the date of the Commission's approval of the redistricting; Petitioner proposes to develop the property in two increments, encompassing 5 years and 3 1/2 years. Petitioner will substantially complete development of the first 124.660 acre increment, consisting of the makai portion of the single-family residential area, all of the multi-family area, and all infrastructure systems within five years. The second increment consisting of the mauka portion of the single-family residential area, totalling 49 acres, is scheduled for completion within 3 1/2 years thereafter. The descriptions of Increment I and Increment II of Petitioner's proposed development

are illustrated on the map attached hereto as Exhibit A and incorporated herein by reference. Petitioner cannot start development on the second increment until development on all on-site and off-site improvements within Increment I have been substantially completed.

RULING ON PROPOSED FINDINGS OF FACT

The Land Use Commission hereby rejects any of the proposed findings of fact submitted by the Petitioner or the other parties not already ruled upon by adoption herein, or rejected by clearly contrary findings of fact herein.

CONCLUSIONS OF LAW

Pursuant to Chapter 205, Hawaii Revised Statutes, as amended, and the Rules of Practice and Procedure and District Regulations of the Land Use Commisison, State of Hawaii, the Commission concludes that the reclassification of all of the lands within Increment I, consisting of approximately 124.660 acres (as shown on Exhibit A attached hereto), from the Agricultural to the Urban District and amendment of the land use district boundary to permit the development of Increment I is reasonable, in conformity with Section 205-2, Hawaii Revised Statutes, and is consistent with the Hawaii State Plan as set forth in Chapter 226, Hawaii Revised Statutes, as amended, and the District Regulations of the Land Use Commission.

The Commission further concludes that although full development of the lands within Increment II (as shown on Exhibit A attached hereto) cannot be reasonably completed within five years from the date of the Commission's decision on this matter, reclassification of the lands within Increment II, consisting of approximately 49 acres, from the Agricultural to the Urban District and the amendment of the land use district boundary to permit the development of Increment II is reasonable, in conformity with Section 205-2, Hawaii Revised Statutes, and is consistent with the Hawaii State Plan, as set forth in Chapter 226, Hawaii Revised Statutes, as amended, and the District Regulations of the Land Use Commission. Therefore, incremental redistricting of the lands within Increment II of Petitioner's development is reasonable and warranted.

DECISION AND ORDER

IT IS HEREBY ORDERED that the lands within Increment I of Petitioner's development plan of the subject property, consisting of 124.660 acres, as depicted in Exhibit A attached hereto and incorporated herein by reference, situated in the ahupua'a of Holualoa First and Second, North Kona, County, Island and State of Hawaii, shall be and the same is hereby reclassified from the Agricultural to the Urban District, and the district boundaries are amended accordingly.

IT IS ALSO HEREBY ORDERED that the lands within Increment II of Petitioner's development plan of the subject property/consisting of approximately 49 acres, as depicted in Exhibit A attached hereto and incorporated herein by reference, situated in the ahupua'a of Holualoa First and Second, North Kona, County, Island and State of Hawaii, shall be and the same are hereby approved for incremental development pursuant to State Land Use Commission's District Regulation 6-2, and that redistricting from the Agricultural to the Urban District will be granted upon receipt of an application by Petitioner for redistricting of Increment II, and upon a prima facie showing by Petitioner that it has substantially completed the on-site and off-site improvements within Increment I, in accordance with Petitioner's development plan as indicated above, within five years of the date of this Order, including but not limited to partial satisfaction of the condition A below, to the extent of the number of lots to be developed in Increment I and full satisfaction of condition B below.

IT IS FURTHER HEREBY ORDERED that the reclassification and incremental districting of the subject property shall be subject to the following conditions:

A. Petitioner shall provide housing opportunities for low and moderate income Hawaii residents prior to assigning or transferring (except by way of mortgage or assignment as security) its interest in the subject property, by offering for sale, on a preferential basis, on its own or in cooperation with either or both the Hawaii Housing Authority or the County of Hawaii, ten percent (10%) of the lots or house and lots to be developed on the subject property, to residents of the State of Hawaii of low and moderate family income as determined by the Hawaii Housing Authority or County of Hawaii from time to time. The preferential lots or houses and lots shall be offered for sale at prices not exceeding prices that enable such purchasers to qualify for and obtain state-assisted financing (i.e., Act 105 or Hula Mae) or federally-insured or assisted financing (i.e., FHA Section 245 program) intended to encourage home ownership by low and moderate income families; and

B. In making the ultimate decision as to whether a historical or archaeological site is significant enough to warrant preservation, the Petitioner shall consult with and accept the decision of the Historic Preservation Officer of the Department of Land and Natural Resources; and

C. Petitioner shall submit annual progress reports to the Commission, Department of Planning and Economic Development, and Hawaii County Planning Department as to its progress in satisfying these conditions; and

D. These conditions may be fully or partially released by the Commission as to all or any portion of the subject properties upon timely motion and provision of adequate assurance of satisfaction of these conditions by the Petitioner.

DOCKET NO. A83-549 - GAMLON CORP.

Done at Honolulu, Hawaii, this 13th day of December, 1983, per motions on December 1, 1983 and December 13, 1983.

LAND USE COMMISSION
STATE OF HAWAII

By William W. L. Yuen
WILLIAM W. L. YUEN
Chairman and Commissioner

By
RICHARD B. F. CHOY
Vice Chairman and Commissioner

By Lawrence F. Chun
LAWRENCE F. CHUN
Commissioner

By Shinsei Miyasato
SHINSEI MIYASATO
Commissioner

By Winona E. Rubin
WINONA E. RUBIN
Commissioner

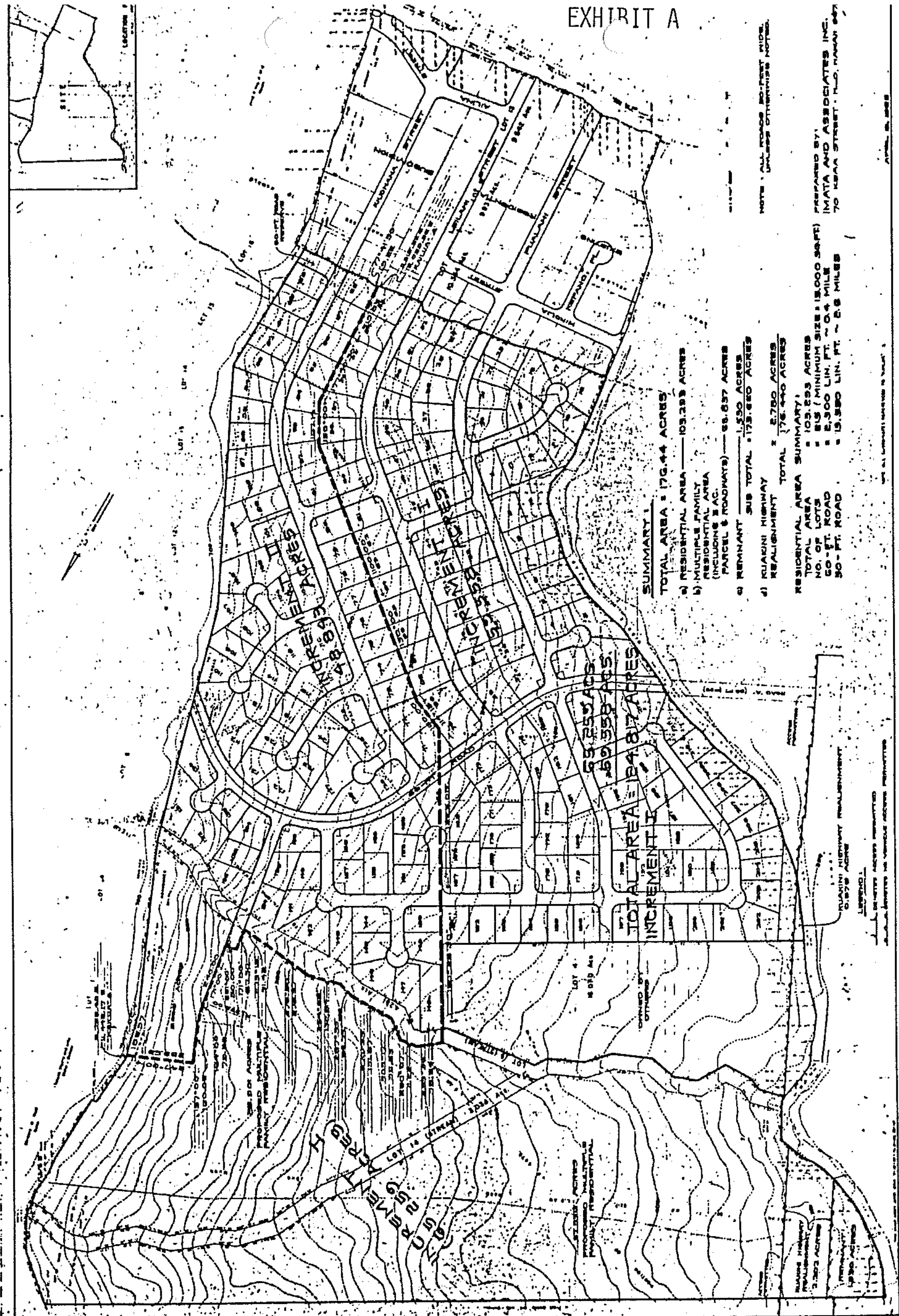
By T P Tacbian
TEOFILO PHIL TACBIAN
Commissioner

By Robert Tamaye
ROBERT S. TAMAYE
Commissioner

By Frederick P. Whittemore
FREDERICK P. WHITTEMORE
Commissioner

A83-519 - GAMLON CORP.

EXHIBIT A



BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of GAMLON CORP. For Amendment of District Boundary and Reclassification of Certain Lands Situated at North Kona, County, Island and State of Hawaii	DOCKET NO. A83-549 GAMLON CORP.

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Land Use Commission's Decision and Order was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by certified mail:

KENT M. KEITH, Director
Department of Planning and Economic Development
State of Hawaii
250 South King Street
Honolulu, Hawaii 96813

SIDNEY FUKE, Planning Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

RICHARD G. MACMILLAN
KARL K. KOBAYASHI
The Queen Street Building
345 Queen Street, Suite 800
Honolulu, Hawaii 96813

DATED: Honolulu, Hawaii, this 26th day of January, 1984.

GORDAN Y. FURUTANI
Executive Officer

Loc file 534

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of GAMREX, INC. To Amend the Agricultural Land Use District Boundary into the Urban Land Use District for Incremental Redistricting of Increment II For Approximately 49 Acres of Land at North Kona, County, Island and State of Hawaii, Tax Map Key No.: (Third Division) 7-6-21:15 and portions of 4, 9, 10, 11 and 17.	DOCKET NO. A83-549 GAMREX, INC.

This is to certify that this is a true and correct copy of the Decision and Order on file in the office of the State Land Use Commission, Honolulu Hawaii.

MAY 10 1993 by [signature]
Date Executive Officer

LAND USE COMMISSION
STATE OF HAWAII
MAY 10 11 17 AM '93

FINDINGS OF FACT,
CONCLUSIONS OF LAW, AND DECISION AND ORDER

05520

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of GAMREX, INC. To Amend the Agricultural Land Use District Boundary into the Urban Land Use District for Incremental Redistricting of Increment II For Approximately 49 Acres of Land at North Kona, County, Island and State of Hawaii, Tax Map Key No.: (Third Division) 7-6-21:15 and portions of 4, 9, 10, 11 and 17.	DOCKET NO. A83-549 GAMREX, INC.

FINDINGS OF FACT,
CONCLUSIONS OF LAW, AND DECISION AND ORDER

GAMREX, INC., a Hawaii corporation, as successor in interest to Kalott Properties, Inc. and Gamlon Corp., (hereinafter "Petitioner") filed on June 4, 1992, a Motion to Approve Redistricting of Increment II, pursuant to Chapter 205, Hawaii Revised Statutes, (hereinafter "HRS") and Section 15-15-78, Hawaii Administrative Rules, (hereinafter "Commission Rules"), to amend approximately 49 acres of land in the Agricultural District to the Urban District at North Kona, County, Island and State of Hawaii, Tax Map Key No. (Third Division) 7-6-21:15 and portions of parcels 4, 9, 10, 11 and 17 (hereinafter "Increment II"), and comprising the second increment of lands described in the Land Use Commission's (hereinafter "Commission") Decision and Order dated

December 13, 1983, (hereinafter "Order") in the Petition by Gamlon Corp. in this docket. The Commission, having heard and examined the testimony, evidence and argument of the parties, the Petitioner's Proposed Findings of Fact, Conclusions of Law, and Decision and Order, and the parties' stipulation filed thereto, does hereby make the following Findings of Fact, Conclusions of Law, and Decision and Order.

FINDINGS OF FACT

PROCEDURAL MATTERS

1. The Motion to Approve Redistricting of Increment II and Memorandum in Support of Motion was filed on June 4, 1992, by Petitioner to reclassify Increment II, consisting of approximately 49 acres of land in the Agricultural District to the Urban District for certain land situated at North Kona, County, Island and State of Hawaii.

2. On June 12, 1992, Petitioner filed a Motion to Approve Change of Name of Petition from Gamlon Corp. to Gamrex, Inc.

3. On August 3, 1992, Petitioner filed its List of Witnesses and List of Exhibits, together with Exhibit Nos. 1 through 5. These exhibits were subsequently withdrawn by Petitioner.

4. A prehearing conference was held on August 11, 1992, at the conference room of the Department of Business, Economic Development and Tourism, 11th Floor, Central Pacific Plaza, 220 South King Street, in Honolulu with the Petitioner

and the Office of State Planning present. The County of Hawaii Planning Department was not present. At the prehearing conference, witness and exhibit lists, and exhibits were exchanged among the parties present.

5. On August 19, 1992, Petitioner filed its Supplemental Memorandum in Support of Motion to Approve Redistricting of Increment II.

6. On August 19, 1992, Petitioner filed its Revised List of Witnesses, Revised List of Exhibits, and Exhibit Nos. 1 to 16.

7. On August 27, 1992, Petitioner filed a Motion to Continue Motion to Approve Redistricting of Increment II.

8. The Commission held a hearing on August 27, 1992, at the Kamakahonu Ballrooms, King Kamehameha Kona Beach Hotel, Kailua-Kona, Hawaii pursuant to notice published in the Honolulu Advertiser, Hawaii Tribune-Herald and West Hawaii Today on July 17, 1992. At the hearing, the Commission approved Petitioner's Motion to Approve Change of Name of Petition and Petitioner's Motion to Continue Motion to Approve Redistricting of Increment II.

9. On January 21, 1993, Petitioner filed its Second Revised List of Witnesses, Second Revised List of Exhibits, and Exhibit Nos. 17 to 20.

10. On January 21, 1993, Petitioner filed its Second Supplemental Memorandum in Support of Motion to Approve Redistricting of Increment II.

11. On January 28, 1993, Petitioner filed its Third Revised List of Witnesses, Third Revised List of Exhibits, and Exhibit Nos. 21 and 22.

12. The Commission held a continued hearing on the Motion to Approve Redistricting of Increment II on January 28, 1993, at the Kamakahonu Ballrooms, King Kamehameha Kona Beach Hotel, Kailua-Kona, Hawaii.

DESCRIPTION OF PROPERTY

13. The subject property was approved for incremental districting by the Commission's Order dated December 13, 1983, and consists of approximately 173.66 acres, at North Kona, County, Island and State of Hawaii, Tax Map Key Nos. (Third Division) 7-6-21:4, 9, 10, 11, 12, 13, 15, 16 and 17 (hereinafter the "Property").

14. Increment I, approved by the Commission's Order dated December 13, 1983, consists of approximately 124.66 acres (hereinafter "Increment I"), and Increment II consists of approximately 49 acres.

15. The Property is bound to the north by undeveloped lands, the south by the Kalani Sunset, Leilani Sunset and Kainana Subdivisions, the west by the old Kailua-Keauhou Middle Road, and the east by the Iolani Subdivision. Increment II is generally located in the eastern portion of the Property.

16. The Property is owned in fee by Petitioner.

17. By Order dated December 13, 1983, the Commission reclassified from the Agricultural District to the Urban

District on an incremental basis approximately 124.66 acres of land comprising Increment I. Pursuant to Section 15-15-78 of the Commission Rules, and the above-mentioned Order dated December 13, 1983, Petitioner may apply to reclassify Increment II from the Agricultural District to the Urban District upon a prima facie showing by Petitioner that it has substantially completed the on and off site improvements within Increment I, in accordance with the approved development plan for Increment I.

18. On November 16, 1988, Petitioner filed a Motion to Extend Time to Complete Substantial Development of Increment I and to Apply for Incremental Districting of Increment II with the Commission.

19. The Commission approved the Motion to Extend Time to Complete Substantial Development of Increment I and to Apply for Incremental Districting of Increment II per motion on January 10, 1989 and subsequently by Decision and Order dated February 10, 1989. The time limit was extended until December 13, 1993.

IMPROVEMENTS COMPLETED WITHIN INCREMENT I

20. After Increment I was reclassified to the Urban District by the Commission by its Order dated December 13, 1983, the following approvals affecting Increment I have been processed by the County of Hawaii:

a. County of Hawaii incremental zoning approval pursuant to County of Hawaii Ordinance Nos. 84-23, 84-42, 88-4, 90-62 and 91-96 ("Zoning Ordinance").

b. County of Hawaii's final subdivision approval for County of Hawaii Subdivision Units I-A and I-B which consists of single-family residential areas in Increment I. Petitioner has also received County of Hawaii preliminary subdivision approval for County of Hawaii Subdivision Unit I-C.

21. The on-site improvements which have been substantially completed or in progress to date within Increment I are as follows:

a. Improvements for Units I-A and I-B. All infrastructure improvements, including roads, water system, electrical system, and telephone transmission system, within the portion of Increment I which comprises County of Hawaii Subdivision Units I-A and I-B have been completed.

b. Improvements for Unit I-C. Roads and utilities are partially completed within County of Hawaii Subdivision Unit I-C.

c. Drainage system for multi-family residential area. The construction of the drainage system for the multi-family residential areas has been delayed because: (a) Petitioner did not control the lands below Queen Kaahumanu Highway which the County of Hawaii determined were needed to complete the portion of the Holualoa drainage system running through Petitioner's property; and (b) the County of Hawaii has required Petitioner to participate in certain flood studies and improvements for the area below Queen Kaahumanu Highway. In June of 1989, Petitioner completed the purchase of a 12-acre parcel (Tax Map Key No. (Third Division) 7-6-24:25) located west (makai) of Queen Kaahumanu Highway, at a cost of $1,000,000 to resolve a problem concerning the construction of its portion of the Holualoa drainage system which portion runs mainly through the multi-family residential areas within Increment I. All flood studies have been completed and have been submitted to the County of Hawaii Department of Public Works, which will submit them to the Federal Emergency Management Agency (hereinafter "FEMA"). Upon approval by FEMA, Petitioner will be permitted to construct its portion of the Holualoa drainage system. After completion of the drainage system, the County of Hawaii will permit construction of the infrastructure improvements within the multi-family residential areas within Increment I.

d. Drainage System for Unit I-C. Petitioner, in connection with adjacent landowners and the County of Hawaii, have completed a study for the drainage system, which affects only a small portion of County of Hawaii Subdivision Unit I-C. After approval by the FEMA, the drainage system which affects Unit I-C will be completed and Petitioner will complete the infrastructure improvements within Unit I-C. After completion of such improvements, all of the infrastructure improvements within the single-family areas within Increment I will have been completed.

e. Infrastructure Improvements for Multi-Family Residential Area Within Increment I. The water system master plan for the area requires Petitioner to develop the water system and other infrastructure improvements within Increment II prior to development of infrastructure improvements in the multi-family residential areas within Increment I.

f. Model Homes and Recreation Center. Petitioner has completed eight model homes and a recreation center within Increment I.

22. The off-site improvements which have been substantially completed or in progress to date within Increment I are as follows:

a. Petitioner has completed construction of the main access road from Kuakini Highway to the project which is the Lako Street extension. Petitioner has also completed construction of the Lako Street/Kuakini Highway intersection.

b. Off-Site Drainage. Petitioner has submitted drainage plans for the 12-acre parcel of land located west (makai) of Queen Kaahumanu Highway (Tax Map Key No. (Third Division) 7-6-24:25) and these plans are currently being reviewed by the County of Hawaii Department of Public Works and FEMA. Petitioner is also participating in flood (HEC2) studies for the area west (makai) of the 12-acre parcel and these studies have been submitted to the County of Hawaii Department of Public Works and FEMA.

23. Total costs, including on and off-site improvement costs, expended by Petitioner is approximately $20,000,000.

24. Due to the existing water system for the area, Petitioner cannot construct any additional water system and other infrastructure improvements in Increment I without urban districting of Increment II and cannot proceed with further development of the multi-family residential areas within Increment I without such urban redistricting of Increment II.

25. The County of Hawaii will allow Petitioner to construct the water system and other infrastructure improvements within Increment II subject to subsequent adjustments, realignments, or other revisions to such infrastructure improvements as may be required by the County of Hawaii zoning and subdivision process.

26. Petitioner has already commenced preparation of plans for the construction of infrastructure improvements within Increment II in order that it can proceed with such construction without delay if the Commission approves Petitioner's request for redistricting of Increment II.

27. Based on the aforesaid findings, and the findings in the Commission's Order filed December 13, 1983 in this docket, the proposed reclassification of Increment II conforms with the following objectives, policies and priorities of the

Hawaii State Plan provided under HRS §§226-19(a)(1), 226-19(b)(1), and 226-19(b)(3).

28. The Commission, by Order dated December 13, 1983, imposed the following conditions on the reclassification and incremental districting of the Property:

A. Petitioner shall provide housing opportunities for low and moderate income Hawaii residents prior to assigning or transferring (except by way of mortgage or assignment as security) its interest in the subject property, by offering for sale, on a preferential basis, on its own or in cooperation with either or both the Hawaii Housing Authority or the County of Hawaii, ten percent (10%) of the lots or house and lots to be developed on the subject property, to residents of the State of Hawaii of low and moderate family income as determined by the Hawaii Housing Authority or County of Hawaii from time to time. The preferential lots or houses and lots shall be offered for sale at prices not exceeding prices that enable such purchasers to qualify for and obtain state-assisted financing (i.e., Act 205 or Hula Mae) or federally-insured or assisted financing (i.e., FHA Section 245 program) intended to encourage home ownership by low and moderate income families (hereinafter "Condition A"); and

B. In making the ultimate decision as to whether a historical or archaeological site is significant enough to warrant preservation, the Petitioner shall consult with and accept the decision of the Historic Preservation Officer of the Department of Land and Natural Resources (hereinafter "Condition B"); and

C. Petitioner shall submit annual progress reports to the Commission, Department of Planning and Economic Development, and the Hawaii County Planning Department as to its progress in satisfying these conditions (hereinafter "Condition C").

29. Petitioner has addressed Condition A by entering into an agreement with the County of Hawaii Housing Department providing for conveyance of the 12-acre parcel, Tax Map Key No. (Third Division) 7-6-24:25, to the County of Hawaii, in satisfaction of the affordable housing requirement.

30. Petitioner has addressed Condition B by receiving approval of its archaeological report from the State Historic Preservation Division of the Department of Land Natural Resources.

31. Petitioner has addressed Condition C by submission of Exhibit A to its Second Supplemental Memorandum filed January 21, 1993, which the Commission accepted as Petitioner's Annual Report for 1992, and having filed previous annual reports with appropriate parties.

RULING ON PROPOSED FINDINGS OF FACT

Any of the proposed findings of fact submitted by the Petitioner or other parties not already ruled upon by the Commission by adoption herein, or rejected by clearly contrary findings of fact herein, are hereby denied and rejected.

Any conclusion of law herein improperly designated as finding of fact should be deemed or construed as a conclusion of law; any finding of fact herein improperly designated as a conclusion of law should be deemed and construed as a finding of fact.

CONCLUSIONS OF LAW

Pursuant to Chapter 205, HRS, and the Commission Rules including Section 15-15-78 thereof, the Commission finds upon a preponderance of evidence that the incremental redistricting of lands within Increment II of the Property, and approximately shown on Exhibit A attached hereto and incorporated herein by reference, consisting of approximately 49 acres of land situate at North Kona, County, Island and State of Hawaii, identified as Tax Map Key No. (Third Division) 7-6-21:15 and portions of parcels 4, 9, 10, 11 and 17 from the Agricultural District to the Urban District, subject to the additional conditions provided in this Order, conforms to the standards established in the Commission Rules including Section 15-15-78 relating to incremental districting, is reasonable, non-violative of Section 205-2, HRS, and is consistent with the Hawaii State Plan as set forth in Chapter 226, HRS.

DECISION AND ORDER

IT IS HEREBY ORDERED that the lands within Increment II of the Property, consisting of approximately 49 acres situate at North Kona, County, Island and State of Hawaii, more particularly identified by Tax Map Key No. (Third Division) 7-6-21:15 and portions of parcels 4, 9, 10, 11 and 17 and approximately shown in Exhibit A attached hereto and incorporated herein, for incremental redistricting from the Agricultural District to the Urban District shall be and the same is hereby approved, and the district boundaries are amended accordingly, subject to the following additional conditions:

1. Petitioner shall develop the Property in substantial compliance with the representations made to the Commission. Failure to so develop the Property may result in reversion of the Property to its former classification, or change to a more appropriate classification.

2. Petitioner shall give notice to the Commission of any intent to sell, lease, assign, place in trust, or otherwise voluntarily alter the ownership interests in the Property, prior to development of the Property.

3. Petitioner shall provide annual reports to the Land Use Commission, the Office of State Planning, and the County of Hawaii Planning Department in connection with the status of the subject project and the Petitioner's progress in complying with the conditions imposed.

4. The Land Use Commission may fully or partially release these conditions as to all or any portions of the Property upon timely motion and upon the provision of adequate assurance of satisfaction of these conditions by Petitioner.

5. Petitioner shall record the conditions imposed by the Commission with the Bureau of Conveyances pursuant to Section 15-15-92, Hawaii Administrative Rules.

6. Within 7 days of the issuance of the Commission's Decision and Order for the subject reclassification, Petitioner shall (a) record with the Bureau of Conveyances a Statement to the effect that the Property is subject to conditions imposed by the Land Use Commission in the reclassification of the Property, and (b) shall file a copy of such recorded statement with the Commission.

DOCKET NO. A83-549 - GAMREX, INC., a Hawaii corporation

Done at Honolulu, Hawaii, this 10th day of May 1993, per motion on April 29, 1993.

LAND USE COMMISSION
STATE OF HAWAII

By ______________________
ALLEN Y. KAJIOKA
Chairman and Commissioner

By (absent)
KAREN S. AHN
Vice Chairperson and Commissioner

By ______________________
JOANN N. MATTSON
Vice Chairperson and Commissioner

By ______________________
ALLEN K. HOE
Commissioner

By (absent)
EUSEBIO LAPENIA, JR.
Commissioner

By (absent)
RENTON L. K. NIP
Commissioner

By ______________________
TRUDY K. SENDA
Commissioner

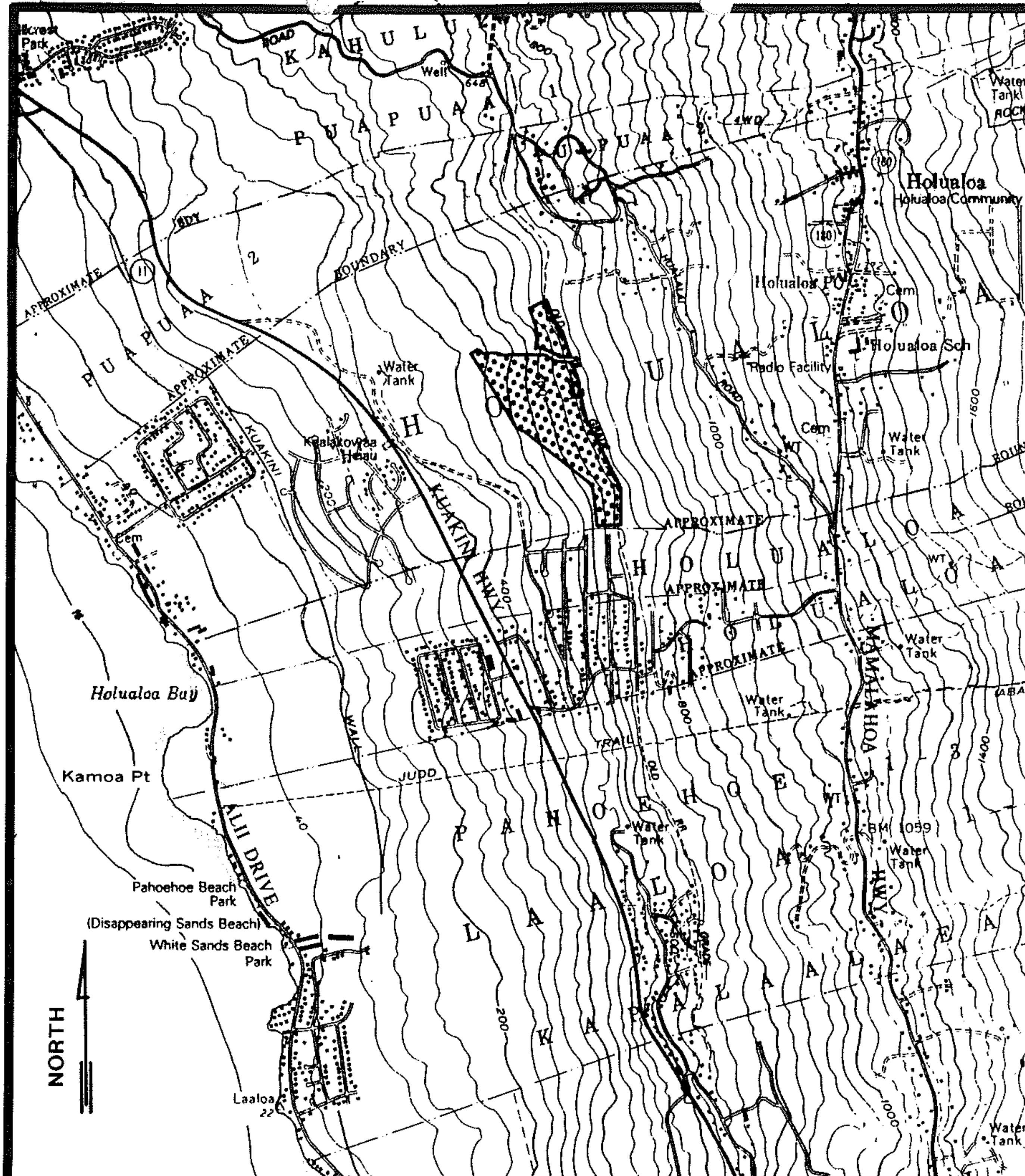
By ______________________
ELTON WADA
Commissioner

By ______________________
DELMOND J. H. WON
Commissioner

Filed and effective on
May 10, 1993

Certified by:

____
Executive Officer



DOCKET NO. A83 - 549 / GAMREX, INC.,

a Hawaii Corporation

LOCATION MAP

TAX MAP KEY: 7 - 6 - 21: por. 4, por. 9,

por. 10, por. 11, por. 17 & 15

HOLUALOA 1ST & 2ND, NORTH KONA, HAWAII

SCALE: 1" = 2,000 ft. ±

APPROVED AREA (INCREMENT II)

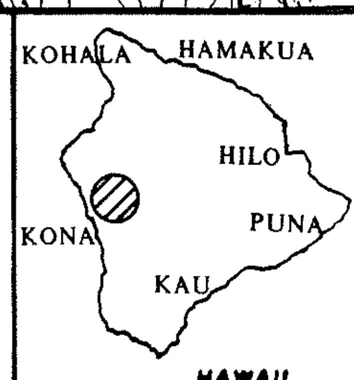


EXHIBIT "A"

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of GAMREX, INC. To Amend the Agricultural Land Use District Boundary into the Urban Land Use District for Incremental Redistricting of Increment II For Approximately 49 Acres of Land at North Kona, County, Island and State of Hawaii, Tax Map Key No.: (Third Division) 7-6-21:15 and portions of 4, 9, 10, 11 and 17.	DOCKET NO. A83-549 GAMREX, INC.

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Findings of Fact, Conclusions of Law, and Decision and Order was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by certified mail:

HAROLD S. MASUMOTO, Director
Office of State Planning
P. O. Box 3540
Honolulu, Hawaii 96811-3540

CERT. VIRGINIA GOLDSTEIN, Planning Director
Planning Department, County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

CERT. KARL K. KOBAYASHI, ESQ., Attorney for Petitioner
Carlsmith Ball Wichman Murray
Case Mukai & Ichiki
2200 Pacific Tower
1001 Bishop Street
Honolulu, Hawaii 96813

DATED: Honolulu, Hawaii, this 10th day of May 1993.

Esther Ueda

ESTHER UEDA
Executive Officer

BILL NO. 1075

COUNTY OF HAWAII - STATE OF HAWAII

ORDINANCE NO. **84 23**

AN ORDINANCE AMENDING SECTION 25-87 (NORTH KONA ZONE MAP) ARTICLE 3, CHAPTER 25 (ZONING CODE) OF THE HAWAII COUNTY CODE, BY CHANGING THE DISTRICT CLASSIFICATION FROM UNPLANNED (U) TO MULTIPLE FAMILY (RM-5) AND SINGLE FAMILY RESIDENTIAL (RS-15) AT HOLUALOA 1 AND 2, NORTH KONA, HAWAII, COVERED BY TAX MAP KEY 7-6-21:4, 9-13, AND 15-17.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAII:

SECTION 1. Section 25-87, Article 3, Chapter 25 (Zoning Code) of the Hawaii County Code, is amended to change the district classification of property described hereinafter as follows:

The district classification of the following area situated at Holualoa 1 and 2, North Kona, Hawaii, shall be Multiple Family Residential (RM-5):

(PARCEL 1)

Beginning at the northwest corner of this parcel of land and on the northeasterly side of Kuakini Highway Realignment, Project No. 11A-03-69, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA," being 9,193.71 feet South and 8,705.53 feet East, thence running by azimuths measured clockwise from true South:

1.	240°	28'	30"	2,903.35	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
2.	255°	18'		17.97	feet along same;
3.	311°	55'		219.92	feet along same;
4.	331°	14'	15"	143.36	feet along same;

Thence along Stream Lot 14 for the next thirteen (13) courses, the direct azimuths and distances being:

5.	96°	54'		67.99 feet;
6.	112°	56'		86.79 feet;
7.	90°	55'		56.48 feet;
8.	69°	49'		76.70 feet;
9.	46°	39'		114.37 feet;
10.	51°	06'		83.31 feet;
11.	76°	01'		139.84 feet;
12.	51°	29'		175.76 feet;
13.	66°	32'		91.49 feet;
14.	44°	49'		170.06 feet;
15.	25°	59'		247.57 feet;
16.	37°	21'		124.60 feet;
17.	31°	20'	30"	825.56 feet;

Thence along Stream Lot 15 for the next ten (10) courses, the azimuths and distances being:

18.	37°	01'	57.76 feet;
19.	66°	24'	138.13 feet;
20.	44°	01'	114.46 feet;
21.	67°	01'	134.84 feet;
22.	102°	13'	107.13 feet;
23.	69°	30'	139.97 feet;
24.	31°	40'	114.38 feet;
25.	88°	52'	64.54 feet;
26.	114°	04'	60.04 feet;
27.	77°	28'	132.01 feet;

28.	152°	18'	10"	95.72	feet along Kuakini Highway Realignment Project No. 11A-03-69;
29.	139°	59'	30"	20.75	feet along same;
30.	99°	48'	30"	35.58	feet along same;
31.	154°	11'		597.05	feet along same to the point of beginning and containing an area of 37.936 Acres. (Refer to Parcel 1 as shown on Exhibit A)

The district classification of the following area situated at Holualoa 1 and 2, North Kona, Hawaii, shall be Multiple Family Residential (RM-5):

(PARCEL 2)

Beginning at the southeast corner of this parcel of land, being the northeast corner of Stream Lot 15, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA," being 9,565.90 feet South and 11,749.51 feet East, thence running by azimuths measured clockwise from true South:

Along Stream Lot 15 for the next thirteen (13) courses, the direct azimuths and distances being:

1.	65°	05'	2.53 feet;
2.	98°	56'	151.87 feet;
3.	121°	57'	191.39 feet;
4.	95°	15'	205.20 feet;
5.	96°	50'	273.37 feet;
6.	74°	55'	132.84 feet;
7.	107°	39'	54.73 feet;
8.	90°	53'	191.87 feet;
9.	129°	17'	96.53 feet;
10.	80°	07'	71.22 feet;

11.	53°	36'		104.76	feet;
12.	83°	27'		205.32	feet;
13.	84°	08'		104.72	feet;

Thence along Stream Lot 14 for the next thirteen (13) courses, the direct azimuths and distances being:

14.	211°	20'	30"	763.45	feet;
15.	217°	21'		127.42	feet;
16.	205°	59'		243.59	feet;
17.	224°	49'		148.60	feet;
18.	246°	32'		87.91	feet;
19.	231°	29'		170.64	feet;
20.	256°	01'		140.06	feet;
21.	231°	06'		98.89	feet;
22.	226°	39'		104.41	feet;
23.	249°	49'		53.22	feet;
24.	270°	55'		33.64	feet;
25.	292°	56'		83.57	feet;
26.	276°	54'		90.29	feet;
27.	354°	02'		55.41	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
28.	21°	41'	50"	8.60	feet along same;
29.	359°	37'	20"	20.09	feet along same;
30.	5°	07'	20"	44.89	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu and along the remainder of R.P. 8217, L.C. Aw. 3660 to John P. Munn;

31.	355°	00'	65.72	feet along the remainder of R.P. 8217, L.C. Aw. 3660 to John P. Munn and along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
32.	3°	05'	265.06	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
33.	77°	08'	20.55	feet along same;
34.	4°	39'	203.73	feet along same;
35.	347°	02'	187.60	feet along same;
36.	337°	00'	679.20	feet along same to the point of beginning and containing an area of 30.901 Acres. (Refer to Parcel 2 as shown on Exhibit A)

The district classification of the following area situated at Holualoa 1 and 2, North Kona, Hawaii, shall be Single Family Residential (RS-15):

(PARCEL 3)

Beginning at the southwest corner of this parcel of land and on the easterly side of Kailua-Keauhou Middle Road, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA," being 12,047.12 feet South and 11,089.83 feet East, thence running by azimuths measured clockwise from true South:

Along Kailua-Keauhou Middle Road for the next thirty-six (36) courses, the direct azimuths and distances being:

1.	172°	54'	30"	186.38	feet;
2.	177°	19'		91.93	feet;
3.	167°	17'	30"	51.67	feet;
4.	185°	12'		69.99	feet;
5.	192°	52'		74.50	feet;

6.	173°	31'	30"	20.57 feet;
7.	161°	40'	30"	49.48 feet;
8.	141°	33'		41.74 feet;
9.	128°	06'		63.19 feet;
10.	135°	52'		140.78 feet;
11.	124°	23'	30"	65.66 feet;
12.	113°	18'		37.19 feet;
13.	119°	09'	30"	50.14 feet;
14.	111°	13'	30"	24.45 feet;
15.	107°	15'		108.48 feet;
16.	102°	13'		70.44 feet;
17.	112°	58'		84.72 feet;
18.	115°	15'	30"	178.23 feet;
19.	121°	06'		87.41 feet;
20.	111°	55'		32.57 feet;
21.	110°	49'	30"	55.63 feet;
22.	104°	37'		24.92 feet;
23.	104°	38'	30"	35.05 feet;
24.	102°	57'	30"	40.04 feet;
25.	112°	43'	30"	58.53 feet;
26.	102°	40'		32.94 feet;
27.	95°	37'	30"	32.48 feet;
28.	104°	23'		85.44 feet;
29.	91°	43'		44.66 feet;
30.	99°	18'	30"	25.27 feet;
31.	112°	14'		66.03 feet;

32.	117°	51'	30"	31.69	feet;
33.	125°	07'		43.90	feet;
34.	134°	37'	30"	40.62	feet;
35.	134°	37'	30"	41.48	feet;
36.	134°	00'	30"	47.64	feet;
37.	154°	11'		400.86	feet along Kuakini Highway Realignment, Project No. 11A-03-69;
38.	240°	28'	30"	1,332.99	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu (Lot 4);
39.	150°	28'	30"	337.56	feet along same;

Thence along Stream Lot 15 for the next ten (10) courses, the direct azimuths and distances being:

40.	233°	36'	91.73	feet;
41.	260°	07'	29.64	feet;
42.	309°	17'	89.97	feet;
43.	270°	53'	203.93	feet;
44.	286°	30'	113.50	feet;
45.	267°	11'	352.71	feet;
46.	275°	15'	185.94	feet;
47.	301°	57'	189.37	feet;
48.	278°	56'	182.35	feet;
49.	245°	05'	10.28	feet;
50.	345°	30'	902.50	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu and along the remainder of Grant 3630 to W. H. Cornwell;

51.	334°	30'		969.30	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
52.	2°	00'		537.04	feet along same;
53.	86°	51'	30"	120.73	feet along Grant 988 to Kamalo;
54.	93°	48'		45.22	feet along same;
55.	84°	14'		106.16	feet along same;
56.	104°	06'	30"	41.60	feet along same;
57.	77°	41'	30"	76.19	feet along Grant 988 to Kamalo and along Grant 1591 to Hoolawaihonua;

Thence along Grant 1591 to Hoolawaihonua for the next nine (9) courses, the direct azimuths and distances being:

58.	82°	34'		126.79	feet;
59.	142°	51'		32.82	feet;
60.	81°	37'		106.15	feet;
61.	67°	57'	30"	30.29	feet;
62.	83°	03'	30"	258.61	feet;
63.	72°	49'	30"	90.07	feet;
64.	84°	37'	30"	76.23	feet;
65.	78°	08'		62.37	feet;
66.	82°	02'	30"	157.05	feet to the point of beginning and containing an area of 103.293 Acres. (Refer to Parcel 3 as shown on Exhibit A)

All as shown on the map attached hereto, marked Exhibit "A" and by reference made a part hereof.

SECTION 2. These changes in district classification are conditioned upon the following:

(A) The zoning for the property shall be effective only after: (1) there are assurances satisfactory to the Departments of Water Supply and Planning, upon consultation with the State Department of Health, and the Division of Water and Land Development of the State Department of Land and Natural Resources, that a water source of sufficient quality and quantity has been established within two years from the effective date of this ordinance; provided that a maximum one-year extension to the two-year time limit may be granted by the Planning Director with reasonable and sufficient justification; and (2) an agreement, accompanied by an appropriate surety bond or other acceptable security, is executed with the Department of Water Supply for the actual development of a proven water source and its water transmission and distribution system within one year from the official date of compliance with condition A(1); provided that a one-year extension to the one-year time limit may be granted by the Planning Director with reasonable and sufficient justification; or (3) the Department of Water Supply issues a water commitment for the proposed development;

(B) No subdivision or development of any portion of the land shall occur unless and until condition A has been complied with;

(C) The Planning Director shall be mandated to initiate action for the repeal of this ordinance if conditions A or B have not been complied with;

(D) The petitioner, its assigns or successors, shall be responsible for complying with all conditions of approval;

(E) The zoning for the 49± acres designated by the State Land Use Commission as its second zoning increment shall not become effective until that land is certified by that commission to be within the Urban District;

(F) The RS zoned area shall be developed in two increments. The first increment shall consist of a maximum of 59.5± contiguous acres, and the second, the remaining area. The effective date of zoning for the second increment shall be after development has occurred in the first increment, as determined by the Planning Director. "Development" means that building permits have been issued for dwelling units and construction has been partially completed to the extent that roofs have been constructed on a minimum of twenty-five percent of the number of units proposed for the entire area of 103.4± acres. In lieu of actual construction, the petitioner may enter into an agreement with the Hawaii County Housing Agency to assure the County that the dwellings will be constructed within a given period. Such agreement shall be secured by a surety bond, certified check, or other security acceptable to Corporation Counsel and the Hawaii County Housing Agency. Upon final execution of such agreement and filing of the security with the Hawaii County Housing

Agency, the zoning of the second increment may be deemed by the Planning Director to be effective prior to the actual construction of the dwellings in the first increment provided that condition E is complied with;

(G) Subdivision plans for the first increment of the RS zoned area shall be submitted within one year from the effective date of the zoning. Final subdivision approval shall be secured within one year from the date of receipt of tentative subdivision approval;

(H) The RM zoned area shall be developed in two increments. The first increment shall consist of a maximum of 42 acres of the Multiple Family Residential zoned land and the second increment, the remaining area. The effective date of zoning for the second increment shall be after "development," as defined in condition F, has occurred in the first increment, as determined by the Planning Director;

(I) Plans for the development within the first increment of the RM zoned area shall be submitted to the Planning Department and final plan approval secured within one year from the effective date of the zoning. Construction shall commence within one year from the date of receipt of final plan approval and be completed within three years thereafter;

(J) Housing opportunities for Hawaii residents shall be provided in accordance with the condition imposed by the State Land Use Commission. The number of units and manner in which they are to be provided shall meet with the approval of the Hawaii County Housing Agency;

(K) Improvements to the intersections with Kuakini Highway and the Kuakini Highway Extension shall be constructed meeting with the approval of the State Department of Transportation, Highways Division. The intersection improvements shall be constructed concurrently with the development of the first increment of the RS or RM zoned areas, whichever occurs first;

(L) No direct access shall be provided for the lots within the RS zoned area from the mauka-makai collector road;

(M) The roadways within the RM zoned area which are proposed for dedication shall be constructed to dedicable standards with curbs, gutters, and sidewalks meeting with the approval of the Department of Public Works. Where a roadway crosses a zone line or if a zone line should divide a roadway, the curbs, gutters, and sidewalks shall be provided for the entire right-of-way and shall continue to the nearest intersection in order to avoid telescoping and to provide consistent improvement;

(N) At a minimum, roadways within the RS zoned area shall be provided with paved shoulders and paved swales meeting with the approval of the Department of Public Works;

(O) The method of sewage disposal shall meet with the approval of the appropriate governmental agencies;

(P) A drainage master plan shall be submitted to the Department of Public Works for review and approval prior to issuance of any subdivision or plan approvals. The plan shall include, as a minimum, hydrological and hydraulic calculations for all components of the drainage system, a construction timetable for all elements of the system, and an analysis of downstream impacts. Further, mitigating measures as approved by the Department of Public Works shall be taken to eliminate any downstream impacts;

(Q) An intensive archaeological survey shall be conducted for the entire property and a report shall be submitted to the Planning Department prior to issuance of any subdivision or plan approvals;

(R) Should any unanticipated archaeological sites be found during land preparation activities, work shall immediately stop and the Planning Department notified. Work shall not resume in the affected area until clearance is given by the Planning Department; and,

(S) All other applicable rules, regulations and requirements shall be complied with. Should any of the foregoing conditions not be met, rezoning of the area to its original or more appropriate designation may be initiated.

SECTION 3. In the event that any portion of the ordinance is declared invalid, such invalidity shall not affect other parts of this ordinance.

SECTION 4. This ordinance shall take effect upon its approval.

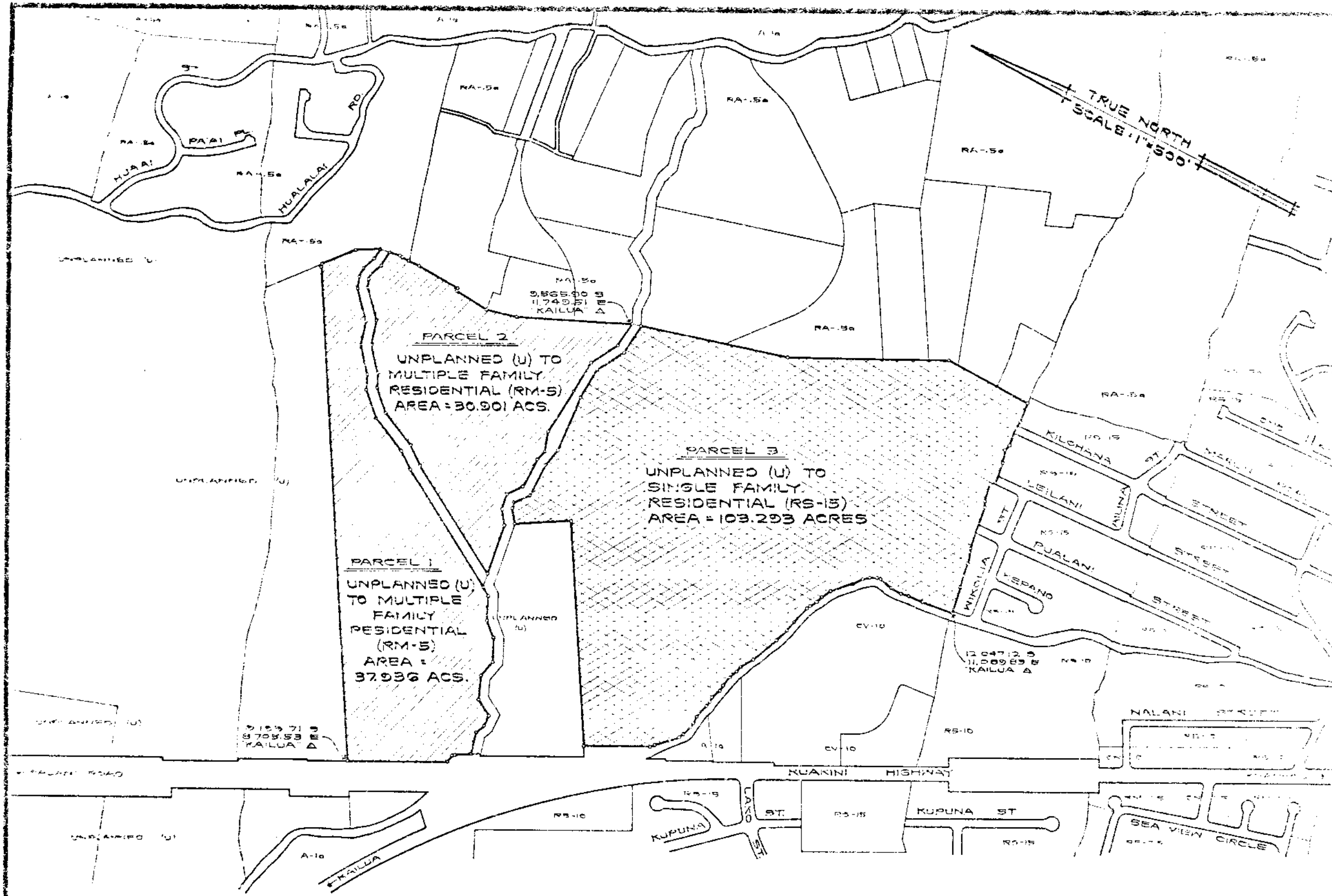
Introduced by:

Takeshi Domingo

COUNCIL MEMBER, COUNTY OF HAWAII

Hilo, Hawaii

Date of Introduction: April 18, 1984
Date of 1st Reading: April 18, 1984
Date of 2nd Reading: May 9, 1984
Effective Date: May 15, 1984



AMENDMENT TO THE ZONING CODE

AMENDING SECTION 25-87 (NORTH KONA ZONE MAP) ARTICLE 3, CHAPTER 25 (ZONING CODE) OF THE HAWAII COUNTY CODE, BY CHANGING THE DISTRICT CLASSIFICATION FROM UNPLANNED (U) TO MULTIPLE FAMILY RESIDENTIAL (RM-5) AND SINGLE FAMILY RESIDENTIAL (RS-15) AT HOLUALOA 1 AND 2, NORTH KONA, HAWAII.

PREPARED BY:
PLANNING DEPARTMENT
COUNTY OF HAWAII

TAX MAP KEY: 7-8-21: 4, 8-13, 15-17

MARCH 19, 1984

EXHIBIT 'A'

COUNTY OF HAWAI'I STATE OF HAWAI'I

BILL NO. 268

ORDINANCE NO. 02 131

AN ORDINANCE AMENDING ORDINANCE NO. 97-99, WHICH AMENDED ORDINANCE NOS. 84-23, 84-42, 88-4, 90-62, 91-96, 93-26, and 94-34, WHICH RECLASSIFIED CERTAIN LANDS FROM UNPLANNED (U) TO MULTIPLE FAMILY (RM-5) AND SINGLE-FAMILY RESIDENTIAL (RS-15) ZONED DISTRICT AT HOLUALOA 1 and 2, NORTH KONA, HAWAII, COVERED BY TAX MAP KEY 7-6-21:4, 9-13, AND 15-17.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAII:

SECTION 1. Ordinance No. 97-99, which amended Ordinance Nos. 84-23, 84-42, 88-4, 90-62, 91-96, 93-26, and 94-34, is amended as follows:

"SECTION 1. Section 25-8-3, Article 8, Chapter 25 (Zoning Code) of the Hawaii County Code, is amended to change the district classification of property described hereinafter as follows:

The district classification of the following area situated at Holualoa 1 and 2, North Kona, Hawaii, shall be Multiple Family Residential (RM-5) and Single Family Residential (RS-15).

(PARCEL 1)

Beginning at the northwest corner of this parcel of land and on the northeasterly side of Kuakini Highway Realignment, Project No. 11A-03-69, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA," being 9,193.71 feet South and 8,705.53 feet East, thence running by azimuths measured clockwise from true South:

1. 240° 28' 30" 2,903.35 feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;

2.	255°	18'		17.97	feet along same;
3.	311°	55'		219.92	feet along same;
4.	331°	14'	15"	143.36	feet along same;

Thence along Stream Lot 14 for the next thirteen (13) courses, the direct azimuths and distances being:

5.	96°	54'		67.99	feet;
6.	112°	56'		86.79	feet;
7.	90°	55'		56.48	feet;
8.	69°	49'		76.70	feet;
9.	46°	39'		114.37	feet;
10.	51°	06'		83.31	feet;
11.	76°	01'		139.84	feet;
12.	51°	29'		175.76	feet;
13.	66°	32'		91.49	feet;
14.	44°	49'		170.06	feet;
15.	25°	59'		247.57	feet;
16.	37°	21'		124.60	feet;
17.	31°	20'	30"	825.56	feet;

Thence along Stream Lot 15 for the next ten (10) courses, the azimuths and distances being:

18.	37°	01'		57.76	feet;
19.	66°	24'		138.13	feet;

20.	44°	01'		114.46	feet;
21.	67°	01'		134.84	feet;
22.	102°	13'		107.13	feet;
23.	69°	30'		139.97	feet;
24.	31°	40'		114.38	feet;
25.	88°	52'		64.54	feet;
26.	114°	04'		60.04	feet;
27.	77°	28'		132.01	feet;
28.	152°	18'	10"	95.72	feet along Kuakini Highway Realignment Project No. 11A-03-69;
29.	139°	59'	30"	20.75	feet along same;
30.	99°	48'	30"	35.58	feet along same;
31.	154°	11'		597.05	feet along same to the point of beginning and containing an area of 37.936 Acres. (Refer to Parcel 1 as shown on Exhibit A)

The district classification of the following area situated at Holualoa 1 and 2, North Kona, Hawaii, shall be Multiple Family Residential (RM-5):

(PARCEL 2)

Beginning at the southeast corner of this parcel of land, being the northeast corner of Stream Lot 15, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA," being 9,565.90 feet South and 11,749.51 feet East, thence running by azimuths measured clockwise from true South:

Along Stream Lot 15 for the next thirteen (13) courses, the direct azimuths and distances being:

1.	65°	05'		2.53	feet;
2.	98°	56'		151.87	feet;
3.	121°	57'		191.39	feet;
4.	95°	15'		205.20	feet;
5.	96°	50'		273.37	feet;
6.	74°	55'		132.84	feet;
7.	107°	39'		54.73	feet
8.	90°	53'		191.87	feet;
9.	129°	17'		96.53	feet;
10.	80°	07'		71.22	feet;
11.	53°	36'		104.76	feet;
12.	83°	27'		205.32	feet;
13.	84°	08'		104.72	feet;

Thence along Stream Lot 14 for the next thirteen (13) courses, the direct azimuths and distances being:

14.	211°	20'	30"	763.45	feet;
15.	217°	21'		127.42	feet;
16.	205°	59'		243.59	feet;
17.	224°	49'		148.60 feet;	
18.	246°	32'		87.91	feet;
19.	231°	29'		170.64	feet;

20.	256°	01'		140.06	feet;
21.	231°	06'		98.89	feet;
22.	226°	39'		104.41	feet;
23.	249°	49'		53.22	feet;
24.	270°	55'		33.64	feet
25.	292°	56'		83.57	feet;
26.	276°	54'		90.29	feet;
27.	354°	02'		55.41	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
28.	21°	41'	50"	8.60	feet along same;
29.	359°	37'	20"	20.09	feet along same;
30.	5°	07'	20"	44.89	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu and along the remainder of R.P. 8217, L.C. Aw. 3660 to John P. Munn;
31.	355°	00'		65.72	feet along the remainder of R.P. 8217, L.C. Aw. 3660 to John P. Munn and along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
32.	3°	05'		265.06	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
33.	77°	08'		20.55	feet along same;
34.	4°	39'		203.73	feet along same;

35.	347°	02'		187.60	feet along same;
36.	337°	00'		679.20	feet along same to the point of beginning and containing an area of 30.901 Acres. (Refer to Parcel 2 as shown on Exhibit A).

The district classification of the following area situated at Holualoa 1 and 2, North Kona, Hawaii, shall be Single Family Residential (RS-15):

(PARCEL 3)

Beginning at the southwest corner of this parcel of land and on the easterly side of Kailua-Keauhou Middle Road, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA," being 12,047.12 feet South and 11,089.83 feet East, thence running by azimuths measured clockwise from true South:

Along Kailua-Keauhou Middle Road for the next thirty-six (36) courses, the direct azimuths and distances being:

1.	172°	54'	30"	186.38	feet;
2.	177°	19'		91.93	feet;
3.	167°	17'	30"	51.67	feet;
4.	185°	12'		69.99	feet;
5.	192°	52'		74.50	feet;
6.	173°	31'	30"	20.57	feet;
7.	161°	40'	30"	49.48	feet;
8.	141°	33'		41.74	feet;
9.	128°	06'		63.19	feet;

10.	135°	52'		140.78	feet;
11.	124°	23'	30"	65.66	feet;
12.	113°	18'		37.19	feet;
13.	119°	09'	30"	50.14	feet;
14.	111°	13'	30"	24.45	feet;
15.	107°	15'		108.48	feet;
16.	102°	13'		70.44	feet;
17.	112°	58'		84.72	feet;
18.	115°	15'	30"	178.23	feet;
19.	121°	06'		87.41	feet;
20.	111°	55'		32.57	feet;
21.	110°	49'	30"	55.63	feet;
22.	104°	37'		24.92	feet;
23.	104°	38'	30"	35.05	feet;
24.	102°	57'	30"	40.04	feet;
25.	112°	43'	30"	58.53	feet;
26.	102°	40'		32.94	feet;
27.	95°	37'	30"	32.48	feet;
28.	104°	23'		85.44	feet;
29.	91°	43'		44.66	feet;

30.	99°	18'	30"	25.27	feet;
31.	112°	14'		66.03	feet;
32.	117°	51'	30"	31.69	feet;
33.	125°	07'		43.90	feet;
34.	134°	37'	30"	40.62	feet;
35.	134°	37'	30"	41.48	feet;
36.	134°	00'	30"	47.64	feet;
37.	154°	11'		400.86	feet along Kuakini Highway Realignment, Project No. 11A-03-69;
38.	240°	28'	30"	1,332.99	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu (Lot 4);
39.	150°	28'	30"	337.56	feet along same;

Thence along Stream Lot 15 for the next ten (10) courses, the direct azimuths and distances being:

40.	233°	36'		91.73	feet;
41.	260°	07'		29.64	feet;
42.	309°	17'		89.97	feet;
43.	270°	53'		203.93	feet;
44.	286°	30'		113.50	feet;
45.	267°	11'		352.71	feet;
46.	275°	15'		185.94	feet;
47.	301°	57'		189.37	feet;

48.	278°	56'		182.35	feet;
49.	245°	05'		10.28	feet;
50.	345°	30'		902.50	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu and along the remainder of Grant 3630 to W.H. Cornwell;
51.	334°	30'		969.30	feet along the remainder of R.P. 4475, L.C. Aw. 7713, Ap. 43 to Victoria Kamamalu;
52.	2°	00'		537.04	feet along same;
53.	86°	51'	30"	120.73	feet along Grant 988 to Kamalo;
54.	93°	48'		45.22	feet along same;
55.	84°	14'		106.16	feet along same;
56.	104°	06'	30"	41.60	feet along same;
57.	77°	41'	30"	76.19	feet along Grant 988 to Kamalo and along Grant 1591 to Hoolawaihonua;

Thence along Grant 1591 to Hoolawaihonua for the next nine (9) courses, the direct azimuths and distances being;

58.	82°	34'		126.79	feet;
59.	142°	51'		32.82	feet;
60.	81°	37'		106.15	feet;
61.	67°	57'	30"	30.29	feet;
62.	83°	03'	30"	258.61	feet;
63.	72°	49'	30"	90.07	feet;

64.	84°	37'	30"	76.23	feet;
65.	78°	08'		62.37	feet;
66.	82°	02'	30"	157.05	feet to the point of beginning and containing an area of 103.293 Acres. (Refer to Parcel 3 as shown on Exhibit A)

All as shown on the map attached hereto, marked Exhibit "A" and by reference made a part hereof.

SECTION 2. These changes in district classification are conditioned upon the following:

(A) the zoning for the property shall be effective only after: (1) there are assurances satisfactory to the Departments of Water Supply and Planning, upon consultation with the State Department of Health, and the Division of Water and Land Development of the State Department of Land and Natural Resources, that a water source of sufficient quality and quantity has been established within two years from the effective date of this ordinance; provided that a maximum one-year extension to the two-year time limit may be granted by the Planning Director with reasonable and sufficient justification; and (2) an agreement, accompanied by an appropriate surety bond or other acceptable security, is executed with the Department of Water Supply for the actual development of a proven water source and its water transmission and distribution system within one year from the official date of compliance with condition A (1); provided that a one-year extension to the one-year time limit may be granted by the Planning Director with reasonable and sufficient justification; or (3) the Department of Water Supply issues a water commitment for the proposed development;

(B) no subdivision or development of any portion of the land shall occur unless and until condition A has been complied with;

(C) the Planning Director shall be mandated to initiate action for the repeal of this ordinance if conditions A or B have not been complied with;

(D) the petitioner, its assigns of successors, shall be responsible for complying with all conditions of approval;

(E) the zoning for the 49± acres designated by the State Land Use Commission as its second zoning increment shall not become effective until that land is certified by that commission to be within the Urban District;

(F) the RS zoned area shall be developed in two increments. The first increment shall consist of a maximum of 59.5± contiguous acres, and the second, the remaining area. The effective date of zoning for the second increment shall be after development has occurred in the first increment, as determined by the Planning Director. "Development" means the applicant has completed the on-site and off-site improvements within the first increment of the RS zoned area and has dedicated the roadway to the County;

(G) subdivision plans for the first increment of the RS zoned area shall be submitted within one year from the effective date of the zoning. Final subdivision approval shall be secured within two years from the effective date of this amendment;

(H) the RM zoned area shall be developed in two increments. The first increment shall consist of a maximum of 42 acres of the Multiple Family Residential zoned land and the second increment, the remaining area. The effective date of zoning for the second increment shall be after the applicant has completed the on-site and off-site improvements of the first increment of the RM zoned area and has dedicated the improvements to the County;

(I) plans for the development within the first increment of the RM zoned area shall be submitted to the Planning Department and final plan approval secured within five years from the effective date of this sixth amendment. Construction shall commence within one year from the date of receipt of final plan approval and be completed within three years thereafter;

(J) should the Council adopt a Unified Impact Fees Ordinance setting forth criteria for the imposition of exactions or the assessment of impact fees, conditions included herein shall be credited towards the requirements of the Unified Impact Fees Ordinance;

(K) housing opportunities for Hawaii residents shall be provided in accordance with the condition imposed by the State Land Use Commission. The number of units and manner in which they are to be provided shall meet with the approval of the Hawaii County Housing Agency;

(L) improvements to the intersections with Kuakini Highway and the Kuakini Highway Extension shall be constructed meeting with the approval of the State Department of Transportation, Highways Division. The intersection improvements shall be constructed concurrently with the development of the first increment of the RS or RM zoned areas, whichever occurs first;

(M) no direct access shall be provided for the lots within the RS zoned area from the mauka-makai collector road;

(N) the roadways and stubout within the RM zoned area shall be constructed to dedicable standards with curbs, gutters, and sidewalks meeting with the approval of the Department of Public Works and shall be dedicated to the County of Hawaii upon completion. Where a roadway crosses a zone line or if a zone line should divide a roadway, the curbs, gutters, and sidewalks shall be provided for the entire right-of-the-way and shall continue to the nearest intersection in order to avoid telescoping and to provide consistent improvement;

(O) at a minimum, roadways and stubouts within the RS zoned area shall be provided with paved shoulders and paved swales meeting with the approval of the Department of Public Works and shall be dedicated to the County of Hawaii upon completion;

(P) the method of sewage disposal shall meet with the approval of the appropriate governmental agencies;

(Q) a drainage master plan shall be submitted to the Department of Public Works for review and approval prior to issuance of any subdivision or plan approvals. The plan shall include, as a minimum, hydrological and hydraulic calculations for all components of the drainage system, a construction timetable for all elements of the system, and an analysis of downstream impacts. Further, mitigating measures as approved by the Department of Public Works shall be taken to eliminate any downstream impacts;

(R) an intensive archaeological survey shall be conducted for the entire property and a report shall be submitted to the Planning Department prior to issuance of any subdivision or plan approvals;

(S) should any unanticipated archaeological sites be found during land preparation activities, work shall immediately stop and the Planning Department notified. Work shall not resume in the affected area until clearance is given by the Planning Department;

(T) prior to the Final Approval of the second increment, the applicant, its successors of assigns shall pay for any additional real property taxes owed for the new residential assessed value of the subject property which was previously taxed at the agricultural rate; and

(U) an initial extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances:

1) the non-performance is the result of conditions that could not have been foreseen or are beyond the control of the applicants, successors or assigns, and that are not the result of their fault or negligence;

2) granting of the time extension would not be contrary to the general plan or zoning code;

3) granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;

4) the time extension granted shall be for a period not to exceed the period originally granted for performance (i.e., a condition to be performed within one year may be extended for up to one additional year); and

5) if the applicant should require an additional extension of time, the Planning Director shall submit the applicant's request to the County Council for appropriate action. Further, should any of the conditions not be met or substantially complied with in a timely fashion, the Director initiate rezoning of the area to its original or more appropriate designation."

SECTION 2. Material to be deleted is bracketed. New material is underscored.

SECTION 3. In the event that any portion of the ordinance is declared invalid, such invalidity shall not affect the other parts of this ordinance.

SECTION 4. This ordinance shall take effect upon its approval.

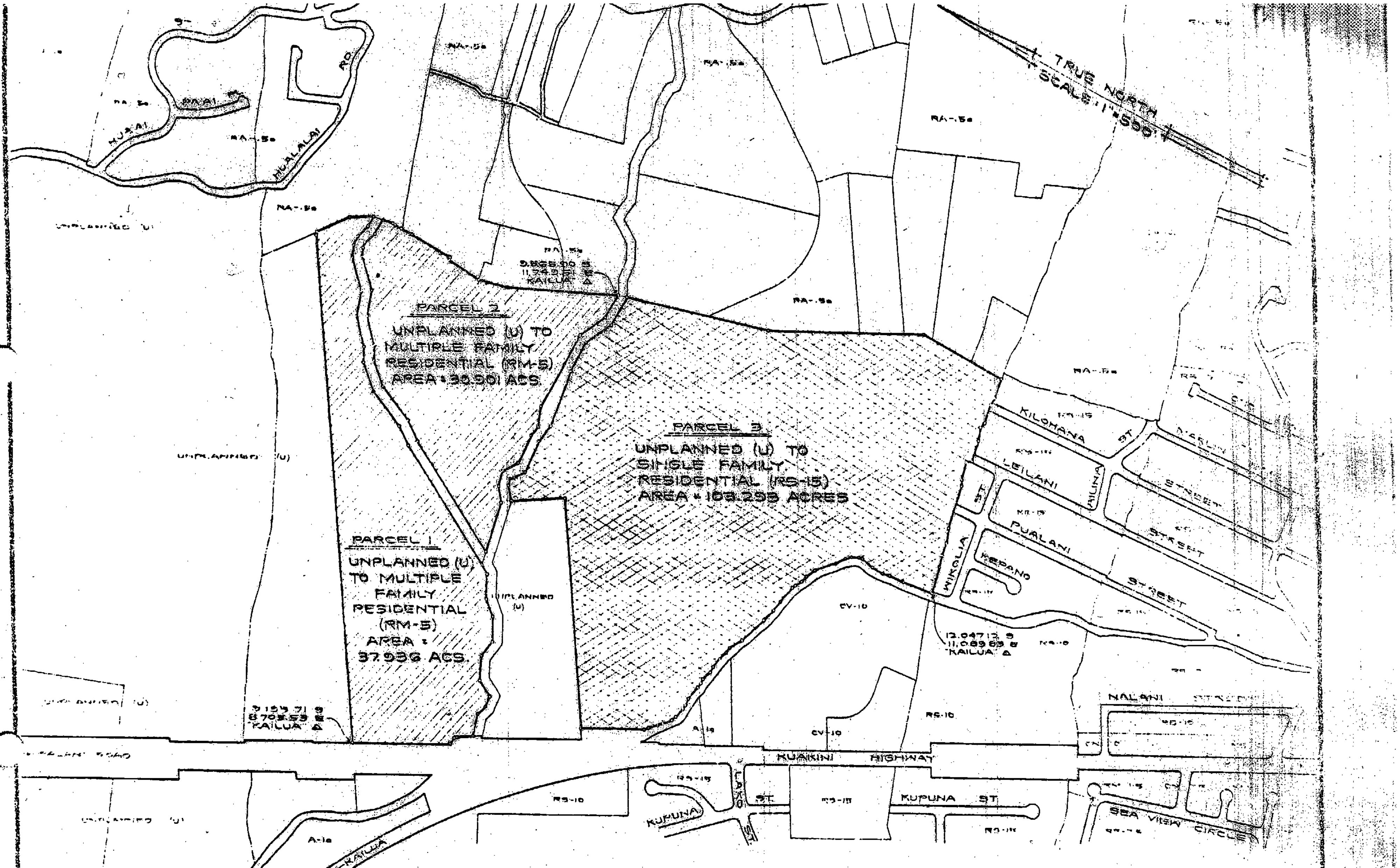
INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAII

Hilo, Hawaii

Date of Introduction: November 8, 2002
Date of 1st Reading: November 8, 2002
Date of 2nd Reading: November 20, 2002
Effective Date: November 27, 2002

REFERENCE: Comm. 768



AMENDMENT TO THE ZONING CODE

AMENDING SECTION 25-37 (NORTH KONA ZONE MAP) ARTICLE 3, CHAPTER 25 (ZONING CODE) OF THE HAWAII COUNTY CODE, BY CHANGING THE DISTRICT CLASSIFICATION FROM UNPLANNED (U) TO MULTIPLE FAMILY RESIDENTIAL (RM-5) AND SINGLE FAMILY RESIDENTIAL (RS-15) AT HOLUALOA 1 AND 2, NORTH KONA, HAWAII.

PREPARED BY:
PLANNING DEPARTMENT
COUNTY OF HAWAII

TAX MAP KEY: 7-6-21: 4, 9-13, 15-17

OFFICE OF THE COUNTY CLERK
County of Hawaii
Hilo, Hawaii

Introduced By: Bobby Jean Leithead-Todd
Date Introduced: November 8, 2002
First Reading: November 8, 2002
Published: N/A

REMARKS:

ROLL CALL VOTE	AYES	NOES	ABS	EX
Arakaki	X			
Chung	X			
Elarionoff	X			
Jacobson	X			
Leithead-Todd	X			
Pisicchio	X			
Safarik	X			
Tyler	X			
Yagong	X			
	9	0	0	0

Second Reading: November 20, 2002
To Mayor: November 25, 2002
Returned: November 29, 2002
Effective: November 27, 2002
Published: December 10, 2002

REMARKS:

ROLL CALL VOTE	AYES	NOES	ABS	EX
Arakaki	X			
Chung			X	
Elarionoff	X			
Jacobson	X			
Leithead-Todd			X	
Pisicchio	X			
Safarik	X			
Tyler	X			
Yagong	X			
	7	0	2	0

I DO HEREBY CERTIFY that the foregoing BILL was adopted by the County Council published as indicated above.

APPROVED AS TO
FORM AND LEGALITY:

DEPUTY CORPORATION COUNSEL
COUNTY OF HAWAII

Date November 26, 2002

COUNCIL CHAIRMAN

COUNTY CLERK

Bill No.: 268
Reference: C-768/PC-105
Ord No.: 02 131

Approved/Disapproved this 27th *day*
of November, *20* 02.

MAYOR, COUNTY OF HAWAII

Mitchell D. Roth
Mayor

Lee E. Lord
Managing Director

West Hawai'i Office
74-5044 Ane Keohokālole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

FILE COPY

SEP 2 3 2021

Zendo Kern
Director

Jeffrey W. Darrow
Deputy Director

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

County of Hawai'i
PLANNING DEPARTMENT

September 13, 2021

Environmental Review Program
Office of Planning and Sustainable Development
235 S. Beretania St., Rm. 702
Honolulu, HI 96813

Dear Director,

Subject:	**Final Environmental Assessment (FEA) and Finding of No Significant Impact (FONSI) for the Proposed Royal Vistas Housing Project**
Location:	**North Kona District, Island of Hawai'i**
TMK(s):	**(3) 7-6-021:016 – 019**

With this letter, the County of Hawai'i Planning Department (Accepting Authority) hereby transmits electronically the Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) for the proposed Royal Vistas Housing Project for publication in the next available edition of the Environmental Notice.

The Royal Vistas Housing Project is being proposed to construct up to 450 multi-family residential units in clusters of two- and three-story buildings on approximately 70 acres of land. Additional improvements are also planned such as landscaping, roadways, and utilities.

The Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) was published in the OEQC's September 8, 2020, issue of the Environmental Notice. The FEA includes copies of comments received and the corresponding responses from the applicant that were received during the 30-day public comment period on the DEA-AFONSI.

Based on the findings from Part 5 of the FEA, the Planning Department has determined that this project will not have a "significant effect" or "significant impact" on the quality of the environment and have therefore issued a FONSI. **This FONSI does not constitute approval of the project or of any project components or proposed uses.**

22 - 036

If there are any questions regarding this letter or the project, please contact Alex Roy of our Planning Department staff at (808) 961-8140 or via email at Alex.Roy@hawaiicounty.gov.

Sincerely,

Jeffrey W. Darrow
Jeffrey W. Darrow (Sep 13, 2021 11:35 HST)

JEFFREY W. DARROW
Deputy Planning Director

AJR:jaa
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From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Thursday, September 16, 2021 3:10:47 PM

Action Name

Royal Vistas Housing Project

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

North Kona, Hawaiʻi

Tax Map Key(s) (TMK(s))

(3) 7-6-021:016; (3) 7-6-021:017; (3) 7-6-021:018; (3) 7-6-021:019

Action type

Applicant

Other required permits and approvals

Grading Permit, Drainage Plan (County DPW); Building Permits and Plan Approval (County DPW and Planning); National Pollutant Discharge Elimination System Permit (State DOH); Chapter 6E, HRS, determination from State Historic Preservation Division on historic property effects (obtained)

Discretionary consent required

Approval of Amendments to Zoning Ordinance (County Council)

Approving agency

County of Hawaiʻi Planning Department

Agency contact name

Alex Roy

Agency contact email (for info about the action)

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Agency address

COUNTY OF HAWAI'I PLANNING DEPARTMENT
101 PAUAHI STREET, SUITE 3
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United States
Map It

Applicant

Kona Three LLC

Applicant contact name

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Applicant contact email

richard@eastwestrealty.org

Applicant contact phone

(808) 753-3167

Applicant address

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Hilo, HI 96720
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

Stantec Consulting and Geometrician Associates LLC

Consultant contact name

Michele Lefebvre

Consultant contact email

michele.lefebvre@stantec.com

Consultant contact phone

(808) 494-2039

Consultant address

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Hilo, HI 96721
United States
Map It

Action summary

The proposed project is located approximately 2.7 miles south of downtown Kailua-Kona and would consist of necessary improvements to construct up to 450 multi-family residential units in clusters of two- and three-story buildings on approximately 70 acres. Units would target local renters and buyers in the "market" price points. The project is the final phase of the original zoning ordinance (No. 84-23) signed on May 15, 1984, and includes the multi-family zoned land which was planned for work-force housing. Electrical and sewer would be extended from nearby utility grid terminus and water commitments have already been purchased for the project. The proposed project has been designed to minimize impacts from surface water run-off. Traffic impacts would be minimized with a new un-signalized intersection off Queen Kaʻahumanu Highway. No impacts to biological resources, historic or archaeological resources, or cultural sites or practices are expected from the project.

Reasons supporting determination

(1) Irrevocably commit a natural, cultural, or historic resource.

No valuable natural or cultural resources would be committed or lost as a result of the Proposed Project. No impacts to archaeological resources would occur with the planned preservation of the railroad berm and petroglyph.

(2) Curtail the range of beneficial uses of the environment;

The proposed mid-market housing development does not curtail beneficial uses of the environment and is consistent with the medium density zoning in the LUPAG and conforms to the guiding principles regarding urban growth patterns as defined by the Kona CDP.

(3) Conflict with the State's environmental policies or long-term environmental goals established by law;

The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The impact from the Proposed Project is minor and, therefore, is consistent with all elements of the State's long-term environmental policies and environmental goals.

(4) Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State;

The Proposed Project would not adversely affect the social welfare of the community and would contribute to services. The Proposed Project would generate work for the local construction industry, which would stimulate local economic spending. The Proposed Project would balance the social welfare of the community by providing infill mid-market housing and allow resident households better access and the ability to safely manage commutes between home, work, and recreation. Stable households lead to stable communities and associated workforce, and promotes a functional economy.

(5) Have a substantial adverse effect on public health;

The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design.

(6) Involve adverse secondary impacts, such as population changes or effects on public facilities;

No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services.

(7) Involve a substantial degradation of environmental quality;

The impact from the Proposed Project is minor, and would thus not contribute to environmental degradation. BMPs and appropriate erosion control measures would be utilized during construction. Short-term impacts on air and noise quality will be mitigated by employing BMPs. No long-term adverse impacts are expected from the Proposed Project.

(8) Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions;

The Proposed Project is not related to other activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions.

(9) Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat;

There are no rare, threatened, or endangered species or suitable habitat for these species present at the Project Site, and no effects to these species are anticipated. Endangered Hawaiian hoary bats and formerly listed Hawaiian hawks, which are island wide-ranging species, would experience no adverse impacts due to mitigation in the form of timing of vegetation removal and/or hawk nest survey. Additionally, no rare, threatened, or endangered species of fauna are known to exist on or near the Project Site, and none would be directly affected by any project activities.

(10) Have a substantial adverse effect on air or water quality or ambient noise levels;

No adverse effects on air quality or noise would occur. The increase in noise levels on the site are acceptable and would be only a moderate increase in the existing levels. To minimize impacts to air quality during construction, the Proposed Project would implement a watering program for dust abatement. Other control measures during construction such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens would also be utilized as necessary to minimize impacts to air quality.

(11) Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;

Although the property is located in an area with volcanic and seismic risk, the entire Island of Hawaiʻi shares this risk, and the Proposed Project is not imprudent to construct. The property is approximately 0.85 miles from the shoreline and the development is outside any flood plain. Based on potential impacts from climate change, the Proposed Project has been designed to accommodate increased stormwater run-off from larger storms in the adjacent drainages and on site.

(12) Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies; or

No scenic vistas or viewplanes identified in the Hawaiʻi County General Plan will be adversely affected by the Proposed Project.

(13) Require substantial energy consumption or emit substantial greenhouse gases.

The development would have solar water heating and incorporate efficient appliances, as practical and possible. Negligible emissions of greenhouse gases would occur during construction and occupation of the proposed development. Since the Project addresses an existing demand for housing, it is expected that a portion of the residents that would occupy the development already live in Kona or on Hawaiʻi Island, and there would not be a substantial increase in emissions when residents occupy the Project. Therefore, Project impacts would be considered a negligible increase to the global annual greenhouse gas emissions.

Attached documents (signed agency letter & EA/EIS)

- Final_EA_Royal_Vistas.September.2021.pdf
- Royal_Vistas_PD_to_OEQC_FEA.pdf

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

- Royal_Vistas_TMKs.zip

Authorized individual

Alex J. Roy

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

FINAL ENVIRONMENTAL ASSESSMENT

Royal Vistas Housing Project

TMKs (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019
North Kona District, Hawaiʻi Island
State of Hawaiʻi

September 2021

Applicant
Kona Three LLC
101 Hualalai Street
Hilo, HI 96720

Approving Agency
County of Hawaiʻi Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720

FINAL ENVIRONMENTAL ASSESSMENT

Royal Vistas Housing Project

TMKs (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019
North Kona District, Hawaiʻi Island, State of Hawaiʻi

APPLICANT:

Kona Three LLC
101 Hualalai Street
Hilo, HI 96720

APPROVING AGENCY:

County of Hawaiʻi Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720

CONSULTANT:

Stantec Consulting Inc.
P.O. Box 191
Hilo, HI 96721

Geometrician Associates
P.O. Box 396
Hilo, HI 96721

CLASS OF ACTION:

Use of County Lands

This document is prepared pursuant to:

The Hawaiʻi Environmental Policy Act,
Chapter 343, Hawaiʻi Revised Statutes, and
Title 11, Chapter 200.1, Hawaiʻi Department of Health Administrative Rules

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SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS, AND MITIGATION MEASURES

The proposed project is located approximately 2.7 miles south of downtown Kailua-Kona and would consist of necessary improvements to construct up to 450 multi-family residential units in clusters of two- and three-story buildings on approximately 70 acres. The following are estimates for the number of units, floor plans, bedroom/bathroom counts, and buildings heights. The numbers may be adjusted during final design and permitting. The development would conceptually include approximately 174 "For Rent" units consisting of 122 two-bedroom/two-bath units and 52 three-bedroom/two-bath units plus a resident manager's unit, all in two-story buildings on the *makai* portion of the project site. The development would also include approximately 274 "For Sale" units consisting of 147 two bedroom/two-bath units and 137 three-bedroom/two-bath units plus a resident manager's unit. The "For Sale" units would be located in approximately ten two-story buildings and approximately 39 three-story buildings, with the two-story buildings being four units each and the three-story buildings being six units each. Parking would consist of a mix of covered and open spaces for residents and guests. The project would be developed in two or more phases, with Phase I having a maximum of 258 units and Phase II having the balance of 192 units. Phase I would include all the Rental units and some Sale units. Both Rental and Sale units would target local renters and buyers in the "market" price points. There would be two Community Centers, one for the Rental units and one for the Sale units. Each center would have a pool and facilities for use by the residents. The development would be compliant with American with Disabilities Act Standards for accessible design. The project is the final phase of the original zoning ordinance (No. 84-23) signed on May 15, 1984, and includes the multi-family zoned land which was planned for work-force housing. Electrical and sewer would be extended from nearby utility grid terminus and water commitments have already been purchased for the project.

The proposed project has been designed to minimize impacts from surface water run-off. Traffic impacts would be minimized with a new un-signalized intersection serving the project off Queen Ka'ahumanu Highway. No impacts to biological resources, historic or archaeological resources, or cultural sites or practices, are expected from the project.

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PART 1: PROJECT DESCRIPTION, LOCATION, AND ENVIRONMENTAL ASSESSMENT PROCESS

1.1 Project Location and Property Ownership

Kona Three LLC (Kona Three) proposes to develop the Royal Vista Housing Project ("Proposed Project") which would occur within Tax Map Keys (TMKs) (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 in North Kona ("Project Site") as shown on Figures 1 and 2. Kona Three owns TMKs 7-6-021:016 and 7-6-021:017 which together cover approximately 69 acres, while the County of Hawai'i Department of Public Works (DPW) manages TMKs 7-6-021:018 and 7-6-021:019 which together cover approximately 7.3 acres. The Project Site is located 2.7 miles south of downtown Kailua-Kona along Queen Ka'ahumanu Highway (Highway 19). Photos 1 and 2 were taken at the Project Site.

1.2 Project Description

Housing Project

Kona Three proposes to construct up to 450 multi-family residential units in clusters of two- and three-story buildings on approximately 70 acres. A conceptual drawing of the layout of the buildings is shown on Figure 3. The following are estimates for the number of "For Rent" and "For Sale" units, floor plans, bedroom/bathroom counts, and buildings heights. Although the numbers may be adjusted during final design and permitting, the EA analyzes the maximum building height of three stories and the maximum number of units (450 units). The medium density development would include approximately 174 "For Rent" units consisting of 122 two-bedroom/two-bath units and 52 three-bedroom/two-bath units plus a resident manager's unit, all in two-story buildings on the *makai* portion of the Project Site. A property management firm would manage the rental units. A schematic showing the site sections for two- and three-story buildings is shown on Figure 4, and the concepts for layout shown on Figure 5. The development would also include approximately 274 "For Sale" units consisting of 147 two bedroom/two-bath units and 137 three-bedroom/two-bath units plus a resident manager's unit. The "For Sale" units would be located in ten two-story buildings and 39 three-story buildings, with the two-story buildings being four units each and the three-story buildings being six units each. Parking would consist of a mix of covered and open spaces for residents and guests. <u>A comment from Gary East on the Draft EA asked about walkability within the development (Appendix 1b). Private driveways within the development would be paved and provide safe access for residents (including streetlights). Additionally, the location of walk paths within the development would be determined upon final design.</u>

The Project would be developed in two or more phases, with Phase I having a maximum of 258 units and Phase II having the balance of 192 units. Phase I would include all the Rental units and some Sale units. Both Rental and Sale units would target local renters and buyers in the "market" price points. Phase I is expected to be completed by 2024, and Phase II is expected to be completed by 2029. There would be two Community Centers, one for the Rental units and one for the Sale units. Each center would have a pool and facilities for use by the residents. A comment from Clyde Hemby on the Draft EA asked whether the proposed development would comply with accessibility standards (Appendix 1b). The development would be compliant with American with Disabilities Act Standards for accessible design. Construction could start as early as third quarter of 2021, following Plan Approval and construction permits, and would be expected to last 12 to 18 months. Construction would be conducted in accordance with any applicable COVID-19 emergency proclamations in place at that time.

The Project is the final residential development identified in the zoning ordinance (No. 84-23) signed in 1984. The original zoning ordinance and subsequent amendments included the following:

- 103 acres for 215 single-family units;
- 71 acres for multi-family, mid-market[1] units (the Proposed Project); and
- An additional 12 acres acquired at the behest of the County of Hawai'i, Office of Housing and Community Development (OHCD) at TMK (3): 7-6-24:025.

The development of the single-family units on 103 acres was mostly completed by the previous developer. The previous developers built and installed roadways, intersection, and drainage improvements, as well as driveways, light poles, utility infrastructure, landscaping, and other assets for the new community. The 12-acre area for the affordable housing project is located on what are now TMKs (3) 7-6-24:25, 112, and 113 and the area could be developed in the near future. As a condition in the zoning ordinance, Kona Three had an agreement to convey the 12 acres of land for the affordable housing when construction of the Project's drainage system is completed. A comment from Martin Ohan on the Draft EA asked about the affordable housing project (Appendix 1b). If OHCD decides not to pursue an affordable housing project at this location, Kona Three would negotiate a new agreement with OHCD to satisfy the requirement of the zoning ordinance using options such as dedicating some of the Project's units for affordable housing, providing affordable housing elsewhere off-site in Kona, acquiring affordable housing credits from another location in Kona, or a combination of these options.

[1] Mid-market refers to the price point that the Project targets, which is in between the subsidized housing market and the wealthy or upper middle market groups.

Electrical and sewer service would be extended from nearby public grid terminus and water commitments have already been purchased for the Project. The Project is in an urban area located between Kona Vistas and Pualani Estates subdivisions and is in close proximity to major roadways, recreational opportunities, and essential services, including grocery and wholesale stores, employment, hospital/clinics, public transit, gas stations, schools, financial institutions, government agencies/ services, and the airport.

To address housing shortages in Kona, the Kona Community Development Plan (CDP) identifies Objective HSG-4: Build More Units and Policy HSG-4.2: Workforce Housing. The workforce gap group (up to 180% of median income) includes the part of the population that earns too much to qualify for affordable housing programs, yet too little to buy or rent decent housing close to their jobs. The Project would build units that offer a variety of housing types for both the rental and buyer segments of the mid-market which includes the workforce group. Although the Project is not specifically a workforce project, it would provide a housing option for the workforce gap group.

The Project is an infill project located within the Kona Urban Area as designated by the Official Kona Land Use Map (Figure 4-7 in the Kona CDP), although it is not in the Transit-Oriented Development (TOD) area nor within a CDP Concurrency Zone. As stated in the CDP, "Within this Kona Urban Growth Area, growth would be directed to compact villages located along proposed transit routes **or to infill areas within, or adjacent to, existing development**." The Proposed Project is consistent with this designation.

Roads

The existing Zoning Ordinance for the Project requires Kona Three to build three main road segments to County dedicable standards and to dedicate these segments to the County. Specifically, these segments are laid out in the "Official Transportation Network Map - Nani Kailua Area" as part of the County's plan to expand the road grid to help alleviate traffic and provide safer driving conditions. These segments that are designed include:

- to connect County-owned Leilani Street (in the Kona Vistas project) to County-owned Ho'omama Street (in the Pualani Estates project);
- to connect County-owned Kekuana'oa Place (in the Kona Vistas project) to County-owned Paulehia Street (in the Pualani Estates project); and
- to connect these new roads to each other within the Project area. Kona Three is required to build and dedicate these roads by Ordinance.

The Proposed Project would extend Kekuana'oa Place, it would construct Royal Vistas Roadway, and it would construct the Leilani Street extension in the Project Site as shown on Figure 2. The Proposed Project would stub-out the Leilani Street extension on the southern Project Site boundary and would not connect it across the private parcel (TMK (3) 7-6-021:014 owned by the Calvary Community Church of Kona) to the existing Leilani Street. Comments from Gary East and John Powell on the Draft EA were provided regarding sidewalks and gutters within the development (Appendix 1b). These road segments that would be built to dedicable standards would include sidewalks and curved gutters. None of the roads proposed for the Project would be connected to Ho'omama Street and Paulehia Street. Those connections occur across another privately-owned parcel TMK (3) 7-6-013:004 north of the Project Site not controlled by Kona Three. In response to public comments on the Draft EA, Figure 3 shows the phasing of when the connector roads would be built.

Drainage Improvements

TMKs 7-6-021:018 and 7-6-021:019 are owned and managed by the County of Hawai'i Department of Public Works (DPW) as drainages located adjacent to the proposed housing development (Figure 1). TMK (3) 7-6-21:19 encompasses approximately 4.25 acres, includes part of the Holualoa Ditch, and runs along the southern boundary of the Project Site. Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuana'oa Street, which would then be dedicated to the County as required by Ordinance and called for in the KCDP "Official Transportation Map." Figure 2 illustrates where the Holualoa Ditch is located. This improvement is the HEPA trigger for the EA since it crosses County-owned land.

TMK (3) 7-6-21:18 encompasses approximately 3.0 acres, includes the *mauka* portion of the Horseshoe Bend Ditch proximate to the Project, and runs between the two subject parcels of the Proposed Project. The Proposed Project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the KDCP's "Official Transportation Map." Figure 2 also illustrates the location of the Horseshoe Bend Ditch. This is also a HEPA trigger for the EA.

The *makai* portion of the Horseshoe Bend Ditch is located within the Project Site (TMK (3) 7-6-21:016), and as part of the Project this portion would be channelized where it is primarily sheet flow and moved closer to the northern Project boundary to make room for the planned roadway intersection at Queen Ka'ahumanu Highway at the location approved by the State Department of Transportation Highways Division. Aside from the drainage improvements, utilities, and roadways, the applicant is not proposing to construct any additional structures in the County-owned parcels.

In response to comments received on the Draft EA (Appendix 1b), additional detail regarding the need for the drainage improvements as well as possible improvement options are discussed with more context in Section 3.3.2.

1.3 Purpose and Need

The purpose of the Proposed Project is to complete the final phase of the project and provide multi-family mid-market housing in North Kona. According to the Kona Community Development Plan (CDP), although home construction has outpaced population growth, Kona continues to experience a housing crisis as the production of new homes has been skewed to upper income levels. The project would "provide housing choices" to residents of North Kona, consistent with several of the guiding principles in the CDP.

The Project is the final phase of the larger development project that includes Kona Vistas, which was approved as part of the same zoning ordinance passed in 1984 and is needed to provide mid-market housing (for rent and for sale) in North Kona in a centrally located area near existing infrastructure, including shopping, schools, and job centers, and easily accessible from existing main roads and utility grids.

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Figure 1 Project Location Map

Figure 2 Proposed Roads and Existing Ditches in the Project Site

Photo 1 Project Site: Mid-*makai* section (looking west)

Photo 2 Project Site: *Mauka* section (looking northeast)

Figure 3 Conceptual Building Layout

Figure 4 Two-Story and Three-Story Building Schematic

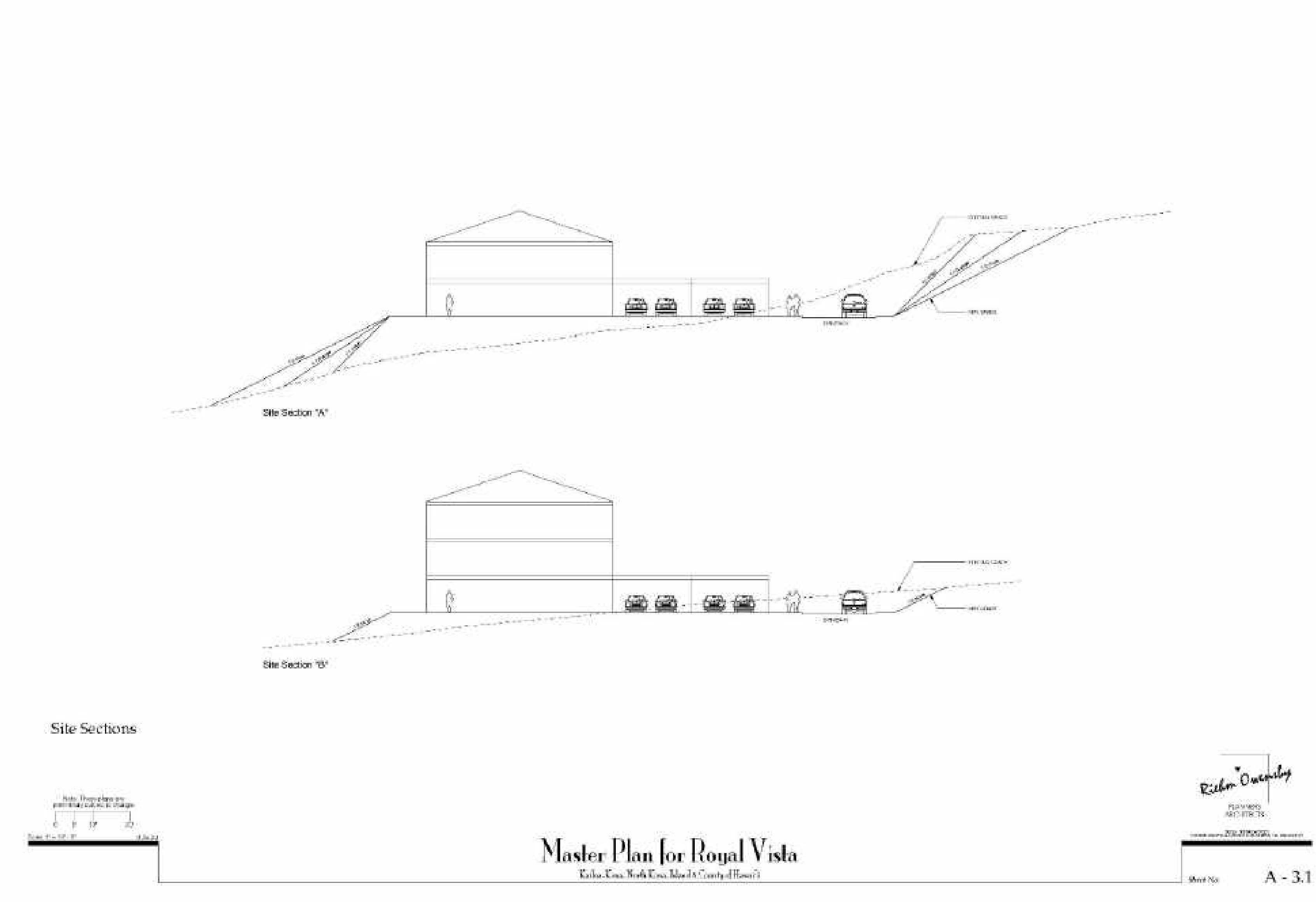
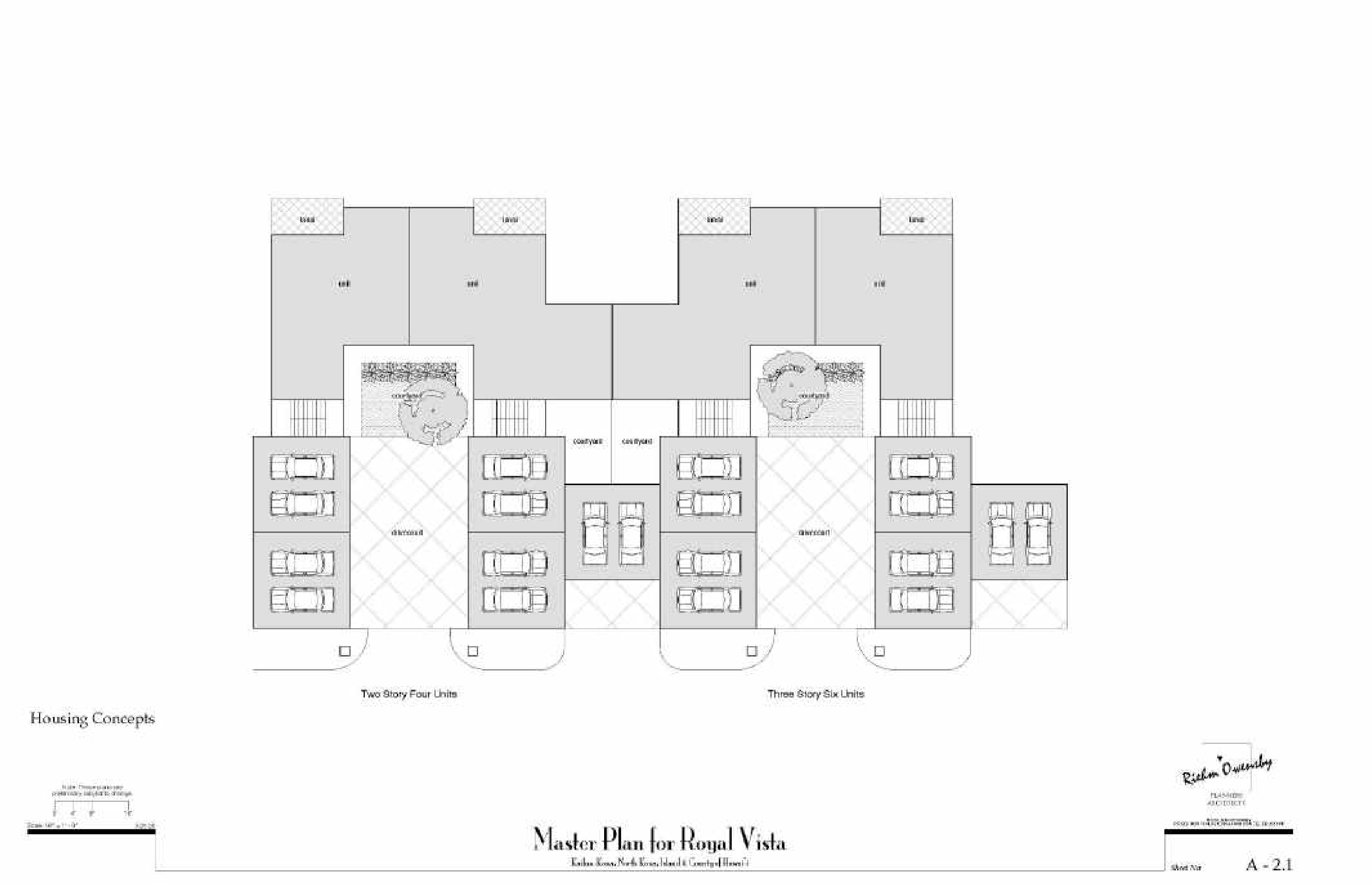


Figure 5 Concepts for Building Layout



1.4 Environmental Assessment Process

This Environmental Assessment (EA) process is being conducted in accordance with Chapter 343 of the Hawaiʻi Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200.1, of the Hawaiʻi Administrative Rules (HAR), is the basis for the environmental impact process in the State of Hawaiʻi. Section 343-5, HRS established nine types of actions that "trigger" compliance. The use of State or County lands is one of these "triggers." Since portions of the Proposed Project cross parcels (TMK (3) 7-6-21:18 and 19) that are controlled by the County of Hawaiʻi DPW, compliance with HRS and HAR is required.

According to Chapter 343, an EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria.

Part 4 of this document states the anticipated Finding of No Significant Impact; Part 5 provides a review and analysis of the "Significance Criteria" defined in Section 12 of the Chapter 11-200.1, HAR. In the EA process, if the approving agency determines after considering comments to the Draft EA that no significant impacts would likely occur, then the agency issues a Finding of No Significant Impact (FONSI), and the action is permitted to proceed to obtaining any other discretionary permits and approvals. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, then an Environmental Impact Statement is prepared to analyze the impacts and identify mitigation.

1.5 Public Involvement and Agency Coordination

The following agencies and organizations were consulted in development of the EA:

<u>Federal</u>:

National Park Service, Kaloko-Honokōhau National Historical Park
U.S. Fish and Wildlife Service

<u>State:</u>

Department of Education
Department of Land and Natural Resources
Department of Transportation
Governor's Office
State Historic Preservation Division
Office of Hawaiian Affairs

<u>County</u>:

Civil Defense Agency
County Council
Department of Environmental Management
Department of Parks and Recreation
Department of Public Works
Department of Water Supply
Fire Department
Mass Transit Agency
Planning Department
Police Department

<u>Private:</u>

Inter Pacific Motors Inc.
Sierra Club
Calvary Community Church of Kona
Kona Vistas Community Association

Copies of communications received during early consultation are contained in Appendix 1a and relevant aspects of reply letters are discussed in the text of the EA. <u>Notice of the availability of the Draft EA was published in the August 8, 2020, and September 8, 2020, editions of the Environmental Notice. Appendix 1b contains written comments on the Draft EA and responses to these comments. Various sections of the EA have been modified to reflect input received in the comment letters. Additional or modified non-procedural text is denoted in double underlines, as in this paragraph.</u>

PART 2: ALTERNATIVES

2.1 Proposed Project

The action under consideration is described in Sections 1.1 to 1.3, above.

2.2 No Action

Under the No Action Alternative, the Proposed Project would not be developed on the site and no ground disturbance associated with the Proposed Project would occur. Under this alternative, there would not be 450 multi-family units available in North Kona at this site. The site is owned by Kona Three; however, under this alternative the parcel could either be held or sold. The parcel could be developed as some other type of project or not be developed for some time. These options would not help the existing and growing mid-market/workforce population in Kona and if it is developed, it is unknown whether it would be developed with both Rental and Sale units. Focusing development within the Kona Urban Area is a guiding principle of the Kona CDP. The no action alternative would fail to focus such uses and provide such improvements within the Kona Urban Area as prescribed by the Kona CDP. Also, under the no action alternative Policy TRAN 2.1: Connectivity Standards would not occur and there would be no roadway interconnectivity.

2.3 Alternatives Considered but Eliminated from Detailed Analysis

Kona Three considered alternative building configurations, alternative building locations and numbers, alternative access, and different numbers of Rental and Sale units.

Kona Three looked at building larger structures more like conventional high-density buildings with a heavier density (zoning of the land allows in excess of 600 units to be built). However, it was decided that the larger structures did not match nearby communities, were less aesthetically pleasing, and would have more environmental impacts than the 450 units of "flats" and "courtyard" styles that are the style for the Proposed Project. Kona Three considered that the larger structures did not offer a lifestyle to the target market (both Rental and Sale units) that is conducive to family living on Hawaiʻi Island as compared to the "flats" and "courtyard" style structures.

Alternative design features were considered including wider access roads and stand-alone rather than clustered structures, but these features limited the amount of green space available for the Project.

Kona Three's initial land plan (known then as "Kona Village") presented to the community and government officials in late 2018 included 260 of the 450 units contained in three-story buildings to help minimize ground disturbance. Access for the first phase of that plan was designed to be from Lako Street via Kekuana'oa Place, in Kona Vistas Phase IV, which would have eventually connected to Paulehia Street in Pualani states.

Based on responses from members of the communities of Kona Vistas and Pualani Estates, Kona Three changed the name of the Project from Kona Village, reduced the estimated number of units in three-story buildings from 260 to 156 units (a 40 percent reduction), and moved the access for Phase I from Kekuana'oa Place to Queen Ka'ahumanu Highway via a new un-signalized intersection (proposed to be built).

These changes were made in response to community concerns about 1) confusing the Project with the similar named "Kona Village Resort," 2) eliminating all three-story buildings on the *makai* portion of the Project site to reduce visual impacts to existing Kona Vistas residents, and 3) providing separate access to the Project from Queen Ka'ahumanu Highway to reduce and delay traffic impacts on the Lako Street/Queen Ka'ahumanu Highway intersection as well as traffic on Kekuana'oa Place.

In response to community concerns, Kona Three also considered changing the zoning from Multiple-Family Residential, with a minimum building site of 5,000 square feet per dwelling unit (RM-5) to either Single-Family Residential District (minimum building site area of 10,000 square feet) (RS-10) or Single-Family Residential District (minimum building site area of 15,000 square feet) (RS-15) for the development. However, rezoning to RS-10 or RS-15 would result in a development with homes similar to those already present in the vicinity, which would not meet the purpose and need for the Project to provide housing choices for various community sub-markets compared to the RM-5 zoning.

Additionally, if there were a change of zoning that resulted in a reduction of density of less than 450 units, then any left over water credits (which have already been committed and paid for) would be effectively "lost" since they cannot be transferred except to "adjacent" properties. Currently, there is no known plan by the owner to develop the adjacent property. These credits are difficult to obtain and cannot be transferred by County policy, except to adjoining properties. Not building on this site at the proposed density would effectively eliminate a housing project that serves the mid-market/workforce community in the Kona area for the foreseeable future, since any other similar projects would depend on further water improvements in Kona which is a process that would take years. Similarly, the extension of the County sewer system to this Project would allow leveraging Kona's limited amount of sewer capacity required for multi-family housing, in addition to providing the future opportunity to have surrounding, existing properties hook up to the extended sewer system to eliminate environmental contamination.

In the end, none of the other alternatives were found to be optimal for the property or the perceived demand in the market, or resulted in more environmental impacts than the Proposed Project and were eliminated from detailed analysis.

PART 3: ENVIRONMENTAL SETTING, ENVIRONMENTAL CONSEQUENCES, CUMULATIVE IMPACTS, AND MITIGATION MEASURES

3.1 General Setting

The two parcels and location of the Project is referred to throughout this EA as the Project Site. The term Project Area is used to describe the general area of North Kona. The Project Site is located approximately 2.7 miles south of downtown Kailua-Kona on Queen Ka‘ahumanu Highway adjacent to its intersection with Kuakini Highway.

Archaeological studies indicate that the Project Site was used prior to Western contact for a variety of activities, leaving features associated with agriculture, habitation, burial, and transportation (SCS 2016). More recently, the Project Site was farmed for coffee and ranched since the early 1900s. The lower portion of the Project Site was still used to pasture cattle until August 2019; evidence of ranching including fencing, cattle walls, several corrals and cattle chutes are present. The Project Site and surrounding lands were bulldozed sometime between the 1940s and 1970s in preparation for a commercial agricultural project, most likely coffee growing. The Project is bounded to the north by undeveloped cattle pasture, to the east and south by residential subdivisions and by Queen Ka‘ahumanu Highway to the west. Topography at the Project Site is consistent with the vicinity and is relatively steep, with elevations ranging from approximately 330 feet above mean sea level (amsl) to 900 feet amsl.

3.2 Environmental Consequences

This section of the EA includes a description of the environmental setting of the Project Site as well as the potential impacts from the Proposed Project and alternatives to the resources. Environmental consequences, both primary and secondary, and the cumulative as well as the short-term and long-term impacts are considered. Cumulative impacts are impacts on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. Cumulative impacts include the direct and indirect impacts of a project together with the reasonably foreseeable future actions of others.

Past projects in the vicinity of the Project Site have included the following: flood control projects for the Horseshoe Bend and Holualoa Drainageways; urban residential development including Kona Vistas Phases 1 through 4; commercial development west of the Project Site (Scarlet Thread alteration shop, Power Self Storage-Kuakini) and south of the Project Site (Orchid Isle Auto Center);

construction and use of the Calvary Community Church; as well as a number of infrastructure projects including construction of the Lako Street-Kuakini Highway intersection, construction of the Leilani Street extension, Pualani Street extension, and Kilohana Street extension, and ongoing road maintenance and improvements.

The nearest reasonably foreseeable future project is dedication of the three remaining roadway lots (Kona Three is currently working with the County of Hawaiʻi DPW to accept dedication of these). The development of the affordable housing project located approximately 0.1 mile from the Proposed Project to be built by others, *makai* of Kuakini Highway is also reasonably foreseeable. The affordable housing requirement was part of the original zoning ordinance (1984) and is located on approximately 12 acres. Subject to approval by the OHCD, Kona Three's affiliate which owns the 12 acres would deed the parcel to the County or their nominee to satisfy a portion of the affordable housing development requirement, and the homes would be built by qualified affordable housing developers. If OHCD decides not to pursue an affordable housing project at this location, Kona Three would negotiate a new agreement with OHCD to satisfy the requirement of the zoning ordinance using options such as dedicating some of the Project's units for affordable housing, providing affordable housing elsewhere off-site in Kona, acquiring affordable housing credits from another location in Kona, or a combination of these options.

In the Traffic Impact Analysis Report (TIAR) prepared for the Project (Appendix 2), future road improvements include the widening of Kuakini Highway from Henry Street to Kamehameha III Road by two travel lanes as well as bicycle facilities and sidewalks. The Bike Plan Hawaiʻi also identifies a signed shared road on Kuakini Highway from Lako Street to Hualalai Road, and a signed shared road on Queen Kaʻahumanu Highway from Henry Street to Kuakini Highway.

3.3 Physical Environment

3.3.1 Climate, Geology, Soils, and Geologic Hazards

Environmental Setting

The Project Site has an elevation that varies from 330 feet amsl to 900 feet amsl and receives an average annual rainfall of between 35 and 38 inches, increasing in the *mauka* direction (Giambelluca et al. 2013).

The geologic substrate on most of the Project Site is soil-covered pahoehoe lava flows from Hualālai dated between 5,000 and 10,000 years in age (Wolfe and Morris 1996). Soil in the Project Site is classified as Waiaha medial silt loam (Map Unit Symbol 243), on 2 to 10 or 10 to 20 percent slopes, depending on location

(NRCS 2019). This soil forms on ash-covered pahoehoe flows and has a 10- to 25-inch depth to bedrock. It is well drained but also has a high runoff potential (Sato et al. 1973).

Hawaiʻi Island is subject to geologic hazards, such as lava flows and earthquakes. However, the Project Site appears to be stable with no evidence of subsidence or landslides. Volcanic hazard as assessed by the U.S. Geological Survey in this area of North Kona is Zone 4, on a scale of ascending risk from 9 to 1 (Heliker 1990). The hazard risk is based on the fact that Hualālai has steep slopes and is the third most historically active volcano on the island.

Volcanic hazard Zone 4 areas have about 5 percent of their land area covered by lava or ash flows since the year 1800 and less than 15 percent of their land area covered by lava in the past 750 years. They are at lower risk than Zone 3 areas because the frequency of Hualālai eruptions is lower than those of Kilauea and Mauna Loa.

The Island of Hawaiʻi experiences high seismic activity caused by eruptive process within active volcanoes or by deep structural adjustments due to the weight of the islands on Earth's underlying crust (USGS 2019a). Although the earthquakes are seldom large enough to cause widespread damage, they can produce locally extensive ground fractures and subsidence (USGS 2019b). For example, the 6.6 magnitude earthquake that occurred in 2006 centered just off the northwest shore of Hawaiʻi Island resulted in widespread damage to buildings and roads in Kona.

Impacts and Mitigation Measures

<u>Geologic Hazards</u>
In general, geologic conditions do not impose undue constraints on the Project Site. Building design will meet all appropriate seismic standards ensuring safety for the future residents.

<u>Climate Change</u>
According to the EPA, global climate change could mean a rise in sea level that could worsen Hawaiʻi's existing coastal hazards, including waves, hurricanes, and tsunamis, and extreme tides (EPA 2016). Of the man-made greenhouse gases, the greatest contribution currently comes from CO_2 emissions. Through complex interactions on a regional and global scale, these greenhouse gas emissions and net losses of biological carbon sinks (i.e., vegetation) cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although greenhouse gas levels have varied for millennia, recent industrialization and burning of fossil carbon sources have

caused greenhouse gas concentrations to increase dramatically and are a possible contributor to overall global climatic changes (IPCC 2007).

Potential changes to Hawai'i resulting from the effects of climate change include higher than normal temperatures, contraction or expansion of existing vegetation species distribution, the expansion of the range of existing invasive species populations, and the introduction of new pathogens and invasive species, decrease in prevailing northeasterly trade winds, decline in rainfall and increased variability in rainfall patterns, increased ocean acidity, sea level rise, and threats to human health (University of Hawai'i at Mānoa Sea Grant College Program 2014).

The State of Hawai'i in Hawai'i Revised Statutes §226-109 identifies priorities to prepare the State to address the impacts of climate change. Also, Title 11-200.1-13 includes significance criteria to consider in environmental impact analysis that includes the hazardousness of sea level rise including: 1) the potential effects of a proposed action on climate change as indicated by assessing greenhouse gas emissions in a qualitative, or if reasonable, quantitative way; and 2) the effects of climate change on a proposed action and its environmental impacts. It recommends that agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis in terms of climate change effects and resiliency to the effects of a changing climate.

Figure 6 illustrates that the Project's elevation of more than 300 feet above amsl and 0.85-mile distance from the coast protects the site from sea level rises of 3.2 feet, which could occur as early as the 2060s (PacIOOS 2017). The Project's design including surface runoff drainage plans address the potential impact from flooding that could occur if increased variability in rainfall patterns occur. A more detailed description of flood and drainage plans are described in Section 3.3.2.

Potential impacts to climate change from the Project include direct impacts from emissions of greenhouse gases during construction and occupation of the proposed development related to the consumption of fuels (combustion) and indirect impacts from greenhouse gas emissions associated with electrical power consumption. Since the Project addresses an existing demand for housing, it is expected that a portion of the residents that would occupy the development already live in Kona or on Hawai'i Island, and there would not be a substantial increase in emissions when residents occupy the Project. Therefore, Project impacts would be considered a negligible increase to the global annual greenhouse gas emissions.

Under the No Action Alternative, the Proposed Project would not be constructed, and the site would remain unchanged from current conditions. There would be no change in impacts to climate, or from geologic conditions or seismic activity, under this alternative.

Figure 6 Sea Level Rise Exposure Map

Cumulative Impacts

Since there are no impacts from the Proposed Project, there are no anticipated cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions to these resources.

3.3.2 Flood Zones and Drainage

Existing Environment

The Project Site is located approximately 0.85 miles from the ocean at elevations ranging from 330 to 900 feet amsl, outside the area affected by coastal flooding. The area of North Kona includes a series of narrow drainageways that flow to the ocean. Two intermittent drainageways are located adjacent to the proposed development on the parcels managed by the County of Hawaiʻi DPW, Horseshoe Bend and Holualoa Drainageways.

The Federal Emergency Management Agency's (FEMA's) Flood Insurance Rate Map (FIRM) 1551660952F (9/29/2017) shows the Project Site and proposed development is in Flood Zone X, and part of the Project Site is in the 0.2% annual chance floodplain (Figure 7). Horseshoe Bend and Holualoa Drainageways, cross and are adjacent to the Project Site, are located in Special Flood Hazard Areas (SFHAs) Zone AE. Zone AE is defined as areas inundated by flood having a 1% probability of being equaled or exceed in any given year (base flood) and the floodways are in Zone AEF. These drainages merge *makai* of Queen Ka‘ahumanu Highway.

Channelization of much of both Horseshoe Bend and Holualoa Drainages was planned starting in 1976 (Master Plan for Kona Flood Control Project for the County of Hawai‘i DPW by Stanley S. Shimabakuro & Associates), but not completed. The County installed a lined drainageway just south of the Ali‘i Kai subdivision and a basin to contain the flow from this channel, but the *mauka* end of the channel ended below Kupuna Street.

During the extension of Queen Ka‘ahumanu Highway (downstream of the Project) in the early 1980s, the State of Hawaii constructed culverts for the Holualoa Drainageway and the Horseshoe Bend Drainageway under Queen Ka‘ahumanu Highway to direct flow under this major arterial. Culverts were also constructed under Kuakini Highway by the State for the Holualoa Drainageway; however, the culverts that were proposed under County-owned Kuakini Highway for the Horseshoe Bend Drainageway waters were never constructed. As a result, during heavy rain events flooding occurs across Kuakini Highway which flows down and impacts Kuakini Highway and the residents *makai* of Kuakini Highway, all downstream from the Project.

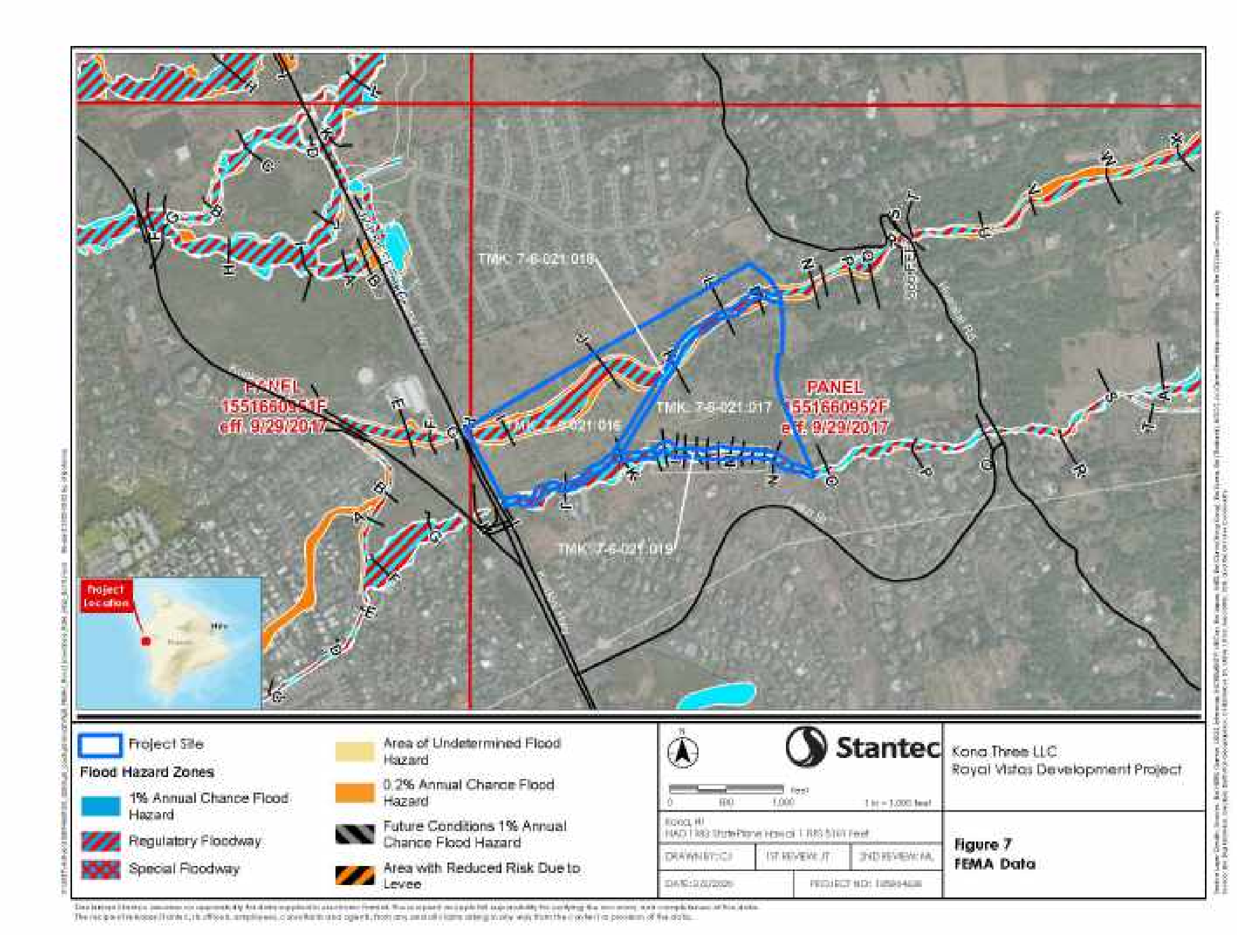
Holualoa Drainageway and Horseshoe Bend Drainageway waters have a confluence at the *makai* end of the 12 acres, downstream of the Project. Working with the County, the previous developer of the Project assisted in obtaining private property owners’ co-operation to achieve land use rights that allow the confluence to feed into the County channel. The current developer is now processing a Conditional Letter of Map Revision (CLOMR) with the FEMA to further channelize the portion of Holualoa Drainageway that crosses the 12 acres to allow more safe and efficient transfer of these flood waters. This channelization protects the lands adjacent to and *makai* of this work from flood exposure as well as further implementing Phase II of the County of Hawai‘i’s Master Flood Control Plan. It also allows more efficient development of the 12 acres into residential use in a safe manner.

These drainageways continue to act as runoff distribution and flood control and most recently, the Effective FIRM (effective September 2017) increased the Q (estimated flow) within the Holualoa Drainageway, including the section within the County-owned ditch adjacent to the Project Site. To help mitigate the existing downstream flooding concerns, several options for mitigation are being considered in the vicinity of the Project Site in conjunction with the County of

Hawaiʻi DPW. <u>Multiple comments on the Draft EA were regarding what the drainage improvements could be (Appendix 1b). The potential options for addressing the flooding that have been previously discussed include: (1) the County's disposal of TMK 7-6-021:018 to Kona Three for use in the drainage improvements; (2) diverting some or all of the Horseshoe Bend flow into the Holualoa Ditch; (3) installation of a retention basin(s) and/or downstream culvert; and (4) leave the drainages in their current configuration with on-site improvements within the existing drainage boundaries. The final design could include one or a combination of these options, or an option to be identified in future coordination with DPW.</u>

The State of Hawaiʻi, Department of Land and Natural Resources Flood Assessment Tool shows the Project Site outside the area that should be evacuated during a tsunami warning (http://gis.hawaiinfip.org/fhat/, accessed December 2019). No known areas of local (non-stream or ocean related) flooding are present at the Project Site.

Figure 7 National Flood Hazard Layer FIRM Map



Impacts and Mitigation Measures

Comments on the Draft EA inquired about flooding and drainage improvements (Appendix 1b). The Project would be required to follow County regulations and policies related to flood control and drainage, among them Chapter 27 of the Hawaiʻi County Code. Chapter 27 requires the difference between pre-development and post-development runoff to be contained onsite, limiting impacts. A drainage study will be prepared and reviewed and approved by the County of Hawaiʻi DPW, which would be submitted as part of the grading permit process. As part of this requirement, the amount of expected runoff would be calculated according to DPW standards and these calculations would include the effects of the proposed project. As required by Chapter 27, storm water should be disposed into drywells, infiltration basins, or other approved infiltration methods (Section 27-20(e)). Implementation of the approved Drainage Plan would ensure that runoff from the Project Site would not be directed toward adjacent properties and the development would not alter the general drainage pattern above or below the development (Section 27-20(e)). The Project does not propose to impact the existing flows within the Horseshoe or Holualoa Drainageways, other than to channelize portions of the Horseshoe Bend Drainageway where it sheet flows and as needed to address downstream flooding issues once the options are analyzed and a solution is approved. Kona Three would coordinate with County of Hawaiʻi DPW and FEMA on the CLOMR discussed above, which proposes to re-locate the Flood Zone (Zone AEF) within the new flood control channels; therefore, no Project-related surface disturbance associated with grading, parking, and landscaping would occur within the Flood Zone.

Kona Three will continue working with the County to alleviate the downstream flooding issue caused by the lack of culverts under Kuakini Highway; however, these issues would not be exacerbated by the Project. The final design of the improvement projects for the Horseshoe Bend and Holualoa Drainages would be developed by Kona Three in coordination with the County of Hawaiʻi DPW. Completion of the drainage system improvements is required prior to the issuance of a certificate of occupancy for the Project. A comment from HDOT on the Draft EA identified potential impacts to existing culverts (Appendix 1b). There would be no changes to existing culverts or the headwall at the proposed intersection with Queen Kaʻahumanu. The proposed intersection (discussed in Section 3.7.2) has been designed to avoid all impacts to existing culverts and headwall within the highway right-of-way.

Under the No Action Alternative, the Proposed Project would not be constructed and the site would remain unchanged from current conditions. There would be no impacts to flood zones under this alternative and improvements to the drainages to reduce flooding of downstream properties would not occur.

Cumulative Impacts

Since there are no impacts associated with flood zone exposure from the Proposed Project, there are no anticipated cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions to flood zones.

3.3.3 Water Quality and Water Quantity

Existing Environment

Groundwater

The State Commission on Water Resource Management (CWRM) classification of aquifers locates this part of Kona within the Keauhou Aquifer System of the Hualālai Aquifer Sector. The Project Site is not located above any of the nine Principal or Sole-Source aquifers identified in the U.S. EPA's Region 9 (https://archive.epa.gov/region9/water/archive/web/html/ssa.html, accessed on-line December 2019).

Water commitments for the Proposed Project have been secured from the DWS and fully paid for all the multi-family residential units through Keauhou Source Agreement commitments and Kealakekua Source Agreement commitments. According to a letter received during early consultation, the Project Site is served by an existing service that can accommodate a 4-inch meter on ʻIo Place, and is limited to 180,400 gallons per day, or 451 units of water. The demand for the Project is expected to be 180,400 gallons per day, which is included in the Department of Water Supply's calculation of Authorized Plan Use.

Landscaping is planned for the Project Site as well, and water use for landscaping is accounted for in the water credits.

Surface Waters

The Project Site is approximately 0.85 miles from the Pacific Ocean and has no nearby surface water bodies or waters of the U.S. According to maps from the U.S. Fish and Wildlife Service, confirmed by field inspection, no wetlands are present on the Project Site (http://www.fws.gov/wetlands/Data/Mapper.html). The Waiʻaha Stream is the nearest riverine habitat and is located approximately one mile north of the Project.

Impacts and Mitigation Measures

Potential impacts from the Project could occur to water quality during land clearing and construction activities from erosion and sedimentation. These impacts would be minimized since grading of the Project Site during construction would be conducted in accordance with the grading permit which would be issued by Hawaiʻi County. Prior to the initiation of construction for the Proposed Project, Kona Three would ensure that a National Pollutant Discharge Elimination System (NPDES) general permit is in place. The permit would require best management practices (BMPs) to minimize erosion and for stormwater pollution prevention. Oversight of the BMPs would be conducted weekly for the duration of construction, with updates and corrective actions documented and transmitted to the State Department of Health, Clean Water Branch. Additionally, all earthwork and grading would conform with Chapter 10 – Erosion and Sedimentation Control – of the Hawaiʻi County Code.

The intent is for the Proposed Project to collect and convey stormwater runoff into multiple onsite seepage pits with sizing based on a 10-year, 1-hour rainfall event. Based on the initial concept plan shown on Figure 3, a portion of the Project Site would be landscaped, including two parks in Phase 1, and the rest of the site would consist of buildings, parking areas, and roads. Water runoff from parking lots, driveways, and other surfaces would be treated to minimize potential impacts to inland and coastal waters using standard stormwater pollution prevention technology. The specific technology, or combination of technologies, that would be implemented for the Project would be identified during the final design.

Where feasible, the Proposed Project would include water efficient fixtures and provide water-saving recommended measures for residents. To minimize water demand, the Project would minimize landscaping and use xeriscape landscaping where landscaping is installed. In addition, the Proposed Project aims to implement and balance xeriscape with the provision of safe and adequate recreational space for residents. The Project would utilize reclaimed or reuse water for landscaping, if possible.

No impacts to groundwater are expected from generation of wastewater since the Project would tie in with the County's sewer system.

Under the No Action Alternative, the Proposed Project would not be constructed and the site would remain unchanged from current conditions. There would be no impacts to water quality under this alternative.

Cumulative Impacts

The relevant past, present, and reasonably foreseeable future projects for cumulative impacts are described in Section 3.2. Each project has or could result in depletion of water quantity and impacts to water quality, including depletion of available groundwater, sedimentation or nutrient loading to surface water and groundwater. The issue comes not from the impacts of an individual project, but cumulative impacts in the region. As described above, impacts to water quality and water quantity from the Proposed Project would be negligible. Therefore, the cumulative impacts of the Proposed Project in combination with past, present, and reasonably foreseeable future actions are expected to be minor.

3.3.4 Flora, Fauna, and Ecosystems

Existing Environment

Vegetation

A survey for biological resources was conducted by Geometrician Associates for the Project Site (Appendix 3). The pre-human vegetation in the Project Site was likely Lowland Dry/Mesic Forest, which likely consisted of an open canopy forest dominated by a wide variety of trees, shrubs, herbs, vines, and ferns. However, current vegetation at the Project Site includes introduced species that are common throughout Kona and include the non-native haole koa (*Leucaena leucocephala*), opiuma (*Pithecellobium dulce*), and guinea grass (*Megathyrsus maximus*).

The Project Site includes two vegetation types that are distinguished primarily by previous management activities. The higher elevation portion of the Project Site contains few cattle, is intensely overgrown with guinea grass, and could be described as a scattered forest or thick savanna dominated by koa haole, opiuma, and monkeypod (*Samanea saman*). The lower elevation portion of the Project Site is moderately grazed and has a very similar but slightly more diverse canopy, including kiawe (*Prosopis pallida*), klu (*Acacia farnesiana*), and several other non-native trees. The understory in both vegetation types include a diversity of non-native grasses, herbs, shrubs and vines, with a very few natives, including ʻuhaloa (*Waltheria indica*) and ʻilima (*Sida fallax*).

Although two drainageways traverse the property, no aquatic or true riparian vegetation is present in the Project Site.

All plant species found on the property during the survey are listed in Table 1. Of the 46 species detected, six were indigenous (native to the Hawaiian Islands and elsewhere) and only three were endemic (found only in the Hawaiian Islands). No rare, threatened, or endangered plant species were present in the Project Site.

Table 1 Plant Species Observed in the Project Site

Scientific Name	Family	Common Name	Life Form	Status*
Ferns				
Nephrolepis multiflora	Nephrolepidaceae	Sword fern	Herb	A
Phymatosorus grossus	Polypodiaceae	Maile scented fern	Fern	A
Flowering Plants				
Abutilon grandifolium	Malvaceae	Abutilon	Shrub	A
Acacia farnesiana	Fabaceae	Klu	Shrub	A
Aleurites moluccana	Euphorbiaceae	Kukui	Tree	PI
Amaranthus viridis	Amaranthaceae	Slender amaranth	Herb	A
Bidens alba	Asteraceae	Beggar's tick	Herb	A
Bidens cynapiifolia	Asteraceae	Blue bidens	Herb	A
Bidens pilosa	Asteraceae	Beggar's tick	Herb	A
Buddleia asiatica	Scrophulariaceae	Buddleia	Shrub	A
Caesalpinia decapetala	Fabaceae	Wait-a-bit	Vine	A
Chamaecrista nictitans	Fabaceae	Partridge pea	Herb	A
Chamaesyce hirta	Euphorbiaceae	Garden spurge	Herb	A
Chamaesyce hypericifolia	Euphorbiaceae	Graceful Spurge	Herb	A
Chloris barbata	Poaceae	Swollen fingergrass	Herb	A
Coccinia grandis	Cucurbitaceae	Ivy gourd	Vine	A
Crotalaria sp.	Fabaceae	Crotalaria	Herb	A
Cynodon dactylon	Poaceae	Bermuda grass	Herb	A
Desmanthus virgatus	Fabaceae	Slender mimosa	Shrub	A
Digitaria ciliaris	Poaceae	Crabgrass	Herb	A
Digitaria insularis	Poaceae	Sourgrass	Herb	A
Digitaria setigera	Poaceae	Crabgrass	Herb	A
Dysphania carinata	Chenopodiaceae	Dysphania	Herb	A
Eleusine indica	Poaceae	Goose grass	Herb	A
Eragrostis tenella	Poaceae	Lovegrass	Herb	A
Hyptis pectinate	Lamiaceae	Comb hyptis	Shrub	A
Indigofera suffruticosa	Fabaceae	Indigo	Shrub	A
Ipomoea obscura	Convolvulaceae	Obscure morning glory	Vine	A
Kalanchoe pinnata	Crassulaceae	Air plant	Herb	A
Lantana camara	Verbenaceae	Lantana	Shrub	A
Leonotis nepetifolia	Lamiaceae	Lion's ear	Herb	A
Leucaena leucocephala	Fabaceae	Haole koa	Shrub	A
Malvastrum coromandelianum	Malvaceae	False mallow	Herb	A
Megathyrsus maximus	Poaceae	Guinea grass	Herb	A
Melinis repens	Poaceae	Natal redtop	Herb	A
Merremia tuberosa	Convolvulaceae	Woodrose	Vine	A
Mimosa pudica	Fabaceae	Sleeping grass	Herb	A
Momordica charantia	Cucurbitaceae	Bitter gourd	Vine	A
Paederia foetida	Rubiaceae	Maile pilau	Vine	A
Parthenium hysterophorus	Asteraceae	Santa Maria	Herb	A
Passiflora edulis	Passifloraceae	Lilikoi	Vine	A
Phyllanthus debilis	Euphorbiaceae	Niruri	Herb	A

Scientific Name	Family	Common Name	Life Form	Status*
Pithecellobium dulce	Fabaceae	Dulce	Tree	A
Plumbago auriculata	Plumbaginaceae	Leadwort	Shrub	A
Plumbago zeylanica	Plumbaginaceae	‘Ilie’e	Herb	I
Portulaca pilosa	Portulacaceae	Portulaca	Herb	A
Prosopis pallida	Fabaceae	Kiawe	Tree	A
Psidium guajava	Myrtaceae	Common guava	Tree	A
Ricinus communis	Euphorbiaceae	Castor bean	Shrub	A
Rivina humilis	Phytolaccaceae	Coral berry	Herb	A
Samanea saman	Fabaceae	Monkeypod	Tree	A
Schinus terebinthifolius	Anacardiaceae	Christmas berry	Tree	A
Senna occidentalis	Fabaceae	Coffee senna	Shrub	A
Sida fallax	Malvaceae	‘Ilima	Shrub	I
Sida rhombifolia	Malvaceae	Sida	Herb	A
Sida spinosa	Malvaceae	Sida	Herb	A
Solanum americanum	Solanaceae	Popolo	Herb	I
Solanum seaforthianum	Solanaceae	Vining solanum	Herb	A
Sonchus oleraceus	Asteraceae	Sow thistle	Herb	A
Spathodea campanulata	Bignoniaceae	African tulip	Tree	A
Thevetia peruviana	Apocynaceae	Be-still tree	Tree	A
Thunbergia fragrans	Acanthaceae	White thunbergia	Vine	A
Triumfetta rhomboidea	Tiliaceae	Bur brush	Shrub	A
Waltheria indica	Sterculiaceae	‘Uhaloa	Herb	I

*A = alien, E = endemic, I = indigenous, PI = Polynesian, END = Federal and State Listed Endangered (none)

An online mapping tool provided by the USFWS indicates that no designated or proposed critical habitat for endangered plant (or animal) species is located on or near the property (USFWS 2019). The nearest designated critical plant habitat is for endangered haha (*Cyanea hamatiflora* ssp. *carlsonii*) approximately seven miles northeast of the Project Site.

Blackburn’s Sphinx Moth

The one endangered insect found in many parts of Kona is the Blackburn’s sphinx moth (*Manduca blackburnii*). It is generally associated with drier environments and ‘a‘a substrates. The native host plant aiea (*Nothocestrum* spp.) is extremely rare, but a substitute host, the prolific weed tree tobacco (*Nicotiana glauca*), quickly colonizes dry, disturbed lava flows. Neither host was found within the survey area.

Birds

The 15 species of birds detected during the survey were all non-native and typical of those found in similar areas of lowland disturbed habitat in Kona (Table 2). The most common species encountered were spotted dove (Streptopelia chinensis), northern cardinal (*Cardinalis cardinalis*), cattle egret (*Bubulcus ibis*), parakeet (*Aratinga* sp.), Japanese white-eye (*Zosterops japonicus*), and house finch (*Carpodacus mexicanus*). No native birds were detected, and it is generally poor habitat for most native birds. The short-eared owl may utilize habitat at the Project Site and vicinity for foraging. The trees in the survey area are generally too short to serve as typical Hawaiian hawk (*Buteo solitarius*) nests, but individuals could forage at least occasionally in the area.

Table 2 Bird Species Observed in the Project Site

Scientific Name	Common Name	Status
Acridotheres tristis	Common myna	Alien resident
Aratinga sp.	Parakeet	Alien resident
Bubulcus ibis	Cattle egret	Alien resident
Cardinalis	Northern cardinal	Alien resident
Carpodacus mexicanus	House finch	Alien resident
Francolinus pondecerianus	Black francolin	Alien resident
Geopelia striata	Zebra dove	Alien resident
Leiothrix lutea	Red-billed leiothrix	Alien resident
Lonchura punctulata	Nutmeg mannikin	Alien resident
Padda oryzivora	Java sparrow	Alien resident
Passer domesticus	House sparrow	Alien resident
Serinus mozambicus	Yellow-fronted canary	Alien resident
Sicalis flaveola	Saffron finch	Alien resident
Streptopelia chinensis	Spotted dove	Alien resident
Zosterops japonicus	Japanese white-eye	Alien resident

A number of other rare, threatened, and endangered birds are fairly unlikely to be found at the Project Site and vicinity. The Hawaiian goose or nēnē (*Branta sandvicensis*) is an endemic, federally listed endangered species that is only occasionally observed in urban Kona, although it is more abundant at Big Island Country Club in the Kekaha region of Kona. Some endangered Hawaiian petrels (*Pterodroma sandwichensis* or ʻuaʻu) and band-rumped storm-petrels (*Oceanodroma castro*), as well as threatened Newell's shearwaters (*Puffinus auricularis newelli*), may overfly the area between the months of June and October. All three of these pelagic seabird species nest high in the mountains in burrows. Most recently (November 2019) a Hawaiian petrel burrow and chick were observed in a newly documented ʻuaʻu colony inside the Puʻu O Umi Natural Reserve Area on Kohala Mountain.

There is no suitable nesting habitat for any of these seabird species within or near the Project Site. The primary cause of mortality in all these seabird species in Hawaiʻi is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds may collide with manmade structures. If they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals. Although not a listed species, the Hawaiian endemic sub-species of the short-eared owl or pueo (*Asio flammeus sandwichensis*), a protected migratory bird, nests and hunts in tall grasslands and shrublands and could conceivably be occasionally present at the Project Site.

<u>Hawaiian Hoary Bat</u>

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the only native Hawaiian land mammal, may utilize the property, as it is found in most areas on the island of Hawaiʻi and has been observed in surrounding areas with similar vegetation. It was not observed in our survey, which took place in daylight and did not use any detection equipment, but it should be presumed present. Bats may forage for flying insects over portions of the property on a seasonal basis, and they may find some of the larger shrubs and trees (both exotic and native) suitable roosting habitat. Hawaiian hoary bats are vulnerable to disturbance during the summer pupping season.

<u>Introduced Mammals, Reptiles, and Amphibians</u>

The only live mammals seen during the survey were cattle (*Bos taurus*), feral pigs (*Sus scrofa*) which were abundant in the survey area, and small Indian mongooses (*Herpestes a. auropunctatus*). Given the Project's location in an urban area, it is likely that feral cats (*Felis catus*), mice (*Mus* spp.), rats (*Rattus* spp.), and domestic dogs, (*Canis f. familiaris*) are occasionally present. There are no native terrestrial reptiles or amphibians in Hawaiʻi. The only reptile observed during the survey was the day gecko (*Phelsuma* sp.). It is likely that other species of gecko, anoles, and skinks are also present. No amphibians were seen or heard. None of these alien mammals or reptiles have conservation value and all are deleterious to native flora and fauna.

Impacts and Mitigation Measures

<u>Vegetation</u>

As discussed above, no threatened or endangered plant species as listed by the USFWS appear to be present in the Project Site, nor are there uniquely valuable habitats. No existing or proposed federally designated critical plant (or animal) habitat is present in the Project Site. There appears to be no potential to adversely affect rare, threatened, or endangered plant species.

Although existing vegetation would be cleared during Project construction activities including grading, the plants that would be removed are all non-native. Landscaping is an important aspect for housing developments both for residents' experience and property value. The Proposed Project would plant new vegetation as part of landscaping following Project construction. As requested in an early consultation letter from DLNR, Kona Three would plant native or non-invasive trees as part of landscaping for the Proposed Project.

Blackburn's Sphinx Moth

In order to prevent potential impacts to the Blackburn's sphinx moth, the Proposed Project would include the following protection measures. A biologist familiar with the species would survey for Blackburn's sphinx moth and its larval host plants (tree tobacco and native 'aiea) between November and April or several weeks after a significant rain and within four to six weeks prior to construction. Surveys should include searches for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If moths or native 'aiea or tree tobacco over three feet are found during the survey, Kona Three would coordinate with the USFWS for guidance to avoid impacts.

If no Blackburn's sphinx moth, 'aiea, or tree tobacco are found during pre-disturbance surveys, Kona Three would ensure that measures are taken to avoid attraction of Blackburn's sphinx moth and prohibit tree tobacco from entering the site. Tree tobacco can grow more than three feet in approximately six weeks, and above three feet in height the tree tobacco can become a host plant for Blackburn's sphinx moth. The Proposed Project would remove tree tobacco less than three feet tall and monitor the Project Site for new tree tobacco grown before, during, and after Project construction. Monitoring for tree tobacco after construction, can be completed by any staff, such as regular maintenance crew, provided with pictures of tree tobacco at different life stages.

Birds

If construction for the Project is scheduled to occur in the Hawaiian hawks breeding season (between March 1 and September 30), a qualified biologist would conduct a pre-disturbance survey for hawk nests within and immediately adjacent to the property. If a Hawaiian hawk nest is located during the pre-disturbance nest survey, no land clearing or construction should occur within 1,600 feet of any active Hawaiian hawk nest during the breeding season until the young have fledged (usually October). Regardless of time of year, Kona Three would coordinate with the DOFAW prior to trimming or cutting trees with Hawaiian hawk nests, as nests may be re-used during consecutive breeding seasons.

The Proposed Project would not involve any unshielded lighting for either construction or operation, in conformance with Hawaiʻi County Code § 14 – 50 et seq, which would avoid impacts to nocturnally flying Hawaiian petrels and Newell's shearwaters. Additionally, during operation the site would use lighting only where and when it is needed for safety purposes. The use of outdoor lamps with warmer colors (less blue light) and energy efficient fixtures would be considered when the building is being constructed. Subject to local rules and regulations, the Proposed Project would utilize lighting on the 2700 degrees Kelvin scale in response to a public comment received on the Draft EA regarding potential impacts to astronomy.

If the Proposed Project incorporates additional outdoor lighting, it may attract threatened and endangered Hawaiian seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these threatened and endangered seabirds due to interaction with outdoor lighting, no construction using unshielded equipment maintenance lighting should be permitted after dark between the months of April and October. All additional permanent lighting should conform to the Hawaiʻi County Outdoor Lighting Ordinance (Hawaiʻi County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting. The Proposed Project would also avoid nighttime construction during the seabird fledging period, September 15 through December 15.

Hawaiian Hoary Bat

The endangered Hawaiian hoary bat is vulnerable to disturbance while roosting with its juveniles in the pupping season. To minimize impacts during construction, woody plants taller than 15 feet would not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Additionally, Hawaiian hoary bats forage for insects from as low as 3 feet to higher than 500 feet above the ground and can become entangled in barbed wire, if used for fencing. The Proposed Project would not use barbed wire for fencing.

Marine Species

Factors that might impair urban Kona's coastal water quality and potentially affect threatened or endangered marine species are wastewater, chemical contaminants from industrial and commercial uses, and polluted runoff from streets and parking lots. Runoff from the drainageways in the Project Site could reach the ocean; however, the runoff from the Project would not be directed into the drainageways or increase flow during flood events. Potential impacts to water quality would be minimized through wastewater and stormwater treatments described in Section 3.3.2 and 3.3.3.

Additional Impacts

A mix of native species, Polynesian introduced species, and non-invasive introduced ornamentals would be used in landscaping for the Project Site and an invasive weed control plan for the Project Site would be developed to minimize impacts from fire-prone, non-native vegetation species. Additionally, where no grading or grubbing is required, existing vegetation would be left in place. Biosecurity protocols during construction would include cleaning and inspection of construction equipment for invasive species (including insects, frogs, rats, and mice), and would be applied as applicable. A comment from DOFAW recommended consulting with Big Island Invasive Species Committee (BIISC) (Appendix 1b). The developer would also request current recommendations from BIISC at the time of development.

Under the No Action Alternative, the Project would not be constructed and the site would remain unchanged from current conditions. There would be no vegetation removed, and, therefore, no impacts to the native plant species present in the Project Site or removal of potential habitat for protected wildlife species. However, there would be no invasive weed control plan in place under this alternative, and existing weeds at the Project Site would continue to spread at the Project Site.

Cumulative Impacts

Past, present, and reasonably foreseeable future projects in the vicinity have impacted biological resources through alteration of the landscape through introduction of weeds, removal of native vegetation, and loss of habitat for native wildlife species.

Impacts to biological resources from the Proposed Project would be minor, due to the limited number of native species present at the Project Site and the protection measures outlined to avoid impacts to Federally-listed species and prevent spread of non-native weeds.

Therefore, the cumulative impacts of the Proposed Project in combination with past, present, and reasonably foreseeable future actions are expected to be minor.

3.3.5 Noise

Environmental Setting

Noise on the Project Site is low to moderate; the main source of noise at the site is traffic traveling on Queen Kaʻahumanu Highway.

The noise descriptor used to assess environmental noise by the Department of Housing and Urban Development (HUD) is the day-night average A-weighted (dBA) sound level (DNL). DNL is a representation of the average noise during a typical day of the year. DNL levels of 55 or less are typical of quiet, rural or suburban areas. DNL exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. DNL exposure levels above 65 are representative of dense urban sites and areas near large highways or airports.

Administrative Rules for the Department of Health, Chapter 11-46, Community Noise Control set permissible noise levels to provide for the prevention, control, and abatement of noise pollution in the state. The Project Site is zoned Multiple-Family Residential 5,000 square feet (RM-5). Multi-family dwellings are in a Class B zoning district defined by HAR §11-46-3. The maximum permissible sound level in a Class B zoning district is 60 dBA from 7:00 a.m. until 10:00 p.m. and 50 dBA from 10:00 p.m. to 7:00 a.m. (HAR §11-46-4).

Various agencies have different standards of noise compatibility. Per 24 CFR 51.103, HUD exterior standards are as follows:

- Acceptable (DNL not exceeding 65 dBA): The noise exposure may be of some concern but common building constructions will make the indoor environment acceptable and the outdoor environment will be reasonably pleasant for recreation and play.
- Normally Unacceptable (DNL above 65 but not exceeding 75 dBA): The noise exposure is significantly more severe; barriers may be necessary between the Project Site and prominent noise sources to make the outdoor environment acceptable; special building constructions may be necessary to ensure that people indoors are sufficiently protected from outdoor noise.
- Unacceptable (DNL above 75 dBA): The noise exposure at the site is so severe that the construction cost to make the indoor noise environment acceptable may be prohibitive and the outdoor environment would still be unacceptable.

Impacts and Mitigation Measures

During construction of the Proposed Project, there would be moderate levels of noise from the operation of heavy equipment during grading and construction. In cases where construction noise is expected to exceed the State DOH "maximum permissible" property-line noise levels, builders must obtain a permit per Title 11, Chapter 46, HAR (Community Noise Control) prior to construction. The DOH reviews the proposed activity, location, equipment, project purpose, and timetable in order to decide upon conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers. Kona Three and/or its construction contractor will consult with DOH to determine if a permit will be required and what, if any, noise reduction measures are necessary. During operation, moderate levels of noise which would be consistent with the level of noise from neighboring residential subdivisions is anticipated. Therefore, the Proposed Action is not expected to significantly impact any existing residential subdivisions within the vicinity of the Project Site.

Under the No Action Alternative, the Proposed Project would not be constructed and the site would remain unchanged from current conditions. There would be no additional impacts to noise from this alternative.

Cumulative Impacts

Since there are no impacts from the Proposed Project, there are no anticipated cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions from noise.

3.3.6 Air Quality and Scenic Resources

Environmental Setting

Air quality in Hawaiʻi is generally good, below criteria levels for most pollutants in most locations at almost all times. There are no State Department of Health (DOH) air monitoring stations in the immediate vicinity of the Project Site. The nearest site is the Kailua-Kona monitoring site which is located on Walua Road approximately one mile north of the Project Site. Air pollution in West Hawaiʻi, when present, is mainly derived from volcanic emissions of sulfur dioxide, which convert into particulate sulfate and produce a volcanic haze (vog) that can affect North and South Kona. Vog concentrations are dependent on the amount of sulfur dioxide emitted from Kīlauea Volcano, the distance downwind, and the wind direction and speed on a given day. Minor levels of air pollution also come from urban uses including traffic and other nearby industrial activities.

Neither the Project Site nor any surrounding areas are mentioned in the County of Hawaiʻi General Plan as being notable for their natural beauty (County of Hawaiʻi 2005). The nearest site is the White Sands Beach which is located on the coast approximately 2.6 miles northwest of the Project and is not visible from the Project Site.

Impacts and Mitigation Measures

Short term direct and indirect impacts on air quality could potentially occur due to Project construction, principally through fugitive dust from vehicle movement and soil excavation, and exhaust emissions from onsite construction equipment.

Adequate fugitive dust control can typically be accomplished by the establishment of a frequent watering program to keep bare dirt surfaces in construction areas from becoming significant sources of dust. In dust prone or dust sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Onsite mobile and stationary construction equipment also would emit air pollutants from engine exhausts, but no sensitive receptors are present. The contractor will be required to prepare a dust control plan during construction compliant with provisions of HAR, Chapter 11-60.1, "Air Pollution Control," and Section 11-60.1-33, "Fugitive Dust."

Also, the Proposed Project includes proposed landscaping on the Proposed Project's parcel; therefore, impacts to scenic resources are not expected to occur.

Under the No Action Alternative, the Proposed Project would not be constructed and the site would remain unchanged from current conditions. There would be no additional impacts to air quality or scenic resources from this alternative.

Cumulative Impacts

Since there are only minimal impacts from the Proposed Project, any potential cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions to air quality or scenic resources would be minor.

3.3.7 Hazardous Materials and Wastes

Existing Environment

Based on the known land uses of the Project Site for agricultural and livestock grazing and since the Project Site has not been previously developed or used for industrial purposes, no hazardous materials or waste are expected to be present. Additionally, no hazardous or solid wastes were noted by the field inspections completed for the Project.

State databases did not indicate any Underground Storage Tanks (USTs), Leaking Underground Storage Tanks (LUSTs), or records of incidents or releases on the Project Site or in surrounding properties (https://eha-cloud.doh.hawaii.gov/iheer/#!/viewer, accessed December 2019).

Impacts and Mitigation Measures

Previous land use and informal review has shown that is unlikely that any potentially hazardous, toxic, or radioactive waste would be found on the Project

Site. Reasonable precautions would be undertaken in the context of the Project construction Best Management Practices to include provisions for the appropriate reporting to the State and readiness for response and remediation should any such hazardous, toxic, or radioactive material be encountered during the construction phase of the Project.

Construction equipment would use fossil fuels, and hydraulic power would be used in grading and construction. There is a possibility of leaks, spills, or accidents during construction and during occupation of the development by residents (from an accidental vehicle leak). The construction contractors will be required to develop and maintain an emergency action plan for management and recovery of any release of petroleum or hazardous materials to the environment. Onsite stormwater treatment would minimize impacts from spills during when the Project Site is occupied by residents.

No impacts to hazardous materials or waste are expected from the No Action Alternative.

Cumulative Impacts

Since there are minimal potential impacts from the Proposed Project, there are no anticipated cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions to hazardous materials or wastes.

3.4 Socioeconomics

Population as measured in the 2010 U.S. Census (the most recent U.S. census) for North Kona, a Census County Division (CCD), was 18,642 (U.S. Census Bureau 2010a). Table 3 provides information on the socioeconomic characteristics of the State of Hawaiʻi, the County of Hawaiʻi, and North Kona CCD, from the U.S. Census Bureau.

Table 3 Selected Socioeconomic Characteristics

Description	State of Hawaiʻi	County of Hawaiʻi	North Kona CCD
Total Population	1,360,301	185,079	37,875
Median age (years)	37.2	40.9	41.4
Total housing units	519,508	82,324	18,642
Median Household Income[2]	$71,977	$53,936	$65,682*
Individuals below poverty level[2]	10.8%	18.7%	13.7%*
Race and Hispanic Origin			
White alone	24.7%	33.7%	45.6%
Black or African American	1.6%	0.6%	0.5%
American Indian or Alaska Native	0.3%	0.5%	0.5%
Asian alone	38.6%	22.2%	15.3%

Description	State of Hawai‘i	County of Hawai‘i	North Kona CCD
Native Hawaiian	5.9%	8.5%	11.2%
Two or More Races	23.6%	29.5%	23.8%
Hispanic or Latino (of any race)	8.9%	11.6%	11.3%

Source: U.S. Census Bureau 2010a, 2010b, and 2010c
[2]Source: U.S. Census Bureau 2016
*Estimates for CCDs have a high margin of error due to small population and sample size.

The County of Hawai'i's population in the 2010 census was 185,079, an increase of 24 percent from 2000. The population of the North Kona District increased from 28,543 in 2000 to 37,875 in 2010, representing a 33 percent increase. In South Kohala the population increased from 13,131 in 2000 to 17,627 in 2010 which is a 34 percent increase. This rate of population growth is significantly higher than the rate of growth for the state which was only 12 percent over the same period and the County of Hawai'i which was 25 percent. The combined population of the two districts was 55,502 in 2010 which amounted to 30 percent of the island-wide population (U.S. Census Bureau 2010a, 2010b, 2010c).

According to the latest Housing Planning Study, in recent years building has focused on units that are not available for Hawai‘i families (SMS 2019). "In spite of continuing moderate growth of subdivision activity and housing construction in the North Kona district, housing problems for the low and moderate income groups have been particularly acute." Residents, including families, compete with the visitor market for the rental of apartment and condominium units. The General Plan anticipated in 2005 that the in-migration to the district would continue as would the need for housing for residents. The Draft General Plan 2040 predicts that over the next 25 years the population in Hawai‘i County will grow roughly 50 percent, and identifies that housing is a burden for more than 50 percent of households (County of Hawai‘i 2019).

Lastly, the high cost of housing is reflected in the number of households that are crowded (two or more persons/bedroom), doubled up, or both. In the North Hawai'i District, 17.3 percent of the 10,203 households are crowded, doubled up or both while 14.6 percent of the 14,184 North Kona households were in the same category. As such, there are 3,836 households in North Hawai'i and North Kona living in crowded conditions or are doubled up (OHCD 2019). This is a trend that has been increasing since 2003 (SMS 2019).

As discussed in Section 3.10.2, the Proposed Project conforms with all land use designations.

Impacts and Mitigation Measures

The Proposed Project would provide 450 mid-market Rental units and For Sale units. These units are much needed in the area of North Kona as identified in the 2005 General Plan and Draft 2040 General Plan (County of Hawai'i 2005 2019). Occupants for the development would either come from on-island residents (i.e., existing overcrowded or doubled-up households) or new residents to the island.

The Proposed Project would address a portion of this demand.

The Proposed Project would generate work for the local construction industry, which would stimulate local economic spending. The Proposed Project would provide infill mid-market housing in the urban area and allow resident households better access and the ability to safely manage commutes between home, work, and recreation. Stable households lead to stable communities, and promotes a functional economy. The Project would also increase demand for services from residents both during construction (transportation and trade services) and during occupancy (infrastructure, school, utilities, government) (see Section 3.7). Revenues of local government can increase as a result of a housing development project, at first from building fees, taxes on construction workers' wages, and taxes on sale and transport of building materials and then in the long term from property taxes and mortgage and deed transfer taxes (Housing Assistance Council 2019).

Under the No Action Alternative, the site would remain unchanged from current conditions and the mid-market housing development Project would not be constructed.

Cumulative Impacts

Since there are no impacts from the Proposed Project, there are no anticipated cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions to socioeconomics. The Proposed Project does not require any changes to land use designations and would not cumulatively affect land use because it is consistent with community plans.

3.5 Cultural Practices and Sites

The following text are excerpts quoted from the Cultural Impact Assessment (CIA) prepared for the Project Site (Appendix 4).

The Project Site is in Hōlualoa 1st Ahupuaʻa within the area of *Kona kaiʻōpua in Kona ʻākau*. Hōlualoa literally means "long sled course," and Hōlualoa 1st is a traditional *ahupuaʻa* stretching from the ocean to the foot of Hualālai in the uplands.

Very little is recorded of Hōlualoa Ahupuaʻa in traditional oral accounts. *The Heart Stirring Legend of Ka-Miki*, published in the Hawaiian language newspaper *Ka Hoku o Hawaii* contains the only description of Hōlualoa. The legend is set in the 13th century but also reflects more recent influences. According to the narrative,

> The lands of Hōlualoa were named for the chief of that name; both Hōlualoa and Puapuaʻa were high chiefs, who controlled the lands from mountain to sea, which bear their names… Kaluaokalani served as a priest of Hōlualoa at the temple of Pākiha. This heiau was near the contest field of Hōlualoa… The lands of this region are named for various aliʻi, all of whom were related. When the chief Hōlualoa took up the challenge against Kepakaʻiliʻula on behalf of the Kona chiefs, Hōlualoa called upon his god Kālaipāhoa to assist him in his battle… Hōlualoa was the first chief to call upon the god Kālaipāhoa, and this was the beginning of this god's use by the chiefs of Hawaiʻi.

Pre-Contact Era

Hōlualoa, Kona, and much of the leeward side of Hawaiʻi Island, while well populated at the time of European Contact, were settled later than the windward side. This in part may be due to the fertile land, numerous streams, and abundant rainfall on the windward side. Many archaeologists believe that Hawaiʻi Island was first settled around A.D. 1,000 by people sailing from the Marquesas.

During early settlement of the leeward side permanent habitations were established in Kona concentrated along the shoreline and lowland slopes. Informal fields were cleared at higher elevations where rainfall was higher. Between AD 1200 and 1400, habitation and agriculture expanded across the slopes and coastal area of Hualālai. The initial construction of the Kona Field System (KFS) began approximately between AD 1400 to 1600. The development of these extensive formal walled fields coincides with a dramatic population increase and with the development of the stratified chiefdom structure which is reflected through large residential complexes and heiau. Thus, there was a need to expand the previously limited agricultural base. The royal centers and larger heiau were in place by AD 1600 to 1800 which reflect the growth in power of the rulers and chiefs in the region. Royal centers are located at Kailua, Hōlualoa, Kahaluʻu, Kealakekua, and Hōnaunau.

The region of Hōlualoa developed into a royal center in the late 1600s to early 1700s under the reigns of Keakamahana (reigned 1680-1700) and Keakealaniwahine (reigned 1700-1720). Many ʻaliʻi and konohiki residences and numerous religious sites are known to have existed in this region. The majority of the heiau and royal residences were constructed along or near the coast, most notably at Kamoa Point south of the project area. The royal center at Hōlualoa was eclipsed in the second half of the 1700s by the royal center in the Kahaluʻu and Keauhou region.

The Kona Field System

The Kona Field System extends north at least to Kau Ahupuaʻa and south to Hōnaunau, west from the coastline and east to the forested slopes of Hualālai. During his travels in 1823, William Ellis noted the extensive field system divided with "low stone walls, made of fragments of lava", producing "bananas, sweet potatoes, mountain taro, tapa trees, melons and sugar cane" and "flourishing luxuriantly in every direction." Many of the archaeological projects conducted within Kona deal with components of the Kona Field System. The kula zone of the Kona Field System is from sea level to 150 meters amsl. This zone is associated with habitations along the shoreline and cultivation of sweet potatoes (uala), paper mulberry (wauke), and gourds (ipu). Clearing mounds, planting depressions, planting mounds, planting terraces, and modified outcrops are common agricultural features in the kula zone. Permanent habitation including royal and high chiefly centers as well as non-agricultural activities such as fishing, ceremonies and burial practices were usually concentrated along the shoreline zone portion of the kula zone. The higher elevation zones are the kaluʻulu zone, ʻapaʻa zone and the ʻamaʻu zone. The current project area is in the kaluʻulu zone. This wetter region is above 150 meters amsl where bread fruit, sweet potatoes (*Ipomoea batatas*), ki (*Cordyline fruticosa*) wauke (*Broussonetia papyrifera*), karo (*Colocasia esculenta*), sugar cane (*Saccharum* sp.), and other arboreal crops were grown. The ʻapaʻa zone is above the kaluʻulu zone. Hawaiians cultivated melons, sweet potatoes, ti, bananas, taro, wauke and sugar cane in fields with low stone walls. The highest zone, the ʻamaʻu zone, was used to grow bananas and plantains in walled fields. The ʻapaʻa zone and the ʻamaʻu zone were also used to collect timber and catch birds therefore temporary habitations were constructed.

Post-Contact Era

During the post-contact era, the Kona Field System was exploited and the planting of coffee, sugar, sisal, citrus, and cotton took over original Hawaiian crops until eventually the land was used for cattle pasture. The first cattle and sheep were brought to the island by Vancouver in 1793 and 1794. Horses, mules, oxen, goats, and donkeys were brought shortly after. Feral cattle, sheep, and goats overran agricultural fields by 1813 to 1815. By 1848, in the Kona District, a Great Wall (the Kuakini Wall) was constructed from Lanihau to ʻŌnouli to keep them away from homes and agricultural areas. Formal cattle ranching began in the Kona region in the mid-1800s.

The Kona landscape evolved rapidly with the turn of the century. The rapid growth of the sugar industry produced the Kona Sugar Company in 1899. A railroad was built in 1901 to help sustain this influx in produce. It was later used to haul lumber and freight along with the sugarcane. The rail line was seven miles long and extended from Hōlualoa to Ka‘awaloa. Cotton, tobacco, and sisal were grown in the drier lands below the railroad.

The changing subsistence and trade regimes developed by incoming European and American settlers, as well as other historical factors, caused a depopulation of the coastal areas of Kona. Ranches were established at middle and upper elevations, and farms were established in the uplands where rainfall was higher and the temperatures were cooler. Cattle ranching and clearing for sugar cane and coffee removed many of the endemic species of plants. The suite of vegetation that existed prior to the pre-Contact era were replaced by koa haole (*Leucaena leucocephala*), kiawe (*Prosopis pallida*), and other newly introduced invasive plant species.

Schools, churches, stores, and other businesses were also established in the uplands. During the late 1800s and early 1900s, coastal Kona was no longer the densely populated sociopolitical center it once was. It became a small cluster of houses along the trail from Kailua Bay to Keauhou. Homesteads, ranches, and plantations developed in the uplands during this period as reflected in the pattern of Land Commission Awards (LCA) and Land Grants (LG) recorded during the Māhele.

The project area is just *makai* (west) of most of the land commission awards and is at the same elevation as portions of the land grants in the region. Based on historic documents, the project area and surrounding lands were likely being used for subsistence and commercial agriculture, as well as for cattle pasture from the mid to late 1800s. The project area might have been used later than surrounding lands because of its steep slopes and very rocky soil, but based on aerial photographs, the project area was bulldozed sometime around the 1950s through the 1970s in preparation for commercial agriculture.

The Māhele

The Land Commission awarded the majority of Hōlualoa 1st and 2nd Ahupua‘a to Victoria Kamāmalu Ka‘ahumanu IV, Kuhina Nui of Hawai‘i Island and Crown Princess of Hawai‘i as Land Commission Award (LCA) Number 7713, ‘Apana 43. Several smaller LCA and LG properties were also recorded in the upland region of Hōlualoa 1st and 2nd Ahupua‘a. Twenty four Land Commission awards were recorded in Hōlualoa 1st Ahupua‘a, the *ahupua‘a* where the project area is located. A portion of LCA #3660 to John G. Munn makes up a thin strip of land located through the center of the current project area. With the notable exception of LCA #3660 and a few other large LCAs, the average award was 2.8 acres, most (n=16) were for less than 3.0 acres. Three Land Grants (LG #1592, 1602, and 3630) were also recorded in Hōlualoa 1st and 2nd Ahupuaʻa. LG #1592 was a 25.0-acre parcel sold to Kealalio and LG #3630 was a 38.2-acre parcel sold to W.H. Cromwell. Almost all of the awards and grants were used as subsistence and commercial farm land, and some were used to pasture cattle.

Cultural Resources and Practices Related to the Proposed Development

Consultation for the Proposed Project

Gathering input from community members with genealogical ties and longstanding residency relationships to the Project Area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. These individuals ascribe meaning and value to traditional resources and practices.

The following text has been quoted from SCS's CIA for the Project (Appendix 4).

> In the case of the present parcel, consultation was sought from Jordan Kea Calpito, SHPD Burial Sites Specialist; Kamakana Ferreira, OHA Compliance Officer; Nicole Lui, cultural descendant, Sean Naleimaile, State Historic Preservation Division (SHPD) Hawaiʻi Island Archaeologist; Kekoa Nazara, Kona Hawaiian Civic Club President; Shane Nelson, OHA West Hawaiʻi Representative; and J. Curtis Tyler III, cultural descendant. Consultation was also conducted via telephone with Gregg Kashiwa who served as project property manager for parcels 016 and 017 in the early 1980s.
>
> Public notices were placed in the December 2019 issue of the Office of Hawaiian Affairs (OHA) Ka Wai Ola Newspaper. Public notices were also published in the Honolulu Star-Advertiser, and the West Hawaiʻi Today on November 17th, 20th and 21st.
>
> There were no responses to the public notices published in the OHA Ka Wai Ola, West Hawaiʻi Today or the Honolulu Star-Advertiser newspapers. J. Curtis Tyler III, Nicole Lui and Greg Kashiwa did provide information concerning lands of Hōlualoa 1st Ahupuaʻa. There were no past or ongoing cultural practices identified with lands of the current project area.

Impacts and Mitigation Measures

The following text has been quoted from SCS's CIA for the Project (Appendix 4).

An analysis of the potential effect of the proposed construction of residences on cultural resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place is a requirement of the OEQC (No. 10, 1997). Based on historical research and responses from the above listed contacts, it is reasonable to conclude that, there would be no traditional cultural practices affected and there would be no direct adverse effect upon cultural practices or beliefs in the broader project area region.

Under the No Action Alternative, no impacts to cultural practices or sites would occur.

Cumulative Impacts

Through on-going consultation, no cultural practices have been identified in the Project Site. Any potential impacts to cultural sites from the Proposed Project would be mitigated; therefore, no cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions are anticipated to cultural practices or sites.

3.6 Historic and Archaeological Resources

An archaeological inventory survey (AIS) was conducted in 1984 for the entire project except for a 5-acre portion in TMK (3) 7-6-021:017 of the project site (CSH 1984). In a letter to the County of Hawaiʻi Planning Department dated July 30, 2018, (Log. No. 2018.00878 Doc. No. 1807SN01), the SHPD requested a new pedestrian survey to identify all archaeological historic properties present in the Project Site and an update of the previous archaeological documentation to include site plans for each site with site boundaries and areas impacted by bulldozing, photographs of all sites and features, an assessment of their integrity, and site significance.

Kona Three contracted with SCS to conduct an inventory on 76.1 acres to update the original 1984 area and a second archaeological inventory was conducted on the 5-acre portion that had been previously excluded. Based on an interview with a local resident, the five-acre section of the project area was excluded from the original AIS because the property owners were planning to give the five acres to a group to use as a school. The two most current AISs are included in Appendix 5, and the results are summarized below.

Existing Resources

In the AIS for the 76.121-acre portion of the project site, 18 archaeological sites were identified and recorded. Fifteen of the sites were previously documented in the 1984 AIS and three sites were previously unrecorded and included a small coffee shed enclosure (Site TS-1), several ranch walls (Site TS-2), and a possible petroglyph (Isolated Find-1). The Draft AIS was submitted in March 2020.

Six of the 18 sites recorded were determined to be pre-Contact era, three associated with habitation, one with agriculture, a single petroglyph site, and one single feature site (Site 10012) contained two burials. The remaining 12 sites were determined to be historic era, with many of the sites associated with coffee agriculture and cattle ranching, as well as two historic era habitation sites. The following text is from the AIS submitted in 2020 for the 76.121-acre portion of the Project Site (Appendix 5).

> All of the archaeological sites were assessed significant under criterion "d" as they are likely to yield information important to prehistory and/or history. The railroad berm Site 30592 is also significant under criteria "a" and "c" as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. A petroglyph (Isolated Find-1) is also significant criterion "e" as it has important value to Hawaiian people and people of other ethnic backgrounds in the state.
>
> The railroad berm Site 30592 and the petroglyph were recommended for preservation with preservation measures to be outlined in an archaeological Preservation Plan. The petroglyph (Site TS-1) is recommended for preservation in a safe location on the project area. No further work was recommended at the remaining 16 sites.

Site 10012, a pre-Contact site described in the 1984 AIS, included two burials. The burials were removed and reinterred off-project prior to 1984. The site was further excavated to ensure that all *iwi* had been removed. The site was then back-filled and leveled by bulldozer.

In the AIS for the 5.0-acre portion of the project site, 22 newly identified archaeological sites were recorded. The AIS was accepted by SHPD (Log No. 2018.01123, Doc. No. 1805SN05) (Appendix 5). The following text is from the AIS prepared for the 5.0-acre portion (Appendix 5).

> The sites are primarily agricultural terraces associated with pre-Contact era to Historic era agriculture. Several rock walls and enclosures are associated with Historic era agriculture and ranching. A pre-Contact era to later post-Contact era lava tube burial and a portion of the old railroad berm were also recorded.

All 22 sites identified during the current AIS study were assessed significant under criterion "d" as they are likely to yield information important to history. The railroad berm is also significant under criteria "a" and "c" as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. The burial is also significant criterion "e" as it has important value to Hawaiian people and people of other ethnic backgrounds in the state. The burial is recommended for preservation in place with preservation treatments to be outlined in a Burial Site Component of a Preservation Plan (BSCPP), which has been completed and approved. The railroad berm is recommended for preservation with preservation measures to be outlined in an archaeological preservation plan now under review by SHPD.

Impacts and Mitigation

The preservation of the railroad berm (Site 30592) and petroglyph (IF-1) with a Preservation Plan would prevent impacts to archaeological resources from the Project (Appendix 6). The Preservation Plan was drafted in February 2019 for the railroad berm, and revised in March 2020 to include preservation of the petroglyph which was located in the subsequent AIS.

The Preservation Plan outlines short-term and long-term preservation measures for the railroad berm, as well as archaeological monitoring during construction. During construction, a 20-foot buffer from the western perimeter of the berm would be established with orange fencing. An archaeological monitor would be required for any construction work using earthmoving equipment in close proximity to the buffer. No construction activities would take place between the railroad berm and the eastern property boundary except for the breaches allowed for access as outlined in the Preservation Plan. Any construction within 30 feet of the railroad bed and berm would be monitored by an archaeological monitor. A permanent preservation buffer would be established twenty feet from the western perimeter of Site 30592, excluding the approved breaches. Native ornamental plants may be used to mark the 20-foot preservation buffer, excluding the breaches. No use of heavy earthmoving equipment would be allowed within the twenty foot buffer. Hand-tools only would be permitted within the twenty-foot permanent preservation buffer, excluding the breaches.

Kona Three is responsible for keeping the easement clear and open, and ensuring pedestrian access to the site. Parking is available on ʻIo Place. Access would be permitted seven days a week, one-half hour before sunrise to one-half hour after sunset. Signage would also be placed at the railroad bed at the end of ʻIo Place.

Under the No Action Alternative, no impacts to historic or archaeological resources would occur.

Cumulative Impacts

Following implementation of an archaeological preservation plan, there are not expected to be any impacts to historic or archaeological resources from the Project; therefore, no cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions are anticipated to historic or archaeological resources.

3.7 Infrastructure

3.7.1 Utilities and Public Services including Wastewater Treatment and Solid Waste Management

Existing Facilities and Services

The Project would also increase demand for services from residents during construction and occupancy including utilities, services, infrastructure, school, and government. Electrical power to the Project Site would be supplied by Hawaiʻi Electric Light Company. A comment from Clyde Hemby pointed out that the name of the utility provider was incorrect (Appendix 1b). Telephone and data service are provided by local utilities. Wastewater would be disposed of through a tie-in with the County sewer system.

During Project operation, solid waste would be hauled off site by a private contractor on a regular basis to a solid waste management facility in compliance with the applicable provisions (HAR, Chapter 11-58.1, "Solid Waste Management Control"). No burning of wastes would occur on site during construction or during operation of the Proposed Project.

Fire, police, and emergency management services are available in this part of North Kona. A police station is located in Kona, about five miles north of the Project Site. The Kailua Fire Station is located approximately 3.5 miles northeast of the Project Site. Emergency medical services are provided by the Hawaiʻi County Fire Department. Emergency medical services are available at Kona Community Hospital, approximately 7.5 miles to the south.

Kahakai and Holualoa Elementary Schools are the nearest public elementary schools to the Proposed Project, approximately 1.2 miles west and 1 mile east, respectively, of the Project Site. In a Final EA prepared for a new classroom building for Kealakehe Elementary School in 2018, the Department of Education (DOE) projected the school could see a growth of approximately 33 students from 2015 to 2021 at the nearby Kealakehe Elementary School (DOE 2018). It is reasonable that the same level of growth could be assumed for Kahakai and Holualoa Elementary Schools. With a current student population of 749 students at Kahakai (DOE 2019a) and 519 students at Holualoa Elementary (DOE 2019b), this would be a three percent increase over a six-year period.

Kealakehe Intermediate School is the nearest intermediate school, located approximately 3.2 miles north of the Project Site. Konawaena High and Kealakehe High School are the nearest public high schools, located approximately 7.9 miles south and 2.8 miles north, respectively, of the Project Site. Current student populations at the Intermediate school is 689 (DOE 2019c). There are currently 1,374 students at Kealakehe High School and 831 students at Konawaena High School (DOE 2019d and 2019e). According to a letter received during early consultation, Konawaena Intermediate has capacity for additional students for the next five years, and the remaining schools are currently over capacity and expected to remain over capacity for the next five years (Appendix 1).

Additionally, Hawaiʻi Community College – Pālamanui campus and the University of Hawaiʻi Center, West Hawaiʻi, are located approximately 10 miles north of the Project Site. The nearest private schools are Makua Lani Christian Academy approximately 9 miles north of the Project Site, and West Hawaii Explorations Academy Public Charter School is approximately 8 miles northwest of the Project Site.

The Proposed Project is designed to serve the demand of the existing mid-market population of North Kona, which as described in the socioeconomics section consists of households that are currently overcrowded or doubled-up in market rate rentals.

Impacts and Mitigation Measures

Electricity and telephone/data service would be extended from existing lines. There could be minimal impacts from solid waste generated from construction. However, these would be hauled off-site. Since the development is approximately 450 units, the Project would result in moderate impacts to the county solid waste disposal system if occupancy is at 100 percent. Trash from all parts of Hawaii Island are trucked north of Kona to the Puʻuanahulu landfill, which has anywhere from 20 to 100 years capacity (HPR 2020).

The Project is expected to serve the existing demand for mid-market housing for on-island residents.

According to a comment letter received on the Draft EA from the Department of Education, the Project is expected to house approximately 99 HIDOE students.

Although the Proposed Project is located within the West Hawaii School Impact Fee District, the DOE has currently suspended fee collections. Kona Three would coordinate with DOE and comply with all applicable DOE requirements at the time of Project implementation.

Although this may result in a shift or addition of approximately 99 students potentially from other on-island or North Kona DOE schools, the Proposed Project would provide much-needed housing for residents including families. The net of impact of the Project to the mid-market community in general is expected to be positive compared to the impacts to facilities. Multiple comments identified potential issues to local schools from the development (Appendix 1b). Since the Project would be constructed in phases, occupancy would occur over an extended period of time and not all new students would be added at once but rather over a longer period of time.

Under the No Action Alternative, the Proposed Project would not be constructed and the site would remain unchanged from current conditions and no utilities would be needed and no solid waste from the Proposed Project would be generated.

Cumulative Impacts

Existing utilities and public services have and plan for the capacity to accommodate developments such as the Proposed Project, therefore, cumulative impacts from the Proposed Project in combination with past, present, or reasonably foreseeable future actions are expected to be minor.

3.7.2 Traffic

Existing and Proposed Facilities

The concept of level-of-service (LOS) is often used to describe the quality of traffic flow. There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. LOS D is typically considered acceptable for peak hour conditions in urban areas. LOS is usually applied to peak hour traffic, which is the “worst-case” scenario.

A traffic study for the Proposed Project conducted by SSFM International included analysis at eight existing intersections on Queen Ka‘ahumanu Highway (Appendix 2). Five intersections were analyzed north of the Project Site: 1) Palani Road, 2) Henry Street, 3) Hualalai Road (North), 4) Hualalai Road (South), and 5) Puapuaanui Street. Three additional intersections south of the Project Site were also analyzed: 6) Kuakini Highway, 7) Lako Street, 8) Kamehameha III Road (Figure 8).

In the vicinity of the Project Site, Queen Ka‘ahumanu Highway (Route 19) is undivided, two-lane, State-owned arterial, oriented in the north-south direction. Queen Ka‘ahumanu Highway extends from Kawaihae Road (Route 19) in the north to the intersection with Palani Road (Route 130) where it turns into State Route 11. The posted speed limit varies from 45 to 55 miles per hour (mph). Approximately 2.4 miles north of the Project Site, Queen Ka‘ahumanu Highway opens to four to five lanes with dedicated left turning and right turning lanes at major intersections.

Turning movement counts were recorded at each of the intersections at peak morning and afternoon traffic hours. The peak hours for the local roadway network were found to be between 7:00am to 8:00am and 3:45 to 4:45pm. Existing LOS were determined for the morning and evening (AM/PM) peak hours at each of the eight intersections. The results are included in the TIAR (Appendix 2).

Impacts and Mitigation

The TIAR calculated the projected increase in background traffic volumes within the local roadway network (without the Proposed Project) in 2024 and 2029 (Appendix 2: Tables 12, 13, 19, and 20). Background traffic volumes are volumes not directly associated with the development proposed. These volumes are comprised of regional volumes using Queen Ka‘ahumanu Highway and the rest of the local roadway network to travel past the Proposed Project. A background growth rate of one percent per year was assumed, to account for additional traffic at the intersections. This one percent takes into account the following proposed projects: Penaloza School; Youth Gymnastic and Sports Fitness Facility; and Pualani Makai development.

The TIAR also assessed impacts from the Proposed Project following completion of 258 units in Phase I (2024) and then following completion of 192 units in Phase II (2029) (Appendix 2: Tables 14, 15, 21, and 22). Only one roadway is planned to provide access for Phase I of the Proposed Project. This roadway would intersect with Queen Ka‘ahumanu Highway, approximately 600 feet north of the intersection with Kuakini Highway. In the TIAR this Proposed Project access road is referred to as “Royal Vistas Roadway.”

The TIAR analyzed impacts of the Proposed Project under the presumption that the Royal Vistas Roadway approach would have a left turn and a right turn lane. Turn lanes for this road would be provided for the southbound left turn and northbound right turn into the Proposed Project. Right turns would be channelized and this intersection was analyzed as a two-way stop-controlled intersection. A crosswalk would be provided on the east side of the intersection for pedestrian connectivity to cross Royal Vistas Roadway. There would be a refuge lane for westbound left turns onto Queen Kaʻahumanu Highway to make this turn easier for drivers. The expected future lane configuration is shown in Figure 9 and a close-up of the intersection is shown on Figure 10.

The traffic analysis for Phase I of the Proposed Project indicates the only detectable changes to LOS under the With Project condition would occur at one turn movement. The Hualalai Westbound Right turn at the Queen Kaʻahumanu Highway and Hualalai Road (South) intersection is predicted to decrease from LOS E to F in morning traffic. Under the Without Project condition, the analysis for 2024 projects a decrease in LOS at both (1) Queen Kaʻahumanu Highway and Puapuaanui Street intersection (from LOS A to B in the morning and evening) and (2) Queen Kaʻahumanu Highway and Lako Street intersection (from LOS C to D in the morning). No other turning movement at any other intersection or turn movement within the roadway network is projected (in 2024) to demonstrate a detectable delay increase (Appendix 2).

The traffic analysis for Phase II of the Project indicates the detectable changes to LOS under the With Project condition include: (1) afternoon decrease from LOS C to D in the Hualalai westbound right turn movement at Queen Kaʻahumanu Highway and Hualalai Road (South) intersection; (2) morning decrease from LOS C to D in the Queen Kaʻahumanu northbound left turn movement at the Queen Kaʻahumanu Highway and Kuakini Highway intersection; and morning decrease from LOS B to C at the Queen Kaʻahumanu Highway/Kamehameha III Road intersection. Under the Without Project condition, the analysis for 2029 projects a decrease in LOS at the following: (1) afternoon decrease from LOS C to D at the Queen Kaʻahumanu Highway and Henry Street intersection; (2) morning decrease from LOS E to F at Hualalai westbound right turn at the Queen Kaʻahumanu Highway and Hualalai Road (South) intersection; and (3) morning decrease from LOS C to D at Queen Kaʻahumanu Highway and Lako Street intersection (Appendix 2).

The traffic analysis indicates that only one intersection and two turn movements would experience decreased LOS under the With Project condition, and many vehicle trip delay issues are unrelated to the Proposed Project (i.e., they would occur even if the Project did not proceed) (Appendix 2).

Figure 8 Local Intersections Studied for the Project

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

Figure 9 Proposed Improvements to Project Intersection with Queen Ka‘ahumanu

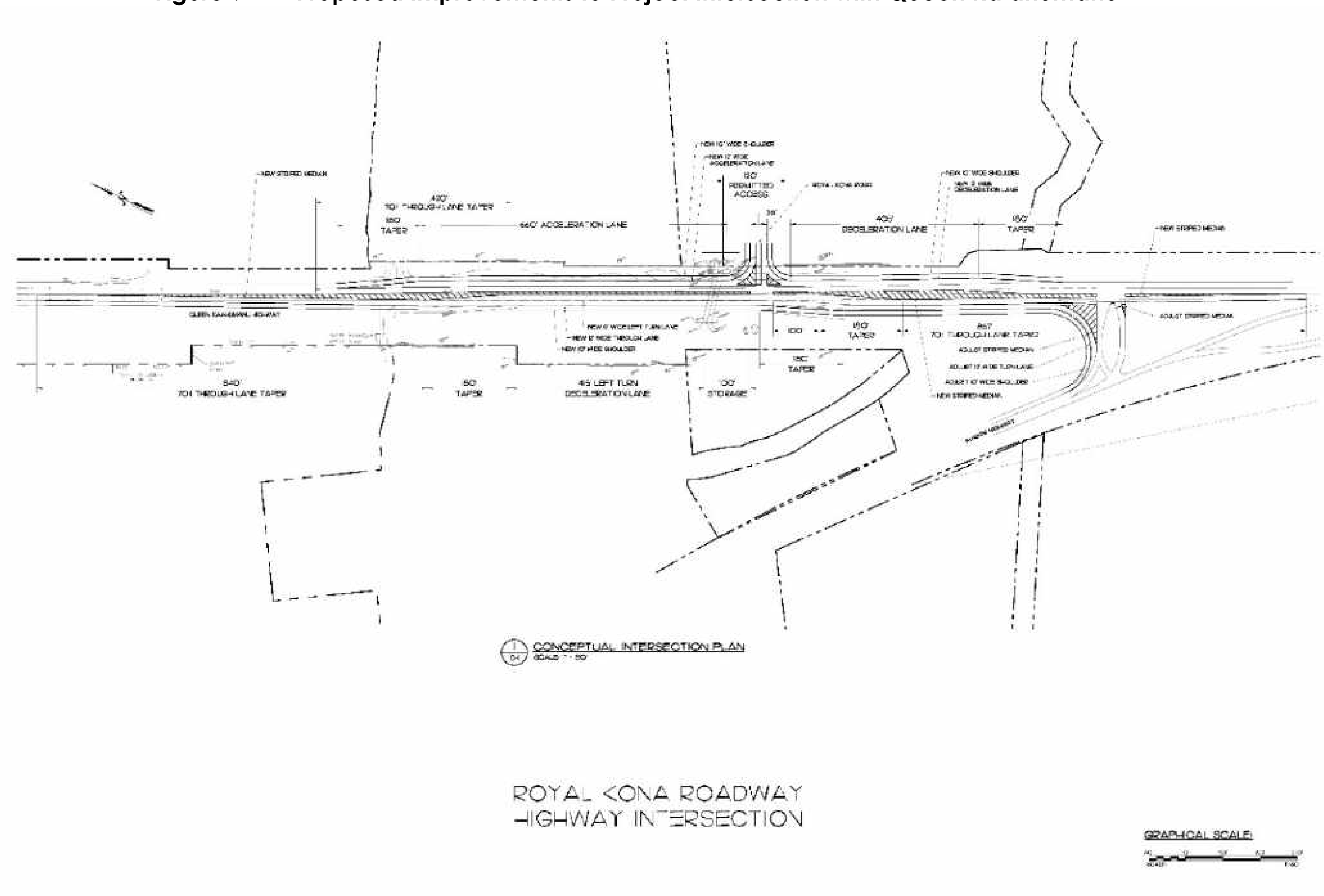
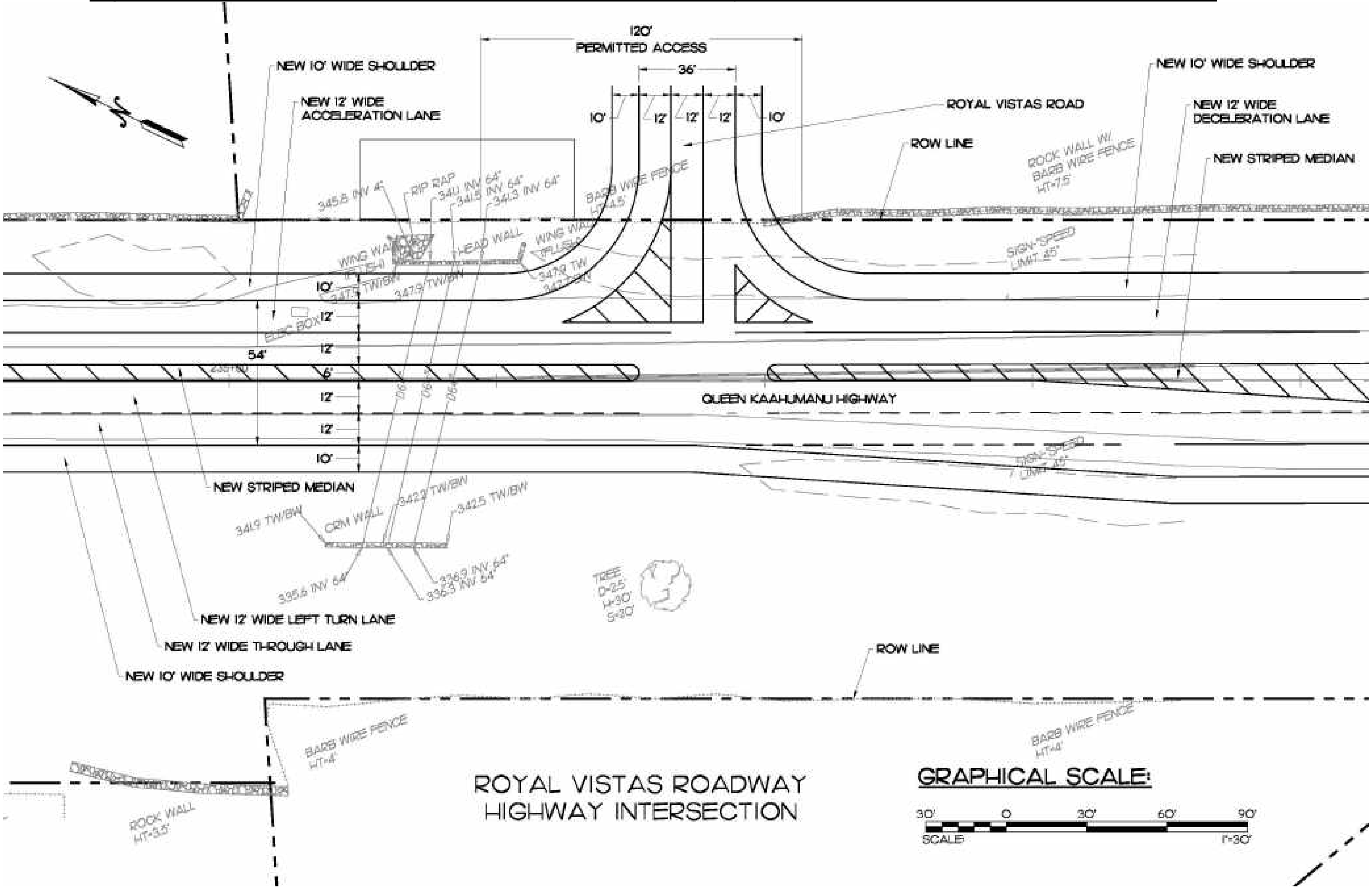


Figure 10 Close-up of Proposed Improvements to Project Intersection with Queen Ka'ahumanu



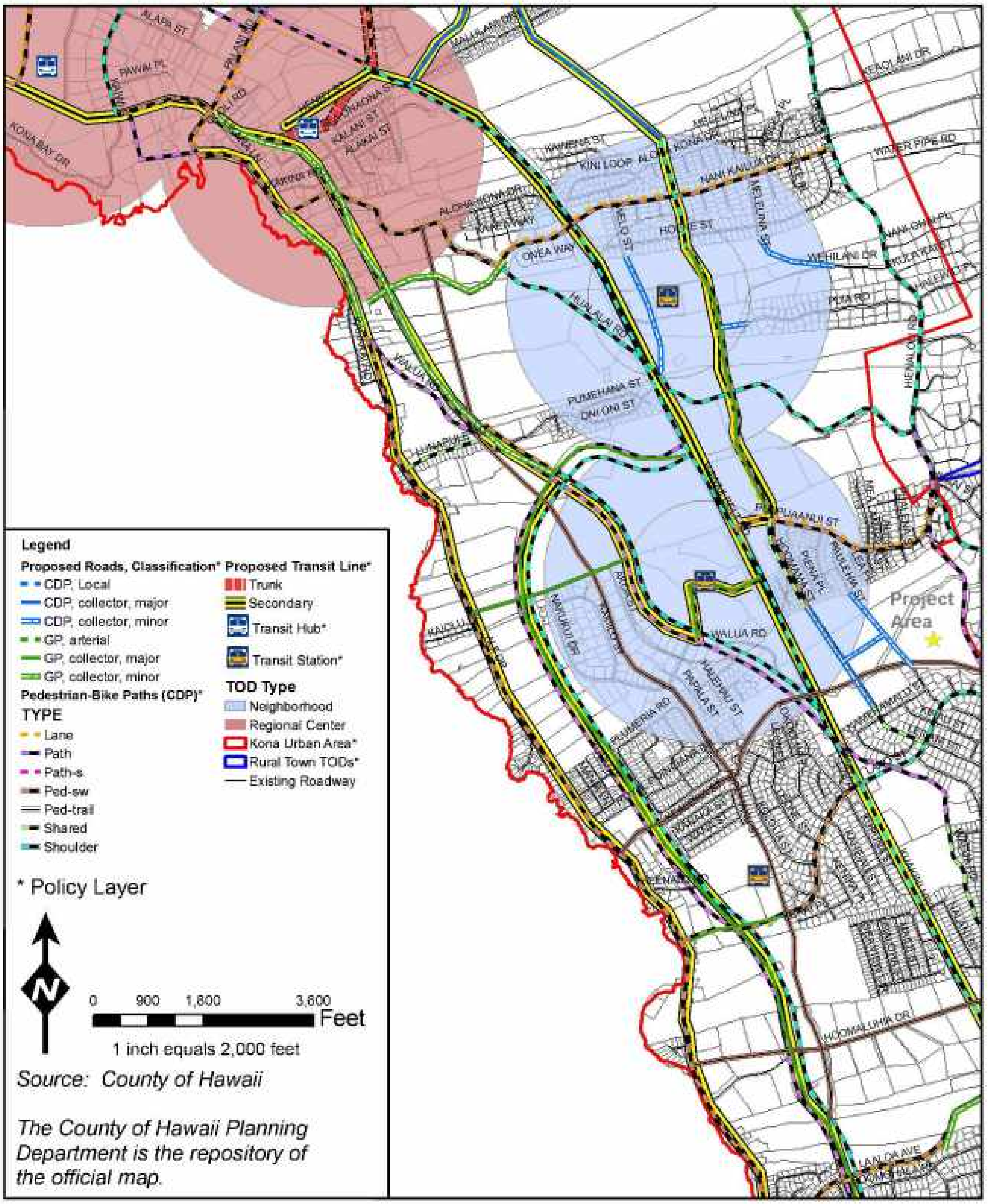
The Kona CDP includes the official Transportation Network Map – Nani Kailua Area and shows future connections of 'minor collectors' running parallel to Queen Ka'ahumanu Highway in the location of the Proposed Project, extending Hoomama Street to Leilani Street and Paulehia Street to Kekuana'oa Place (Figure 11). While the exact timing of these improvements is unknown, it is not expected they would be completed prior to Phase I (i.e., in 2024). The most likely scenario is that the developers of Royal Vistas would construct a collector road to the south before the completion of Phase II.

The connection of these roads north to the Pualani Estates subdivision is not proposed for this Project, since these roads cross TMK (3) 7-6-013:004 which is owned by the Frank and Betty Gomes Trust (Figure 1). In addition, the traffic impact analysis shows no impacts to LOS from the Project above the background rate at the intersection of Queen Ka'ahumanu Highway and Puapuaanui Street which is the main entrance to Pualani Estates subdivision.

Potential impacts to the Kona Vistas subdivision would be alleviated by constructing the Royal Vistas Roadway intersection with Queen Ka'ahumanu Highway. Also, the traffic impact analysis shows no impacts to LOS from the Project above the background rate to the intersection of Queen Ka'ahumanu Highway and Lako Street which is the main entrance to the neighboring Kona Vistas subdivision.

As shown on Figure 2 and explained under Roads in the Project description (Section 1.3), one existing County-owned road would be extended (Kekuana'oa Street), the Leilani Street extension would be constructed and stubbed-out on the south end of the Project Site at the Calvary Church property between the Project and Kona Vistas, and one new road would be constructed (Royal Vistas Roadway). All would be dedicated to the County as part of the Proposed Project. Based on comments received on the Draft EA on potential impacts to traffic from the connector roads (Appendix 1b), Figure 3 shows the location and phasing of these connector roads. While Figure 11 from the Kona CDP shows connector roads connecting County-owned Leilani Street (in the Kona Vistas project) to County-owned Ho'omama Street (in the Pualani Estates project) and Kekuana'oa Street (in the Kona Vistas project) to County-owned Paulehia Street (in the Pualani Estates project), these connections would not be built as part of the Proposed Project. Additionally, no *mauka-makai* connector roads from Hualalai Road to Queen Ka'ahumanu Highway are proposed as part of the Proposed Project. Therefore, the Proposed Project would have no effect to neighbors in adjacent subdivisions from Phase I, and only minimal impacts after Phase II.

Figure 11 CDP Transportation Network Map in the Vicinity of the Project



Kona Community Development Plan, Figure 4-2d Official Transportation Network Map - Nani Kailua Area

Figure 10: CDP Transportation Network Map in the Vicinity of the Project Area

Additionally, any work that is conducted within the County Right-of-Way would conform to Chapter 22 – County Streets – of the Hawaiʻi County Code.

Under the No Action Alternative, the Proposed Project would not be constructed, and the site would remain unchanged from current conditions and LOS are predicted to decline in 2024 and 2029 as shown in the Without Project tables in Appendix 2.

Cumulative Impacts

The predicted impacts from past, present, and reasonably foreseeable future projects are estimated for 2024 and 2029 in Appendix 2. The predicted cumulative impacts of the Proposed Project in addition to past, present, and reasonably foreseeable future actions are estimated in the With Project projections in Appendix 2. As stated above, the traffic analysis indicates the only detectable changes to LOS in the With Project condition in 2024 and 2029 would occur at one intersection and two turn movements, and other predicted delays are not predicted as a result of the Project. The cumulative traffic analysis completed for this Project was conducted before the Covid-19 pandemic reduced traffic. The traffic analysis included a background growth rate that took into account nearby projects that are proposed in the vicinity of the Proposed Project including: Penaloza School; Youth Gymnastic and Sports Fitness Facility; and Pualani Makai development.

Based on existing traffic volumes and future projections of traffic from Royal Vistas on the surrounding roadways (and input from public comments), the following system-wide intersection improvements are recommended in the TIAR (Appendix 2) for ongoing consideration by Hawaii County and the Hawaii Department of Transportation (HDOT):

1. Queen Kaʻahumanu Highway and Palani Road: monitor and update signal timing to ensure left turn queues clear every cycle.
2. Queen Kaʻahumanu Highway and Henry Street: monitor and update signal timing to ensure left turn queues clear every cycle.
3. Queen Kaʻahumanu Highway and Hualalai Road (North): depending on monitoring, a traffic signal may need to be installed but priority should be given to keep Queen Kaʻahumanu Highway traffic moving.
4. Queen Kaʻahumanu Highway and Hualalai Road (South): monitor future traffic.
5. Queen Kaʻahumanu Highway and Puapuaanui Street: monitor and update signal timing to increase traffic clearing the Queen Kaʻahumanu intersection in one cycle.

6. Queen Ka‘ahumanu Highway and Kuakini Highway: monitor future traffic and conduct a traffic signal study.
7. Queen Ka‘ahumanu Highway and Lako Street: consider changing the phasing from split to protected left turns to help lower the predicted delay, suggest further traffic study to analyze signal modification. This intersection would also improve significantly if Queen Ka‘ahumanu Highway is widened to four lanes as in the 2035 Transportation Plan.
8. Queen Ka‘ahumanu Highway and Kamehameha III Road: monitor and update signal timing as needed.

3.8 Irreversible and Irretrievable Commitments of Resources

A commitment of resources is irreversible when primary or secondary impacts limit the future options for a resource; an irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for future use.

All the land to be used by the Proposed Project is in a State Land Use Urban District and, therefore, has been characterized by “city-like” concentrations of people, structures and services. This District also includes vacant areas for future development. No new land would be irreversibly and irretrievably committed as a result of the Proposed Project.

The Proposed Project would require the commitment of natural, physical, and human resources to plan, design, construct, and operate. Diesel fuel to power equipment would be used during Proposed Project construction and building materials, such as concrete and asphalt, would be consumed. Some of those materials could ultimately be recycled for reuse, those that are not would be expended.

3.9 Unavoidable Adverse Impacts

No unavoidable adverse impacts from the Proposed Project are anticipated.

3.10 Unresolved Issues

No unresolved issues for the EA have been identified.

3.11 Required Permits and Approvals

The Proposed Project requires granting the following permits and approvals, which are listed by responsible agency:

- County of Hawai‘i, Department of Public Works, Building Division Approval and Building Permit
- County of Hawai‘i, Department of Public Works, Engineering Division, Grading Permit
- County of Hawai‘i, Department of Public Works, Engineering Division, Drainage Plan
- County of Hawai‘i, Planning Department Plan Approval
- State Department of Health, National Pollutant Discharge Elimination System Permit
- State Historic Preservation Division, Chapter 6e Historic Sites Clearance
- State Department of Transportation – Highways Division, Permit to Perform Work in State ROW
- County Council – Approval of Amendments to Zoning Ordinance

3.12 Consistency with Government Plans and Policies

3.12.1 Hawai‘i State Land Use Law, Hawai‘i State Plan, and State Housing Functional Plan

The subject parcels are designated as Urban by the State Land Use Commission, and State Land Use Commission Docket No. A83-549 determined the status of condition compliance for these land use entitlements.

The Hawaii State Plan (Hawaii Revised Statutes, Chapter 226, as amended) establishes a set of themes, goals, objectives and policies that are meant to guide the State’s long-run growth and development activities. The three themes that express the basic purpose of the Hawai‘i State Plan are individual and family self-sufficiency, social and economic mobility, and community or social well-being. The Proposed Project would provide much needed mid-market housing to residents of North Kona.

The Proposed Project is consistent with the State Plan objectives and policies related to housing and facility systems as cited below:

Ch. 226-4 State goals. In order to ensure, for present and future generations, those elements of choice and mobility that ensure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve:

(1) A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaii's present and future generations.

(2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.

(3) Physical, social, and economic well-being, for individuals and families in Hawaii, that nourishes a sense of community responsibility, of caring, and of participation in community life.

The Proposed Project would meet this goal by providing choices for mid-market/workforce families in North Kona to rent or buy homes in communities near their work.

Ch. 226-5 Objective and policies for population.

(a) It shall be the objective in planning for the State's population to guide population growth to be consistent with the achievement of physical, economic, and social objectives contained in this chapter.

(b) To achieve the population objective, it shall be the policy of this State to:

(1) Manage population growth statewide in a manner that provides increased opportunities for Hawaii's people to pursue their physical, social, and economic aspirations while recognizing the unique needs of each county.

(2) Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.

(3) Promote increased opportunities for Hawaii's people to pursue their socio-economic aspirations throughout the islands.

(4) Encourage research activities and public awareness programs to foster an understanding of Hawaii's limited capacity to accommodate population needs and to address concerns resulting from an increase in Hawaii's population.

(5) Encourage federal actions and coordination among major governmental agencies to promote a more balanced distribution of immigrants among the states, provided that such actions do not prevent the reunion of immediate family members.

(6) Pursue an increase in federal assistance for states with a greater proportion of foreign immigrants relative to their state's population.

(7) Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.

By providing mid-market housing to those that need it, the Proposed Project would promote increased opportunities for local residents to pursue their socio-economic aspirations.

Ch. 226-13 Objectives and policies for the physical environment--land, air, and water quality.

(a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:

(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.

(2) Greater public awareness and appreciation of Hawaii's environmental resources.

(b) To achieve the land, air, and water quality objectives, it shall be the policy of this State to:

(1) Foster educational activities that promote a better understanding of Hawaii's limited environmental resources.

(2) Promote the proper management of Hawaii's land and water resources.

(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.

(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaii's people.

(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

(6) Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.

(7) Encourage urban developments in close proximity to existing services and facilities.

(8) Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors.

The Proposed Project has been designed to minimize impacts to natural and cultural resources during construction and operation as described in the resource sections above.

Ch. 226-15 Objectives and policies for facility systems--solid and liquid wastes.

(a) Planning for the State's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:

(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.

(2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.

(b) To achieve solid and liquid waste objectives, it shall be the policy of this State to:

(1) Encourage the adequate development of sewerage facilities that complement planned growth.

(2) Promote reuse and recycling to reduce solid and liquid wastes and employ a conservation ethic.

(3) Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes.

As described in the water quality and water quantity section above, the Proposed Project has been designed to maintain basic public health and sanitation standards by tying with the County sewer service. As the final phase of the larger development, the Proposed Project complements planned growth as part of the authorized 1984 zoning ordinance.

Ch. 226-16 Objective and policies for facility systems – water.

(a) Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

(b) To achieve the facility systems water objective, it shall be the policy of this State to:

(1) Coordinate development of land use activities with existing and potential water supply.

(2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.

(3) Reclaim and encourage the productive use of runoff water and wastewater discharges.

(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.

(5) Support water supply services to areas experiencing critical water problems.

(6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.

As described in the water quality and quantity section above, the Proposed Project would utilize the existing water supply through coordination with DWS and meet that objective. Through water efficient fixtures and xeriscape landscaping, it would meet the water conservation objective.

Ch. 226-19 Objectives and policies for socio-cultural advancement – housing.

(a) Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:

(1) Greater opportunities for Hawaii's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individual, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to extremely low-, very low-, lower-, moderate-, and above moderate-income segments of Hawaii's population.

(2) The orderly development of residential areas sensitive to community needs and other land uses

(3) The development and provision of affordable rental housing by the State to meet the housing needs of Hawaii's people.

(b) To achieve the housing objectives, it shall be the policy of this State to:

(1) Effectively accommodate the housing needs of Hawaii's people.

(2) Stimulate and promote feasible approaches that increase housing choices for low income, moderate-income, and gap-group households.

(3) Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.

(4) Promote appropriate improvement, rehabilitation, and maintenance of existing housing units and residential areas.

(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.

(6) Facilitate the use of available vacant, developable, and underutilized urban lands for housing.

(7) Foster a variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods that reflect the culture and values of the community.

(8) Promote research and development of methods to reduce the cost of housing construction in Hawaii.

The Proposed Project would meet this objective by providing the mid-market/workforce population (a gap-group) housing options to buy or rent in North Kona. The Project Site is zoned for multi-family residential and is an in-fill project on vacant land that is surrounded by residential development and has utilities available.

Ch. 226-104 Population growth and land resources priority guidelines.

(a) Priority guidelines to effect desired statewide growth and distribution:

(1) Encourage planning and resource management to ensure that population growth rates throughout the State are consistent with available and planned resource capacities and reflect the needs and desires of Hawaii's people.

(2) Manage a growth rate for Hawaii's economy that will parallel future employment needs for Hawaii's people.

(3) Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State.

(4) Encourage major state and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.

(5) Explore the possibility of making available urban land, low-interest loans, and housing subsidies to encourage the provision of housing to support selective economic and population growth on the neighbor islands.

(6) Seek federal funds and other funding sources outside the State for research, program development, and training to provide future employment opportunities on the neighbor islands.

(7) Support the development of high technology parks on the neighbor islands.

(b) Priority guidelines for regional growth distribution and land resource utilization:

(1) Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are

present, such as protection of important agricultural land or preservation of lifestyles.

(2) Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

(3) Restrict development when drafting of water would result in exceeding the sustainable yield or in significantly diminishing the recharge capacity of any groundwater area.

(4) Encourage restriction of new urban development in areas where water is insufficient from any source for both agricultural and domestic use.

(5) In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling public interest dictates development of a noncontiguous new urban core.

(6) Seek participation from the private sector for the cost of building infrastructure and utilities, and maintaining open spaces.

(7) Pursue rehabilitation of appropriate urban areas.

(8) Support the redevelopment of Kakaako into a viable residential, industrial, and commercial community.

(9) Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.

(10) Identify critical environmental areas in Hawaii to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.

(11) Identify all areas where priority should be given to preserving rural character and lifestyle.

(12) Utilize Hawaii's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.

(13) Protect and enhance Hawaii's shoreline, open spaces, and scenic resources.

The Proposed Project helps meet the demand for mid-market housing in North Kona, which is needed to support existing needs as well as predicted population growth in the area. It is located on vacant land in an urban area surrounded by residential development with utilities available.

Ch. 226-108 (2) – Sustainability.

(1) Encouraging balanced economic, social, community, and environmental priorities;

(2) Encouraging planning that respects and promotes living within the natural resources and limits of the State;

(3) Promoting a diversified and dynamic economy;

(4) Encouraging respect for the host culture;

(5) Promoting decisions based on meeting the needs of the present without compromising the needs of future generations;

(6) Considering the principles of the ahupuaa system; and

(7) Emphasizing that everyone, including individuals, families, communities, businesses, and government, has the responsibility for achieving a sustainable Hawaii.

The Project Site is within the Urban Expansion and Low Density Urban zoning district in the LUPAG, and is consistent with this designation. The Proposed Project would provide much needed housing options for the mid-market/workforce population in North Kona, and meets the sustainability objective by meeting the needs of the present without compromising the needs of future generations and promotes living within the natural resources and limits of the State.

Chapter 205 Hawai'i Revised Statutes classifies all land in the State of Hawai'i into one of four land use categories – Urban, Rural, Agricultural, or Conservation – and determines permissible uses in each district. The Project Site is in the State Land Use Urban District. The proposed use is consistent with intended uses for this land use district.

3.12.2 Coastal Zone Management Program (Chapter 205A, Hawaii Revised Statutes)

HRS 205A defines the coastal zone as "all the lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the United States territorial sea", the Project Site is located in the coastal zone management area.

The Project Site is located approximately 0.85 miles *mauka* of the shoreline at an elevations from 330 to 900 feet amsl and would not influence coastal process or conditions. The Proposed Project would also have no impact to coastal recreation opportunities, historic resources, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards, managing development, public participation, beach protection, and marine resources (HAR § 205A-2). Detailed explanations of potential impacts are described above in the environmental consequences sections. As the site and actions on it are not likely to influence coastal processes or conditions within coastal areas, no potential impacts are anticipated.

3.12.3 Hawai'i County Zoning, Special Management Area, and General Plan

The subject parcels are zoned Multiple-Family Residential, with a minimum building site of 5,000 square feet per dwelling unit (RM-5), by the County of Hawaii. County of Hawaii Ordinance No. 02-131, which amended previous ordinances to establish zoning on the parcels. As described in Section 1.2, the Project is the final residential development identified in the zoning ordinance (No. 84-23) signed in 1984, and subject to subsequent amendments. An amendment is required in order to provide additional time to commence construction of the Project. This amendment request would be reviewed by the Planning Commission, with a decision by the County Council. Aside from the need for more time, this Project and the zoning that supports it continues to conform with the original findings and reasons for its approval by the County Council in 1984, and as amended as recently as in 2002.

County of Hawai'i Ordinance 02-131 amended previous ordinances to establish the zoning on the properties and required the applicant comply with conditions A through S, and the State Land Use Commission Docket No. A83-549, to determine the status of condition compliance for these land use entitlements.

The General Plan for the County of Hawai'i is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawai'i (County of Hawai'i 2005). The plan was adopted by ordinance in 1989 and revised in 2005 (Hawai'i County Planning Department). The General Plan itself is organized into thirteen functional elements. In general, the Proposed Project would be consistent with the goals, policies and objectives, standards, and principles for several functional areas. This section addresses the consistency of the proposed action with relevant policies of the County.

Housing Goals:

- Attain safe, sanitary, and livable housing for the residents of the County of
- Hawaii.

- Attain a diversity of socio-economic housing mix throughout the different parts of the County.
- Maintain a housing supply that allows a variety of choices.
- Improve and maintain the quality and affordability of the existing housing inventory
- Seek sufficient production of new affordable rental and fee-simple housing in the County in a variety of sizes to satisfactorily accommodate the needs and desires of families and individuals.
- Encourage and expand home ownership opportunities for residents.

Housing Policies:

- Encourage a volume of construction and rehabilitation of housing sufficient to meet growth needs and correct existing deficiencies.
- Increase rental opportunities and choices in terms of quality, cost, amenity, style and size of housing, especially for low and moderate income households.
- Aid and encourage the development of a wide variety of housing to achieve a diversity of socio-economic housing mix.

Discussion: The Proposed Project would incorporate measures to provide additional mid-market housing in a quickly growing part of the County. The location of the Proposed Project is adjacent to other housing developments and services for future residents, and would provide choices for the mid-market population in North Kona.

Historic Sites Goals:

- Protect and enhance the sites, buildings and objects of significant historical and cultural importance to Hawaiʻi.
- Appropriate access to significant historic sites, buildings and objects of public interest should be made available.

Discussion: No impacts to archaeological sites would occur from the Proposed Project.

Natural Beauty Goals:

- Protect scenic vistas and view planes from becoming obstructed. Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

Discussion: The Proposed Project would not degrade the scenic environment of the area.

Transportation Goals:

- Provide a transportation system whereby people and goods can move efficiently, safely, comfortably and economically.

Discussion: The Proposed Project would include constructing an intersection from Queen Ka‘ahumanu Highway that would allow for safe ingress and egress during Project construction and occupancy. In addition, the Proposed Project would build and dedicate a substantial portion of the expanding County planned roadway grid system.

Land Use Goals:

- Designate and allocate land uses in appropriate proportions and mix and in keeping with the social, cultural, and physical environments of the County.
- Protect and preserve forest, water, natural and scientific reserves and open areas.

Land Use Standards

- The designated land uses will be delineated on the General Plan Land Use Pattern Allocation Guide Map. The broad-brush boundaries indicated are graphic expressions of the General Plan policies, particularly those relating to land uses. They are long-range guides to general location and will be subject to: a) existing zoning; and b) State Land Use District. Similarly, the acreages allocated represent alternatives for the various levels of economic activity and supporting functions, such as resort, residential, commercial and industrial activities. Land required for community and governmental services and programs as well as new towns and resort centers may be accommodated within the allocated acreages.

Discussion: The *Hawai‘i County General Plan Land Use Pattern Allocation Guide (LUPAG) and Facilities Map* components of the *General Plan* are graphic representations of the Plan's goals, policies, and standards as well as of the physical relationship between land uses. They also establish the basic urban and non-urban form for areas and the planned public and cultural facilities, public utilities and safety features, and transportation corridors. The Project Site is within the Urban Expansion and Low Density Urban zoning district in the LUPAG. As discussed above in this section, the Project Site has been found to be consistent with this designation. The Proposed Project would provide much needed mid-market housing for residents in North Kona.

3.12.4 Kona Community Development Plan

The Kona CDP encompasses the judicial districts of North and South Kona was developed under the framework of the February 2005 County of Hawaiʻi General Plan. The CDP is intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County.

The General Plan now requires that a CDP shall be adopted by the County Council as an "ordinance," giving the CDP the force of law. This is in contrast to plans created over past years, adopted by "resolution" that served only as guidelines or reference documents to decision-makers. The Kona CDP was adopted in September 2008 and amended by Ordinance 19-91 in 2019 by the County Council. The version referenced in this Environmental Assessment is at: http://www.hawaiicountycdp.info/north-and-south-kona-cdp/cdp-final-drafts.

The Plan has many elements and wide-ranging implications, but there are several major strategies that embody the guiding principles related to the economy, energy, environmental quality, flooding and other natural hazards, historic sites, natural beauty, natural resources and shoreline, housing, public facilities, public utilities, recreation, transportation, and land use. The Proposed Project's proposed development is consistent with all aspects of the Kona CDP, including three of the eight guiding principles: (1) provide connectivity and transportation choices; (2) provide housing choices; and (3) Provide infrastructure and essential facilities concurrent with growth.

It is in keeping with the Plan's the Goals, Objectives, Policies, and Actions to develop a system of interconnected roads in Kona (Section 4.1). In particular, Section 4.1.3:

> **Objective TRAN-2 Street Network Connectivity. To develop a system of interconnected roads in Kona that will provide alternative transportation routes that will disperse automobile trips and reduce their length, while not compromising the through functions of arterials and major collectors with excessive intersections.**

Under this Objective, the Project complies with guiding principles established by the Kona Urban Area by promoting Policy TRAN-2.1: Connectivity Standards (5) Future Extensions and (6) Connectivity.

It is in keeping with the Plan's the Goal, Objectives, Policies, and Actions to guide the development of housing in Kona (Section 4.5). In particular, Section 4.5.3:

Housing Goal: Diversity of housing choices for all segments of the population close to places of employment and/or daily needs.

The Proposed Project specifically aligns with Objective HSG-4: Build More Units, Policy HSG-4.2: Workforce Housing and HSG-4.4: Housing Variety.

The final guiding principle emphasizes that future growth should occur where infrastructure (roads and utilities) and essential facilities (i.e., police, fire, and schools) are already in place. These facilities should be maintained at a level that will enhance the quality of life for Kona residents. This project is the final phase of a larger residential development that saw the completion of Kona Vistas, a 215-unit, single-family residential project on approximately 103 acres. The zoning that supports both the existing Kona Vistas and proposed Royal Vistas projects spans over 35 years. As last amended in 2002 to provide for additional time by which to complete both projects, the completion of Royal Vistas is encouraged by the Kona CDP as an infill rezoning.

PART 4: DETERMINATION

Based on the findings below, and upon consideration of the public comments received during pre-consultation and on the Draft EA, the County of Hawai‘i Planning Department has determined that the proposed action will not significantly alter the environment and has accordingly issued a Finding of No Significant Impact (FONSI).

PART 5: FINDINGS AND REASONS

Chapter 11-200.1-13, HAR, outlines those factors agencies must consider when determining whether an Action has significant effects:

1. *Irrevocably commit a natural, cultural, or historic resource*. No valuable natural or cultural resources would be committed or lost as a result of the Proposed Project. No impacts to archaeological resources would occur with the planned preservation of the railroad berm and petroglyph.
2. *Curtail the range of beneficial uses of the environment*. The proposed mid-market housing development does not curtail beneficial uses of the environment and is consistent with the medium density zoning in the LUPAG and conforms to the guiding principles regarding urban growth patterns as defined by the Kona CDP.
3. *Conflict with the State's environmental policies or long-term environmental goals established by law*. The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The impact from the Proposed Project is minor and, therefore, is consistent with all elements of the State's long-term environmental policies and environmental goals.
4. *Have a substantial adverse effect on the economic, social welfare, or cultural practices of the community or State*. The Proposed Project would not adversely affect the social welfare of the community and would contribute to services. The Proposed Project would generate work for the local construction industry, which would stimulate local economic spending. The Proposed Project would balance the social welfare of the community by providing infill mid-market housing and allow resident households better access and the ability to safely manage commutes between home, work, and recreation. Stable households lead to stable communities and associated workforce, and promotes a functional economy.
5. *Have a substantial adverse effect on public health*. The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design.
6. *Involve adverse secondary impacts, such as population changes or effects on public facilities*. No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services.
7. *Involve a substantial degradation of environmental quality*. The impact from the Proposed Project is minor, and would thus not contribute to environmental degradation. BMPs and appropriate erosion control measures would be utilized during construction. Short-term impacts on air

and noise quality will be mitigated by employing BMPs. No long-term adverse impacts are expected from the Proposed Project.

8. *Is individually limited but cumulatively has substantial adverse effect upon the environment or involves a commitment for larger actions.* The Proposed Project is not related to other activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions.
9. *Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat.* There are no rare, threatened, or endangered species or suitable habitat for these species present at the Project Site, and no effects to these species are anticipated. Endangered Hawaiian hoary bats and formerly listed Hawaiian hawks, which are island wide-ranging species, would experience no adverse impacts due to mitigation in the form of timing of vegetation removal and/or hawk nest survey. Additionally, no rare, threatened, or endangered species of fauna are known to exist on or near the Project Site, and none would be directly affected by any project activities.
10. *Have a substantial adverse effect on air or water quality or ambient noise levels.* No adverse effects on air quality or noise would occur. The increase in noise levels on the site are acceptable and would be only a moderate increase in the existing levels. To minimize impacts to air quality during construction, the Proposed Project would implement a watering program for dust abatement. Other control measures during construction such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens would also be utilized as necessary to minimize impacts to air quality.
11. *Have a substantial adverse effect on or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.* Although the property is located in an area with volcanic and seismic risk, the entire Island of Hawaiʻi shares this risk, and the Proposed Project is not imprudent to construct. The property is approximately 0.85 miles from the shoreline and the development is outside any flood plain. Based on potential impacts from climate change, the Proposed Project has been designed to accommodate increased stormwater run-off from larger storms in the adjacent drainages and on site.
12. *Have substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies.* No scenic vistas and viewplanes identified in the Hawaiʻi County General Plan will be adversely affected by the Proposed Project.
13. *Require substantial energy consumption or emit substantial greenhouse gases*. The development would have solar water heating and incorporate

efficient appliances, as practical and possible. Negligible emissions of greenhouse gases would occur during construction and occupation of the proposed development. Since the Project addresses an existing demand for housing, it is expected that a portion of the residents that would occupy the development already live in Kona or on Hawaiʻi Island, and there would not be a substantial increase in emissions when residents occupy the Project. Therefore, Project impacts would be considered a negligible increase to the global annual greenhouse gas emissions.

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APPENDIX 1a: Early Consultation Letters

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November 27, 2019

Michele Lefebvre, PhD
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Subject: Environmental Assessment Early Consultation for Proposed Royal Vistas Housing Project, Island of Hawai'i, North Kona District
Tax Map Key: (3) 7-6-021:016 and 7-6-021:017

We have reviewed the request for early consultation for an Environmental Assessment and our comments are as follows:

1. Flood zones AE and AEF affect the subject parcels as designated by the Flood Insurance Rate Map (FIRM). New construction and substantial improvements shall comply with Chapter 27 – Floodplain Management – of the Hawaii County Code.

2. Drainage improvements, including the combination of the Holualoa Drainageway and the Horseshoe Bend Drainageway, shall be submitted to the Department of Public Works for review and approval.

3. All development generated runoff shall be disposed of on-site and shall not be directed toward adjacent properties.

4. All earthwork and grading shall conform to Chapter 10 – Erosion and Sedimentation Control – of the Hawaii County Code.

5. All work within the County Right-of-Way shall conform to Chapter 22 – County Streets – of the Hawaii County Code.

Please provide us with a copy of the EA when it is completed for our review.

Should there be any questions concerning this matter, please feel free to contact Natalie Whitworth of our Kona Engineering Division office at 323-4853.

Natalie Whitworth

for Ben Ishii, Division Chief
Engineering Division

NW

Copy: Engineering Division - HILO/KONA, Planning Department - Hilo

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County of Hawai'i

POLICE DEPARTMENT
349 Kapi'olani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

December 6, 2019

Ms. Michele Lefebvre, PhD
Environmental Scientist
Stantec Consulting Services Inc.
P.O. Box 191
Hilo, Hawaii 96721

Dear Ms. Lefebrvre:

SUBJECT: ENVIRONMENTAL ASSESSMENT EARLY CONSULTATION FOR PROPOSED ROYAL VISTAS HOUSING PROJECT, ISLAND OF HAWAI'I, NORTH KONA DISTRICT, TMKS: 7-6-021:016 AND 7-6-021:017

This is in response to your letter dated November 18, 2019, requesting comments related to your project.

Thank you for allowing the Hawaii Police Department the opportunity to participate. At this time, the Hawaii Police Department has no comments.

Should you have any questions, please contact Captain Gilbert Gaspar Jr., Commander of the Kona District, at 326-4646, extension 299.

Sincerely,

PAUL K. FERREIRA
POLICE CHIEF

ROBERT WAGNER
ASSISTANT POLICE CHIEF
AREA II OPERATIONS

GG/jaj
19HQ1210

DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

STATE OF HAWAI'I

DEPARTMENT OF EDUCATION

P.O. BOX 2360

HONOLULU, HAWAI'I 96804

OFFICE OF FACILITIES AND OPERATIONS

December 10, 2019

Michele Lefebvre
Stantec Consulting services
P.O. Box 191
Hilo, Hawaii 96721

Re: Environmental Assessment Early Consultation Request for Proposed Royal Vistas Housing Project; Hawaii TMK: 7-6-021:016 & 017, North Kona, Hawaii

Dear Ms. Lefebvre:

The Hawaii State Department of Education (HIDOE) has the following comments for the proposed Royal Vistas Housing Project (Project). According to the information provided Kona Three LLC proposes to develop 450 multi-family units, a combination of rental and for sale units, located in North Kona, Island of Hawaii, Hawaii, TMK: 7-6-021:016 & 017.

When the Project is mature and unit turnover stabilized, we would expect roughly 99 HIDOE students to reside there.

The HIDOE schools currently servicing the proposed Project area are Holuoloa Elementary, Kahakai Elementary, Kealakehe Middle, Konawaena Middle, Kealakehe High and Konawanena High. Konawaena Middle has capacity and is expected to have capacity over the next five years. The remaining schools are currently over capacity and are expected to remain over capacity over the next five years.

The proposed Project is located within the West Hawaii School Impact Fee District, however we are currently not collecting impact fees.

The HIDOE would like to receive a copy of the Draft Environmental Assessment for review.

Thank you for the opportunity to comment. Should you have questions, please contact Robyn Loudermilk, School Lands and Facilities Specialist, Facilities Development Branch, Planning Section at (808) 784-5093 or via email at robyn.loudermilk@k12.hi.us.

Respectfully,

Kenneth G. Masden II
Public Works Manager
Planning Section

KGM:rll

c: Art Souza Complex Area Superintendent, Honokaa/Kealakehe/Kohala/Konawaena Complex Area

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

December 16, 2019

Ms. Michele Lefebvre
Stantec Consulting Services Inc.
1239 Moku Place
Hilo, HI 96720

Dear Ms. Lefebvre:

**Subject: Pre-Environmental Assessment Consultation for
Proposed Royal Vistas Housing Project
Island of Hawai'i, North Kona District
Tax Map Key 7-6-021:016 and 017**

We have reviewed your Pre-Environmental Assessment Consultation letter, dated November 18, 2019.

Please be informed that the subject parcels are served by an existing service that can accommodate a 4-inch meter on Io Place, which is limited to 180,400 gallons per day, or 451 units of water.

Please note that the Department of Water Supply acknowledges that potable water is Hawai'i Island's most precious resource and encourages our communities to promote water conservation and reserve the highest quality of water for the most valuable end-use, which is the sustenance of life.

We request that the developer address the non-potable demand of water by minimizing the demand or propose to supply the demand by alternate methods (i.e. reclaimed or reuse water). The overall water demand should be reviewed as the water use, other than the residential dwelling units, will need to be included which would reduce the number of dwelling units that can be developed. Additional water beyond the total number of water units allocated to the subject parcels is not available.

Should there be any questions, please contact Mr. Ryan Quitoriano of our Water Resources and Planning Branch at 961-8070, extension 256.

Sincerely yours,

Keith K. Okamoto, P.E.
Manager-Chief Engineer

RQ:dmj

National Park Service
U.S. Department of the Interior

Kaloko-Honokōhau
National Historical Park

73-4786 Kanalani Street # 14
Kailua-Kona, Hawai'i 96740

808 329-6881 Phone
808 329-2597 Fax

Kaloko-Honokōhau

IN REPLY REFER TO:
L7621 (2019-10)

December 18, 2019

Dr. Michele Lefebvre
Stantec Consulting Services Inc.
P.O. Box 191
Hilo, Hawai'i 96721

Subject: National Park Service Comments for an early Consultation for an Environmental Assessment for the Proposed Royal Vistas Housing Project, Island of Hawai'i, North Kona District, TMKs: 7-6-021:016 and 7-6-021:017

Dear Dr. Lefebvre:

Thank you for providing the National Park Service (NPS) with the opportunity to comment for an early Consultation for an Environmental Assessment for the Proposed Royal Vistas Housing Project. The proposed project is located approximately 5 miles south of Kaloko-Honokōhau National Historical Park (Park) and 2.7 miles south of downtown Kailua-Kona along Queen Ka'ahumanu Highway and would consist of necessary improvements to construct up to 450 residential units in multi-family configurations with clusters of two- and three-story buildings.

Congress established Kaloko-Honokōhau National Historical Park in 1978 to preserve, interpret, and perpetuate traditional native Hawaiian activities and culture by protecting the cultural and natural resources within the Park (16 U.S.C. § 396d(a)). The Park contains more than 450 known archeological and cultural sites, among which are several heiau, networks of ancient and historic trails, traditional dry-laid masonry features, more than 180 known anchialine pools, two ancient Hawaiian fishponds with associated wetlands, and a fishtrap. The park lands and waters provide habitat for 17 federally listed species, and candidate species for listing, under the Endangered Species Act. 'Aimakapā Fishpond and wetland is "core habitat" for the recovery of two endangered waterbird species, the Hawaiian stilt (*Himantopus mexicanus knudseni*) and the Hawaiian coot (*Fulica americana alai*), and is an important habitat for migratory waterfowl.[1] In addition to the fishponds and pools, the Park boundary encompasses 596 acres of marine waters and coral reef habitat. As we stated above, there are many groundwater dependent ecosystems (GDEs) in the Park. All of the Park's GDEs are dependent upon groundwater inputs to maintain these ecosystems, especially as habitat for culturally important and rare native aquatic species.

[1] US Fish and Wildlife Service. 2011. Recovery Plan for Hawaiian Waterbirds, Second Revision.

Approximately 220,000 visitors per year visit the Park.[2] Local residents, cultural practitioners, and visitors from around the world come to experience Kaloko-Honokōhau's unique sense of place, bio-cultural and natural history, and to understand and perpetuate Hawaiian traditions.

According to the Water Resource Protection Plan 2019 Update, the current methodology used by the State of Hawai'i Commission on Water Resource Management (CWRM) for determining sustainable yields does not explicitly account for freshwater flows needed to preserve GDEs such as anchialine pools, fishponds, and wetlands.[3] CWRM has recognized the need to refine its management approach to groundwater and requested that its staff study ways to refine the estimation of sustainable yields to account for the needs of GDEs.[4] Therefore, CWRM is developing a "pilot adaptive management plan" for protecting GDEs in partnership with the NPS and cultural practitioners.[5] The pilot adaptive management plan will focus on GDEs within Kaloko-Honokōhau National Historical Park.

The Hawai'i County Department of Water Supply has also proposed measures to minimize the effects of new groundwater withdrawals on groundwater dependent ecosystems and the Native Hawaiian traditional and customary practices that rely upon them. The 2017 Water Use and Development Plan Update for the Keauhou Aquifer System Area describes these efforts and includes refined demand projections and a calculation of Authorized Plan Use (or Anticipated Water Demand) for the aquifer system (28.07 million gallons per day). Therefore, the NPS requests that the Environmental Assessment include the water demand for the proposed project and address whether this demand was included in the Department of Water Supply's calculation of Authorized Planned Use.

Thank you for allowing us to comment on the early Consultation for an Environmental Assessment for the Proposed Royal Vistas Housing Project. If you have any questions regarding this letter, please do not hesitate to contact Dr. Jeff Zimpfer of my staff (808-329-6881 x 1500 or jeff_zimpfer@nps.gov).

Sincerely,

Leonel Arguello

Leonel Arguello
Acting Superintendent
Kaloko-Honokōhau National Historical Park
Pu'uhonua o HōnaunauNational Historical Park

[2] https://irma.nps.gov/Stats/
[3] Commission on Water Resource Management, 2018. Water Resource Protection Plan 2019 Update, Appendix F, Page 9, Public Review Draft, October 2018. Available at: http://dlnr.hawaii.gov/cwrm/planning/hiwaterplan/wrpp/
[4] Ibid., 11.
[5] Ibid., 65.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 19, 2019

Stantec Consulting Services Inc.
Attention: Ms. Michele Lefebvre
Environmental Scientist
P.O. Box 191
Hilo, Hawaii 96721

via email: michele.lefebvre@stantec.com

Dear Ms. Lefebvre:

SUBJECT: Environmental Assessment Early Consultation for Proposed **Royal Vistas Housing Project** located at North Kona District, Island of Hawaii; TMKs: (3) 7-6-021:016 & 7-6-021:017 on behalf of Kona Three LLC

Thank you for the opportunity to review and comment on the subject matter. The Land Division of the Department of Land and Natural Resources (DLNR) distributed or made available a copy of your request pertaining to the subject matter to DLNR's Divisions for their review and comments.

At this time, enclosed are comments from the (a) Engineering Division, (b) Division of Forestry & Wildlife, and (c) Land Division – Hawaii District on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

for Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 26, 2019

MEMORANDUM

~~TO:~~ FROM

DLNR Agencies:
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation

~~FROM:~~ TO

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Environmental Assessment Early Consultation for Proposed **Royal Vistas Housing Project**
LOCATION: North Kona District, Island of Hawaii; TMKs: (3) 7-6-021:016 & 7-6-021:017
APPLICANT: Stantec Consulting Services, Inc. on behalf of Kona Three LLC

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **December 18, 2019.**

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:

Print Name: Carty S. Chang, Chief Engineer

Date: 11/29/19

Attachments
cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji
Ref: Environmental Assessment Early Consultation for Proposed Royal Vistas Housing Project
Location: North Kona District, Island of Hawaii
TMK(s): (3) 7-6-021:016 & 7-6-021:017
Applicant: Stantec Consulting Services, Inc. on behalf of Kona Three LLC

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM), which can be viewed on our Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT).

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7253.
- Kauai: County of Kauai, Department of Public Works (808) 241-4896.

Signed: ______________________
CARTY S. CHANG, CHIEF ENGINEER

Date: 11/29/19

2373

DAVID Y. IGE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION

DEC 12 AM 11:00

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 26, 2019

MEMORANDUM

~~TO:~~ From **DLNR Agencies:**

__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation

~~FROM:~~ To: Russell Y. Tsuji, Land Administrator
SUBJECT: Environmental Assessment Early Consultation for Proposed **Royal Vistas Housing Project**
LOCATION: North Kona District, Island of Hawaii; TMKs: (3) 7-6-021:016 & 7-6-021:017
APPLICANT: Stantec Consulting Services, Inc. on behalf of Kona Three LLC

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **December 18, 2019.**

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:

Print Name: **DAVID G. SMITH, Administrator**

Date: 12/11/19

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DEC 11 2019

Log no. 2373

MEMORANDUM:

TO: Russell Tsuji, Administrator
Land Division

FROM: David G. Smith, Administrator pG?

SUBJECT: Division of Forestry and Wildlife Comments on Royal Vistas Housing Project

TMK No.: **(3) 7-6-02:016 & 7-6-021:017**

The Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) has received your inquiry regarding Royal Vistas Housing Project. We appreciate the opportunity to provide consultation and first, because it appears trees will be removed for this proposed project, underscore but a few of the multiple benefits of trees and green infrastructure:

Clean Air: In addition to creating oxygen, essential for all life on Earth, trees clean the air by removing carbon dioxide and other air pollutants. One hundred large trees can remove 19 tons of carbon dioxide and 372 pounds of other air pollutants annually.

Health & Well-being: Tree-filled neighborhoods are safer, reduce mental and physical stress, and encourage people to spend more time outdoors, including transportation (i.e., walking and biking vs. driving). Tree-lined streets encourage slower driving and promote pedestrian safety.

Energy Cost Savings: Trees provide shade and cooling, greatly reducing energy costs. Trees save more than $622,000 per year (based on 2013 rates of $.32/kwh for 43,000 inventoried street trees in Honolulu.)

Watershed Protection: Trees cost-effectively filter and improve water quality by reducing stormwater runoff and flooding. Trees in Honolulu intercept more than 35 million gallons of stormwater per year. This contribution is valued at more than $350,000 annually.

Reef Protection: A healthy urban forest reduces erosion and filters pollutants significantly reducing runoff and the destruction of our valuable reefs.

Our comments as they pertain to trees, forests, and green infrastructuare are below:

☐ **Proposed tree removal:**
- Scope of work should include a tree protection plan and be supervised by a

certified arborist

- Consider pruning as an alternative to removal
- Replace removed trees with native or non-invasive canopy trees
- Designate which species of trees are proposed for removal

☐ **Proposed disturbance of area:**

- Scope of work should include a tree protection plan and be supervised by a certified arborist
- Install green infrastructure for rehabilitated areas post-disturbance

☐ **Proposed tree root & crown pruning:**

- Scope of work should include a tree protection plan and be supervised by a certified arborist

☐ **Proposed paving:**

- Consider permeable pavement or other permeable surface to allow for absorption of groundwater

Should you have any questions, please contact Heather McMillen @ heather.l.mcmillen@hawaii.gov

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 26, 2019

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Environmental Assessment Early Consultation for Proposed **Royal Vistas Housing Project**
LOCATION: North Kona District, Island of Hawaii; TMKs: (3) 7-6-021:016 & 7-6-021:017
APPLICANT: Stantec Consulting Services, Inc. on behalf of Kona Three LLC

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **December 18, 2019.**

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed:

Print Name: GORDON C. HEIT

Date: 12/12/19

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 23, 2019

Stantec Consulting Services Inc.
Attention: Ms. Michele Lefebvre
Environmental Scientist
P.O. Box 191
Hilo, Hawaii 96721

via email: michele.lefebvre@stantec.com

Dear Ms. Lefebvre:

SUBJECT: Environmental Assessment Early Consultation for Proposed **Royal Vistas Housing Project** located at North Kona District, Island of Hawaii; TMKs: (3) 7-6-021:016 & 7-6-021:017 on behalf of Kona Three LLC

Thank you for the opportunity to review and comment on the subject matter. In addition to our previous comments dated December 19, 2019, enclosed are comments from the Commission on Water Resource Management on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 26, 2019

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation

FR

TD

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Environmental Assessment Early Consultation for Proposed **Royal Vistas Housing Project**
LOCATION: North Kona District, Island of Hawaii; TMKs: (3) 7-6-021:016 & 7-6-021:017
APPLICANT: Stantec Consulting Services, Inc. on behalf of Kona Three LLC

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **December 18, 2019.**

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
(x) Comments are attached.

Signed: /s/ M. Kaleo Manuel

Print Name: Deputy Director

Date: December 16, 2019

Attachments
cc: Central Files

FILE ID: RFD.5288.8
DOC ID: 22029

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

December 16, 2019

REF: RFD.5288.8

TO: Mr. Russell Tsuji, Administrator
Land Division

FROM: M. Kaleo Manuel, Deputy Director
Commission on Water Resource Management

SUBJECT: Environmental Assessment Early Consultation for Proposed Royal Vistas Housing Project

FILE NO.: RFD.5288.8
TMK NO.: (3) 7-6-021:016 & 7-6-021:017

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://dlnr.hawaii.gov/cwrm.

Our comments related to water resources are checked off below.

[X] 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

[ ] 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

[X] 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.

[X] 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/

[X] 6. We recommend the use of alternative water sources, wherever practicable.

[ ] 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.

[X] 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

☐ 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

☐ 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☐ 11. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.

☐ 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 14. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.

☐ 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

☐ 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☒ OTHER: Planning - The proposed water sources and projected water demands for the project, both potable and non-potable, should be identified and the calculations used to estimate demands should be provided. A discussion of the potential impacts on water resources and other public trust uses of water should be included, and any proposed mitigation measures described. Water conservation and efficiency measures to be implemented should also be discussed.

If you have any questions, please contact Lenore Ohye of the Commission staff at 587-0216.

Harry Kim
Mayor

Wil Okabe
Managing Director

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

Michael Yee
Director

Duane Kanuha
Deputy Director

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

December 23, 2019

Michele Lefebvre, PhD
Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721

Dear Ms. Lefebvre:

SUBJECT: Comments for Early Consultation for Environmental Assessment for Proposed Royal Vistas Housing Project
Tax Map Keys: (3) 7-6-021:016 & 017, Hōlualoa 1st & 2nd, N. Kona, Hawai'i

This is in response to your letter dated November 18, 2019 requesting early consultation comments for an environmental assessment being prepared for a 450 multi-family residential unit development and related improvements on the above referenced property, including drainage and roadway improvements within County-owned parcels 18 and 19.

1. The subject properties are zoned Multiple-Family Residential, with a minimum building site of 5,000 square feet per dwelling unit (RM-5), by the County of Hawai'i and designated as Urban by the State Land Use Commission. Refer to County of Hawai'i Ordinance No. 02-131, which amended previous ordinances to establish the zoning on the properties, and State Land Use Commission Docket No. A83-549, to determine the status of condition compliance for these land use entitlements.

2. The General Plan Land Use Pattern Allocation Guide (LUPAG) map designation for the properties are Urban Expansion and Low Density Urban. Be aware that the County General Plan is undergoing a comprehensive review and these lands use designations may change soon upon adoption of an amended General Plan.

3. The property is not located within the Special Management Area (SMA) and is situated about 4,500 feet mauka of the shoreline.

4. The property is in an area affected by the Kona Community Development Plan, which was adopted by the Hawai'i County Council by Ordinance No. 08-131 and amended in 2019 by ordinance No. 19-91. Please indicate how the proposed project meets the goals, objectives, policies, and actions of the CDP.

5. The EA should describe the specific drainage and roadway improvements proposed within the County property and analysis of impacts and alternatives considered.

6. We strongly recommend you review the Planning Department files related to these properties because they contain information related to land use permitting history, cultural and historic resources, flooding, traffic, and public sentiment regarding the proposed project. The files can be viewed in the Hilo or Kona office. Please schedule an appointment so that we can ensure all the files are available for viewing.

7. Please include in the EA consultation process, surrounding property owners and community associations, including but not limited to, Kona Vistas Subdivision, Pualani Estates Subdivision, Kuakini Makai Subdivision, and property owners directly east of the subject properties.

We look forward to reviewing the draft EA when it is available. If you have any questions, please feel free to contact Maija Jackson at 961-8159.

Sincerely,

RK MICHAEL YEE
Planning Director

MJJ:mads
P:\wpwin60\CH343\2019\Royal Vistas\LLefebvre-PreEADraftConsult-RoyalVistas.doc

cc w/copy of letter: Ronald Kim, Deputy Corporation Counsel

APPENDIX 1b: Comments on Draft EA and Responses

7-V-021-016, 017, 018 & 019

Mori, Ashley

From: Joel Gimpel <alohafidlr@aol.com>
Sent: Thursday, August 13, 2020 8:06 AM
To: Planning Internet Mail
Subject: Kona Three, LLC Royal Vistas Housing Projec,t Draft Environmental Assessment

COH PLANNING DEPT
AUG 13 2020 AM11:52

Dear Director Lee:

As a ten-year resident of Pualani Estates and President of the Homeowners Association, I've reviewed the subject DEA for the Royal Vistas Housing Project and have a number of concerns regarding the Traffic Impact Analysis. My concerns include the failure to take into account the potential effect on traffic on Highway 11 that could result from the Suffolk Investment and Puaa Development applications for amendment to ordinances now pending before the Leeward Planning Commission.

I presume you recall my comments on those applications, which propose a 60,000 sq. ft. commercial development and 386 multi-family residential units on the west side of Highway 11, that I submitted to you on April 2 and June 3, 2020. Those comments noted the already horrendous traffic jams experienced daily between Henry Street and Kamehameha III Rd. during peak hours that would be unalterably worsened by the additional traffic resulting from those applications. It is inexcusable for the Kona Three environmental assessment to fail to take the Suffolk and Puaa applications into account.

In addition, the Royal Vistas Traffic Impact Analysis, while appropriately appearing to forgo use of Ho'omama and Paulehia Streets in Pualani Estates to gain access for Royal Vistas residents and visitors to Highway 11 via Puapuaanui Street, seeks to create a new, direct but non-signalized access to the highway via Royal Vistas Roadway. Even assuming that access lanes can be provided on the highway, the absence of traffic signals will inevitably lead to accidents and injuries. Furthermore, the existing access to the highway at the Lako Street intersection is already woefully inadequate because of the necessarily short north and southbound access lanes.

But I also note that the applicant could also seek to have the County exercise eminent domain to allow the development to access Ho'omama and Pualehia Streets in Pualani Estates through the Gomes property, and thereby access Highway 11 at the Puapuaanui intersection. Our previous comments on these applications included our strenuous objection to such Highway 11 access through Pualani Estates roadways.

In sum, I firmly believe that adding 450 two and three-bedroom residential units with at least 900 vehicle trips per day will aggravate the already unacceptable traffic delays on Highway 11 between Henry Street and Kamehameha III Rd., even with the proposed added access via Royal Vistas Roadway.

I note also that the DEA fails to adequately deal with the existing problem of overcrowding in most of the public schools serving the area. Even acknowledging that the development would generate 99 students, there appears no provision for funding needed classroom space in the area.

Finally, neither I, other owners of properties in Pualani Estates, nor Hawaiian Management, our managing agent, received your original notice of this 700-page DEA. After learning of its

135200

existence from a third party, I reviewed it, notified our managing agent, and prepared these comments. Because many interested parties were not officially notified of the DEA, I believe that the 30-day deadline for comments should be extended.

Aloha and mahalo in advance for your careful consideration of these concerns.

Joel Gimpel
75-628 N. Mea Lanakila Pl.
Kailua-Kona, HI 96740
808/325-4991

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Joel Gimpel
75-628 N. Mea Lanakila Pl.
Kailua-Kona, HI 96740
Via email: alohafidlr@aol.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Gimpel:

Thank you for the comment letter dated August 13, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The impact analysis fails to take into account the potential traffic on Highway 11 from the Suffolk Investment and Puaa Development applications for amendments to ordinances being considered by the Leeward Planning Commission, given the existing traffic issues between Henry Street and Kamehameha III Road.

> **Response 1:** Existing traffic conditions were established as part of the analysis in the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the EA). As described in Section 3.7.2 and Appendix 2 of the EA, turning movement traffic counts were taken at eight study intersections, including Queen Ka'ahumanu Highway and Henry Street as well as Queen Ka'ahumanu and Kamehameha III Road. Although these intersections may experience delays, Appendix 2 demonstrates that Queen Ka'ahumanu Highway and Henry Street functions at level-of-service (LOS) C in the morning and evening while Queen Ka'ahumanu and Kamehameha III Road functions at LOS B in the morning and level C in the evening. These are both considered acceptable levels of service by the County of Hawai'i. Based on the methodology described in Appendix 2, the TIAR assumes a growth rate of one percent to account for additional traffic at the study intersections. Projects such as the ones you mentioned, Suffolk Investment and Puaa Development, have been accounted for in this one percent growth rate. With these assumptions, the traffic impact analysis shows no impacts to level of service from the project above the background rate to these intersections.

Comment 2: The DEA does not consider accessing the proposed project from Queen Ka‘ahumanu along Puapuaanui Street and then along Ho‘omama and Paulehia Streets in Pualani Estates. Kona Three could seek to have the County exercise eminent domain through the Gomes property. Accessing the project directly from Queen Ka‘ahumanu will lead to more accidents and injuries.

> **Response 2:** As described in Section 3.7.2, Kona Three LLC does not have rights to extend these streets across private land owned by the Frank and Betty Gomes Trust, and Kona Three LLC as a good neighbor is not seeking to exercise eminent domain when another access option is available and supported by the Hawaii Department of Transportation (HDOT). Regarding the safety of accessing the site from the proposed intersection of Royal Vistas Blvd and Queen Ka‘ahumanu, Kona Tree LLC has coordinated with HDOT and continues to coordinate with HDOT on ensuring the safest design and construction of this intersection.

Comment 3: The existing access at the Lako Street intersection is currently inadequate due to the short north and southbound access.

> **Response 3:** Figure 2 has been revised to show that access to the project site would not be connected to Kekuana‘oa Place from Lako Street until Phase 2. Although this intersection may experience delays, Appendix 2 demonstrates that Queen Ka‘ahumanu Highway and Lako Street functions at level of service C in the morning and evening which is considered acceptable level of service by the County of Hawai‘i. The traffic impact analysis shows no impacts to level of service from the project above the background rate to this intersection.

Comment 4: The project would increase overcrowding in public schools with the addition of 99 students and does not include provision to fund needed classroom space.

> **Response 4:** As described in Section 3.7.1, the West Hawaii School Impact Fee District has suspended fee collections. Therefore, there is no funding requirement in place for new developments. The project would be constructed in phases, and occupancy would occur over time. Additionally, it is expected that the project would provide workforce housing for the local community. The project's first phase would construct rental units, and it is expected that occupants of these units would be local and many of the students already attend local public schools. Section 3.7.1 has been revised to clarify that since the project would be constructed in phases, all 99 students would not all arrive at once and occupancy would occur over a longer period of time. This is consistent with predicted rates of growth for the area which are considered by the Department of Education in their forecast planning for public schools.

Comment 5: Request to extend the 30-day deadline for comments.

> **Response 5:** This request was granted by the Hawai'i County Planning Department and the DEA was released for a second 30-day comment period.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

7-U-021: 016 - 019

Mori, Ashley

From: Lester Shirley <lwslaw@sbcglobal.net>
Sent: Friday, August 14, 2020 11:06 AM
To: Michele.lefeebvre@stantec.com; Planning Internet Mail
Subject: Royal Vistas Housing Project

COH PLANNING DEPT
AUG 17 2020 AM9:53

Aloha Ms. Lefebvre and the Planning Department

I live on Kinau Street in the Kona Vistas Subdivision.

My concern about this proposed project is traffic. Kona Vistas is a quite subdivision with the exception of Lako Street. The intersection of the highway and Lako is already very busy, without adding the additional traffic from 450 multi-family units.

The Royal Vistas Housing Project needs to have an exit directly to the highway, in addition to entry and exit through Kona Vistas.

Lester W. Shirley, Esq. Retired

135249

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Lester Shirley, Esq. Retired
Via email: lwslaw@sbcglobal.net

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Shirley:

Thank you for the comment letter dated August 14, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The project would add traffic to the Lako Street intersections which is already a busy intersection.

> **Response 1:** Although this intersection may experience delays, Appendix 2 in the EA demonstrates that Queen Ka'ahumanu Highway and Lako Street functions at level-of-service (LOS) C in the morning and evening which is considered acceptable LOS by the County of Hawai'i. The traffic impact analysis shows no impacts to LOS from the project above the background rate to this intersection.

Comment 2: The project should have an exit directly to the highway, in addition to entry and exit through Kona Vistas.

> **Response 2:** As described in Section 3.7.2 of the EA, Kona Three LLC proposes to construct a new intersection Royal Vistas Blvd. at the project's intersection with Queen Ka'ahumanu. Additionally, Figure 2 has been revised to show that access to the project site would be connected to Kekuana'oa Place from Lako Street during Phase 2 of the project. At project completion, there would be two ways to access the project.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

COH PLANNING DEPT
AUG 19 2020 PM2:16

REC'D BY MAIL

August 16, 2020

County of Hawaii Planning Department

101 Pauahi Street, Suite 3, Hilo, Hawaii 96720

RE: Royal Vistas Housing Project, North Kona District

TMKs (3) 7-6-021:016, 017, 018, and 019

Dear Sirs:

I am a long-time homeowner in Paulehia Street, having purchased my house in 2007. As a homeowner, I am adamantly opposed to the proposed Royal Vistas Housing Project. It would add about 450 multi-family residential units just south of Pualani Estates. The reasons I am against such a project are as follows;

1. Much-increased traffic on the main highway between Henry and Lako Streets, especially when tourists and mainland people return to live, work, and play on our island.

2. Possible traffic from Royal Vistas through Pualani Estates, on Paulehia Street (my street), and Ho'omama Street. The streets here are narrow and many families with small children live here. Such traffic would then have to turn left on Puapuaanui Street to get to the highway, creating traffic backups on Puapuaanui Street.

3. Loss of property values in Pualani Estates due to the above possible scenarios.

Please do not allow the Royal Vistas proposed project to go forward!!

Ronald F. Raridon

Ronald F. Raridon

75-6133 Paulehia Street, Kailua-Kona, HI 96740

135408

Ronald F. Raridon
75-6133 Paulehia St.
Kailua Kona, HI 96740

HONOLULU HI 968

17 AUG 2020 PM 1 1

COH PLANNING DEPT
AUG 19 2020 PM2:16

County of Hawaii Planning Dept.
101 Pauahi Street, Suite 3
Hilo, Hawaii 96720

96720-422403

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Ronald Raridon
75-6133 Paulehia Street
Kailua-Kona, HI 96740

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Raridon:

Thank you for the comment letter dated August 16, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The project would add to existing traffic problems between Henry Street and Lako Street on Queen Kaahumanu Highway.

> **Response 1:** Existing traffic conditions were established as part of the analysis in the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the EA). As described in Section 3.7.2 and in Appendix 2 of the EA, turning movement traffic counts were taking at eight study intersections, including Queen Kaʻahumanu Highway and Henry Street as well as Queen Kaʻahumanu and Lako Street. Although these intersections may experience delays, Appendix 2 demonstrates that both of these intersections (Queen Kaʻahumanu Highway and Henry Street, and Queen Kaʻahumanu and Lako Street) function at level-of-service C in the morning and evening. These are considered acceptable levels-of-service by the County of Hawaiʻi. Based on the methodology described in Appendix 2, the TIAR accounted for traffic measured during peak periods of use in April and August 2019, prior to the Covid-19 pandemic reduction of local and visitor traffic. The TIAR also assumed a growth rate of one percent from use in 2019 to account for additional traffic at the study intersections. With these conservative assumptions, the traffic impact analysis shows no impacts to level-of-service from the project above the background rate to these intersections.

Comment 2: Traffic from the project would impact Hoʻomama and Paulehia Streets in Pualani Estates, and create backups on Puapuaanui Street.

> **Response 2:** As described in Section 3.7.2 of the EA, Kona Three LLC does not have rights to extend these streets across private land owned by the Frank and Betty Gomes Trust and Kona Three LLC is not proposing to access the project from these streets.

<u>Comment 3</u>: Loss of property values in Pualani Estates.

> **<u>Response 3</u>:** The project is consistent with medium density zoning and conforms to the guiding principles regarding urban growth patterns as defined by the Kona Community Development Plan (CDP). It is beyond the scope of the EA to speculate on property values in the analysis.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: Kathy Winter <khkealani@gmail.com>
Sent: Wednesday, August 26, 2020 9:06 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA comments
Attachments: Hui Response letter.docx

COH PLANNING DEPT
AUG 26 2020 PM5:34

135594

Keau Kukui `Ula Heiau Hui

August 22, 2020

To: Michael Yee, Planning Director
From: Heiau Preservation Hui, Keau Kukui 'Ula Heiau
Re: Royal Vistas Development Plan

As the hui that is responsible for the preservation and protection of the heiau in the Pualani Estates subdivision, we wish to express our concerns with the proposed development "Royal Vistas Housing Project" [TMK (3) 7-6-021:016-019].

- The study of the area shows that there is evidence of pre-contact agricultural, habitation, burial and transportation features, lava tubes and caves that were not obscured already by the bulldozing done in past. The size of the development proposed will erase some of that history that cannot be restored or recreated.

- That land is a significant part of the Kona Field System (KFS) that fed and supported a large population in a fairly inhospitable area. The land proposed for acquisition retains some of the historical evidence which was lost when neighboring developments were built.

- Though the area roads and streets flood, there are no perennial streams in Kona. The area under consideration contains one of the few seasonal watersheds that could provide insight into the historical uses of the land in relation to water sources.

- Most preservation efforts in Kona are at the shoreline, so this parcel is especially valuable for preservation that such a large development threatens.

Kate H Winter
RLB
Jeff Nohea Alexander

Dr. Kate Kealani H. Winter Co-chair
Ric Likeke Bumanglag - Co-chair
Jeff Nohea Alexander - Res. & Doc. Manager

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Dr. Kate Kealani H. Winter, Co-Chair
Mr. Ric Likeke Bumanglag, Co-Chair
Mr. Jeff Nohea Alexander, Resident and Doc. Manager
Heiau Preservation Hui, Keau Kukui ʻUla Heiau
Email: khkealani@gmail.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Dr. Winter, Mr. Likeke, and Mr. Nohea:

Thank you for the comment letter dated August 22, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The project area shows there is evidence of pre-contact cultural resources that not obscured already by previous bulldozing. The size of the project will erase some of that history that cannot be restored or recreated. The project is located on land that is a significant part of the Kona Field System and retains historical evidence that was lost when neighboring developments were built.

> **Response 1:** As described in Section 3.6 of the EA and included in Appendix 5, two Archaeological Inventory Surveys (AISs) were prepared. The AISs and EA describe the project's location within the Kona Field System and how sites identified during the inventories are relevant to the Kona Field System. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites. Two of the sites were identified for preservation (the railroad berm and petroglyph). As described in Section 3.6 of the EA, Kona Three LLC is coordinating with State Historic Preservation Division (SHPD) to ensure protection and preservation of these sites.

Comment 2: Although there are no perennial streams in Kona, the project area contains one of the few seasonal watersheds that could provide insight into the historical uses of the land in relation to water sources.

> **Response 2:** As described in Section 1.2 of the EA, the project includes a small portion of the Horseshoe Bend Ditch that would be re-routed but not destroyed.

Historic land use is described in Sections 3.5 and 3.6 of the EA. None of the existing Holualoa Ditch will be re-routed or destroyed; therefore, if anyone wanted to study the drainage ditches in the future, that opportunity would still exist. *Mauka* areas where rainfall occurs could be considered watershed areas and would not be impacted by the project.

Comment 3: Most preservation efforts in Kona are at the shoreline, so this parcel is especially valuable for preservation that such a large development threatens.

Response 3: Regulations for evaluating site significance and eligibility for preservation were applied to all sites in the project area. These criteria apply regardless of proximity to the shoreline. The project is following required regulations for development to protect cultural resources in coordination with the SHPD.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: Kathy Winter <khkealani@gmail.com>
Sent: Wednesday, August 26, 2020 9:03 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA comments
Attachments: Letter to Yee.docx

To: Michael Yee, Planning Director
From: Dr. Kate H. Winter
Re: Royal Vistas Housing Project [TMK (3) 7-6-021: 016-019]
Date: August 23, 2020

As a teaching professional, I have deep concerns about the housing development referenced above. I have taught some of Kona's teachers as undergraduates and know the talents and challenges they work with. As a professor at University of Hawai'i Hilo and West Hawai'i Community College, I have witnessed the deficits that the district schools leave our students with.

Socioeconomic stresses associated with such a large housing development in this district will have adverse impacts on our schools, our teachers and our students.

The report states that 5 of our 6 public schools are over capacity at this time. Where does the County plan to have the additional children from this 450 unit development go to school?

Thank you for your consideration of this problem.

Dr. Kate H. Winter, Professor Emeritus
University at Albany

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Dr. Kate H. Winter, Professor Emeritus
Via email: khkealani@gmail.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Dr. Winter:

Thank you for the comment letter dated August 23, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: As a professor, I have witnessed the deficits that the district schools leave our students with. The project will have adverse impacts to schools which are already over capacity.

> **Response 1:** As described in Section 1.2 of the EA, the project would be constructed in phases and occupancy would occur over time. It is expected that the project would provide workforce housing for the local community. The project's first phase would construct rental units, and it is expected that occupants of these units would be local residents and many of the students already attend local public schools. Even if the project added 99 new students to the district, all 99 students would not all arrive at once since the units would be built in phases and occupancy would occur over a longer period of time. This is consistent with predicted rates of growth for the area which are considered by the Hawaii State Department of Education in their forecast planning for public schools.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

7-6-021-016, 017, 018 & 019

Mori, Ashley

COH PLANNING DEPT
AUG 25 2020 AM 11:18

From: malakied@hawaii.rr.com
Sent: Tuesday, August 25, 2020 10:31 AM
To: Planning Internet Mail
Cc: 'dbmkona@aol.com'
Subject: Royal Vistas
Attachments: Royal Vistas.pdf

Please see attached.

Thank you,

Daniel Malakie

135478

LTC DANIEL C. MALAKIE (R)
76-117 KAMEHAMALU STREET
KAILUA-KONA, HI 96740
25 AUG 20

County of Hawaii Planning Commission.

I am writing in opposition to the proposed new development , Royal Vistas.

I have lived here for over 25 years and have been very active in our community. I have seen the lack of infrastructure causing numerous problems for our community.

As you know if you live in Kona, the biggest problem is traffic. When things return to normal and the tourists and visitors return and when we are able to open all our businesses and return to work, the traffic extends bumper to bumper from north of the airport to Captain Cook. The traffic light at Lako and Queen K. intersection takes 3.5 minutes to change. Only a few cars are able to go through this light at one time. There is the potential for over 2000 new vehicles from the new proposed development traveling through this light every day. This intersection is already one of the deadliest intersections in town, having numerous fatal accidents. This alone could add on an additional 30+ minutes to our commute. We need a 4-lane highway from Henry Street to Kam 3 Highway.

There is terrible flooding in this area. Numerous times when there was a heavy rain, I have personally witnessed a waterfall that was 20 meters wide go over Queen K. Highway between Pualani Estates and Lako Street. It blocked the entire highway. It also caused much destruction. There is sheet flooding in this area and not much you can do to stop it. A new development will compound this problem.

Another major concern is for our water. If there are 750 new apartments and condos built, what will happen to our water supply and additional sewage? There is already a strain on the existing wells and watershed. Additional schools will also be needed.

This area is rich in cultural places and activities. There is a lack of parks and recreational areas in our community. Just look at the amount of people that walk the Wailua trail and the Old Airport trail every day. You can check with PATH for additional information. If the County bought this piece of property they could have a beautiful park, hiking trails and show significant cultural landmarks. There are numerous burial grounds in this area and one of our former councilmen has relatives who are buried in caves by this area.

I have spoken to many of my neighbors and residents of our town. I am very active in many community organizations. Our veterans groups, which account for about 900 active members are opposed to this. ROTARY, Knights of Columbus and Elks Lounge personnel are also concerned with the traffic. I propose you consider building a new park for our growing community in this area. This would service our community greatly.

electronically signed
DANIEL C. MALAKIE

Stantec
Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Daniel Malakie
76-117 Kamehamalu Street
Kailua-Kona, HI 96740
Via email: malakied@hawaii.rr.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Malakie:

Thank you for the comment letter dated August 25, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The biggest problem in Kona is traffic and impacts could occur at the traffic light at the Lako and Queen Kaahumanu intersection with the addition of the proposed project. We need a 4-lane highway from Henry Street to Kamehameha III Road.

> **Response 1:** The Traffic Impact Analysis Report (TIAR) (Appendix 2 of the EA) acknowledges the bottleneck that occurs at Lako Street. The traffic signal timing and phasing can be changed in the interim from split phasing to protected or protected/permitted or permitted phasing on Lako Street. The long-term solution is the widening of Queen Ka'ahumanu Highway. The widening of Queen Ka'ahumanu Highway from Henry to Kamehameha III Road has been in the long-range transportation plan; however, this falls outside the scope of this project.

Comment 2: There is terrible flooding in this area, especially over Queen K. Highway between Pualani Estates and Lako Street. There is sheet flooding in this area and not much you can do to stop it. A new development will compound this problem.

> **Response 2:** Queen Ka'ahumanu Highway is owned and maintained by the State of Hawai'i, together with the two culvert systems traversing Queen Ka'ahumanu Highway which transport the floodwaters of Holualoa Ditch and Horseshoe Bend Ditch below Queen Ka'ahumanu Highway. The State has not indicated any problems with being able to maintain the highway or the culverts, and the proposed project would not increase the amount of water in the ditches (per Section 27-20 of the Hawaii County Code).

Comment 3: Another major concern is for our water. If there are 750 new apartments and condos built, what will happen to our water supply and additional sewage? There is already a strain on the existing wells and watershed. Additional schools will also be needed.

> **Response 3:** The Project is planned for 450 units, not 750 units. As described in Section 3.3.3 of the EA, the water credits for this project have already been committed and paid for. The Department of Water Supply assigns credits based on capacity, so the infrastructure can provide the water for this project. Potential impacts to schools through the addition of students from the project is described in Section 3.7.1 of the EA, and is not expected to have a major impact to local schools.

Comment 4: There is a lack of parks and recreational areas in our community. If the County bought this piece of property, they could have a beautiful park, hiking trails, and show significant cultural landmarks. There are numerous burial grounds in this area and one of our former councilmen has relatives who are buried in caves by this area.

> **Response 4:** The project is consistent with medium density zoning and conforms to the guiding principles regarding urban growth patterns as defined by the Kona Community Development Plan. The applicant action being considered and analyzed on private land in the EA does not include a proposal for change in zoning or creation of a public park. Although the project site has been nominated for County of Hawai‘i Public Access, Open Space and Natural Resources Preservation Commission (PONC) acquisition twice, both times the Committee declined. Potential impacts to cultural resources are described in Section 3.6 of the EA. The entire property has been inventoried and this section describes two burials that were located in the project site, which were removed and reinterred prior to 1984. There is one single burial on the project’s 70 acres, and this burial has been approved for preservation by the State and Burial council. Based on these results, impacts to burials in the project site have been mitigated.

Comment 5: I am very active in many community organizations. Our veterans groups, which account for about 900 active members are opposed to this. ROTARY, Knights of Columbus and Elks Lounge personnel are also concerned with the traffic. I propose you consider building a new park for our growing community in this area.

> **Response 5:** Impacts to traffic are described in Section 3.7.2 of the EA. Additionally, the applicant action being considered and analyzed on private land in the EA does not include a proposal for change in zoning or creation of a public park.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

From:	Zimpfer, Jeff F
To:	Lefebvre, Michele
Cc:	Broward, John
Subject:	NPS comments: Draft Environmental Assessment for Royal Vistas
Date:	Tuesday, August 25, 2020 3:52:45 PM
Attachments:	2020 08 25 NPS letter re DEA.pdf

Attached please find our comment letter.

~Jeff

Jeff Zimpfer, Ph.D.
National Park Service
Environmental Protection Specialist
Kaloko-Honokōhau National Historical Park
73-4786 Kanalani St., #14
Kailua Kona, HI 96740
ph: 808-329-6881 x1500
fax: 808-329-2597
jeff_zimpfer@nps.gov
http://www.nps.gov/kaho/index.htm

The National Park Service cares for special places saved by the American people so that all may experience our heritage

National Park Service
U.S. Department of the Interior

Kaloko-Honokōhau
National Historical Park

73-4786 Kanalani Street # 14
Kailua-Kona, Hawai'i 96740

808 329-6881 Phone
808 329-2597 Fax

Kaloko-Honokōhau

IN REPLY REFER TO:
L7621 (2020-3)

August 25, 2020

Dr. Michele Lefebvre
Stantec Consulting Services Inc.
P.O. Box 191
Hilo, Hawai'i 96721

Subject: National Park Service Comments for a Draft Environmental Assessment for the Proposed Royal Vistas Housing Project, Island of Hawai'i, North Kona District, TMKs: 7-6-021:016 and 7-6-021:017

Dear Dr. Lefebvre:

The National Park Service commented for an early Consultation for the Environmental Assessment (EA) for the Proposed Royal Vistas Housing Project. Thank you for addressing our comments in the Draft EA. As a physically small park in a developing region, we depend on the careful and thoughtful actions of our neighbors to protect the fishponds, coast, and anchialine pools that are valuable cultural and natural resources for our community and our nation.

Mahalo for working with us to help protect this precious place. We have no further comments for the EA.

If you have any questions regarding this letter, please do not hesitate to contact Dr. Jeff Zimpfer of my staff (808-329-6881 x 1500 or jeff_zimpfer@nps.gov).

Sincerely,

John Broward

John Broward
Acting Superintendent
Kaloko-Honokōhau National Historical Park

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. John Broward, Acting Superintendent
Kaloko-Honokōhau National Historic Park
73-4786 Kanalani Street #14
Kailua-Kona, HI 96740
Via e-mail: Jeff Zimpfer, jeff_simpfer@nps.gov

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Broward:

Thank you for the letter dated August 25, 2020, in which you stated that the National Park Service had no further comments on the Environmental Assessment.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: John Randerson <fjr123@gmail.com>
Sent: Thursday, August 27, 2020 2:23 PM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EZ Comments

Aloha

I live near this proposed development and wish to make the following submission:

The Traffic Information Report (TIAR) (Appendix Two of the EA) measured peak traffic flows on two days: Tuesday, April 30, 2019 and Thursday, August 24, 2019. (Page 125 of the EA and numbered page 9 of Appendix Two).

Those dates both exclude the highest density traffic periods which begin in November and end in the following March. That five-month period is the period during which the population of Kona is substantially increased by "snowbirders" from Alaska, Canada, and other US states that experience very cold winters. It is during those periods that northbound traffic backs up to Akoni Street in the morning as late as 11am and southbound traffic backs up as far as Hualalai Road in the late afternoon. The proposed Royal Vistas Roadway is in the middle of that backed up traffic and the proposed two way stop intersection will simply not work.

These comments are based on my observations as a resident of Kona Vistas since 2013 but are not scientifically verified. The only way for them to be verified is for Kona Three LLC to resubmit the TIAR with traffic data selected from two dates during that peak period (Nov - March). As it stands, the TIAR is fatally flawed because its findings are based on dates that fall outside peak traffic periods. It thus provides an unrealistic assessment of that aspect of the Environmental Impact of this subdivision.

--
John & Sonja Randerson
76-4353 Leilani Street

135596

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. and Mrs. Randerson
76-4353 Leilani Street
Kailua-Kona, HI 96740
Via email: fjr123@gmail.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mrs. Sonja Randerson and Mr. John Randerson:

Thank you for the comment letter dated August 27, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The Traffic Impact Analysis Report (TIAR) (Appendix Two of the EA) measured peak traffic flows on two days: Tuesday, April 30, 2019 and Thursday, August 24, 2019. Those dates exclude the highest density traffic periods which begin in November and end in the following March. The proposed Royal Vistas Roadway is in the middle of that backed up traffic and the proposed two way stop intersection will simply not work. Kona Three LLC should resubmit the TIAR with traffic data selected from two dates during that peak period (Nov -March).

> **Response 1:** Historic Hawaii Department of Transportation (HDOT) counts show that the overall average weekday volume is fairly consistent throughout the year. While tourism traffic is higher during the winter months, summer break, and spring break, the overall traffic due to work and school being on break is also lower. A typical school/work day will usually have higher AM and PM peaks. It is this school peak hour in the AM and PM peak hours that the TIAR is aimed at analyzing.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

STATE OF HAWAI'I

DEPARTMENT OF EDUCATION

P.O. BOX 2360

HONOLULU, HAWAI'I 96804

OFFICE OF FACILITIES AND OPERATIONS

September 1, 2020

Michele Lefebvre
Stantec Consulting Services
P.O. Box 191
Hilo, Hawaii 96721

Re: Proposed Royal Vistas Housing Project Draft Environmental Assessment
North Kona, Hawaii, TMK: 7-6-021:016, 017, 018, & 019

Dear Ms. Lefebvre:

The Hawaii State Department of Education (HIDOE) has the following comments for the proposed Royal Vistas Housing Project (Project). Kona Three LLC proposes to develop 450 multi-family units, a combination of rental and for sale units, and associated improvements in North Kona, Island of Hawaii, TMK: 7-6-021:016, 017, 018 & 019.

The HIDOE previously provided comments on the proposed Project by the enclosed letter dated December 10, 2019. As there are no changes to the previously reviewed Project, we have no further comments.

Thank you for the opportunity to comments. Should you have questions, please contact Robyn Loudermilk, Acting Land Use Planner, Facilities Development Branch, Planning Section, at (808) 784-5093 or via email at robyn.loudermilk@k12.hi.us.

Respectfully,

Brenda Lowrey TA for Planning Section

Kenneth G. Masden II
Public Works Manager
Planning Section

KGM:rll
Enclosure

c: Janette Snelling Complex Area Superintendent, Honokaa/Kealakehe/Kohala/Konawaena Complex
Hawaii County Planning Department

DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

STATE OF HAWAI'I

DEPARTMENT OF EDUCATION

P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF FACILITIES AND OPERATIONS

December 10, 2019

Michele Lefebvre
Stantec Consulting services
P.O. Box 191
Hilo, Hawaii 96721

Re: Environmental Assessment Early Consultation Request for Proposed Royal Vistas Housing Project; Hawaii TMK: 7-6-021:016 & 017, North Kona, Hawaii

Dear Ms. Lefebvre:

The Hawaii State Department of Education (HIDOE) has the following comments for the proposed Royal Vistas Housing Project (Project). According to the information provided Kona Three LLC proposes to develop 450 multi-family units, a combination of rental and for sale units, located in North Kona, Island of Hawaii, Hawaii, TMK: 7-6-021:016 & 017.

When the Project is mature and unit turnover stabilized, we would expect roughly 99 HIDOE students to reside there.

The HIDOE schools currently servicing the proposed Project area are Holuoloa Elementary, Kahakai Elementary, Kealakehe Middle, Konawaena Middle, Kealakehe High and Konawanena High. Konawaena Middle has capacity and is expected to have capacity over the next five years. The remaining schools are currently over capacity and are expected to remain over capacity over the next five years.

The proposed Project is located within the West Hawaii School Impact Fee District, however we are currently not collecting impact fees.

The HIDOE would like to receive a copy of the Draft Environmental Assessment for review.

Thank you for the opportunity to comment. Should you have questions, please contact Robyn Loudermilk, School Lands and Facilities Specialist, Facilities Development Branch, Planning Section at (808) 784-5093 or via email at robyn.loudermilk@k12.hi.us.

Respectfully,

Kenneth G. Masden II
Public Works Manager
Planning Section

KGM:rll

c: Art Souza Complex Area Superintendent, Honokaa/Kealakehe/Kohala/Konawaena Complex Area

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Kenneth G. Madsen II, Public Works Manager
State of Hawaiʻi
Department of Education
P.O. Box 2360
Honolulu, HI 96804

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Madsen:

Thank you for the letter dated September 1, 2020, in which you stated that the Sate of Hawaiʻi Department of Education had no further comments on the Environmental Assessment.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

From: Melissa Matsuura
To: planning@hawaiicounty.gov
Cc: richard@eastwestrealty.org; Lefebvre, Michele; rmclaren@hawaii.edu; David Lonborg; Richard Wainscoat
Subject: Comments on the Proposed Royal Vistas Project Draft EA
Date: Wednesday, September 02, 2020 2:27:12 PM
Attachments: 09-02-2020 Hawaii County Planning Dept Comments on Royal Vistas Housing Draft EA.pdf

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Aloha,

Attached are comments from Robert McLaren, Interim Director of the University of Hawaii Institute for Astronomy regarding the proposed Proposed Royal Vistas Housing Project DEA, Tax Map Key No. (3) 7-6-021:016-019, North Kona District, Island of Hawai'i.

Melissa A. Matsuura
Operations Coordinator
University of Hawai‘i
Institute for Astronomy
2680 Woodlawn Drive, C-205
Honolulu, Hawaii 96822
(808) 956-6829 – direct
mmatsuur@hawaii.edu

UNIVERSITY OF HAWAIʻI AT MĀNOA

Institute for Astronomy
Office of the Director

September 2, 2020

Via email:

Planning Department, County of Hawaiʻi
101 Pauahi Street, Suite 3
Hilo, HI 96720

Attention: Mr. Michael Yee (planning@hawaiicounty.gov)

Re: Draft Environmental Assessment (DEA)
Royal Vistas Housing Project
TMK: (3) 7-6-021:016-019, North Kona District, Island of Hawaiʻi

Dear Mr. Yee:

Thank you for the opportunity to comment on the Draft Environmental Assessment for the proposed Royal Vistas Housing Project referenced above (published August 8, 2020), specifically with respect to issues and concerns regarding light pollution.

The University of Hawaiʻi Institute for Astronomy (IfA) conducts research in astronomy using telescopes located on Haleakalā and Maunakea and operated by IfA and our partner institutions. Both Haleakalā and Maunakea are among the best sites in the world for astronomical facilities because of their elevation, clear skies, favorable atmospheric conditions, and low levels of light pollution. Hawaiʻi-based observatories have played major roles in the advancement of astronomy and astrophysics for over 50 years and are well positioned to remain at the forefront of astronomical research for decades to come.

Because of the outstanding quality and productivity of these facilities, IfA is acutely concerned about negative impacts on astronomy from increased light pollution. Our work to combat light pollution has also brought us into contact with others concerned about light pollution for other reasons, including impacts on wildlife (particularly seabirds) and on human health. While IfA's comments focus on the impacts of light pollution on astronomy, appropriate mitigation measures also help to reduce non-astronomy impacts.

With that background, we offer the following comments:

Any new or additional artificial light at night has an adverse effect on astronomical observations by increasing the night sky brightness. Nearly all observations performed by the telescopes on Maunakea are sky-background limited. This means that there is a natural sky brightness coming from airflow and zodiacal light. Artificial light increases the sky brightness, thereby decreasing the sensitivity of the telescopes.

Lights can have an adverse effect on astronomical observations by incrementally increasing the night sky brightness, effectively making the telescope smaller and less sensitive.

Appropriate steps to reduce the impact on the observatories would include:

1. Any lighting at the facility must follow the Hawaiʻi County lighting ordinance. All lighting must be fully shielded. This means that all lighting fixtures must emit zero light above the horizontal plane.
2. The minimum possible amount of outdoor lighting should be used. Motion sensor activated lighting is strongly preferred. Blue light is most harmful to the observatories, so blue-deficient lighting should be exclusively selected. The best choices are filtered LED lights, or amber LED lights. Under no circumstances should high-intensity discharge lamps such as metal halide be used; fluorescent lights also must be avoided. Both of these types of lamps use mercury and emit light at wavelengths that is very damaging to astronomy.
3. White light should be avoided because the blue component of white light is very damaging to astronomy. White light should always have a Correlated Color Temperature of 2700 K or below.

Thank you for your consideration of these comments and attention to IfA's concerns. If you have questions or need further detail regarding these comments, please do not hesitate to contact the undersigned or Richard Wainscoat (rjw@hawaii.edu).

Very truly yours,

Robert McLaren
Interim Director

cc: Mr. Richard Wheelock, Konda Three LLC (richard@eastwestrealty.org)
Ms. Michele Lefebvre, Stantac Consulting (michele.lefebvre@stantec.com)

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Robert McLaren
University of Hawaiʻi at Mānoa
Institute for Astronomy
2680 Woodlawn Drive, C-205
Honolulu, HI 96822
Via email: mmatsuur@hawaii.edu

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. McLaren:

Thank you for the comment letter dated September 2, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: Lights can have an adverse effect on astronomical observations by incrementally increasing the night sky brightness, effectively making the telescope smaller and less sensitive. Appropriate steps to reduce the impact on the observatories would include: 1. Any lighting at the facility must follow the Hawaiʻi County lighting ordinance. All lighting must be fully shielded. This means that all lighting fixtures must emit zero light above the horizontal plane.

> **Response 1:** The project has considered potential impacts to night sky brightness and incorporated protection measures to minimize these potential impacts. As described in Section 3.3.4 of the EA in impacts to biological resources, the project would not involve any unshielded lighting for either construction or operation, in conformance with Hawaiʻi County Code § 14 – 50 et seq. Additionally, during operation the site would use lighting only where and when it is needed for safety purposes. No project construction using unshielded equipment maintenance lighting would occur after dark between the months of April and October. All additional permanent lighting would conform to the Hawaiʻi County Outdoor Lighting Ordinance (Hawaiʻi County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting. The proposed project would also avoid nighttime construction from September 15 through December 15 (to avoid during the seabird fledging period). These measures would also reduce potential impacts to the observatories.

Comment 2: The minimum possible amount of outdoor lighting should be used. Motion sensor activated lighting is strongly preferred. Blue light is most harmful to the observatories, so blue-deficient lighting should be exclusively selected. The best choices are filtered LED lights, or amber LED lights. Under no circumstances should high-intensity discharge lamps such as metal halide be used; fluorescent lights also must be avoided. Both of these types of lamps use mercury and emit light at wavelengths that is very damaging to astronomy. White light should be avoided because the blue component of white light is very damaging to astronomy. White light should always have a Correlated Color Temperature of 2700 K or below.

> **Response 2:** As described in Section 3.3.4 of the EA, the use of outdoor lamps with warmer colors (less blue light) and energy efficient fixtures would be considered when the building is being constructed. Additionally, the project does not anticipate using metal halide and fluorescent lights. To minimize Project impacts from lighting, the following text has been added to Section 3.3.4 of the EA to address your comment, "Subject to local rules and regulations, the Proposed Project would utilize lighting on the 2700 degrees Kelvin scale in response to a public comment received on the Draft EA regarding potential impacts to astronomy."

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

DAVID Y. IGE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

JADE T. BUTAY
DIRECTOR

Deputy Director
LYNN A.S. ARAKI-REGAN
DEREK J. CHOW
ROSS M. HIGASHI
EDWIN H. SNIFFEN

IN REPLY REFER TO:
DIR 0740
HWY-PS 2.3918

September 3, 2020

Ms. Michele Lefebvre
Stantec Consulting Inc.
P.O. Box 191
Hilo, Hawaii 96721

Dear Ms. Lefebvre:

Subject: Draft Environmental Assessment (DEA)
Royal Vistas Housing Project
North Kona, Island of Hawaii, Hawaii
Tax Map Key Nos.: (3) 7-6-021: 016, 017, 018, and 019

The applicant, Kona Three LLC proposes to develop 70 acres of vacant land into a multi-family residential subdivision. Total buildout is estimated as 450 units, with 258 units planned as Phase 1. The property is located on the mauka side of Queen Kaahumanu Highway between Kona Vista Subdivision and Pualani Estates Subdivision. Only one roadway is planned to provide access for Phase 1 which intersects with Queen Kaahumanu Highway (State Route 11), approximately 600 feet north of the intersection with Kuakini Highway.

The DEA should include a hydrologic and hydraulic study of the proposed changes to the Horseshoe Bend Drainageway depicted on the FIRM Map Panel 1551660952F where the existing culverts on Queen Kaahumanu Highway may be impacted. The DEA should also note the proposed access to Queen Kaahumanu Highway will apparently conflict with and impact the exiting drainage culverts.

The Draft Traffic Impact Analysis Report (TIAR) for the Royal Vistas, dated May 2020, was included as an Appendix to the DEA. Hawaii Department of Transportation (HDOT) has reviewed the TIAR, and has the following comments relevant to State highways:

1. The TIAR is included as part of a DEA required by Chapter 343, Hawaii Revised Statutes for the subject project for the use of County land.

2. Phase 1 of the project is expected to be completed by 2024 with the only proposed access being the proposed Royal Vistas Roadway intersection with Queen Kaahumanu Highway. This proposed access as a full-intersection on the State highway, which is a major arterial, is not advisable and alternative options should be explored. Alternative

options should include connections of 'minor collectors' running parallel to Queen Kaahumanu Highway from the official Transportation Network Map – Nani Kailua Area from the Kona Community Development Plan. These include extending Hoomana Street to Leilani Street, and Paulehia Street to Kekuanaoa Place which may be done in Phase 1 to provide access to the project. The alternative analysis should include impacts to the study area intersections of Queen Kaahumanu Highway without the proposed Royal Vistas Roadway intersection.

3. The TIAR should include a phasing plan and the transportation improvements of each phase. This should include the road layout and circulation within the project for each phase.

4. The TIAR should provide a mitigation analysis for the intersections that operate at Level of Service E or lower.

5. The TIAR should include an estimate of regional traffic improvements based on a pro-rata basis.

6. The HDOT requests a design setback of 30 feet from the existing Queen Kaahumanu Highway right-of-way for future roadway improvements.

7. The summary and recommendations of the TIAR do not include the proposed left turn lane and right turn lane for the Royal Vistas Roadway. There is also no mention of channelization, a refuge lane, or a crosswalk.

If you have any questions, please contact Jeyan Thirugnanam, Systems Planning Engineer, Highways Division, Planning Branch at (808) 587-6336 or by email at jeyan.thirugnanam@hawaii.gov. Please reference file review number PS 2020-120.

Sincerely,

JADE T. BUTAY
Director of Transportation

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Jade Butay, Director of Transportation
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Butay:

Thank you for the comment letter dated September 3, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

<u>Comment 1</u>: The DEA should include a hydrologic study of the proposed changes to the Horseshoe Bend Drainageway depicted on the FIRM Map Panel 1551660952F where the existing culverts on Queen Kaahumanu Highway may be impacted. The DEA should also note the proposed access to Queen Kaahumanu Highway will apparently conflict with and impact the existing drainage culverts.

> **<u>Response 1</u>:** Please see the response prepared by Mr. Ty Dempsey of Dempsey Pacific Inc. enclosed. Mr. Dempsey is the Civil Engineering consultant for Kona Three LLC, the applicant for this project.

<u>Comment 2</u>: Phase I of the project is expected to be completed by 2024 with the only proposed access being the proposed Royal Vistas Roadway intersection with Queen Kaahumanu Highway. This proposed access is a full-intersection on the State highway, which is a major arterial, is not advisable and alternative options should be explored. Alternative options should include connections of 'minor collectors' running parallel to Queen Kaahumanu Highway from the official Transportation Network Map - Nani Kailua Area from the Kona Community Development Plan. These include extending Hoomana Street to Leilani Street, and Paulehia Street to Kekuanaoa Place which may be done in Phase I to provide access to the project. The alternative analysis should include impacts to the study area intersections of Queen Kaahumanu Highway without the proposed Royal Vistas Roadway intersection.

> **<u>Response 2</u>:** The minor collector roads located within the project site would be built and dedicated by the project to the County of Hawai'i, but these collectors cannot connect Ho'omama Street to Leilani Street due to two intervening properties (one on the north of project and one on the south) that are not owned or controlled by the Kona Three LLC. Kekuana'oa Place would be connected to the project's connector roads in Phase II (as outlined in the TIAR and EA), but cannot be connected to Paulehia Street due to the intervening property on the north side of the Project which is not owned or controlled by Kona Three.

Comment 3: The TIAR should include a phasing plan and the transportation improvements of each phase. This should include the road layout and circulation within the project for each phase.

> **Response 3:** Figure 2 has been revised to show that access to the project site would not be connected to Kekuanaʻoa Place from Lako Street until Phase II.

Comment 4: The TIAR should provide a mitigation analysis for the intersections that operate at Level of Service (LOS) E or lower.

> **Response 4:** The only intersection that operates at LOS E or lower is the intersection of Queen Kaʻahumanu Highway and Lako Street in year 2039 AM Peak period (see Tables 27 and 28 on pages 53 and 54 of the TIAR), which is due primarily to Queen Kaʻahumanu northbound through traffic coupled with Queen Kaahumanu Southbound Left movement and Lako Street Eastbound left movement. Section VI., Item 8 on page 57 of the TIAR provides the following mitigation analysis for that intersection:
>
> > "Queen Kaahumanu Highway and Lako Street:
> >
> > The Lako Street intersection operates at LOS E/D (AM/PM) with or without the Royal Vistas project in the 2039 scenario. Lako Street currently has split phasing (sequential rather than concurrent) on the Lako Street approaches. Changing the phasing from split to protected left turns would help lower the delay. This intersection would also improve significantly if Queen Kaahumanu Highway is widened to 4 lanes as in the 2035 Transportation Plan."

Comment 5: The TIAR should include an estimate of regional traffic improvements based on a pro-rata basis.

> **Response 5:** Based on our understanding of the HDOT Proportional Share Impact Fee Methodology, a transportation fee is charged to new development projects to pay for regional transportation improvements needed as a result of the new development. The fee is proportional to the project's impact. The method for determining the pro-rata share of regional transportations improvements is as follows: (1) list project-related regional transportation improvements determined by TIAR, (2) determine the cost of each regional transportation improvement, (3) identify project's percent of trips towards each regional transportation improvement based on critical peak hour, (4) total project's cost towards regional transportation improvements, and (5) apply the project's total pro-rata share cost towards one or more HDOT initiated regional transportation improvements or require the developer to implement one or more regional transportation improvements.
>
> The TIAR analyzes traffic conditions for existing conditions, 2024, 2029 and 2039 with and without the proposed project. The conditions for future years with and without the project mirror existing conditions: delays for stop controlled traffic at Hualalai (N) and (S) and Kuakini Highway. The delays worsen with time and added traffic. However, the signal controlled intersections operate at overall LOS D or better (acceptably) for 2024 and 2029 with and without the proposed project. In 2039, again all of the signal controlled intersections are expected to operate at LOS D or

better (acceptably) with or without the project, except for the Lako Street intersection in the AM peak hour, when the analysis showed it is expected to operate at LOS E with or without the project. As the highway is widened to 4 lanes, the LOS is expected to improve significantly. Further, the LOS can be improved by changing from split phasing (sequential) to concurrent phasing for the side street traffic.

There are no regional transportation improvements needed as a result of the proposed project, other than building the Royal Vistas Roadway access intersection, which the applicant would fund at 100 percent.

Comment 6: The HDOT requests a design setback of 30 feet from the existing Queen Kaahumanu Highway right-of-way for future roadway improvements.

Response 6: Where possible, Kona Three LLC would accommodate a design setback of 30 feet from existing Queen Ka'ahumanu Highway for future right-of-way improvements.

Comment 7: The summary and recommendations of the TIAR do not include the proposed left turn lane and right turn lane for the Royal Vistas Roadway. There is also no mention of channelization, a refuge lane, or a crosswalk.

Response 7: The TIAR does propose a left turn and right turn lane for Phase 1 and Phase II. As stated in the TIAR (Appendix 2, on page 21), "A crosswalk would be provided on the east side of the intersection for pedestrian connectivity. A refuge lane for westbound left turns onto Queen Ka'ahumanu Highway is recommended as this is an unsignalized intersection and will make this turn easier for the driver."

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

Enclosure

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Dempsey Pacific Inc.

Civil Engineering Design & Consulting Services

October 19, 2020

Mr. Richard Wheelock
Kona Three LLC
101 Hualalai Street
Hilo, HI 96720

Subject: Existing Culvert Information for Queen Kaahumanu Highway Intersection Improvements
Royal Vistas Queen Kaahumanu Highway Preliminary Engineering Assistance
North Kona, Big Island
TMK: (3) 7-6-021: 016

Dear Kona Three LLC:

We have received the review letter from the State of Hawaii Department of Transportation, regarding the Draft Environmental Assessment (DOT Highways reference DIR 0740, HWY-PS 2.3918). The proposed location of the intersection for the Royal Vistas roadway connection with Queen Kaahumanu Highway is planned to be within the existing 120' wide permitted access location. We agree that the existing highway culvert crossing for Horseshoe Bend does reside partially within the left side of the existing 120' wide permitted access location. Based on the ROW Map and topographic survey of the existing culvert and headwall locations as-built from the original highway construction, the northern most portion of the 120' wide permitted access lines up with the centerline of the third culvert of the existing culvert crossing (or the southern culvert of the 3 culverts). The existing culvert wingwalls encroach into the existing 120' wide permitted access by a maximum distance of 16.95'.

The proposed intersection is planned more within the southern portion of the existing 120' wide permitted access in order to allow the existing highway culvert crossing to remain in place and not impact the existing drainageway and culvert crossing. The conceptual intersection plan currently has the Royal Vista roadway pavement shoulders offset 49.00' from the northern point of the 120' wide permitted access, and offset 15.00' from the southern point of the 120' wide permitted access. The preliminary location allows the edges of pavements for the radius's of the intersection to remain within the existing 120' wide permitted access location, and remain clear of the existing highway culvert headwall and wingwall locations. The preliminary layout is clear of the southern most point of the 120' wide permitted access by 9.60' from the edge of the paved shoulder on the intersection radius to the edge of the permitted access. It would be possible to shift the Royal Vista roadway up to 9.60' further south if preferred during final construction plan design, and still remain within the existing 120' wide permitted access location.

P.O. Box 10384, Honolulu, HI 96816 | (808) 277-2043
info@dempseypacific.com | http://www.dempseypacific.com

Attached is a copy of the ROW Map confirming the location of the existing 120' wide permitted access. This location matches the conceptual intersection plan, as the 120' wide permitted access location starts 90.54' from the northern property line corner. The remnant construction parcel matches the conceptual intersection plan, and we are able to keep the proposed Royal Vista roadway improvements outside of the existing remnant construction parcel.

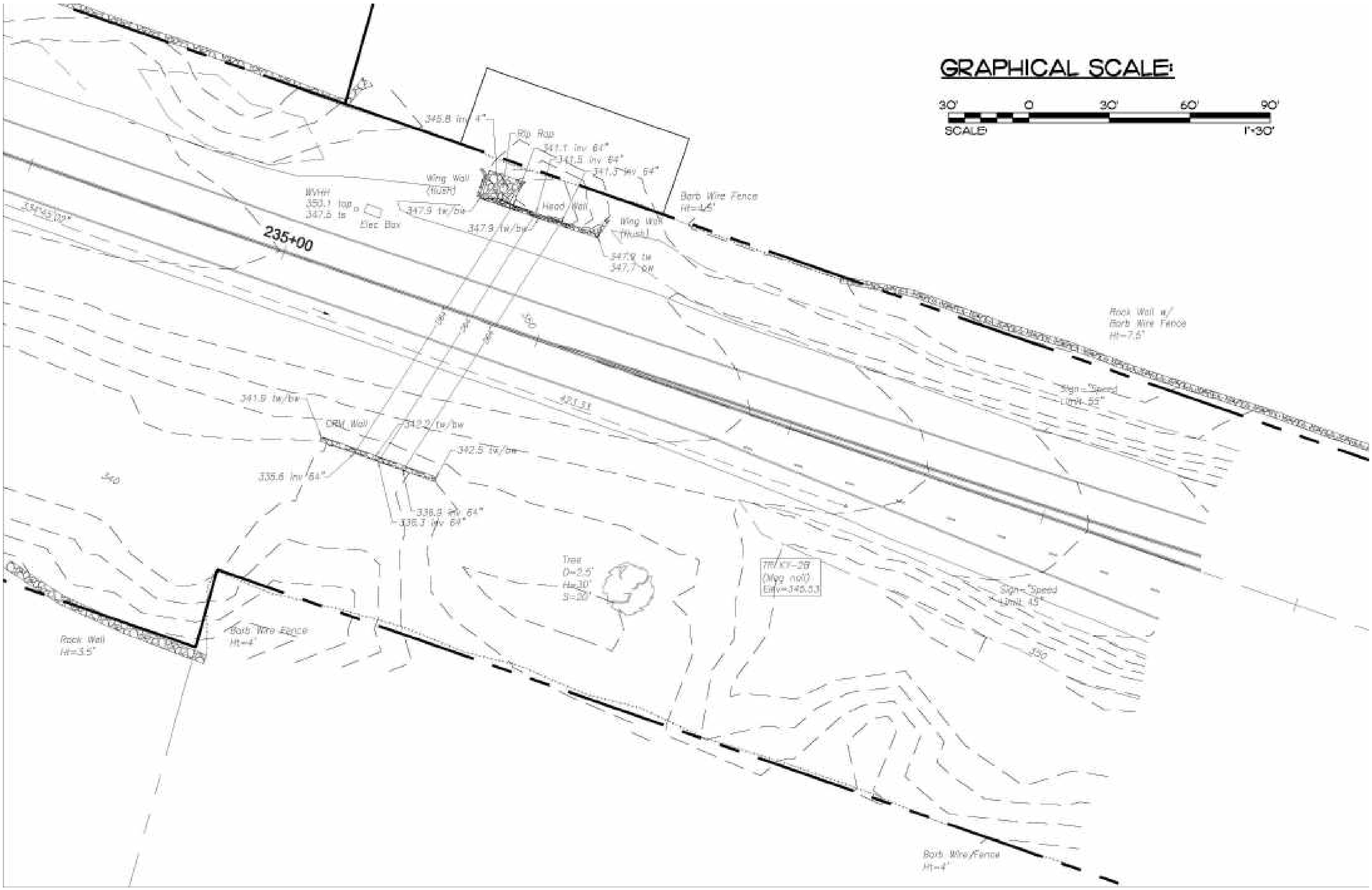
Attached is a copy of a topographic survey of the existing highway culvert crossing. This topographic survey shows the as-built location of the three (3) existing structural plate pipe arch culverts built as part of the original highway construction and Federal Aid Project No. F-011-1(14). Based on the surveyed locations of the existing culverts, culvert headwall and wingwalls, 120' wide permitted access location, and the preliminary Royal Vistas roadway location, it's confirmed that the proposed roadway intersection can be constructed without having to modify the existing highway culvert crossing. Since the existing Horseshoe Bend culvert crossing and drainageway can remain in place, no changes to the 100-year regulatory FEMA floodplain would occur as part of the proposed intersection improvements. Since no changes to the hydrologic or hydraulic conditions of the Horseshoe Bend would occur, the existing Flood Insurance Study (FIS) and FEMA flood map conditions for this highway culvert crossing location will remain valid, and a new study would not be applicable.

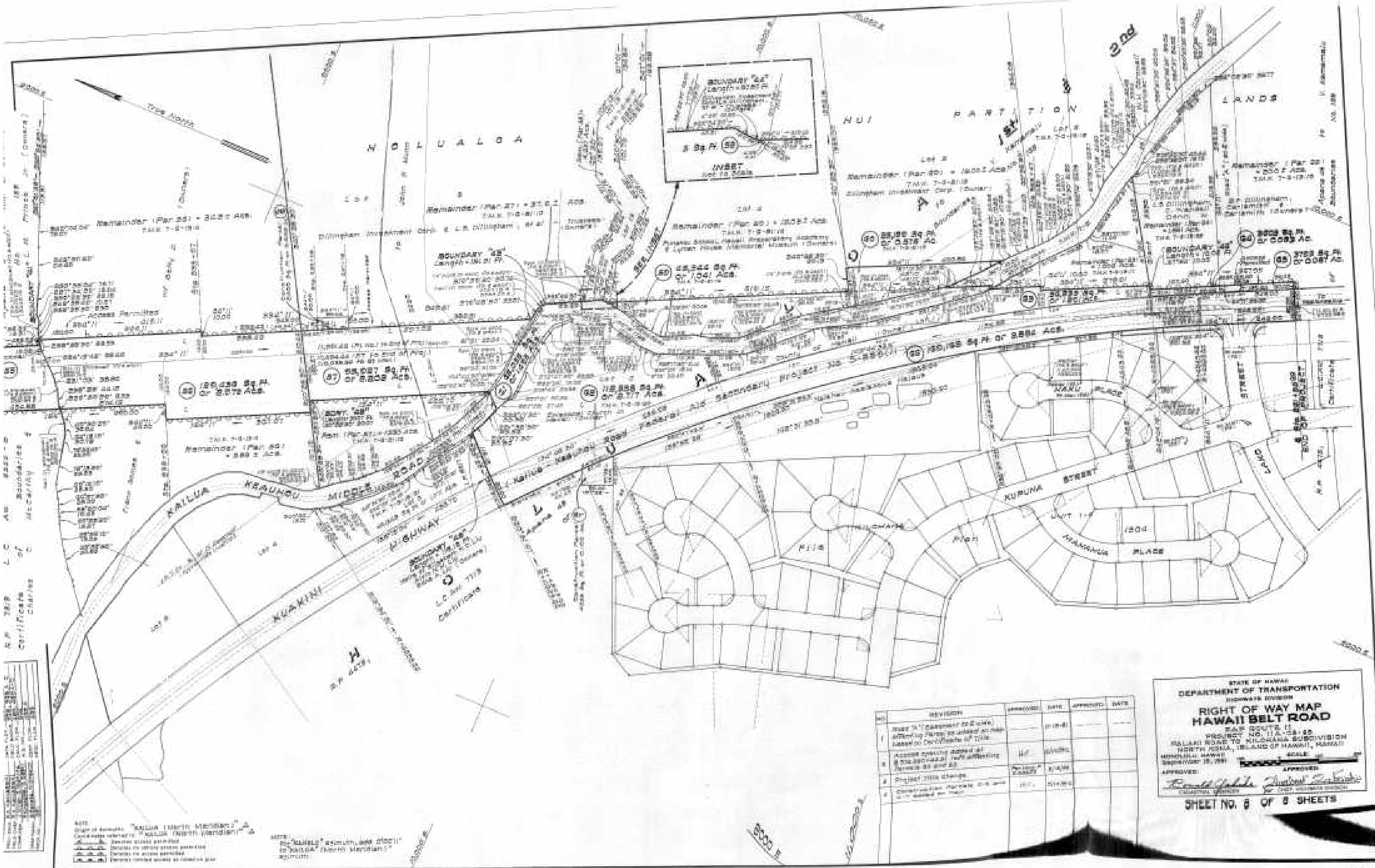
If there are any questions regarding this information, please feel free to contact me at ty@dempseypacific.com or by phone at (808) 277-2043.

Sincerely,

Ty Dempsey, P.E., CFM
Civil Engineer

Attachments: ROW Map
Topographic Survey of existing culvert crossing location


GRAPHICAL SCALE:
30' 0 30' 60' 90'
SCALE 1"=30'
235+00
345.8 inv 4"
Rip Rap
341.1 inv 64"
341.5 inv 64"
341.3 inv 64"
Wing Wall (flush)
WVHH
350.1 top
347.5 ts
Elec Box
347.9 tw/bw
Head Wall
Wing Wall (flush)
Barb Wire Fence
Ht=4.5'
347.9 tw
347.7 bw
Rock Wall w/
Barb Wire Fence
Ht=7.5'
Sign="Speed
Limit 55"
341.9 tw/bw
CRM Wall
342.2 tw/bw
342.5 tw/bw
335.6 inv 64"
336.9 inv 64"
336.3 inv 64"
Tree
D=2.5'
H=30'
S=20'
TR KY-28
(Mag nail)
Elev=346.53
Sign="Speed
Limit 45"
Rock Wall
Ht=3.5'
Barb Wire Fence
Ht=4'
Barb Wire Fence
Ht=4'
350
340



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
RIGHT OF WAY MAP
HAWAII BELT ROAD
SHEET NO. 8 OF 8 SHEETS
HOLUALOA
HUI PARTITION LANDS
KAILUA KEAUHOU MIDDLE ROAD
KUAKINI HIGHWAY
KUKUNA STREET
INSET
True North
P. H. 880

From: Honda, Kyle J
To: Lefebvre, Michele
Subject: DEA for Royal Vistas Housing (TMK: 7-6-021:016, 017, 018 and 019)
Date: Thursday, September 03, 2020 2:36:30 PM
Attachments: DPW Comments DEA Royal Vistas Housing.pdf

Hello Michele,

Attached are my comments for the "Royal Vistas housing Project Draft Environmental Assessment and Anticipated Finding of No Significant Impact" (TMK: 7-6-021:016, 017, 018 and 019).

Please feel free to contact me should you have any questions or concerns regarding my comments.

Thank you!

Kyle Honda
County of Hawaii, Department of Public Works, Engineering Division
74-5044 Ane Keohokalole Hwy, Bldg. D
Kailua-Kona, HI 96740
Tel. (808) 323-4854
Email: kylej.honda@hawaiicounty.gov

Harry Kim
Mayor

Roy Takemoto
Managing Director

David Yamamoto, P.E.
Director

Allan G. Simeon, P.E.
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 · Hilo, Hawai'i 96720-4224
(808) 961-8321 · Fax (808) 961-8630
public_works@hawaiicounty.gov

September 3, 2020

Michele Lefebvre
Stantec Consulting Inc.
P.O. Box 191
Hilo, HI 96721
(transmitted via email to: michele.lefebvre@stantec.com)

Subject: Royal Vistas Housing Project Draft Environmental Assessment and Anticipated Finding of No Significant Impact
Tax Map Key: (3) 7-6-021:016, 017, 018 and 019

We have reviewed the Draft Environmental Assessment and Anticipated Finding of No Significant Impact and our comments are as follows:

1. Flood zones AE and AEF affect the subject parcels as designated by the Flood Insurance Rate Map (FIRM). New construction and substantial improvements shall comply with Chapter 27 – Floodplain Management – of the Hawaii Code.

2. Drainage improvements to Holualoa Drainage way and the Horseshoe Bend Drainageway shall be submitted to the Department of Public Works for review and approval.

Should there be any questions concerning this matter, please feel free to contact Kyle Honda of our Kona Engineering Division office at 323-4854.

FOR Kyle Honda

BEN E. ISHII, Division Chief
Engineering Division

KH

Copy: ENG-HILO/KONA, Planning Department

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Ben Ishii, Division Chief
Department of Public Works, Engineering Division
101 Pauahi Street, Suite 7
Hilo, HI 96720
Via email: Kyle Honda, kylej.honda@hawaiicounty.gov

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Ishii:

Thank you for the comment letter dated September 3, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: Flood zones AE and AEF affect the subject parcels as designated by the Flood Insurance Rate Map (FIRM). New construction and substantial improvements shall comply with Chapter 27 - Floodplain Management - of the Hawaii Code.

> **Response 1:** As described in Section 3.3.2 of the EA, the project would follow County regulations and policies including Chapter 27 of the Hawaiʻi County Code.

Comment 2: Drainage improvements to Holualoa Drainage way and the Horseshoe Bend Drainageway shall be submitted to the Department of Public Works for review and approval.

> **Response 2:** Kona Three LLC would coordinate with the Department of Public Works regarding the final design of the improvement projects for the Horseshoe Bend and Holualoa Drainages as described in Section 3.3.2 of the EA.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

From:	Robert Harris
To:	Lefebvre, Michele
Cc:	planning@hawaiicounty.gov
Subject:	RE: Royal Vistas Housing Project
Date:	Monday, September 07, 2020 8:49:31 AM
Attachments:	Royal Vistas Housing Project letter.pdf

Aloha,

I live in Kona Vistas' subdivision and am attaching a letter in reference to my objection to Royal Vistas having access to their project through Kona Vistas' Subdivision.

Mahalo for the opportunity to present my comments regarding this project.

Robert D. Harris
76-4323 Kekuanaoa Place
Kailua Kona, HI 96740-6958

September 7, 2020

RE: Royal Vistas Housing Project

Aloha,

My wife, Bonnie, and I have lived in Kona Vistas Subdivision for over two years. We very much enjoy our home and look forward too many more years of enjoyment. Our home is located on Kekuanaoa Place which currently is the only access to Royal Vistas Housing Project specified on the Royal Vistas' plans. When we purchased our lot almost four years ago we were not informed of this project or Kekuanaoa Place as being the only access to the Royal Vistas Housing Project.

The Royal Vistas Housing Project owner presented to Kona Vistas' owners their plans for the Royal Vistas Housing Project and what it would look like. They had proposed two entrance/exits to their project from Kona Vistas and two entrance/exits from a subdivision on the north side of their project, Pualani Estates. One of the accesses from Kona Vistas, not Kekuanaoa Place, requires permission from the owner of the property for access the Royal Vistas which has been denied by the owner from my understanding. Also, the two accesses from Pualani Estates requires Royal Vistas to be granted access across a strip of land owned by another owner who has also denied Royal Vistas access to their project from my understanding. This only leaves Kekuanaoa Place in Kona Vistas as the only access to Royal Vistas Housing Project.

Since Queen K Highway is adjacent to Royal Vistas Housing Project there should be access from this highway and not from Kona Vistas Subdivision. Kona Vistas only access is from Queen K Highway by Lako St. for our subdivision with 200 homesites. Royal Vistas Housing Project is slated for 490 homes (Condos, some rental units and some purchased units). If Kona Vistas has only one access to it's subdivision why shouldn't Royal Vistas only access be Queen K Highway as well.

Why should Royal Vistas have an access through Kona Vistas and allow all their traffic, including the construction equipment traffic over the next 20 years of their development, to drive through Kona Vistas Subdivision? Royal Vistas Housing Project with 490 units has almost 2.5 times larger density and this traffic should not be funneled through Kona Vistas Subdivision.

Mahalo for your time,

Robert D. Harris

76-4323 Kekuanaoa Place

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Robert Harris
76-4323 Kekuana'oa Place
Kailua-Kona, HI 96740
via email: bobh.home@gmail.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Harris:

Thank you for the comment letter dated September 7, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: Our home is located on Kekuanaoa Place which currently is the only access to Royal Vistas Housing Project specified on the Royal Vistas' plans. When we purchased our lot almost four years ago we were not informed of this project or Kekuanaoa Place as being the only access to the Royal Vistas Housing Project.

> **Response 1:** The project would be accessed in two different ways. As described in Section 3.7.2 of the EA, Kona Three LLC proposes to construct a new intersection Royal Vistas Roadway at the project's intersection with Queen Ka'ahumanu. The second access point would be from Kekuana'oa Place, which would not occur until Phase II of the project. Figure 2 has been revised to show that access to the project site would be connected to Kekuana'oa Place from Lako Street during Phase II of the project. At project completion, there would be two ways to access the project.

Comment 2: The Royal Vistas Housing Project owner presented to Kona Vistas' owners their plans for the Royal Vistas Housing Project and what it would look like. They had proposed two entrance/exits to their project from Kona Vistas and two entrance/exits from a subdivision on the north side of their project, Pualani Estates. One of the accesses from Kona Vistas, not Kekuanaoa Place, requires permission from the owner of the property for access the Royal Vistas which has been denied by the owner from my understanding. Also, the two accesses from Pualani Estates requires Royal Vistas to be granted access across a strip of land owned by another owner who has also denied Royal Vistas access to their project from my understanding. This only leaves Kekuanaoa Place in Kona Vistas as the only access to Royal Vistas Housing Project.

> **Response 2:** The plans for access into the development have evolved over time based on discussions with various stakeholders. Section 2.3 of the EA describes how access from Pualani Estates from Paulehia Street was an alternative

considered but eliminated from detailed analysis. The project as described in Section 1.2 and analyzed in this EA for approval presents two access points for the project, from a new intersection (Royal Vistas Roadway at the project's intersection with Queen Ka‘ahumanu) in Phase I and from Kekuana‘oa Place in Phase II.

Comment 3: Since Queen K Highway is adjacent to Royal Vistas Housing Project there should be access from this highway and not from Kona Vistas Subdivision. Kona Vistas only access is from Queen K Highway by Lako Street for our subdivision with 200 homesites.

Response 3: A small number of 'left turn out' (southbound) vehicles will be pushed through Kekauna‘oa Place and Lako Street. For emergency reasons, it would be beneficial if more than one access is provided to any development. The master plan for this area shows connector streets parallel to Queen Ka‘ahumanu Highway through these developments to purposely provide connectivity redundant to Queen Ka‘ahumanu Highway. This is not a new or recent concept in the area.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai‘i Planning Department

Standard Comments for Land Use Reviews
Clean Air Branch
Hawaii State Department of Health

If your proposed project:

Requires an Air Pollution Control Permit

You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements. If you do not know if you need an air pollution control permit, please contact the Permitting Section of the Clean Air Branch.

s

Includes construction or demolition activities that involve asbestos

You must contact the Asbestos Abatement Office in the Indoor and Radiological Health Branch.

Has the potential to generate fugitive dust

You must control the generation of all airborne, visible fugitive dust. Note that construction activities that occur near to existing residences, business, public areas and major thoroughfares exacerbate potential dust concerns. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. The plan, which does *not* require Department of Health approval, should help you recognize and minimize potential airborne, visible fugitive dust problems.

Construction activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust. In addition, for cases involving mixed land use, we strongly recommend that buffer zones be established, wherever possible, in order to alleviate potential nuisance complaints.

You should provide reasonable measures to control airborne, visible fugitive dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:

a) Planning the different phases of construction, focusing on minimizing the amount of airborne, visible fugitive dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
b) Providing an adequate water source at the site prior to start-up of construction activities;
c) Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
d) Minimizing airborne, visible fugitive dust from shoulders and access roads;
e) Providing reasonable dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
f) Controlling airborne, visible fugitive dust from debris being hauled away from the project site.

If you have questions about fugitive dust, please contact the Enforcement Section of the Clean Air Branch

Clean Air Branch (808) 586-4200 cab@doh.hawaii.gov	Indoor Radiological Health Branch (808) 586-4700

April 1, 2019

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Clear Air Branch
Hawaii State Department of Health
Via email: cab@doh.hawaii.gov

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

To Whom it May Concern:

Thank you for the comment letter dated September 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses to your substantive comments below.

Comment 1: You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements.

You must control the generation of all airborne, visible fugitive dust. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. Construction activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust.

> **Response 1:** As described in Section 3.3.6 in the EA, the contractor for the development would be required to prepare a dust control plan during construction compliant with provisions of Hawaii Administrative Rules (HAR), Chapter 11-60.1, "Air Pollution Control," and Section 11-60.1-33, "Fugitive Dust."

Comment 2: Includes construction or demolition activities that involve asbestos. You must contact the Asbestos Abatement Office in the Indoor and Radiological Health Branch.

> **Response 2:** The project does not expect to encounter asbestos during construction, and no demolition is proposed.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAIʻI
345 KEKŪANAŌʻA STREET, SUITE 20 • HILO, HAWAIʻI 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

September 8, 2020

Ms. Michele Lefebvre
Stantec Consulting Services Inc.
1239 Moku Place
Hilo, HI 96720

Dear Ms. Lefebvre:

Subject: Draft Environmental Assessment for Royal Vistas Housing Project
North Kona District, Island of Hawaiʻi
Tax Map Key 7-6-021:016, 017, 018 and 019

We have reviewed the subject Draft Environmental Assessment (DEA) and have the following comments.

Please be informed that the subject parcels are served by an existing service that has an allocation of 451 units of water, or an average usage of 180,400 gallons per day.

The development will need to provide water at adequate pressure and volume under peak-flow and fire-flow conditions.

The overall water demand calculations should be submitted for review, as the water use other than the residential dwelling units will need to be included, which could reduce the number of dwelling units that can be developed. Additional water beyond the total number of allocated water units to the subject parcels is not available.

Should there be any questions, please contact Mr. Ryan Quitoriano of our Water Resources and Planning Branch at 961-8070, extension 256.

Sincerely yours,

Keith K. Okamoto, P.E.
Manager-Chief Engineer

RQ:dfg

copy – Planning Department

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Keith Okamoto, Manager-Chief Engineer
Department of Water Supply
345 Kekūanaōʻa Street, Suite 20
Hilo, Hawaii 96720

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Okamoto:

Thank you for the comment letter dated September 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: Please be informed that the subject parcels are served by an existing service that has an allocation of 451 units of water, or an average usage of 180,400 gallons per day.

> **Response 1:** The project would not exceed the amount of water allocated by Department of Water Supply.

Comment 2: The development will need to provide water at adequate pressure and volume under peak-flow and fire-flow conditions.

> **Response 2:** Kona Three LLC would ensure that the development provides water at adequate pressure and volume to occupants under both peak-flow and fire-flow conditions.

Comment 3: The overall water demand calculations should be submitted for review, as the water use other than the residential dwelling units will need to be included, which could reduce the number of dwelling units that can be developed. Additional water beyond the total number of allocated water units to the subject parcels is not available.

> **Response 3:** Kona Three LLC would submit water demand calculations as part of Plan Approval. Additionally, as described in Section 3.3.3 of the EA, the project would minimize water demand by limiting landscaping and using xeriscape landscaping where landscaping is installed. The project aims to implement and balance xeriscape and providing safe and adequate recreational space for residents. The project would also utilize reclaimed or reuse water for landscaping if possible.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T. L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai‘i Planning Department

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

September 8, 2020

Stantec Consulting Services Inc.
Attention: Ms. Michele Lefebvre
Environmental Scientist
P.O. Box 191
Hilo, Hawaii 96721

via email: michele.lefebvre@stantec.com

Dear Ms. Lefebvre:

SUBJECT: Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) for the Proposed **Royal Vistas Housing Project** located at North Kona, Island of Hawaii; TMK: (3) 7-6-021:016, 017, 018, and 019 on behalf of Kona Three LLC

Thank you for the opportunity to review and comment on the subject matter. The Land Division of the Department of Land and Natural Resources (DLNR) distributed or made available a copy of your request pertaining to the subject matter to DLNR's Divisions for their review and comments.

At this time, enclosed are comments from the (a) Engineering Division, (b) Division of Forestry & Wildlife, and (c) Land Division-Hawaii District on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files
County of Hawaii (w/copies)
Attn: Planning Department (via email: planning@hawaiicounty.gov)

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 14, 2020

MEMORANDUM

FROM:

~~TO:~~ **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)
X Historic Preservation (DLNR.Intake.SHPD@hawaii.gov)

TO:

~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) for the Proposed **Royal Vistas Housing Project**
LOCATION: North Kona, Island of Hawaii; TMK: (3) 7-6-021:016, 017, 018, and 019
APPLICANT: Stantec Consulting on behalf of Kona Three LLC

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit any comments by **September 7, 2020.**

The DEA can be found on-line at: http://health.hawaii.gov/oeqc/ (Click on The Environmental Notice in the middle of the page.)

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

additional
( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: [signature]
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Aug 29, 2020

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 14, 2020

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)
X Historic Preservation (DLNR.Intake.SHPD@hawaii.gov)

FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) for the Proposed **Royal Vistas Housing Project**
LOCATION: North Kona, Island of Hawaii; TMK: (3) 7-6-021:016, 017, 018, and 019
APPLICANT: Stantec Consulting on behalf of Kona Three LLC

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit any comments by **September 7, 2020.**

The DEA can be found on-line at: http://health.hawaii.gov/oeqc/ (Click on The Environmental Notice in the middle of the page.)

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed: [signature]
Print Name: DAVID G. SMITH, Administrator
Division: Forestry and Wildlife
Date: Sep 4, 2020

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813

September 4, 2020

MEMORANDUM

Log no. 2763

TO: RUSSELL Y. TSUJI, Administrator
Land Division

FROM: DAVID G. SMITH, Administrator DGS
Division of Forestry and Wildlife

SUBJECT: Division of Forestry and Wildlife Comments for the Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) for the Proposed Royal Vistas Housing Project.

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has received your inquiry regarding the DEA and anticipated FONSI of the proposed Royal Vistas Housing Project in North Kona on Hawai'i Island, Hawai'i, TMKs: (3) 7-6-021:016, 017, 018, 019. The proposed project consists of constructing up to 450 multi-family residential units in clusters of two and three-story buildings on approximately 70 acres of previously undeveloped land.

The State listed Hawaiian Hawk or 'Io (*Buteo solitarius*) is known to occur in the project vicinity. DOFAW recommends surveying the area to ensure no Hawaiian Hawk nests are present if trees are to be cut. 'Io nests might be present during the breeding season from March to September.

The State listed Hawaiian Hoary Bat or 'Ōpe'ape'a (*Lasiurus cinereus semotus*) has the potential to occur in the vicinity of the project area and may roost in nearby trees. If any site clearing is required this should be timed to avoid disturbance during the bat birthing and pup rearing season (June 1 through September 15). If this cannot be avoided, woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed without consulting DOFAW.

The State listed Blackburn's Sphinx Moth (BSM; *Manduca blackburni*) has a historic range that encompasses the project area. Larvae of BSM feed on many nonnative hostplants that include tree tobacco (*Nicotiana glauca*) which grows in disturbed soil. We recommend contacting our Hawai'i Island DOFAW office at (808) 974-4226 for further information about where BSM may be present and whether a vegetation survey should be conducted to determine the presence of plants preferred by BSM. To avoid harm to BSM, DOFAW recommends removing plants less than one meter in height or during the dry time of the year. If you remove tree tobacco over one meter in height or disturb the ground around or within several meters of these plants they must be checked thoroughly for the presence of eggs and larvae.

DOFAW recommends minimizing the movement of plant or soil material between worksites, such as in fill. Soil and plant material may contain invasive fungal pathogens (e.g. Rapid ʻŌhiʻa Death), vertebrate and invertebrate pests (e.g. Little Fire Ants, Coconut Rhinoceros Beetles), or invasive plant parts that could harm our native species and ecosystems. We recommend consulting the Big Island Invasive Species Committee at (808) 933-3340 in planning, design, and construction of the project to learn of any high-risk invasive species in the area and ways to mitigate spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species.

DOFAW recommends using native plant species for landscaping that are appropriate for the area (i.e. climate conditions are suitable for the plants to thrive, historically occurred there, etc.). Please do not plant invasive species. DOFAW recommends consulting the Hawaiʻi-Pacific Weed Risk Assessment website to determine the potential invasiveness of plants proposed for use in the project (https://sites.google.com/site/weedriskassessment/home). We recommend that you refer to www.plantpono.org for guidance on selection and evaluation for landscaping plants.

We note that artificial lighting can adversely impact seabirds that may pass through the area at night by causing disorientation. This disorientation can result in collision with manmade artifacts or grounding of birds. For nighttime lighting that might be required, DOFAW recommends that all lights be fully shielded to minimize impacts. Nighttime work that requires outdoor lighting should be avoided during the seabird fledging season from September 15 through December 15. This is the period when young seabirds take their maiden voyage to the open sea. For illustrations and guidance related to seabird-friendly light styles that also protect the dark, starry skies of Hawaiʻi please visit: https://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf.

We appreciate your efforts to work with our office for the conservation of our native species. Should the scope of the project change significantly, or should it become apparent that threatened or endangered species may be impacted, please contact our staff as soon as possible.

If you have any questions, please contact Lauren Taylor, Protected Species Habitat Conservation Planning Coordinator at (808) 587-0010 or lauren.taylor@hawaii.gov.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 14, 2020

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
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__Office of Conservation & Coastal Lands
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)
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FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) for the Proposed **Royal Vistas Housing Project**
LOCATION: North Kona, Island of Hawaii; TMK: (3) 7-6-021:016, 017, 018, and 019
APPLICANT: Stantec Consulting on behalf of Kona Three LLC

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit any comments **by September 7, 2020.**

The DEA can be found on-line at: http://health.hawaii.gov/oeqc/ (Click on The Environmental Notice in the middle of the page.)

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: [signature]
Print Name: GORDON C HEIT
Division: Land Division
Date: 9/4/20

Attachments
cc: Central Files

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. David Smith, Administrator
Department of Land and Natural Resources, Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawaii 96813

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Smith:

Thank you for the comment letter dated September 4, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The State listed Hawaiian Hawk or 'Io (*Buteo solitarius*) is known to occur in the project vicinity. Division of Forestry and Wildlife (DOFAW) recommends surveying the area to ensure no Hawaiian Hawk nests are present if trees are to be cut. 'Io nests might be present during the breeding season from March to September.

> **Response 1:** The EA includes protection measures to avoid impacts to Hawaiian hawk nests. As stated in Section 3.3.4 of the EA, if construction for the project is scheduled to occur in the Hawaiian hawks breeding season (between March 1 and September 30), a qualified biologist would conduct a pre-disturbance survey for hawk nests within and immediately adjacent to the property. If a Hawaiian hawk nest is located during the pre- disturbance nest survey, no land clearing or construction should occur within 1,600 feet of any active Hawaiian hawk nest during the breeding season until the young have fledged (usually October). Regardless of time of year, Kona Three LLC would coordinate with the DOFAW prior to trimming or cutting trees with Hawaiian hawk nests, as nests may be re-used during consecutive breeding seasons.

Comment 2: The State listed Hawaiian Hoary Bat or 'Ōpe'ape'a (*Lasiurus cinereus semotus*) has the potential to occur in the vicinity of the project area and may roost in nearby trees. If any site clearing is required this should be timed to avoid disturbance during the bat birthing and pup rearing season (June 1 through September 15). If this cannot be avoided, woody plants greater than 15 feet (4.6 meters) tall should not be disturbed , removed , or trimmed without consulting DOFAW.

> **Response 2:** As stated in Section 3.3.4 of the EA, to minimize impacts to hoary bats during construction, woody plants taller than 15 feet would not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Additionally, Hawaiian hoary bats forage for insects from as low

as 3 feet to higher than 500 feet above the ground and can become entangled in barbed wire, if used for fencing. The proposed project would not use barbed wire for fencing.

Comment 3: The State listed Blackburn's Sphinx Moth (BSM; *Manduca blackburni*) has a historic range that encompasses the project area. Larvae of BSM feed on many nonnative hostplants that include tree tobacco (*Nicotiana glauca*) which grows in disturbed soil. To avoid harm to BSM, DOFAW recommends removing plants less than one meter in height or during the dry time of the year. If you remove tree tobacco over one meter in height or disturb the ground around or within several meters of these plants they must be checked thoroughly for the presence of eggs and larvae.

Response 3: A biologist surveyed the project site and did not find the species present, and did not find potential habitat. As stated in Section 3.3.4 of the EA, to prevent potential impacts to the Blackburn's sphinx moth, the project would include the following protection measures. A biologist familiar with the species would survey for Blackburn's sphinx moth and its larval host plants (tree tobacco and native ʻaiea) between November and April or several weeks after a significant rain and within four to six weeks prior to construction. Surveys should include searches for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If moths or native ʻaiea or tree tobacco over three feet are found during the survey, Kona Three would coordinate with the U.S. Fish and Wildlife Service (USFWS) for guidance to avoid impacts.

If no Blackburn's sphinx moth, ʻaiea, or tree tobacco are found during pre-disturbance surveys, Kona Three LLC would ensure that measures are taken to avoid attraction of Blackburn's sphinx moth and prohibit tree tobacco from entering the site. Tree tobacco can grow more than three feet in approximately six weeks, and above three feet in height the tree tobacco can become a host plant for Blackburn's sphinx moth. The proposed project would remove tree tobacco less than three feet tall and monitor the Project Site for new tree tobacco grown before, during, and after project construction. Monitoring for tree tobacco after construction, can be completed by any staff, such as regular maintenance crew, provided with pictures of tree tobacco at different life stages.

Comment 4: DOFAW recommends minimizing the movement of plant or soil material between worksites, such as in fill. Soil and plant material may contain invasive fungal pathogens (e.g. Rapid ʻŌhiʻa Death), vertebrate and invertebrate pests (e.g. Little Fire Ants, Coconut Rhinoceros Beetles), or invasive plant parts that could harm our native species and ecosystems. We recommend consulting the Big Island Invasive Species Committee in planning, design, and construction of the project to learn of any high-risk invasive species in the area and ways to mitigate spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species.

Response 4: To minimize the introduction and spread of invasive species, Section 3.3.4 of the EA states that "where no grading or grubbing is required, existing vegetation would be left in place. Biosecurity protocols during construction would include cleaning and inspection of construction equipment for invasive species (including insects, frogs, rats, and mice), and would be applied as applicable." Text has been added to the EA to state, "The developer would also request current recommendations from Big Island Invasive Species Committee (BIISC) at the time of development."

Comment 5: DOFAW recommends using native plant species for landscaping that are appropriate for the area (i.e. climate conditions are suitable for the plants to thrive, historically occurred there, etc.). Please do not plant invasive species. DOFAW recommends consulting the Hawai'i- Pacific Weed Risk Assessment website to determine the potential invasiveness of plants proposed for use in the project.

Response 5: Also, to minimize the spread of introduced species, no invasive species would be planted and Section 3.3.4 of the EA states "a mix of native species, Polynesian introduced species, and non-invasive introduced ornamentals would be used in landscaping for the Project Site and an invasive weed control plan for the Project Site would be developed to minimize impacts from fire-prone, non-native vegetation species."

Comment 6: We note that artificial lighting can adversely impact seabirds that may pass through the area at night by causing disorientation. This disorientation can result in collision with manmade artifacts or grounding of birds. For nighttime lighting that might be required, DOFAW recommends that all lights be fully shielded to minimize impacts. Nighttime work that requires outdoor lighting should be avoided during the seabird fledging season from September 15 through December 15. This is the period when young seabirds take their maiden voyage to the open sea.

Response 6: To prevent impacts to seabirds from lighting, as stated in Section 3.3.4 of the EA, the project "would not involve any unshielded lighting for either construction or operation, in conformance with Hawaiʻi County Code § 14 – 50 et seq, which would avoid impacts to nocturnally flying Hawaiian petrels and Newell's shearwaters. Additionally, during operation the site would use lighting only where and when it is needed for safety purposes. The use of outdoor lamps with warmer colors (less blue light) and energy efficient fixtures would be considered when the building is being constructed. To minimize Project impacts from lighting, the following text has been added to Section 3.3.4, "Subject to local rules and regulations, the Proposed Project would utilize lighting on the 2700 degrees Kelvin scale."

If the proposed project incorporates additional outdoor lighting, it may attract threatened and endangered Hawaiian seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these threatened and endangered seabirds due to interaction with outdoor lighting, no construction using unshielded equipment

> maintenance lighting should be permitted after dark between the months of April and October. All additional permanent lighting should conform to the Hawai'i County Outdoor Lighting Ordinance (Hawai'i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting. The proposed project would also avoid nighttime construction during the seabird fledging period, September 15 through December 15."

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

From:	Jackson, Maija
To:	Lefebvre, Michele
Subject:	FW: Kona Three LLC Project (Royal Vistas)
Date:	Thursday, September 10, 2020 7:58:00 AM

FYI-

From: Martin Ohan <martyohan@hibr.net>
Sent: Wednesday, September 09, 2020 2:37 PM
To: Jackson, Maija <Maija.Jackson@hawaiicounty.gov>
Cc: 'Martin Ohan' <martyohan@hibr.net>
Subject: FW: Kona Three LLC Project (Royal Vistas)

Hello Maija,

Well that was quite a long and detailed EA for the Royal Vistas Project.

Some of my objections to this project moving forward as outlined in the EA are as follows;

This is primarily a single family neighborhood/area. The current Zoning and Density proposed
is not a good fit and creates a suffocating impact on the existing road system. The vehicle
access points for this project will clog an already stressed Road system or grid and unduly impact
the adjacent neighborhoods. Much has changed since the original 1984 zoning designation.

I would suggest that a down Zoning be initiated to RS-15 or RS-.50 from the current multifamily zoning.
The work force concept at this location is not feasible based on the proposed high rental values.
The Vacation Rental concept, with the proposed higher density, will add an unknown higher volume of
trip generations to this region. A safety and quality of life concern.

The required affordable housing development has not been funded or finalized

which is a
Requirement for this Royal Vistas or Kona Three, LLC project moving forward in any capacity.
This designated land is adjacent to the Kilohana Subdivision, et al with a very extensive drainage problem
with no known Developers or Builders under contract at this time that I am aware of.

Let me know if I am misstating any of the facts. I may also add other EA concerns in a future email.

I am opposed to this Project being granted approval by the Hawaii County Planning Department/Commission
or the Hawaii County Council.

Mahalo and Aloha,

Martin M. Ohan/Vice President
Kuakini Makai Homeowners Association

From: Martin Ohan [mailto:martyohan@hibr.net]
Sent: Monday, August 03, 2020 12:37 PM
To: 'Jackson, Maija'
Cc: 'Mark Holst'
Subject: RE: Kona Three LLC Project (Royal Vistas)

Hello Maija,

Mahalo plenty for the update with the Kona Vistas Project.

Does this EA mention the affordable housing proposal or plans
adjacent to the Kuakini Makai subdivision?

Name change from Ted Baldau to Mark Holst, President HOA.

Same address.

Take care.

Aloha,

Martin M. Ohan

From: Jackson, Maija [mailto:Maija.Jackson@hawaiicounty.gov]
Sent: Monday, August 03, 2020 11:43 AM
To: Martin Ohan
Subject: Kona Three LLC Project (Royal Vistas)

Hi Marty,

I just wanted to let you know that the draft Environmental Assessment (EA) for the Royal Vistas Housing Project will be available for a 30-day public review and comment period starting August 8^{th}. To view the draft EA go to the following website on or after August 8th:
http://oeqc2.doh.hawaii.gov/_layouts/15/start.aspx#/Doc_Library/Forms/AllItems.aspx
A hard copy of the draft EA is also being sent to the Kona Planning Office.

I also asked the consultant for the applicant to send a copy to the Kuakini Makai Association. I believe she is sending it to Ted Baldau at PO Box 2924, Kailua Kona since Ted is listed as the registered agent. If that is not the correct contact info for the association please let me know.

I look forward to hearing from you.

Maija Jackson, Planner
County of Hawaii Planning Department
(808) 961-8159

Stantec
Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Martin Ohan, Vice President
Kuakini Makai Homeowners Association
Via email: martyohan@hibr.net

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Ohan:

Thank you for the comment letter dated September 9, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: This is primarily a single family neighborhood/area. The current Zoning and Density proposed is not a good fit and creates a suffocating impact on the existing road system. The vehicle access points for this project will clog an already stressed Road system or grid and unduly impact the adjacent neighborhoods. Much has changed since the original 1984 zoning designation. I would suggest that a down Zoning be initiated to RS-15 or RS-.50 from the current multifamily zoning.

> **Response 1:** The proposed action being considered in the EA is the proposed development project within the current zoning. The project is consistent with medium density zoning and conforms to the guiding principles regarding urban growth patterns as defined by the Kona Community Development Plan (CDP). The applicant is not proposing any change in zoning for the development, so the EA does not analyze any change in zoning.

Comment 2: The work force concept at this location is not feasible based on the proposed high rental values.

> **Response 2:** The need for the project has been identified by a private developer based on demands for mid-market, including workforce housing in the area.

Comment 3: The Vacation Rental concept, with the proposed higher density, will add an unknown higher volume of trip generations to this region. A safety and quality of life concern.

> **Response 3:** The first phase of development has been identified as long-term rental, but the exact nature of the rental units has not yet been determined. The traffic analysis in Section 3.7.2 of the EA conservatively accounts for occupancy of all the units, and daily trips are not expected to be different whether the rentals are short-term or long-term.

<u>Comment 4</u>: The required affordable housing development has not been funded or finalized which is a Requirement for this Royal Vistas or Kona Three, LLC project moving forward in any capacity.

> **<u>Response 4</u>:** As described in Sections 1.2 and 3.2 of the EA, the affordable housing development is required as part of the original zoning ordinance. The EA states, "Subject to approval by the OHCD, Kona Three's affiliate which owns the 12 acres would deed the parcel to the County or their nominee to satisfy a portion of the affordable housing development requirement, and the homes would be built by qualified affordable housing developers." The Final EA identifies options for the affordable housing project if this parcel is not selected. Finally, the approval of this project is not dependent on the completion of the affordable housing project which would be built by a qualified affordable housing developer.

<u>Comment 5</u>: This designated land is adjacent to the Kilohana Subdivision, et al with a very extensive drainage problem with no known Developers or Builders under contract at this time that I am aware of.

> **<u>Response 5</u>:** The flooding that occurs across Kuakini Highway is described in Section 3.3.2 of the EA. As described in this section, the sheet flooding occurs as a result of a lack of infrastructure on the highway. The applicant recognizes this existing condition and as described in the EA, is working with Hawai'i County's Department of Public Works to correct these issues. As discussed in the EA, the project would not contribute or exacerbate the flooding issues. Per Section 27-20 of the Hawaii County Code, the project is not allowed to increase any run-off onto neighboring properties, so there are no effects on any neighbors from project run-off including on the County-owned parcels.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

September 17, 2020

Stantec Consulting Services Inc.
Attention: Ms. Michele Lefebvre
Environmental Scientist
P.O. Box 191
Hilo, Hawaii 96721

via email: michele.lefebvre@stantec.com

Dear Ms. Lefebvre:

SUBJECT: Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) for the Proposed **Royal Vistas Housing Project** located at North Kona, Island of Hawaii; TMK: (3) 7-6-021:016, 017, 018, and 019 on behalf of Kona Three LLC

Thank you for the opportunity to review and comment on the subject matter. In addition to our previous comments dated September 8, 2020, enclosed are comments from the Commission on Water Resource Management on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files
County of Hawaii (w/copies)
Attn: Planning Department (via email: planning@hawaiicounty.gov)

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

September 14, 2020

REF: RFD.5288.8

TO: Mr. Russell Tsuji, Administrator
Land Division

FROM: M. Kaleo Manuel, Deputy Director
Commission on Water Resource Management

SUBJECT: Draft Enviromental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) for the Proposed Royal Vistas Housing Project

FILE NO.: RFD.5288.8
TMK NO.: (3) 7-6-021:016, (3) 7-6-021:017, (3) 7-6-021:018, (3) 7-6-021:019

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://dlnr.hawaii.gov/cwrm.

Our comments related to water resources are checked off below.

[X] 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

[ ] 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

[X] 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.

[X] 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/

[X] 6. We recommend the use of alternative water sources, wherever practicable.

[ ] 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.

[ ] 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at

http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

☐ 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

☐ 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☐ 11. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.

☐ 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 14. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.

☐ 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

☐ 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☐ OTHER:

If you have any questions, please contact Lenore Ohye of the Commission staff at 587-0216.

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Kaleo Manuel, Deputy Director
Commission on Water Resource Management
P.O. Box 621
Honolulu, HI 96809

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai‘i Island

Dear Mr. Manuel:

Thank you for the comment letter dated September 14, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

> **Response 1:** The water units have already been acquired for the project. Additionally, Kona Three LLC would coordinate with the county regarding the Water Use and Development Plan, as it applies to the project.

Comment 2: We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources.

> **Response 2:** As described in Sections 3.3.3 and 3.3.4 of the EA, the project would include water efficient fixtures and provide water-saving recommended measures for residents.

Comment 3: We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events.

> **Response 3:** Prior to the initiation of construction for the proposed project, Kona Three LLV would ensure that a National Pollutant Discharge Elimination System (NPDES) general permit is in place as described in Section 3.3.3 of the EA. The permit would require best management practices (BMPs) to minimize erosion and for stormwater pollution prevention. Oversight of the BMPs would be conducted weekly for the duration of construction, with updates and corrective actions documented and transmitted to the State Department of Health, Clean Water Branch.

Comment 4: We recommend the use of alternative water sources, wherever practicable.

> **Response 4:** No alternative sources of water have been identified for the project since 451 water units have already been allocated for the project.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Harry Kim
Mayor

Paul K. Ferreira
Police Chief

Kenneth Bugado, Jr.
Deputy Police Chief

County of Hawai'i

POLICE DEPARTMENT
349 Kapi'olani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

August 18, 2020

Ms. Michele Lefebvre, PhD
Environmental Scientist
Stantec Consulting Inc.
PO Box 191
Hilo, Hawaii 96721

Dear Ms. Lefebvre:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA) AND ANTICIPATED FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR ROYAL VISTAS HOUSING PROJECT, ISLAND OF HAWAI'I, NORTH KONA DISTRICT, TMKS: (3RD) 7-6-021:016, 7-6-021:017, 7-6-021:018, AND 7-6-021:019

This is in response to your letter received on August 10, 2020, requesting comments related to your project.

Thank you for allowing the Hawaii Police Department the opportunity to participate. At this time, the Hawaii Police Department has no comments.

Should you have questions, please contact Captain Gilbert Gaspar Jr., Commander of the Kona District, at 326-4646, extension 299.

Sincerely,

PAUL K. FERREIRA
POLICE CHIEF

R Wagner

ROBERT WAGNER
ASSISTANT POLICE CHIEF
AREA II OPERATIONS

GG/jaj
19HQ1210

cc: Planning Department

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Robert Wagner, Assistant Police Chief - Area II Operations
County of Hawaiʻi Police Department
349 Kapiʻolani Street
Hilo, HI 96720

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Wagner:

Thank you for the letter dated August 18, 2020, in which you stated that the Hawaii Police Department had no comments on the Environmental Assessment.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Harry Kim
Mayor

Roy Takemoto
Managing Director

Darren J. Rosario
Fire Chief

Robert R.K. Perreira
Deputy Fire Chief

County of Hawai'i
HAWAI'I FIRE DEPARTMENT
25 Aupuni Street • Suite 2501 • Hilo, Hawai'i 96720
(808) 932-2900 • Fax (808) 932-2928

September 22, 2020

Michele Lefebvre
Michele.lefebvre@stantec.com
Stantec Consulting Inc.
P.O. Box 191
Hilo, Hawai'i 96721

Dear Ms. Michele Lefebvre:

SUBJECT: Draft Environmental Assessment
Royal Vistas Housing Project
North Kona, Hawai'i
TMK: 7-6-021:016, 7-6-021:017, 7-6-021:018, 7-6-021:019

In regards to the above-mentioned Environmental Assessment application, the following shall be in accordance:

NFPA 1, UNIFORM FIRE CODE, 2006 EDITION

Note: Hawai'i State Fire Code, National Fire Protection Association 2006 version, with County of Hawai'i amendments. County amendments are identified with a preceding "C-" of the reference code.

Chapter 18 Fire Department Access and Water Supply

18.1 General. Fire department access and water supplies shall comply with this chapter.

For occupancies of an especially hazardous nature, or where special hazards exist in addition to the normal hazard of the occupancy, or where access for fire apparatus is unduly difficult, or areas where there is an inadequate fire flow, or inadequate fire hydrant spacing, and the AHJ may require additional safeguards including, but not limited to, additional fire appliance units, more than one type of appliance, or special systems suitable for the protection of the hazard involved.

18.1.1 Plans.

18.1.1.1 Fire Apparatus Access. Plans for fire apparatus access roads shall be submitted to the fire department for review and approval prior to construction.

18.1.1.2 Fire Hydrant Systems. Plans and specifications for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

C~ 18.1.1.2.1 Fire Hydrant use and Restrictions. No unauthorized person shall use or operate any Fire hydrant unless such person first secures permission or a permit from the owner or representative of the department, or company that owns or governs that water supply or system. Exception: Fire Department personnel conducting firefighting operations, hydrant testing, and/or maintenance, and the flushing and acceptance of hydrants witnessed by Fire Prevention Bureau personnel.

18.2 Fire Department Access.

18.2.1 Fire department access and fire department access roads shall be provided and maintained in accordance with Section 18.2.

18.2.2* Access to Structures or Areas.

18.2.2.1 Access Box(es). The AHJ shall have the authority to require an access box(es) to be installed in an accessible location where access to or within a structure or area is difficult because of security.

18.2.2.2 Access to Gated Subdivisions or Developments. The AHJ shall have the authority to require fire department access be provided to gated subdivisions or developments through the use of an approved device or system.

18.2.2.3 Access Maintenance. The owner or occupant of a structure or area, with required fire department access as specified in 18.2.2.1 or 18.2.2.2, shall notify the AHJ when the access is modified in a manner that could prevent fire department access.

18.2.3 Fire Department Access Roads. (*may be referred as FDAR)

18.2.3.1 Required Access.

18.2.3.1.1 Approved fire department access roads shall be provided for every facility, building, or portion of a building hereafter constructed or relocated.

18.2.3.1.2 Fire Department access roads shall consist of roadways, fire lanes, parking lots lanes, or a combination thereof.

18.2.3.1.3* When not more than two one- and two-family dwellings or private garages, carports, sheds, agricultural buildings, and detached buildings or structures 400ft^2 (37 m^2) or less are present, the requirements of 18.2.3.1 through 18.2.3.2.1 shall be permitted to be modified by the AHJ.

18.2.3.1.4 When fire department access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the AHJ shall be authorized to require additional fire protection features.

18.2.3.2 Access to Building.

18.2.3.2.1 A fire department access road shall extend to within in 50 ft (15 m) of at least one exterior door that can be opened from the outside that provides access to the interior of the building. Exception: 1 and 2 single-family dwellings.

18.2.3.2.1.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.1 shall be permitted to be increased to 300 feet.

18.2.3.2.2 Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 ft (46 m) from fire department access roads as measured by an approved route around the exterior of the building or facility.

18.2.3.2.2.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.2 shall be permitted to be increased to 450 ft (137 m).

18.2.3.3 Multiple Access Roads. More than one fire department access road shall be provided when it is determined by the AHJ that access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions, or other factors that could limit access.

18.2.3.4 Specifications.

18.2.3.4.1 Dimensions.

C~ **18.2.3.4.1.1** FDAR shall have an unobstructed width of not less than 20ft with an approved turn around area if the FDAR exceeds 150 feet. **Exception:** FDAR for one and two family dwellings shall have an unobstructed width of not less than 15 feet, with an area of not less than 20 feet wide within 150 feet of the structure being protected. An approved turn around area shall be provided if the FDAR exceeds 250 feet.

C~ 18.2.3.4.1.2 FDAR shall have an unobstructed vertical clearance of not less then 13ft 6 in.

C~ 18.2.3.4.1.2.1 Vertical clearances may be increased or reduced by the AHJ, provided such increase or reduction does not impair access by the fire apparatus, and approved signs are installed and maintained indicating such approved changes.

18.2.3.4.1.2.2 Vertical clearances shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

C~ 18.2.3.4.2 Surface. Fire department access roads and bridges shall be designed and maintained to support the imposed loads (25 Tons) of the fire apparatus. Such FDAR and shall be comprised of an all-weather driving surface.

18.2.3.4.3 Turning Radius.

C~ 18.2.3.4.3.1 Fire department access roads shall have a minimum inside turning radius of 30 feet, and a minimum outside turning radius of 60 feet.

18.2.3.4.3.2 Turns in fire department access road shall maintain the minimum road width.

18.2.3.4.4 Dead Ends. Dead-end fire department access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for the fire apparatus to turn around.

18.2.3.4.5 Bridges.

18.2.3.4.5.1 When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with county requirements.

18.2.3.4.5.2 The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

18.2.3.4.5.3 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

18.2.3.4.6 Grade.

C~ 18.2.3.4.6.1 The maximum gradient of a Fire department access road shall not exceed 12 percent for unpaved surfaces and 15 percent for paved surfaces. In areas of the FDAR where a Fire apparatus would connect to a Fire hydrant or Fire Department Connection, the maximum gradient of such area(s) shall not exceed 10 percent.

18.2.3.4.6.2* The angle of approach and departure for any means of fire department access road shall not exceed 1 ft drop in 20 ft (0.3 m drop in 6 m) or the design limitations of the fire apparatus of the fire department, and shall be subject to approval by the AHJ.

18.2.3.4.6.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.61 m) beyond each edge of the fire lane.

18.2.3.4.7 Traffic Calming Devices. The design and use of traffic calming devices shall be approved the AHJ.

18.2.3.5 Marking of Fire Apparatus Access Road.

18.2.3.5.1 Where required by the AHJ, approved signs or other approved notices shall be provided and maintained to identify fire department access roads or to prohibit the obstruction thereof of both.

18.2.3.5.2 A marked fire apparatus access road shall also be known as a fire lane.

18.2.4* Obstruction and Control of Fire Department Access Road.

18.2.4.1 General.

18.2.4.1.1 The required width of a fire department access road shall not be obstructed in any manner, including by the parking of vehicles.

18.2.4.1.2 Minimum required widths and clearances established under 18.2.3.4 shall be maintained at all times.

18.2.4.1.3* Facilities and structures shall be maintained in a manner that does not impair or impede accessibility for fire department operations.

18.2.4.1.4 Entrances to fire departments access roads that have been closed with gates and barriers in accordance with 18.2.4.2.1 shall not be obstructed by parked vehicles.

18.2.4.2 Closure of Accessways.

18.2.4.2.1 The AHJ shall be authorized to require the installation and maintenance of gates or other approved barricades across roads, trails, or other accessways not including public streets, alleys, or highways.

18.2.4.2.2 Where required, gates and barricades shall be secured in an approved manner.

18.2.4.2.3 Roads, trails, and other access ways that have been closed and obstructed in the manner prescribed by 18.2.4.2.1 shall not be trespassed upon or used unless authorized by the owner and the AHJ.

18.2.4.2.4 Public officers acting within their scope of duty shall be permitted to access restricted property identified in 18.2.4.2.1.

18.2.4.2.5 Locks, gates, doors, barricades, chains, enclosures, signs, tags, or seals that have been installed by the fire department or by its order or under its control shall not be removed, unlocked, destroyed, tampered with, or otherwise vandalized in any manner.

18.3 Water Supplies and Fire Hydrants

18.3.1* A water supply approved by the county, capable of supplying the required fire flow for fire protection shall be provided to all premises upon which facilities or buildings, or portions thereof, are hereafter constructed, or moved into or within the county. When any portion of the facility or building is in excess of 150 feet (45 720 mm) from a water supply on a fire apparatus access road, as measured by an approved route around the exterior of the facility or building, on-site fire hydrants and mains capable of supplying the required fire flow shall be provided when required by the AHJ. For on-site fire hydrant requirements see section 18.3.3.

EXCEPTIONS:

1. When facilities or buildings, or portions thereof, are completely protected with an approved automatic fire sprinkler system the provisions of section 18.3.1 may be modified by the AHJ.
2. When water supply requirements cannot be installed due to topography or other conditions, the AHJ may require additional fire protection as specified in section 18.3.2 as amended in the code.
3. When there are not more than two dwellings, or two private garage, carports, sheds and agricultural. Occupancies, the requirements of section 18.3.1 may be modified by AHJ.

18.3.2* Where no adequate or reliable water distribution system exists, approved reservoirs, pressure tanks, elevated tanks, fire department tanker shuttles, or other approved systems capable of providing the required fire flow shall be permitted.

18.3.3* The location, number and type of fire hydrants connected to a water supply capable of delivering the required fire flow shall be provided on a fire apparatus access road on the site of the premises or both, in accordance with the appropriate county water requirements.

18.3.4 Fire Hydrants and connections to other approved water supplies shall be accessible to the fire department.

18.3.5 Private water supply systems shall be tested and maintained in accordance with NFPA 25 or county requirements as determined by the AHJ.

18.3.6 Where required by the AHJ, fire hydrants subject to vehicular damage shall be protected unless located within a public right of way.

18.3.7 The AHJ shall be notified whenever any fire hydrant is placed out of service or returned to service. Owners of private property required to have hydrants shall maintain hydrant records of approval, testing, and maintenance, in accordance with the respective county water requirements. Records shall be made available for review by the AHJ upon request.

C~ 18.3.8 Minimum water supply for buildings that do not meet the minimum County water standards:

Buildings up to 2000 square feet, shall have a minimum of 3,000 gallons of water available for Firefighting.

Buildings 2001- 3000 square feet, shall have a minimum of 6,000 gallons of water available for Firefighting.

Buildings, 3001- 6000 square feet, shall have a minimum of 12,000 gallons of water available for Firefighting.

Buildings, greater than 6000 square feet, shall meet the minimum County water and fire flow requirements.

Multiple story buildings shall multiply the square feet by the amount of stories when determining the minimum water supply.

Commercial buildings requiring a minimum fire flow of 2000gpm per the Department of Water standards shall double the minimum water supply reserved for firefighting.

Fire Department Connections (FDC) to alternative water supplies shall comply with 18.3.8 (1)-(6) of *this code*.

NOTE: In that water catchment systems are being used as a means of water supply for firefighting, such systems shall meet the following requirements:

1) In that a single water tank is used for both domestic and firefighting water, the water for domestic use shall not be capable of being drawn from the water reserved for firefighting;

2) Minimum pipe diameter sizes from the water supply to the Fire Department Connection (FDC) shall be as follows:
   a) 4" for C900 PVC pipe;

b) 4" for C906 PE pipe;
c) 3" for ductile Iron;
d) 3' for galvanized steel.

3) The Fire Department Connection (FDC) shall:
   a) be made of galvanized steel;
   b) have a gated valve with 2-1/2 inch, National Standard Thread male fitting and cap;
   c) be located between 8 ft and 16 ft from the Fire department access. The location shall be approved by the AHJ;
   d) not be located less than 24 inches, and no higher than 36 inches from finish grade, as measured from the center of the FDC orifice;
   e) be secure and capable of withstanding drafting operations. Engineered stamped plans may be required;
   f) not be located more than 150 feet of the most remote part, but not less than 20 feet, of the structure being protected;
   g) also comply with section 13.1.3 and 18.2.3.4.6.1 of *this code.*

4) Commercial buildings requiring a fire flow of 2000gpm shall be provided with a second FDC. Each FDC shall be independent of each other, with each FDC being capable of flowing 500gpm by engineered design standards. The second FDC shall be located in an area approved by the AHJ with the idea of multiple Fire apparatus'conducting drafting operations at once, in mind.

5) Inspection and maintenance shall be in accordance to NFPA 25.

6) The owner or lessee of the property shall be responsible for maintaining the water level, quality, and appurtenances of the system.

EXCEPTIONS TO SECTION 18.3.8:

1) Agricultural buildings, storage sheds, and shade houses with no combustible or equipment storage.

2) Buildings less than 800 square feet in size that meets the minimum Fire Department Access Road requirements.

3) For one and two family dwellings, agricultural buildings, storage sheds, and detached garages 800 to 2000 square feet in size, and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 1000 feet.

4) For one and two family dwellings, agricultural buildings, and storage sheds greater than 2000square feet, but less than 3000 square feet and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 500 feet.

5) For buildings with an approved automatic sprinkler system, the minimum water supply required may be modified.

If there are any questions regarding these requirements, please contact Deputy Fire Chief Robert Perreira at (808) 932-2902.

DARREN J. ROSARIO
Fire Chief

RP:nac

Email: planning@hawaiicounty.gov

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Darren Rosario, Fire Chief
County of Hawaiʻi
Hawaiʻi Fire Department
25 Aupuni Street
Hilo, HI 96720

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Rosario:

Thank you for the comment letter dated September 22, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comment.

Comment 1: The project should be in accordance with National Fire Protection Association (NFPA) 1, Uniform Fire Code, 2006 Edition.

> **Response 1:** The project would be compliant with all applicable codes and standards of the NFPA 1, Uniform Fire Code, 2006 Edition.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From:	ARTHUR FELIX <artfelix@verizon.net>
Sent:	Wednesday, September 30, 2020 3:10 AM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA Comments
Attachments:	KV;Arch;AF.pdf

Please see my attached email which describes my opposition to the Royal Vistas Housing Project on the basis of archeological concerns.

Arthur M. Felix

DECLARATION OF_ARTHUR M FELIX

I, ATHUR M FELIX, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 250 feet [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about the environmental impact of this project.

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment.

4. I am aware that this project will have serious impact on the immediate and surrounding area.

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation, among other errors.

6. A bare conclusion by the applicant or accepting authority that needed

infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, September 30, 2020.

Signature: Arthur M Frlix

Arthur M. Frlix:

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Arthur Felix
Via email: artfelix@verizon.net

RE: Comments on Drainage Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai‘i Island

Dear Mr. Felix:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. I am aware that this project will have serious impact on the immediate and surrounding area.

> **Response 1:** Kona Three LLC is not aware of any damage to adjoining properties, including Queen Ka‘ahumanu Highway, from water flowing from the subject property.

Comment 2: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

> **Response 2:** Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuana‘oa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan (CDP) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.
>
> Additionally, the text in Section 3.3.2 of the EA describes that Kona Three would prepare a Drainage Plan to ensure that development runoff would be

contained onsite. The Drainage Plan which would be reviewed and approved by the Department of Public Works (DPW). Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.

There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 3: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

Response 3: The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: ARTHUR FELIX <artfelix@verizon.net>
Sent: Wednesday, September 30, 2020 3:14 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA Comments
Attachments: KV;Drain;AF.pdf

Please see my attached email which describes my opposition to the Royal Vistas Housing Project on the basis of drainage concerns which concerns the entire area around this project.

Arthur M. Felix

136528

DECLARATION OF ARTHUR M. FELIX

I, ARTHUR M. FELIX, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 25 feet[distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about the cultural impact of this project

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku Stone, a copy of which is attached.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, September 30, 2020.

Signature: Arthur M. Felix

Arthur M. Felix

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Arthur Felix
Via email: artfelix@verizon.net

RE: Comments on Cultural Resource Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Felix:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I do not consider that the archaeological studies in support of the DEA are adequate. I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

> **Response 1:** As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Surveys (AISs) were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.
>
> Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the

same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 2: I base my concerns upon the evaluation performed by Tom Pohaku Stone, a copy of which is attached. The DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved. The DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 2: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of he'ehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	ARTHUR FELIX <artfelix@verizon.net>
Sent:	Wednesday, September 30, 2020 3:17 AM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA Comments
Attachments:	KV;Traffic;AF.pdf

Please see my attached email which describes my opposition to the Royal Vistas Housing Project on the basis of traffic concerns which will have a negative impact on the entire community.

Arthur M. Felix

136522

DECLARATION OF ARTHUR M. FELIX

I, ARTHUR M. FELIX, declare:

1. I am a resident of Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 250 feet[distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: September 30, 2020; Kailua-Kona, Hawai'i.

Signature: Arthur M Felix

Arthur M. Felix

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Arthur Felix
Via email: artfelix@verizon.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Felix:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 1:** Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 2:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multi-family housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the TIAR for the project is undercounting, but the project's TIAR report does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: malakied@hawaii.rr.com
Sent: Wednesday, September 30, 2020 8:31 AM
To: Planning Internet Mail
Subject: Proposed Royal Vistas Housing Project
Attachments: KV OWNERS Declaration re Traffic.pdf

COH PLANNING DEPT
SEP 30 2020 PM12:20

Please see attached.

Daniel Malakie

136526

DECLARATION OF TRAFFIC

I, Daniel Malakie, declare:

1. I am a resident of [/ Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 mile [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic

arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

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a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

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7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, Sept 30, 2020.

electronically signed

Signature: Daniel C. Malakie

Printed name:

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Daniel Malakie
Via email: malakied@hawaii.rr.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Malakie:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 1:** Specific comments for traffic impacts are discussed below.

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We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: malakied@hawaii.rr.com
Sent: Wednesday, September 30, 2020 8:37 AM
To: Planning Internet Mail
Cc: 'dbmkona@aol.com'
Subject: Proposed Royal Vistas Housing Project
Attachments: KV OWNERS Declaration re Traffic.pdf; KV OWNERS Declaration re drainage.pdf

Please see attached.

Daniel Malakie

DECLARATION OF TRAFFIC

I, Daniel Malakie, declare:

1. I am a resident of [__________ / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 mile [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic

arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, Sept 30, 2020.

electronically signed

Signature: Daniel C. Malakie
Printed name:

DECLARATION OF DRAINAGE

I, Daniel Malakie, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 mile [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: flooding, sewage and water table.

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. See pp. _________ thereof.

4. I am aware that [cite specific facts]:

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation, among other errors.

6. A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawaiʻi, Sept 30, 2020.

electronically signed

Signature: Daniel C. Malakie

Printed name:

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Daniel Malakie
Via email: malakied@hawaii.rr.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai‘i Island

Dear Mr. Malakie:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana‘oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana‘oa Place from Royal Vistas Phase I as designed as the connection of Kekuana‘oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana‘oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana‘oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

Response 3: Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

Response 4: The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

Response 5: Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 6: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 10: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. I am aware that this project will have serious impact on the immediate and surrounding area.

Response 10: The developer is not aware of any damage to adjoining properties, including Queen Kaʻahumanu Highway, from water flowing from the subject property.

Comment 11: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

Response 11: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. It describes that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system across the ditch to extend Kekuanaʻoa Street, which would then be dedicated to the County as required by Ordinance and called for in the KCDP "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the KDCP's "Official Transportation Map." Additionally, as described in Section 3.3.2 of the EA, Kona Three would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by DPW. There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 12: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

Response 12: The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From:	Micky <maureenfelix@verizon.net>
Sent:	Wednesday, September 30, 2020 3:29 AM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA Comments
Attachments:	KV;traffic;MF.pdf

COH PLANNING DEPT
SEP 30 2020 PM12:20

Please find my attached letter to the Hawaii County Planning Department which documents my concerns about the impact of the proposed Royal Vistas Housing Project on the traffic situation which is already overburdened.

Maureen Felix

136525

DECLARATION OF MAUREEN A. FELIX

I, MAUREEN A. FELIX, declare:

1. I am a resident of Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 250 feet [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report, are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: September 30, 2020; Kailua-Kona, Hawai'i.

Signature: Maureen A. Felix

Maureen A. Felix

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Maureen Felix
Via email: maureenfelix@verizon.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Felix:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

<u>Comment 3</u>: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **<u>Response 3</u>:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

<u>Comment 4</u>: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **<u>Response 4</u>:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

<u>Comment 5</u>: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **<u>Response 5</u>:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

<u>Comment 6</u>: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **<u>Response 6</u>:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum l 0% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: Micky <maureenfelix@verizon.net>
Sent: Wednesday, September 30, 2020 3:26 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA Comments
Attachments: KV;Drain;MF.pdf

The attached letter expresses my concern about the impact of the proposed Royal Vistas Housing Project on the drainage problems that already exist in the area.

Maureen A. Felix

136524

DECLARATION OF MAUREEN A. FELIX

I, MAUREEN A. FELIX, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 250 feet [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about the environmental impact of this project.

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment.

4. I am aware that this project will have serious impact on the immediate and surrounding area.

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation, among other errors.

6. A bare conclusion by the applicant or accepting authority that needed

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, September 30, 2020.

Signature: Maureen A. Felix

Maureen A.. Felix

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Maureen Felix
Via email: maureenfelix@verizon.net

RE: Comments on Drainage and Cultural Resource Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Felix:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the DEA. I am aware that this project will have serious impact on the immediate and surrounding area.

> **Response 1:** Kona Three LLC is not aware of any damage to adjoining properties, including Queen Ka'ahumanu Highway, from water flowing from the subject property.

Comment 2: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

> **Response 2:** Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuana'oa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan (CDP) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.
>
> Additionally, the text in Section 3.3.2 of the EA describes that Kona Three would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved

by Department of Public Works (DPW). Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.

There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 3: In sum, the DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved.

At a minimum, the DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 3: As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Survey (AIS) reports were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai‘i Planning Department

Mori, Ashley

From: Micky <maureenfelix@verizon.net>
Sent: Wednesday, September 30, 2020 3:22 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA Comments
Attachments: KV;.Arch;MFpdf.pdf

I am concerned about the archaeological impact of the proposed Royal Vistas Housing Project; please see my attached letter.

Maureen Felix

DECLARATION OF MAUREEN A. FELIX

I, MAUREEN A. FELIX, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 250 feet [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about the environmental impact of this project.

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment.

4. I am aware that this project will have serious impact on the immediate and surrounding area.

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation, among other errors.

6. A bare conclusion by the applicant or accepting authority that needed

infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, September 30, 2020.

Signature: Maureen A. Felix
Maureen A. Felix

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Maureen Felix
via email: maureenfelix@verizon.net

RE: Comments on Drainage Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Felix:

Thank you for the comment letter dated September 30, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. I am aware that this project will have serious impact on the immediate and surrounding area.

> **Response 1:** Kona Three LLC is not aware of any damage to adjoining properties, including Queen Ka'ahumanu Highway, from water flowing from the subject property.

Comment 2: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

> **Response 2:** Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuana'oa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan (CDP) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.
>
> Additionally, the text in Section 3.3.2 of the EA describes that Kona Three LLC would prepare a Drainage Plan to ensure that development runoff would be

contained onsite. The Drainage Plan which would be reviewed and approved by Department of Public Works (DPW). Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.

There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 3: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

Response 3: The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: joseph Visconti <javisconti@sbcglobal.net>
Sent: Thursday, October 01, 2020 11:33 AM
To: Planning Internet Mail
Cc: Christina♥♥♥♥ Visconti
Subject: Royal Vistas Housing Project EA comments
Attachments: JV Declaration.pdf

COH PLANNING DEPT
OCT 1 2020 PM3:56

Planning,

See attached declaration in opposition to the proposed development referred to above. I am very concerned about the additional traffic through our neighborhood, not just the safety issue but also, the increased road noise. The school bus pick up/drop off on our corner, Paulehia Street & Puapuaani Street is of additional concern as it is somewhat a blind corner.

Thank your for considering us and our neighbors,

Joe Visconti

75 6104 Paulehia Street

Kailua Kona, HI

136531

DECLARATION OF ______________

I, JOSEPH VISCONTI, declare:

1. I am a resident of Paulani Estates (subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

8. I am very concerned about the additional Traffic on our street and through our neighborhood from a safety and "noise" perspective.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10- 01 - , 2020.

Signature:
Printed name:
Joseph A Visconti

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Joseph Visconti
via email: javisconti@sbcglobal.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Visconti:

Thank you for the comment letter dated October 1, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 10: I am very concerned about the additional traffic on our street and through our neighborhood from a safety and "noise" perspective.

Response 10: Impacts to traffic and safety from the project are described in Section 3.7.2 of the EA, and project impacts from noise are described in Section 3.3.5.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Greg Olsen <gregolsen@earthlink.net>
Sent:	Thursday, October 01, 2020 1:44 PM
To:	Planning Internet Mail
Cc:	Greg Olsen
Subject:	Royal Vistas Housing Project EA comments
Attachments:	Kona Vistas Owners Declaration re Traffic.pdf

COH PLANNING DEPT
OCT 1 2020 PM3:56

Aloha:

My name is Greg Olsen. I own and live at 76-158 Kamehamalu Street, Lot 33. I'm attaching my declaration for use at the Planning Departments' review of the Royal Vistas project.

Mahalo,

Greg Olsen

136530

DECLARATION OF GREGORY OLSEN

I, GREGORY OLSEN, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 500' of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

2a. My concern is that new residents of Royal Vistas who work south of Lako will cut up Sunset Ave. to Leilani and then proceed to drive north to their homes in Royal Vistas. Leilani will become a "short cut" due to the traffic on Kuakini Highway at Lako so people will drive through Sunset and Kona Vistas on their way home from work/school. Our streets were not meant to handle that amount of traffic which will result in far more traffic driving home on residential roads not intended to handle the traffic. Children ride their bikes down the steep driveways, seniors walk along our roads, and people walk their dogs along all the roads of Kona Vistas. This behavior has evolved over time since our streets are quiet with little rushing traffic. The volume of traffic can only result in adverse conditions through the neighbors in Kona Vistas and Sunset.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL

ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. <u>Traffic impacts have been taken into careful consideration in project design.</u>" Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawaiʻi, __Oct. 1, 2020.

Signature: Gregory R. Olsen
Printed name: Gregory R. Olsen

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Gregory Olsen
Via email: gregolsen@earthlink.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Olsen:

Thank you for the comment letter dated October 1, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 1:** Specific comments for traffic impacts are discussed below.

Comment 2: My concern is that new residents of Royal Vistas who work south of Lako will cut up Sunset Ave. to Leilani and then proceed to drive north to their homes in Royal Vistas. Leilani will become a "short cut" due to the traffic on Kuakini Highway at Lako so people will drive through Sunset and Kona Vistas. The volume of traffic can only result in adverse conditions through the neighbors in Kona Vistas and Sunset.

> **Response 2:** While it is possible that after Kekuana'oa Place is connected in Phase II of the project, some residents could travel into the project site from the south by turning onto Sunset Avenue, then north on Leilani Street (or Pualani Street), then east on Lako Street, and then west on Kekuana'oa Place, this would represent the majority of traffic or where backups could occur. This is why the traffic study focused on impacts at the intersections identified in Section 3.7.2 and in Appendix 2 of the EA.

Comment 3: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **<u>Response 3</u>:** Kekuanaʻoa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuanaʻoa Place from Royal Vistas Phase I as designed as the connection of Kekuanaʻoa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuanaʻoa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuanaʻoa Place every 4 minutes for the peak periods, which would not cause congestion.

<u>Comment 4</u>: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **<u>Response 4</u>:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

<u>Comment 5</u>: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **<u>Response 5</u>:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

<u>Comment 6</u>: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **<u>Response 6</u>:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local

residential traffic. Delays to these intersections are not expected to be significant.

Comment 7: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 7: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 8: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

Response 8: It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 9: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

Response 9: The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 10: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 10:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai‘i Planning Department

Mori, Ashley

From:	Christina Visconti <christina_visc@sbcglobal.net>
Sent:	Thursday, October 01, 2020 6:16 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments
Attachments:	CV Declaration .pdf

COH PLANNING DEPT
OCT 2 2020 PM3:26

Planning,

See attached declaration in opposition to the proposed development referred to above. I am very concerned about the additional traffic through our neighborhood, not just the safety issue but also, the increased road noise. The school bus pick up/drop off on our corner, Paulehia Street & Puapuaani Street is of additional concern as it is somewhat a blind corner.

Thank your for considering us and our neighbors,

Christina Visconti
75-6104 Paulehia Street
Kailua Kona, HI 96740
(530)448-6907
"Peace I leave with you; my peace I give you. I do not give to you as the world gives. Do not let your hearts be troubled and do not be afraid."—JOHN 14:27

136534

DECLARATION OF ____________

I, CHRISTINA VISCONTI, declare:

1. I am a resident of Paulani Estates (subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

8. I am very concerned about the additional Traffic on our street and through our neighborhood from a safety and "noise" perspective.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10-1-2020, 2020.

Signature: Christina Visconti
Printed name: Christina Visconti
~~Joseph A Visconti~~

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Christina Visconti
75-6104 Paulehia Street
Kailua Kona, HI 96740
Via email: christina_visc@sbcglobal.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Visconti:

Thank you for the comment letter dated October 1, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

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an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 10: I am very concerned about the additional traffic on our street and through our neighborhood from a safety and "noise" perspective.

Response 10: Impacts to traffic and safety from the project are described in Section 3.7.2 of the EA, and project impacts from noise are described in Section 3.3.5.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T. L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Robert Harris <bobh.home@gmail.com>
Sent:	Thursday, October 01, 2020 5:19 AM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments
Attachments:	Declaration Of Traffic Concerns.pdf; Declaration Of Drainage Concerns.pdf; Declaration Of Archaeological Concerns.pdf

Aloha,

I have attached three declaration concerns for this project. I have also attached a letter (p. 5) to the declaration of traffic concern.

Mahalo for your time to consider my concerns.

With Aloha,

Robert D Harris
76-4323 Kekuanaoa Place
Kailua Kona, HI 96740-6958

DECLARATION OF TRAFFIC CONCERNS

I, Robert D. Harris, declare:

1. I am a resident of [Kekuanaoa Place / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 100 feet [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

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addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

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6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

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c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

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corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

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7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 1, 2020.

Signature: Robert Harris

Printed name: Robert D. Harris

See Attached Letter on next Page

October 1, 2020

RE: Royal Vistas Housing Project

Aloha,

My wife, Bonnie, and I have lived in Kona Vistas Subdivision for over two years. We very much enjoy our home and look forward too many more years of enjoyment. Our home is located on Kekuanaoa Place which currently is the only access to Royal Vistas Housing Project specified on the Royal Vistas' plans. When we purchased our lot almost four years ago, we were not informed of this project or Kekuanaoa Place as being the only access to the Royal Vistas Housing Project.

The Royal Vistas Housing Project owner presented to Kona Vistas' owners their plans for the Royal Vistas Housing Project and what it would look like. They had proposed two entrance/exits to their project from Kona Vistas and two entrance/exits from a subdivision on the north side of their project, Pualani Estates. One of the accesses from Kona Vistas, not Kekuanaoa Place, requires permission from the owner of the property for access the Royal Vistas which has been denied by the owner from my understanding. Also, the two accesses from Pualani Estates requires Royal Vistas to be granted access across a strip of land owned by another owner who has also denied Royal Vistas access to their project from my understanding. This only leaves Kekuanaoa Place in Kona Vistas as the only access to Royal Vistas Housing Project.

Since Queen K Highway is adjacent to Royal Vistas Housing Project there should be access from this highway and not from Kona Vistas Subdivision. Kona Vistas only access is from Queen K Highway by Lako St. for our subdivision with 200 homesites and two other subdivisions. Royal Vistas Housing Project is slated for 490 homes (Condos, some rental units and some purchased units). If Kona Vistas has only one access to its subdivision, why shouldn't Royal Vistas only access be Queen K Highway as well.

Why should Royal Vistas have an access through Kona Vistas and allow all their traffic, including the construction equipment traffic over the next 20 years of their development, to drive through Kona Vistas Subdivision? Royal Vistas Housing Project with 490 units has almost 2.5 times larger density and this traffic should not be funneled through Kona Vistas Subdivision via Kekuanaoa Place or any other street.

Mahalo for your time,

Robert D. Harris

76-4323 Kekuanaoa Place

DECLARATION OF Archaeological Concerns

I, Robert D. Harris, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 100 feet [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: Holualoa Slide Rock wall being damaged

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate. See pp. _________ thereof.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku

Stone, a copy of which is attached.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 1, 2020.

Signature: Robert D. Harris
Printed name: Robert D. HARRIS

DECLARATION OF Drainage Concerns

I, Robert D. Harris, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 100 feet [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: Drainage interruptions

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. See pp. _________ thereof.

4. I am aware that [cite specific facts]:

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation, among other errors.

6. A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 1, 2020.

Signature:

Printed name: Robert D. Harris

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Robert Harris
76-4323 Kekuanaʻoa Place
Kailua-Kona, HI 96740
Via email: bobh.home@gmail.com

RE: Comments on Drainage Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Harris:

Thank you for the comment letter dated October 1, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 1:** Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 2:** Kekuanaʻoa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuanaʻoa Place from Royal Vistas Phase I as designed as the connection of Kekuanaʻoa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuanaʻoa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuanaʻoa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TTIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

<u>Comment 7</u>: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **<u>Response 7</u>:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

<u>Comment 8</u>: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum I 0% variation generally accepted in day-to-day measurements and thus unreliable.

> **<u>Response 8</u>:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

<u>Comment 9</u>: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **<u>Response 9</u>:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 10: Our home is located on Kekuanaoa Place which currently is the only access to Royal Vistas Housing Project specified on the Royal Vistas' plans. When we purchased our lot almost four years ago we were not informed of this project or Kekuanaoa Place as being the only access to the Royal Vistas Housing Project.

Response 10: The project would be accessed in two different ways. As described in Section 3.7.2 of the EA, Kona Three LLC proposes to construct a new intersection Royal Vistas Roadway at the project's intersection with Queen Ka'ahumanu. The second access point would be from Kekuana'oa Place, which would not occur until Phase II of the project. Figure 2 has been revised to show that access to the project site would be connected to Kekuana'oa Place from Lako Street during Phase II of the project. At project completion, there would be two ways to access the project.

Comment 11: The Royal Vistas Housing Project owner presented to Kona Vistas' owners their plans for the Royal Vistas Housing Project and what it would look like. They had proposed two entrance/exits to their project from Kona Vistas and two entrance/exits from a subdivision on the north side of their project, Pualani Estates. One of the accesses from Kona Vistas, not Kekuanaoa Place, requires permission from the owner of the property for access the Royal Vistas which has been denied by the owner from my understanding. Also, the two accesses from Pualani Estates requires Royal Vistas to be granted access across a strip of land owned by another owner who has also denied Royal Vistas access to their project from my understanding. This only leaves Kekuanaoa Place in Kona Vistas as the only access to Royal Vistas Housing Project.

Response 11: The plans for access into the development have evolved over time based on discussions with various stakeholders. Section 2.3 of the EA describes how access from Pualani Estates from Paulehia Street was an alternative considered but eliminated from detailed analysis. The project as described in Section 1.2 and analyzed in this EA for approval presents two access points for the project, from a new intersection (Royal Vistas Roadway at the project's intersection with Queen Ka'ahumanu) in Phase I and from Kekuana'oa Place in Phase II.

Comment 12: Since Queen K Highway is adjacent to Royal Vistas Housing Project there should be access from this highway and not from Kona Vistas Subdivision. Kona Vistas only access is from Queen K Highway by Lako Street for our subdivision with 200 homesites.

Response 12: A small number of 'left turn out' (southbound) vehicles will be pushed through Kekauna'oa Place and Lako Street. For emergency reasons, it would be beneficial if more than one access is provided to any development.

The master plan for this area shows connector streets parallel to Queen Ka‘ahumanu Highway through these developments to purposely provide connectivity redundant to Queen Ka‘ahumanu Highway. This is not a new or recent concept in the area.

Comment 13: I have reviewed the pending Draft Environmental Assessment and attachments. I am specifically concerned about the Holualoa Slide rockwall being damaged.

I do not consider that the archaeological studies in support of the DEA are adequate. I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

Response 13: As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Survey (AIS) reports were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. No hōlua slide has been identified in the project site.

Comment 14: I base my concerns upon the evaluation performed by Tom Pohaku Stone, a copy of which is attached. The DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved. The DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 14: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of heʻehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

Comment 15: I have reviewed the pending Draft Environmental Assessment and attachments. I am specifically concerned about drainage interruptions.

Response 15: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuanaʻoa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan's (CDP's) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the Kona CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.

Additionally, the text in Section 3.3.2 describes that Kona Three would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by Department of Public Works, and there would be no drainage interruptions.

Comment 16: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. I am aware that this project will have serious impact on the immediate and surrounding area.

Response 16: Kona Three LLC is not aware of any damage to adjoining properties, including Queen Ka'ahumanu Highway, from water flowing from the subject property.

Comment 17: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

Response 17: There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 18: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

Response 18: The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

RCVD COH PLANNING DEPT
OCT 2 '20 PM3:16

HAND DELIVERED

October 3, 2020

Planning Department

County of Hawaii

74-5044 Ane Keoholalole Highway Bldg E

Kailua Kona, HI 96740

RE: ROYAL VISTA Housing Project EA comments

Dear Planning Department Officials:

I am submitting to you my comments regarding the Royal Vista Housing Project EA. I am opposed to the project as it is currently proposed. My husband and I are full time residents of Hawaii and I have attached my comments regarding the EA. Further, I fully concur with the detailed comments that have been submitted by the Kona Vista Homeowners Association and Board.

Sincerely

Margaret Donnellan Todd

76-151 Kamehamalu

Kailua Kona. HI 96740

MDT@JPS.NET

562 879-0546(cell)

136521

JD

RCVD COH PLANNING DEPT
OCT 2 '20 PM3:17

HAND DELIVERED

DECLARATION OF ____________

I, MARGARET DONNELLAN TODD, declare:

1. I am a resident of 76-151 Kamehamalu St Kailua Kona / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within approximately two blocks of the boundaries of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71. I am also concerned that the mitigations for ingress/egress in emergency situations is inadequate.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight

distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald

conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 3, 2020.

Signature:

Printed name: Margaret Donnellan Todd

RCVD COH PLANNING DEPT
OCT 2 '20 PM3:17

HAND DELIVERED

DECLARATION OF ______________________

I, MARGARET DONNELLAN TODD, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within approximately two blocks of the proposed land development project (76-151 Kamehamalu St.). In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: the proposal's failure to adequately address drainage and runoff issues including the increased potential for adverse weather events resulting from climate change. Prudent planning requires that new developments are planned to address the potential increase in adverse weather events.

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment

4. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation,

among other errors.

5. A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i , October3, 2020.

Signature: Margaret Donnellan Todd
Printed name: Margaret Donnellan Todd

RCVD COH PLANNING DEPT
OCT 2 '20 PM3:17

HAND DELIVERED

DECLARATION OF ____________________

I, MARGARET TODD, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within approximately two blocks (76-151 Kamehamalu St. Kailua Kona) of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: inadequate assessment of archealogical features .

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku Stone, a copy of which is attached.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 3, 2020.

Signature:
Printed name: Margaret Donnellan Todd

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Margaret Donnellan Todd
76-151 Kamehamalu
Kaulia-Kona, HI 96740

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Ms. Donnellan Todd:

Thank you for the comment letter dated October 3, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR. I am also concerned that the mitigations for ingress/egress in emergency situations is inadequate.

> **Response 1:** As described in Section 3.7.2 of the EA, Kona Three LLC proposes to construct a new intersection Royal Vistas Roadway at the project's intersection with Queen Ka'ahumanu. This intersection would be built to County and State standards, and dedicated to the County. Additionally, Figure 2 in the EA has been revised to show that access to the project site would be connected to Kekuana'oa Place from Lako Street during Phase II of the project. At project completion, there would be two ways to access the project. This is consistent with access of other communities in Kona.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 2:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to

Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuanaʻoa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuanaʻoa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

Response 3: Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

Response 4: The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

Response 5: Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 6: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

Response 7: It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

Response 8: The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

Response 9: The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 10: I am specifically concerned about: the proposal's failure to adequately address drainage and runoff issues including the increased potential for adverse weather events resulting from climate change.

Response 10: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuana'oa Street, which would then be dedicated to the County as required by Ordinance and called for in the KCDP "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the KDCP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.

Additionally, the text in Section 3.3.2 of the EA describes that Kona Three LLC would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by Department of Public Works.

Comment 11: The steep topography, historical rapid storm water run-off and associated damage resent hazards that are not adequately addressed in the DEA.

Response 11: Queen Ka'ahumanu Highway is owned and maintained by the State of Hawai'i, together with the two culvert systems traversing Queen Ka'ahumanu Highway which transport the floodwaters of Holualoa Ditch and Horseshoe Bend Ditch below Queen Ka'ahumanu Highway. The State has not indicated any problems with being able to maintain the highway or the culverts, and the proposed project would not increase the amount of water in the ditches (per Section 27-20 of the Hawaii County Code).

Additionally, Kona Three LLC is not aware of any damage to adjoining properties, including Queen Ka'ahumanu Highway, from water flowing from the subject property.

Comment 12: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

> **Response 12:** See response to comment 10. Also, the Drainage Plan which would be reviewed and approved by DPW. Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.
>
> There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 13: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

> **Response 13:** The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

Comment 14: I am specifically concerned about the inadequate assessment of archaeological features, and don't consider that the archaeological studies in support of the DEA are adequate. I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

> **Response 14:** As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Survey (AIS) reports were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.
> Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to

similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 15: I base my concerns upon the evaluation performed by Tom Pohaku Stone, a copy of which is attached. The DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved. The DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 15: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of heʻehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai‘i Planning Department

Mori, Ashley

From: Yee, Michael
Sent: Friday, October 02, 2020 1:57 PM
To: Mori, Ashley
Subject: FW: Comments on Royal Vistas proposed project
Attachments: Royal Vistas comments_final.pdf

Please intake to Jeff.

From: Gary East <gweast2@gmail.com>
Sent: Friday, October 02, 2020 1:12 PM
To: Yee, Michael <Michael.Yee@hawaiicounty.gov>
Subject: Fwd: Comments on Royal Vistas proposed project

---------- Forwarded message ---------
From: **Gary East** <gweast2@gmail.com>
Date: Fri, Oct 2, 2020 at 12:53 PM
Subject: Comments on Royal Vistas proposed project
To: <planning@hawaiicounty.gov>

Aloha,

I wish to submit public comments on the Royal Vistas proposed project that are attached as a PDF file to this email.

Aloha Gary W. East
gweast2@gmail.com

136533

From: Gary W. East

To: planning@hawaiicounty.gov

Subject: Comments on Royal Vistas Housing Project
TMKs: (3) 7-6-021:016-019

Date: October 2, 2020

Aloha,

I am writing to submit public comments on the proposed development of the Royal Vistas Housing Project. I am a homeowner in the Pualani Estates subdivision located directly north of the anticipated project.

My greatest concern about the development is the lack of highway infrastructure currently in place to accommodate all of the additional traffic generated from 450 housing units. It is important to remember that the 450 housing units will contain 1,105 bedrooms when the project is complete.[1] The demographic for the occupants of these units will contribute to more than one driver per household thus compounding the total number of vehicles for each unit.

The Queen Ka'ahumanu Highway, Route11, that will provide access to the proposed development is only a two-lane road between Henry Street to the north and the Kamehameha III Road to the south. Traffic is currently highly congested in the morning and afternoon along this entire stretch of roadway. Hawaii county has planned for the reconstruction and widening of the roadway between Henry Street and Kam III in the future and I believe this investment in infrastructure must be completed before additional housing is constructed.

The Traffic Impact Analysis Report prepared for Kona Three LLC by SSFM International in May 2020 has provided an abundance of data to model the anticipated traffic generated by the proposed Royal Vistas project. However, the report is biased by selecting the dates for the traffic study of April 30, 2019 and August 29, 2019 when tourism for Hawaii Island is at historical lows as shown in figure 1 below

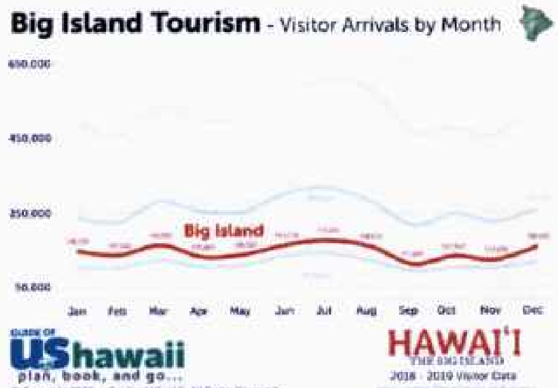

Figure 1

https://www.hawaii-guide.com/files/images/charts/big-island-visitor-arrivals.png

A more realistic assessment would have included the traffic associated with rental vehicles from visitors to this island.

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[1] Phase 1 contains 122 two bedroom units and 53 three bedroom units for a total of 400 bedrooms. Phase 2 contains 147 two bedroom units and 137 three bedroom units for a total of 705 bedrooms. Total bedrooms for the project are 1,105.

The SSFM document references the number of trips generated from The Institute of Transportation Engineers *Trip Generation*, 10th Edition (ITE, 2016). The ITE land use category 220 is described as multifamily housing low rise containing one or two floors and classification 221 is for multifamily housing containing three to ten floors. The proposed development is a combination of two and three story units so neither category completely describes the intended project.

The data listed Table 9: Estimated Trips Generated – Phase I on page 19 of the SSFM document is **very misleading** as the equation shown is for statistical analysis of a fitted curve for the **ITE data**. There is no Standard Deviation calculated, range of values or confidence interval rho indicated. The calculated trip numbers are not based on any of the local traffic data that is included in the SSFM document.

Table 9: Estimated Trips Generated - Phase 1

	AM		PM	
Land Use [ITE Code]	Equation		Equation	
Multi-family Housing (Low Rise) [220]	Ln (T) = 0.95 Ln (X) – 0.51		Ln (T) = 0.89*Ln (X) - 0.02	
Dwelling Units	258		258	
New Trips	117		137	
	In[2]	Out	In	Out
	23%	77%	63%	37%
	27	90	86	51

T = Total number of trips generated, X = Dwelling Units

Also, the AM and PM designations from ITE only relate to the number of trips between the hours of 7—9 AM and 4—6 PM. The total number of trips generated over a 24 hour period using the ITE data for 258 units is estimated to be about 1,700[2] and this is just phase I. For this reason, I believe it is imperative that the existing highway needs to be upgraded before this project is developed. Adding an additional 75% more units in phase II will have a large impact on the traffic generated by this project.

I also have some concerns about inadequacies and omissions from the draft Environmental Assessment submitted for the proposed Royal Vistas Housing Project to be developed by Kona Three LLC.

The new road that will provide access to the development off of a Queen Ka'ahumanu Highway appears to be 36 feet wide as shown on the scale drawing. In phase one, the access roads to the buildings and surface parking appear to be only 18 feet wide. The drawing indicates about 354 surface parking spaces are provided for the 258 units. Is this adequate for Hawaii County standards? Is this neighborhood intended to be walkable? I do not see any clear indication of sidewalks or streetlights. If this is the case, I think this is a big concern especially because the intended occupants of these units will certainly contain a high percentage of children. How are any residents supposed to access the park and swimming pool if there is no safe way to get to them? The park area for phase I looks to only have at most 15 parking spaces which appears to be inadequate.

The access roadways for phase two also appear restricted to a single lane 18 feet wide. How could two vehicles safely pass each other if they were traveling in the opposite direction? Again, I see no clear indication of sidewalks and streetlights for these units. Vehicle parking in phase two appears to be underserved. Is everyone living in these units expected to park inside of their garage? Many occupants of these two and three bedroom units will have additional vehicles and where are they expected to park them?

I have no way to judge the design of for rainwater mitigation except to say that the square footage of the upper portion is then compressed to what appears to be a relatively small 40 foot wide culvert. How deep is this structure required to be so that it can contain the runoff from the upper portion? And will this be fenced, or access restricted from the occupants of this development?

Aloha Gary East

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[2] The estimate was obtained using a spreadsheet from the Florida Department of Transportation with data from the 8th Edition ITE Trip Generation Report https://www.fdot.gov/planning/systems/documents/sm/

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Gary East
Via email: gweast2@gmail.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. East:

Thank you for the comment letter dated October 2, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: My greatest concern about the development is the lack of highway infrastructure currently in place to accommodate all of the additional traffic generated from 450 housing units. It is important to remember that the 450 housing units will contain 1,105 bedrooms when the project is complete. The demographic for the occupants of these units will contribute to more than one driver per household thus compounding the total number of vehicles for each unit.

> **Response 1:** The Institute of Transportation Engineers (ITE), Trip Generation Handbook referenced in the Traffic Impact Analysis Report (TIAR) (Appendix 2 in the EA) used for the traffic analysis uses housing units, and it does not assume one person per unit. This is taken from the ITE trip gen handbook regarding land use 220: 2.72 residents are assumed for each unit. There is no trip generation for number of bedrooms. It is difficult to analyze and make projections based on number of bedrooms, or how many people we expect in bedrooms. The ITE trip generation for land use 220 collected data on low-rise multi-family housing, and based on that data, the traffic model came up with a best fitted curve, which discussed below, has a very low standard deviation, and a very high R squared value, which indicated that the data collected is not scattered. The TIAR assumes a land use that is typical, and with the best possible data, captures the number of project generated trips.

Comment 2: The Queen Ka'ahumanu Highway, Route 11, that will provide access to the proposed development is only a two-lane road between Henry Street to the north and the Kamehameha III Road to the south. Traffic is currently highly congested in the morning and afternoon along this entire stretch of roadway. Hawaii county has planned for the reconstruction and widening of the roadway between Henry Street and Kam III in the future and I believe this investment in infrastructure must be completed before additional housing is constructed.

Response 2: The State's plans to widen Queen Ka'ahumanu Highway from Henry Street to Kamehameha III Road as a result of existing levels of traffic congestion have been contemplated for more than ten years. This improvement is listed in the 2035 long range transportation plan for the Big Island. However, the project's analysis was conducted with the 2-lane highway and levels-of-service at the signalized intersections were acceptable.

Comment 3: The TIAR provided an abundance of data to model the anticipated traffic generated by the proposed project. However, the report is biased by selecting the dates for the traffic study of April 30, 2019 and August 29, 2019 when tourism for Hawaii Island is at historical lows. A more realistic assessment would have included the traffic associated with rental vehicles from visitors to this island.

Response 3: Based on the numbers for the 2018-2019 monthly tourism numbers, August 2019 had the 4th highest visitor total and April 2019 had the 10th highest visitor total. This is consistent with the information you provided. For all islands, the pattern is similar with high visitor volume in June through August, December, and March which corresponds to summer break, winter break, and spring break. These are when school is not in session, so visitor traffic is high as people travel more. When school is out, typically the overall traffic volume during the AM and PM peak hour is lower. Generally, traffic counts are taken during "worst case" scenarios, which are historically on Tuesday through Thursday during school days. This is information we know, and we purposely target school days as when we take our traffic counts. While tourism numbers may be low, the intensity of the peak during the AM and PM school day peaks are generally more intense than the AM and PM peak during non-school days. Here is the HDOT station on Queen Kaahumanu Highway in 2016. It shows that the monthly weekday average is very close to the yearly weekday average. The standard that traffic engineers use is the school day peak; therefore, the counts taken in April and August are defendable.

Comment 4: The TIAR references the number of trips generated from the Institute of Transportation Engineers Trip Generation, 10th Edition (ITE, 2016). The ITE land use category 220 is described as multifamily housing low rise containing one or two floors and classification 221 is for multifamily housing containing three to ten floors. The proposed development is a combination of two and three story units so neither category completely describes the intended project.

Response 4: The project proposes mostly 1- to 3-story buildings. The traffic engineer reviewed low-rise and mid-rise multi-family housing options. Mid-rise, Land use 221, would actually provide lower numbers than Low-Rise. Therefore, the trip generation utilized in the traffic analysis is more conservative. The project's density does not correspond with high-rise multi-family housing, Land Use 222. Therefore, the trip generation used in the analysis is appropriate.

Comment 5: The data listed Table 9: Estimated Trips Generated - Phase I on page 19 of the SSFM document is very misleading as the equation shown is for statistical analysis of a fitted curve for the ITE data. There is no Standard Deviation calculated, range of values or confidence interval rho indicated. The calculated trip numbers are not based on any of the local traffic data that is included in the SSFM document.

> **Response 5:** The fitted curve is available when there are "enough" data points to determine a best fitted curve. If there are not enough data points, the ITE trip generation will have only an average rate, but the best fitted curve is generally a more accurate projection based on actual data points collected. The standard deviation was not provided in the TIAR. As shown in the figure below shows the standard deviation of 0.12, which indicates that the fitted curve will generate outputs really close to the overall mean. The R squared value is 0.90, which also indicated that the regression prediction is very close to the collected data. Therefore, the best fitted curve is the correct curve to use when available, and the traffic engineer is confident in the number selected.

Comment 6: Also, the AM and PM designations from ITE only relate to the number of trips between the hours of 7-9 AM and 4-6 PM. The total number of trips generated over a 24 hour period using the ITE data for 258 units is estimated to be about 1,7002 and this is just phase I. For this reason, I believe it is imperative that the existing highway needs to be upgraded before this project is developed. Adding an additional 75% more units in phase II will have a large impact on the traffic generated by this project.

> **Response 6:** While it is accurate that the 24-hour traffic is higher than the AM and PM peak hour traffic generated by the project, the AM and PM peak hours are when traffic is at its worse. The TIAR looks to provide mitigation during the worst traffic periods. The overall traffic on Queen Kaahumanu Highway is much lower during the non-peak hours. Figure 4 in the TIAR shows the 24-hour volume on Queen Kaahumanu Highway between Nani Kailua Drive and Hualalai Road. This chart shows the AM and PM peak periods, with lower midday volumes, and much lower volumes before the AM peak and after the PM peak.

Comment 7: The new road that will provide access to the development off of a Queen Ka'ahumanu Highway appears to be 36 feet wide as shown on the scale drawing. In phase one, the access roads to the buildings and surface parking appear to be only 18 feet wide. The drawing indicates about 354 surface parking spaces are provided for the 258 units. Is this adequate for Hawaii County standards? Is this neighborhood intended to be walkable? I do not see any clear indication of sidewalks or streetlights. Vehicle parking in phase two appears to be underserved. Is everyone living in these units expected to park inside of their garage?

> **Response 7:** As designated on Figure 3 of the EA, the layout and number of buildings and parking spaces are conceptual. The final number of parking spaces will determined upon final identification of unit mix (i.e., number of 2-bedroom and 3-bedroom units), and will have the number of parking spaces as required by Hawaii County Code and zoning ordinance based on the numbers of each unit type. Regarding sidewalks, the text in Section 1.2 of the EA has been revised to clarify that the road segments that would be built to dedicable

standards would include sidewalks and curved gutters. Regarding walkability, the text in Section 1.2 of the EA has been revised to clarify that private driveways in the development would be paved and provide safe access to residents (including streetlights), and that walk paths within the development would be identified upon final design.

Comment 8: I have no way to judge the design of for rainwater mitigation except to say that the square footage of the upper portion is then compressed to what appears to be a relatively small 40 foot wide culvert. How deep is this structure required to be so that it can contain the runoff from the upper portion? And will this be fenced, or access restricted from the occupants of this development?

> **Response 8:** As discussed in the EA, the project would not contribute or exacerbate the flooding issues from the project. To prevent these issues (described in Section 3.3.2), the project would prepare a Drainage Plan in accordance with Chapter 27 of the Hawaii County Code which would be reviewed and approved by DPW. As required by Chapter 27, runoff from the project site would not be directed toward adjacent properties (both private and County-owned) and the development would not alter the drainage pattern above or below the development. This plan would be submitted as part of the grading plan submittal prior to project construction. The text in Section 3.3.2 of the EA has been revised to clarify what is required as part of Chapter 27 of the Hawaii County Code for developments regarding containment of runoff. To ensure public safety, any structures constructed to manage runoff as identified in the Drainage Plan would be compliant with County requirements, with public access restricted.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From:	Candace Hallett <hallettcj@gmail.com>
Sent:	Saturday, October 03, 2020 11:33 AM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments
Attachments:	Royal Vistas Declaration - Traffic - Candy.pdf

COH PLANNING DEPT
OCT 5 2020 AM8:07

Please find attached affidavit on behalf of
Candace J Hallett, residing at 76-156 Kamehamalu St., Lot#2632
Thank you for your consideration.
Candace Hallett

136519

DECLARATION OF CANDACE J HALLETT________

I, _CANDACE J HALLETT___________, declare:

1. I am a resident of [76-156 Kamehamalu St / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within __500 feet________ [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

2.a The potential for new residents of Royal Vistas to use Sunset Ave and Leilani St. as a cut-through to Kekuana'oa Place poses a real threat to the residents of Kona Vistas. Streets within Kona Vistas were not meant to handle high volumes of traffic. In addition, our residents regularly walk along our roads, walk their dogs and children ride their bikes all on our streets since we do not have sidewalks. The increased volume of traffic due to the influx of residents in Royal Vistas can only have adverse effects for the residents of Kona Vistas and those living on Sunset.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and

15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, ____October 3, 2020.

Signature:

Printed name: Candace J Hallett

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Candace Hallett
Via email: hallettcj@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Hallett:

Thank you for the comment letter dated October 3, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 1:** Specific comments for traffic impacts are discussed below.

Comment 2: The potential for new residents of Royal Vistas to use Sunset Ave and Leilani St. as a cut-through to Kekuana'oa Place poses a real threat to the residents of Kona Vistas. Streets within Kona Vistas were not meant to handle high volumes of traffic. In addition, our residents regularly walk along our roads, walk their dogs and children ride their bikes all on our streets since we do not have sidewalks. The increased volume of traffic due to the influx of residents in Royal Vistas can only have adverse effects for the residents of Kona Vistas and those living on Sunset.

> **Response 2:** While it is possible that after Kekuana'oa Place is connected in Phase II of the project, some residents could travel into the project site from the south by turning onto Sunset Avenue, then north on Leilani Street (or Pualani Street), then east on Lako, and then west on Kekuana'oa Place, this would represent the majority of traffic or where backups could occur. This is why the traffic study focused on impacts at the intersections identified in Section 3.7.2 and in Appendix 2 of the EA.

Comment 3: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **<u>Response 3</u>:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

<u>Comment 4</u>: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuana'oa Place.

> **<u>Response 4:</u>** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuana'oa Place, the number of vehicles projected to use Kekauna'oa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

<u>Comment 5</u>: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **<u>Response 5</u>:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

<u>Comment 6</u>: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **<u>Response 6</u>:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local

residential traffic. Delays to these intersections are not expected to be significant.

Comment 7: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 7: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 8: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

Response 8: It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 9: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

Response 9: The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 10: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 10:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: Candace Hallett <hallettcj@gmail.com>
Sent: Saturday, October 03, 2020 11:29 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA comments
Attachments: Royal Vistas Declaration - Traffic - Ron.pdf

Please find attached an affidavit on behalf of
Ronald R Hallett residing at 76-156 Kamehamalu St., Lot #2632
Thank you for your consideration.
Ronald Hallett

DECLARATION OF _RONALD R HALLETT________

I, _RONALD R HALLETT____________, declare:

1. I am a resident of [76-156 Kamehamalu St / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within __500 feet________ [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

2.a The potential for new residents of Royal Vistas to use Sunset Ave and Leilani St. as a cut-through to Kekuana'oa Place poses a real threat to the residents of Kona Vistas. Streets within Kona Vistas were not meant to handle high volumes of traffic. In addition, our residents regularly walk along our roads, walk their dogs and children ride their bikes all on our streets since we do not have sidewalks. The increased volume of traffic due to the influx of residents in Royal Vistas can only have adverse effects for the residents of Kona Vistas and those living on Sunset.

2.b. I am a senior with health issues and limited mobility so the increased traffic definitely poses a serious threat to me personally.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL

ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. <u>Traffic impacts have been taken into careful consideration in project design.</u>" Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

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7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, ____October 3, 2020.

Signature: ________________
Printed name: Ronald R Hallett

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Candace Hallett
Via email: hallettcj@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Hallett:

Thank you for the comment letter dated October 3, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

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Response 1: Specific comments for traffic impacts are discussed below.

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We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: Ed and Janet Tong <jtong60091@gmail.com>
Sent: Sunday, October 04, 2020 8:04 PM
To: Planning Internet Mail
Subject: Royal Vistas
Attachments: Royal Vistas.pdf

COH PLANNING DEPT
OCT 5 2020 AM8:05

Please find my declarations regarding the proposed Royal Vistas development below.

Edward Tong

136520

DECLARATION OF

I, EDWARD TONG, declare:

1. I am a resident of [76-4305 KEKUANAOA PL / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 block [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

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7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, OCTOBER 4, 2020.

Signature:
Printed name: EDWARD TONG

DECLARATION OF

I, Edward Tong, declare:

76-4305 Kekuanaoa Place

1. I am a resident of Kona Vistas, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 block [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: drainage.

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. See pp. ________ thereof.

4. I am aware that [cite specific facts]:

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation, among other errors.

6. A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 4, 2020.

Signature: Edward Tong

Printed name: Edward Tong

DECLARATION OF

I, Edward Tong, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 block [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: archaeological significance.

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate. See pp. ________ thereof.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku

Stone, a copy of which is attached.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 4, 2020.

Signature:
Printed name: Edward Tong

Below are communications with
Mr. Tom Pohaku Stone about the twin walls and the slide with a Kona Vista Board members

Below are communications with Mr. Tom Pohaku Stone about the twin walls and the slide with a Kona Vista Board members

On Mon, Jul 1, 2019, 8:55 AM Tom Pohaku Stone <> wrote:

To answer the question regarding the walls -YES. Not all hōlua slides had walls but nearly all those on Hawai'i Island do. The purpose was to hold the rock in the slide in some sections and in areas that needed to be raised. When you mention moving of logs from mauka-makai that is an important point because the koa forest line was at a lower elevation when we were gathering the great trees for our wa'a, papahe'enalu, etc. This was the main purpose of the slides thousands of years ago, which overtime changed to reflect an association to the gods of the wao kele (upland forest) and the spirituality we connected with then and now. The physical cultural landscape found of the hōlua slides is the telling of the story what made these specific areas important to our cultural practices especially since this massive complex is connected to Pa'ao, his lineage, and the great Ali'i Nui of this mokupuni (island). There were several significant complexes along this coastline but none as grandeur. Kaneakā in Keauhou/Kahalu'u is another. Waha'ula, Mo'okini, and Kahikinui (Maui) were the earlier complexes established for migration purposes and the change in religion. The Hōlualoa complex solidifies the complete adaptation to the established religion of Pa'ao.

On Mon, Jul 1, 2019 at 8:15 AM john

Tom,

Thank you for taking the time to educate me. It is greatly appreciated. The history of Holualoa is truly remarkable, and I know I have only scratched the surface.

One question I have, the intact portion of the holua at the Holualoa inn has a rock wall on both sides. Would these walls have been built at the same time? Perhaps to keep the logs contained as they traveled down. I have found, in the proposed development area a section, of parallel rock walls. Do any of the other Holuas have walls?

I again thank you for all your help. Very respectful and grateful, John

On Mon, Jul 1, 2019, 6:35 AM Tom wrote:

Aloha John,

I know I have not been in contact for some time but I have been going through all my records and info for this area. You are not going to find much in any library about that slide because I'm the person who did the study of that area. A lot of development has changed the cultural landscape in the area over the years (past 200 yrs.) and with it my native cultural and architectural landscape so it's a puzzle. Hōlua has been part of my 'ohana and it has been my academic focus archaeologically and culturally. I have spent years providing cultural education to our community regarding the significane of the remaining architectural landscape. The effort is to integrate the cultural landscape into the development process if it will save the physical cultural landscape. With that said, there is a direct correlation between the "Hōlualoa slide, Keolonāhihi, Keākealaniwahine, Kamalumalu, Kealakowa'a, and Kamoa (Lyman)". The development of Kona over the years has separated (destroyed) the physical connection of the slide to the greater complex that had existed. The coastal area of this complex has now been protected but not the mauka sections that are still undeveloped. It's at this point the emphasize should be on protecting what is left of this great complex. We do know that Kamehameha I was trained in this complex which included learning to hōlua slide and surf. I would advise you to look at the greater picture and focus on what is left of the entire complex and how this would benefit the cultural history of Kona. Sorry I'm not on island to assist, but at this point I believe the development will destroy more. If you need someone with Hawaiian cultural/traditional architectural/archaeological background let me know. I can assist but if you need someone to do in-depth research, prepare presentations, or provide community education we can discuss this. Henry Kekahuna provided the most detailed archaeological record of this area. Knowledge, interpretation, and understanding of these cultural sites and how it's all intertwined is significant.

Me ka ha'aha'a
Tom Pōhaku Stone

--

Kanalu (K38) is a 501 c 3 non profit organization dedicated to cultural & ocean education based on traditions of our kupuna.

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Edward Tong
Via email jtong60091@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Tong:

Thank you for the comment letter dated October 4, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

<u>Comment 1</u>: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **<u>Response 1</u>:** Specific comments for traffic impacts are discussed below.

<u>Comment 2</u>: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **<u>Response 2</u>:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 10: I am specifically concerned about drainage. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. I am aware that this project will have serious impact on the immediate and surrounding area.

Response 10: Kona Three LLC is not aware of any damage to adjoining properties, including Queen Kaʻahumanu Highway, from water flowing from the subject property.

Comment 11: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

Response 11: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuanaʻoa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan's (CDP's) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.

Additionally, the text in Section 3.3.2 of the EA describes that Kona Three would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by Department of Public Works. Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.

There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 12: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

Response 12: The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

Comment 13: I am specifically concerned about archaeological significance. I do not consider that the archaeological studies in support of the DEA are adequate. I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

Response 13: As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Survey (AIS) reports were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 14: I base my concerns upon the evaluation performed by Tom Pohaku Stone, a copy of which is attached. The DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved. The DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 14: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of he'ehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Mark Powell <markp50@att.net>
Sent:	Tuesday, October 06, 2020 4:30 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments
Attachments:	Royal Vistas County docs.pdf

COH PLANNING DEPT
OCT 7 2020 AM9:23

Attached are 3 different comments about this project, Archaeological, Drainage, Traffic.
Mahalo
John

136584

DECLARATION OF ARCHAEOLOGICAL

I, JOHN POWELL, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within half a mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: the history and the undiscovered artifacts that could be lost. Very likely that more hand excavation is needed on the complete site. Only five acers was barely scratched doing light hand excavation which uncovered many things.

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate thereof.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku Stone.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels and other historical artifacts.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10/6/2020, 2020.

Signature: John Powell
Printed name:

DECLARATION OF DRAINAGE

I, JOHN POWELL, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within Half Mile [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: drainage/runoff, water quality, groundwater recharge, flooding. There is no drainage plan that I could find. Projects need to have this plan first not after. These monster buildings appear to have major runoff that can add to the problem.

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment that I could find, thereof

4. I am aware that flooding has occurred Makai of the highway.

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation,

among other errors.

6. A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10/6/2020, 2020.

Signature: John Powell
Printed name:

DECLARATION OF TRAFFIC

I, JOHN POWEL, declare:

1. I am a resident of Kailua-Kona and live in the Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within a half mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to the grades, extreme curves and is narrow with no curbs, gutters, or sidewalks.

The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns. Royal Vistas road system should follow County standards of Mauka to Makai with a signalized intersection at the highway.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place with young children present..

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald

conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts throughout the entire Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10/6/2020, 2020.

Signature: John Powell
Printed name:

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. John Powell
Via email: markp50@att.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Powell:

Thank you for the comment letter dated October 4, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I am specifically concerned about the history and the undiscovered artifacts that could be lost. Very likely that more hand excavation is needed on the complete site. Only five acres was barely scratched doing light hand excavation which uncovered many things.

> **Response 1:** As described in Section 3.6 and in Appendix 5 (Archaeological Inventory Survey [AIS] Reports) of the EA, the entire project site has been recently inventoried for archaeological resources. One inventory covered 76.1 acres and the other covered 5 acres. Section 3.6 includes a summary discussion of the findings for both surveys that cover the entire site, as well as a discussion of how potential impacts would be minimized. The reports have been submitted to SHPD for review and acceptance.

Comment 2: I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

> **Response 2:** As described in Section 3.6 and included in Appendix 5 of the EA, two AISs were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 3: I base my concerns upon the evaluation performed by Tom Pohaku Stone, a copy of which is attached. The DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved. The DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 3: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of heʻehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

Comment 4: I am specifically concerned about drainage/runoff, water quality, groundwater recharge, and flooding. There is no drainage plan that I could find. Projects need to have this plan first not after. These monster buildings appear to have major runoff that can add to the problem.

Response 4: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuanaʻoa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan's (CDP's) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.

Additionally, the text in Section 3.3.2 of the EA describes that Kona Three would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by Department of Public Works.

Comment 5: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. I am aware that this project will have serious impact on the immediate and surrounding area.

Response 5: Kona Three LLC is not aware of any damage to adjoining properties, including Queen Kaʻahumanu Highway, from water flowing from the subject property.

Comment 6: I am aware that flooding has occurred makai of the highway.

Response 6: Flooding has occurred *makai* of Queen Kaʻahumanu Highway from waters in the County-owned Holualoa Ditch and the Horseshoe Bend Ditch; however, as described in Section 3.3.2 of the EA, the proposed project would not be increasing the amount of water carried by these ditches from the entire drainage basin extending miles up-hill (above the proposed project).

Comment 7: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

Response 7:. See response to comment 4. Also, text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.

There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 8: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

> **Response 8:** The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

Comment 9: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 9:** Specific comments for traffic impacts are discussed below.

Comment 10: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no curbs, gutters, or sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns. Royal Vistas road system should follow County standards of Mauka to Makai with a signalized intersection at the highway.

> **Response 10:** As described in Section 1.2 of the EA, Kona Three LLC would extend County-owned Kekuana'oa Place and construct a new intersection Royal Vistas Roadway at the project's intersection with Queen Kaahumanu. The TIAR (Appendix 2), did not identify a signal warrant for the new intersection based on current and projected levels of growth. To ensure safety, Kekuana'oa Place and the new intersection would be built to County and State standards, and dedicated to the County. The Kekuana'oa Place extension constructed as part of this project would include sidewalks and curved gutters. To clarify when the Kekuana'oa Place connection would occur, Figure 2 has been revised to show that access to the project site would be connected to Kekuana'oa Place from Lako Street during Phase II of the project. Therefore, at project completion, there would be two ways to access the project and would alleviate impacts to any one entrance.

Comment 11: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuana'oa Place with young children present.

> **Response 11:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not

expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. The traffic analysis includes a detailed analysis of secondary traffic effects impacts (in Section 3.7.2 of the EA).

Comment 12: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

Response 12: The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 13: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

Response 13: Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 14: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 14: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 15: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

Response 15: It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 16: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 16:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 20: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 20:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: Joel Gimpel <alohafidlr@aol.com>
Sent: Wednesday, October 07, 2020 7:54 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project (TMK Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019) DEA comments

Dear Director Yee:

I humbly apologize for misspelling your name on the comments regarding the subject DEA that I submitted late yesterday.

Sincerely,

Joel Gimpel

Mori, Ashley

From:	Joel Gimpel <alohafidlr@aol.com>
Sent:	Tuesday, October 06, 2020 5:22 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project (TMK Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019) DEA comments

Dear Director Lee:

You may recall the comments I submitted on August 13 stating my many concerns over the shortcomings of the Traffic Impact Analysis in the subject DEA, and commenting on the problem of already overcrowded public schools serving the area that was not adequately addressed. I hereby express my thanks and appreciation for your decision to extend the deadline for comments because of the delayed notification. Accordingly, I had the opportunity to more carefully review the DEA and prepare the following comments and concerns regarding the archeological and cultural issues raised.

Because I live in and own a home in Pualani Estates, the 362-single family home subdivision several hundred yards north of the subject property, the pending DEA affects me and my family's personal and property interests. I am specifically concerned about the inadequacy of the archeological studies purporting to support the DEA because there is substantial evidence that the subject includes features of the Holualoa Slide, including rock walls, that are inadequately described as agricultural walls. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed. In short, the DEA doesn't contain facts and analysis sufficient to understand and preserve the important Hawai'ian cultural and archaeological features.

Mahalo for your careful consideration of these additional concerns.

Joel Gimpel
75-628 N. Mea Lanakila Pl.
Kailua-Kona, HI 96740
808/325-4991

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Joel Gimpel
75-628 N. Mea Lanakila Pl.
Kailua-Kona, HI 96740
Via email: alohafidlr@aol.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Gimpel:

Thank you for the comment letter dated October 6, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I am specifically concerned about the inadequacy of the archeological studies purporting to support the DEA because there is substantial evidence that the subject includes features of the Holualoa Slide, including rock walls, that are inadequately described as agricultural walls. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed. In short, the DEA doesn't contain facts and analysis sufficient to understand and preserve the important Hawai'ian cultural and archaeological features.

> **Response 1:** Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Bruce Kirschenbaum <brucek4555@gmail.com>
Sent:	Tuesday, October 06, 2020 10:28 AM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments
Attachments:	Kirschenbaum Declaration re Traffic 100120.docx; Kirschenbaum Declaration re archealogical features 10012020.docx

COH PLANNING DEPT
OCT 7 2020 AM9:21

To whom it may concern:

Attached to this email are two declarations concerning the Royal Vistas Development Draft Environmental Assessment submission. I would appreciate an email indicating receipt of the same for my records. Thank you for your consideration.

Bruce Kirschenbaum
360-904-9563
Kona Vistas Resident

136589

DECLARATION OF BRUCE KIRSCHENBAUM

I, BRUCE KIRSCHENBAUM, declare:

1. I am a resident of the Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within two blocks of the proposed land development project and live on Kukuanaoa Place, one of two main ingress/egress points to Royal Vistas. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

Today, the number of trips that passes directly in front of my house on Kukuanaoa Place is less than thirty per day. Kukuanaoa Place is a quiet residential street that "T's" into Lako Street. Per the roads and traffic plan for Royal Vistas, Kukuanaoa Place would be used as one of the two major ingress/egress points to service traffic for the 450-unit subdivision. Not being a traffic expert, but assuming each of the 450 units owns 1.5 cars and each of those cars makes two trips in/out of the development per day and those trips equally use the main highway and Kukuanaoa Place as their thoroughfares for the trips, that would increase the traffic on Kukuanaoa Place from 30 to 675 trips per day. That's a 2,000% increase. How would you like to have the street you live on turned into a major roadway when it was never intended or designed for such a purpose. Why should the residents of Kukuanaoa Street and Kona Vistas bear the brunt of establishing essentially a solution to Royal Vistas traffic requirement? That simply is not fair and wrong in my view.

If you examine a similar development that is the next group of parcels directly to the North of Royal Vistas, Pualani Estates, Puapuaanui Street is the main and sole ingress/egress point for 100% of their traffic flow. There are no cross roads that have been used to offlay traffic to another area in order service their development. I believe the same concept should be used for Royal Vistas with all traffic routed through the new connection to the main Queen K highway.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

8. I wish to add a statement expressing my concerns for safety on the proposed roadway through Kona Vistas as well. As the street does not have sidewalks only lines separating the main road from the sideboards, the people who walk, children who play, bike riders, skateboard riders have little concern for their safety due to the very low residential neighborhood traffic that exists today. Once Kekuanaoa Place is opened to Royal Vistas and its almost a thousand trips per day, it would be extremely unsafe to enjoy the activities I just described especially with the fact the street is hilly and there are not unobstructed views of oncoming traffic or pedestrians. This could lead to a very dangerous situation in a residential neighborhood.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 1, 2020.

Signature:

Printed name: Bruce Kirschenbaum

76-4314 Kukuanaoa Place
Kailua-Kona, HI 96740
Brucek4555@gmail.com
360-904-9563

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Bruce Kirschenbaum
Via email: brucek4555@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Kirschenbaum:

Thank you for the comment letter dated October 6, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: Today, the number of trips that passes directly in front of my house on Kukuanaoa Place is less than thirty per day. Kukuanaoa Place is a quiet residential street that "T's" into Lako Street. Per the roads and traffic plan for Royal Vistas, Kukuanaoa Place would be used as one of the two major ingress/egress points to service traffic for the 450-unit subdivision. Not being a traffic expert, but assuming each of the 450 units owns 1.5 cars and each of those cars makes two trips in/out of the development per day and those trips equally use the main highway and Kukuanaoa Place as their thoroughfares for the trips, that would increase the traffic on Kukuanaoa Place from 30 to 675 trips per day. That's a 2,000% increase.

Response 2: Regarding the methods for calculating trips, the Institute of Transportation Engineers (ITE), Trip Generation Handbook referenced in the TIAR (Appendix 2 in the EA) used for the traffic analysis uses housing units, and it does not assume one person per unit. This is taken from the ITE trip gen handbook regarding land use 220: 2.72 residents are assumed for each unit. There is no trip generation for number of bedrooms. It is difficult to analyze and make projections based on number of bedrooms, or how many people we expect in bedrooms. The ITE trip generation for land use 220 collected data on low-rise multi-family housing, and based on that data, the traffic model came up with a best fitted curve, which discussed below, has a very low standard deviation, and a very high R squared value, which indicated that the data collected is not scattered. The TIAR assumes a land use that is typical, and with the best possible data, captures the number of project generated trips.

Comment 3: If you examine a simjlar development that is the next group of parcels directly to the North of Royal Vistas, Pualani Estates, Puapuaanui Street is the main and sole ingress/egress point for 100% of their traffic flow. There are no cross roads that have been used to offlay traffic to another area in order service their development. I believe the same concept should be used for Royal Vistas with all traffic routed through the new connection to the main Queen K highway.

> **Response 3:** As described in Section 3.7.2 of the EA, Kona Three LLC proposes to construct a new intersection Royal Vistas Roadway at the project's intersection with Queen Kaahumanu. As required by the County, and in accordance with Kona Community Development Plan (CDP), the major roads in Royal Vistas would be build and dedicated to the County. The County has long-range plans as outlined in the CDP Official Transportation Map for these dedicated roads to link Kona Vistas roads Leilani Street and Kekuanaʻoa Place to Pualani Estates' roads Hoʻomama Street and Paulehia Street respectively as part of their community connectivity policy. These roads are also planned to further extend to the north eventually. Additionally, Figure 2 has been revised to show that access to the project site would be connected to Kekuanaʻoa Place from Lako Street during Phase II of the project. At project completion, there would be two ways to access the project and according to the traffic analysis would serve the needs of the project without exacerbating regional traffic.

Comment 4: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 4:** Kekuanaʻoa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuanaʻoa Place from Royal Vistas Phase I as designed as the connection of Kekuanaʻoa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuanaʻoa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuanaʻoa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 5: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 5:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 6: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 6:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 7: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 7:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 8: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 8:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

<u>Comment 9</u>: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **<u>Response 9</u>:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

<u>Comment 10</u>: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **<u>Response 10</u>:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

<u>Comment 11</u>: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **<u>Response 11</u>:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 12: I am concerned about safety on the proposed roadway through Kona Vistas as well. As the street does not have sidewalks only lines separating the main road from the sideboards, the people who walk, children who play, bike riders, skateboard riders have little concern for their safety due to the very low residential neighborhood traffic that exists today. Once Kekuanaoa Place is opened to Royal Vistas and its almost a thousand trips per day, it would be extremely unsafe to enjoy the activities I just described especially with the fact the street is hilly and there are not unobstructed views of oncoming traffic or pedestrians. This could lead to a very dangerous situation in a residential neighborhood.

Response 12: As described in Section 1.2 of the EA, Kona Three LLC would extend County-owned Kekuanaʻoa Place and construct a new intersection Royal Vistas Roadway at the project's intersection with Queen Kaahumanu. These roads would be built to County and State standards, and dedicated to the County. The Kekuanaʻoa Place extension constructed as part of this project would include sidewalks and curved gutters. To clarify when the Kekuanaʻoa Place connection would occur, Figure 2 in the EA has been revised to show that access to the project site would be connected to Kekuanaʻoa Place from Lako Street during Phase II of the project. Therefore, at project completion, there would be two ways to access the project and would alleviate impacts to any one entrance.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele J L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

COH PLANNING DEPT
OCT 7 2020 AM9:22

From:	Bonnie Miki <kinaust2@gmail.com>
Sent:	Tuesday, October 06, 2020 5:38 PM
To:	Planning Internet Mail
Cc:	dbmkona@aol.com; Joan & Mark Powell
Subject:	Royal Vista Housing Project EA comments
Attachments:	img005.pdf; ATT00001.htm; img006.pdf; ATT00002.htm; img007.pdf; ATT00003.htm; img008.pdf; ATT00004.htm; img009.pdf; ATT00005.htm

136588

<u>DECLARATION OF JOHN GERALD MIKI</u>

I, JOHN GERALD MIKI declare:

1. I am a resident of 76-4344 Kinau Street / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 100 Yards of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

At 82 years old, I spent summers during WWII with other kids, playing in front of my Chinese grandparents grocery stores in Honaunau on Mamalahoa Highway, the only level area between the pahoehoe and a'a lava roadside. Only an occasional sampan taxi carrying tourists from Hilo to the Kona Inn or Dr. Hiyashi making house calls in his Model T interrupted our play. Now, 75 years later, our South Kona ohana relations complain that endless traffic makes it hard to enter the two-lane road to go to work, doctor or the grocery store.

After retiring to our Komohana home off Lako Street in 1990, my wife and I watched the traffic turn into gridlock where Kuakini Highway intersects Queen Ka'ahumanu Highway. Auwe! Now Kona Three LLC wants to build a 450 unit subdivision which will add 900 plus cars into the two-lane vehicle crawl stretching from Captain Cook to Palani Road.

Using an outdated 1983 EIS, Kona Three request access through narrow residential streets in Kona Vistas and Pualani Estates. Issues not adequately addressed include traffic safety and density, emergency vehicle access, kids disembarking from school busses, the lack of curbs and sidewalks required by code, impatient drivers cutting through Pualani Estates, Kona Vistas, and Sunset subdivisions to bypass gridlock, and merging mauka and makai traffic from Lako Street onto Queen Ka'ahumanu Highway. In addition, the original easement for Sunset Subdivision's Leilani Street was only 40 feet wide. To provide safe access for modern emergency ambulance and fire trucks, plus access for underground utilities, cable and electric lines, etc., the easement for Leilani Street was widened to 60 feet when Kona Vistas portion was built. It is hazardous if emergency vehicles, encountering traffic accident gridlock on Queen Ka'ahumanu Highway or Lako Street, are forced to enter the proposed Royal Vistas subdivision through Sunset's narrow portion of Leilani Street to quell a fire and/or save lives.

We're not against development. But the people of West Hawaii need affordable housing with reasonable access to and from work, rather than another developer building more million dollar homes for wealthy snowbirds. We need a wider highway, not 900 more cars, trucks and vans choking our two-lane Queen Ka'ahumanu Highway while we sit in gridlock.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents alon Kekuana'oa Place. I consider the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and

15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 6 October , 2020.

Signature: John G Miki

John Gerald Miki
Colonel USAF (retired)

5 of 5 JGMiki

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. John Gerald Miki
Via email: kinaust2@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Miki:

Thank you for the comment letter dated October 6, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: After retiring to our Komohana home off Lako Street in 1990, my wife and I watched the traffic turn into gridlock where Kuakini Highway intersects Queen Ka'ahumanu Highway. Using an outdated 1983 EIS, Kona Three request access through narrow residential streets in Kana Vistas and Pualani Estates. Issues not adequately addressed include traffic safety and density, emergency vehicle access, kids disembarking from school busses, the lack of curbs and sidewalks required by code, impatient drivers cutting through Pualani Estates, Kona Vistas, and Sunset subdivisions to bypass gridlock, and merging mauka and makai traffic from Lako Street onto Queen Ka'ahumanu Highway.

In addition, the original easement for Sunset Subdivision's Leilani Street was only 40 feet wide. It is hazardous if emergency vehicles, encountering traffic accident gridlock on Queen Ka'ahumanu Highway or Lako Street, are forced to enter the proposed Royal Vistas subdivision through Sunset's narrow portion of Leilani Street to quell a fire and/or save lives.

Response 2: Kona Three is not requesting access through Pualani Estates. As described in Section 1.2 of the EA, Kona Three LLC would extend County-owned Kekuana'oa Place and construct a new intersection Royal Vistas Roadway at the project's intersection with Queen Kaahumanu. To ensure safety these roads would be built to County and State standards, and dedicated to the County. The Kekuana'oa Place extension constructed as part of this project would include sidewalks and curved gutters. To clarify when the Kekuana'oa Place connection would occur, Figure 2 of the EA has been revised to show that access to the project site would be connected to Kekuana'oa Place from Lako Street during Phase II of the project. Therefore, at project completion, there would be two ways to access the project and would alleviate traffic (and safety) impacts to any one entrance.

Comment 3: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 3:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 4: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuana'oa Place.

> **Response 4:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuana'oa Place, the number of vehicles projected to use Kekauna'oa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 5: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

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Response 6: Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 7: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 7: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 8: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

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Comment 9: The TIAR employs an unusually low vehicle volume compared with the 2018 Witcher Engineering TIAR. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

Response 9: The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

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Response 10: The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: Bonnie Miki <kinaust2@gmail.com>
Sent: Tuesday, October 06, 2020 5:11 PM
To: Planning Internet Mail
Cc: dbmkona@aol.com
Subject: Royal Vista Housing Project EA comments
Attachments: img002.pdf; ATT00001.htm; img003.pdf; ATT00002.htm; img004.pdf; ATT00003.htm

COH PLANNING DEPT
OCT 7 2020 AM9:22

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DECLARATION OF JOHN GERALD MIKI

I, JOHN GERALD MIKI, declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 100 Yards of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about the destruction of Archeological Features of the said Area being considered for extensive housing development.

I am 82 years old, born and raised in Hawaii, who spent summers living with my grandparents in Kealia in Honaunau during WWII. During the school year, I attended weekly classes at the City Parks and Recreation Resource Center at the McCoy Pavilion at Ala Moana Park where kids from Honolulu were bussed to learn about Hawaii. We were awed by tales of the holualoa slides built throughout our islands, where warrior chiefs hurtled down rock courses at breakneck speeds up to 40 plus MPH on skinny 12 foot long by six-inch wide sleds on mamane hardwood runners, often wagering their lands, wives and even their lives against rival chiefs. The holualoa experience was a hair-raising but thrilling tale for us youngsters.

The Holualoa Slide is an important Hawaiian archaeological feature from pre-Western contact times that cannot be replaced. In 1994, I took a "Hawaiian Beliefs & Practices" religion

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class taught by Pualani Kanakaole, Hawaiian Studies instructor at University of Hawaii in Hilo. She said that when pre-contact Hawaiians needed to carve a canoe or a tiki god they would take a human sacrifice (slave or captured enemy chief) up into the rainforest and search for a suitable tree. Upon finding one, the kahuna would sacrifice the human before felling the tree with adzes, and bury the body at the base of the tree (trading a life for a life in thanks to the forest gods). Then they'd use holualoa, like the one in question at the Royal Vistas site, to slide the giant, now sacred log, down the mountain using ropes. (If a violent thunderstorm and lightening occurred before the cutting, the life of the human sacrifice was spared.)

Twenty years ago, my wife and I attended a lecture at the King Kamehameha Hotel by famed archeologist Dr. Yosihiko Sinoto who told the audience that the largest archeological artifact in the entire Pacific Basin was the Great Holualoa Slide built in Keauhou, Kona. Working with his mentor, the renowned Dr. Kenneth Emory of the Bishop Museum, they determined that the Keauhou Slide was 60 feet wide and 6,500 feet long, four to six feet in height and built on a 1200 A.D. lava flow. Commoners smoothed the slide with ti leaf and banana fronds but there were still holes on the rough surface that could kill chiefs speeding down its treacherous surface. When winter waves rose high in Kona, a kahuna would stand on the beach and signal with a white tapa flag for the race to the beach to start. The chief caught a big wave to race against a competing chief speeding down the holualoa; the first chief to reach the beach and grab the white tapa flag was the winner. Hawaii was a warrior society where men died in such contests.

As we walked the upper 2000 foot slope, Dr. Sinota told us that Bishop Estate had bulldozed the lower 4,500 feet of the holualoa to build a golf course which one can view today at the cut in the old government road mauka of the golf course's Vista Restaurant. This marked the destruction of an irreplaceable historical artifact. Auwe! How much more of Hawaii must be destroyed? We respectfully request the Leeward Planning Board defer approval of the Royal Vista project until a complete archeological evaluation of the site is complete.

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment.

5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku Stone, a copy of which is attached.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 6 October , 2020.

Signature: John G. Miki

Printed name: John G. Miki
Colonel USAF (retired)

3 of 3 JMiki

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. John Gerald Miki
Via email: kinaust2@gmail.com

RE: Comments on Cultural Resource Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Miki:

Thank you for the comment letter dated October 6, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I am specifically concerned about the destruction of archaeological features of the said area being considered for extensive housing development. We respectfully request the Leeward Planning Board defer approval of the Royal Vistas project until a complete archaeological evaluation of the site is complete.

> **Response 1:** As described in Section 3.6 and in Appendix 5 (Archaeological Inventory Survey [AIS] reports) in the EA, the entire project site has been recently inventoried for archaeological resources. One inventory covered 76.1 acres and the other covered 5 acres. Section 3.6 includes a summary discussion of the findings for both surveys that cover the entire site, as well as a discussion of how potential impacts would be minimized. The reports have been submitted to SHPD for review and acceptance.

Comment 2: I do not consider that the archaeological studies in support of the DEA are adequate. I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

> **Response 2:** As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Surveys (AISs) were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 3: I base my concerns upon the evaluation performed by Tom Pohaku Stone, a copy of which is attached. The DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved. The DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 3: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of he'ehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Frankie Hemby <frankie.hemby@gmail.com>
Sent:	Tuesday, October 06, 2020 4:52 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments

Below are my comments on the Royal Vistas (Kona) Draft EA. I include it below as text which can be searched or evaluated as text instead of scanning to a picture file or forcing you to handle an attachment. This however means I am unable to include a signature. Please accept the signing at the end as my digital signature. If another form is required, let me know quickly by email- Frankie.Hemby@Gmail.com - or phone (575) 748-9003 or (575) 365-7255.

DECLARATION OF MARY T HEMBY

I, MARY T. Hemby declare:

1. I am a resident of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within half a mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated May 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is

narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Ka'ahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Ka'ahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Ka'ahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Ka'ahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Ka'ahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. Our household has personally observed some very dangerous events and situations pertaining to traffic inside the Kona Vistas Subdivision and on roads and intersections in the project area defined in the

DRAFT ENVIRONMENTAL ASSESSMENT SSFM Traffic Impact Analysis Report. The following is just a partial list of memorable events:

a. Events inside Kona Vistas Subdivision:

1. Many occasions of vehicles running the stop sign at Kamehamalu and Leilani St. at full speed.
2. Many occasions of vehicles making incomplete stops at Kamehamalu and Leilani St.
3. Gardner and landscaping vehicles parked in the traffic lanes on Kamehamalu St.
4. School bus crossing double yellow line and speeding on Kamehamalu St.
5. Commercial car hauling semi-trailer truck crossing double yellow line on Kamehamalu St. Forced into Kona Vistas from lack of space to turn Westbound from Ford dealership.
6. Building contractor parked in traffic lane on Leilani St just off Lako St. As we turned the pickup was not visible but was left in traffic lanes and we had to go around the empty truck.
7. Commercial vehicles speeding in subdivision, including but not limited to UPS, water delivery, pest control, pool cleaners, dump trucks, concrete trucks and real estate agency vehicles.

b. Events outside Kona Vistas Subdivision in study area of SSFM TIAR.

1. Westbound on Lako St. and unable to get into turning lane at Queen Ka'ahumanu highway.
2. Westbound on Lako St. and unable to get into thru traffic lane at Queen Ka'ahumanu highway.
3. Eastbound on Lako St. and unable to get into turning lane at Queen Ka'ahumanu highway because thru traffic blocked access to turning lane.
4. Eastbound on Lako St. and unable to get into thru traffic lane at Queen Ka'ahumanu highway because left turn lane was full and blocking access to thru traffic. Delay was 2 cycles of the traffic signal which was an unacceptable waiting time.
5. Southbound on Queen Ka'ahumanu highway and unable to get into turning lane at Lako St. because thru traffic was blocking access to turning lane.
6. Southbound on Queen Ka'ahumanu highway and unable to get into thru traffic lane because left turning lane was full and additional vehicles turning left blocked access.
7. Experienced stop and go traffic from Henry St to Lako St. in mid-September during a pandemic with very few tourists on the road.
8. Observed rolled vehicles after accidents on Queen Ka'ahumanu highway and intersections at Lako St., Kuakini highway, Puapuaanui St and Nani Kailua Dr. Two accidents had multiple rolled vehicles.
9. Observed the aftermath of many more accidents with crunched vehicles wait for tow trucks.

10. Had to turn onto a street not on my trip plan to yield to an emergency vehicle around the Sunset Dr. –Sea View Circle area.

11. Experienced inattentive or distractive drivers behind our vehicle come to a screeching stop or have to pull into the right shoulder while stopping, narrowly avoiding a rear-end accident.

12. Have multiple friends that were in rear end accidents that totaled their vehicles and in one case caused neck and back injury that required treatment and lost work days.

13. Observed drivers on Henry street that have turned on green lights without waiting for the turn arrow as posted and required.

14. Avoided objects in the road that were lost or blown from truck or trailers with unsecured loads.

15. Hear emergency vehicle sirens on Queen Ka'ahumanu highway multiple times every day.

8. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

Signature: Please accept the below as my digital signature

Mary T. Hemby

Dated October 6, 2020

-
-
-

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Mary Hemby
via email: frankie.hemby@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Hemby:

Thank you for the comment letter dated October 6, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 10: Our household has personally observed some very dangerous events and situations pertaining to traffic inside the Kona Vistas Subdivision and on roads and intersections in the project area defined in the DEA's TIAR.

Response 10: Unfortunately, these events are not unique to this neighborhood or this part of the island. The proposed intersection and minor connector roads would be built to County standards to ensure their safety.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: Mark Powell <markp50@att.net>
Sent: Tuesday, October 06, 2020 4:33 PM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project
Attachments: Royal Vistas Traffic Pictures.pdf

COH PLANNING DEPT
OCT 7 2020 AM9:22

Attached is a brief description of the West side traffic issues.
John

136585

To Whom It May Concern,

All the residents on the West side of Hawaii Island have a major concern with traffic and safety. There is a proposed development called **Royal Vistas Housing Project** that will adversely affect the already backed up traffic situation on the Queen Ka'ahumanu Highway and Kuakini Highway and could add 1,000 car trips or more a day.

Lako Street intersection is already a bottle neck because of the 3 south bound lanes, 2 turning and 1 south on Kuakini.

Picture #1 shows north bound traffic on Kuakini having to turn across south bound traffic on Queen K to head north on Kuakini highway which is very dangerous. Picture #1 also shows 2 merge lanes from lower Kuakini onto the highway heading south with a very short distance to move into a left turn, right turn, or straight lane. All of this traffic movements causes backups and accidents.

Picture #2 shows the lanes a little further south on the highway toward the Lako intersection. This area is a real bottle neck with traffic having to move into a lanes depending where you are going.

Picture #3 shows the Lako Street intersection. This intersection is very congested because of all the movement there. Vehicles are heading north, south, turning left, right, in all directions. Adding to the problems is the fact that Mauka bound Lako there are 4 business commercial driveways located on the corner, the Shell Gas Station and the Ford Dealership. Also there is no merge or acceleration lane from west bound Lako turning right (North Bound) onto the Highway. Because Lako Street is so busy now traffic backs up on Lako to try and enter the highway in either direction.

Adding this new development without proper planning will bring traffic to an even great backup and create a high danger of accidents.

Part of the issues could be alleviated if the State, County, and Developers would work together.

Build a signalized intersection bringing all the Royal Vistas Housing Project traffic (Mauka to Makai), Kuakini's, and the Queen K's into 1 intersection. This would be much safer than it is now and with what's being planned. This would also improve the Lako Street intersection because it would eliminate the 2 Kuakini merge lanes heading south.

Also the State and County must think about the full widening of both the Queen K and Kuakini highways. If this development is approved before the highways are widened, the developers should be **conditioned** to widen the highway fronting there property frontage now. I know this has been a requirement on the mainland in some cases.

Summary

Build 1 signalized intersection bringing Kuakini, Queen K highways, and all the Royal Vistas Housing Project traffic together in one place. This will help traffic flow and greatly improve safety for everyone.

Require the developers to widen the highway along there project frontage. Require the developers main road through the development go Mauka to Makai so there is the lower way or an upper way out (safety). Mauka to Makai is an existing County requirement.

Don't approve the development until the Highway is fully widened in all directions and a new intersection is built.

Mahalo

John P.

You are currently running an experimental version of Earth

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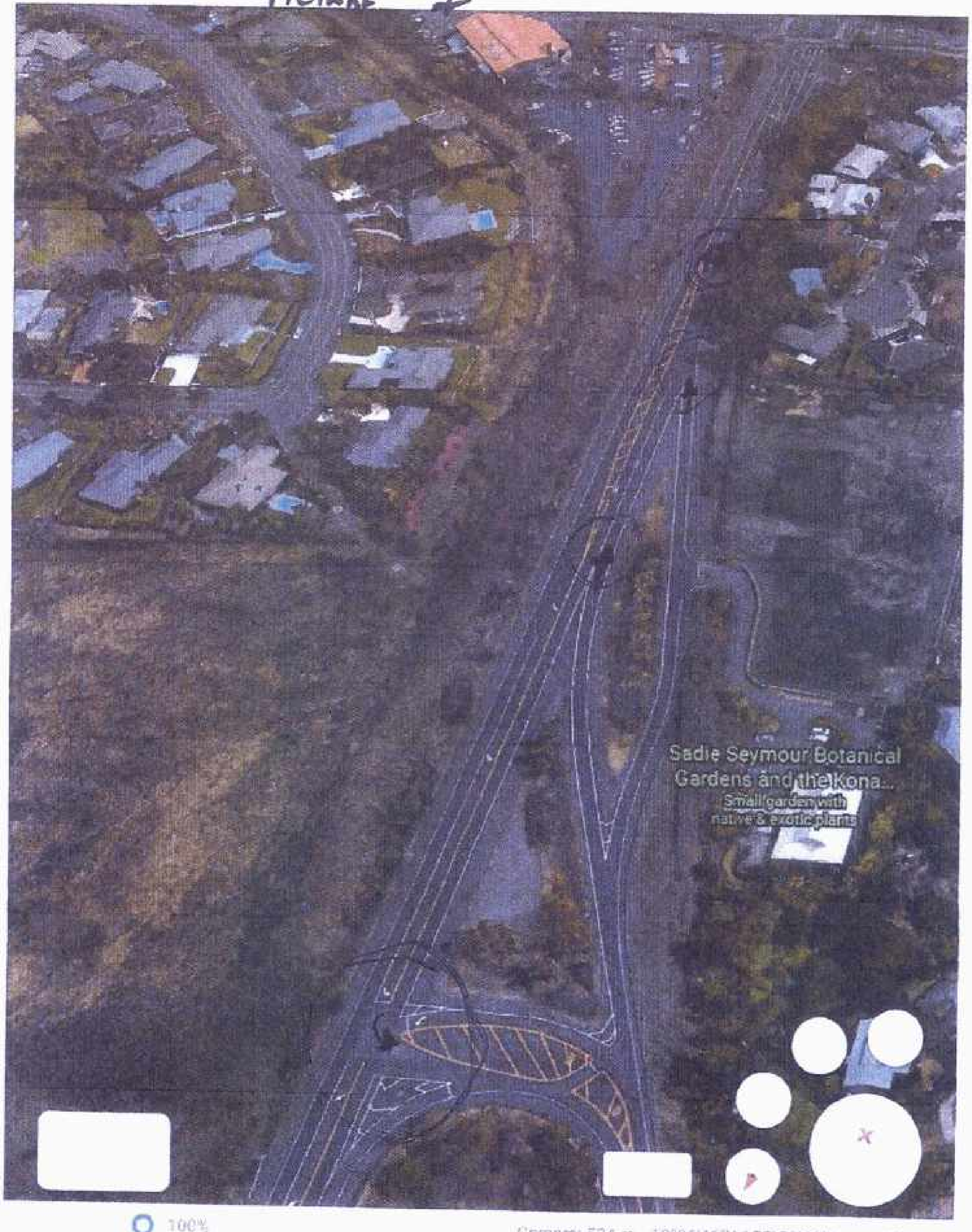
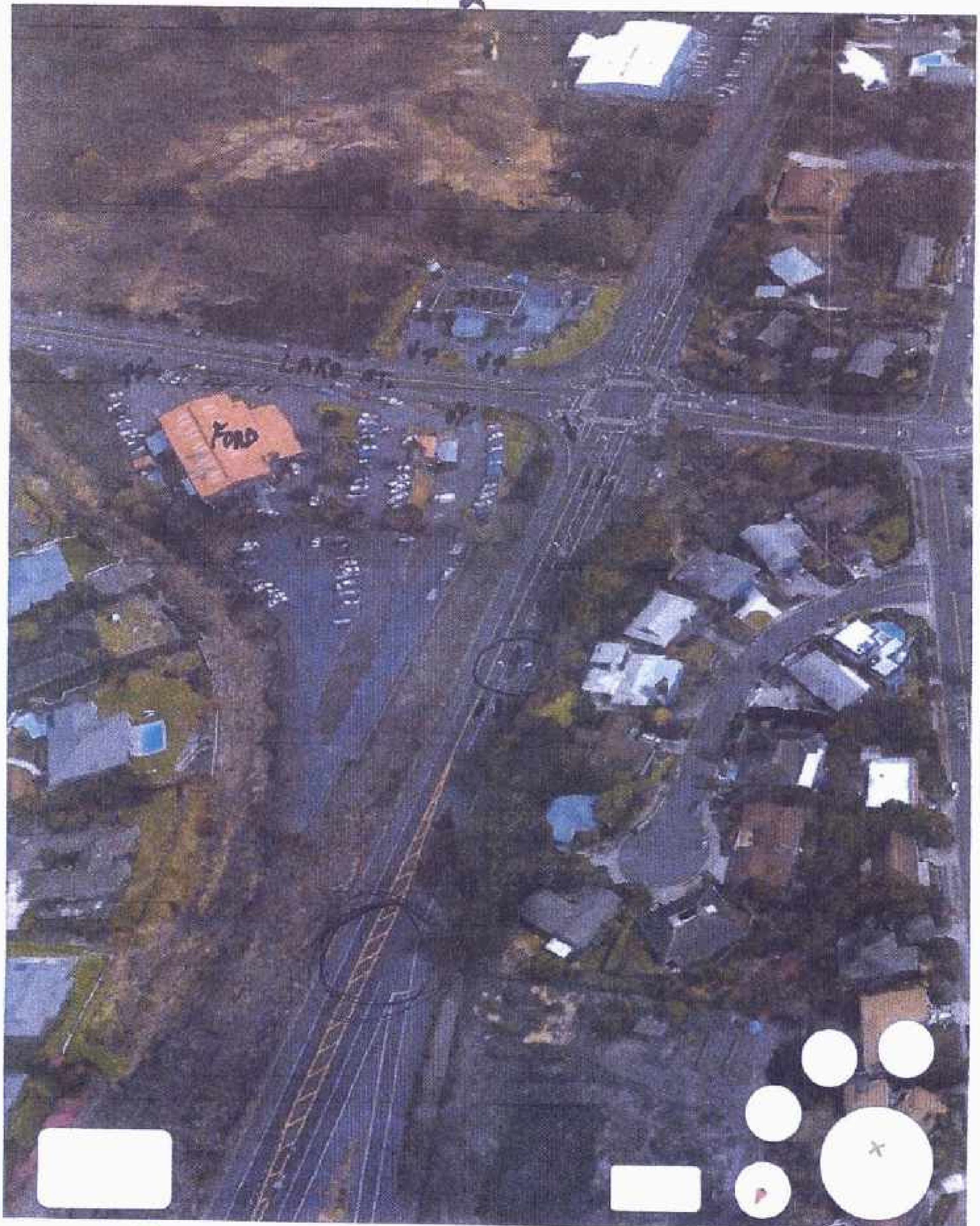
PICTURE #1



100%

Camera: 524 m 19°36'46"N 155°58'08"W 75 m

#2



100%

Camera: 525 m 19°36'44"N 155°58'03"W 98 m

You are currently running an experimental version of Earth.

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#3

100%

Camera: 525 m 19°36'24"N 155°58'06"W 60 m

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. John Powell
via email: markp50@att.net

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Powell:

Thank you for the comment letter dated October 6, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: Lako Street intersection is already a bottle neck because of the 3 south bound lanes, 2 turning and 1 south on Kuakini. This intersection is very congested because of all the movement there. Adding to the problems is the fact that Mauka bound Lako there are 4 business commercial driveways located on the corner, the Shell Gas Station and the Ford Dealership. Because Lako Street is so busy now traffic backs up on Lako to try and enter the highway in either direction. Adding this new development without proper planning will bring traffic to an even great backup and create a high danger of accidents.

> **Response 1:** The Traffic Impact Analysis Report (TIAR) in the EA acknowledges the bottleneck that occurs at Lako Street. The traffic signal timing and phasing can be changed in the interim from split phasing to protected or protected/permitted or permitted phasing on Lako Street. The long term solution is the widening of Queen Kaahumanu Highway. The widening of Queen Kaahumanu Highway from Henry Street to Kam III has been in the long-range transportation plan.

Comment 2: Part of the issues could be alleviated if the State, County, and Developers would work together. Build a signalized intersection bringing all the Royal Vistas Housing Project traffic (Mauka to Makai), Kuakini's, and the Queen K's into 1 intersection. This would be much safer than it is now and with what's being planned.

> **Response 2:** There are plans to re-align Kuakini Highway at Queen Ka'ahumanu Highway as shown in Figure 6 of the TIAR. This shows a new intersection just south of Puapuaanui Street. The 2010 Kona Development Plan shows the roadway with bike lanes and pedestrian facilities. This new intersection, with a new intersection at Kona Vistas driveway, and the signal at Lako Street would need to be coordinated. This is outside the scope of this project.

Comment 3: The State and County must think about the full widening of both the Queen K and Kuakini highways. If this development is approved before the highways are widened, the developers should be conditioned to widen the highway fronting there property frontage now.

> **Response 3:** The development is building a dedicated right turn lane. From a traffic operation standpoint, widening a short section of Queen Ka'ahumanu Highway to 4 lanes (2 through lanes in each direction) is not justified. Vehicles would have to merge back after the short widened section, creating another bottleneck. Therefore, the project does not propose making these improvements.

Comment 4: Require the developers to widen the highway along the project frontage. Require the developers main road through the development go Mauka to Makai so there is the lower way or an upper way out (safety). Mauka to Makai is an existing County requirement.

> **Response 4:** There would be a right turn into the development. In the professional opinion of the traffic engineer, widening Queen Kaahumanu for a short section, since vehicles will have to merge back into 1 lane. Therefore, widening the highway is not proposed.

Comment 5: Don't approve the development until the Highway is fully widened in all directions and a new intersection is built.

> **Response 5:** The widening of Queen Ka'ahumanu Highway has been discussed and planned for many years now. The completion of this project is not in Kona Three LLC's control. The TIAR in the EA includes analysis of future traffic projections and includes mitigations that show that while the delay would increase, the overall intersection level-of-service (LOS) would be acceptable.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Wayne Hemby <wayne.hemby@gmail.com>
Sent:	Monday, October 05, 2020 4:45 PM
To:	Planning Internet Mail
Cc:	colonybarb@hotmail.com
Subject:	Royal Vistas Housing Project EA Comments
Attachments:	Royal Vistas Comments by Barbara Repasky signed 2020 Oct 3.pdf

COH PLANNING DEPT
OCT 7 2020 AM9:20

If you have any questions please contact me at (808) 322-0189

I have attached a signed and scanned copy to this email. I have the same contents in the email below in a form that is searchable but without signature.

Mahalo,
Barbara Repasky 76-152 Kamehamalu St Kailua-Kona, Hawaii 96740

1

DECLARATION OF BARBARA REPASKY

I, BARBARA REPASKY, declare:

1. I am a resident of Hawaii / Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within half a mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated May 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

2

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

136590

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

3

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

4

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 3, 2020.

Signature: ____________________

Printed name: Barbara Repasky

DECLARATION OF BARBARA REPASKY

I, BARBARA REPASKY, declare:

1. I am a resident of Hawaii / Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within half a mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated May 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 3, 2020.

Signature: Barbara Repasky
Printed name: Barbara Repasky

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Barbara Repasky
76-152 Kamehamalu Street
Kailua Kona, HI 96740
via email: wayne.hemby@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Repasky:

Thank you for the comment letter dated October 5, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: Caleb Kekoa Nazara <knazara@protonmail.com>
Sent: Wednesday, October 07, 2020 10:00 AM
To: Planning Internet Mail
Subject: Kona Vistas housing project EA

Aloha

This is just to inform you that my name was mentioned as having sought comsultation. I have no recollection of receiving any document seeking consultation, and surely have not spoken with anyone on any consultation.

Mahalo

Caleb Kekoa Nazara-Pelekikena
Kona Hawaiian Civic Club

Sent from ProtonMail Mobile

136662

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Caleb Kekoa Nazara-Pelekikena
Via email: knazara@protonmail.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Nazara-Pelekikena:

Thank you for the comment letter dated October 7, 2020, on the Draft Environmental Assessment (DEA) for the proposed project stating that you had not been contacted for consultation.

We apologize for any confusion, but attached please find attached an email chain between our cultural consultant (Mr. Glenn Escott) and yourself confirming communication, contact, and request for consultation during the Cultural Impact Assessment (CIA) process for this EA.

If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Kekoa Nazara <koanazara@gmail.com>
To:Glenn Escott
Wed, Feb 19 at 10:45 AM
Aloha glenn

Will do. By the way I did find one other contact for that deal and DLNR project. I've been so busy I haven't had a chance To call him but I will this week and get back to you thanks

Sent from my iPhone

On Feb 18, 2020, at 12:28 PM, Glenn Escott <ggescott@yahoo.com> wrote:

Aloha e Kekoa,

Mahalo for consulting on the DLNR Kona project area in Kalaoa 5th Ahupua`a. It was good to talk story with you and Jake. We are conducting another CIA in Holualoa if you are interested in consulting on cultural practices at the project area lands..

Please see the attached CIA consultation request for lands of Holualoa 1st, North Kona. If you or anyone you know has information regarding past or ongoing cultural practices in Holualoa 1st, please let contact me to consult.

Mahalo Nui Loa,
Glenn G. Escott, MA
Senior Archaeologist
Scientific Consultant Services, Inc.
808/938-0968

Mori, Ashley

From:	inabaventures@yahoo.com
Sent:	Wednesday, October 07, 2020 5:17 PM
To:	Planning Internet Mail
Cc:	Yee, Michael
Subject:	Royal Vistas Housing Project EA Comments
Attachments:	Planning Dept Submission Royal Vistas 10-7-20.pdf

COH PLANNING DEPT
OCT 8 2020 AM8:06

Director Yee and the Members of the Hawai'i County Planning Department,

Please see the attached PDF document containing my comments, questions and concerns regarding the Draft EA submitted by the Royal Vistas Housing Project developers and their consultants. As the EA is noted as a "Draft", it would be my hope that important open questions, issues, gaps, and concerns will be more fully and directly addressed in a Final version.

Thank you for the opportunity to comment.

,
Renee Inaba

ATTACHMENT/PDF Document for submission of requested comments to Planning Dept.

136664

SUBMISSION OF COMMENTS/QUESTIONS TO HAWAI'I COUNTY PLANNING DEPT/OPEN PUBLIC COMMENT AND QUESTION PERIOD DUE 10/8/2020, RE: ROYAL VISTAS HOUSING PROJECT DRAFT EA

I, Renee L. Inaba, declare:

1. I am a resident of Kailua Kona, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects my family, my community, and me personally as well as affects my interest in real property. I reside within 0.1 miles of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: the completeness, accuracy and adequacy of the information provided.

3. ARCHAEOLOGICAL/HISTORICAL/CULTURAL AND THOSE CONSULTED. It is not clear that the archaeological studies offered in support of the Draft Environmental Assessment are fully complete or adequate. A) Sample size and completeness: There are a number of features of archaeological, historical and cultural significance that are not documented inasmuch as the document has addressed only a small sample of the land and features as opposed to a full study for purposes of: identification, logging/cataloging, and

memorialization of key features of concern to local Hawaiian, kama'aina, and stakeholder populations. B) Consultations Sought and Actual Output/Comments: There are also questions that need to be better answered about what constitutes "consultation was sought", see Page 42, as noted quoted from the SCS CIA for the Project. It is not clear what information was provided and if the parties that were listed, as asked, had additional queries that still stand unanswered and not disclosed in this document. The statement as shown might imply or give an impression of acceptance, agreement or concurrence by these parties when it is not clear that has occurred, i.e., in the absence of affirmative statements by these individuals and related constituencies. That said, a more complete understanding of the nature of the inquiry, casual or significant, would be helpful as well as documentation from the parties listed asserting their actual positions and/or questions.

4. <u>CULTURAL AND OTHER FEATURES APPEAR NOT FULLY DOCUMENTED OR ASSESSED OR POSSIBLY MIS-IDENTIFIED FROM THE CULTURAL LANDSCAPE</u>. A) Substantial evidence exists that the land encompassed by the subject land parcels include a culturally significant Holua/ Historic Slide, and rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. That is a significant difference and clearly important to understand much better before any equipment is even considered to roll. The Holua Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed. B) Concerns expressed are based upon the evaluation and analysis performed by Tom Pohaku Stone, who has much personal information about this particular land and the importance of Holua, and who has shared that information with local community members. Was Mr. Stone consulted about his concerns, knowledge and

information? C) Local historians from the iconic, 200-year-old, historic Mokuaikaua Church, including Yolanda Olson and the late Roxanne Olson, have been researching this area (land parcels as described). They have discussed linkage to the culturally significant paths and sacred building materials brought down from the mauka forests presumed through this land, its paths, holua, etc. by the early post-contact Hawaiians in the building of the iconic Kona landmark Mokuaikaua Church. Was Ms. Olson consulted on this study? D) Were the cultural stewards and caretakers of the Kealakowa'a Heiau as well as the cultural leaders of Kona Outdoor Circle notified of this work and proposed development? Given the connection of the Heiau to the land as outlined in the Draft EA, as well as its position directly below the property they would also be key stakeholders in these land issues and any alterations. Pre- and post-contact materials were transported reverently through these lands to Kealakowa'a, thought to be the last remaining canoe building heiau in the State of Hawai'i and directly connected to these upslope parcels and the slide. Materials, presumed to have included timbers, canoe hulls, and other significant products and items needed for mauka-makai provisioning along the Hawaiian's path through the property and this ahupua'a, would travel further makai. The mid-level lands were very critical for life and food provisioning as these parcels were the life of the people and home to the Kona field System. Timbers that now support our most iconic, landmark buildings in Kona (Mokuaikaua and the Palace) are thought to have traveled this route before being dropped in the ocean's salty, curing waters and floated up to the building sites. These lands are presumed linked to not only those post-contact icons but to the pre-contact and now sadly rare canoe heiau of Kealakowa'a Heiau as well as other relevant sites now largely lost due to past development. E) Were lineal descendants with ancestral claims to the land and the bones/iwi fully afforded information and notification? It was noted in the study that paper media was used, but given the importance of land issues here in Hawai'i and recent issues with Mauna Kea, it would seem out of an abundance of transparency and inclusiveness electronic notification would also be necessary if the idea is to actually provide full awareness and notification. Were other methods used but not noted fully in the report?

5. <u>Endangered Species Studies and Assessments Appear Incomplete and Mis-timed</u>. Assorted species of high value to our population and the island are present on these lands. It was noted in the study that there was an awareness of this but it also was noted that studies, such as for the Endangered Hoary Bats, were not conducted at a time when they are active. Thus, additional studies that cover the times of day assorted rare and endangered species are active should be required. This would also seem to require a level of concern and care for the local and native flora and fauna that supports these endangered species. Given that the report appears to acknowledge the concern and issues with such species including the Hoary Bats, is there a plan to better evaluate all the native, rare, and endangered species present on the parcels? Is there a plan to conduct a full and complete study of the population of Hoary Bats during a sufficient period of time inclusive of the right time of day to fully assess the impact of any development on any endangered species?

6. <u>Environmental, Safety, Traffic, Waterflows, Water Sheds</u>. A) Significant issues have arisen around our island when development or ground disruption is done without full awareness or proper mitigation of the future adverse effects. These become both costly for the County and dangerous to the public at large. We have noted in West Hawai'i, inclusive of in and around Kuakini Highway, makai of this area, that significant flooding has occurred when larger and intermediate levels of precipitation are present. The two important waterways already noted are the Holualoa Ditch and Horseshoe Bend, which currently manage water excess and flow

when precipitation is heavier, are effective old historic flows and watersheds. Was water flow impact fully studied should any alteration of the landscape and hillside occur after all cultural, archaeological and endangered species issues have been resolved? The details looked a bit light in the document and this is a critical concern. B) Has the County of Hawai'i developed a plan to deal with waterflow disruptions, flooding, etc. and/or made provisions for any developer, contractor, or agent to set aside significant funds to reimburse the County should development adversely impact adjacent, upslope and downslope areas that end up damaged from alterations of pre-contact flows? Drainage and water flow disruptions need to be handled with a full and complete environmental assessment. C) The Traffic Study, as noted in the Draft EA including the report by SSFM international dated 7/2020 does not seem sufficient to deal with the overall and significant levels of traffic on any of our secondary and residential streets and roadways. The comment addressing that "Traffic impacts have been taken into careful consideration…" is not sufficient to alleviate valid concerns that will be held by the public. Those concerns include significant excess and hazardous traffic conditions. Having been an active member of our County Traffic group as well as for our community here in Pualani Estates, we have found 'normal', non-Covid time traffic to be increasingly risky and dangerous on all of our streets within our community and also in the surrounding area. Any increase in population or density or access through neighborhoods already serving relatively large populations poses credible risk that should not be ignored. It was already a stated concern in assorted forums specifically related to our roadways in and around Pualani Estates, i.e., that some grade and curvature issues pose significant and life-threatening risks that we have identified over the past many years. Please be very conscious of these very significant safety and infrastructure concerns. It would be prudent of the County to require any developer, as in this case or any other large scale proposal, to set aside significant escrow or bond funds with the County to remunerate for losses due to environmental disruption, property devaluation, loss of use, and in the case of infrastructure strain additional costs that might otherwise fall on the County or the people of the County of Hawai'i. Issues left for future remediation and remedy rarely work out well for the citizen stakeholders or for the Governmental Authority. It is best to have adequate and substantial provisions set in place. Has the developer adequately made provisions to maintain safety in and around existing communities and roadways to assure safety, peace and quiet as is present now on our streets and infrastructure? Has the developer set aside sufficient funds in County accounts to settle any issues and liabilities that could result in a poorly executed or inadequately completed plan that strains and taxes our fragile ecosystems or infrastructure challenges? It does not appear that those were sufficiently documented in the report but might we anticipate additional information and thought on funding the County for these significant costs, risks, liabilities in the Final Version?

6. In summary, the Draft Environmental Assessment does not discuss sufficient facts and analysis concerning important Hawaiian cultural and archaeological features, nor does it fully address waterflow concerns, infrastructure issues, traffic, environmental and related future costs and liability to the County. We need to be assured that all steps are fully vetted and understood to avoid costly and dangerous future issues. We also need to try to always look with a vision to preserve and protect our peace, safety and lands and frankly those things once gone that can never be restored.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holua (Slide) and related artifacts and lineal ancestry components present on the subject parcels. All infrastructure concerns need to be fully

addressed with public, in person meetings, i.e., not Covid lockdown limited participation or ability to speak. Our kupuna and community population will both want and need to share their wisdom/mana'o and relevant concerns before anything is started. Species protection along with historical preservation need to be done in earnest and the key issues of safety, peace, and maintaining the aloha of the land and its current flow need to be held as a priority to avoid issues similar to those we have seen on other parts of the island. In all things openness and transparency and working toward a positive future, fully respecting our past and those that came before us will hold us all in good stead.

These are my thought and question for you, the members of the Planning Commission to relay back to the developer as you vet the entirety of their proposals and their report and declarations. I appreciate the opportunity to voice comments, concerns, and questions on these issues of great importance for our island and for Kona.

Dated: Kailua-Kona, Hawai'i, October 7, 2020.

Signature: ELECTRONIC SIGNATURE/rli
Printed name: Renee L. Inaba

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Renee Inaba
Via email: inabaventures@yahoo.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Inaba:

Thank you for the comment letter dated October 7, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: It is not clear that the archaeological studies offered in support of the Draft Environmental Assessment are fully complete or adequate. There are a number of features of archaeological, historical and cultural significance that are not documented.

> **Response 1:** As described in Section 3.6 of the EA and included in Appendix 5, two AISs were prepared. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Comment 2: There are also questions that need to be better answered about what constitutes "consultation was sought", see Page 42, as noted quoted from the SCS CIA for the Project. It is not clear what information was provided and if the parties that were listed, as asked, had additional queries that still stand unanswered and not disclosed in this document.

> **Response 2:** The information regarding cultural consultations is included in the Cultural Impact Assessment including methodology in Appendix 4 of the EA.

Comment 3: Substantial evidence exists that the land encompassed by the subject land parcels include a culturally significant Holua/Historic Slide, and rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment.

Response 3: Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 4: Concerns expressed are based upon the evaluation and analysis performed by Tom Pohaku Stone, who has much personal information about this particular land and the importance of Holua, and who has shared that information with local community members. Was Mr. Stone consulted about his concerns, knowledge and information? Was Ms. Olson consulted on this study? Were the cultural stewards and caretakers of the Kealakowa'a Heiau as well as the cultural leaders ofKona Outdoor Circle notified of this work and proposed development? Were other methods used but not noted fully in the report?

Response 4: In the email provided from Mr. Stone by other commenters, there is reference to "the portion of the hōlua at the Hōlua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls. Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of heʻehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area. A list of those consulted for the project are included in Appendix 4 of the EA.

The information regarding cultural consultations, including who was consulted, is included in the Cultural Impact Assessment including methodology in Appendix 4 of the EA.

Comment 5: Endangered Species Studies and Assessments Appear Incomplete and Mis-timed. It was noted in the study that there was an awareness of this but it also was noted that studies, such as for the Endangered Hoary Bats, were not conducted at a time when they are active. Thus, additional studies that cover the times of day assorted rare and endangered species are active should be required.

> **Response 5:** The EA includes a description potential habitat for native species (including the hoary bat) in the existing conditions part of Section 3.3.4. The biological survey acknowledges that just because a species is not detected during the survey does not preclude its presence. In fact, the biological survey stated that the hoary bat should be presumed to be present. The impact discussion includes potential impacts to individuals and to habitat for native species (including those not directly detected during the survey). The impact discussion including protection measures to eliminate potential impacts to native species (including avifauana and bats) and their habitat in Section 3.3.4.

Comment 6: Given that the report appears to acknowledge the concern and issues with such species including the Hoary Bats, is there a plan to better evaluate all the native, rare, and endangered species present on the parcels?

> **Response 6:** Since the endangered Hawaiian hoary bat is vulnerable to disturbance while roosting with its juveniles in the pupping season, the EA (Section 3.3.4) includes a protection measure for all potential habitat. "To minimize impacts during construction, woody plants taller than 15 feet would not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Additionally, Hawaiian hoary bats forage for insects from as low as 3 feet to higher than 500 feet above the ground and can become entangled in barbed wire, if used for fencing. The Proposed Project would not use barbed wire for fencing." So whether the species is detected or not, the applicant will adhere to this protection measure for the project. With these measures in place, the project would not result in impacts to bats.

Comment 7: We have noted in West Hawai'i, inclusive of in and around Kuakini Highway, makai of this area, that significant flooding has occurred when larger and intermediate levels of precipitation are present. The two important waterways already noted are the Holualoa Ditch and Horseshoe Bend, which currently manage water excess and flow when precipitation is heavier, are effective old historic flows and watersheds. Was water flow impact fully studied should any alteration of the landscape and hillside occur after all cultural, archaeological and endangered species issues have been resolved?

> **Response 7:** A new drainage study must be approved by the County prior to construction of any improvements for the Project, ensuring review and approval of proposed drainage improvements. As discussed in the EA, the project would not contribute or exacerbate the flooding issues. Per Section 27-20 of the Hawaii County Code, the project is not allowed to increase any run-off onto

neighboring properties, so there are no effects on any neighbors from project run-off including on the County-owned parcels.

Comment 8: Has the County of Hawai'i developed a plan to deal with waterflow disruptions, flooding, etc. and/or made provisions for any developer, contractor, or agent to set aside significant funds to reimburse the County should development adversely impact adjacent, upslope and downslope areas that end up damaged from alterations of pre-contact flows?

Response 8: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. It describes that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system across the ditch to extend Kekuanaʻoa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan (CDP) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the Kona CDP's "Official Transportation Map." Additionally, as described in Section 3.3.2, Kona Three would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by Department of Public Works, and there would be no drainage interruptions.

Comment 9: The Traffic Study, as noted in the DEA does not seem sufficient to deal with the overall and significant levels of traffic on any of our secondary and residential streets and roadways.

Response 9: Existing traffic impacts were accounted for in baseline conditions. Traffic counts that served as baseline conditions were taken pre-Covid and, therefore, could be considered a conservative estimate of impacts compared to current conditions. The TIAR (Appendix 2) thoroughly analyzes traffic impacts from the project to relevant intersections at the project site and nearby intersections.

Comment 10: Has the developer adequately made provisions to maintain safety in and around existing communities and roadways to assure safety, peace and quiet as is present now on our streets and infrastructure?

Response 10: The proposed project would be built using best practices currently in place in the State and County of Hawaii, as well as all applicable laws, regulations, and policies.

Comment 11: In summary, the DEA does not discuss sufficient facts and analysis concerning important Hawaiian cultural and archaeological features, nor does it fully address waterflow concerns, infrastructure issues, traffic, environmental and related future costs and liability to the County.

Response 11: These impacts and protection measures are discussed in the EA in Sections 3.5 (Cultural Practices and Sites), 3.6 (Historic and Archaeological Resources), 3.3.2 (Water Quality and Water Quantity), 1.2 (Infrastructure), and 3.7.2 (Traffic).

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: john bennett <jwb1266@gmail.com>
Sent: Wednesday, October 07, 2020 10:58 AM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project

COH PLANNING DEPT
OCT 8 2020 AM8:09

To whom it may concern,

In regards to the proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i.

I have found the Environmental Assessment of this project inadequate. The Assessment shows great detail on a 5 acre portion of the property that was performed in 2018, and a much lesser detail, as well as dated, assessment of the remaining 65 acres. Within the property are very likely remnants of Kealakekowa'a road (path of the canoe). Koa Trees were harvested above Holualoa and logged down to the Kealakekowa'a Heiau where the Koa logs were carved and made ready. A portion of the actual path exists on the property of the Holualoa Inn bed and breakfast. https://www.holualoainn.com/history-of-the-holua-slide/ . Most Holuas were used for sport, however this Holua was built for hauling Koa wood to the sea. One unique aspect of this Holua is its parallel rock walls to help contain the Koa as it was transported down the holua. In the Royal Vistas Assessment it shows these walls and how they were used for cattle in the late 1800s and early 1900s. In the assessment core samples of the revealing kukui nut. The ancient Hawaiians used kukui nuts and ti leaves to help lubricate the holua for sliding the logs. Holualoa is translated to english as "Long Slide". This is a serious omission in the assessment.

It has been observed by me, Hawaiian Hawks, Hoary Bats, and Owls live in the proposed development. The assessment only suggested that they could possibly reside in the proposed area. The traffic study miraculously claims that the traffic has gotten better than in their previous traffic study. The entire Kona population would agree without hesitation, that it has become much worse. To suggest that adding 1000 cars to this area won't really have much of an impact is wishful thinking.

Lastly, I find it very unnerving that the owners of this land that is currently zoned as multi family have been using it as a cattle ranch allowing cows to trample historical sights. The majority of the cattle have been removed recently, but at least 2 cows are still within the property. I think it shows a lack of respect for an owner to do as they please, Ag land for now, and Multifamily tomorrow. Laws do not allow for this, yet it appears KV3 doesn't want to play by the same rules as the rest of us. Thank you for for your time, Sincerely,

John Bennett

136663

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. John Bennett
Via email: jwb1266@gmail.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Bennett:

Thank you for the comment letter dated October 7, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have found the DEA of this project inadequate. It shows great detail on a 5 acre portion of the property that was performed in 2018, and a much lesser detail, as well as dated, assessment of the remaining 65 acres.

> **Response 1:** As described in Section 3.6 and in Appendix 5 (Archaeological Inventory Survey [AIS] reports) of the EA, the entire project site has been recently inventoried for archaeological resources. One inventory covered 76.1 acres and the other covered 5 acres. Section 3.6 includes a summary discussion of the findings for both surveys that cover the entire site, as well as a discussion of how potential impacts would be minimized.

Comment 2: Within the property are very likely remnants of Kealakekowa'a road (path of the canoe). Most Holuas were used for sport, however this Holua was built for hauling Koa wood to the sea. One unique aspect of this Holua is its parallel rock walls to help contain the Koa as it was transported down the holua. The DEA shows these walls and how they were used for cattle in the late 1800s and early 1900s. This is a serious omission in the assessment.

> **Response 2:** Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since

the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 3: It has been observed by me, Hawaiian Hawks, Hoary Bats, and Owls live in the proposed development. The assessment only suggested that they could possibly reside in the proposed area.

Response 3: The EA includes a description potential habitat for native species (including the hoary bat) in the existing conditions part of Section 3.3.4. The biological survey acknowledges that just because a species is not detected during the survey does not preclude its presence. In fact, the biological survey stated that these species may occur in the project area, and the impact discussion includes potential impacts to individuals and to habitat for native species (including those not directly detected during the survey). The impact discussion including protection measures to minimize these impacts to native species (including avifauana and bats) and their habitat in Section 3.3.4.

Comment 4: The traffic study claims that the traffic has gotten better than in their previous traffic study. To suggest that adding 1000 cars to this area won't really have much of an impact is wishful thinking.

Response 4: Section 3.7.2 and the Traffic Impact Assessment Report (TIAR) in Appendix 2 of the EA include a discussion of current traffic conditions and analysis of predicted changes to traffic. The changes in level-of-service from projected growth with and without the project condition in the analysis is based on the results of modeling by a professional traffic engineer, not wishful thinking.

Comment 5: I find it very unnerving that the owners of this land that is currently zoned as multi-family have been using it as a cattle ranch allowing cows to trample historical sights. The majority of the cattle have been removed recently, but at least 2 cows are still within the property.

Response 5: In response to neighboring community concerns, Kona Three LLC ceased cattle grazing in the proposed project site in 2019. To their best knowledge, Kona Three LLC knows of no cattle on the project site. However, it is possible that cattle grazing from the adjacent Gomes' property temporarily moved to the project site.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From:	Wayne Hemby <wayneh72@hotmail.com>
Sent:	Wednesday, October 07, 2020 3:29 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments
Attachments:	LOS-defined.pdf; Royal Vistas DEA Comments by Clyde Hemby.pdf; SSFM High Injury Network Map-1024x791.jpg; SSFM Vision Zero Study 10 30 2019.pdf

I have attached the files which contain my comments on the Royal Vistas Draft Environmental Assessment and 3 support documents referenced in my comments. Please contact me if the 4MB size of the SSFM Vision Zero study presents a problem or if any of the attachments arrive damaged or unreadable. The SSFM Vision Zero Study is large but that is their original file which I did not want to modify. All the files except the comment letter itself are available on the Internet and I can provide links.

Mahalo,
Clyde Hemby

FIGURE 1. LEVEL OF SERVICE (LOS) DEFINITIONS

Level of Service A: Free-flow traffic with individual users virtually unaffected by the presence of others in the traffic stream.

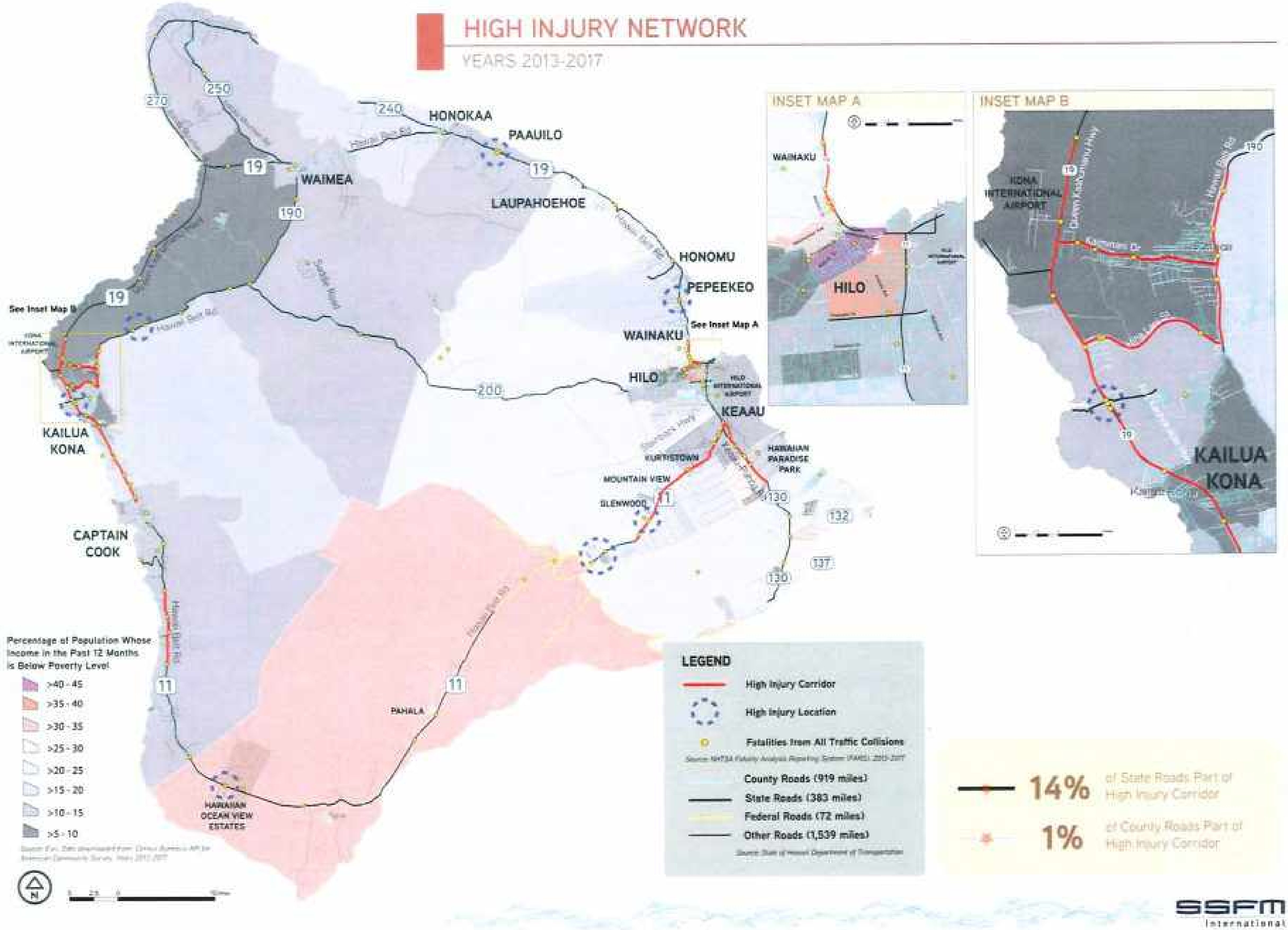
Level of Service B: Stable traffic flow with a high degree of freedom to select speed and operating conditions but with some influence from other users.

Level of Service C: Restricted flow that remains stable but with significant interactions with others in the traffic stream. The general level of comfort and convenience declines noticeably at this level.

Level of Service D: High-density flow in which speed and freedom to maneuver are severely restricted and comfort and convenience have declined even though flow remains stable.

Level of Service E: Unstable flow at or near capacity levels with poor levels of comfort and convenience.

Level of Service F: Forced traffic flow in which the amount of traffic approaching a point exceeds the amount that can be served. LOS F is characterized by stop-and-go waves, poor travel times, low comfort and convenience, and increased accident exposure.


HIGH INJURY NETWORK
YEARS 2013-2017
INSET MAP A
INSET MAP B
270
250
240
19
190
200
11
130
132
137
HONOKAA
PAAUILO
WAIMEA
LAUPAHOEHOE
HONOMU
PEPEEKEO
See Inset Map A
WAINAKU
HILO
KEAAU
HAWAIIAN PARADISE PARK
KURTISTOWN
MOUNTAIN VIEW
GLENWOOD
See Inset Map B
KAILUA KONA
CAPTAIN COOK
PAHALA
HAWAIIAN OCEAN VIEW ESTATES
KONA INTERNATIONAL AIRPORT
Percentage of Population Whose Income in the Past 12 Months is Below Poverty Level
>40 - 45
>35 - 40
>30 - 35
>25 - 30
>20 - 25
>15 - 20
>10 - 15
>5 - 10
LEGEND
High Injury Corridor
High Injury Location
Fatalities from All Traffic Collisions
County Roads (919 miles)
State Roads (383 miles)
Federal Roads (72 miles)
Other Roads (1,539 miles)
14% of State Roads Part of High Injury Corridor
1% of County Roads Part of High Injury Corridor
SSFM International

Introduction and Conclusion- Royal Vistas Housing Project EA comments

In order to be efficient I have designed this document to convey the basic elements into two pages of reading. More detail with headings is supplied but the reader is not forced to scroll to the end for conclusions. Those headings will be arranged in order of importance.

My name is Clyde Hemby and I live in the Kona Vistas subdivision about a half mile from the proposed Royal Vistas project.

The Big Island is my home because it is mostly rural. It has some large hotels in appropriate tourist locations in Hilo, Kailua-Kona and Waikoloa. There are no skyscrapers full of apartments and hopefully never will be, because that would signal the end of the serenity and natural beauty that is the treasure of Hawai'i Island. Currently there are times when I can hear the crashing winter surf mixed with the sound of a cow mooing to the North along with the underlying and ever-present sound of traffic that seems to grow steadily worse. You can imagine my sorrow upon finding that Kona Three LLC, a real estate developer from Honolulu, is proposing to build a high density 450 unit project just to the North. While Kona needs affordable and single family housing, this project is a bunch of duplex, 4-plex and 6-plex clusters of two and three story buildings. It will resemble the "monster homes" which have plagued Oahu and caused outrage and dissatisfaction within governing agencies to control them. It is like building a Blockbuster video store when we live in a digital age. It was evidently proposed in 1984 when Kona was a blank canvas with a single traffic light. In 2020 that is no longer true. That blank canvas has been transformed into a paint-by-numbers painting with just a few unpainted parts. Those parts should be used to fill the needs of the community and not some developer with dreams of dollar signs for motive. The development is designed to use the least amount of materials, the least amount of labor, and is a large urban project being stuffed into a place with insufficient infrastructure to support it. The schools are over capacity and projected to be for at least five years. The flood control is insufficient and will be made much worse by this development. Pages 36 and 69 of the .pdf file (pages 23 and 56 of the DEA) acknowledge that no Certificate of Occupancy can be issued without completion of drainage system improvements, so why is a building permit even being considered? The current roadway is a rural two lane road, with wide shoulders to allow vehicles to yield to the frequent emergency vehicles, and is not adequate for current traffic. Under Hawaii County Code Chapter 25-2-46 (e) "Mitigation required" there can be no occupation until the unacceptable traffic conditions described in page 63 of the DEA are fixed, so why would a building permit even be considered? There will be a substantive traffic safety problem with more traffic congestion and more severe accidents if this development is allowed before the roadway is improved. The proposed Royal Vistas Roadway, an un-signalized intersection near the Lako Street and the Kuakini highway intersections with a left turn across traffic to enter the development for southbound traffic will be disastrous considering most of it will be heavier and slower commercial vehicles.

While it is tempting to accept a development for the economic and property tax boost, the proposed development of Royal Vistas as specified will be hurtful to the community in the long run. It will not fit in with the spirit of the community in the way it looks with clusters of multi-story buildings, especially the three story buildings which should be prohibited. It will adversely affect three or more established nearby subdivisions. It will not be substantially cheaper for buyers. Market value will put the units out of reach of local families where the annual median household income is $65,682 according to a Sept 8, 2020 article entitled "The Pandemic-Driven Future Of Affordable Homes In North Kona" on Civil Beat Honolulu. Most of the units will be sold to mainland investors or rented out by the Honolulu developer so money will not stay within the Hawai'i island economy. It is even unclear if the project will use local labor or materials. The developer would have you believe this is a simple "infill" project but it is so poorly planned that they cannot complete the required roadways specified as requirements because they don't own all the property. They are also not infilling with like and comparable properties but insist on loading the area with at least 450 units to utilize water commitments they may have purchased prematurely. By their own DEA "Alternative design features were considered including wider access roads and stand-alone rather than clustered structures, but these features limited the amount of green space available for the Project". That also drives the requirement for the three story 6 plex clusters which is not desirable to anyone but the owner or developer and not on the wish list of most families. They have raised disgust and anger from the surrounding subdivisions which have endured years of construction and when finally there seems to be an end, this developer comes along insisting on using the roads of those subdivisions as if they were unpopulated. Commuters from South of the project revile it as an additional obstacle to a difficult commute.

Please consider that the best long term plan for this land might be to leave it undeveloped. It could be set aside or acquired as open space land and used for a purpose that has a light footprint. This Development might have been useful in 1984, but like that Blockbuster Video store it should no longer be considered.

I urge you to reject the DEA and the development because of the lack of infrastructure in the proposed location and because of incorrect or inadequate parts within the DEA, which I will highlight in the following pages.

Clyde Hemby

Clyde Hemby 10/7/2020

Traffic

Many pages of the DEA is devoted to a traffic study (see Appendix 2 of the DEA for this Traffic Impact Analysis Report) filled with industry jargon and diagrams which concludes the project will only make traffic a little worse. The study also has some serious mistakes, some suspicious data questions and lacks scope:

- Page 125 of the DEA .pdf file (Page 9 of TIAR) cites data counted on *Thursday*, August 24, 2019, which was a **Saturday**
- Page 125 of the DEA .pdf file (Page 9 of TIAR) tells us data collection was on Tuesday, April 30, 2019 and ~~Thursday~~, August 24, 2019 which are 116 days apart! Are they "cherry picking" data because of unfavorable results? Why was this done?
- The DEA is very inconsistent in reference to the very important TIAR, referring to it as a Traffic Impact Assessment Report in the table of contents and the cover page for Appendix 2 and a Traffic Impact Analysis Report elsewhere. With all the narrow scope and failure to address many important areas, this report actually is reduced to a Traffic Volume Study.
- Page 65 of the DEA .pdf file, numbered DEA Part I page 52 (Figure 9-Proposed Improvements to Project Intersection with Queen Ka'ahumanu) is provided in very low resolution, making it difficult to see details to evaluate problems with turning lane capacity, refuge lanes location and length, or dangers and conflicts with the Kuakini intersection. This deserves a very serious look in order to plan for a signalized intersection when lanes are added. Planning, approvals, and installation for a signalized installation can take over three years. **Intersections that pass warrants but remain unsignalized are a traffic safety liability for the agency in charge.**
- The TIAR never examined traffic impact on Pualani Estates or Kona Vistas roads even as Phase II plans to use their streets. They also omitted La'aloa Ave and Sea View Circle which are signalized intersections between Lako Street and Kamehameha III which were studied. Nani Kailua Drive was also left out. Had they been included I believe they would be found problematic.
- The TIAR does not mention the new Niumalu Marketplace at Henry Street that will open in 2020. This 22 acre shopping center with spaces for over 750 cars will have an impact on the Henry Street intersection, especially where the southbound two lanes quickly merge into a single lane at the Malulani Road traffic light which is also not considered in the TIAR. I wouldn't be surprised to see gridlock in this area because I've already experienced it when the car waiting capacity between Henry Street and Malulani has been full and the Henry Street southbound signal turns green and there's nowhere to go. The problem will be worse when the old Safeway is repurposed.
- The TIAR does not mention the approved Homelands' Villages of La'i 'Opua 200 unit project in Kealakehe. This would alter the results of the 5 year estimate at Makala Blvd., Palani Road and Henry St. intersections.
- Safety and Health concerns were never mentioned and should be an important part of the evaluation. Mere traffic capacity is too narrow in scope. SSFM, which produced the TIAR in Appendix 2 should be well aware of safety problems in the area because they produced a study and a set of crash maps of accidents from 2013-2017 for Vision Zero and classified every intersection in the Royal Vistas TIAR to be part of a "High Injury Network". On Wednesday, Feb

20, 2019 the Hawai'i County Council Transportation Committee passed Resolution Number 38-19 to adopt the goals, strategies and policies of the Zero Vision Task Force to prevent traffic-related fatalities and severe injuries in Hawai'i County, by a vote of 8-1.

- Queen Kaahumanu highway south of Henry Street is not an urban roadway or freeway. It is a two lane undivided road and **One** slow vehicle or accident can take it from free flowing to stopped. This means infrastructure must come before the project starts building. It would be a disaster to have this project delay road improvements or try to do both projects at the same time.
  The draft DEA announces in six places Kuakini Highway from Henry Street to Kamehameha III Road will be widened by 2 travel lanes (Page30 of the .pdf file(page 17 of the DEA), page 68 of the .pdf file (page 55 of the DEA), page 133 of the .pdf file (Page 17 of the TIAR), Page 148 of the .pdf file (page 32 of the TIAR), page 172 of the .pdf file (Page 56 of the TIAR) and page 173 of the .pdf file (page 57 of the TIAR)). Most of these references indicate inclusion of bicycle facilities and sidewalks but West Hawaii Today reports in a September 29, 2020 article that due to Covid-19 state revenues are gone for road improvements, which rely on rental car fees which is down 69% and gas tax which is also drastically short of projections. No Hawaii road projects will be approved for federal BUILD funds for 2020 which will make prioritization unlikely. The improvement will have to be treated as a new project instead of an improvement because right-of-ways and property must be acquired, according to Freshman Senator Dru Kanuha (D-Kona) who was trying to get the project back into consideration, as stated in a West Hawaii Today Newspaper article dated February 13, 2019 and titled "Kona Traffic is a Nightmare". The review committee would be wise to consider the improvements will not happen in a timely manner and will be much harder than the recent widening project to the airport, which was over budget and severely behind schedule.

As a resident that has lived with the traffic near the proposed project for years, I have tried to convey in layman's terms why the project will cause a substantive safety hazard and convince you further study is needed at best, and at worst this project should be delayed or abandoned until mitigation under Hawaii County Code Chapter 25-2-46 (e) is completed for the 5 LOS E&F deficiencies listed on pages 25-29 of the TIAR.

The traffic study report has many references to **L**evel **O**f **S**ervice or **LOS**, which is just a rating or a grade for the flow of traffic. LOS A is free flowing traffic and LOS F is when traffic exceeds the capacity of the roadway and usually includes waves of stop and go traffic. I have included Figure 1-LOS Defined which is a visual depiction of the different traffic levels. Many of the state regulations, including Hawaii, accepts LOS D during peak hours as acceptable but you can see from Figure 1 that LOS C is where general level decline is noticeable. In Hawaii with many tourists on the road, it is important that roadway speed be stable in order to prevent accidents from distracted or inattentive drivers that are not familiar with the roads. As a driver, I have personally seen the aftermath of rollover accidents at Lako Street, Puapuaanui Street, and Nani Kailua Drive. I also have a neighbor that had a cherished vehicle totaled at one of the intersection in the study after being rear-ended by a driver suspected of being distracted by her phone. Another friend had her SUV totaled and suffered back and neck injury at a different intersection in the TIAR study.

The roadway section that is the key to the substantive safety hazard is state road 19 between Henry Street and Kamehameha III. It is not an urban roadway, just a two lane undivided road with some turning lanes. Some of this section of roadway has wide shoulders which are used by scooters, joggers, bikers and allow traffic to yield to the frequent emergency vehicles. The road from Lako Street to Kamehameha III has only inches of shoulder which is often obscured by vegetation. In many places there are guard rails or rock walls. The only way vehicles can yield to the frequent emergency vehicles is to turn onto side streets or into private property parking lots, driveways, etc. It is no wonder that an October 30, 2019 SSFM International Study classified this entire section of road as part of a "High Injury Network" corridor.

I will conclude the traffic comments with the following declarations which were professionally written:

1. I am a resident of Kona Vistas subdivision, County of Hawaiʻi, State of Hawaiʻi. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawaiʻi Island, State of Hawaiʻi affects me personally as well as affects my interest in real property. I reside within half a mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated May 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaʻoa Place. Kekuanaʻoa Place is very steep, has limited sight

distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; storm water would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald

conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

Flood Zones and Drainage

1. I am a resident of Kona Vistas subdivision, County of Hawaiʻi, State of Hawaiʻi. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawaiʻi Island, State of Hawaiʻi affects me personally as well as affects my interest in real property. I reside within a half mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: Floods similar or worse than those from 2015 which damaged homes, exposed a critical water main and posed danger to motorists on Kuakini highway.

3. The steep topography, historical rapid storm water run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. See pp. 36 and 69 thereof. It is clearly understood by the developer that no certificate of occupancy is expected to be issued until the completion of the drainage improvements are completed. Until that necessary and required infrastructure is in place **no building permits should be issued**.

4. I am aware that page 21 of the DEA in a conceptual drawing illustrates the large flood plain that will be directed and concentrated into a ditch that runs over or under two of the subdivision roads. With roofs and pavement preventing any water absorption it will worsen flooding as it proceeds downhill.

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation, among other errors.

6. A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

Birds

The DEA **Table 2 Bird Species Observed in the Project Site** seems incomplete which is not surprising if the field study only allocated an hour during daylight hours for bird observation. I have often heard the rooster from that direction and have observed Kalij pheasants coming from the direction of the proposed project several times. In the past I have heard the shrill cry of hawks and seen birds scatter that didn't want to be lunch. I've seen large wingspan owls swooping low at night on the old trail. I can only suspect that they are also present in the nearby area of the proposed project. I have also seen black birds that didn't look like common myna but I have no reason or expertise to think they were endangered or extinct Hawaiian crows. The study for this DEA does however accept the responsibility to do a thorough and complete job and not just speculate, especially when it comes to endangered and migratory species. The review committee should reject this section of the DEA and require a proper and thorough study be made. I am including a time stamped picture of a Kalij pheasant taken 5/5/2020 at the edge of the Calvary Community Church property.

Blackburn's Sphinx Moth

I have seen large moths resting in shady areas of our lanai and have always left them alone. They appear to be a match or similar to pictures of Internet images of Blackburn's Sphinx Moths. In the future I will try to take a picture from a distance when I see one.

It seems odd that an unmonitored survey that at one point in time does not find evidence of the Blackburn's Sphinx Moth would then allow the developer to destroy food and habitat for the endangered species from that point in perpetuity for 70 acres. The DEA review committee should examine this approach carefully and verify it is appropriate and supported by the governing agencies.

Miscellaneous Infrastructure

While the lack of infrastructure regarding roads, traffic, floods and drainage has been covered there is a shortage of school infrastructure to support such a large medium density project, because the schools are already over capacity and expected to remain over capacity for five years or longer (See Appendix 1 of the DEA). That will make it hard to attract buyers from other areas that commute to jobs around Kona but have school age children. No solution is offered for this problem.

On page 59 of the DEA .pdf file (page 46 of the DEA), a fictitious telephone and data supplier has been specified as "Hawaiian Telephone".

Unanswered Questions

There are so many aspects of this project where no information is offered. The DEA Review Committee should be wary of what is not in the DEA. Some of my questions:

- Will these units have photovoltaic panels to help with the Hawai'i initiative for renewable energy? This should be required just as solar hot water is required.
    - Would any photovoltaic power be shared
        - With a single resident that would own the system?
        - With the Building residents?
        - With the entire development residents?
    - Will there be batteries at every building in fire protected utility areas?
- Fire Protection on multi-unit clusters of buildings
    - Will there be 2 hour or better firewalls to protect individual units?
    - Will there be a shared attic space that will spread fire danger?
    - Will there be sprinkler systems?
    - Will there be permanent fire hoses and risers for fire department use?
    - Will fire extinguishers be provided by the developer for each floor?
    - Will carports or garage structures be attached to the living spaces?
    - Could one bad turkey fry incident destroy a 6-plex or cluster of units?
- Access
    - Will the units be ADA compliant?

  - Will the units have ramps?
  - Will the units have elevators?
- Fees
  - Will there be a maintenance fee?
  - Will there be a HOA fee or an HOA or just a management company?
  - Will there be a fee for satellite dish installation. Landlords cannot ban satellite dishes

Thank you for letting my voice be heard on this very important issue. I also wish that everyone that gave me information or had an opinion would comment, but sadly they probably won't. For every comment you receive there may be a hundred that stay in the silent majority.

If there are any questions or if file attachments are damaged or missing, please contact me

Sincerely,

Clyde Hemby

Clyde Hemby

10/7/2020

Attachments: LOS Defined .pdf file

SSFM October 30, 2019 map at highest resolution available .jpg file

Vision Zero SSFM Oct 30 2019 Study .pdf file

Hawaii Island Vision Zero Traffic Collision Data & Mapping

Traffic Collision Data

Maps were prepared using the following data sources:

- **NHTSA Fatality Analysis Reporting System (FARS)**, years 2013 through 2017: Data includes the specific locations of fatal motor vehicle traffic collisions with pedestrians, bicycles, or other motor vehicles. Data includes demographics of persons involved in the collision, transportation modes involved, day and time of collision, and potential causes of the collision (i.e., drugs, alcohol, speed) notated by the collision report.
- **NHTSA National Center for Statistics and Analysis (NCSA)**, years 2013 through 2017: Average percentage of traffic related fatalities within the state of Hawaii and nationally, associated with speed, alcohol, and time of day.
- **County of Hawaii Police Department**, years 2014 through 2018: Data includes location, when provided, of major motor vehicle traffic collisions. Major traffic collisions are those in which the total property damage (damages to all involved vehicles, fixed objects, animals, etc.) on a public trafficway amounts to more than $3,000, or one in which a traffic collision involves injury or death. Details on the cause or results of the traffic collision were not provided with this data. At times, locations were represented only by the road and nearest town in which the collision occurred, with no reference to cross-street or road mile post. These limitations in the data reduce its utility for determining high-crash locations and identifying mitigation measures, however, it still lends itself to an understanding of high collision corridors.
- **Census Bureau's API for American Community Survey**
  - Years 2013 through 2017: Percentage of the population, by census tract, whose income in the past 12 months was below the poverty level. This, in addition to a high percentage of minorities or persons of color, make up the federal definition for Environmental Justice (EJ) populations. As a minority-majority state, use of high poverty populations was determined to be most effective in assessing EJ populations in Hawaii.
  - Year 2017: Reported commuter mode share.
- **Hawaii Department of Transportation**: Miles of roadway owned by the State of Hawaii, County of Hawaii, Federal Government, or other (often less-used roads, reflective of private roads or "roads in limbo").

Areas of discrepancy existed in the years of data used from FARS (2013-2017) and COH PD (2014-2018). This was due to the desire to use the latest 5 years of data from each source, with FARS data not being as recent as the data provided by the COH PD. Going forward, it would be beneficial to work with COH PD to find a means to record and provide more details on all involved, the potential cause, and specific locations of all collisions. This will help the evaluation portion of the Vision Zero work with the hope of identifying areas for increased engineering, enforcement, encouragement, and education.

Traffic Collision Map Evaluation

1. **Fatal Traffic Collisions:** Vulnerable users were disproportionally killed (bicycle: 5%; pedestrian: 12%; motor vehicle: 83%) on Hawaii Island as compared to the latest reported commuter mode share (bicycle: 0.4%; walk: 2.2%; personal vehicle: 87%). This indicates a higher likelihood of people dying on Hawaii Island roads if traveling by foot or by bicycle. The majority of all fatalities (68%) occurred on State owned roads even though the State owns only 28% of all government (State/County/Federal) owned roads on island. The highest concentration (37%) of bicycle (2) and pedestrian (5) fatal traffic collisions occurred in Hilo. Of those, 5 (26%) fatal traffic collisions fell within areas where greater than 30% of the population's income is below the poverty level. Village and town centers expectedly have the highest number of people walking and bicycling due to the ease of traveling short distances by means other than personal vehicle. This is why context matters in roadway design, and safety of pedestrians and bicycles should be prioritized in these population centers.

   Over the 5-year study period (2013-2017), fatal traffic collisions increased steadily following a low in 2014 (13). Further research into historical NHTSA FARS data shows that following a high number of fatal traffic collisions in 2006 (35), collisions gradually reduced to a 19-year low in 2014 (13). Total fatalities resulting from those collisions similarly reached a 19-year low in 2014 (13), following a high in 2004 (41). When comparing trend lines from annual vehicle miles traveled (VMT) for the state of Hawaii to fatal traffic collisions for Hawaii Island, it can be seen that as VMT increased gradually from 2000, fatal traffic collisions have not increased at the same rate. This is indicative of the improvements to vehicle safety. However, the significant reduction in VMT realized in 2014 directly correlates with the reduction in traffic related fatalities. Thereby, suggesting that a transition to more sustainable transportation modes, such as bus transit, bicycling, and walking, in addition to more compact development and land use, can have the intended result of a reduction in traffic related fatalities.

October 30, 2019

Year	Fatal Traffic Collisions	Traffic Related Fatalities
2000	34	38
2001	29	30
2002	27	28
2003	30	33
2004	33	41
2005	33	40
2006	35	39
2007	34	38
2008	29	29
2009	24	27
2010	29	31
2011	23	23
2012	34	38
2013	21	26
2014	13	13
2015	16	21
2016	27	32
2017	33	35
2018 *	30	32

* - During the work on this project, 2018 NHTSA FARS data was made available and included in this table for comparison but not included in the more detailed analysis.

5. **Residing Zip Code of Motorist Involved in Fatal Traffic Collisions:** The overwhelming majority (87%) of all motor vehicle drivers involved in a fatal traffic collision were residents of Hawaii Island. Other drivers involved were from neighbor islands (4%) and other states (6%). Of those drivers from Hawaii Island, the largest percentage were from zip codes 96720 (Hilo, 33), 96740 (Kailua Kona, 19), 96749 (Keaau, 13), 96778 (Pahoa, 13), and 96737 (Ocean View, 7). Parts of zip code 96720 (Hilo), 96778 (Pahoa), and all of 96737 (Ocean View) have areas where greater than 25% of the population is below the poverty level. This shows that the problem of motor vehicles killing people on Hawaii Island roads is one that needs to be addressed through the education and encouragement of local residents.

6. **High Fatality Network:** High Fatality Corridors are reflective of continuous roadway segments with the highest percentage of fatal traffic collisions per mile on Hawaii Island. End points were chosen at likely termini such as intersections or changes in road typology/geometrics. Where clusters of fatal traffic collisions were found to be isolated from all major traffic collisions, the area was considered a High Fatality Location. In general, the roadways with the highest percentage of fatal traffic collisions per mile also had the highest density of major traffic collisions. These tended to be on the high-speed, high-volume arterials. However, there were some exceptions, which are likely to be more a result of roadway geometry or topography.

   In summary, 14% of all State-owned roads and 1% of all County-owned roads fell along a High Fatality Corridor. Parts of the High Fatality Corridor cross through populations with the highest percentage of poverty, such as in North Hilo and Hawaiian Paradise Park. The area adjacent to Hawaiian Ocean View Estates, a location with a high percentage of the population below the poverty level, was also identified as a High Fatality Location.

   Specific locations of the High Fatality Network are as follows:
   a. Hawaii Belt Road (Route 19), in the vicinity of Paauilo
   b. Hawaii Belt Road (Route 19), in the vicinity of Pepeekeo
   c. Hawaii Belt Road (Route 19), from Honolii Bridge (MP 4.5) to Wailuku Bridge (MP 0.5)
   d. Volcano Road (Route 11), from Kahaualea Road (MP 22.5) to Kipimana Street (MP 6.2)
   e. Keaau-Pahoa Road (Route 130), from Route 11 to Ainaloa Boulevard (MP 7.7)
   f. Hawaii Belt Road (Route 11), in the vicinity of Glenwood
   g. Hawaii Belt Road (Route 11), in the vicinity of Volcano
   h. Hawaii Belt Road (Route 11), in the vicinity of Hawaiian Ocean View Estates
   i. Hawaii Belt Road (Route 11), from Ke Alanui O Aoi (MP 101.1) to Ohia Malu Road (MP 92.9)
   j. Hawaii Belt Road (Route 11)/Queen Kaahumanu Highway (Route 19), from Kealaola Road (Route 11, MP 111.87) to Route 19 (MP 89.5)
   k. Hawaii Belt Road (Route 190), from Milepost 31 to Hina Lani Street (MP 35.1)
   l. Kaiminani Drive, from Queen Kaahumanu Highway (Route 19) to Hawaii Belt Road (Route 190)
   m. Hina Lani Street, from Queen Kaahumanu Highway (Route 19) to Hawaii Belt Road (Route 190)

2. **Fatal Speed-Related Traffic Collisions:** Traffic collisions where speed was considered a factor make up 41% of all fatal traffic collisions. In the state of Hawaii, that percentage is 44%. Nationally, the average is 28% of all fatal traffic collisions. The percentage for Hawaii Island is in line with the state of Hawaii however both are significantly higher than the national average, suggesting a problem throughout Hawaii that should be addressed through education, enforcement, and engineering.

   The highest percentage of speed-related fatalities on Hawaii Island occurred on roads with posted speed limits of 30-35mph (40%). This is true for all fatal traffic collisions on Hawaii Island as well, where 35% of fatal traffic collisions were on roads with posted speed limits of 30-35mph. Nationally, the highest percentage of fatalities is on roads with posted speed limits of 50-55mph (31%). Roads with posted speed limits of 30-35mph made up 17% of all traffic related fatalities nationally. The higher percentage of fatalities on 30-35mph roads on Hawaii Island is potentially due to a lower number of road miles that have speeds higher than 35mph. However, the geometrics and design of these roads may be a factor in inducing speeding.

3. **Fatal Alcohol/Drug-Related Traffic Collisions:** The majority (55%) of fatal traffic collisions were noted to be alcohol and/or drug-related. Of those fatal traffic collisions where alcohol and/or drugs were a factor, speed was also considered a factor in 43%. When separating out traffic collisions where alcohol (not including drugs alone) was a factor, 29% of all fatal traffic collisions involved alcohol. In the state of Hawaii, the percentage of traffic related fatalities associated with alcohol is 35%. Nationally, the average is 30% of all traffic related fatalities which is in line with the numbers from Hawaii Island. More significantly, the 20-25% difference when considering all forms of inebriation (drugs and/or alcohol), points towards a greater need for cultural change through education, as well as a need for increased enforcement.

   Over the 5-year stretch that FARS data was analyzed, fatal drug and/or alcohol related traffic collisions have increased steadily following a low in 2014. This is in line with all fatal traffic collision trend.

Year	Fatal Traffic Collisions			Difference
	Alcohol	Drug (only)	Total	
2013	7	3	10	
2014	3	4	7	-30%
2015	6	4	10	+42%
2016	7	9	16	+60%
2017	9	9	18	+13%

4. **Fatal Traffic Collisions During Day/Night:** The majority (55%) of fatal traffic collisions on Hawaii Island occurred at nighttime. Nationally, the average is 47% of all fatal traffic collisions. With limitations on streetlight luminescence levels, and hundreds of miles of rural, unlit, roadways, it is not unexpected to have a slightly higher than normal percentage of fatal traffic collisions on Hawaii Island occurring at nighttime.

October 30, 2019

7. **Traffic Collision Density (Heat Maps):** The highest density of traffic collisions occurred in and around the most populated village and town centers. Crash density was highest in and around Hilo town. Crash density in and around Kailua-Kona was less concentrated, likely due to the limited road grid network, resulting in collisions being concentrated on major roads in the area. Similarly, major arterials south of Hilo, which constitute the majority of commuter traffic in the region, had high densities of crashes. Waimea and Honokaa reflected smaller, yet concentrated, densities of traffic collisions.

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Tel: (808) 494-2039

September 13, 2021

Mr. Clyde Hemby
Via email: wayneh72@hotmail.com

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Hemby:

Thank you for the comment letter dated October 7, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The development is designed to use the least amount of materials, the least amount of labor, and is a large urban project being stuffed into a place with insufficient infrastructure to support it.

> **Response 1:** The project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. The proposed action being considered in the EA is the proposed development project within the current zoning. The project is consistent with medium density zoning and conforms to the guiding principles regarding urban growth patterns as defined by the Kona Community Development Plan (CDP).

Comment 2: The schools are over capacity and projected to be for at least five years.

> **Response 2:** As described in Section 3.7.1 of the EA, the project would be constructed in phases, and occupancy would occur over time. Additionally, it is expected that the project would provide mid-market, including workforce housing for the local community. The project's first phase would construct rental units, and it is expected that occupants of these units would be local and many of the students already attend local public schools. Section 3.7.1 has been revised to clarify that since the project would be constructed in phases, all 99 students would not all arrive at once and occupancy would occur over a longer period of time. This is consistent with predicted rates of growth for the area which are considered by the Hawaii State Department of Education in their forecast planning for public schools.

Comment 3: The flood control is insufficient and will be made much worse by this development.

> **Response 3:** There is no history of flooding on this property. As discussed in the EA, the project would not contribute or exacerbate the flooding issues. Per Section 27-20 of the Hawaii County Code, the project is not allowed to increase any run-

off onto neighboring properties, so there are no effects on any neighbors from project run-off including on the County-owned parcels.

Comment 4: The current roadway is a rural two lane road, with wide shoulders to allow vehicles to yield to the frequent emergency vehicles, and is not adequate for current traffic. There will be a substantive traffic safety problem with more traffic congestion and more severe accidents if this development is allowed before the roadway is improved.

Response 4: The other two options would be to (1) add a signal at the proposed project and (2) distribute the inbound project volume to make a south-bound (SB) left turn (LT) at Lako Street, and a *mauka* bound LT onto Kekauna'oa Place to enter the development. Alternative 1 would add a signal, increase delay on Queen Ka'ahumanu Highway. Alternative 2 would increase delay at Lako Street, and would add considerable travel time for the inbound traffic. A SB LT at Kona Vistas would be basically waiting for a gap provided by the Lako Street intersection. A vehicle in alternative 2 using Lako Street would need to wait for a protected green arrow at Lako Street. Basically, the southbound left is waiting for a gap provided by the Lako Street intersection, it is more reasonable to provide and allow for left turns in at the roadway.

Comment 5: While it is tempting to accept a development for the economic and property tax boost, the proposed development of Royal Vistas as specified will be hurtful to the community in the long run.

Response 5: The project is consistent with medium density zoning and conforms to the guiding principles regarding urban growth patterns as defined by the Kona CDP, and is expected to provide infill housing for on-island residents.

Comment 6: It will adversely affect three or more established nearby subdivisions. It will not be substantially cheaper for buyers. Market value will put the units out of reach of local families. Most of the units will be sold to mainland investors or rented out by the Honolulu developer so money will not stay within the Hawai'i island economy.

Response 6: The intent for the project as described in the EA is to address housing shortages in Kona (Section 1.2). "To address housing shortages in Kona, the Kona CDP identifies Objective HSG-4: Build More Units and Policy HSG-4.2: Workforce Housing. The workforce gap group (up to 180% of median income) includes the part of the population that earns too much to qualify for affordable housing programs, yet too little to buy or rent decent housing close to their jobs. The Project would build units that offer a variety of housing types for both the rental and buyer segments of the mid-market which includes the workforce group. Although the Project is not specifically a workforce project, it would provide a housing option for the workforce gap group."

As evidenced by resort projects on the Big Island, as well as communities such as Waikoloa and lower Kalaoa (Ka'iminani Street and environs), different housing product types targeting different socio-economic built in close proximity do not necessarily adversely affect property values or quality of life.

<u>Comment 7</u>: Please consider that the best long term plan for this land might be to leave it undeveloped. It could be set aside or acquired as open space land and used for a purpose that has a light footprint.

<u>Response 7</u>: Comment noted; however, the applicant action being considered and analyzed on private land in the EA does not include a proposal for change in zoning or creation of a public park. Although the project site has been nominated for PONC acquisition twice, both times the Committee declined.

<u>Comment 8</u>: Page 125 of the DEA .pdf file (Page 9 of TIAR) cites data counted on Thursday, August 24, 2019, which was a Saturday.

<u>Response 8</u>: The TIAR states Thursday, August 24, 2019. The wrong date is written here. It should be Thursday, August 29, 2019, as shown in the data sheets in the appendix and has been corrected.

<u>Comment 9</u>: Page 125 of the DEA .pdf file (Page 9 of TIAR) tells us data collection was on Tuesday, April 30, 2019 and Th1,1rsday, August 24, 2019 which are 116 days apart! Are they "cherry picking" data because of unfavorable results? Why was this done?

<u>Response 9</u>: Based on the numbers for the 2018-2019 monthly tourism numbers, August 2019 had the 4th highest visitor total and April 2019 had the 10th highest visitor total. This is consistent with the information you provided. For all islands, the pattern is similar with high visitor volume in June-August, December, and March which corresponds to summer break, winter break, and spring break. These are when school is not in session, so visitor traffic is high as people travel more. When school is out, typically the overall traffic volume during the AM and PM peak hour is lower. Generally, traffic counts are taken during “worst case” scenarios, which are historically on Tuesday through Thursday during school days. This is information we know, and we purposely target school days as when we take our traffic counts. While tourism numbers may be low, the intensity of the peak during the AM and PM school day peaks are generally more intense than the AM and PM peak during non-school days. Here is the HDOT station on Queen Kaahumanu Highway in 2016. It shows that the monthly weekday average is very close to the yearly weekday average. The standard that traffic engineers use is the school day peak; therefore, the counts taken in April and August are defendable.

<u>Comment 10</u>: The DEA is very inconsistent in reference to the very important TIAR, referring to it as a Traffic Impact Assessment Report in the table of contents and the cover page for Appendix 2 and a Traffic Impact Analysis Report elsewhere. With all the narrow scope and failure to address many important areas, this report actually is reduced to a Traffic Volume Study.

Response 10: The acronym has been added to the table of contents and Appendix 2 cover page. The report does more than account for volumes, it analyzes the impacts on traffic from the proposed project.

Comment 11: Page 65 of the DEA .pdf file, numbered DEA Part I page 52 (Figure 9-Proposed Improvements to Project Intersection with Queen Ka'ahumanu) is provided in very low resolution, making it difficult to see details to evaluate problems with turning lane capacity, refuge lanes location and length, or dangers and conflicts with the Kuakini intersection.

Response 11: The MUTCD states: "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention that where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The project is not necessarily triggering the satisfaction of a traffic signal warrant. The EA has been updated to include a higher resolution Figure 9.

Comment 12: The TIAR never examined traffic impact on Pualani Estates or Kana Vistas roads even as Phase II plans to use their streets. They also omitted La'aloa Ave and Sea View Circle which are signalized intersections between Lako Street and Kamehameha III which were studied.

Response 12: Most of the proposed project's traffic would be going to and coming from the north and would not affect developments south of Royal Vistas. Laaloa Avenue and Sea View Circle would not be impacted significantly from the inbound and outbound traffic south of the development. Not more than several vehicles would be added to the Queen Ka'ahumanu Highway through movement at these intersections, and those would be 'through' vehicles which have very little impact on an intersection.

Comment 13: The TIAR does not mention the new Niumalu Marketplace at Henry Street that will open in 2020. Or the approved Homelands' Villages of La'i 'Opua 200 unit project in Kealakehe.

Response 13: The TIAR does not include the Niumalu or La'i 'Opua projects. It included the Henry Street intersection, which is over 2.5 miles away from the proposed project's access, for an in-depth look at the potential regional effects on the roads. The analysis showed that, as traffic to/from the proposed project disperses, there will be very little effect at these far away intersections due to the project's traffic. As for the two SB LTs from Henry that need to merge into one lane, this problem has existed for a while. This is not a result of any particular development. This is the start of the bottleneck in the SB direction because of the merge, and realistically will only be improved by then widening of Queen Kaʻahumanu Highway.

Comment 14: Safety and Health concerns were never mentioned and should be an important part of the evaluation. Mere traffic capacity is too narrow in scope. SSFM, which produced the TIAR in Appendix 2 should be well aware of safety problems in the area because they produced a study and a set of crash maps of accidents from 2013-2017 for Vision Zero and classified every intersection in the Royal Vistas TIAR to be part of a "High Injury Network". On Wednesday, Feb 20, 2019 the Hawai'i County Council Transportation Committee passed Resolution Number 38-19 to adopt the goals, strategies and policies of the Zero Vision Task Force to prevent traffic-related fatalities and severe injuries in Hawai'i County, by a vote of 8-1.

Response 14: While the TIAR did not include an in-depth crash study, as this was not scoped, SSFM did do a cursory review of the FARS website and did not note any recent fatal crashes in the vicinity of the proposed project's access.

Comment 15: Queen Kaahumanu highway south of Henry Street is not an urban roadway or freeway. It is a two lane undivided road and One slow vehicle or accident can take it from free flowing to stopped. This means infrastructure must come before the project starts building. It would be a disaster to have this project delay road improvements or try to do both projects at the same time.

Response 15: While the widening of Queen Kaʻahumanu Highway would help out traffic, the timing of this improvement is not known and is outside the scope of this project.

Comment 16: The project will cause a substantive safety hazard and further study is needed, or this project should be delayed or abandoned until mitigation under Hawaii County Code Chapter 25-2-46 (e) is completed for the 5 LOS E&F deficiencies listed on pages 25-29 of the TIAR.

Response 16: The LOS E/F on these pages refer to left turns from Queen Kaʻahumanu Highway or movements from minor streets. These are typical of left turns on major highways or minor streets. Even the installation of a traffic signal would still likely result in LOS E/F for these movements.

Comment 17: The traffic study report has many references to Level of Service or LOS, which is just a rating or a grade for the flow of traffic. Many of the state regulations, including Hawaii, accepts LOS D during peak hours as acceptable but LOS C is where general level decline is noticeable.

Response 17: The analysis has been completed per State regulations regarding Level of Service, and has taken into account the peak traffic numbers.

Comment 18: The roadway section that is the key to the substantive safety hazard is state road 19 between Henry Street and Kamehameha III. The road from Lako Street to Kamehameha III has only inches of shoulder which is often obscured by vegetation.

> **Response 18:** Although the condition of the Lako Street to Kamehameha III roadway is currently very narrow and offers little room to move over for emergency vehicles, this is a current need of the roadway and is out of scope for the project.

Comment 19: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 19:** Specific comments for traffic impacts are discussed below.

Comment 20: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 20:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 21: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuana'oa Place.

> **Response 21:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuana'oa Place, the number of vehicles projected to use

Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 22: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 22:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 23: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 23:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 24: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 24:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 25: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 25:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 26: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 26:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 27: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 27:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 28: I am specifically concerned about floods similar or worse than those from 2015 which damaged homes, exposed a critical water main and posed danger to motorists on Kuakini highway.

> **Response 28:** Flooding has occurred *makai* of Queen Ka'ahumanu Highway from waters in the County-owned Holualoa Ditch and the Horseshoe Bend Ditch, and as described in Section 3.3.2 of the EA the proposed project would not

increase the amount of water carried by these ditches from the entire drainage basin extending miles up-hill as the project is not allowed to do so.

Comment 29: The steep topography, historical rapid storm water run-off and associated damage present hazards that are not adequately addressed in the DEA.

Response 29: As noted, the steep topography results in rapid runoff during heavy rain events. There is no record of damage to the project site or adjacent properties from said runoff, which is carried away by the two County-owned ditches and State-owned culverts.

Comment 30: I am aware that page 21 of the DEA in a conceptual drawing illustrates the large flood plain that will be directed and concentrated into a ditch that runs over or under two of the subdivision roads. With roofs and pavement preventing any water absorption it will worsen flooding as it proceeds downhill.

Response 30: Any increase in drainage from improvements would be directed to alternative run-off or storage facilities such as dry-wells, as approved by a County-reviewed drainage plan, and would not flow onto adjacent properties.

Comment 31: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors.

Response 31: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuana'oa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona CDP "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the Kona CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.

Additionally, the text in Section 3.3.2 of the EA describes that Kona Three would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by DPW. Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.

There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 32: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

> **Response 32:** The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

Comment 33: The DEA Table 2 Bird Species Observed in the Project Site seems incomplete which is not surprising if the field study only allocated an hour during daylight hours for bird observation. The study for this DEA does accept the responsibility to do a thorough and complete job and not just speculate, especially when it comes to endangered and migratory species.

> **Response 33:** The biological inventory report documents the species detected (which took many hours and many avian species were detected) and potential habitat at the project site. The Biological Survey Report in Appendix 3 of the EA acknowledges the limitations of a biological survey of a large project area and the absence of any particular species cannot be warranted from the survey's results. While additional species may be present, it is the professional opinion of the Hawaiian biologist that there is no possibility that the Hawaiian crow is present in the project area. Therefore, the EA includes a description of species detected as well as potential habitat for native species in the existing conditions part of Section 3.3.4. The impact discussion includes potential impacts to individuals and to habitat for native species (including those not directly detected during the survey). The impact discussion including protection measures to minimize these impacts to native species (including avifauana and bats) and their habitat in Section 3.3.4.

Comment 34: It seems odd that an unmonitored survey that at one point in time does not find evidence of the Blackburn's Sphinx Moth would then allow the developer to destroy food and habitat for the endangered species.

> **Response 34:** During the survey, none of the host plants for either the adult or larval stages of the moth are present. As stated in Section 3.3.4 of the EA, to prevent potential impacts to the Blackburn's sphinx moth, the project would include the following protection measures. A biologist familiar with the species would survey for Blackburn's sphinx moth and its larval host plants (tree tobacco and native ʻaiea) between November and April or several weeks after a significant rain and within four to six weeks prior to construction. Surveys should include searches for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If moths or native ʻaiea or tree tobacco over three feet are found during the survey, Kona Three would coordinate with the USFWS for guidance to avoid impacts.

If no Blackburn's sphinx moth, 'aiea, or tree tobacco are found during pre-disturbance surveys, Kona Three would ensure that measures are taken to avoid attraction of Blackburn's sphinx moth and prohibit tree tobacco from entering the site. Tree tobacco can grow more than three feet in approximately six weeks, and above three feet in height the tree tobacco can become a host plant for Blackburn's sphinx moth. The Proposed Project would remove tree tobacco less than three feet tall and monitor the Project Site for new tree tobacco grown before, during, and after Project construction. Monitoring for tree tobacco after construction, can be completed by any staff, such as regular maintenance crew, provided with pictures of tree tobacco at different life stages.

Comment 35: While the lack of infrastructure regarding roads, traffic, floods and drainage has been covered there is a shortage of school infrastructure to support such a large medium density project, because the schools are already over capacity and expected to remain over capacity for five years or longer. On page 59 of the DEA .pdf file (page 46 of the DEA), a fictitious telephone and data supplier has been specified as "Hawaiian Telephone".

Response 35: As described in Section 3.7.1 of the EA, the project would be constructed in phases, and occupancy would occur over time. Additionally, it is expected that the project would provide workforce housing for the local community. The project's first phase would construct rental units, and it is expected that occupants of these units would be local and many of the students already attend local public schools. Section 3.7.1 has been revised to clarify that since the project would be constructed in phases, all 99 students would not all arrive at once and occupancy would occur over a longer period of time. This is consistent with predicted rates of growth for the area which are considered by the DOE in their forecast planning for public schools.

Regarding telephone and data provider, the text has been revised to clarify that telephone and data services are provided by local utilities.

Comment 36: There are so many aspects of this project where no information is offered.

Response 36: These details would be identified during final project design, which would be completed close to project development. For the purposes of the EA, potential impacts from the project to the environment are disclosed.

Comment 37: Fire Protection on multi-unit clusters of buildings.

Response 37: The project would be compliant with all applicable codes and standards of the National Fire Protection Association (NFPA) 1, Uniform Fire Code, 2006 Edition (which is the Hawaii State Fire Code).

Comment 38: Will the units be ADA compliant? Will the units have ramps? Will the units have elevators?

> **Response 38:** Text has been added to the EA to clarify that the development would be compliant with American with Disabilities Act Standards for accessible design.

Comment 39: Will there be a maintenance fee? Will there be a HOA fee or an HOA or just a management company? Will there be a fee for satellite dish installation.

> **Response 39:** Consistent with standard practice for housing developments, for Phase I of the project the rental units would not have any separate maintenace fees since these would be incorporated into the rental costs. For Phase II of the project, an Association of Apartment Owners (AOAO) would be established and that group will determine fees. Regarding satelitte dishes, in Phase I the owners would likely provide reception to the tenants and in Phase II the installation of satellite dishes would be regulated by the AOAO.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

DATE: October 8, 2020

TO: Michele Lefebvre
Stantec Consulting Inc.
P.O. Box 191
Hilo, HI 96721
Email: michele.lefebvre@stantec.com

CC: County of Hawai'i Planning Department
101 Pauahi Street, Suite 3
Hilo, HI 96720
Email: planning@hawaiicounty.gov

FROM: Janice Kerr
76-4320 Leilani St.
Kona Vistas Subdivision
Kailua-Kona, HI 96740
808-938-1185

RE: Project: Royal Vistas Housing Project
Island: Hawaii
District: North Kona
TMK: (3^{rd}) 7-6-021:016, 7-6-021:017, 7-6-021:018
and 7-6-021:019

I have reviewed the Proposal provided to the County of Hawai'i Planning Department by the Developer of Royal Vistas. I currently live on Leilani Street in the Kona Vistas Subdivision, and have resided here since 1994. I have some serious concerns about the negative impacts of this proposed development:

I have watched the traffic at the intersection of Lako Street and Queen "K" Hwy increase exponentially over these past 26 years. It is now at the point where the volume of West-bound traffic down Lako Street backs up from the intersection at the Highway to the extent that the signal turns **RED**, before all the backed-up vehicles turning **NORTH OR SOUTH** onto Queen "K" can proceed through the intersection. They are forced to endure a lengthy wait for another green light. Per the Proposal, this intersection's traffic flow grade is currently rated **"C" and "D**". The impact of Royal Vistas will cause deterioration to **"E" and "F**". The same is true of East-bound traffic coming up Lako Street to Queen "K".

The volume of vehicles on Queen "K" North-bound **AND** South-bound is increasing at an alarming rate, and soon we will not even be able to turn onto Lako Street from Leilani Street (and other streets in Kona Vistas), due to the volume of vehicles backed up from the intersection. The additional traffic from Royal Vistas pouring onto the Queen "K", increasing the existing volume, will worsen every direction of travel significantly more than the models show. That is because the models do not depict the ACTUAL - **on the street** - difficulties of travel present now due to the **current degree of congestion**.

Most likely the proposed subdivision will generate more traffic than presented in the Proposal because there will be more significantly more **delivery vehicles**, which are not considered in the Proposal. There will be more personal vehicles, also - - houseguests, rentals and purchased **units with multiple families**, vacation rentals with **multiple parties per unit**, to name just a few of the possibilities.

In addition, the north end of Leilani Street (from Lako Street to the Church) is a quiet (quasi-cul-de-sac), used by a significant number of Kona Vistas' families with children and pets, for walking, running, biking, etc. **There are no curbs, everyone is on the street pavement**. My driveway is less than 25 feet long, my only option is to back out of the driveway onto Leilani Street, which would be close to impossible with traffic. It would be very unsafe to add any volume of traffic to Leilani Street as it is. It would also add enormous vehicular **noise pollution**.

This Proposal will significantly lower my property value and that of most of my neighbors in Kona Vistas. It is unacceptable and very unfair to lose the value of our collective investment in order to make money for the Developers. **We have all worked hard to keep Kona Vistas quiet, healthy and safe for Families and Seniors.** Please do not destroy the good environment so many of us strive so hard to maintain here, merely for the benefit of a few greedy people.

I strongly recommend denial of this proposal.

Sincerely,

Janice Kerr

Mori, Ashley

From: Janice Kerr <jkkona@hawaiiantel.net>
Sent: Thursday, October 08, 2020 2:58 PM
To: Michele Lefebvre
Cc: Planning Internet Mail
Subject: PROJECT: Royal Vistas Housing Project; island of Hawaii; District of North Kona
Attachments: Final RV.docx

Please see attached response to above referenced Royal Vistas Housing Project, Hawaii Island, North Kona District

Sincerely,
Janice Kerr
-76-4320 Leilani St.
Kailua-Kona, HI 96740
808-938-1185

DATE:	October 8, 2020
TO:	Michele Lefebvre Stantec Consulting Inc. P.O. Box 191 Hilo, HI 96721 Email: michele.lefebvre@stantec.com
CC:	County of Hawai'i Planning Department 101 Pauahi Street, Suite 3 Hilo, HI 96720 Email: planning@hawaiicounty.gov
FROM:	Janice Kerr 76-4320 Leilani St. Kona Vistas Subdivision Kailua-Kona, HI 96740 808-938-1185
RE:	Project: Royal Vistas Housing Project Island: Hawaii District: North Kona TMK: (3rd) 7-6-021:016, 7-6-021:017, 7-6-021:018 and 7-6-021:019

I have reviewed the Proposal provided to the County of Hawai'i Planning Department by the Developer of Royal Vistas. I currently live on Leilani Street in the Kona Vistas Subdivision, and have resided here since 1994. I have some serious concerns about the negative impacts of this proposed development:

I have watched the traffic at the intersection of Lako Street and Queen "K" Hwy increase exponentially over these past 26 years. It is now at the point where the volume of West-bound traffic down Lako Street backs up from the intersection at the Highway to the extent that the signal turns **RED**, before all the backed-up vehicles turning **NORTH OR SOUTH** onto Queen "K" can proceed through the intersection. They are forced to endure a lengthy wait for another green light. Per the Proposal, this intersection's traffic flow grade is currently rated **"C" and "D"**. The impact of Royal Vistas will cause deterioration to **"E" and "F"**. The same is true of East-bound traffic coming up Lako Street to Queen "K".

The volume of vehicles on Queen "K" North-bound **AND** South-bound is increasing at an alarming rate, and soon we will not even be able to turn onto Lako Street from Leilani Street (and other streets in Kona Vistas), due to the volume of vehicles backed up from the intersection. The additional traffic from Royal Vistas pouring onto the Queen "K", increasing the existing volume, will worsen every direction of travel significantly more than the models show. That is because the models do not depict the ACTUAL - **on the street** - difficulties of travel present now due to the **current degree of congestion**.

Most likely the proposed subdivision will generate more traffic than presented in the Proposal because there will be more significantly more **delivery vehicles**, which are not considered in the Proposal. There will be more personal vehicles, also - - houseguests, rentals and purchased **units with multiple families**, vacation rentals with **multiple parties per unit**, to name just a few of the possibilities.

In addition, the north end of Leilani Street (from Lako Street to the Church) is a quiet (quasi-cul-de-sac), used by a significant number of Kona Vistas' families with children and pets, for walking, running, biking, etc. **There are no curbs, everyone is on the street pavement**. My driveway is less than 25 feet long, my only option is to back out of the driveway onto Leilani Street, which would be close to impossible with traffic. It would be very unsafe to add any volume of traffic to Leilani Street as it is. It would also add enormous vehicular **noise pollution**.

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I strongly recommend denial of this proposal.

Sincerely,

Janice Kerr

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Janice Kerr
73-4320 Leilani Street
Kailua-Kona, HI 96740
Email: jkkona@hawaiianintel.net

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Kerr:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: Traffic at the intersection of Lako Street and Queen "K" Hwy has increased exponentially over these past 26 years. Per the Proposal, this intersection's traffic flow grade is currently rated "C" and "D". The impact of Royal Vistas will cause deterioration to "E" and "F".

> **Response 1:** This traffic signal is long due to the split phasing, and the volume on Queen Ka'ahumanu Highway, which is still two lanes at this intersection. A short term, interim improvement can include the changing of the phasing at Lako Street from split to protected, protected permitted, or permitted, and changing the cycle length. It is known that this cycle length is very long, shortening the cycle length could provide shorten waiting times for the minor street approach. Also, the widening of Queen Ka'ahumanu Highway would improve the LOS at Lako Street. These improvements are discussed in the Traffic Impact Analysis Report (TIAR).

Comment 2: Most likely the proposed subdivision will generate more traffic than presented in the Proposal because there will be more significantly more delivery vehicles, which are not considered in the Proposal.

> **Response 2:** The Institute of Transportation Engineers (ITE), Trip Generation Handbook referenced in the TIAR (Appendix 2 in the EA) used for the traffic analysis uses housing units, and it does not assume one person per unit. This is taken from the ITE trip gen handbook regarding land use 220: 2.72 residents are assumed for each unit. There is no trip generation for number of bedrooms. It is difficult to analyze and make projections based on number of bedrooms, or how many people we expect in bedrooms. The ITE trip generation for land use 220 collected data on low-rise multi-family housing, and based on that data, the traffic model came up with a best fitted curve, which discussed below, has a very low standard deviation, and a very high R squared value, which indicated

that the data collected is not scattered. The TIAR assumes a land use that is typical, and with the best possible data, captures the number of project generated trips.

Comment 3: In addition, the north end of Leilani Street (from Lako Street to the Church) is a quiet (quasi-cul-de-sac), used by a significant number of Kona Vistas' families with children and pets, for walking, running, biking, etc. There are no curbs, everyone is on the street pavement.

> **Response 3:** While it is possible that after Kekuana'oa Place is connected in Phase II of the project, some residents could travel into the project site from the south by turning onto Sunset Avenue, then north on Leilani Street (or Pualani Street), then east on Lako, and then west on Kekuana'oa Place, this would represent the majority of traffic or where backups could occur. This is why the traffic study focused on impacts at the intersections identified in Section 3.7.2 and in Appendix 2 of the EA.

Comment 4: This Proposal will significantly lower my property value and that of most of my neighbors in Kona Vistas. It is unacceptable and very unfair to lose the value of our collective investment in order to make money for the Developers. We have all worked hard to keep Kona Vistas quiet, healthy and safe for Families and Seniors. Please do not destroy the good environment so many of us strive so hard to maintain here, merely for the benefit of a few greedy people.

> **Response 4:** The project is consistent with medium density zoning and conforms to the guiding principles regarding urban growth patterns as defined by the Kona Community Development Plan. The analysis in the EA cannot speculate on property values.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T. L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: Marta Barreras <barrerasmarta@yahoo.com>
Sent: Thursday, October 08, 2020 12:23 PM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA comments

COH PLANNING DEPT
OCT 8 2020 PM1:50

DECLARATION OF MARTA BARRERAS

I, _MARTA BARRERAS, declare:

1. I am a resident of Kailua Kona, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within .05 miles [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: Archealogical sites.

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate. The EA was done on only a VERY SMALL portion of the large acreage area. The Northwest and North area of the property is the home of an ancient holua and was NOT assessed or documented.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

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5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku Stone, I have spoken with him personally and he has statements regarding the ancient historic holua running through this site. He is very interested in the restoration of this site.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural and archaeological features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

8. The developer's report states that they consulted many parties from OHA, etc, whom I personally know are against this desecration. The developer's report seems to allude that they had consent from these parties, from whom they definitely DO NOT have consent.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 8, 2020.

Sincerely,

Marta Barreras

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Marta Barreras
via email: barrerasmarta@yahoo.com

RE: Comments on Cultural Resource Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Barreras:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I do not consider that the archaeological studies in support of the DEA are adequate. The EA was done on only a very small portion of the large acreage area. The northwest and north area of the property is the home of an ancient holua and was not assessed or documented.

> **Response 1:** Numerous archeological studies were performed, covering 100% of the entire project's land area. Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 2: I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

> **Response 2:** As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Survey (AIS) reports were prepared for the project.

As part of the AISs, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 3: I base my concerns upon the evaluation performed by Tom Pohaku Stone, I have spoken with him personally and he has statements regarding the ancient historic holua running through this site. He is very interested in the restoration of this site.

Response 3: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of heʻehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

Comment 4: The developer's report states that they consulted many parties from Office of Hawaiian Affairs (OHA), etc, whom I personally know are against this desecration. The developer's report seems to allude that they had consent from these parties, from whom they definitely DO NOT have consent.

> **Response 4:** Section 3.5 of the EA states that consultation was sought from OHA and other parties. Consultation does not imply consent. As described in Section 3.5, consultation means gathering input in an effort to assess impacts.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: angy chesler <Angy@vipconcepts.com>
Sent: Thursday, October 08, 2020 1:27 PM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project
Attachments: KV Declaration re Traffic-non kv owners.pdf

COH PLANNING DEPT
OCT 8 2020 PM1:49

VIP-Concepts
http://www.vipconcepts.com
75-6130 Paulehia St.
Kailua-Kona, Hi 96740
p. 808.990.2649
f.808.217.9942

136660

DECLARATION OF ____________________

I, ANGELA CHESLER, declare:

1. I am a resident of [Pualani Estates subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 1 mile [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10.8., 2020.

Signature: A. Chesler

Printed name: Angela Chesler

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Angela Chesler
via email: Angy@vipconcepts.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Chesler:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

<u>Comment 7</u>: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **<u>Response 7</u>:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

<u>Comment 8</u>: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **<u>Response 8</u>:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

<u>Comment 9</u>: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **<u>Response 9</u>:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T. L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

COH PLANNING DEPT
OCT 8 2020 PM4:20
REC'D HAND DELIVERED

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October 8, 2020

Michael Yee, Director
Hawai'i County Planning Department
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720

Re: pending Draft Environmental Assessment submitted by Royal Vistas Housing Project
Tax Map Key Nos. (3) 7-6-021:016, (3) 7-6-021:017, (3) 7-6-021:018, and (3) 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i

Dear Mr. Yee:

I represent Kona Vistas Association, Inc., a non-profit corporation comprising an association of homeowners and residents of real properties located within the Kona Vistas subdivision adjacent to the proposed development project. Thank you for the opportunity to provide input regarding the draft Environmental Assessment. This submission addresses three main issues: traffic impacts, archaeological information and stormwater drainage. These issues must be addressed individually and cumulatively. For the reasons stated below, my client considers that draft Environmental Assessment is deficient in each of these areas. Accordingly, the Planning Department should not accept the draft Environmental Assessment in its present form. See, e.g., Kaleikina v. Yoshioka, 128 Hawaii 53, 283 P.2d 60 (2012) (in context of accepted EIS, a reviewing court uses the 'rule of reason' to determine whether an EIS is legally sufficient in adequately disclosing facts to enable a decision-making body to render an informed decision. Under the "rule of reason," an EIS need not be exhaustive to the point of discussing all possible details bearing on the proposed action but will be upheld as adequate <u>if it has been compiled in good faith and sets forth sufficient information to enable the decision-maker to consider fully the environmental factors involved and to make a reasoned decision after balancing the risks of harm to the environment against the benefits to be derived from the proposed action, as well as to make a reasoned choice between alternatives. (Emphasis added.)</u>

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Traffic Impacts

The Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the draft Environmental Assessment does not fully or accurately address traffic impacts likely to result from the proposed development both within and without the Kona Vistas subdivision. Traffic and the SSFM Traffic Impact Analysis Report are discussed in the body of the draft Environmental Assessment at pp. 48-56, 67 and 71.

First, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. Of particular concern are the resulting addition of numerous vehicle trips to and from the Royal Vistas Housing Project separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. Kona Vistas Association, Inc. considers that the Planning Department should require the applicant to address these concerns.

Second, the draft Environmental Assessment requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the draft Environmental Assessment simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the draft Environmental Assessment to fail to address the potential adverse impacts of the proposed project's increased use and reliance upon substandard existing infrastructure, like Kekuana'oa Place.

Third, the draft Environmental Assessment addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules. The Planning Department should require the applicant to specifically address adverse traffic impacts resulting from the proposed project in the context of *adverse secondary impacts, such as population changes or effects on public facilities* as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

Fourth, the Planning Department should not accept the draft Environmental Assessment reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies[1]:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

[1] Please see attached Assessment of two TIAR for the Royal Vistas / Kona Village Development dated September 25, 2020 by Panos D. Prevedouros, Ph.D.

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

In sum, the draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

2. Archaeological Information

The draft Environmental Assessment at pp. 42 - 43 recites that the applicant's experts sought consultation from, inter alia, J. Curtis Tyler III, cultural descendent, and from Kekoa Nazara, Kona Hawaiian Civic Club President. Supposedly, Mr. Tyler provided specific information that was not included with the draft Environmental Assessment. Kona Vistas Association, Inc., however, is informed that neither Mr. Tyler nor Kekoa Nazara were contacted. Kona Vistas Association, Inc. is presently investigating these discrepancies and will seek to supplement this input statement. In the interim, the Planning Department should require the applicant to verify the information presented in the draft Environmental Assessment and the June, 2020 Cultural Impact Assessment For A 78.122-Acre Property In Hōlualoa 1st Ahupua'a, North Kona District, Hawai'i Island, Hawai'i [TMK: (3) 7-6-021:016-019] attached to the draft. An open question exists whether the draft Environmental Assessment has been compiled in good faith and sets forth sufficient information to enable the decision-maker to consider fully the environmental factors involved.

Next, the draft Environmental Assessment only lightly touches on potentially important cultural Archaeological Resources at pp. 71-73. Chapter 11-200.1-13, HAR, however, requires agencies to consider irrevocable commitments of natural, cultural or historic resources when determining whether an Action has significant effects. Although the draft Environmental Assessment claims that "no valuable natural or cultural resources would be committed or lost as a result of the Proposed Project" and "No impacts to archaeological resources would occur with the planned preservation of the railroad berm and petroglyph.", Kona Vistas Association, Inc. is informed to the contrary According to an evaluation and analysis performed by Tom Pohaku Stone, substantial evidence exists that the land encompassed by the subject land parcels includes

features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed. See correspondence and figures attached hereto.
It appears that the draft Environmental Assessment identifies the Holualoa slide parallel walls only as walls used for agricultural / ranching.

Kona Vistas Association, Inc. is presently seeking to verify the information attributed to Mr. Stone and will seek to supplement this input statement upon receipt of such verification. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

3. <u>Drainage</u>

The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the draft Environmental Assessment. The draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future, which would lead to unlawful project segmentation, among other errors.

A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

4. <u>Cumulative Effects</u>

Once the three areas identified above are properly and fully addressed, the cumulative effects of adverse impacts in these areas and all others must also be addressed.

Thank you for your consideration of this input from Kona Vistas Association, Inc.

Kind regards,

Steven D. Strauss

Enclosures

pc: client

TRAFFIC IMPACTS

Assessment of two TIAR for the Royal Vistas / Kona Village Development

Panos D. Prevedouros, PhD, Professor of Transportation Engineering, Univ. of Hawaii at Manoa

Honolulu, September 25, 2020

Throughout this document I refer to the **Current TIAR** (by SSFM International, dated July 2020) and the **Old TIAR** (by Witcher Engineering, dated October 18, 2018.)

Both TIAR use the standard methodology in the Highway Capacity Manual (HCM) for assessing traffic impacts, which is generally accepted in Hawaii. I was a past contributor of specifications in the HCM and teach it routinely in my CEE 462—Traffic Engineering course at UH Manoa.

A critical component in a TIAR is the number of trips generated by the project during the AM and PM peak hours. Both TIAR used the standard ITE Trip Generation models and came to very similar results as shown below.

Table 9: Estimated Trips Generated - Phase 1

	AM		PM	
Land Use [ITE Code]	**Equation**		**Equation**	
Multi-family Housing (Low Rise) [220]	$\ln(T) = 0.95 \ln(X) - 0.51$		$\ln(T) = 0.89 * \ln(X) - 0.02$	
Dwelling Units	258		258	
New Trips	117		137	
	In[2]	**Out**	**In**	**Out**
	23%	77%	63%	37%
	27	90	86	51
Old TIAR	22	92	86	48

T = Total number of trips generated, X = Dwelling Units

Trip Distribution

Typically we expect measurable impacts when a project generates 100 or more trips along the peak direction. This project does not in Phase 1; in Phase 2 the right turn from Kona Villages onto Queen Kaahumanu Hwy. will be 108 vehicles per hour in the AM peak. It should be noted that some movements, left turns in particular, can become problematic with much lower volumes.

Another critical component is the "background growth" which specifies the annual growth of traffic due to general population growth, other developments in the region, etc. This number typically ranges between 0% and 5%, with 1% to 2% being most typical rates for areas experiencing growth, unless detailed estimates are available from a regional planning model. The latter are preferred to an assumed growth rate.

Traffic congestion is very sensitive to growth rate; it increases the volume in the Volume-to Capacity ratio. When the V/C ratio exceeds 0.75, the existing capacity is 75% utilized. It is a non-linear (exponential) relation, therefore delays "skyrocket" when the V/C ratio exceeds 0.9.

A growth rate of 1% means that a road that carries 1,000 vehicles now will carry 1,150 vehicles in 15 years. A growth rate of 2% means that a road that carries 1,000 vehicles now will carry 1,300 vehicles in 15 years. If the capacity of the road is 1,500 vehicles per hour, then current conditions are good (the V/C ratio is 0.67), the future conditions with 1% growth rate we be concerning (the V/C ratio is 77%), and the future conditions with 2% growth rate will be poor (the V/C ratio is 87%).

If one were to add just 50 additional vehicles from a development, then future conditions with 1% growth rate will be concerning (the V/C ratio is 80%), and the future conditions with 2% growth rate will be poor (the V/C ratio is 90%), both of which will exacerbate lost time due to traffic congestion which in TIAR is represented by the delay per vehicle.

Interestingly, the Old TIAR used a growth rate of 2% and the Current TIAR used a growth rate of 1%, which, as I demonstrated in the paragraphs above, is a big difference. In the latter case, the estimated traffic impacts will be lower (e.g., lower delays) and better level of service (LOS). However, the justification given in the Current TIAR is credible.

Old TIAR: "There are several other developments in the general area in the planning stages. Nearly all have been in various stages of planning for some time (10 years). The reasons they have not proceeded vary from not obtaining proper zoning to requirements set by the Planning Department in the past. It cannot be projected when, or if, these projects will proceed. Therefore, the 2% rise per year in the traffic volume required by the County should suffice this development's coming on line."

Current TIAR: "The 2035 Federal Aid Highways Long Rage Transportation Plan Forecasts average daily traffic in Kona and Hawaii Belt Road to be 41,900 vehicles in 2020 and 48,000 vehicles in 2035. This equates to a 1% annual growth rate over 15 years in the Kona area. A background growth rate of 1% per year was assumed, to account for additional traffic at the study intersections."

Relying on a regional model for forecasts is preferred to making an assumption.

TIAR analysis depends on traffic volumes collected in the field to form the base conditions upon which the future scenarios with and without the project are analyzed. Both TIAR use pre-Covid data, therefore their base volumes are fairly representative of a normal economy, and normal travel activity conditions.

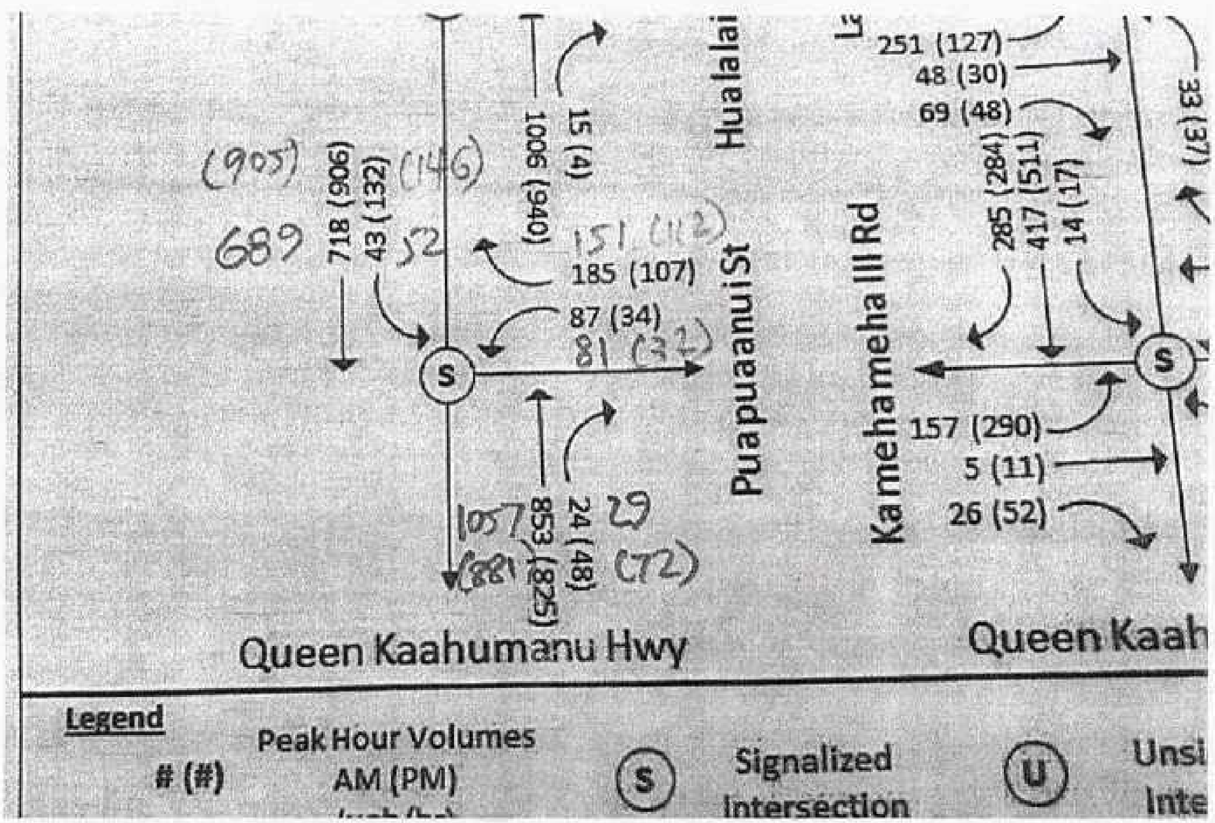
The two TIAR chose to analyze different intersections and have only one intersection in common: Puapuaanui St. with Queen Kaahumanu Hwy. The volumes reported are shown in a screen capture for the Current TIAR, and in my handwriting for the Old TIAR (see page 3.) Due to day-to-day variation, a close match in the volume of each movement is not realistic; small deviations are normal. However, one large deviation is worrisome: the volume on Northbound Queen Kaahumanu Hwy.

Old TIAR: 1057 (taken on January 14 and 15, 2016)

Current TIAR: 853 (taken on April 30 and August 24, 2019)

The 2019 level of volume in the Old TIAR assuming 1% growth over three years would update to 1,057x1.03=1,089. It is concerning that this critical volume on the Current TIAR is lower by 236 vehicles or 22%. A difference in volume over 10% is not generally accepted as normal day-to-day variation, particularly for critical movements such as this heavy through movement on Queen Kaahumanu Hwy. This lower level of volume on Northbound Queen Kaahumanu Hwy. likely affects all prior intersection between Puapuaanui St. and Kam. III Rd. including the access point for Kona Villages. Low volumes result in lower impacts and less conservative estimates in general.

Unfortunately, due to prevailing conditions (with Covid), a quick verification of this volume is not possible. However, Figure 4 in the Current TIAR clearly shows that Northbound Queen Kaahumanu Hwy. carried approximately 1,050 vehicles at 7 AM in 2016 which puts in question the accuracy of the 850 vehicles per hour volume used in the Current TIAR.



Both TIAR show Level of Service (LOS) results for the traffic movements at the intersections. The A to F scale is easy to comprehend. In rural locations, LOS of B and C should dominate compared to LOS D and E which are common in busy cities. However, in both TIAR several movements show a LOS of D or worse.

To improve my understanding of how conditions are likely to evolve, I prefer to use the Volume-to-Capacity ratio reported as the v/c number in the Current TIAR. As I mentioned earlier, this decimal number represents the portion of roadway capacity (in vehicles per hour) that is utilized. Typically traffic impacts and delays are becoming substantial when this ratio exceeds 0.75. I counted those instances and summarized below. I also noticed that quite a few other movements had a v/c ratio of 0.73 or 0.74, so I included those as well, in a separate and in a combined column.

Looking at the column in boldface, in 2019, 27% of the movements analyzed were substantially busy, that is, utilized at 73% of capacity or more. The busy movements are expected to more than double in 2029 without the project, and nearly triple by 2039. On the other hand, the incremental effect of the traffic added by the project is small, as the resultant 2%, 5% and 2% estimates indicate (at the bottom of the last column.)

								% of movements with high V/c		
	Volume to capacity ratios							with V/c >=0.73	with V/c >=0.75	diff. with and without
	AM			PM						
Tables of Current TIAR	>=0.75	0.73, 0.74	Sum	>=0.75	0.73, 0.74	Sum	Total			
Table 6: Existing 2019 Intersection Level of Service	5	1	6	6	0	6	12	**27%**	25%	
Table 12: Future 2024 Without Project Intersection Level of	6	4	10	8	2	10	20	**45%**	32%	
Table 19: Future 2029 Without Project Intersection Level of	11	3	14	11	2	13	27	**61%**	50%	
Table 25: Future 2039 Without Project Intersection Level of	15	1	16	18	2	20	36	**82%**	75%	
Table 14: Future 2024 With Project Intersection Level of Service	7	6	13	8	2	10	23	**48%**	31%	2%
Table 21: Future 2029 With Project Intersection Level of Service	16	1	17	11	4	15	32	**67%**	56%	5%
Table 26: Future 2039 With Project Intersection Level of Service	17	0	17	22	1	23	40	**83%**	81%	2%

This outcome is in agreement with the following concluding quote from the Old TIAR: "It can be seen from this discussion that the impact on existing traffic by this development is minimal. However, with other developments factored in using the 2% per annum growth rate there can be significant impact of the traffic if no mitigating measures are introduced."

The Current TIAR provides arterial speed estimates for Southbound and Northbound Queen Kaahumanu Hwy.; see Table 30 on page 55. The Northbound direction is expected to operate substantially slower than current conditions. The estimated 15.6 mph for the AM period is comparable to busy arterials in

Honolulu (pre-Covid.) Average speeds over 20 mph along signalized arterials are considered good, i.e., LOS C or better.

Finally, I reviewed the recommendations for the mitigation of traffic impacts for intersections or movements with a poor LOS. A major weakness of the Old TIAR is that it did not offer any specific mitigations to improve the estimated future LOS=E or F to more acceptable LOS=C and D. The Current TIAR includes specific suggestions for every intersection but is lacking of specific assessments on whether the proposed improvements will actually work and improve LOS. The Current TIAR recommendations are copied below with my comments added in boldface.

1. Queen Kaahumanu Highway and Palani Road

Signal timing should be monitored and updated to ensure that left turn queues clear every cycle.

This is an appropriate recommendation.

2. Queen Kaahumanu Highway and Henry Street

Signal timing should be monitored and updated to ensure that left turn queues clear every cycle.

Henry Street approaches currently operate in split phases. Changing the split phasing to protected left turn phases on Henry Street will allow more green time on the major through movements, lowering the overall delay of the intersection.

This is an appropriate recommendation. Quantitative assessment of the improvement of the proposed phasing change is needed.

3. Queen Kaahumanu Highway and Hualalai Road (North)

Based on the 2019 traffic volumes, this intersection passes the Four-Hour warrant. This intersection passed the Peak-Hour warrant in the 2019 AM peak hour and for all peak hours in all future scenarios. Future traffic should be monitored, and a traffic signal or roundabout should be installed if needed, but priority should be given to keeping Queen Kaahumanu Highway traffic moving and not installing a traffic signal if not warranted by 4- or 8-hour warrants. The overall delay at this intersection is 41.0 and 50.6 seconds per vehicle in the 2039 AM peak hour, without and with the project, respectively. When the delay experienced by drivers reaches this level, the eastbound drivers are likely to find alternative routes.

The suggestion for a roundabout is odd and will be inconsistent along this corridor. This intersection requires close monitoring and study for signalization possibly within 5 years, depending on economic

and tourism conditions. Intersections that pass warrants but remain unsignalized are a traffic safety liability for the agency in charge.

4. Queen Kaahumanu Highway and Hualalai Road (South)

As the westbound left turn delay gets worse, drivers may decide to use Puapuaanui Street to access Queen Kaahumanu Highway in the southbound direction. Based on the existing volumes, this intersection did not pass the Four-Hour warrant or the Peak-Hour warrant. This intersection did pass the Peak-Hour warrant for all future AM peak hour scenarios. Future traffic should be monitored.

This is an appropriate recommendation. Recall that Northbound Queen Kaahumanu Highway volume may be low in this TIAR which would conceal a potentially bigger problem.

5. Queen Kaahumanu Highway and Puapuaanui Street

Signal timing should be monitored and adjusted as needed to increase the probability that queues on Queen Kaahumanu Highway can clear the intersection in 1 cycle.

This is an appropriate recommendation. However, it is not clear whether there is enough space to accommodate the waiting queue of vehicles turning left.

6. Queen Kaahumanu Highway and Royal Vistas Roadway

This intersection will function acceptably through the full Phase 1 buildout. Before any Phase 2 residences are occupied, it is recommended that the connection to Kekuanao'a Place is completed so that Royal Vistas Phase 2 'left out' traffic can access the Lako Street traffic signal.

This is an appropriate recommendation.

7. Queen Kaahumanu Highway and Kuakini Highway

This intersection passes the Four-Hour warrant and Peak-Hour warrants during all peak hours for all scenarios. Future traffic should be monitored, and a traffic signal or roundabout should be installed if needed. The northbound left turn movement is very heavy (300-600 veh/hour by 2039 with project), which will be nearly at capacity. The westbound left turn, while small, is already over capacity in 2019 and will be far over capacity by 2039. Royal Vistas traffic has very little effect on this intersection.

This is a weak recommendation. An intersection that passes more than one warrant under all conditions should be on a priority list for study and design of a signal for installation. It can take over 3

years to install a new signalized intersection. Monitoring is not adequate. A detailed study and plan by Hawaii County is needed, regardless of the Kona Vistas development.

8. Queen Kaahumanu Highway and Lako Street

The Lako Street intersection operates at LOS E/D (AM/PM) with or without the Royal Vistas project in the 2039 scenario. Lako Street currently has split phasing (sequential rather than concurrent) on the Lako Street approaches. Changing the phasing from split to protected left turns would help lower the delay. This intersection would also improve significantly if Queen Kaahumanu Highway is widened to 4 lanes as in the 2035 Transportation Plan.

Quantitative assessment of the improvement of the proposed phasing change is needed. Recommendation 6 on this list may add more volume to this intersection.

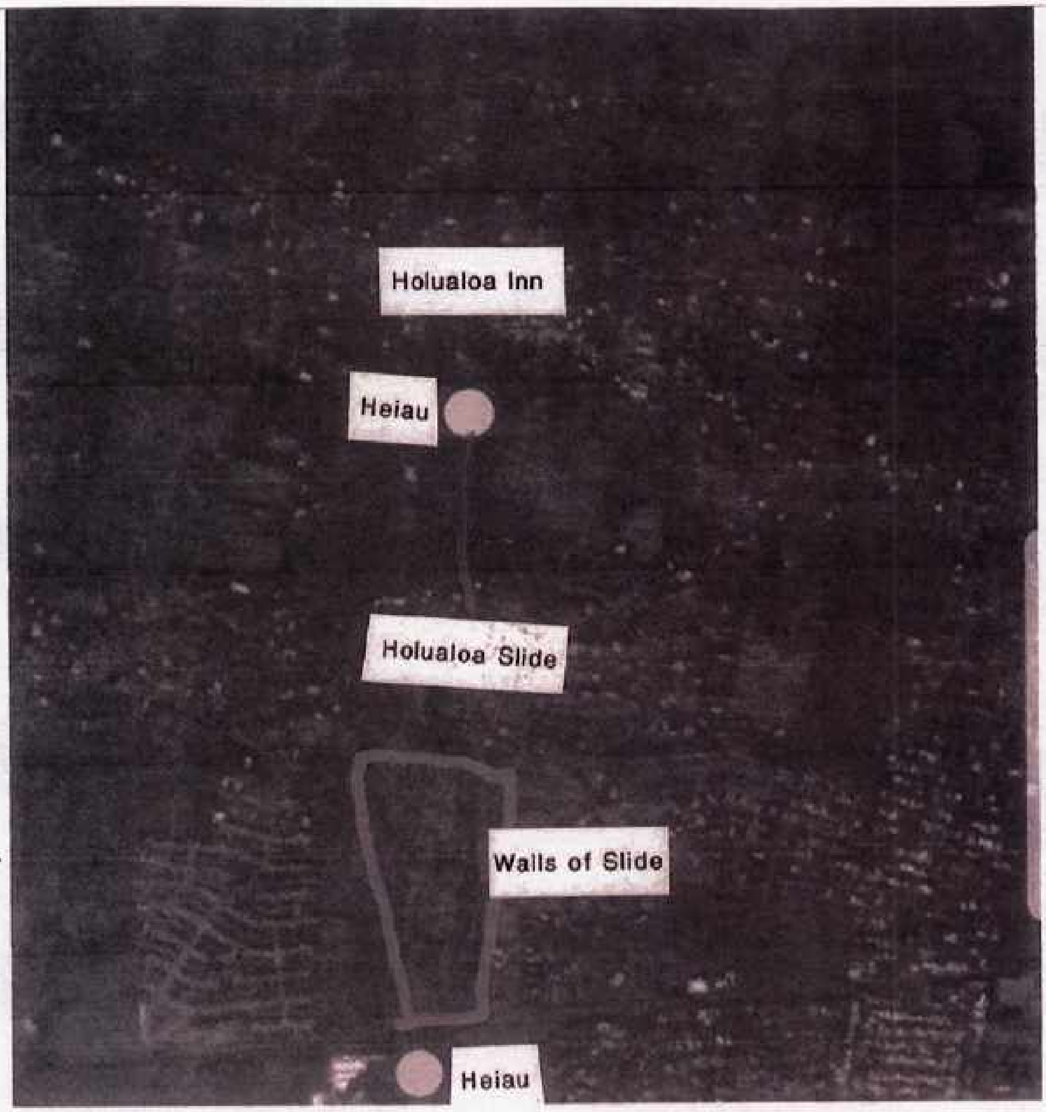
9. Queen Kaahumanu Highway and Kamehameha III Road

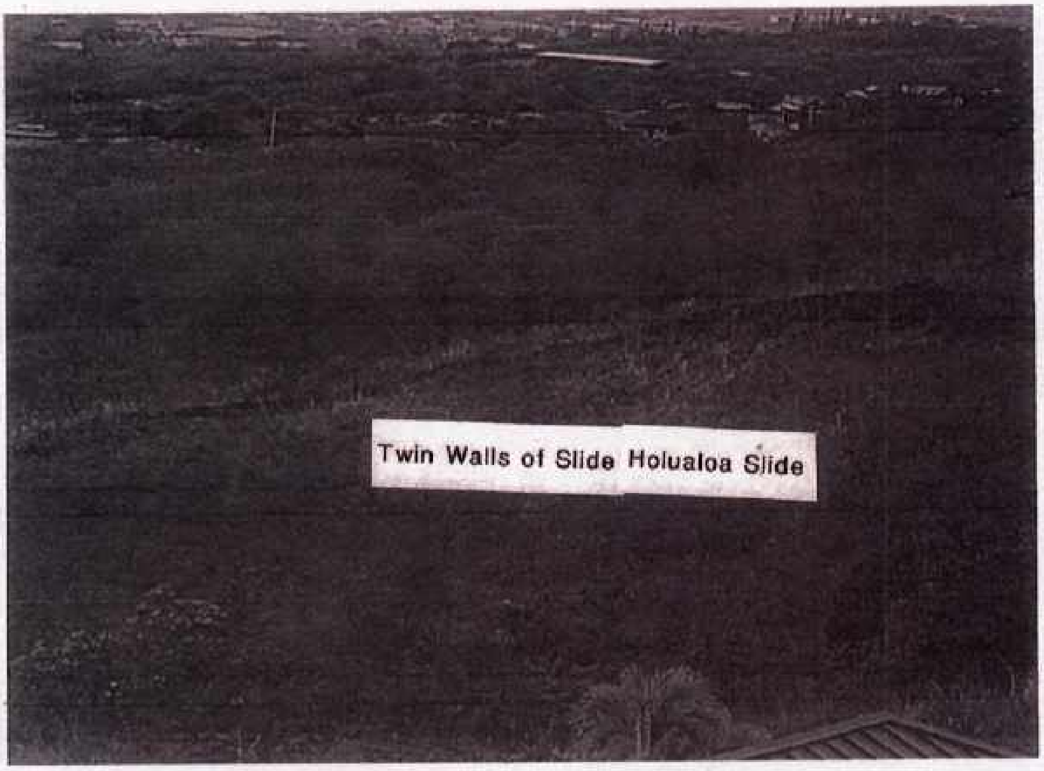
Signal timing should be monitored and updated as needed.

This is an appropriate recommendation.

ARCHAEOLOGICAL INFORMATION

Holualoa Inn Slide Information


Holualoa Inn
Heiau
Holualoa Slide
Walls of Slide
Heiau


Twin Walls of Slide Holualoa Slide

Below are communications with
Mr. Tom Pohaku Stone about the twin walls and the slide with a Kona Vista Board members

Below are communications with Mr. Tom Pohaku Stone about the twin walls and the slide with a Kona Vista Board members

On Mon, Jul 1, 2019, 8:55 AM Tom Pohaku Stone <> wrote:

To answer the question regarding the walls -YES. Not all hōlua slides had walls but nearly all those on Hawai'i Island do. The purpose was to hold the rock in the slide in some sections and in areas that needed to be raised. When you mention moving of logs from mauka-makai that is an important point because the koa forest line was at a lower elevation when we were gathering the great trees for our wa'a, papahe'enalu, etc. This was the main purpose of the slides thousands of years ago, which overtime changed to reflect an association to the gods of the wao kele (upland forest) and the spirituality we connected with then and now. The physical cultural landscape found of the hōlua slides is the telling of the story what made these specific areas important to our cultural practices especially since this massive complex is connected to Pa'ao, his lineage, and the great Ali'i Nui of this mokupuni (island). There were several significant complexes along this coastline but none as grandeur. Kaneakā in Keauhou/Kahalu'u is another. Waha'ula, Mo'okini, and Kahikinui (Maui) were the earlier complexes established for migration purposes and the change in religion. The Hōlualoa complex solidifies the complete adaptation to the established religion of Pa'ao.

On Mon, Jul 1, 2019 at 8:15 AM john

Tom,

Thank you for taking the time to educate me. It is greatly appreciated. The history of Holualoa is truly remarkable, and I know I have only scratched the surface.

One question I have, the intact portion of the holua at the Holualoa Inn has a rock wall on both sides. Would these walls have been built at the same time? Perhaps to keep the logs contained as they traveled down. I have found, in the proposed development area a section, of parallel rock walls. Do any of the other Holuas have walls?

I again thank you for all your help. Very respectful and grateful, John

On Mon, Jul 1, 2019, 6:36 AM Tom wrote:

Aloha John,

I know I have not been in contact for some time but I have been going through all my records and info for this area. You are not going to find much in any library about that slide because I'm the person who did the study of that area. A lot of development has changed the cultural landscape in the area over the years (past 200 yrs.) and with it my native cultural and architectural landscape so it's a puzzle. Hōlua has been part of my 'ohana and it has been my academic focus archaeologically and culturally. I have spent years providing cultural education to our community regarding the significane of the remaining architectural landscape. The effort is to integrate the cultural landscape into the development process if it will save the physical cultural landscape. With that said, there is a direct correlation between the "Hōlualoa slide, Keolonāhihi, Keākealaniwahine, Kamalumalu, Kealakowa'a, and Kamoa (Lyman)". The development of Kona over the years has separated (destroyed) the physical connection of the slide to the greater complex that had existed. The coastal area of this complex has now been protected but not the mauka sections that are still undeveloped. It's at this point the emphasize should be on protecting what is left of this great complex. We do know that Kamehameha I was trained in this complex which included learning to hōlua slide and surf. I would advise you to look at the greater picture and focus on what is left of the entire complex and how this would benefit the cultural history of Kona. Sorry I'm not on island to assist, but at this point I believe the development will destroy more. If you need someone with Hawaiian cultural/traditional architectural/archaeological background let me know. I can assist but if you need someone to do in-depth research, prepare presentations, or provide community education we can discuss this. Henry Kekahuna provided the most detailed archaeological record of this area. Knowledge, interpretation, and understanding of these cultural sites and how it's all intertwined is significant

Me ka ha'aha'a
Tom Pōhaku Stone

--
Kanalu (K38) is a 501 c 3 non profit organization dedicated to cultural & ocean education based on traditions of our kupuna.

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September 13, 2021

Mr. Steven Strauss
P.O. Box 11517
Hilo, HI 96721

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Strauss:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The submission addresses three main issues: traffic impacts, archaeological information and stormwater drainage. These issues must be addressed individually and cumulatively.

> **Response 1:** Specific comments on the various resource are addressed below.

Comment 2: The Traffic Impact Analysis Report (TIAR) included as Appendix 2 in DEA does not fully or accurately address traffic impacts likely to result from the proposed development both within and without the Kona Vistas subdivision.

> **Response 2:** Specific comments for traffic impacts are discussed below.

Comment 3: The proposed project relies on the use of a substandard roadway, Kekuana'oa Place. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, and am concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place.

> **Response 3:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 4: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 4**: Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 5: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 5:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 6: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 6:** Intersections within the proposed project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 7: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 7:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 8: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

Response 8: It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 9: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

Response 9: The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 10: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

Response 10: The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

Comment 11: The DEA recites that the applicant's experts sought consultation from, inter alia, J. Curtis Tyler 111, cultural descendent, and from Kekoa Nazara, Kana Hawaiian Civic Club President. Kona Vistas Association, Inc., however, is informed that neither Mr. Tyler nor Kekoa Nazara were contacted. The Planning Department should require the applicant to verify the information presented in the DEA and the Cultural Impact Assessment (CIA).

> **Response 11:** In regards to the letter's statement that neither J. Curtis Tyler II nor Kekoa Nazara were contacted to provide, enclosed please find two email chains; one is between the project archeological consultant and Mr. Tyler and one between our cultural consultant and Mr. Nazara, confirming communication, contact, and request for consultation was made with both parties. Neither party chose to submit information to the consultant.
>
> In regards to the letter's assertion that portions of the "Hōlua Slide" may be on the property, a detailed investigation and analysis of this assertion was made (copy attached) and it is confirmed that there is no evidence of any slide being on the subject property.

Comment 12: Next, the DEA only lightly touches on potentially important cultural archaeological resources. Although the DEA claims that no impacts to archaeological resources would occur, Kona Vistas Association, Inc. is informed to the contrary According to an evaluation and analysis performed by Tom Pohaku Stone, substantial evidence exists that the land encompassed by the subject land parcels includes features of the Hōlualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA.

> **Response 12:** In the email provided, there is reference to "the portion of the hōlua at the Hōlua Inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.
>
> Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of he'ehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

Comment 13: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the draft Environmental

Assessment. The draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future, which would lead to unlawful project segmentation, among other errors.

A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

> **Response 13:** Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuanaʻoa Street, which would then be dedicated to the County as required by Ordinance and called for in the KCDP "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the KDCP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.
>
> Additionally, the text in Section 3.3.2 of the EA describes that Kona Three LLC would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by DPW. Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.
>
> There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.
>
> The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

Comment 14: Once the three areas identified above are properly and fully addressed, the cumulative effects of adverse impacts in these areas and all others must also be addressed.

> **Response 14:** There has been no substantive change in analysis as a result of the comments above. Cumulative effects are discussed under each resource in Chapter 3.

Traffic Supplement: Summarized Comments and Responses

Summarized Comments	Responses
Failure to address traffic impact within the project area.	The internal study intersections were not a part of this TIAR; internal volumes are expected to be small and not cause significant impacts at intersections.
1% growth rate as opposed to the 2% used in the Witcher Engineering TIAR.	A better comparison for the project's numbers are historic HDOT counts rather than a TIAR done by another engineering firm. Our counts at the Hualalai (north) intersection were compared to HDOT counts between Nani Kailua Road and Hualalai (north).
The report does not recognize multi-generational housing characteristics common in Hawaii	It is the professional opinion of the traffic engineer that the ITE trip generation is the best source to determine the number of trips generated by the project, as it uses data points from existing developments. Without justification, the analysis cannot depend on the use an arbitrary number, i.e., 3 vehicles per household.
SSFM traffic data seems to be lower than the data in the Witcher Engineering TIAR.	The traffic counts were taken on different days, which can vary. However, the data were taken on a typical school/work day, and is comparable to historic HDOT volumes.
Recommendation for roundabout is not consistent with corridor. Intersections that satisfy warrants but remain signalized present traffic safety liability for the government	The roundabout recommendations has been removed from the TIAR. The satisfaction of a signal does not mean that a signal needs to be installed. There are other factors, such as signal timing and phasing that could cause delay and bottlenecks, rear end accidents that occur more frequently at newly installed signals, and others. The recommendation includes monitored, and that a further study can be done for the signal.
The recommendation for QK Hwy and Kuakini Hwy to be monitored is inadequate.	recommendation will be changed from "Future traffic should be monitored, and a traffic signal or roundabout should be installed if needed" to "A future traffic signal study should be done to determine if the installation of a traffic signal at this intersection is appropriate".
The northbound volume seems low. It has much lower volumes than the old 2016 TIAR.	The TIAR counts are comparable to the HDOT historic counts. The counts used and comparison to adjacent intersections are defendable. At Kuakini Highway, the NB departing volume is 808, and the arriving NB volume at Puapuaanui is 877. The NB

	at Kuakini Highway is a little less than 10% lower than the NB at Puapuaanui during the AM peak hour. During all other peak hours and at all other intersections, the difference volumes of the arriving and departing vehicles is really small. Also, our southbound volumes are a little higher than the historic HDOT counts, but our southbound volumes are correct as well.
Recommendations for the current TIAR includes specific suggestions, but is lacking specific assessments on whether proposed improvements will actually work. Comments were provided for each intersection's recommendations.	See responses below. Additionally, as stated in the EA Section 3.7.2 and the TIAR, these are improvements for consideration by Hawaiʻi County and the Hawaii Department of Transportation.
1. Queen Kaʻahumanu Highway and Palani Road: This is an appropriate recommendation.	Comment noted.
2. Queen Kaʻahumanu Highway and Henry Street: This is an appropriate recommendation. Quantitative assessment of the prosed phasing is needed.	The TIAR does not propose a change from the split phasing. This intersection works acceptably, it was merely stated that changing the split phasing can help the overall intersection LOS. To clarify this, the recommendation for split phasing has been removed in the TIAR and EA, and this intersection has the same recommendation as Palani Road.
3. Queen Kaʻahumanu Highway and Hualalai (north): Roundabout is odd for this corridor. Intersections that warrant a signal and remain unsignalized are a traffic liability for agency in charge	Roundabout recommendation removed in the TIAR and EA. The signalization of the intersection should be further studied. The satisfaction of a warrant does not mean a signal needs to be installed.
4. Queen Kaʻahumanu Highway and Hualalai (south): This is an appropriate recommendation. Recall that the NB QK Hwy volumes may be lower in the TIAR.	See response to comments above about traffic volumes.
5. Queen Kaʻahumanu Highway and Puapuaanui Street: This is an appropriate recommendation. However, it is not clear if there is enough space to accommodate the waiting queue of vehicles turning left.	The recommendation says that this intersection works well, but just in case, the signal can be adjusted if future traffic patterns change and signal retiming or modification is needed.
6. Queen Kaʻahumanu Highway and Royal Vistas Roadway: This is an appropriate recommendation.	Comment noted.
7. Queen Kaʻahumanu Highway and Kuakini Highway: This is a weak recommendation. An intersection that passes more than 1 warrant should be a priority for study and design of a signal for installation. A detailed study and plan by	Recommendation has been changed to recommend a traffic study be done for installation of a traffic signal in the TIAR and EA.

Hawaii County is needed, regardless of KV development.	
8. Queen Ka‘ahumanu Highway and Lako Street: Quantitative assessment of the improvements of the proposed phasing change is needed.	New Synchro analysis has been done and added to the report. Table shows the delay decreasing with protected, protected permitted, and permitted phasing.
9. Queen Ka‘ahumanu Highway and Kamehameha III Road: This is an appropriate recommendation.	Comment noted.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

Enclosures

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai‘i Planning Department

J. C. Tyler III <jct3kona@gmail.com>
To:Glenn Escott
Wed, Feb 19 at 7:48 PM
Aloha ē Glenn,

Yes, I am in in AZ,where my wife and I are wrapping yup some medical consults and business matters.

I will be back in Kona and available to talk with you the week of March 9. In the meantime, I will review your attachment.

Thank you for continuing to keep me in the loop on this matter.I presume you have also done the same with Nicole Lui.

A hui hou,

Curtis

> On Feb 18, 2020, at 3:34 PM, Glenn Escott <ggescott@yahoo.com> wrote:
>
> Aloha e Curtis,
>
> Hope you are doing well. I heard you were in Arizona. We are conducting a cultural impact assessment for Ric Wheelock's property in Holualoa 1st, North Kona. It includes the property with the burial for which you consulted on the BTP.
>
> Please see the attached CIA consultation request for lands of Holualoa 1st, North Kona. If you or anyone you know has information regarding past or ongoing cultural practices in Holualoa 1st, please let contact me to consult.
>
> Mahalo Nui Loa,
> Glenn
> Scientific Consultant Services, Inc.
> 808/938-0968

> <Holualoa 1 CIA Consult Letter.pdf>

Kekoa Nazara <koanazara@gmail.com>
To:Glenn Escott
Wed, Feb 19 at 10:45 AM
Aloha glenn

Will do. By the way I did find one other contact for that deal and DLNR project. I've been so busy I haven't had a chance To call him but I will this week and get back to you thanks

Sent from my iPhone

On Feb 18, 2020, at 12:28 PM, Glenn Escott <ggescott@yahoo.com> wrote:

Aloha e Kekoa,

Mahalo for consulting on the DLNR Kona project area in Kalaoa 5th Ahupua`a. It was good to talk story with you and Jake. We are conducting another CIA in Holualoa if you are interested in consulting on cultural practices at the project area lands..

Please see the attached CIA consultation request for lands of Holualoa 1st, North Kona. If you or anyone you know has information regarding past or ongoing cultural practices in Holualoa 1st, please let contact me to consult.

Mahalo Nui Loa,
Glenn G. Escott, MA
Senior Archaeologist
Scientific Consultant Services, Inc.
808/938-0968

Scientific Consultant Services Inc.

1357 Kapi'olani Boulevard, Suite 850 Honolulu, HI 96814
Hawai'i Island Office: PO Box 155 Kea'au, HI 96749

Richard Wheelock
Kona Three, LLC
Richard@eastwestrealty.org
808-753-3167

11/10/2019

RE: Parallel Walls Site #50-10-37-30595, -30601, and -31182 (Features 2 and 3) Wall Type, Function and Age, Located on 76.122 Acres of Land in Hōlualoa 1st Ahupua'a, Kailua-Kona, North Kona District, Hawai'i Island [Portions of TMK: (3) 7-6-021:016 and 017 (por.)].

Aloha e Richard,

At your request, Scientific Consultant Services, Inc. (SCS) conducted a study of parallel wall sites located on your property referenced in the subject heading of this letter report (Figure 1 through Figure 3). The study was conducted to address specific public comments submitted in response to the Draft Environmental Assessment (DEA). In, particular, this report addresses comments that the DEA and archaeological studies conducted within the project area did not address the entire project area, and that there is an ancient *hōlua* slide within the project area that was not recorded in the archaeological studies.

Project Archaeological Studies

There were three archaeological studies conducted within the DEA project area (Figure 4, numbers 1 through 3). Lands of the project area were first subject to an AIS study conducted by Hammatt et al. (1992) (see Figure 4 study #1). The current project area is located within the northern portion of the Hammatt et al. (1992) AIS project area. The AIS study encompassed 66.039 acres of land within the current project area located between 320 to 690 feet (98 to 210 meters) amsl [TMK: (3) 7-6-021:016 and 017]. Five acres within the southeast corner of the DEA project area were not included in the AIS study. The entire project area was subjected to a pedestrian survey and twenty one archaeological sites were recorded in the AIS report. There were no *hōlua* identified in that study. The AIS report recommended no further work at all 21 sites.

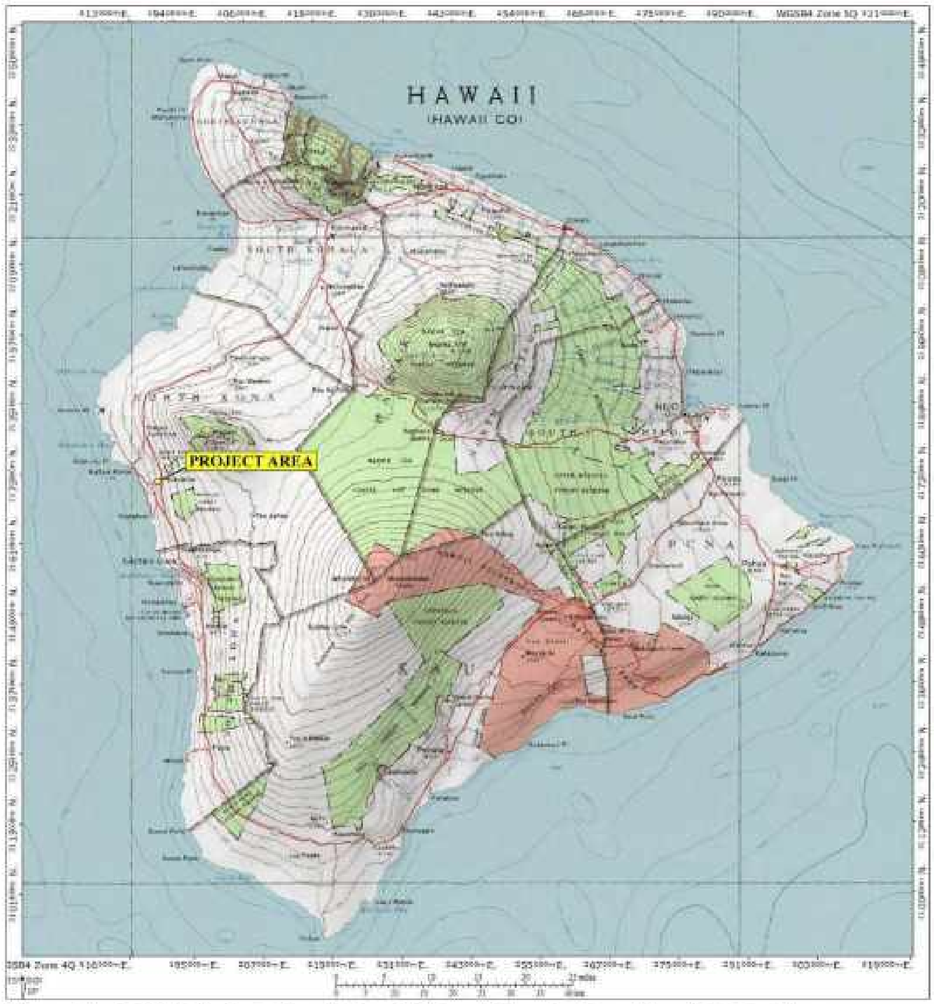

Figure 1: 5,500 K-Series Map of Hawai'i Island Showing Location of Project Area (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

Figure 2: 7.5-Minute Series USGS Topographic Map Showing Location of Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

Figure 3: Aerial Photograph Showing Project Area, Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (ESRI, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

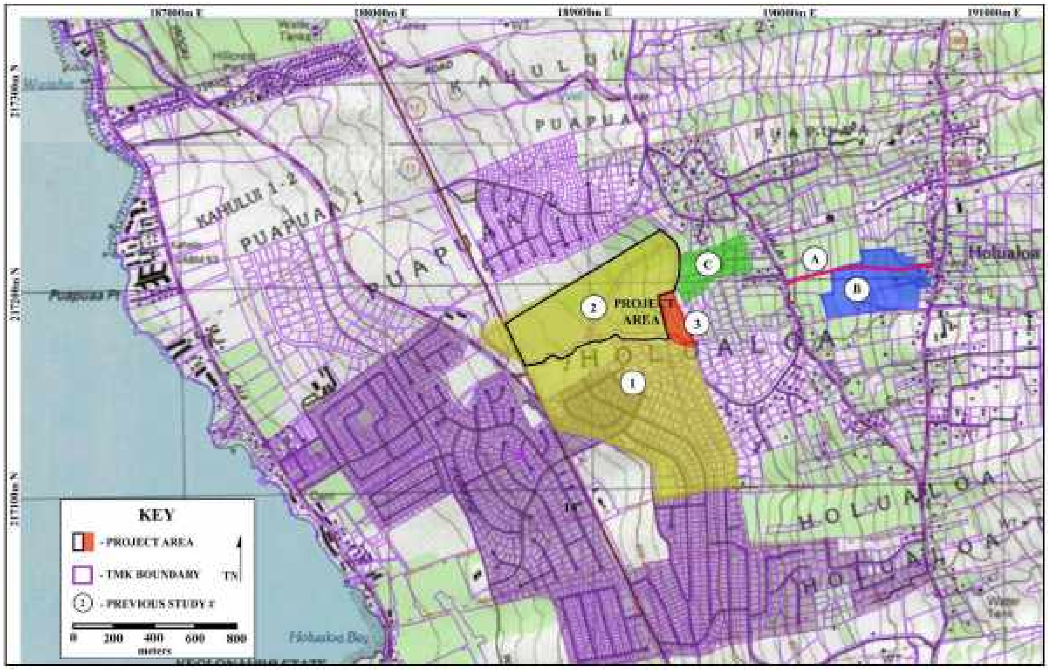

Figure 4: 7.5-Minute Series USGS Topographic Map Showing Location of Previous Archaeological Studies Discussed in this Letter Report and Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

At the request of the State Historic Preservation Division (SHPD), additional documentation of Sites 10011, 10012, 10031, 10049, recorded in the Hammatt et al. (1992) AIS report, was submitted to SHPD in a letter report (Hammatt and Shideler 2007). The Hammatt and Shideler (2007) letter report quoted the AIS recommendation that "all surface sites in the area were documented" in the AIS report and that "significant material from the study area has been recovered and that further investigation would be of minimum productivity" (Hammatt and Shideler 2007:11). However, the authors suggested that prior to future removal of the sites, they should be relocated to document their current condition and to document sites to prevailing SHPD AIS standards.

In a letter to the County of Hawai'i Department of Planning dated July 30, 2018, (Log. No. 2018.00878 Doc. No. 2018.00878), SHPD requested a second AIS study of the Hammatt et al. (1992) project area to identify all archaeological historic properties present, and to update previous archaeological documentation to include site plans with site boundaries and areas impacted by bulldozing, photographs of all sites and features, an assessment of their integrity, and site significance.

SCS completed a second AIS study of 76.121 acres of the project area [TMK: (3) 7-6-021:016, 017 (por.), 018, and 019] (Escott and Escott 2020, see Figure 4 study #2) and submitted a draft AIS report to SHPD for review/approval. The report included all but 5.0 acres in the southeast corner of the DEA project area. The entire project area was subjected to a pedestrian survey. Seventeen of the twenty one previously identified archaeological sites were located (Figure 5). Two of the previously documented sites (Site 10020 and Site 10034) relocated by SCS are natural bedrock outcrops. One site, former burial Site 10012 contained burials that were reinterred off-project in 1993.

The four remaining previously documented sites (Sites 10017, 10033, 10049, and 10071) were bulldozed prior to the SCS fieldwork and the remains of the sites are no longer present on the ground surface. Three previously undocumented sites were also documented, including a portion of the railroad berm (Site 30592), a small coffee shed enclosure (Site 31181), and several ranch walls (Site 31182). There were no remains of a *hōlua* in the project area.

A third AIS (Escott and Escott 2018, see Figure 4 study #3) was conducted in the 5.0 acre southeast corner of the DEA project area [TMK: (3) 7-6-021:017 (por.)] that was not previously studied. The entire project area was subjected to a pedestrian survey and twenty two archaeological sites (Figure 6) were recorded, primarily agricultural complexes and terraces associated with pre-Contact era through early post-Contact era to Historic era agriculture. Several Historic era walls and enclosures, a lava tube burial, and a portion of the old railroad berm were also documented in the report. Preservation was recommended for the burial and the railroad berm. There were no remains of a *hōlua* in the project area.

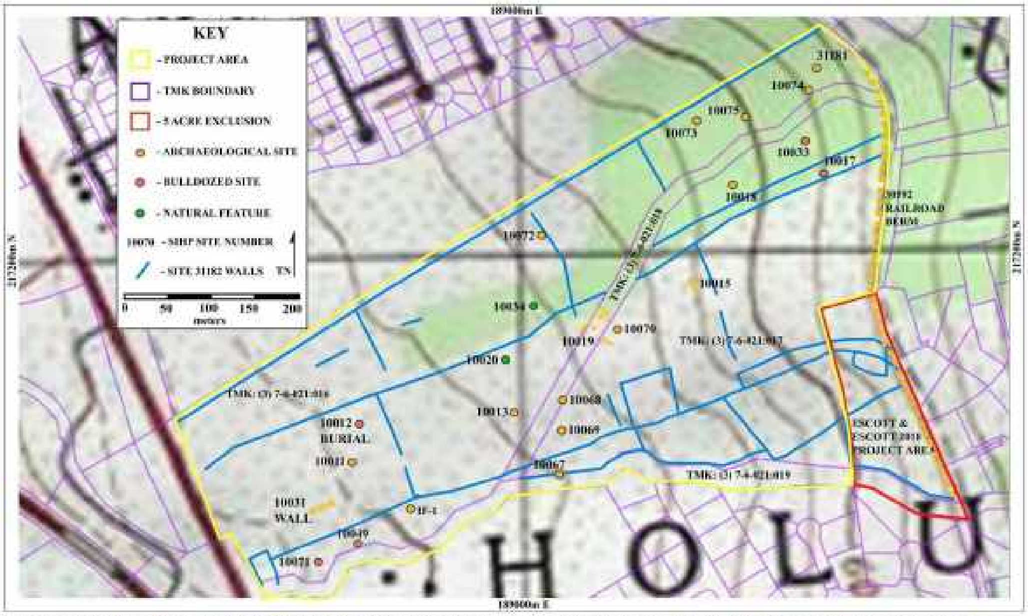

Figure 5: 7.5-Minute Series USGS Topographic Map Showing Location of Archaeological Sites and Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

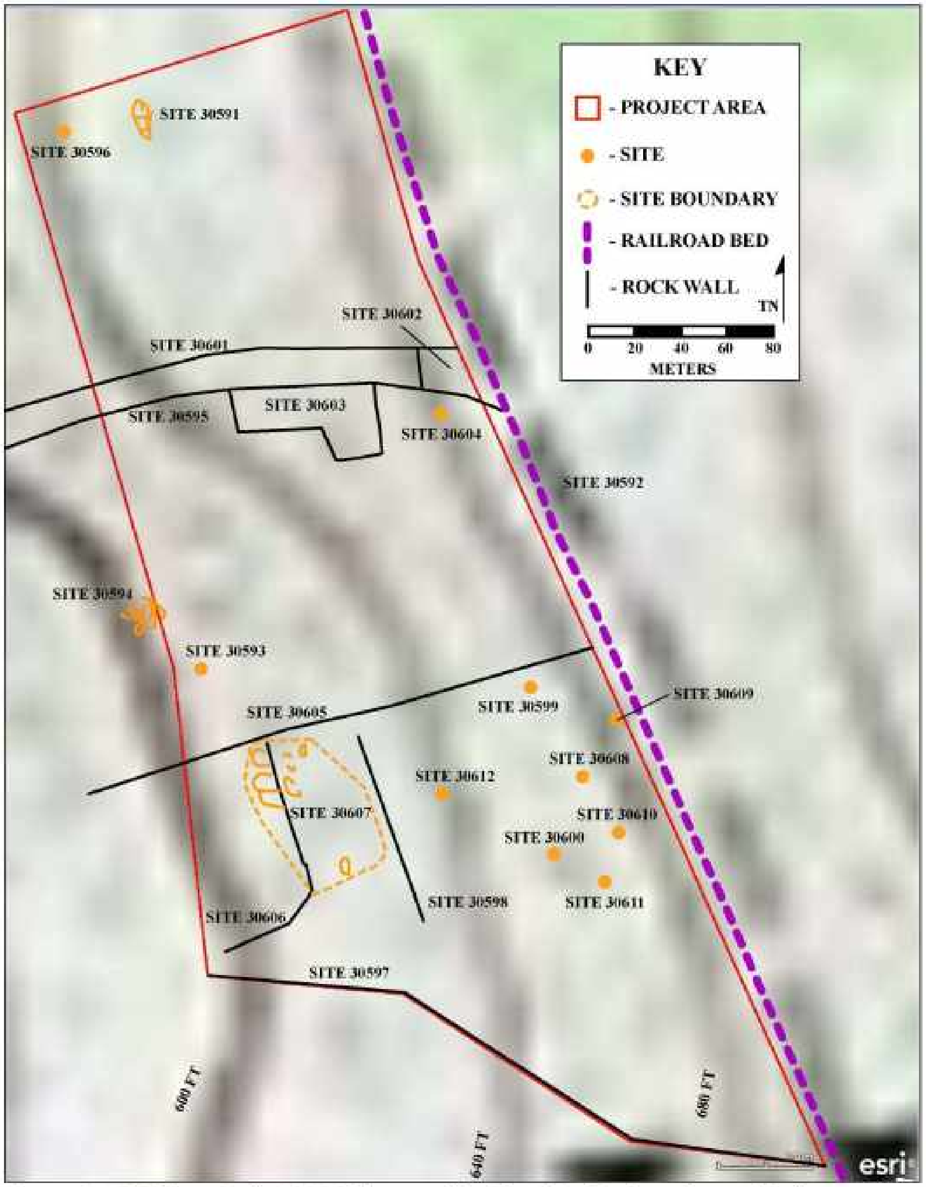

Figure 6: 7.5-Minute Series USGS Topographic Map Showing Locations of Project Area Archaeological Sites (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

Evidence for a *He'ehōlua* Course (*Kahua* Hōlua)

A *he'ehōlua*, or *hōlua*, course (*kahua hōlua*) is a long, very straight course constructed on a slope by removing large rocks, paving the course with cobble and pebble sized rocks and then covering them with fresh dirt, grass, sticks, and/or reeds, and finally lubricating the surface of the course with grass steeped in *kukui* oil. The course was made very smooth and without bumps by this method of construction. The remains of *hōlua* courses on Hawai'i island appear as very straight smooth courses paved with cobbles and boulders. They range in width from 15 feet near the top, or starting position, to 60 feet in width further down the course.

The larger rock removed from the course often lined the edges of the course. In some areas where depressions in the ground surface existed, they were filled level with rock. In such cases, the outer edges of the stonework filling the depressions would appear as walls extending from the ground surface to the top surface of the *hōlua* course. High walls were not constructed along the edges of narrow *hōlua* courses as *papahōlua* (*hōlua* sled) riders often reached speeds of 50 to 60 miles per hour. The *hōlua* course was necessarily very straight and not lined with rock walls that would cause even more serious injury to riders if struck.

Evidence for a *he'ehōlua* course located in Hōlualoa 1st and 2nd Ahupua'a is based on the *ahupua'a* name Hōlualoa, translated as "long sled course" (Pukui *et al.* 1974:48), and by the Hōlualoa Inn's website stating there is a *hōlua* course on their property. Their website starts by stating "here in the village of Holualoa, the origin of the name comes from an actual holua slide that traverses downslope through the area, passing thorough our property at Holualoa Inn" (https://www.holualoainn.com/history-of-the-holua-slide/). Their map of the inn property labels the site as "D, Ancient Holualoa Trail" (Figure 7). It is unclear if the interpretation of the feature as a *hōlua* course is based on oral tradition or some other information. There is no documented oral history, archival documents or archaeological studies describing a *hōlua* in this location or in Hōlualoa 1st and 2nd Ahupua'a.

The one discussion of a possible *hōlua* in Hōlualoa 1st and 2nd Ahupua'a is included in an M.A. thesis by Thomas Keali'iahonui Stone (Pōhaku) (Stone 2002). Mr. Stone is an accomplished Hawaiian cultural practitioner specializing in *he'ehōlua*. The entirety of Mr. Stone's description of a possible *hōlua* located on the Hōlualoa Inn property follows. The italicized emphasis is mine.

> …in the mountains above *Kailua, Kona* there are also the remnants of what was perhaps a great slide from which the area gets its name – *Hōlualoa*, or "the long *hōlua* slide". My investigation of this area found just a small portion of the slide, in an old coffee field behind the *Hōlualoa Lodge* [Hōlualoa Inn], located just below the store. ***No one today remembers the existence of the slide or any stories about it***. From this location and from what we know about the length of the Keauhou slide (4,200 feet) I estimate

Figure 7: Hōlualoa Inn Map Showing Ancient Hōlualoa Trail.

> this slide (in its time) may have been perhaps 6,000 feet or more in length, with a width ranging from about 10 feet (in the area of this particular segment) to varying widths throughout the slide. Because ***there is no other segment*** surviving it is difficult to determine whether the slide had a 60-foot width, as does the slide at *Keauhou*, or if it was narrower. ***Of greater importance is that there are no contemporary records of its origin, time of use, or when it ceased to be used; I found however, that it was rumored to have existed, and this lead me to do a site inspection.*** But, the oral history of the islands is extensive, and it may take some time to perhaps uncover a chant that actually records some information about this slide. [Stone 2002: 116-117]

Two AIS studies were conducted on the *hōlua*/trail site (Desilets and Rechtman 2004, see Figure 4 study A) and on the entire Hōlualoa Inn property (Rechtman 2013, see Figure 4 Study B). The former AIS study (Desilets and Rechtman 2004) conducted exclusively for the *hōlua*/trail feature determined that it is an Historic era road (Site #50-10-37-24211) based on the orientation and construction of the site; based on Historic era maps showing the historic road in this location; based on consultation with and concurrence by Na Ala Hele Trails Association; and based on a 2004 letter from the State of Hawai'i Attorney General Land/Transportation Division summarizing the history and legal ownership of the historic road. The Rechtman (2013) AIS report prepared for the entire Hōlualoa Inn property also did not identify any sites related to a *hōlua* course (Figure 8).

The Historic era road (Site 24211) was documented (Desilets and Rechtman 2004) between Māmalahoa Highway and Hualālai Road (Figure 9). The road orientation is not very straight and has a number of obtuse angle turns (Figure 10 through Figure 14). In addition, the ground surface is not sloped in places, does not have a surface of cobbles and pebbles, and is not smooth, as would be expected if the site were the remains of a *kahua hōlua* (Figure 15). The width of the road varied between 1.5 and 5.0 meter (5 feet to 16 feet 5 inches) with the majority of the trail width measuring 11.5 feet (Desilets and Rechtman 2004:14). The rock walls lining the road averaged 1.0 meter in height. The walls are bi-faced dry-stacked rock walls with cobble core fill in places. The wall construction is similar to Historic era rock walls constructed along Historic era roads, property boundaries, gardens, and cattle pastures.

The western terminus of Historic Road Site 24211 is at Hualālai Road, though, it might have continued west along a trail shown on a 1928 map (see Figure 9 and Figure 10). The western terminus of that trail is at a north/south trail approximately 300.0 m east of the DEA project area. There are two *mauka-makai* (east/west) trails that intersect the north/south trail (see Figure 9 and Figure 10). The southernmost trail passes south of the DEA project area. The northern trail terminates at the railroad berm along the eastern boundary of the DEA project area. The level railroad berm was also used as a route for north/south pedestrian travel.

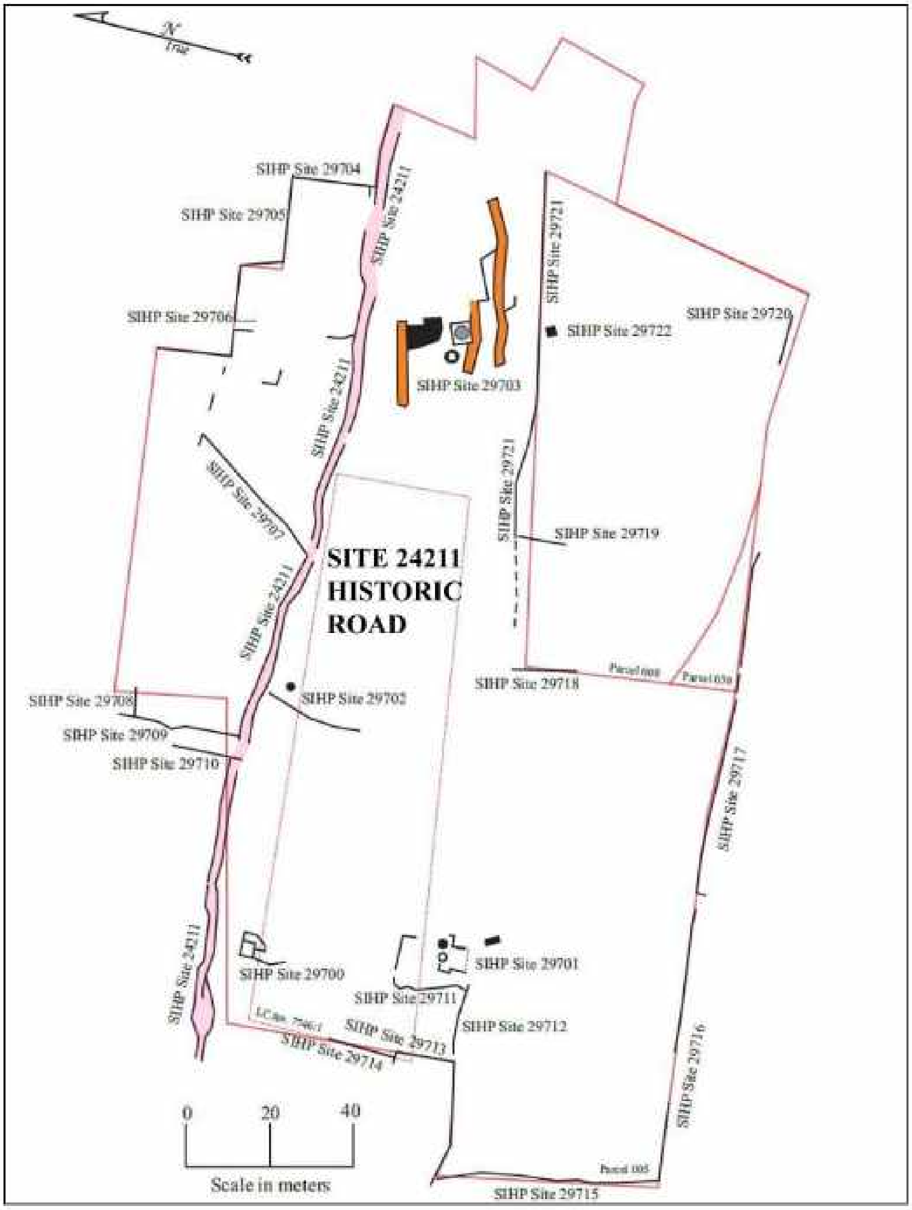

Figure 8: Hōlualoa Inn Property Map Showing Locations of Site 24211 Historic Road and Archaeological Sites Documented in the Rechtman (2013) AIS report (Rechtman 2013:23).

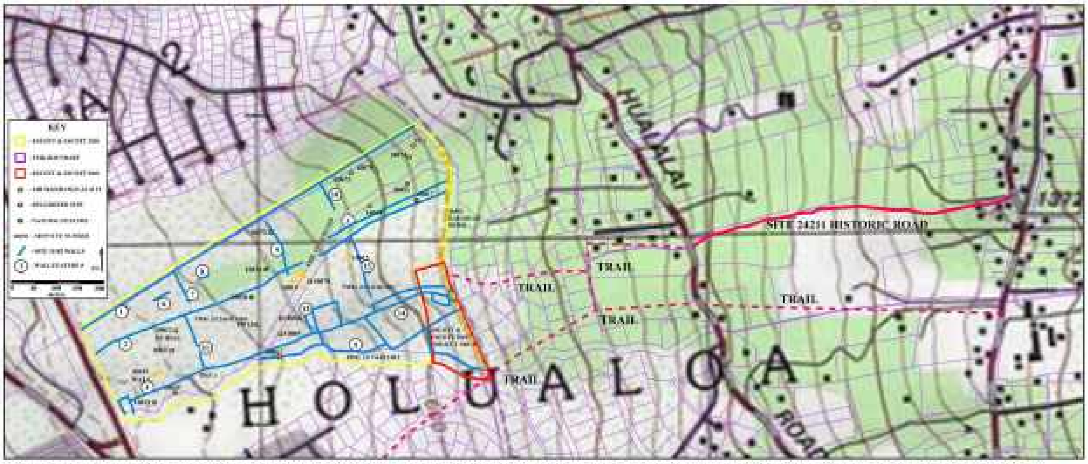

Figure 9: 7.5-Minute Series USGS Topographic Map Showing Location of Archaeological Sites, Trails and Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

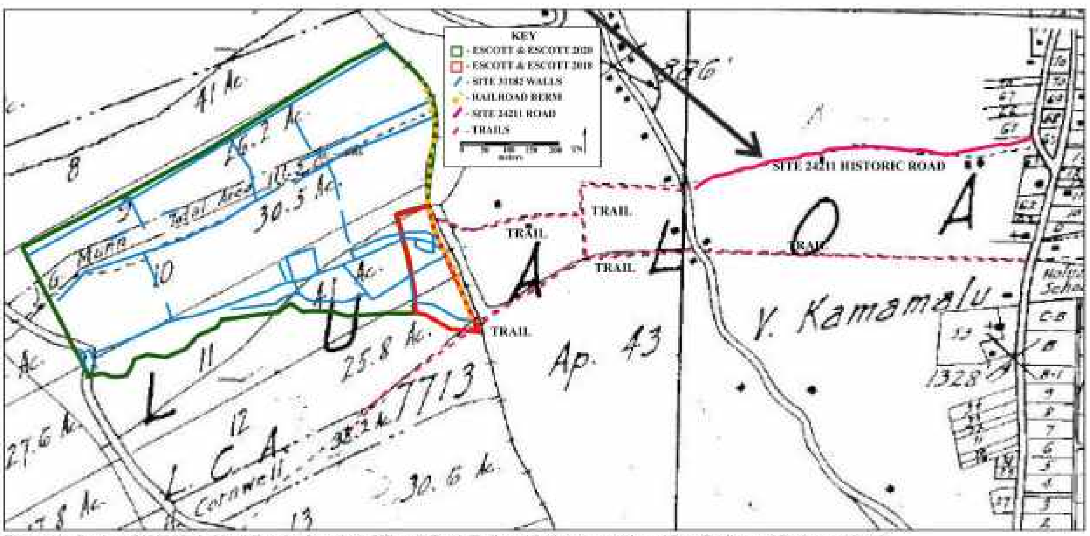

Figure 10: Portion of 1928 "Strip Map" Showing Location of Historic Road, Trails and Project Area (Adapted from Desilets and Rechtman 2004:9).

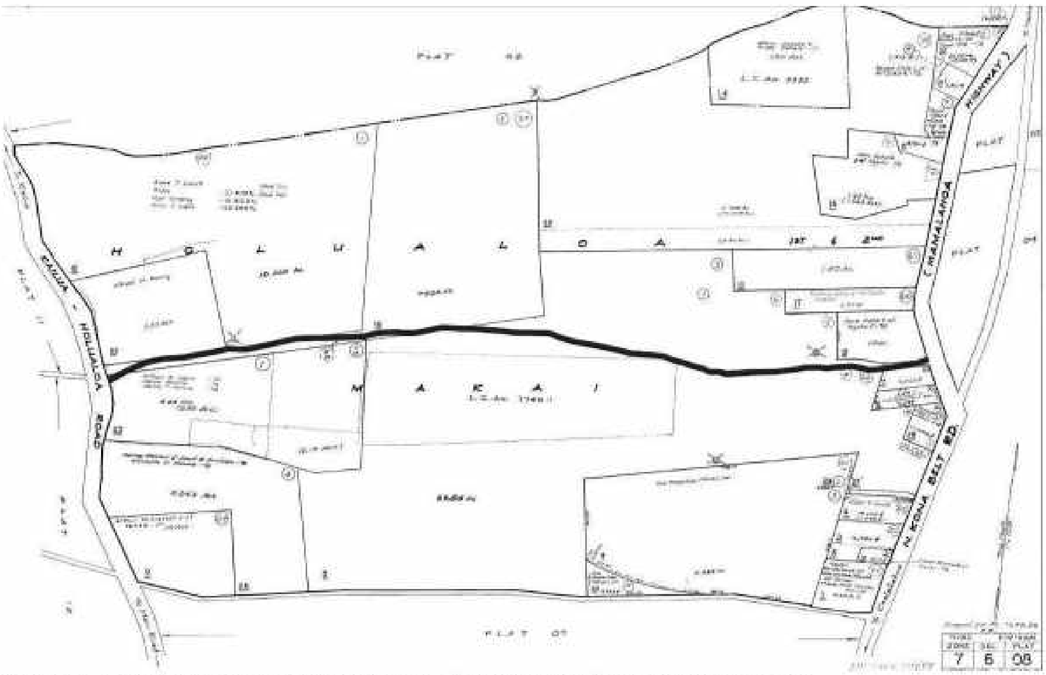

Figure 11: TMK: (3) 7-6-008 Map Showing Orientation of Site 24211 Historic Road (Heavy Black Line).

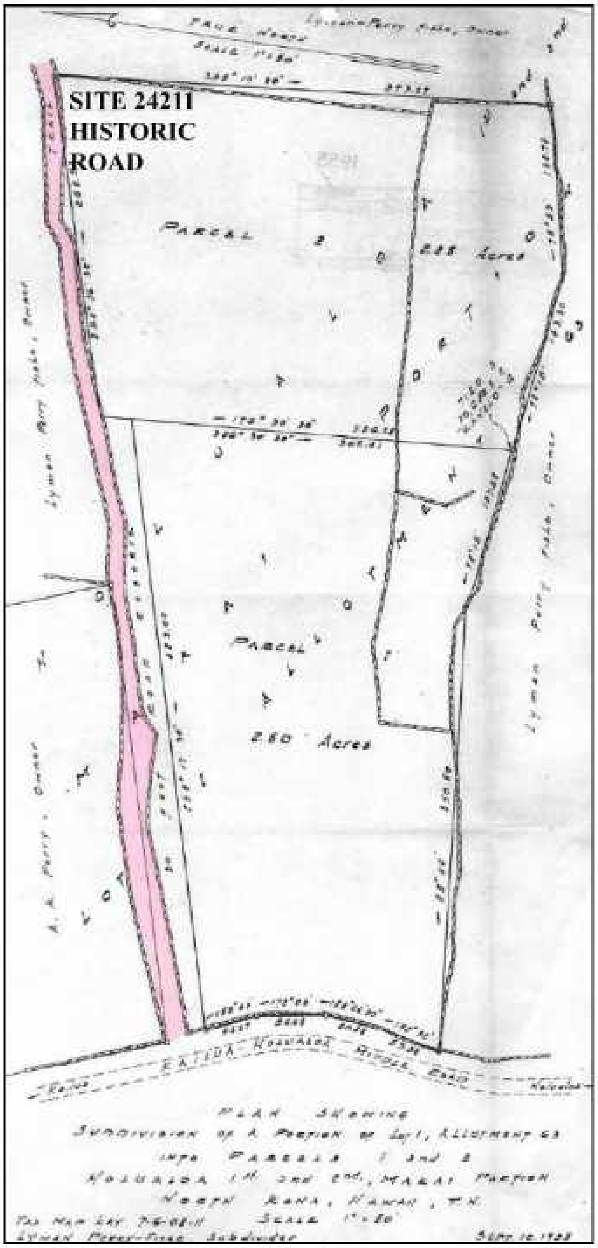

Figure 12: 1955 Survey Plan of Lower (Western) Portion of Site 24211 Historic Road and Kailua – Hōlualoa Middle Road (Hualālai Road).

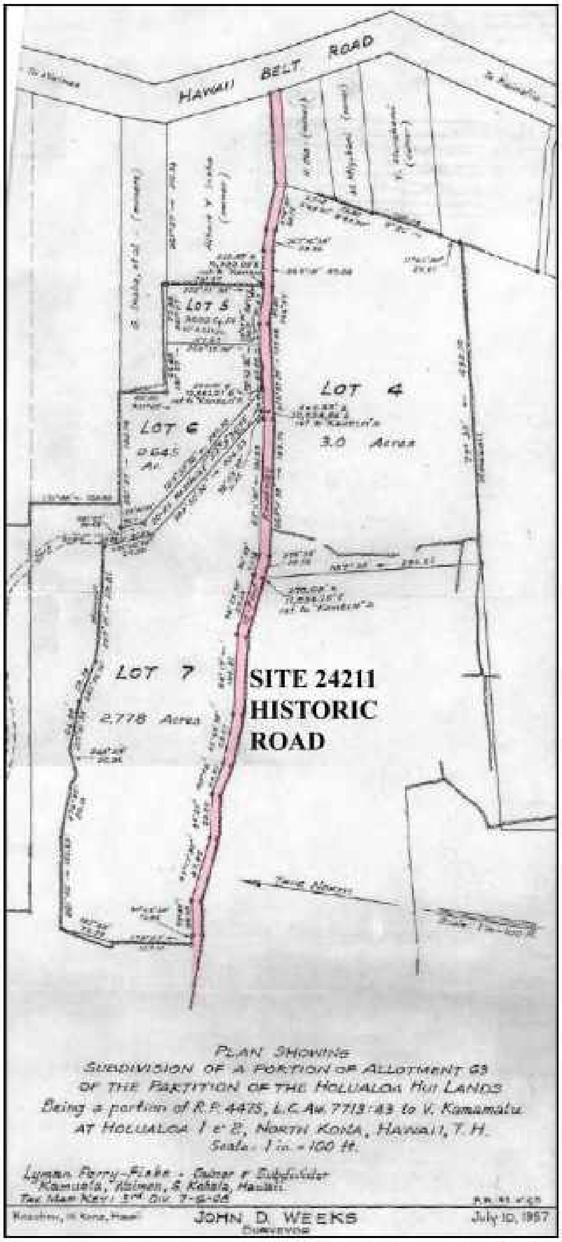

Figure 13: 1955 Survey Plan of Upper (Eastern) Portion of Site 24211 Historic Road and Hawai'i Belt Road (Māmalahoa Highway).

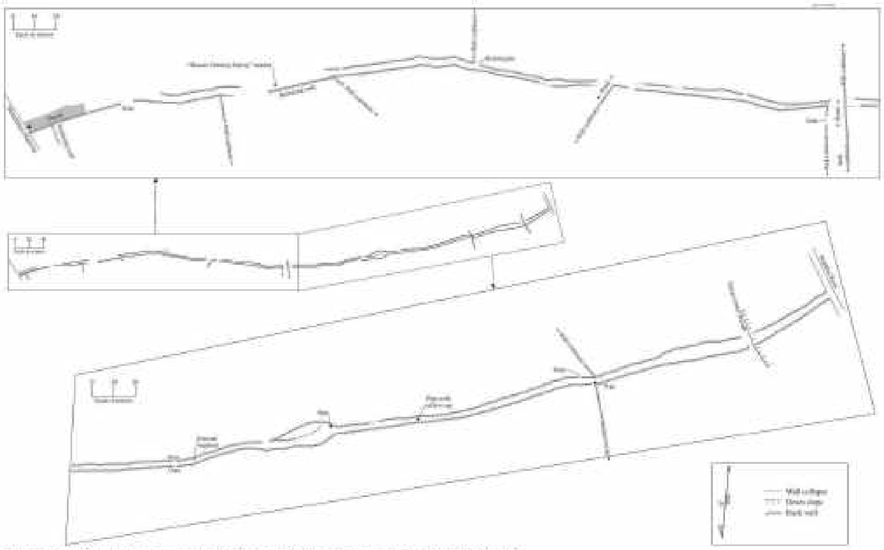

Figure 14: Site 24211 Historic Road Plan View Map (Desilets and Rechtman 2004:15).

Figure 15: Photograph of Site 24211 Historic Road and Rock Walls, Showing Uneven Ground Surface, Looking East (Rechtman 2013:24).

There are several walled gardens and corrals on the DEA project area, south of the trail terminus, that are not related to the trail (see Figure 6 and Figure 9). The eastern ends of parallel walls Site 30595 and Site 30601 are constructed onto the west side of the railroad berm indicating they were built and used after the construction of the railroad berm. The walls are stacked, bi-faced, and are cobble core filled in places, similar to Historic era walls documented in other places on the Island of Hawai'i. There are also north/south cross walls that bisect the space between the parallel walls. Finally, the ground surface between the walls is uneven, stepped with natural geologically-formed level terraces, and is dotted with bedrock outcrops and loose boulders.

The only other parallel walls within the current DEA project area are Site 31182, Feature 2 and Feature 3 walls located in the northern and northeastern portions of the project area, respectively (see Figure 5 and Figure 9). These two walls are located along the boundary of Land Commission award (LCA) #3660 awarded to John G. Munn (Figure 16). The LCA awarded to Munn is also depicted in the Figure 10 1928 map. Site 31182 Feature 2 is the southern LCA boundary wall and Feature 3 is the northern LCA boundary wall. The western end of Feature 3 terminates on the north bank of a seasonal gulch and there is a gap in the Feature 2 wall at the same gulch. If the parallel walls bounded a *hōlua* course, the course would empty into a large gulch, which is an unlikely scenario.

The southern LCA property boundary wall (Feature 2) was also documented in an AIS report (Dirks et al. 2013) conducted within the property adjacent to the northeast boundary of the DEA project area (see Figure 4 study C). The Dirks et al. 2013 report documented 149 features associated with Historic era farming and the LCA boundary wall. There were no *hōlua* or trail sites identified during that study.

There are no surface features within the DEA project area that are associated with a *hōlua* or trail. The ground surface within the DEA project area is uneven, stepped with natural geologically-formed level terraces, and is dotted with bedrock outcrops and loose boulders. The surface remains of a *hōlua* would be substantial, consisting of a long and wide smooth prepared surface of cobbles and pebbles that would contrast with the uneven topography in the project area and would be very easy to identify. There are no such surface features within the DEA project area.

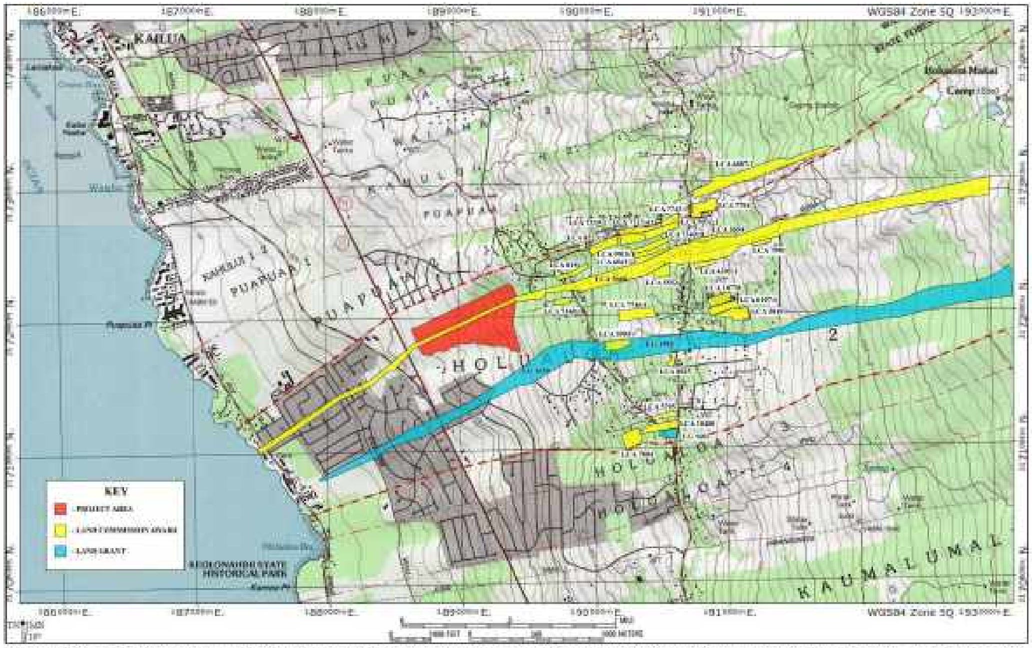

Figure 16: 7.5-Minute Series USGS Topographic Map Showing Location of Land Commission Awards, Land Grants, and the Project Area (National Geographic Topo!, 2003, Kealakekua Quad. Data Sources: National Geographic Society, USGS).

Response to DEA Comments Asserting the Presence of a *Hōlua* within the Project Area

A number of Comments on Form Declaration, and other written comments (notably Attorney Strauss letter), submitted during the DEA process assert that north and northwest portions of the DEA project area contain features of a *hōlua* slide, including rock walls that were not identified or documented in the archaeological studies. It appears the respondents are referring to Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

One of the DEA respondents, John, a member of the Kona Vistas AOAO Board, contacted Mr. Thomas Stone (Pōhaku) by email on July 1, 2019 to ask about the Hōlualoa *hōlua* course. The printed email chain provided by the respondent states the emails are communications between Tom Pōhaku Stone and a Kona Vista Board member but does not show the email address or full name of the correspondent John. In the email, John refers to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of *he'ehōlua* and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the DEA project area and there are no remains of royal, sacred or sociopolitical complexes, or a *hōlua*, within the DEA project area. The existence of a *hōlua* within the DEA project area was asserted by DEA respondents, not by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a *hōlua* course existed within the DEA project area.

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Escott. G., and S. Escott

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Rechtman, R.

2013 *An Archaeological Inventory Survey of the Hōlualoa Inn Property, (TMKs: 3-7-6-08:005, 008, and 030), Hōlualoa 1-2 Ahupua'a, North Kona District, Island of Hawai'i.* Rechtman Consulting Report RC-0800. Prepared for Cassandra Hazen, Carmel, California.

Stone, T.

2002 *The Reinstitution of a Traditional Hawaiian Practice: A Native Perspective of Ritualism through the Performance of He'ehōlua.* Thesis submitted to the graduate division of the University of Hawai'i in partial fulfillment of the requirements for the degree of Master of Arts in Pacific Studies. Honolulu.

Mori, Ashley

From:	Kurt White <thomaskurtwhite@gmail.com>
Sent:	Thursday, October 08, 2020 5:25 PM
To:	Planning Internet Mail
Subject:	Comments on proposed Sub division
Attachments:	KV Declaration re Traffic-non kv owners.docx

COH PLANNING DEPT
OCT 12 2020 PM1:29

Please find attached.

136967

DECLARATION OF ______________________

I, _THOMAS WHITE, declare:

1. I am a resident of Sunset View Terrace Lots subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 2 miles of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10-08-2020.

Thomas White

Printed name: Thomas White

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Thomas White
Via email: thomaskurtwhite@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. White:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum I 0% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Jim Johnson <jjohnson424@outlook.com>
Sent:	Thursday, October 08, 2020 4:40 PM
To:	Planning Internet Mail
Cc:	inabapacific@aol.com; Diane Blancett-Maddock
Subject:	Royal Vistas Housing Project EA comments
Attachments:	kv Declaration re drainage-non kv ownewrs.docx; KV Declaration re Traffic-non kv owners.docx

COH PLANNING DEPT
OCT 12 2020 PM1:28

Aloha,
Attached are my submittals related to the subject.

James H. Johnson
76-157 Kamehamalu St.
Kailua Kona, HI 96740-8937
808-326-4600

136968

DECLARATION OF JAMES H. JOHNSON

I, James H. Johnson, declare:

1. I am a resident of Kona Vistas, *TMK 3-7-6-026-017*, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. *I reside within 200 ft., corner of Leilani and Kamehamalu St's. which is one of two access streets of the proposed land development project.* In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about increased traffic, not designed for the volume projected. *Leilani St. from Lako to the above intersection, has a downhill grade and curves to the Stop Sign. Multiple times in the over 17 years that I have lived here, I have observed vehicles coming to Calvary Community Church, unfamiliar with the area, run the Stop sign.*

3. The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. See pp. _________ thereof.

4. Additionally, *I am aware that the drainage area on West Side of Calvary's 15 acre property, collects water from a large area above. The addition of acres of pavement and roofs collecting water that hasn't been adequately addressed in the proposed project, resulting in downslope issues all the way to the highway, and beyond.*

5. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. *As I understand it, such circumstances would lead to unlawful project segmentation, among other errors. The applicant, in the current lots remaining in Kona Vistas, has been forced*

to build a concrete drainage system, disguised as a wall with plants in front, to take care of current drainage issues. This new area would result in additional systems.

6. A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 8, 2020.

Signature: *James H. Johnson*
Printed name: James H. Johnson

DECLARATION OF JAMES H. JOHNSON

I, James H. Johnson, declare:

1. I am a resident of *Kona Vistas subdivision TMK 3-7-6-026-017* County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside *within 200 ft. of Leilani St which has a downhill grade and curves to the Stop Sign from Lako to the above intersection. Multiple times in the over 17 years that I have lived here, I have observed vehicles coming to Calvary Community Church, unfamiliar with the area, run the Stop sign*_____________ [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report, are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. ***No mention is made of Leilani St, which has the same issues with downhill slope and curves. Additionally, this area has more residences facing the street than the above noted street, resulting in more driveways giving access to the street***. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place *and Leilani St*. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place *and Leilani St.*

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on*

public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

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a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 8, 2020.

Signature: *James H. Johnson*
Printed name: James H. Johnson

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. James Johnson
Via email: jjohnson424@outlook.com

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Johnson:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I am specifically concerned about increased traffic. Leilani St. from Lako to the above intersection, has a downhill grade and curves to the Stop Sign. I have observed vehicles coming to Calvary Community Church, unfamiliar with the area, run the Stop sign.

> **Response 1:** Unfortunately, these events are not unique to this neighborhood or this part of the island. The proposed intersection and minor collector roads in the project site would be built to County standards to ensure their safety.

Comment 2: The steep topography, historical rapid stormwater run-off and associated damage present hazards that are not adequately addressed in the Draft Environmental Assessment. Additionally, I am aware that the drainage area on West Side of Calvary's 15 acre property, collects water from a large area above. The addition of acres of pavement and roofs collecting water hasn't been adequately addressed in the proposed project, resulting in downslope issues all the way to the highway, and beyond.

> **Response 2:** Flooding has occurred makai of Queen Ka'ahumanu Highway from waters in the County-owned Holualoa Ditch and the Horseshoe Bend Ditch, and as described in Section 3.3.2 of the EA the proposed project would not increase the amount of water carried by these ditches from the entire drainage basin extending miles up-hill as the project is not allowed to do so.

Comment 3: The DEA does not discuss sufficient facts and analysis such that the necessary drainage improvements and diversions can be understood. A proper environmental assessment cannot leave meaningful details to be taken care of in the future. As I understand it, such circumstances would lead to unlawful project segmentation among other errors. The applicant, in the current lots remaining in Kona Vistas, has been forced to build a concrete drainage system, disguised as a wall with plants in front, to take care of current drainage issues. This new area would result in additional systems.

Response 3: Section 1.2 of the EA describes the drainage improvements on the two County-owned parcels. The text in Section 1.2 of the Final EA has been revised to clarify that on TMK (3) 7-6-21:19, "Infrastructure during Phase II of the Proposed Project includes installation of a culvert system along with utilities and roadway across the ditch to extend Kekuanaʻoa Street, which would then be dedicated to the County as required by Ordinance and called for in the Kona Community Development Plan (CDP) "Official Transportation Map." For TMK (3) 7-6-21:18, the project includes infrastructure for channelizing a portion of this ditch and includes a road and utility system crossing this ditch to provide the connector road required by Ordinance and the CDP's "Official Transportation Map." Figure 2 has been revised in the Final EA to clarify the locations of the two drainages in the Project Area.

Additionally, the text in Section 3.3.2 of the EA describes that Kona Three LLC would prepare a Drainage Plan to ensure that development runoff would be contained onsite. The Drainage Plan which would be reviewed and approved by DPW. Text has been added in Section 3.3.2 of the Final EA to identify possible options for addressing the issues from existing flooding.

There is no project segmentation since all the components of the project are described and impacts from implementation are analyzed in this EA.

Comment 4: A bare conclusion by the applicant or accepting authority that needed infrastructure will comply with government regulations is insufficient. At a minimum, the Draft Environmental Assessment must be revised to show specifically what infrastructure improvements are required to tie into the County's drainage system and how those improvements will function.

Response 4: The potential impacts from these improvements are discussed in the EA. Even though the final design of the onsite Drainage Plan would be identified at a later date, the potential impacts from their construction are analyzed.

Comment 5: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 5: Specific comments for traffic impacts are discussed below.

Comment 6: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place and Leilani Street. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 6:** Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 7: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuana'oa Place and Leilani Street.

> **Response 7:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuana'oa Place, the number of vehicles projected to use Kekauna'oa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 8: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 8:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 9: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 9:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local

residential traffic. Delays to these intersections are not expected to be significant.

Comment 10: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 10: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 11: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

Response 11: It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 12: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

Response 12: The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 13: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **<u>Response 13</u>:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: Mark Powell <markp50@att.net>
Sent: Thursday, October 08, 2020 4:24 PM
To: Planning Internet Mail
Subject: Royal Vistas Housing Project EA Comments
Attachments: Royal Vistas Habitat.pdf

Royal Vistas Project EA

DECLARATION OF HABITAT/THREATENED & ENDAGERED SPECIES

I, JOHN POWELL, declare:

1. I am a resident of Kona Vistas Subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within Half a Mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT It does not address the threatened or endangered species or loss of habitat. I have personally witnessed Hawks and Owls coving this property. They appear to be living on the upper end of this property. I have seen Hawks in the early morning hours leaving the taller trees on the upper side. Just before dark I have seen Owls leaving from the upper area flying over and to the lower area of the property hunting. Also the 200 foot X 200 foot wide by 40 foot + tall buildings may very well hamper or kill protected Hawaiian Seabirds. Complete test for the Hoary Bat should be done. It appears that the habitat will be totally destroyed. Sound test need to be performed in May through September before any destruction of habitat.

3. In sum, the Draft Environmental Assessment and Impact Analysis Report does not present sufficient, credible facts, investigation, and analysis such that the adverse impacts on existing Habitat, Threatened or Endangered Species.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, 10-8-2020, 2020.

Signature: John Powell
Printed name:

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. John Powell
Via email: markp50@att.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Mr. Powell:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: The DEA does not address the threatened or endangered species or loss of habitat.

> **Response 1:** The biological inventory report documents the species detected and potential habitat at the project site. The Biological Survey Report in Appendix 3 of the EA acknowledges the limitations of a biological survey of a large project area and the absence of any particular species cannot be warranted from the survey's results. Therefore, the EA includes a description of species detected as well as potential habitat for native species in the existing conditions part of Section 3.3.4. The biological section identifies potential habitat for protected species and the impact discussion includes potential impacts to individuals and to habitat for native species (including those not directly detected during the survey). The impact discussion including protection measures to minimize these impacts to native species (including avifauana and bats) and their habitat in Section 3.3.4. Therefore, no impacts to these species are expected from the project.

Comment 2: In sum, the DEA does not present sufficient, credible facts, investigation, and analysis such that the adverse impacts on existing Habitat, Threatened or Endangered Species.

> **Response 2:** The analysis is based on the presence not only of species detected but also of potential habitat in the project site, and protection measures are proposed based on the potential presence of habitat and potential effects to the species.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Derek Inaba <derinaba@gmail.com>
Sent:	Thursday, October 08, 2020 4:06 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Projects EA, Request for Public Comment

COH PLANNING DEPT
OCT 12 2020 PM1:27

Submission/Royal Vistas Housing Projects Draft EA, County of Hawai'i Planning Department Request for Public Comment

Attention: County of Hawai'i Planning Department

I have had the opportunity to see the Royal Vistas Housing Project Draft Environmental Assessment. While it is quite voluminous, it did seem to inadequately assess the risk to our community in a number of areas. I am a lifetime Hawai'i Island resident, born and raised, and my ohana and I are very familiar with the area under review as well as past issues in and around Kona and Holualoa. I currently live In Pualani Estates.

In West Hawai'i we have had substantial issues with water shortages and restrictions due to natural factors and also infrastructure failures with our numerous water well failures and repairs. Were infrastructure concerns in our district and in West Hawai'i fully reviewed and assessed and were plans made to expand the County's capacity with such a large prospective development?

Additional infrastructure and required services issues need to be addressed at all levels. It is not clear that any of our normal infrastructure resources are equipped at all to handle a large condo development and influx of population. These infrastructure issues include such as core needs and services like electric, water, roadways (already greatly stressed in this area), schools, and all governmental services (County, State, and Federal). I did not see these important issues fully addressed in the document. Failure to fully identify and address these issues could result in large backend costs not initially noted or defined.

Having grown up in Holualoa and Kona, actually on this ahupua'a, I am very familiar with the risk of changing or altering land in any way and also related water flows and sheds problems. The land addressed in the Draft Assessment contains two significant waterways that currently carry water safely away from the existing neighboring communities. If water flow is altered from the Holualoa Ditch and Horseshoe Bend, much damage could adversely affect all surrounding properties. This would seem a huge risk for safety, protection of properties and homes where kama'aina like myself live. This needs to be thoroughly reviewed as any improper action here potentially poses great risk to our island ohana and their properties.

We already have substantial traffic and safety concerns in our district. Living in Pualani Estates, very close to this proposed project, I can tell you that we have already experienced significant infrastructure capacity issues with our residential, secondary and main roadway arteries. There has been an active group trying to resolve dangerous roadway issues in our area and neighborhood with the County. We have seen accidents and near misses right along Puapuaanui as well as just above and below Paulehia due to grade and angle, and blind spot issues. Unbelievably we even have speed control issues on our slightly longer residential streets. If the development proceeds, new roadways and access points would need to be built and fully studied. Thorough and comprehensive study and review when we are back to normal traffic flows would be essential. The residents in the area will understandably want assurance of protection to minimize any adverse impacts related to safety, roadway load, devaluations, loss of use and enjoyment, and other factors. This is critical given our existing traffic patterns and flows that may get even more challenging with development already occurring in West Hawai'i, such as Safeway at Henry Street. Will the Royal Vistas developer be required to fully disclose, review

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and seek public input on any alterations to all infrastructure including roadway access? Many people are so distracted now with the issues of Covid 19 but will want Open Forums to personally share, face to face, their concerns. That would afford the County and any developers the opportunity to explain, address, and perhaps allay concerns and minimally open a much needed dialogue among all key parties. As we have seen from other efforts that have faced significant problems, good, measured, well considered steps are essential.

I understand there are a number of historical and archeological features as well as at-risk and endangered species on the property as well. These need to be fully addressed, identified, and studied. It appears that the current draft contains only a partial assessment. Are these issues anticipated to be more completely reviewed? It's my understanding that these steps are necessary.

Thank you for requesting comment on this draft. I'm sure there are many other significant issues and factors you are reviewing or plan to review. The concerns I've addressed are submitted for your consideration as you review these matters further.

Respectfully submitted,
Derek Y. Inaba

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. Derek Inaba
via email: markp50@att.net

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Inaba:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: In West Hawai'i we have had substantial issues with water shortages and restrictions due to natural factors and also infrastructure failures with our numerous water well failures and repairs. Were infrastructure concerns in our district and in West Hawai'i fully reviewed and assessed and were plans made to expand the County's capacity with such a large prospective development?

> **Response 1:** As described in Section 3.3.3 of the EA, the water credits for this project have already been committed and paid for. DWS assigns credits based on capacity, so the infrastructure can provide the water for this project.

Comment 2: Additional infrastructure and required services issues need to be addressed at all levels. It is not clear that any of our minimal infrastructure resources are equipped at all to handle a large condo development and influx of population.

> **Response 2:** Potential impacts to infrastructure including utilities and public services is described in Section 3.7.1 of the EA. As described in Section 3.7.1, the project would be constructed in phases, and occupancy would occur over time. Additionally, it is expected that the project would provide workforce housing for the local community. The project's first phase would construct rental units, and it is expected that occupants of these units would be local and many of the students already attend local public schools. Section 3.7.1 has been revised to clarify that since the project would be constructed in phases, all 99 students would not all arrive at once and occupancy would occur over a longer period of time. This is consistent with predicted rates of growth for the area which are considered by the DOE in their forecast planning for public schools. Impacts to traffic are discussed in detail in Section 3.7.2. Water commitments for the project have already been secured as described in Section 3.3.3.

Comment 3: The land addressed in the DEA contains two significant waterways that currently carry water safely away from the existing neighboring communities. If water flow is altered from the Holualoa Ditch and Horseshoe Bend, much damage could adversely affect all surrounding properties.

> **Response 3:** The County owns all of Holualoa Ditch and most of Horseshoe Bend Ditch in this area. The project would not increase the amount of water flowing in the ditches, nor would it change where the ditches enter or exit the project. Therefore, the project will not affect the existing drainage situation.

Comment 4: We already have substantial traffic and safety concerns in our district. We already experience significant infrastructure capacity issues with our residential, secondary and main roadway arteries.

> **Response 4:** Section 3.7.2 and Appendix 2 (Traffic Impact Analysis Report) in the EA include a discussion of current traffic conditions and analysis of predicted changes to traffic. The EA includes a figure of the proposed intersection which is being developed in coordination with Hawaii Department of Transportation. The intersection is included as Figure 9 in the EA, and was available for public input during the public comment period for the EA. No comments were received during the extended comment period that resulted in changes to the design of the proposed intersection.

Comment 5: I understand there are a number of historical and archeological features as well as at-risk and endangered species on the property as well. These need to be fully addressed, identified, and studied.

> **Response 5:** As described in Section 3.6 and in Appendix 5 (Archaeological Survey Reports) in the EA, the entire project site has been recently inventoried for archaeological resources. One inventory covered 76.1 acres and the other covered 5 acres. Section 3.6 includes a summary discussion of the findings for both surveys that cover the entire site, as well as a discussion of how potential impacts would be minimized. The reports have been submitted to the State Historic Preservation Division for review and acceptance.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele I L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From:	Allison Bennett <info@blissinbloom.com>
Sent:	Thursday, October 08, 2020 4:02 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments re: Archeological, Wildlife and Traffic Impact

COH PLANNING DEPT
OCT 12 2020 PM1:27

Aloha,
I am writing to you with respect to the proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i.

I have found that the Environmental Assessment of this project inadequately addresses its impact on Archeology, Wildlife and Traffic. The Assessment shows great detail on a 5 acre portion of the property that was performed in 2018. The assessment of the remaining 65 acres included dated information and much less detail than the 2018 version.

Within the property in question are very likely remnants of the Kealakekowa'a (path of the canoe) road. Koa Trees were harvested above Holualoa and logged down to the Kealakekowa'a Heiau where the Koa logs were carved and made ready for canoe building. A portion of the actual path exists on the property of the Holualoa Inn Bed and Breakfast. https://www.holualoainn.com/history-of-the-holua-slide/ . Historically, most Holuas were used for sport. This Holua, however was specifically built to haul Koa wood to the sea. One unique aspect of this Holua is its parallel rock walls that were used to contain the Koa as it was transported down the Holua. The Royal Vistas Assessment strictly shows the use of these walls for cattle in the late 1800s and early 1900s. In the assessment, core samples of the walls reveal the kukui nut. The ancient Hawaiians used kukui nuts and ti leaves to help lubricate the Holua for sliding the logs. This would indicate that the walls are a physical and tangible piece of Ancient Hawaiian History. Holualoa is translated to English as "Long Slide". Lack of information regarding this piece of history is a serious omission in the assessment.

My family lives next to the Calvary Church land that is directly adjacent to the proposed Royal Vistas Housing Project. We enjoy seeing the copious wildlife that lives on this land. We regularly see multiple Hawaiian Hawks, Hoary Bats, and Owls! The assessment merely suggests that these animals could possibly reside in the proposed area. They DEFINITELY make their home on the proposed site.

The traffic study is also flawed. Interestingly enough, the study claims that the traffic has improved since the previous traffic study. The entire Kona population would agree without hesitation, that traffic has certainly not improved. In fact, it has become much worse since the initial study. To suggest that adding 1000 cars to this area won't have much of an impact is wishful thinking. Imagine the traffic light at Lako and the Highway during morning and evening rush-hour!

It is additionally innapropriate that the owners of this land, currently zoned as multi family, have been using it as a cattle ranch allowing cows to trample archeological sights. The majority of the cattle have been removed recently, but I have seen at least two cows that are still within the property. For an owner to disregard the zoning of this land shows a lack of respect and indicates

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that we are dealing with an investment group who will do as they please. Laws do not allow for this, yet it appears KV3 doesn't want to play by the same rules as the rest of us. This blatant disregard does not bode well for a responsible, well planned, well vetted and culturally sensitive project.

This project should NOT be allowed.

Thank you for your consideration.

Respectfully,
Allison Bennett

Allison S. Bennett
Phone: +1 (808) 895-6270

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Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Allison Bennett
via email: info@blissinbloom.com

RE: Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Ms. Bennett:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have found the analysis of archaeology, wildlife, and traffic in the DEA inadequate. The DEA shows great detail on a 5 acre portion of the property that was performed in 2018, and a much lesser detail, as well as dated, assessment of the remaining 65 acres.

> **Response 1:** As described in Section 3.6 and in Appendix 5 (Archaeological Survey Reports), the entire project site has been recently inventoried for archaeological resources. One inventory covered 76.1 acres and the other covered 5 acres. Section 3.6 includes a summary discussion of the findings for both surveys that cover the entire site, as well as a discussion of how potential impacts would be minimized. Impacts and protection measures for wildlife are included in Section 3.3.4 and impacts from traffic are included in Section 3.7.2.

Comment 2: Within the property are very likely remnants of Kealakekowa'a road (path of the canoe). Most Holuas were used for sport, however this Holua was built for hauling Koa wood to the sea. One unique aspect of this Holua is its parallel rock walls to help contain the Koa as it was transported down the holua. The DEA shows these walls and how they were used for cattle in the late 1800s and early 1900s. This is a serious omission in the assessment.

> **Response 2:** Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660.

Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 3: We regularly see multiple Hawaiian Hawks, Hoary Bats, and Owls! The assessment merely suggests that these animals could possibly reside in the proposed area. They DEFINITELY make their home on the proposed site.

Response 3: The biological inventory report documents the species detected and potential habitat at the project site. The Biological Survey Report in Appendix 3 of the EA acknowledges the limitations of a biological survey of a large project area and the absence of any particular species cannot be warranted from the survey's results. Therefore, the EA includes a description of species detected as well as potential habitat for native species (including protected species) in the existing conditions part of Section 3.3.4. The impact discussion includes potential impacts to individuals and to habitat for native species (including those not directly detected during the survey). The impact discussion including protection measures to minimize these impacts to native species (including avifauana and bats) and their habitat in Section 3.3.4. Therefore, no impacts to these species are expected from the project.

Comment 4: The traffic study claims that the traffic has gotten better than in their previous traffic study. To suggest that adding 1000 cars to this area won't really have much of an impact is wishful thinking.

Response 4: Section 3.7.2 and the Traffic Impact Assessment Report (TIAR) in Appendix 2 of the EA include a discussion of current traffic conditions and analysis of predicted changes to traffic. The changes in level-of-service from projected growth with and without the project condition in the analysis is based on the results of modeling by a professional traffic engineer, not wishful thinking.

Comment 5: It is innapropriate that the owners of this land, currently zoned as multi family, have been using it as a cattle ranch allowing cows to trample archeological sites. The majority of the cattle have been removed recently, but I have seen at least two cows that are still within the property.

Response 5: In response to neighboring community concerns, Kona Three LLC ceased cattle grazing in the proposed project site in 2019. To their best knowledge, Kona Three LLC knows of no cattle on the project site. However, it is possible that cattle grazing from the adjacent Gomes' property temporarily moved to the project site.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From:	Janice Kerr <jkkona@hawaiiantel.net>
Sent:	Thursday, October 08, 2020 3:49 PM
To:	Planning Internet Mail
Subject:	Project: Royal Vistas Housing Project; Hawaii Island; North Kona District
Attachments:	KV OWNERS Declaration re Traffic.docx

COH PLANNING DEPT
OCT 12 2020 PM1:27

Please see attached Declaration with signature.

Sincerely,
Janice Kerr

136972

DECLARATION OF JANICE KERR

I, Janice Kerr, declare:

1. I am a resident of [_76-4320 Leilani St. / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within one mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 8, 2020.

Signature: Janice Kerr
Printed name: Janice Kerr

Mori, Ashley

From: Janice Kerr <jkkona@hawaiiantel.net>
Sent: Thursday, October 08, 2020 3:46 PM
To: Planning Internet Mail
Subject: PROJECT: Royal Vistas Housing Project; island of Hawaii; District of North Kona
Attachments: Declaration R.V..docx

Please see attached Declaration

Sincerely,
Janice Kerr

DECLARATION OF_JANICE KERR

I, Janice Kerr, declare:

1. I am a resident of [_76-4320 Leilani St. / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within one mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 8, 2020.

Signature: ____________________

Printed name: Janice Kerr

COH PLANNING DEPT
OCT 13 2020 PM12:15

REC'D BY MAIL

DECLARATION OF JANICE KERR

I, Janice Kerr, declare:

1. I am a resident of [_76-4320 Leilani St. / Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within one mile of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately

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addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

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b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic

corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 8, 2020.

Signature: Janice Kerr
Printed name: Janice Kerr

Janice Kerr
76-4320 Leilani St.
Kailua-Kona, HI 96740

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OCT 13 2020 PM 12:15

COUNTY OF HAWAII PLANNING DEPT
101 PAUAHI ST., SUITE 3
HILO, HI 96720

96720-422403

Stantec

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Janice Kerr
73-4320 Leilani Street
Kailua-Kona, HI 96740
Email: jkkona@hawaiiantel.net

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawaiʻi Island

Dear Ms. Kerr:

Thank you for comment letters on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments. Since we received three letters (two by email one at 3:46 pm and one at 3:49 pm on October 8, and by mail post-marked on October 8) with identical comments, these responses address all three sets of your comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 1:** Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

> **Response 2:** Kekuanaʻoa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuanaʻoa Place from Royal Vistas Phase I as designed as the connection of Kekuanaʻoa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuanaʻoa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuanaʻoa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope

covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: D. Blancett-maddoc <dbmkona@aol.com>
Sent: Thursday, October 08, 2020 3:36 PM
To: Planning Internet Mail
Subject: ROYAL VISTAS HOUSING PROJECT EA COMMENTS
Attachments: KV EAD -DAVID SIGNED DECLARATION 10-08-2020.pdf

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OCT 12 2020 PM1:27

ALOHA,

Attached please find my declaration/comments to the Royal Vistas EA report.

With aloha,

David Blancett-Maddock
76-101 Kamehamalu St., Kailua Kona HI 96740
Kona Vistas

136974

DECLARATION OF DAVID BLANCETT-MADDOCK

I, DAVID BLANCETT-MADDOCK ,

declare:

1. I am a resident at 76-101 Kamehamalu Street, Kailua Kona, HI 96740 of Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within less than .5 miles of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

I am concerned that Kona Three, LLC (Developer) submits proposed findings of "no significant Impact (DEA-AFNSI) is not supported by the facts. I am concerned that Developer's DEA Study is proforma, setting forth declarations in boilerplate fashion while obfuscating, omitting or material facts and analysis. It appears that Developer omits material available local factual information from its analysis necessary to calculate the true environmental impact. I believe that Developer has omitted key finding necessary to fair and proper analysis of environmental impact. I am concerned that Developer has substituted generic modeling assumptions and inaccurate or outdated information in disregard of known local conditions and draws conclusions without valid factual support in the record. Instead, it appears that Developer parrots back regulatory agencies stated requirements with mere assurance of future compliance.

Omissions and unsupported Assumptions.

In my opinion, this report seems tellingly devoid of factual statements of essential foundational elements necessary to a valid assessment of the environmental impact of this very large, high density project.

Some primary examples of essential missing ascertainable local factual data include the following. Developer omits any stated estimate of population demographics or even an estimate of the total expected population totals, either in aggregate or detail. Developer omits any actual dollar estimates assigned for any sales prices or rental prices. Developer omits any clear estimate for completion dates for a project that has spanned almost three decades already. The submission is devoid of data to adequately address recreational space or defensibility of living space. On its face, Developer's submission appears to make only proforma reports of contacts and filings with community representatives and governmental agencies with bald assurance to comply, but omits the status of those interactions. Developer omits observable data of known flooding and fails to address or adequately describe how his development will address the consequences to percolation and water run-off resulting from clearing and altering and adding rooftop runoff to 70 acres of land with known flooding conditions. Developer substitutes a single variable national boilerplate model to estimate traffic load impacts which omits and fails to consider observable and ascertainable local data and sociology that more accurately reflects actual local conditions and likely contradicts underlying assumptions in the boilerplate national models, which would likely render those models inadequate to local application as applied

An example of why failure to consider local sociological demographic data is inadequate may help.

For example, I am concerned that Developer relies exclusively on a generic traffic impact model that mechanically applies a national standard without regard to obvious known and available data.

I am concerned that by using this model, the Developers assessment significantly understates impact to our communities because it ignores obvious or readily ascertainable data. In the instant case, there is evidence, that I observe routinely, of a well-known and empirically observable gridlock that occurs daily during rush hour (common times for commute to work). Any person living on this side of the island, including myself, has competently observed that Kuakini Hwy/ Queen K highway is the primary commuter highway for morning and evening commutes to and from the proposed development to a resident's place of work. I have observed the pre-covid gridlock of backed up traffic during morning and evening commute peaks for several miles south (often more than a mile past King Kamehameha III road which is a couple of miles south of Lako Street) and north a couple of miles into Kailua Kona at Henry street. If you need more evidence of this fact than my testimony, this fact can easily been confirmed by polling County Council Members and Mayor's Staff Members who have commuted to hearings in the West Hawaii Community Center for Council hearings in 2019 via South. This clearly observable fact invalidates a primary assumption of baseline traffic congestion assumed by the model and not adjusted for obvious and know conditions. I am concerned that that blind application of off-the shelf statistical based model fails to reflect obvious existing traffic saturation at peak times, rendering its derivative calculations as invalid. (ie; once saturation is apparent, models can reflect no delta-change in consequence because the maximum variable has been met – if the model does not incorporate saturation as a base, the conclusion would be invalid).

By mere observation, Developer's base conclusion that traffic saturation on this essential artery is only 59% is not reliable. Gridlock is evidence of super-saturation.

Secondly, Developer applies "nationally accepted land use rates from the Trip Generation, 10th Edition (ITE, 2016)". Page 19 traffic. It uses the number the "258 dwelling units" in Phase 1 as the sole "independent variable" to estimate new trips expended from the proposed project and "192 dwelling units" in Phase 2 as the sole "independent variable" to estimate new trips expended from the proposed project. Pgs. 19, 34. This results in Phase 1 morning IN/OUT rates of 27/90 and evening IN/OUT rates 86/51. And, Phase 2 morning IN/OUT rates of 20/69 and evening IN/OUT rates 67/39. Accordingly, Developer estimates ultimate post projects after all phases of the development to be IN/OUT rates to total 47/159 mornings and 153/90 evenings.

This boiler-plate model generated analysis conveniently ignores Developer's own estimates of automobile demand (as extrapolated from planned parking spaces and on-street parking) as well as known or ascertainable data specific to the region about occupancy and vehicle ownership and usage specific to our west Hawaii community.

Because Developer's reports disperse critical data throughout the report in a proforma disclosure, much of the data is obscured and hinders candid analysis required by the rules and statutes.

For example, data that is difficult to extract from the narrative of the report seems to dispute the model generated results presented by the Developer as cited above.

While much critical data is suggested in the report, it takes a considerable close reading of the entire text of the report, cross-referenced with manual reading of the plans with a magnifying glass to ascertain the material facts. A careful analysis and reasonable inferences drawn from this data suggest that even these included facts would contradict the conclusions reached by Developers bald application of the national statistical model.

If we consider the number of cars Developer accommodates with designated parking spaces alone, this becomes obvious. Consider the following from the report - Developer appears to represent in his plan map, 2 parking spaces per residential unit, regardless of the size of the unit. If one takes the time to piece together the data dispersed throughout the narrative of the report, Developer proposes:

174 FOR RENT Units.

All are two (2) stories in height.

All are 2 units per footprint

122 are 2 Bedrooms

244 Bedrooms

61 Foot Prints but in multiples, side by side like apartment buildings

244 parking spaces

52 are 3 Bedrooms

156 Bedrooms

26 Foot Prints but in multiples, side by side like apartment buildings

104 parking spaces

Combined Totals FOR RENT units

172 Units

400 Bedrooms

348 Parking Spaces

87 Grouped Lots

274 For Sale Units.

10 are two (2) stories in height.

39 are three (3) stories in height.

All are 2 units per footprint

147 are 2 Bedrooms

294 Bedrooms
(74*) Foot Prints but in multiples, side by side like apartment buildings
294 parking spaces

52 are 3 Bedrooms

156 Bedrooms
26 Foot Prints but in multiples, side by side like apartment buildings
104 parking spaces

Combined Totals FOR SALE units

274 units
450 Bedrooms
398 Parking Spaces
100 Grouped Lots

2 Manager Units

2 Units
Unk Bedrooms
4 Parking Spaces
(*) Unable to ascertain – 1 appears accounted for in 2 bedroom For Sale

Consider Phase 1 - Developer proposes to build up to 258 units in Phase 1. "Phase 1 will include all Rental units and some Sale units."

Using this extrapolated data for parking spaces alone, Developer anticipates 348 parking spaces for Phase 1 RENTALs, and 172 (86 units@ 2 spaces) Phase 1 parking spaces for SALE/Mgr units. That's 520 vehicles in Phase 1 This number does not consider the significant street parking that Developer also anticipates to accommodate additional resident owned vehicles or visitors.

Reviewing Developers projected traffic rates, Developer's off-the shelf model projects, Phase 1 morning IN/OUT rates of 27/90 and evening IN/OUT rates 86/51.

The results from this national boiler-plate model expect us to believe that nearly no more 1 of 5 of these vehicles in Phase 1 will leave for work at rush hour? And that doesn't even consider households that own more than two cars or visitor.

This result is, of course compounded, for the same reasons, by the fact that it was used to reach similar results in Phase 2. [1]

Phase 2 has a remaining 186 units with 2 parking spaces per unit for a total of 276 parking spaces. Reviewing Developers projected traffic rates, Developer's off-the shelf model projects, Phase I morning IN/OUT rates of 20/69 and evening 67/39.

This underscores why the model analysis is inadequate where observable and ascertainable local regional data is available and would significantly change the conclusions on impaction.

Frankly, I believe that the Developer's national boiler-plate model conclusions fly in the face of observable and ascertainable local data on vehicle usage and local sociological conditions. I have observed, and anyone who cares to drive a working-class neighborhood in the Kona area can observe, single-family working-class residences routinely have three (3) or more cars per residence. We cannot dismiss our own local experience that workers renting often share single bedrooms between two or more renters. Even Census data from the 2010 US Census that is somewhat outdated in Developer's favor, shows that single-family households in Kailu reported that multiple household members were working, households with 2 vehicles was not rare, and 18% of the households had 3 or more vehicles According to the 10 year old Census 68 % of the workers drove to work alone, 17% carpooled and only .05% took public transportation.

If this cursory comparison between application of a local analysis impact model based on just the observable and inferred data contained in Developers report could yield a conclusion of traffic impact five (5) times that of the national boiler-plate model conclusions, it is likely that a properly conducted sociological study and model would show even greater impact.

I believe that omitting local sociological data from these calculations grossly underestimates the traffic impact of this development and violates the intended mandate of the legislation to provide

[1] Phase 2 has a remaining 186 units with 2 parking spaces per unit for a total of 276 parking spaces. Reviewing Developers projected traffic rates, Developer's off-the shelf model projects, Phase I morning IN/OUT rates of 20/69 and evening 67/39.

this decisional body with a report accurately reflecting the environmental impacts under the law. I ask this body to follow its duty to enforce, if not strictly – then reasonable, requirements that the environmental assessment report provide accurate, meaningful and data and analysis of the physical, social, historical, economic, and natural resource con- sequences of the proposed action. **(See HRS §343; COUNTY RULE 14)**

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

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c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

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Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, OCTOBER 8, 2020.

Signature: David Blancett-Maddock

Printed name: DAVID BLANCETT-MADDOCK

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Mr. David Blancett-Maddock
76-101 Kamehamalu Street
Kailua Kona, HI 96740
Via email: dbmkona@aol.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Mr. Felix:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

<u>Comment 1</u>: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **<u>Response 1</u>:** Specific comments for traffic impacts are discussed below.

<u>Comment 2</u>: I am concerned that the findings of "no significant Impact (DEA-AFNSJ) is not supported by the facts. I am concerned that Developer's DEA Study is proforma, setting forth declarations in boilerplate fashion while obfuscating, omitting or material facts and analysis.

> **<u>Response 2</u>:** Please see detailed comments on specific resource sections below.

<u>Comment 3</u>: The DEA omits an estimate of population demographics and the total expected population totals, actual dollar estimates assigned for any sales prices or rental prices, estimate for completion dates. The DEA does not address recreational space or defensibility of living space. The DEA omits observable data of known flooding and fails to address or adequately describe how his development will address the consequences. The traffic analysis omits and fails to consider observable and ascertainable local data.

> **<u>Response 3</u>:** Regarding population demographics, Table 3 in Section 3.4 (Socioeconomics) of the EA includes existing population data for the state, county, and North Kona Census County Division which are the areas the project is located within. An estimate of occupancy at project completion would be speculative for 450 multi-family units. Justification for modeling inputs for the size and number of units are included in Appendix 2 (Traffic Impact Assessment Report). Regarding cost for sale and rental units, the units would be rented or

sold at market prices and cannot be determined at this time. Regarding construction schedule, Section 1.2 states that construction could start as early as third quarter of 2021, following Plan Approval and construction permits, and would be expected to last 12 to 18 months. Regarding recreation, Section 1.2 describes that there would be two community centers including a pool and facilities and in Section 3.3.4 it states that landscaping would provide safe and adequate recreational space for residents. Kona Three has a long-standing record of coordinating with agencies to meet requirements for the project, and would continue to do so as stated in the EA. Regarding flooding and drainage issues, the EA explains existing conditions and how Kona Three is working with DPW to address these, and how the project would not exacerbate these issues (see Sections 1.2 and 3.3.2). Per Section 27-20 of the Hawaii County Code, the project is not allowed to increase any run-off onto neighboring properties, so there are no effects on any neighbors from project run-off including on the County-owned parcels. Specific comments on the traffic report are responded to below.

Comment 4: I am concerned that that blind application of off-the shelf statistical based model fails to reflect obvious existing traffic saturation at peak times, rendering its derivative calculations as invalid.

Response 4: The methods for the traffic analysis completed in the TIAR for this project follows widely accepted industry standards – from the data collection, to the growth rate, to the use of HCM. Independent comments provided by Professor Prevedourous on the EA (which were included in a separate comment letter) agree with many of the traffic analysis methods and approaches for the project. The TIAR uses HCM methodologies to analyze the traffic impact in a numerical sense.

There are limitations to the improvements that can be made. The northbound queue seems to be a comment made a lot by residents. Those comments are recognized. The adding of a few vehicles, or the modification of a traffic signal will have little impact to the network. Signalizing unsignalized intersections may cause more delay. The main problem is the capacity of a two-lane Highway, and if/when the widening will be completed. The widening of Queen Ka‘ahumanu Highway will likely lead to the most improvements in the delay, and this project has been planned for a while. The TIAR recognizes the impact of the widening, but Kona Three LLC does not control over that.

Comment 5: The traffic analysis applies "nationally accepted land use rates from the Trip Generation, 10th Edition OTE, 2016)". This boiler-plate model generated analysis conveniently ignores automobile demand, parking, traffic impacts, and data specific to the region about occupancy and vehicle ownership and usage specific to our west Hawaii community.

Response 5: It is hard to predict if a 3 bedroom house will have 10 people with 2 cars, or 3 people with 4 cars, or be unoccupied with 0 people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE), Trip

Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection for the project. The ITE trip generation handbook is the accepted practice to develop trip generation and distribution and future projections.

Although some units in the development could have more than 2 vehicles, not all units will be occupied or have vehicles. It is impossible to predict how many cars will be in the development. We can assume a max number, which would be the total number of stalls provided. But the parking capacity will probably never be at 100%. Also, not all vehicles will leave or enter the development during the AM and PM peak, which is when the TIAR is analyzing. The ITE trip generation handbook analyzes many developments and produces data points and a best fit curve. This is used for the traffic projection for this TIAR.

Comment 6: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 6: Kekuanaʻoa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuanaʻoa Place from Royal Vistas Phase I as designed as the connection of Kekuanaʻoa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuanaʻoa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuanaʻoa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 7: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuanaʻoa Place.

Response 7: Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuanaʻoa Place, the number of vehicles projected to use Kekaunaʻoa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 8: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

Response 8: The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 9: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

Response 9: Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 10: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

Response 10: Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 11: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

Response 11: It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 12: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 12:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 13: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 13:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai‘i Planning Department

Mori, Ashley

From:	Allison Bennett <info@blissinbloom.com>
Sent:	Thursday, October 08, 2020 3:31 PM
To:	Planning Internet Mail
Subject:	Royal Vistas Housing Project EA comments re: Traffic

I, ALLISON BENNETT, declare:

1. I am a resident of Kailua-Kona / Kona Vistas subdivision, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 100 yards of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding

numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities*. See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health*. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai‘i, October 8, 2020.

Respectfully,
Allison Bennett

Allison S. Bennett
Phone: +1 (808) 895-6270

Event Coordination and Design
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P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Allison Bennett
Via email: info@blissinbloom.com

RE: Traffic Comments on Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Bennett:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

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> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

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<u>Comment 7</u>: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

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> **<u>Response 8</u>:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

<u>Comment 9</u>: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

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> **<u>Response 9</u>:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope

covered in this TIAR does not include that analysis. The TIAR does mention where an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

Mori, Ashley

From: D. Blancett-maddoc <dbmkona@aol.com>
Sent: Thursday, October 08, 2020 2:23 PM
To: Planning Internet Mail
Subject: ROYAL VISTAS HOUSING PROJECT EA COMMENTS
Attachments: KV DECLARATION DIANE OCTOBER 7.pdf

ALOHA,

Attached please find my comments to the Royal Vistas EA report.

With aloha,
Diane Blancett-Maddock
Kona Vistas

136977

DECLARATION OF DIANE BLANCETT-MADDOCK

I, Diane Blancett-Maddock, declare:

1. I am a resident of Kona Vistas subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within .5 miles of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International (TIAR), dated May 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

When this multi-family zoning was created in 1984, land was vacant and the impact of adding 450+ multi-family units would not have been a traffic issue. However, in 2020, the area has been developed and this proposed development will have an extremely negative impact on the already stressed infrastructure. The proposed development indicates a non-signaled right-turn only exit onto the highway. However, the TIAR methodology does not accurately reflect or consider the fact that the highway has already reached saturated status. Nor does the TIAR does adequately address the impact to the abutting neighborhood that will be caused when it routes the southbound traffic, that cannot use this intersection for a left turn, through a small neighborhood street to the saturated traffic signal at Lako Street, where it will stack up for a left turn. In short, to avoid proper signalization at the primary highway intersection, developer shifts the burden, costs and impact onto its neighbors and the inadequate County signalization at Lako Street. In 2020, (current conditions without tourism) I have personally observed on most weekdays the intersection of the highway at Lako street is gridlocked during non-peak "rush hours such as late morning, early afternoon and early evenings. The intersection at Lako is barely able to current loads and cannot absorb any additional traffic from this development. Because there is no acceleration lane in any direction at Lako Street intersect, all Lako Street traffic must stop prior to entering the highway. As a result, traffic already backs up into the adjacent neighborhoods, both mauka and makai. This can be observed even now, even when we are not experiencing the pick-up and discharge of children by school buses, or the heavy tourist traffic we are accustom to under non quarantine conditions.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along

Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

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5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

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b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

e. The recommendation by SSFM Traffic Impact Analysis Report for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

f. The recommendation by SSFM Traffic Impact Analysis Report for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 7, 2020.

Signature:
Printed name: Diane Blancett-Maddock

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Diane Blancett-Maddock
Via email: dbmkona@aol.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Blancett-Maddock:

Thank you for the comment letter dated October 8, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

Response 1: Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

Response 2: Kekuana'oa Place is a County-owned road built to County standards, with the same specifications as all other Kona Vistas roads, including paved swales as sidewalks. There will be no traffic impact on Kekuana'oa Place from Royal Vistas Phase I as designed as the connection of Kekuana'oa Place to Royal Vistas is not planned until Phase II in 2029. After that, once full build-out is completed, the TIAR estimates a total of 30 additional vehicles on Kekuana'oa Place during the AM Peak period, and 25 additional vehicles during the PM Peak period. This is roughly one additional vehicle on Kekuana'oa Place every 4 minutes for the peak periods, which would not cause congestion.

Comment 3: This DEA requires evaluation of, among others, adverse secondary impacts, such as population changes or effects on public facilities. Instead of separately discussing these issues, however, the DEA ignores them. It is a serious omission to fail to address potential adverse impacts of increasing the use of substantial existing infrastructure, like Kekuana'oa Place.

> **Response 3:** Secondary effects are indirect effects, or effects that would occur at a different place or time than the proposed project. These effects are not expected since the project is expected to provide infill housing for on-island residents as described in Section 3.7.1 of the EA. Regarding potential traffic impacts to Kekuana'oa Place, the number of vehicles projected to use Kekauna'oa Place is the Phase II outbound traffic (22 and 9, for the AM and PM peak hours, respectively). The traffic analysis includes a detailed analysis of secondary traffic effects impacts (Section 3.7.2 of the EA).

Comment 4: The DEA addresses adverse traffic impacts only in the context of whether the project would Have a substantial adverse effect on public health. The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11.200.1-13, Hawaii Administrative Rules.

> **Response 4:** The EA describes potential impacts under respective resource sections as they could impact human health. The summary statement quoted is included in Part 5: Findings and Reasons, and accurately summarizes the impacts detailed and analyzed above in the body of the EA.

Comment 5: The Planning Department should not accept the DEA's reliance on the TIAR, which fails to address adverse traffic impacts within the Kona Vistas subdivision arising from the project.

> **Response 5:** Intersections within the Kona Vistas project were not analyzed since those internal intersections are probably stop controlled and have only local residential traffic. Delays to these intersections are not expected to be significant.

Comment 6: The TIAR uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering TIAR. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation.

> **Response 6:** Hawaii Department of Transportation (HDOT) counts did not show an increase in traffic volume. The 2035 Federal Aid Highways Long Range Transportation Plan forecast projections for 2020 and 2035 were used to come up with the 1% growth rate. Although we are not certain how Witcher Engineering got 2%, our traffic engineers used 1% from the 2025 LRTP forecast.

Comment 7: The TIAR does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project.

> **Response 7:** It is hard to predict whether a 3-bedroom house will have 10 people with two cars, or three people with four cars, or be unoccupied with no people and no cars, or if residents will use the bus. The Institute of Transportation Engineers (ITE) Trip Generation Handbook was used and low-rise and mid-rise was considered. Low-rise multifamily housing was used since it provided a higher volume output. This land use has a very low standard deviation and an R-squared value very close to 1.00, so statistically this is the best projection used by the traffic engineer.

Comment 8: The TIAR employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Repo11, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the TIAR, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable.

> **Response 8:** The most recent Historic HDOT count available in the study area was the 2016 Queen Kaahumanu Highway section between Nani Kailua Road and Hualalai Road (north). Our traffic count taken in August of 2019 was compared to the 2016 HDOT count and was found to be fairly comparable. It is hard to say if the Witcher Engineering report is overcounting, or if the project's TIAR is undercounting, but the TIAR for the project does use numbers similar to those provided in the 2016 HDOT Count.

Comment 9: The recommendation by the TIAR for a roundabout at Queen Kaahumanu Highway and Hualalai Road (North) is inconsistent with the traffic corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government.

The recommendation by the TIAR for monitoring of the intersection of Queen Kaahumanu Highway and Kuakini Highway is inadequate. Where, as here, an intersection passes more than one warrant under all conditions, it should be prioritized for study and design of a signal for installation. This circumstance will be exacerbated by the proposed project.

> **Response 9:** The Manual on Uniform Traffic Control Devices (MUTCD) states, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." There are other considerations that need to be done before installing a signal, such as the increase in delay, the likely increase in rear end accidents, geometric feasibility, and others. The scope covered in this TIAR does not include that analysis. The TIAR does mention where

an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele T L

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: Peri Steffenhagen <pesteffe@gmail.com>
Sent: Friday, October 09, 2020 8:33 AM
To: Planning Internet Mail
Subject: Fwd: Declaration RE Royal Vistas
Attachments: Scan 27.pdf

I mistakenly sent my declaration only to the person supporting our responses from Pualani Estates. Please accept my apologies and my declaration submission this morning. Thank you!

Peri

Peri Steffenhagen | Wisdom Course Leader | Landmark | mobile 408-859-3248

---------- Forwarded message ---------
From: **Peri Steffenhagen** <pesteffe@gmail.com>
Date: Thu, Oct 8, 2020 at 5:01 PM
Subject: Declaration RE Royal Vistas
To: D. Blancett-maddoc <dbmkona@aol.com>

Peri Steffenhagen | Wisdom Course Leader | Landmark | mobile 408-859-3248

DECLARATION OF PERI STEFFENHAGE

I, PERI STEFFENHAGEN, declare:

1. I am a resident of [Pualani Estates subdivision], County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within 100 Yards [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT including the Traffic Impact Analysis Report by SSFM International, dated July 2020 and attached as Appendix 2 to the DRAFT ENVIRONMENTAL ASSESSMENT. I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the SSFM Traffic Impact Analysis Report. Traffic and the SSFM Traffic Impact Analysis Report. are discussed in the body of the DRAFT ENVIRONMENTAL ASSESSMENT. at pp. 48-56, 67 and 71.

3. In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuana'oa Place. Kekuana'oa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic

arising from Phase 1 and Phase 2 buildouts of the Royal Vistas Housing Project is inadequately addressed in the SSFM Traffic Impact Analysis Report, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuana'oa Place. I consider that the Planning Department should require the applicant to address these concerns.

4. The DRAFT ENVIRONMENTAL ASSESSMENT requires evaluation of, among others, *adverse secondary impacts, such as population changes or effects on public facilities.* See Chapter 11-200.1-13, Hawaii Administrative Rules. Instead of squarely addressing these issues, however, the DRAFT ENVIRONMENTAL ASSESSMENT simply ignores them, claiming that "No adverse secondary effects are expected since the development would utilize existing infrastructure, provide infill housing, and is not expected to result in substantial demands to County services." It is a serious omission for the DRAFT ENVIRONMENTAL ASSESSMENT to fail to address the potential adverse impacts of increasing the use of substandard existing infrastructure, like Kekuana'oa Place.

5. The DRAFT ENVIRONMENTAL ASSESSMENT addresses adverse traffic impacts only in the context of whether the project would *Have a substantial adverse effect on public health.* The Applicant claims, "The Proposed Project would not affect public health in any way; stormwater would be appropriately disposed of in drainage structures. Traffic impacts have been taken into careful consideration in project design." Emphasis added. This bald conclusion does not address potential adverse impacts as required by Chapter 11-200.1-13, Hawaii Administrative Rules.

6. The Planning Department should not accept the DRAFT ENVIRONMENTAL ASSESSMENT's reliance on the SSFM Traffic Impact Analysis Report, which has the following deficiencies:

a. failure to address adverse traffic impacts within the Kona Vistas subdivision arising from the project;

b. The SSFM Traffic Impact Analysis Report uses a growth rate of 1%, in contrast to the 2% growth rate employed by the 2018 Witcher Engineering Traffic Impact Analysis Report. Traffic congestion is very sensitive to growth rate in a non-linear, exponential relation;

c. The SSFM Traffic Impact Analysis Report does not recognize multi-generational housing characteristics common in Hawaii according to census data and likely underestimates daily vehicle trips attributable to buildout of the proposed project;

d. The SSFM Traffic Impact Analysis Report employs an unusually low vehicle volume of 853 vehicles for Northbound Queen Kaahumanu highway on the selected dates of April 30, 2019, a weekday and August 24, 2019, a Saturday, compared with the 2018 Witcher Engineering Traffic Impact Analysis Report, which reported 1057 vehicles for January 14 and 15, 2016, both weekdays. The unusually low reported vehicle volume of 853 is also at odds with Figure 4 of the SSFM Traffic Impact Analysis Report, which shows approximately 1050 vehicles per hour in 2016 for Northbound Queen Kaahumanu Highway at 7 a.m. The difference in volume is more than double the maximum 10% variation generally accepted in day-to-day measurements and thus unreliable;

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corridor. Intersections that pass warrants but remain unsignalized present traffic safety liability concerns for the government;

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7. In sum, the Draft Environmental Assessment and SSFM Traffic Impact Analysis Report does not present sufficient, credible facts and analysis such that the adverse impacts on existing infrastructure and resulting from increased traffic can be fully understood and result in appropriate government planning and response.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, ____October 8____________, 2020.

Signature: [signature]
Printed name: PERI STEFFENHAGEN

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Peri Steffenhagen
Via email: pesteffe@gmail.com

RE: Comments on Traffic Concerns in the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Steffenhagen:

Thank you for the comment letter dated October 9, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment including the Traffic Impact Analysis Report (TIAR) (Appendix 2 of the DEA). I am specifically concerned about adverse traffic impacts both within and without the Kona Vistas subdivision that are not fully or accurately addressed in the TIAR.

> **Response 1:** Specific comments for traffic impacts are discussed below.

Comment 2: In the Kona Vistas subdivision, the proposed project relies on the use of a substandard roadway, Kekuanaoa Place. Kekuanaoa Place is very steep, has limited sight distances due to extreme curves and is narrow with no sidewalks. The impact of increased traffic arising from Phase 1 and Phase 2 buildouts of the proposed project is inadequately addressed in the TIAR, which focuses instead on impacts along Queen Kaahumanu Highway. I am particularly concerned that adding numerous vehicle trips to and from a separate subdivision will present dangers and congestion to residents along Kekuanaoa Place. I consider that the Planning Department should require the applicant to address these concerns.

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an intersection may warrant a signal, and that further study may be needed. It should also be noted that many of these intersections currently warrant a signal without the proposed project. The proposed project is not necessarily triggering the satisfaction of a traffic signal warrant.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawaiʻi Planning Department

Mori, Ashley

From: Peri Steffenhagen <pesteffe@gmail.com>
Sent: Friday, October 09, 2020 8:36 AM
To: Planning Internet Mail
Subject: Fwd: Signed Document Regarding Royal Vistas
Attachments: Royal Vistas Document 1.pdf

I mistakenly sent my declaration only to the person supporting our responses from Pualani Estates. Please accept my apologies and my declaration submission this morning. Thank you!

Peri Steffenhagen | Wisdom Course Leader | Landmark | mobile 408-859-3248

---------- Forwarded message ---------
From: **Peri Steffenhagen** <pesteffe@gmail.com>
Date: Thu, Oct 8, 2020 at 4:56 PM
Subject: Signed Document Regarding Royal Vistas
To: D. Blancett-maddoc <dbmkona@aol.com>

Sending this one separately as I may not get the other one to you by 5 PM.
Peri Steffenhagen | Wisdom Course Leader | Landmark | mobile 408-859-3248

DECLARATION OF _PERI STEFFENHAGEN, PUALANI ESTATES HOMEOWNER__

I, _PERI STEFFENHAGEN____________________, declare:

1. I am a resident of _Kailua-Kona_, County of Hawai'i, State of Hawai'i. The proposed land development project that is the subject of the pending Draft Environmental Assessment submitted by Royal Vistas Housing Project Tax Map Key Nos. (3) 7-6-021:016, 7-6-021:017, 7-6-021:018, and 7-6-021:019 North Kona District, Hawai'i Island, State of Hawai'i affects me personally as well as affects my interest in real property. I reside within _100 yards_______________ [distance] of the proposed land development project. In such capacities, I have firsthand knowledge of the following facts and could and would testify thereto if called upon to do so.

2. I have reviewed the pending DRAFT ENVIRONMENTAL ASSESSMENT and attachments. I am specifically concerned about: cultural artifacts and native fauna habitat, specifically the pueo (owls) and bats that I see nearly nightly from my lanai.

3. I do not consider that the archaeological studies offered in support of the Draft Environmental Assessment are adequate. See pp. _________ thereof.

4. I am aware that substantial evidence exists that the land encompassed by the subject land parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the Draft Environmental Assessment. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

5. I base my concerns upon the evaluation and analysis performed by Tom Pohaku Stone, a copy of which is attached.

6. In sum, the Draft Environmental Assessment does not discuss sufficient facts and analysis such that the important Hawai'ian cultural, archaeological, and native fauna features can be understood, let alone properly preserved.

7. At a minimum, the Draft Environmental Assessment must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

I declare under penalty of perjury that the foregoing is true.

Dated: Kailua-Kona, Hawai'i, October 8, 2020.

Signature: Peri Steffenhagen

Printed name: Peri Steffenhagen

Stantec Consulting Services Inc.
P.O. Box 191
Hilo, HI 96721
Tel: (808) 494-2039

September 13, 2021

Ms. Peri Steffenhagen
Via email: pesteffe@gmail.com

RE: Comments on the Draft Environmental Assessment and Anticipated FONSI for Royal Vistas Housing Project, North Kona District, Hawai'i Island

Dear Ms. Steffenhagen:

Thank you for the comment letter dated October 9, 2020, on the Draft Environmental Assessment (DEA) for the proposed project. Please find responses below to your substantive comments.

Comment 1: I have reviewed the pending Draft Environmental Assessment and attachments. I am specifically concerned about cultural artifacts and native fauna habitat, specifically the pueo (owls) and bats that I see nearly nightly from my lanai.

> **Response 1:** The EA discusses cultural resources including how impacts to cultural resources would be minimized in Sections 3.5 and 3.6. The presence and potential habitat for biological species are included in the existing conditions part of Section 3.3.4, and potential impacts to habitat for native species including protection measures to minimize these impacts are discussed in the impacts part of Section 3.3.4. Any owls observed at night are not pueo, but are non-native barn owls which prey on native species including Newell's shearwaters, Hawaiian stilts, Bulwer's petrels, brown noddies, Hawaiian ducks, and nēnē goslings.

Comment 2: I do not consider that the archaeological studies in support of the DEA are adequate. I am aware that substantial evidence exists that the land encompassed by the subject parcels includes features of the Holualoa Slide, including rock walls that are inadequately described as agricultural walls in the archaeological studies offered in support of the DEA. The Holualoa Slide is an important Hawaiian cultural and archaeological feature from pre-Western contact times that cannot be replaced if damaged or destroyed.

> **Response 2:** As described in Section 3.6 and included in Appendix 5 of the EA, two Archaeological Inventory Surveys (AISs) were prepared for the project. As part of the AIS, sites in the project area were documented and evaluated for their significance. The AISs were conducted following Hawaii Administrative Rules §13-276 and were evaluated according to the process required by 13-284-6. All 40 sites were considered significant under criterion d because of the information that was learned during the study. Documentation of these sites as part of the

AISs ensures that their information is not lost. The documentation done was adequate to mitigate the project's effects to the sites.

Regarding the rock walls within the project site, there is a historic era road (Site 24211) documented. This road is not very straight, has obtuse angle turns, the ground surface is not smooth, as would be expected if the site were the remains of a hōlua. Also, the walls were 1.0 meter in height and is similar in constructed to similar historic era rock walls constructed along historic-era roads, property boundaries, gardens, and cattle pastures. The only other parallel walls within the project site are Site 31182, Features 2 and 3, walls located in the northern and northeastern portions of the project site. These two walls are located along the boundary of a Land Commission Award (LCA) #3660. Additionally, the western end of Feature 3 ends in a gulch and there is a gap in the Feature 2 wall at the same gulch. It is unlikely that this is a hōlua course since the parallel walls empty into a large gulch. Therefore, there is no evidence of a hōlua in the project site.

Comment 3: I base my concerns upon the evaluation performed by Tom Pohaku Stone, a copy of which is attached. The DEA does not discuss sufficient facts and analysis such that the important Hawaiian cultural and archaeological features can be understood let alone properly preserved. The DEA must be revised to address the location, data recovery and preservation of the Holualoa Slide components present on the subject parcels.

Response 3: In the email provided, there is reference to "the portion of the holua at the Holua inn [that] has rock walls on both sides" and refers to parallel walls within the proposed development area, possibly Site 31182 Feature 2 and Feature 3 walls which are LCA #3660 boundary walls.

Primarily, Mr. Stone's email responses provide accurate information concerning the cultural importance of the royal and religious complexes along the coast and within the near-coastal region between Kailua to the north and Keauhou to the south. The remains of many of these complexes were first mapped by Henry Kekahuna. Mr. Stone correctly states the religious and social importance of heʻehōlua and its connection to the sacred and sociopolitical structures along the coast and in the near coastal region. However, the complexes are located more than 1.0 km west of the project area and there are no remains of royal, sacred or sociopolitical complexes, or a hōlua, within the project area. The existence of a hōlua within the project area is not asserted by Mr. Stone. As discussed above, there is no documented oral history, archival documentation, or archaeological evidence to suggest a hōlua course existed within the project area.

We sincerely appreciate your review of the document. If you have any additional comments or questions about the EA, please contact me at (808) 494-2039 or by email.

Sincerely,

Stantec Consulting Services Inc.

Michele Lefebvre, Ph.D.
michele.lefebvre@stantec.com

cc: Richard Wheelock, Kona Three LLC
Maija Jackson, County of Hawai'i Planning Department

APPENDIX 2: Traffic Impact Assessment Report

FINAL

Royal Vistas

Tax Map Key (3) 7-6-021: 016, 17

Traffic Impact Analysis Report

Kona, Island of Hawaii

May 2020

Prepared for
Kona Three LLC.

Prepared by
SSFM International

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List of Appendices

I. PROJECT DESCRIPTION

Kona Three LLC is planning to develop a Multi-family residential subdivision named Royal Vistas in Kona, on the Island of Hawaii. The property is located on the mauka side of the Queen Kaahumanu Highway at TMK (3) 7-6-021:016, 17 between Kona Vista Subdivision and Pualani Estates Subdivision. Only one roadway is planned to provide access for Phase I of the property. This roadway intersects with Queen Kaahumanu Highway, approximately 600 feet north of the intersection with Kuakini Highway. For this traffic impact analysis report (TIAR), this access is referred to as “Royal Vistas Roadway”. The project location, along with the study intersections associated with this TIAR, are shown in Figure 1.

The proposed site is 70-acres and zoned “RM-5”. Even though the new development’s total buildout is estimated as 450 units, only 258 units are planned as Phase 1. Phase 1 is expected to be completed by 2024. Phase 2 will include the full buildout of the remaining 192 units. Phase 2 is expected to be completed by 2029. The Royal Vistas proposed conceptual site plan is shown in Figure 2. The intent of this TIAR is to evaluate existing conditions and assess impacts in the surrounding areas as a result of the proposed development. 5-year (Phase 1 completion) in 2024, 10-year (Phase 2 completion) in 2029, and 20-year future scenarios in 2039 will be analyzed. Future years will be evaluated with and without the Royal Vistas project.

Figure 1: Project Location Map

Figure 2: Conceptual Site Plan

II. EXISTING CONDITIONS

A. Geometric Configuration

1. Roadway Configuration

a) Queen Kaahumanu Highway

Where it intersects with Royal Vistas Roadway, Queen Kaahumanu Highway (Route 19) is undivided, two-lane, State-owned arterial, oriented in the north-south direction. Queen Kaahumanu Highway extends from Kawaihae Road (Route 19) in the north to the intersection with Palani Road (Route 130) where it turns into State Route 11. The posted speed limit varies from 45-55 mph. At the future Royal Vistas Roadway, the posted speed limit is 45 MPH. Queen Kaahumanu Highway opens to 4-5 lanes with dedicated left turning and right turning lanes at major intersections northwest of Henry Street.

2. Study Intersections

The study intersections include the following:

1. Queen Kaahumanu Highway and Palani Road
    a. Queen Kaahumanu Highway is predominantly oriented in an east-west direction and Palani Road is predominantly oriented in a north-south direction.
    b. Four-leg signalized intersection with dedicated left turning lanes and channelized right turn lanes for all approaches. The Queen Kaahumanu Highway approaches and the northbound Palani Road approach have double left turn lanes.
    c. All left turns are protected (have green arrow phases).
    d. The north leg of the intersection extends and connects with Mamalahoa Highway, another state-owned facility.
2. Queen Kaahumanu Highway and Henry Street
    a. Queen Kaahumanu Highway is oriented in an east-west direction and Henry Street is oriented in a north-south direction.
    b. Four-leg signalized intersection with dedicated left turning lanes and channelized right turn lanes for all approaches. The Queen Kaahumanu Highway approaches have double left turn lanes.
    c. Left tuns from Queen Kaahumanu Highway onto Henry Street are protected. The Henry Street phases are split (sequential rather than concurrent).
    d. The north leg of the intersection extends and connects with Ane Keohokalole Highway, another state-owned facility.
3. Queen Kaahumanu Highway and Hualalai Road (North)
    a. Queen Kaahumanu Highway is oriented in a north-south direction and Hualalai Road is oriented in an east-west direction.
    b. Three-leg, STOP sign controlled intersection with dedicated left turning lanes for the northbound and eastbound approaches.
    c. Channelized right turn lanes exist for the eastbound and southbound approaches.
    d. A refuge lane is provided for the eastbound left turns onto Queen Kaahumanu Highway.

4. Queen Kaahumanu Highway and Hualalai Road (South)
    a. Queen Kaahumanu Highway is oriented in a north-south direction and Hualalai Road is oriented in an east-west direction.
    b. Three-leg, STOP sign controlled intersection with dedicated left turning lanes for the southbound and westbound approaches.
    c. Channelized right turn lanes exist for the northbound and westbound approaches.
    d. A refuge lane is provided for the westbound left turns onto Queen Kaahumanu Highway.
5. Queen Kaahumanu Highway and Puapuaanui Street
    a. Queen Kaahumanu Highway is oriented in a north-south direction and Puapuaanui Street is oriented in an east-west direction.
    b. Three-leg, signalized intersection with dedicated left turning lanes for the southbound and westbound approaches.
    c. The southbound left turn is protected.
    d. Channelized right turn lanes provided for the northbound and westbound approaches.
6. Queen Kaahumanu Highway and Kuakini Highway
    a. Queen Kaahumanu Highway is oriented in a north-south direction and Kuakini Highway is oriented in an east-west direction.
    b. Three-leg, STOP sign controlled intersection with dedicated left turning lanes for northbound and eastbound.
    c. Channelized right turn lanes exist for the eastbound and southbound approaches.
    d. A refuge lane is provided for the eastbound left turns onto Queen Kaahumanu Highway.
    e. Kuakini Highway is a state-owned facility.
7. Queen Kaahumanu Highway and Lako Street
    a. Queen Kaahumanu Highway is oriented in a north-south direction and Lako Street is oriented in an east-west direction.
    b. Four-leg, signalized intersection with dedicated left turning lanes for each approach.
    c. Left turns from Queen Kaahumanu Highway onto Lako Street are protected-permitted. This is the only intersection in the project area on Queen Kaahumanu Highway that uses protected-permitted phasing. The Lako Street phases are split.
    d. Channelized right turn lanes exist for each approach.
8. Queen Kaahumanu Highway and Kamehameha III Road
    a. Queen Kaahumanu Highway is oriented in a north-south direction and Kamehameha III Road is oriented in an east-west direction.
    b. Four-leg, signalized intersection with dedicated left turn lanes exist on northbound, and southbound approaches.
    c. Left turns from Queen Kaahumanu Highway are protected. The Kamehameha III Road phases are split.
    d. Channelized right turn lane exists for southbound and eastbound approach.

Existing (2019) lane configurations and traffic controls at the study intersections are shown in Figure 3.

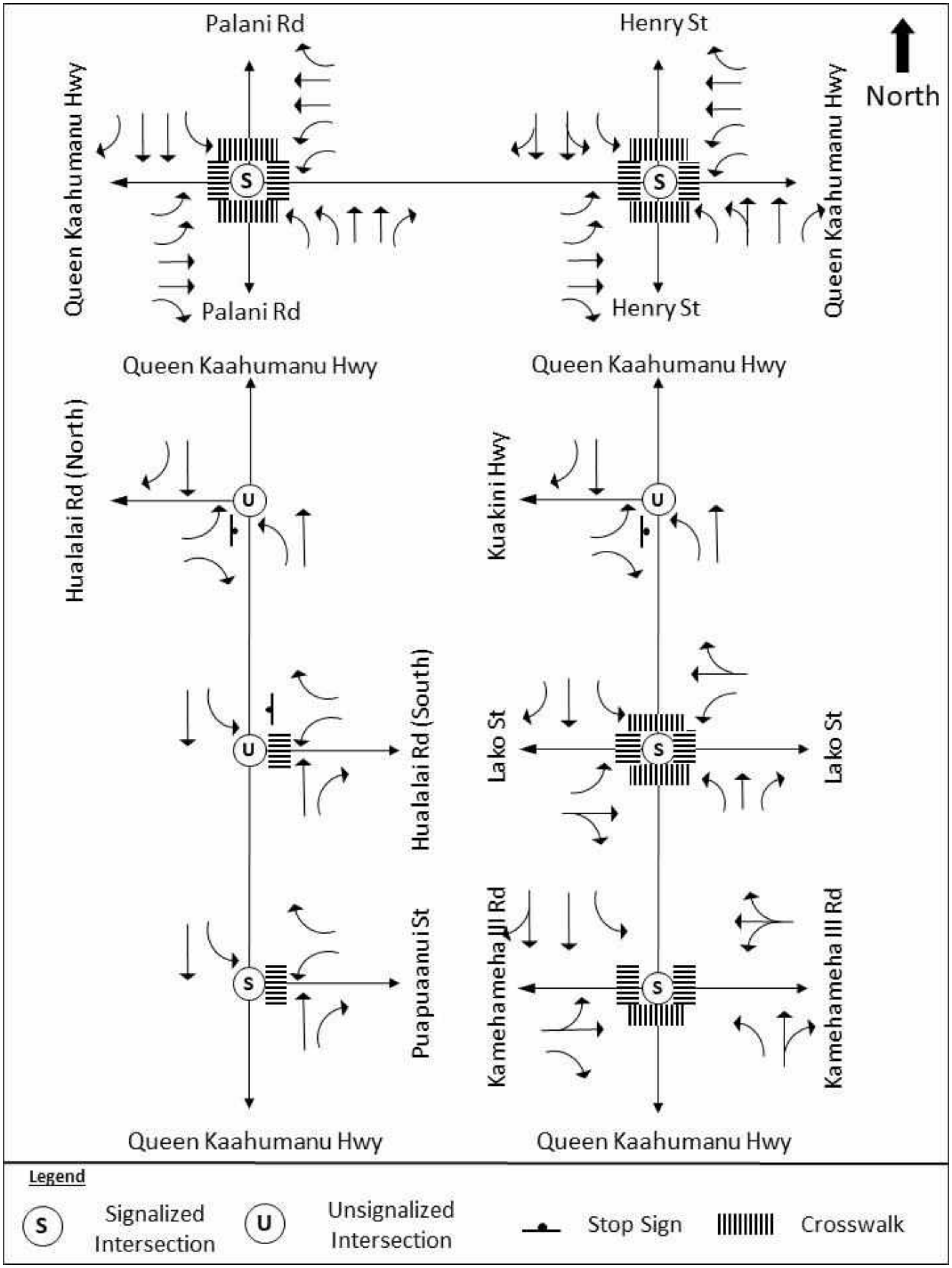

Figure 3: Existing 2019 Lane Configuration

3. Pedestrian Facilities

Sidewalks are provided on each corner of Palani Road and Henry Street. A sidewalk is provided on the south side of Queen Kaahumanu Highway between Palani Road and Henry Street. Sidewalks are provided on both sides of Puapuaanui Street and stop just before the intersection with Queen Kaahumanu Highway. The crosswalks provided at each intersection are shown in Figure 3.

4. Bike Facilities

Marked bike lanes are provided on Queen Kaahumanu Highway at Henry Street and extend north. There are no marked bike lanes south of this intersection. There are bike lanes on Lako Street east of Queen Kaahumanu Highway to Hualalai Road. Based on the State Route System, marked shoulders along Queen Kaahumanu Highway in the study area range from 6 feet to 10 feet.

5. Bus Stops and Bus Routes

The County of Hawaii’s transit system (Hele-on Bus) doesn’t have bus routes that travel along Queen Kaahumanu Highway near the study area. The closest bus stops to the proposed facility are located at Kona Commons Shopping Center, more than 3 miles away. The Intra Kona bus route serves this stop and operates between 6:55 AM to 8:30 PM, Monday to Saturday. Appendix B includes the detailed bus route schedule and map for this route.

B. Volumes

1. Vehicular Volume

a) Roadway Traffic Volumes

Historical average daily traffic (ADT) and peak hour volumes along Queen Kaahumanu Highway in the study area are shown in Table 1. The ADT is based on Hawaii DOT traffic counts included in *Historical Traffic Station Maps*.

Table 1: Roadway Traffic Volumes

Roadway	Location	ADT	Year
Queen Kaahumanu Highway	Between Nani Kailua Drive and Hualalai Road.	25,800	2016
		25,900	2015

Source: *Historical Traffic Station Maps* (HDOT)

The 24-hour traffic volume distribution along Queen Kaahumanu Highway (see Figure 4) at the traffic count station shows a variation in travel patterns throughout the day with prominent morning and afternoon commuter peak periods. Detailed 24-hour counts are included in Appendix A.

Along Queen Kaahumanu Highway, during the morning peak hour of 7:00 - 8:00 AM, there were approximately 1,083 vehicles per hour (vph) travelling northbound and 765 vph travelling southbound for a total of 1,848 vph. During the afternoon peak hour of 3:45 – 4:45 PM, there were approximately 914 vph travelling northbound and 1,017 travelling southbound for a total of 1,931 vph.

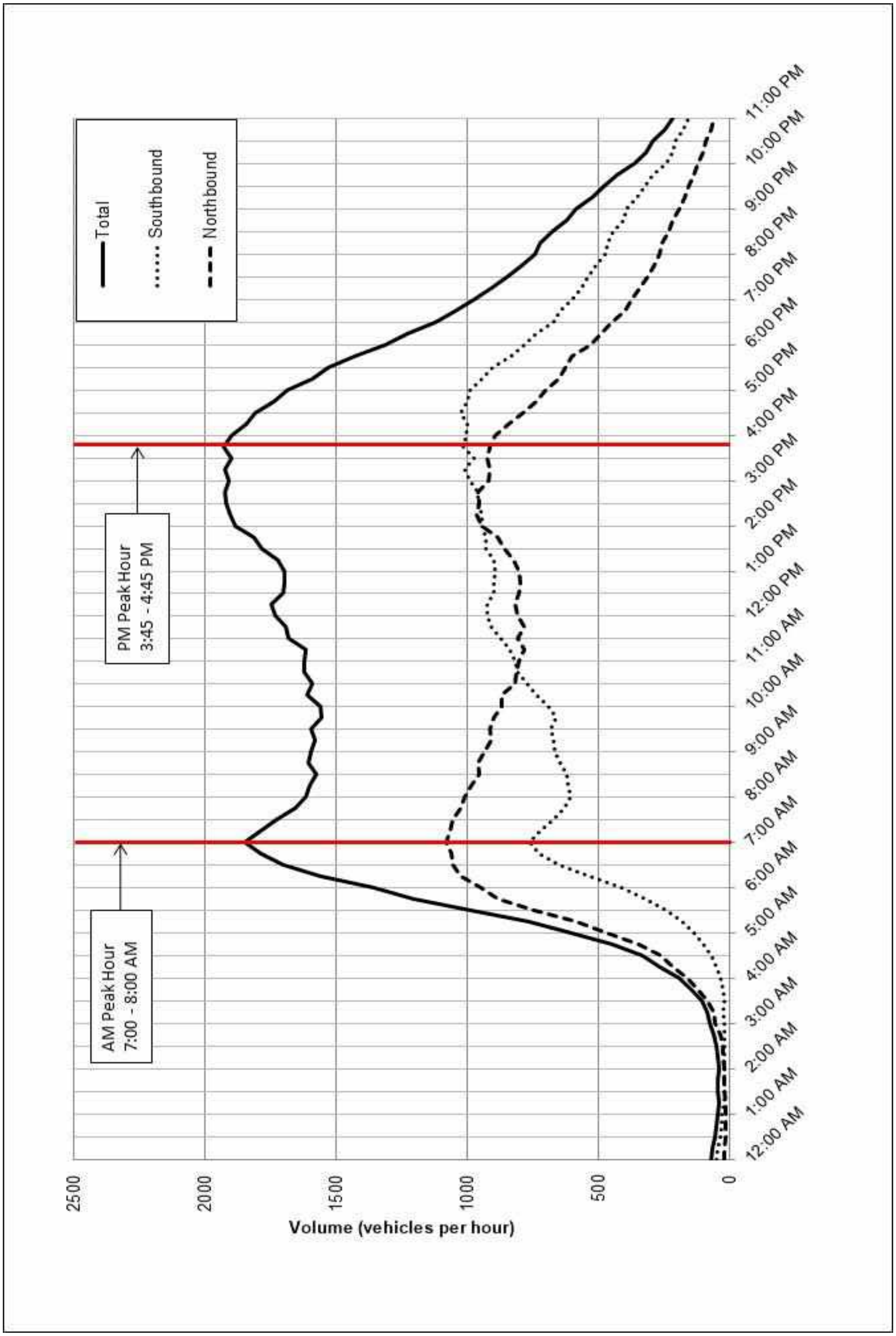

Figure 4: Queen Kaahumanu Hwy (Nani Kailua Dr to Hualalai Rd), 24-Hour Volume Distribution (2016)

b) Existing 2019 Intersection Peak Hour Volumes

Manual intersection turning movement traffic counts were taken at the eight study intersections: 1) Queen Kaahumanu Highway and Palani Road, 2) Queen Kaahumanu Highway and Henry Street, 3) Queen Kaahumanu Highway and Hualalai Road (north), 4) Queen Kaahumanu Highway and Hualalai Road (south), 5) Queen Kaahumanu Highway and Puapuaanui Street, 6) Queen Kaahumanu Highway and Kuakini Highway, 7) Queen Kaahumanu Highway and Lako Street, and 8) Queen Kaahumanu Highway and Kamehameha III Road. Counts were collected during the peak periods on Tuesday, April 30, 2019 and Thursday, August 24, 2019. Counts included tabulation of passenger vehicles, heavy trucks, pedestrians, and bicycles. The Existing (2019) peak hour volumes are shown in Figure 5. Detailed peak period counts are included in Appendix A. Pedestrian and Bicycle Volumes

2. Pedestrian and Bicycle Volumes

Queen Kaahumanu Highway is a frequently used training route for Ironman and therefore has regular bicycle activity. Table 2 shows the 2019 pedestrian and bicycle volumes. Most of the observed pedestrian activity occurred at Henry Street. Bicycle counts were higher in the AM peak hour than the PM peak hour.

Table 2: 2019 Pedestrian and Bicycle Volumes

Study Intersection	AM		PM	
	Ped	Bike	Ped	Bike
Queen Kaahumanu Hwy & Palani Rd	1	3	4	3
Queen Kaahumanu Hwy & Henry St	9	4	12	4
Queen Kaahumanu Hwy & Hualalai Rd (N)	0	3	0	1
Queen Kaahumanu Hwy & Hualalai Rd (S)	0	4	0	0
Queen Kaahumanu Hwy & Puapuaanui St	0	2	1	0
Queen Kaahumanu Hwy & Kuakini Hwy	0	2	0	0
Queen Kaahumanu Hwy & Lako St	1	2	1	0
Queen Kaahumanu Hwy & Kamehameha III Rd	1	10	0	2

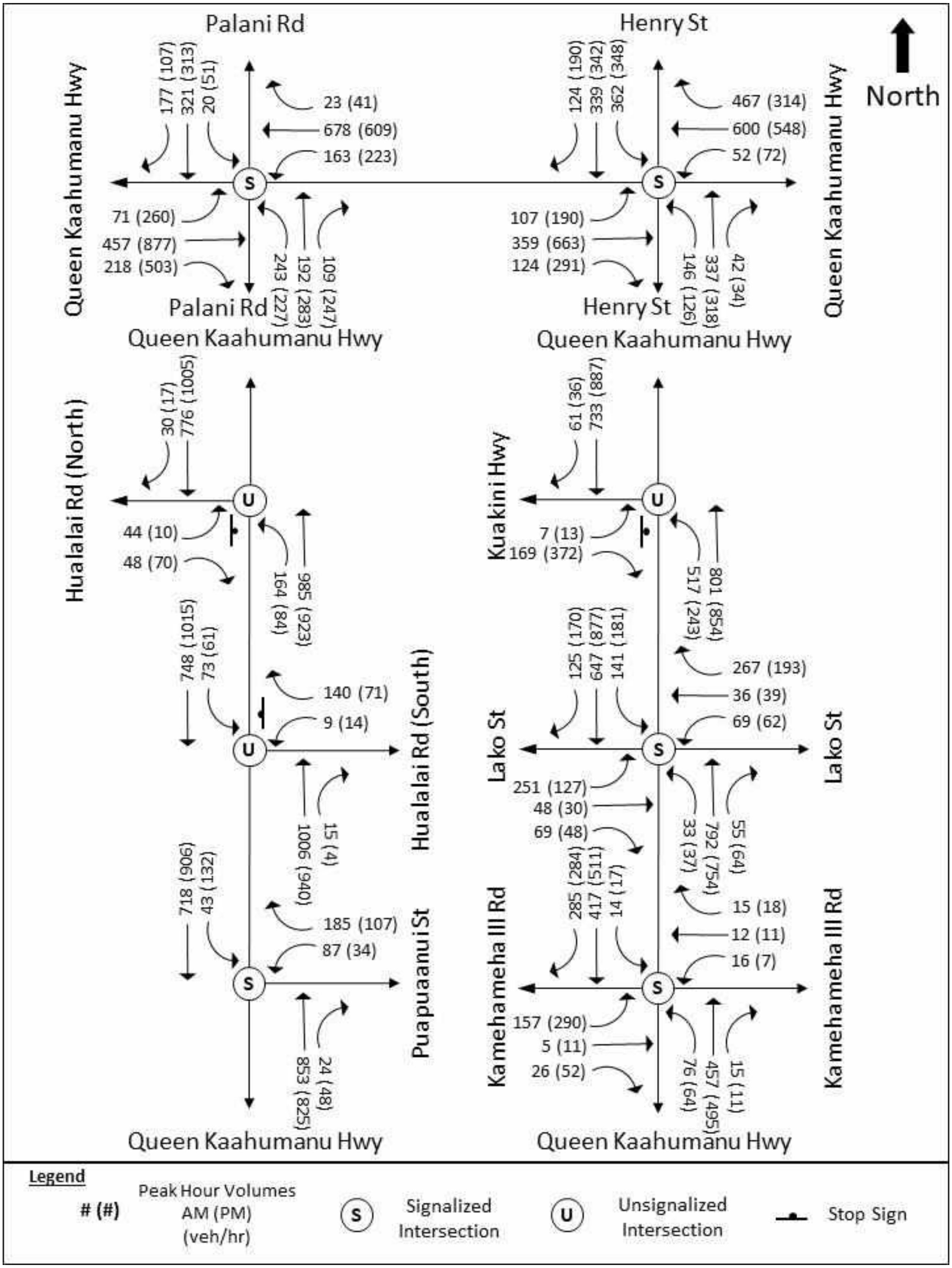

Figure 5: Existing 2019 Peak Hour Volumes

C. Traffic Operation Analysis

1. Level of Service Methodology

Level of service (LOS) is an operational analysis rating system used in traffic engineering to measure the effectiveness of roadway operating conditions. There are six LOS ranging from A to F. LOS A is defined as being the least interrupted flow conditions with little or no delays, whereas LOS F is defined as conditions where extreme delays exist. Guidelines from the *County of Hawaii* Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) state that an"Acceptable level of service" means that the level of service of a transportation facility at the a.m. and p.m. peak hour is "D" or better. Level of service, or LOS, means a qualitative measure describing operational conditions within a traffic stream and shall be determined using the procedures in the latest edition of the Highway Capacity Manual, Transportation Research Board. Intersection LOS and delay were determined for the AM and PM peak hours using *Synchro 10* traffic analysis software and analyzed using *HCM* 6th Edition (TRB, 2016) methodologies.

As stated in the *Highway Capacity Manual* (*HCM*) 6th Edition (TRB, 2016), LOS for a two-way stop controlled (TWSC) intersection is determined by the measured control delay (see Table 3) and is defined for each movement. Vehicles traveling along the major, free-flow road, of a TWSC intersection, proceed through with minimal delay or no delay at all. Those vehicles approaching the intersection along the minor movement are controlled by a stop sign and thus experience delay attributable to the volume of vehicles passing along the free-flow road and the gaps available.

Table 3: LOS Criteria for Unsignalized Intersections

Average Control Delay (s/veh)	LOS by v/c Ratio	
	<=1.0	>1.0
≤ 10.0	A	F
>10 and ≤15	B	F
>15 and ≤25	C	F
>25 and ≤35	D	F
>35 and ≤50	E	F
>50	F	F

Source: *HCM* (TRB, 2016)

The LOS analysis for signalized intersections is based on average total vehicle delay based on the methodologies of the *HCM* (TRB, 2016), as shown in Table 4. The HCM 6th Edition doesn't support the analysis with both exclusive and shared lanes. In those cases, methodologies from HCM (TRB, 2000) are used.

Another measure of intersection delay is the volume to capacity (v/c) ratio. This is the ratio of the volume of traffic utilizing the intersection compared to the maximum volume of vehicles that can be accommodated by the intersection during a specific period. A v/c ratio under 0.85 means the intersection is operating under capacity and excessive delays are not experienced. An intersection is operating near its capacity when v/c ratios range from 0.85 to 0.95. Unstable flows are expected when the v/c ratio is between 0.95 and 1.0. A traffic movement can have a poor LOS but low v/c, which suggests that the traffic volumes along that movement are low but must wait a long time to make the movement. This is common for low volume protected turn movements or side streets that must wait through a long cycle length for their split to come up.

Table 4: LOS Criteria for Signalized Intersections

Average Control Delay (s/veh)	LOS by v/c Ratio	LOS by v/c Ratio
	<=1.0	**>=1.0**
≤ 10.0	A	F
>10 and ≤20	B	F
>20 and ≤35	C	F
>35 and ≤55	D	F
>55 and ≤80	E	F
>80	F	F

Source: *HCM* (TRB, 2016)

Where signalized intersections are less than 2.0 miles apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities (HCM, Chapter 16). For Urban Street Facilities, through vehicle travel speed is used to analyze vehicular LOS. This speed reflects the factors that influence running time along each link, and the delay incurred by through vehicles at each boundary intersection. This performance measure indicates the degree of mobility provided by the facility.

2. Existing 2019 Intersection LOS

Existing intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours.

1. Queen Kaahumanu Highway and Palani Road. Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.
2. Queen Kaahumanu Highway and Henry Street Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.
3. Queen Kaahumanu Highway and Hualalai Road (North)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 1.31 and 0.23 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

4. Queen Kaahumanu Highway and Hualalai Road (South)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.18 and 0.31 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
5. Queen Kaahumanu Highway and Puapuaanui Street Overall Intersection LOS = A/A (AM/PM)
   The AM left turns operate at LOS E. The westbound left turn operates at LOS E during the PM peak hour. The left turn volumes are low and should clear every cycle. These delays are due to the cycle length.
6. Queen Kaahumanu Highway and Kuakini Highway
   At the unsignalized intersection of Queen Kaahumanu Highway with Kuakini Highway, eastbound left turning movement has LOS F (v/c of 1.08 and 0.46 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
7. Queen Kaahumanu Highway and Lako Street. Overall Intersection LOS = C/C (AM/PM)
   At the signalized intersection of Queen Kaahumanu Highway with Lako Street, the eastbound left turn operates at LOS E during the AM peak hour. This delay is attributed to the high eastbound left turn volume, and the split phasing for the Lako Street approaches. All other movements at Lako Street operates at LOS D or better during both peak hours.
8. Queen Kaahumanu Highway and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

Tables 5 and 6 show the existing vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Synchro output is in Appendix C.

3. Existing 2019 Traffic Signal Warrant

Four-Hour and Peak-Hour traffic signal warrants were evaluated at the unsignalized intersections. The 2009 MUTCD states: “At an intersection with high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the ‘minor-street’ volume and the corresponding single direction of opposing traffic on the major street as the ‘major-street” volume’ For analysis purposes, the Queen Kaahumanu Highway left turn was considered the minor street approach, and the opposing through volume was considered the major street approach. The satisfaction of a warrant does not necessarily require installing a traffic signal. The single Peak Hour warrant especially is not a good measure of whether or not a traffic signal should be installed in this setting. It is being evaluated and provided only as an indicator of when an intersection should be monitored. Traffic Signal Warrant analysis can be found in Appendix J.

For the Four-Hour warrant, Figure 4C-2 (MUTCD) was used since the posted speed limit on Queen Kaahumanu Highway is over 40 MPH. The “1 Lane & 1 Lane” curve was used for analysis. Table 7 shows the Four-Hour warrant analysis.

For the Peak-Hour warrant, Figure 4C-4 (MUTCD) was used since the posted speed limit on Queen Kaahumanu Highway is over 40 MPH. The "1 Lane & 1 Lane" curve was used for analysis. Table 8 shows the Peak-Hour warrant analysis.

1. Queen Kaahumanu Highway and Hualalai Road (North)
   This intersection passes the Four-Hour warrant and the Peak-Hour warrant in the AM peak hour.
2. Queen Kaahumanu Highway and Hualalai Road (South)
   This intersection does not pass either warrant.
3. Queen Kaahumanu Highway and Kuakini Highway
   This intersection passes the Four-Hour warrant and the Peak-Hour warrant in both the AM and PM peak hours.

Table 5: Existing 2019 Intersection Level of Service

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Palani Rd (overall)	**23.7**	**-**	**C**	**26.1**	**-**	**C**
Queen Kaahumanu EB Left	38.6	0.45	D	38.0	0.74	D
Queen Kaahumanu EB Through	14.1	0.30	B	17.9	0.57	B
Queen Kaahumanu WB Left	38.9	0.67	D	38.8	0.72	D
Queen Kaahumanu WB Through	14.2	0.42	B	16.4	0.41	B
Palani NB Left	37.4	0.72	D	39.1	0.73	D
Palani NB Through	25.8	0.25	C	28.8	0.42	C
Palani SB Left	47.7	0.50	D	48.3	0.68	D
Palani SB Through	33.7	0.66	C	33.6	0.62	C
Queen Kaahumanu Hwy & Henry St (overall)	**31.8**	**0.62**	**C**	**32.6**	**0.65**	**C**
Queen Kaahumanu EB Left	43.6	0.50	D	46.7	0.65	D
Queen Kaahumanu EB Through	24.6	0.34	C	27.8	0.57	C
Queen Kaahumanu EB Right	22.0	0.08	C	23.1	0.19	C
Queen Kaahumanu WB Left	45.0	0.37	D	48.4	0.52	D
Queen Kaahumanu WB Through	30.5	0.60	C	31.0	0.56	C
Queen Kaahumanu WB Right	26.9	0.31	C	26.7	0.21	C
Henry NB Left	34.9	0.46	C	35.9	0.41	D
Henry NB Left-Through	35.8	0.58	D	37.1	0.56	D
Henry NB Right	31.0	0.03	C	32.5	0.02	C
Henry SB Left	38.3	0.72	D	39.3	0.73	D
Henry SB Left-Through-Right	34.6	0.69	C	34.2	0.67	C
Queen Kaahumanu Hwy & Hualalai (N) (overall)	**10.3**	**-**	**-**	**1.0**	**-**	**-**
Queen Kaahumanu NB Left	10.8	0.22	B	11.2	0.13	B
Hualalai EB Left	429.0	1.31	F	107.3	0.23	F

Table 6: Existing 2019 Intersection Level of Service (continued)

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Hualalai (S) (overall)	**3.3**	-	-	**1.7**	-	-
Queen Kaahumanu SB Left	11.5	0.13	B	10.8	0.09	B
Hualalai WB Left	87.5	0.18	F	112.5	0.31	F
Hualalai WB Right	35.8	0.58	E	20.4	0.24	C
Queen Kaahumanu Hwy & Puapuaanui St (overall)	**9.7**	-	**A**	**9.8**	-	**A**
Queen Kaahumanu SB Left	60.4	0.71	E	53.1	0.81	D
Queen Kaahumanu WB Through	3.3	0.50	A	3.0	0.57	A
Puapuaanui WB Left	55.4	0.78	E	56.0	0.62	E
Puapuaanui WB Right	7.9	0.64	A	8.5	0.63	A
Queen Kaahumanu Hwy & Kuakini Hwy (overall)	**7.7**	-	-	**2.8**	-	-
Queen Kaahumanu NB Left	17.6	0.67	C	12.1	0.33	B
Kuakini EB Left	1035.4	1.08	F	208.2	0.46	F
Queen Kaahumanu Hwy & Lako St (overall)	**30.6**	-	**C**	**21.8**	-	**C**
Queen Kaahumanu NB Left	12.8	0.10	B	12.8	0.14	B
Queen Kaahumanu NB Through	30.4	0.87	C	18.8	0.75	B
Queen Kaahumanu SB Left	21.9	0.58	C	13.5	0.51	B
Queen Kaahumanu SB Through	19.2	0.68	B	20.1	0.82	C
Lako EB Left	60.2	0.88	E	44.3	0.76	D
Lako EB Through-Right	34.1	0.16	C	35.7	0.17	D
Lako WB Left	50.5	0.66	D	45.9	0.64	D
Lako WB Through-Right	44.5	0.33	D	41.2	0.39	D
Queen Kaahumanu Hwy & Kam III Rd (overall)	**17.7**	-	**B**	**22.0**	-	**C**
Queen Kaahumanu NB Left	43.5	0.79	D	47.2	0.75	D
Queen Kaahumanu NB Through	12.4	0.55	B	17.4	0.60	B
Queen Kaahumanu SB Left	42.2	0.46	D	45.7	0.48	D
Queen Kaahumanu SB Through	10.3	0.27	B	14.0	0.34	B
Kamehameha EB Left-Through	32.0	0.73	C	34.1	0.84	C
Kamehameha WB Left-Through-Right	41.4	0.66	D	44.9	0.61	D

Table 7: Four-Hour Warrant based on 2019 traffic volumes

Existing - Hualalai (N)	4-Hour Warrant		
	Major	Minor	Warrant?
6:45-7:45 AM	776	164	YES
7:45-8:45 AM	692	145	YES
3:00-4:00 PM	1005	84	YES
4:00-5:00 PM	926	74	YES
5:00-6:00 PM	986	58	NO
Existing - Hualalai (S)	4-Hour Warrant		
	Major	Minor	Warrant?
6:45-7:45 AM	1006	70	YES
7:45-8:45 AM	1030	26	NO
3:00-4:00 PM	940	59	NO
4:00-5:00 PM	864	64	NO
5:00-6:00 PM	765	56	NO
Existing - Kuakini	4-Hour Warrant		
	Major	Minor	Warrant?
6:45-7:45 AM	776	335	YES
7:45-8:45 AM	683	467	YES
3:00-4:00 PM	881	224	YES
4:00-5:00 PM	872	264	YES
5:00-6:00 PM	870	217	YES

Table 8: Peak-Hour Warrant based on 2019 traffic volumes[1]

Existing	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	776	164	YES	1005	84	NO
Hualalai (S)	1006	73	NO	940	61	NO
Kuakini	733	517	YES	887	243	YES

[1] Single Peak Hour warrant was evaluated because sufficient data was available and to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.

III. Near-Term (2024) – Completion of Phase 1

A. Surrounding Areas

Phase 1 is expected to be completed by 2024, representing the 5-year future forecast. Phase 1 will contain 258 dwelling units, and the only point of access will be the Royal Vistas Roadway intersecting with Queen Kaahumanu Highway, about 600 feet north of the Kuakini Highway intersection.

The official Transportation Network Map – Nani Kailua Area from the Kona Community Development Plan shows future connections of 'minor collectors' running parallel to Queen Kaahumanu Highway in the location of Royal Vistas, extending Hoomama Street to Leilani Street and Paulehia Street to Kekuanaoa Place, as shown in Figure 6. The timing of these improvements is undetermined, but it is not expected they will be completed prior to 2024. The most likely scenario is that the developers of Royal Vistas will complete a collector to the south before Phase 2 is occupied.

Based on the HDOT *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (July 2014), Kuakini Highway from Henry Street to Kamehameha III Road will be widened by 2 travel lanes and include bicycle facilities and sidewalks.

Bike Plan Hawaii (2003) references several near-term projects. Two of the projects nearby are: a signed shared road on Kuakini Highway from Lako Street to Hualalai Road, and a signed shared road on Queen Kaahumanu Highway from Henry Street to Kuakini Highway.

The 2011 Statewide Pedestrian Master Plan does not include any pedestrian facility upgrades or construction in the project area.

No other significant developments or future construction projects are expected in the surrounding area that would significantly affect the roadway geometrics or traffic volumes at the study intersections. This is based on research completed on October 10, 2019 at the State of Hawaii Office of Environmental Quality Control (OEQC) website and the Statewide Transportation Improvements Program (STIP). The projects referenced in the long-range transportation plan and Bike Plan Hawaii are not found in the STIP. The impacts of these projects were not considered in this TIAR.

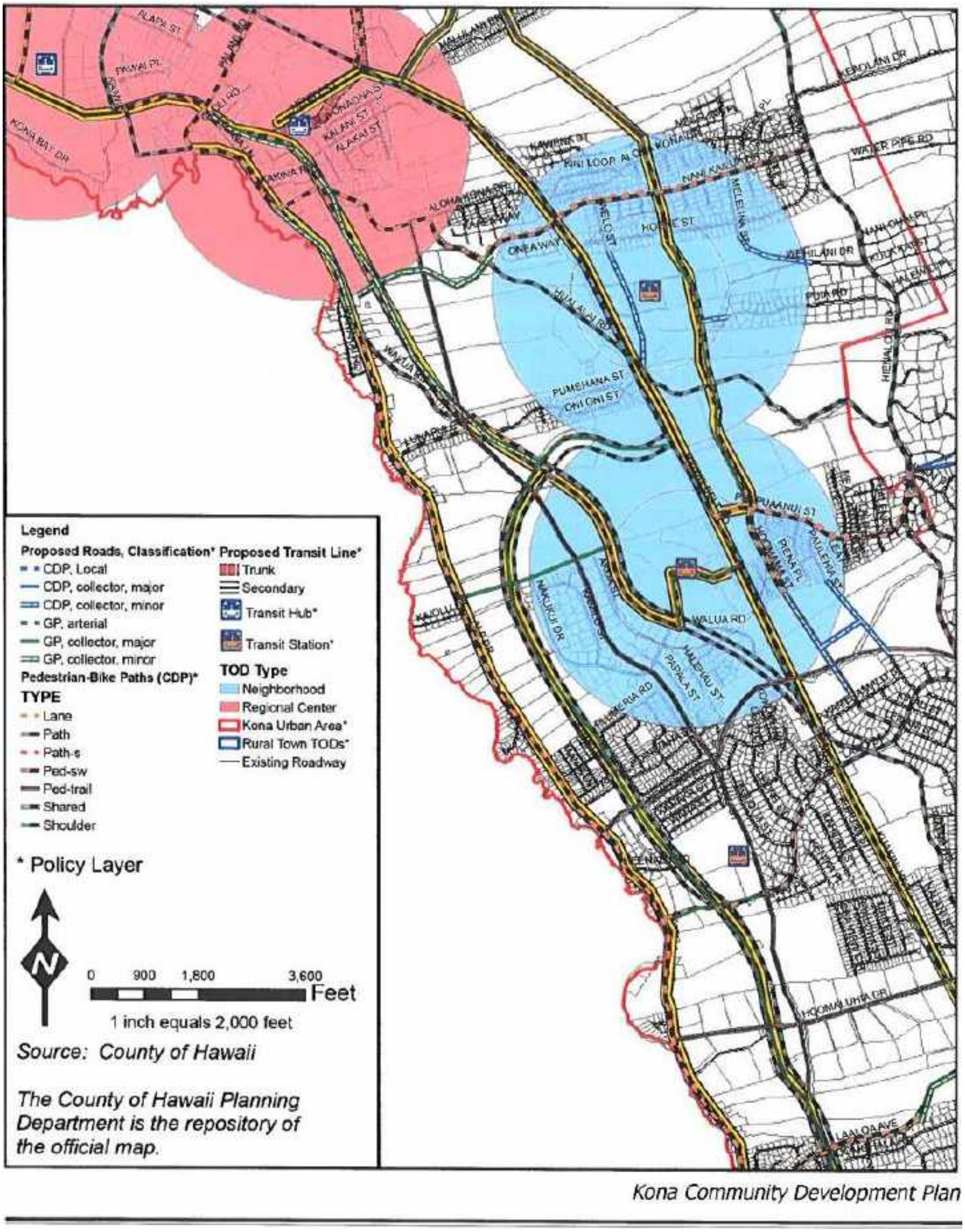

Figure 6: Kona Community Development Plan

B. Volumes

1. Future 2024 Without Project Volumes

The project study area within Kona has been experiencing modest growth. HDOT ADT counts on Queen Kaahumanu Highway between Nani Kailua Drive and Hualalai Road didn't show any increase in vehicular volumes from 2015 to 2016. The 2035 Federal Aid Highways Long Range Transportation Plan forecasts average daily traffic in Kona on Hawaii Belt Road to be 41,900 vehicles in 2020 and 48,000 vehicles in 2035. This equates to a 1% annual growth rate over 15 years in the Kona area. A background growth rate of 1% per year was assumed, to account for additional traffic at the study intersections. The estimated future volumes without the project for the future year 2024 are shown in Figure 7.

2. Project Related Volumes

The proposed Royal Vistas include 258 multi-family residential dwelling units for Phase 1. All of these are expected to be low rise units with two or three stories. Trips generated from the proposed facility were estimated using nationally accepted land use rates from the *Trip Generation*, 10th Edition (ITE, 2016). ITE defines the Multi-family Housing (Low Rise) Land Use [220] as follows: "includes apartments, townhouses and condominiums located within the same building with at least three other dwelling units" The analysis used 258 dwelling units as the independent variable to estimate new trips expected from the proposed project. The estimates for new trips generated by the project are shown in Table 9.

Table 9: Estimated Trips Generated - Phase 1

	AM		PM	
Land Use [ITE Code]	**Equation**		**Equation**	
Multi-family Housing (Low Rise) [220]	Ln (T) = 0.95 Ln (X) – 0.51		Ln (T) = 0.89*Ln (X) - 0.02	
Dwelling Units	258		258	
New Trips	117		137	
	In[2]	**Out**	**In**	**Out**
	23%	77%	63%	37%
	27	90	86	51

T = Total number of trips generated, X = Dwelling Units

3. Trip Distribution

Trips generated by the Royal Vistas Phase 1 will enter and exit at the Royal Vistas Roadway and be distributed onto Queen Kaahumanu Highway. The trips were distributed according to existing travel patterns.

The segment volumes between Puapuaanui Street and Kuakini Street were used to determine the inbound percent distribution.

[2] In and Out split provided by *Trip Generation*, 10th Edition (ITE 2016) for Land Use 220

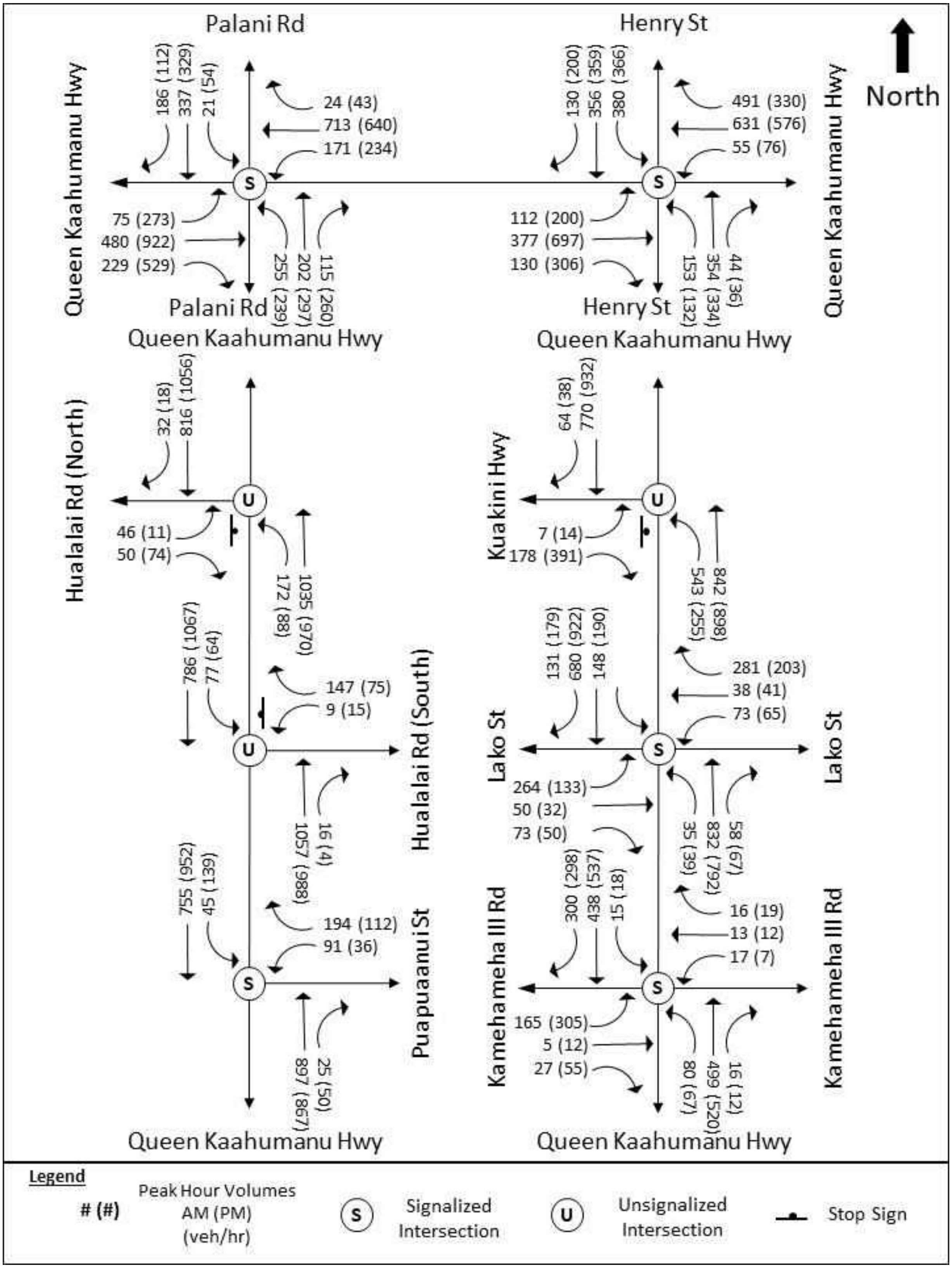

Figure 7: Future 2024 Without Project Peak Hour Volumes

Based on the existing traffic volumes on Queen Kaahumanu Highway between Puapuaanui Street and Lako Street, the AM peak hour direction is northbound, and the PM peak hour direction is southbound. Table 10 shows the directional percentages at Queen Kaahumanu Highway and Puapuaanui Street that were used to determine the inbound trip distribution.

Table 10: 2019 Volumes on Queen Kaahumanu Highway between Puapuaanui St and Kuakini Highway

	AM		PM	
	NB	SB	NB	SB
Volume	877[3]	805	873	940
Percent	52%	48%	48%	52%

The outbound volumes at Puapuaanui Street were used to determine the outbound percent distribution. Royal Vistas will have the same land use as Pualani Estates, which is just north of Royal Vistas and currently uses Puapuaanui Street as the main access to Queen Kaahumanu Highway. Outbound traffic distribution for Pualani Estates at Puapuaanui Street is anticipated to have a similar outbound distribution at Royal Vistas Roadway. Table 11 shows the existing outbound volumes for Pualani Estates at Puapuaanui Street during the AM and PM peak hours. The percentages shown in Table 11 were used for the outbound trip distribution at the Royal Vistas Roadway intersecting Queen Kaahumanu Highway.

Table 11: 2019 Outbound volumes at Puapuaanui Street

	AM		PM	
	WBR	WBL	WBR	WBL
Volume	185	87	107	34
Percent	68%	32%	76%	24%

The future 'with project' scenario analyzed the Royal Vistas Roadway approach to have a left turn and a right turn lane. Turn lanes are provided for the southbound left turn and northbound right turn into Royal Vistas. Right turns are channelized. A peak hour traffic signal warrant and a 4-hour traffic signal warrant were conducted for the new Royal Vistas Roadway. The new roadway intersection did not warrant a signal during the AM or PM peak hour. This intersection was analyzed as a two-way stop-controlled intersection. A crosswalk would be provided on the east side of the intersection for pedestrian connectivity. A refuge lane for westbound left turns onto Queen Kaahumanu Highway is recommended as this is an unsignalized intersection and will make this turn easier for the driver. The expected future lane configuration is shown in Figure 8. Project related trips for 2024 (Phase 1) are shown in Figure 9.

4. Future 2024 With Project Volumes

Phase 1 project related trips were added to the Future 2024 Without Project volumes to estimate Future 2024 With Project peak hour volumes (see Figure 10).

[3] Hourly Volumes taken from 2019 intersection counts at Puapuaanui Street.

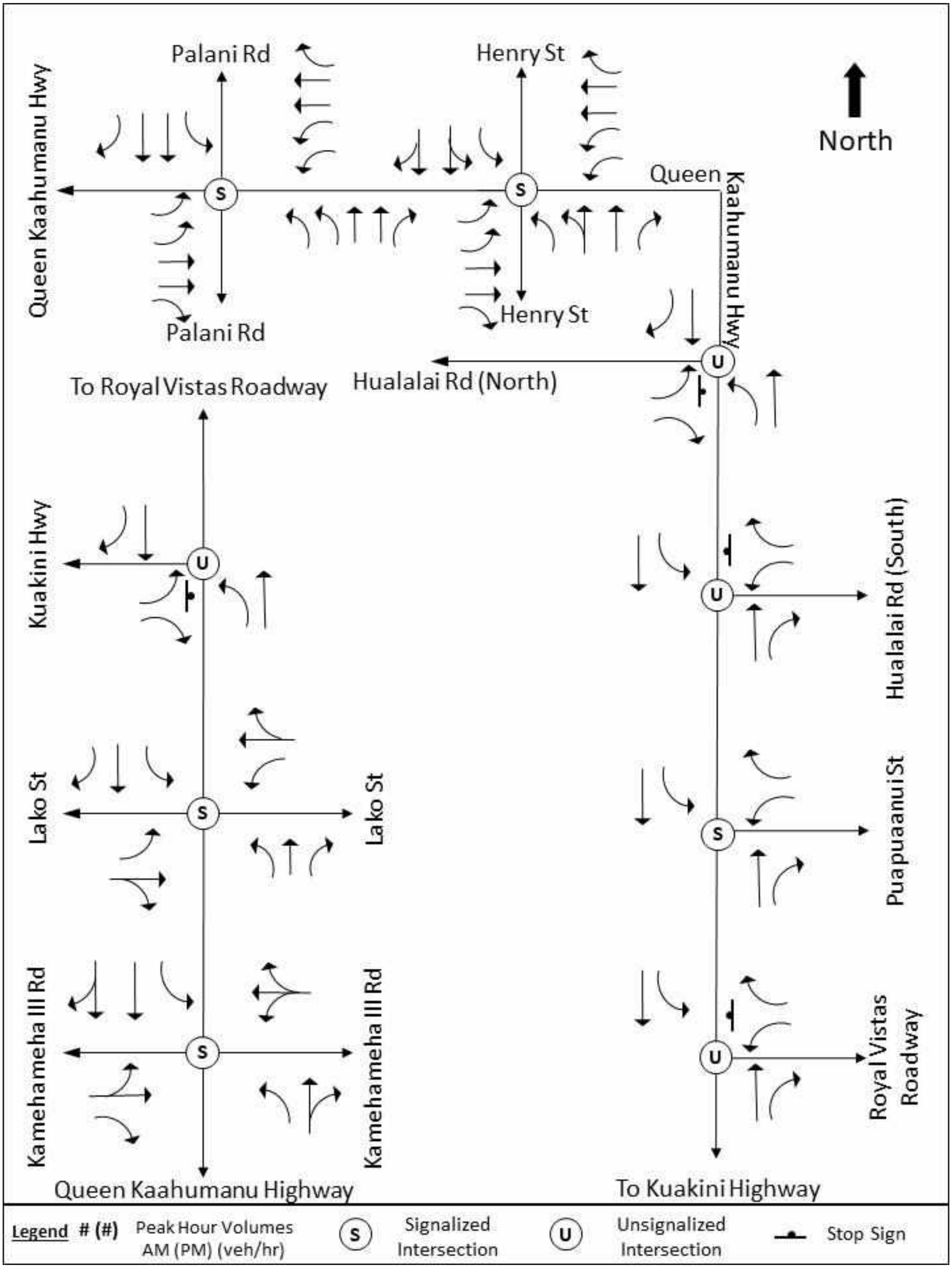

Figure 8: Expected Future Lane Configuration

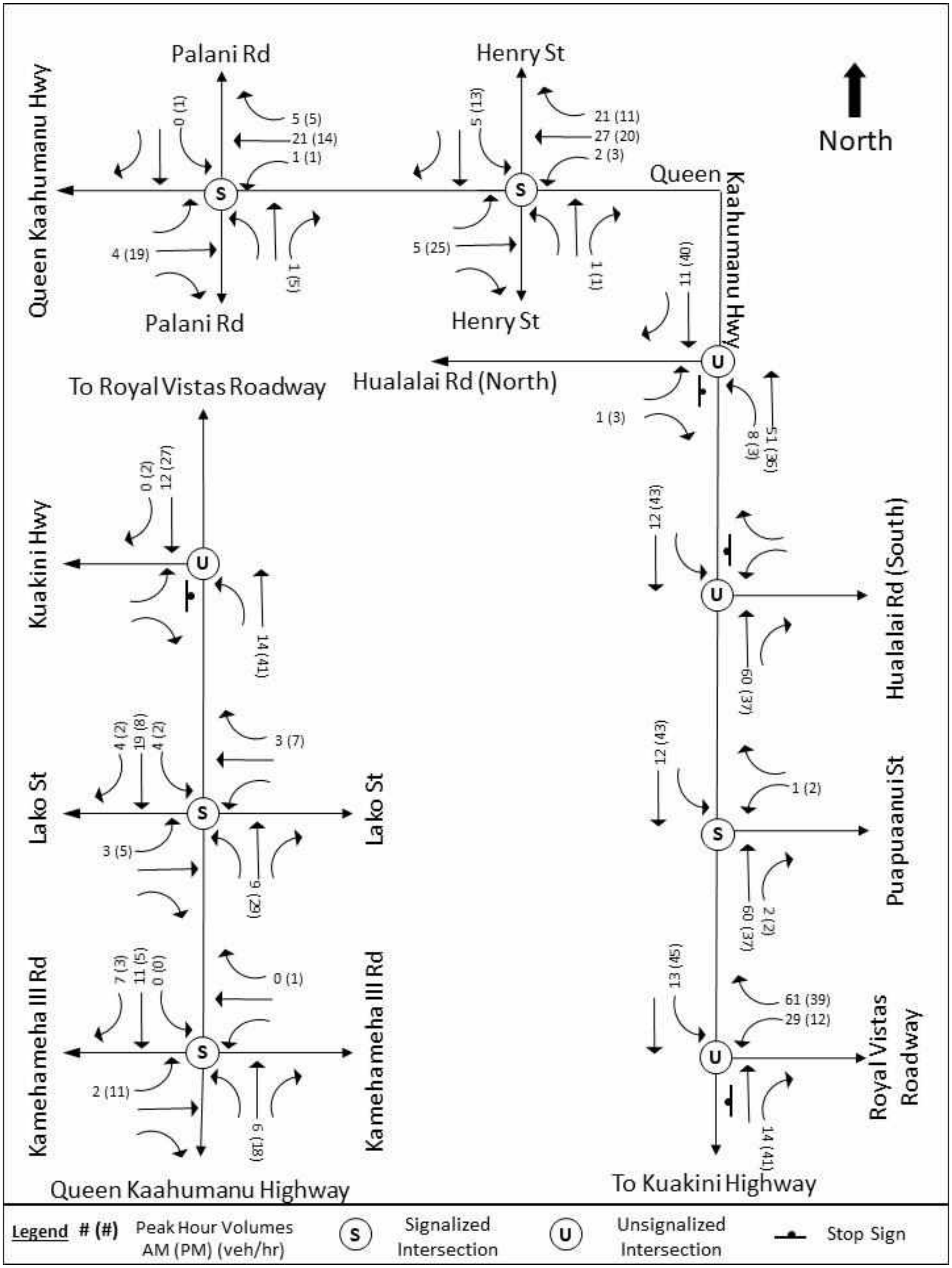

Figure 9: Phase 1 Project Related Trips

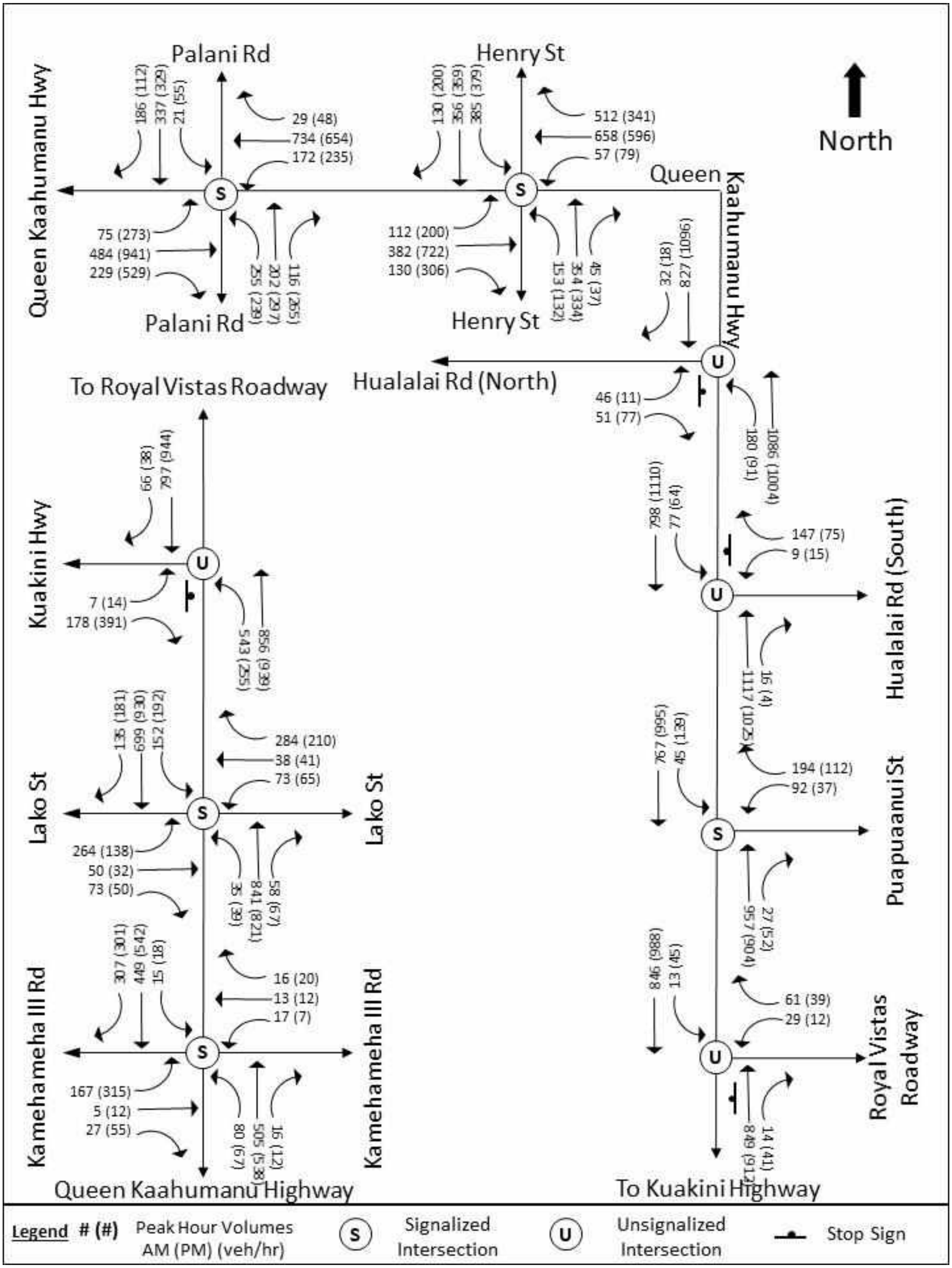

Figure 10: Future 2024 With Project Peak Hour Volumes

C. Future 2024 Intersection Traffic Operation Analysis

1. Future 2024 Without Project Intersection LOS

The 2024 Without Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours.

1. Queen Kaahumanu Highway and Palani Road. Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.
2. Queen Kaahumanu Highway and Henry Street. Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.
3. Queen Kaahumanu Highway and Hualalai Road (North)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 1.65 and 0.30 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
4. Queen Kaahumanu Highway and Hualalai Road (South)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.22 and 0.39 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
5. Queen Kaahumanu Highway and Puapuaanui Street. Overall Intersection LOS = B/B (AM/PM)
   The AM westbound left turn movement from Hualalai Road and southbound left turn movements from Queen K Highway operate at LOS E. The westbound left turn operates at LOS E during the PM peak hour. The left turn volumes are low and should clear every cycle. These delays are due to the cycle length.
6. Queen Kaahumanu Highway and Kuakini Highway
   At the unsignalized intersection of Queen Kaahumanu Highway with Kuakini Highway, eastbound left turning movement has LOS F (v/c of 1.51 and 0.62 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
7. Queen Kaahumanu Highway and Lako Street. Overall Intersection LOS = D/C (AM/PM)
   At the signalized intersection of Queen Kaahumanu Highway with Lako Street, the eastbound left turn operates at LOS E during the AM peak hour. This delay is attributed to the high eastbound left turn volume, and the split phasing for the Lako Street approaches. All other movements at Lako Street operates at LOS D or better during both peak hours.
8. Queen Kaahumanu Highway and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

Tables 12 and 13 show the expected 2024 vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Synchro output is in Appendix D.

Table 12: Future 2024 Without Project Intersection Level of Service

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Palani Rd (overall)	**24.3**	**-**	**C**	**27.1**	**-**	**C**
Queen Kaahumanu EB Left	39.2	0.47	D	39.3	0.76	D
Queen Kaahumanu EB Through	14.8	0.32	B	19.2	0.61	B
Queen Kaahumanu WB Left	39.3	0.68	D	40.1	0.73	D
Queen Kaahumanu WB Through	14.9	0.45	B	17.4	0.44	B
Palani NB Left	37.8	0.73	D	40.5	0.74	D
Palani NB Through	25.7	0.26	C	28.9	0.42	C
Palani SB Left	48.1	0.51	D	49.8	0.71	D
Palani SB Through	34.0	0.66	C	33.9	0.63	C
Queen Kaahumanu Hwy & Henry St (overall)	**32.9**	**0.65**	**C**	**33.8**	**0.68**	**C**
Queen Kaahumanu EB Left	45.2	0.53	D	49.7	0.69	D
Queen Kaahumanu EB Through	25.7	0.37	C	29.3	0.60	C
Queen Kaahumanu EB Right	22.8	0.09	C	24.0	0.20	C
Queen Kaahumanu WB Left	46.1	0.40	D	50.9	0.57	D
Queen Kaahumanu WB Through	32.3	0.65	C	32.6	0.60	C
Queen Kaahumanu WB Right	27.9	0.33	C	27.6	0.22	C
Henry NB Left	35.4	0.48	D	36.3	0.42	D
Henry NB Left-Through	36.6	0.60	D	37.9	0.58	D
Henry NB Right	31.3	0.03	C	32.8	0.02	C
Henry SB Left	39.3	0.74	D	40.2	0.75	D
Henry SB Left-Through-Right	35.2	0.71	D	34.8	0.69	C
Queen Kaahumanu Hwy & Hualalai (N) (overall)	**14.1**	**-**	**-**	**1.2**	**-**	**-**
Queen Kaahumanu NB Left	11.2	0.24	B	11.5	0.14	B
Hualalai EB Left	603.1	1.65	F	135.9	0.30	F
Queen Kaahumanu Hwy & Hualalai (S) (overall)	**4.0**	**-**	**-**	**2.0**	**-**	**-**
Queen Kaahumanu SB Left	12.0	0.14	B	11.1	0.10	B
Hualalai WB Left	105.7	0.22	F	143.3	0.39	F
Hualalai WB Right	43.7	0.65	E	22.1	0.27	C

Table 13: Future 2024 Without Project Intersection Level of Service (continued)

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Puapuaanui St (overall)	**10.2**	**-**	**B**	**10.5**	**-**	**B**
Queen Kaahumanu SB Left	61.3	0.73	E	54.4	0.81	D
Queen Kaahumanu WB Through	3.6	0.52	A	3.3	0.60	A
Puapuaanui WB Left	55.2	0.78	E	56.2	0.63	E
Puapuaanui WB Right	8.1	0.68	A	9.4	0.66	A
Queen Kaahumanu Hwy & Kuakini Hwy (overall)	**9.8**	**-**	**-**	**3.5**	**-**	**-**
Queen Kaahumanu NB Left	20.4	0.73	C	12.8	0.36	B
Kuakini EB Left	1546.3	1.51	F	302.1	0.62	F
Queen Kaahumanu Hwy & Lako St (overall)	**35.4**	**-**	**D**	**24.5**	**-**	**C**
Queen Kaahumanu NB Left	14.1	0.12	B	14.8	0.17	B
Queen Kaahumanu NB Through	38.0	0.93	D	21.4	0.80	C
Queen Kaahumanu SB Left	30.1	0.70	C	16.0	0.58	B
Queen Kaahumanu SB Through	21.3	0.72	C	23.8	0.87	C
Lako EB Left	63.7	0.89	E	44.5	0.77	D
Lako EB Through-Right	34.1	0.16	C	35.7	0.17	D
Lako WB Left	51.1	0.68	D	46.1	0.65	D
Lako WB Through-Right	44.9	0.33	D	41.4	0.40	D
Queen Kaahumanu Hwy & Kam III Rd (overall)	**18.2**	**-**	**B**	**23.3**	**-**	**C**
Queen Kaahumanu NB Left	43.1	0.79	D	49.0	0.78	D
Queen Kaahumanu NB Through	13.3	0.58	B	19.0	0.64	B
Queen Kaahumanu SB Left	42.1	0.47	D	46.1	0.49	D
Queen Kaahumanu SB Through	10.8	0.28	B	14.8	0.36	B
Kamehameha EB Left-Through	32.0	0.74	C	35.7	0.85	D
Kamehameha WB Left-Through-Right	42.1	0.68	D	45.7	0.63	D

2. Future 2024 With Project Intersection LOS

The 2024 With Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours. NOTE: All Royal Vistas vehicles are routed through the one Royal Vistas Access Roadway to Queen Kaahumanu Highway for purposes of the Phase 1 analysis.

1. Queen Kaahumanu Highway and Palani Road. Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.
2. Queen Kaahumanu Highway and Henry Street. Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.
3. Queen Kaahumanu Highway and Hualalai Road (North)

At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 1.98 and 0.34 respectively) during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

4. Queen Kaahumanu Highway and Hualalai Road (South)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.24 and 0.34 respectively) during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The westbound right turn also operates at LOS F (v/c of 0.71) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
5. Queen Kaahumanu Highway and Puapuaanui Street. Overall Intersection LOS = B/B (AM/PM)
   The AM left turns operate at LOS E. The westbound left turn operates at LOS E during the PM peak hour. The left turn volumes are low and should clear every cycle. These delays are due to the cycle length.
6. Queen Kaahumanu Highway and Royal Vistas Roadway
   At the proposed unsignalized intersection of Queen Kaahumanu Highway and the Royal Vistas Roadway, the southbound left turn movement from Queen Kaahumanu Highway into Royal Vistas Roadway functions well, with minimal delay, an average of 10 to 11 seconds during both peak hours. The westbound left turning movement has LOS F (v/c of 0.41 and 0.27 respectively) during both AM (29 vehicles) and PM (12 vehicles) peak hours are due to high through volumes on Queen Kaahumanu Highway. The intersection functions acceptably, with an average of 2.0 seconds of delay per vehicle in the AM peak hour and 1.2 seconds of delay per vehicle in the PM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
7. Queen Kaahumanu Highway and Kuakini Highway
   At the unsignalized intersection of Queen Kaahumanu Highway with Kuakini Highway, eastbound left turning movement has LOS F (v/c of 1.88 and .68 respectively) during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
8. Queen Kaahumanu Highway and Lako Street. Overall Intersection LOS = D/C (AM/PM)
   At the signalized intersection of Queen Kaahumanu Highway with Lako Street, the eastbound left turn operates at LOS E during the AM peak hour. This delay is attributed to the high eastbound left turn volume, and the split phasing for the Lako Street approaches. All other movements at Lako Street operates at LOS D or better during both peak hours.
9. Queen Kaahumanu Highway and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

Tables 14 and 15 show the expected vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Synchro output is in Appendix E.

Table 14: Future 2024 With Project Intersection Level of Service

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Palani Rd (overall)	**24.2**	**-**	**C**	**27.2**	**-**	**C**
Queen Kaahumanu EB Left	39.2	0.47	D	39.3	0.76	D
Queen Kaahumanu EB Through	14.9	0.33	B	19.5	0.62	B
Queen Kaahumanu WB Left	39.3	0.68	D	40.2	0.74	D
Queen Kaahumanu WB Through	15.1	0.46	B	17.6	0.45	B
Palani NB Left	37.8	0.73	D	40.5	0.74	D
Palani NB Through	25.7	0.26	C	28.9	0.42	C
Palani SB Left	48.1	0.51	D	50.0	0.71	D
Palani SB Through	34.0	0.66	C	34.0	0.63	C
Queen Kaahumanu Hwy & Henry St (overall)	**33.2**	**0.66**	**C**	**34.1**	**0.69**	**C**
Queen Kaahumanu EB Left	45.5	0.54	D	49.8	0.69	D
Queen Kaahumanu EB Through	26.1	0.38	C	30.0	0.63	C
Queen Kaahumanu EB Right	23.1	0.09	C	24.1	0.20	C
Queen Kaahumanu WB Left	46.5	0.42	D	52.5	0.59	D
Queen Kaahumanu WB Through	33.4	0.68	C	33.2	0.62	C
Queen Kaahumanu WB Right	28.5	0.34	C	27.8	0.22	C
Henry NB Left	35.7	0.48	D	36.4	0.42	D
Henry NB Left-Through	36.9	0.60	D	38.0	0.59	D
Henry NB Right	31.5	0.03	C	32.9	0.02	C
Henry SB Left	38.4	0.72	D	40.4	0.76	D
Henry SB Left-Through-Right	34.8	0.70	C	35.0	0.70	D
Queen Kaahumanu Hwy & Hualalai (N) (overall)	**17.7**	**-**	**-**	**1.3**	**-**	**-**
Queen Kaahumanu NB Left	11.3	0.26	B	11.9	0.15	B
Hualalai EB Left	789.5	1.98	F	163.1	0.34	F
Queen Kaahumanu Hwy & Hualalai (S) (overall)	**4.5**	**-**	**-**	**2.2**	**-**	**-**
Queen Kaahumanu SB Left	12.4	0.15	B	11.3	0.10	B
Hualalai WB Left	121.6	0.24	F	172.6	0.44	F
Hualalai WB Right	52.8	0.71	F	23.3	0.28	C
Queen Kaahumanu Hwy & Puapuaanui St (overall)	**10.8**	**-**	**B**	**10.8**	**-**	**B**
Queen Kaahumanu SB Left	61.3	0.73	E	54.5	0.81	D
Queen Kaahumanu WB Through	3.7	0.53	A	3.6	0.63	A
Puapuaanui WB Left	55.1	0.78	E	56.4	0.64	E
Puapuaanui WB Right	9.8	0.73	A	10.1	0.69	B

Table 15: Future 2024 With Project Intersection Level of Service (continued)

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Kona Vista Rdwy (overall)	**2.0**	**-**	**-**	**1.2**	**-**	**-**
Queen Kaahumanu SB Left	10.0	0.02	A	10.5	0.07	B
Kona Vista WB Left	81.0	0.41	F	105.9	0.27	F
Kona Vista WB Right	18.8	0.20	C	19.0	0.14	C
Queen Kaahumanu Hwy & Kuakini Hwy (overall)	**11.4**	**-**	**-**	**3.7**	**-**	**-**
Queen Kaahumanu NB Left	21.8	0.75	C	12.9	0.36	B
Kuakini EB Left	1998.6	1.88	F	344.6	0.68	F
Queen Kaahumanu Hwy & Lako St (overall)	**36.9**	**-**	**D**	**25.9**	**-**	**C**
Queen Kaahumanu NB Left	14.6	0.12	B	15.3	0.18	B
Queen Kaahumanu NB Through	40.4	0.94	D	23.5	0.83	C
Queen Kaahumanu SB Left	34.2	0.74	C	18.5	0.62	B
Queen Kaahumanu SB Through	22.2	0.74	C	24.9	0.88	C
Lako EB Left	65.4	0.90	E	44.5	0.78	D
Lako EB Through-Right	34.1	0.16	C	35.5	0.17	D
Lako WB Left	51.3	0.68	D	46.2	0.65	D
Lako WB Through-Right	45.1	0.33	D	41.5	0.40	D
Queen Kaahumanu Hwy & Kam III Rd (overall)	**18.3**	**-**	**B**	**24.1**	**-**	**C**
Queen Kaahumanu NB Left	43.1	0.79	D	49.3	0.78	D
Queen Kaahumanu NB Through	13.5	0.59	B	20.1	0.67	C
Queen Kaahumanu SB Left	42.2	0.47	D	46.5	0.49	D
Queen Kaahumanu SB Through	10.9	0.29	B	15.2	0.37	B
Kamehameha EB Left-Through	32.0	0.74	C	36.7	0.85	D
Kamehameha WB Left-Through-Right	42.2	0.68	D	46.3	0.64	D

3. 2024 Traffic Signal Warrant

Peak-Hour volume traffic signal warrants were evaluated for the 2024 with and without project scenarios. Table 16 shows the Peak-Hour warrant analysis in 2024 with and without the project. Traffic Signal Warrant analysis can be found in Appendix J.

1. Queen Kaahumanu Highway and Hualalai Road (North)
   This intersection passes the Peak-Hour warrant in the AM and PM peak hour with and without the project.
2. Queen Kaahumanu Highway and Hualalai Road (South)
   This intersection passes the Peak-Hour warrant in the AM peak hour with and without the project.
3. Queen Kaahumanu Highway and Royal Vistas Roadway
   This intersection does not pass the peak hour warrant in either peak hour.

4. Queen Kaahumanu Highway and Kuakini Highway
   This intersection passes the Peak-Hour warrant in the AM and PM peak hour with and without the project.

Table 16: 2024 Peak-Hour Warrant

2024 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	816	172	YES	1056	88	YES
Hualalai (S)	1057	77	YES	988	64	NO
Kuakini	842	543	YES	932	255	YES
2024 With Project	**Peak Hour Warrant**					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	827	180	YES	1096	91	YES
Hualalai (S)	1117	77	YES	1025	64	NO
RKV Roadway	819	13	NO	912	45	NO
Kuakini	856	543	YES	944	255	YES

4. 2024 With Project Segment LOS

Arterial LOS was analyzed in Synchro on Queen Kaahumanu Highway from Hualalai (north) to Lako Street. Where signalized intersections are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities. For Urban Street Facilities, through-vehicle travel speed is used to analyze vehicular LOS. Analysis worksheets can be found in Appendix E. The arterial LOS can be found in Table 17.

This segment of Queen Kaahumanu Highway operates at LOS C in the northbound direction and LOS B in the southbound direction during the AM and PM peak hours, respectively, satisfying the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding “acceptable level of service” for transportation facilities.

Table 17: 2024 with Project Segment LOS

	Northbound		Southbound	
	Speed (mph)	LOS	Speed (mph)	LOS
AM Peak Hour	18.3	C	25.3	B
PM Peak Hour	20.7	C	24.6	B

IV. Mid-Term (2029) – Completion of Phase 2

A. Surrounding Area Conditions

Phase 2 is expected to be completed by 2029, representing the full buildout 10-year future forecast. Phase 2 will contain 192 dwelling units. Inbound trips and Phase 1 outbound trips continue to use the Royal Vistas Roadway and Queen Kaahumanu Highway intersection.

Based on the HDOT *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (July 2014), Kuakini Highway from Henry Street to Kamehameha III Road will be widened by 2 travel lanes and include bicycle facilities and sidewalks.

No other significant developments or future construction projects are expected in the immediately surrounding area that would significantly affect the roadway geometrics or traffic volumes at the study intersections. This is based on research completed on October 10, 2019 at the State of Hawaii Office of Environmental Quality Control (OEQC) website and the Statewide Transportation Improvements Program (STIP). The current STIP has a 4-year outlook, from Fiscal Year 2019-2022. Future projects may impact roadway geometrics or traffic volumes. The Mid-Term future analysis may need to be reanalyzed and updated if the Kuakini Highway widening project is scheduled. This project was not included in the analysis.

B. Volumes

1. Future 2029 Without Project Volumes

The project study area within Kona has been experiencing modest growth. HDOT ADT counts on Queen Kaahumanu Highway between Nani Kailua Drive and Hualalai Road didn't show any increase in vehicular volumes from 2015 to 2016. Similarly, the 2035 Federal Aid Highways Long Range Transportation Plan forecasts average daily traffic in Kona to be 41,900 vehicles in 2020 and 48,000 vehicles in 2035. This is approximately equal to a 1% annual growth rate. The estimated future volumes without the project for the future year 2029 are shown in Figure 11.

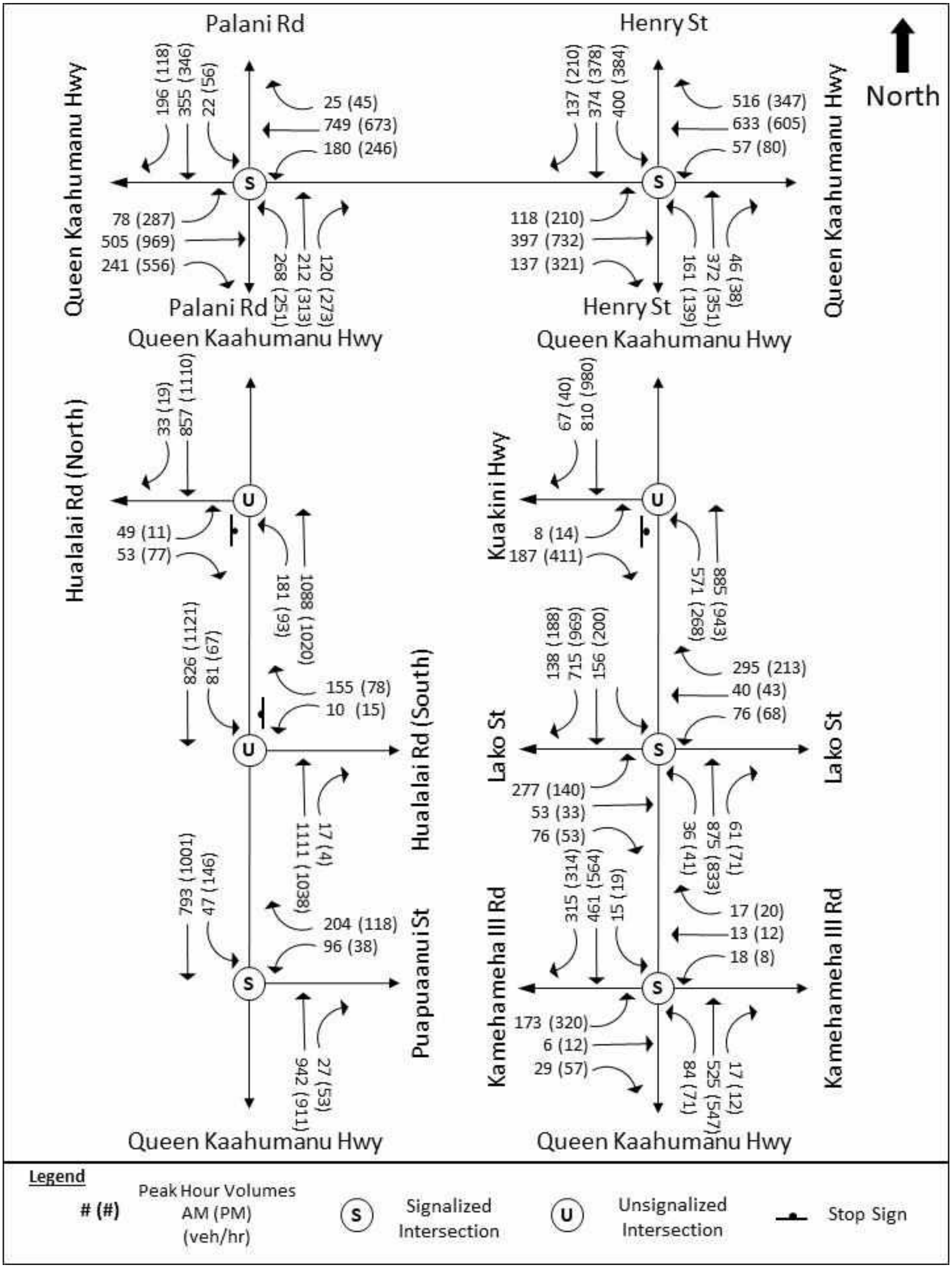

Figure 11: Future 2029 Without Project Peak Hour Volumes

2. Project Related Volumes

The proposed Royal Vistas include 192 multi-family residential dwelling units for Phase 2. All of these are expected to be low rise units with two or three stories. Trips generated from the proposed facility were estimated using nationally accepted land use rates from the *Trip Generation*, 10th Edition (ITE, 2016). ITE defines the Multi-family Housing (Low Rise) Land Use [220] as follows: "includes apartments, townhouses and condominiums located within the same building with at least three other dwelling units" The analysis used 192 dwelling units as the independent variable to estimate new trips expected from Phase 2 of the proposed project. The estimates for new trips generated by Phase 2 are shown in Table 18.

Table 18: Estimated Trips Generated by Project – Phase 2

	AM		PM	
Land Use [ITE Code]	**Equation**		**Equation**	
Multi-family Housing (Low Rise) [220]	Ln (T) = 0.95 Ln (X) – 0.51		Ln (T) = 0.89*Ln (X) - 0.02	
Dwelling Units	192		192	
New Trips	89		106	
	In[4]	**Out**	**In**	**Out**
	23%	77%	63%	37%
	20	69	67	39

T = Total number of trips generated, X = Dwelling Units

3. Trip Distribution

The trips were distributed according to existing travel volumes. The segment volumes between Puapuaanui Street and Kuakini Street were used to determine the inbound percent distribution. Future inbound trips will continue entering at the Royal Vistas Roadway at Queen Kaahumanu Highway. It is expected that once a connection to Lako Street is provided, Phase 2 left out (southbound traffic) will utilize the Lako Street intersection during the peak hours, since the traffic signal will provide guaranteed exit opportunities and drivers will not have to wait for a gap at the stop-controlled Royal Vistas driveway.

Figure 12 shows the Future lane configuration. It is the same as Phase 1 lane configuration.

Figure 13 shows the Phase 2 inbound project generated and distributed trips.

Figure 14 shows the Phase 2 outbound project generated and distributed trips.

4. Future 2029 With Project Volumes

Phase 1 (Figure 9) and Phase 2 project related trips (Figure 13 and Figure 14) were added to the Future 2029 Without Project volumes (Figure 11) to estimate Future 2029 With Project peak hour volumes (see Figure 15).

[4] In and Out split provided by *Trip Generation*, 10th Edition (ITE 2016) for Land Use 220

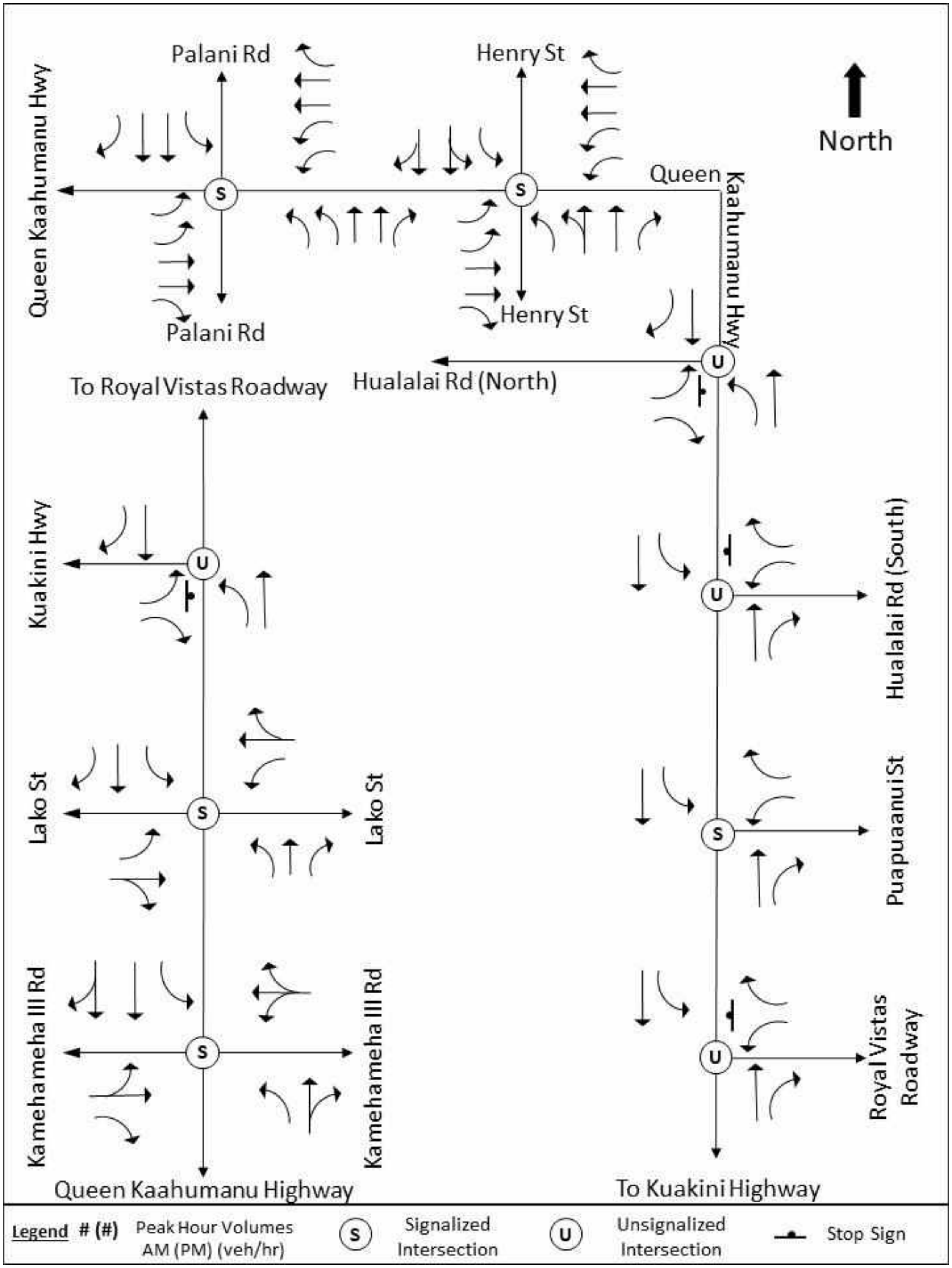

Figure 12: Future Lane Configuration for Phase 2

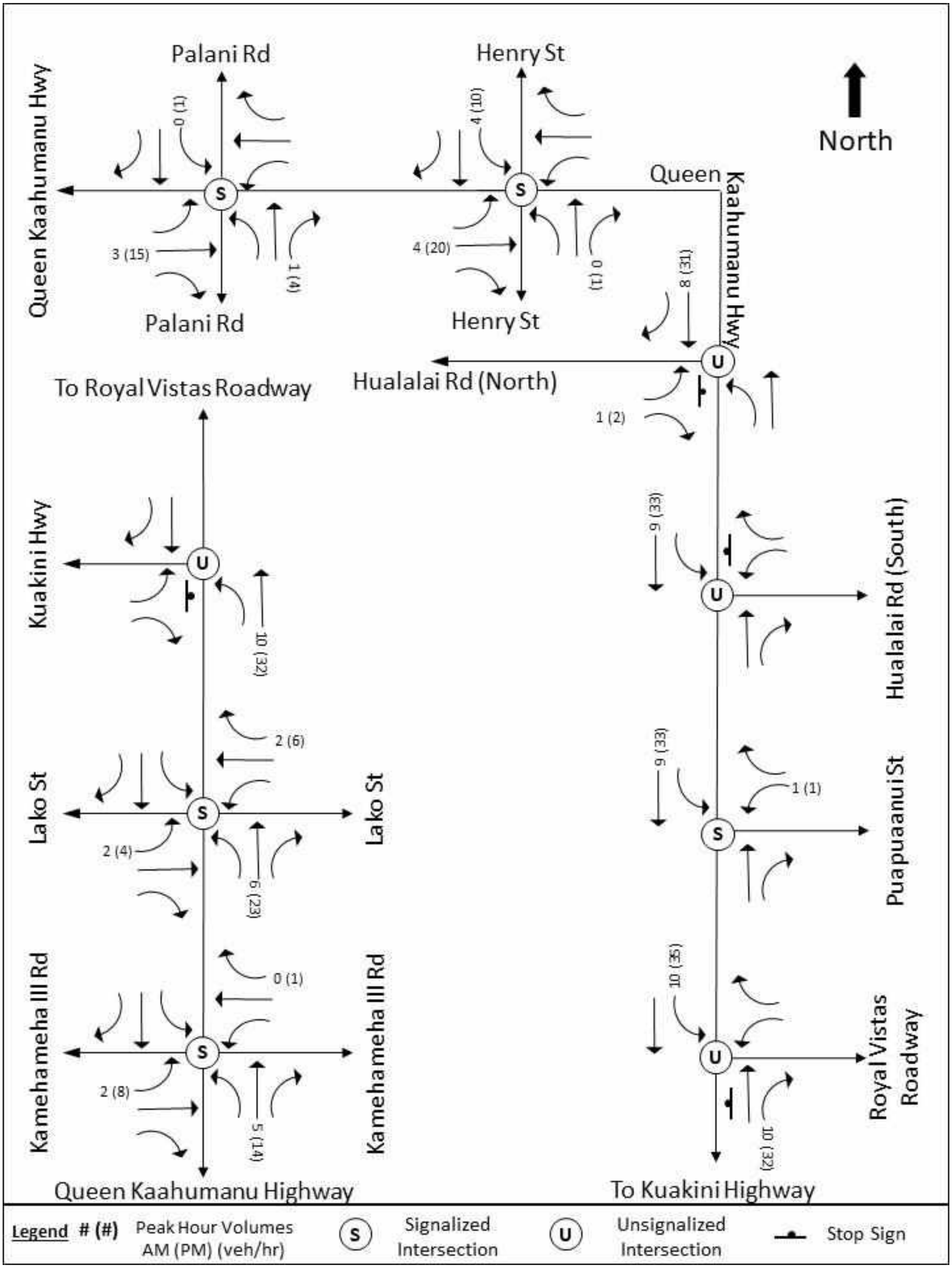

Figure 13: Phase 2 Inbound Project Related Trips

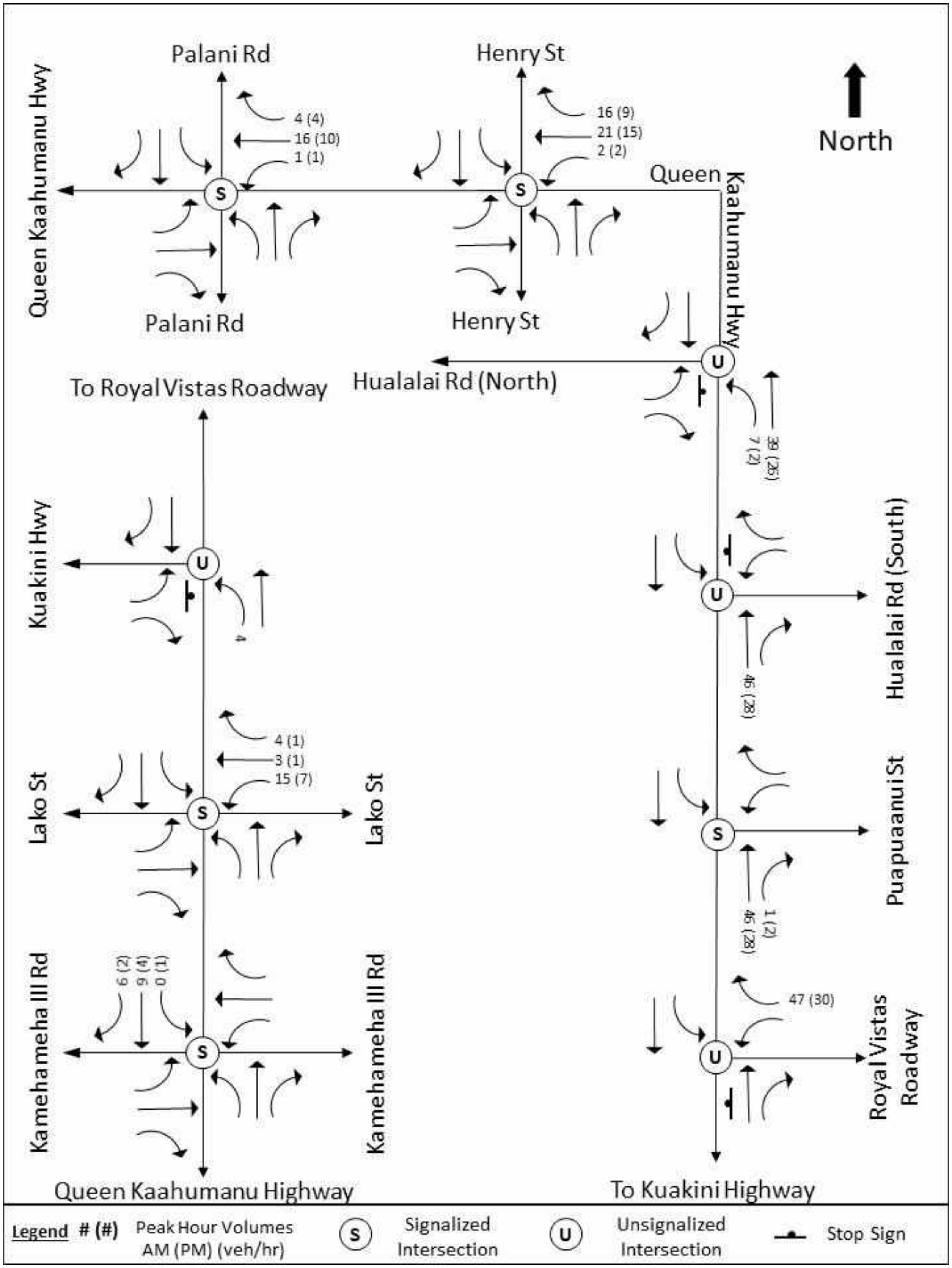

Figure 14: Phase 2 Outbound Project Related Trips

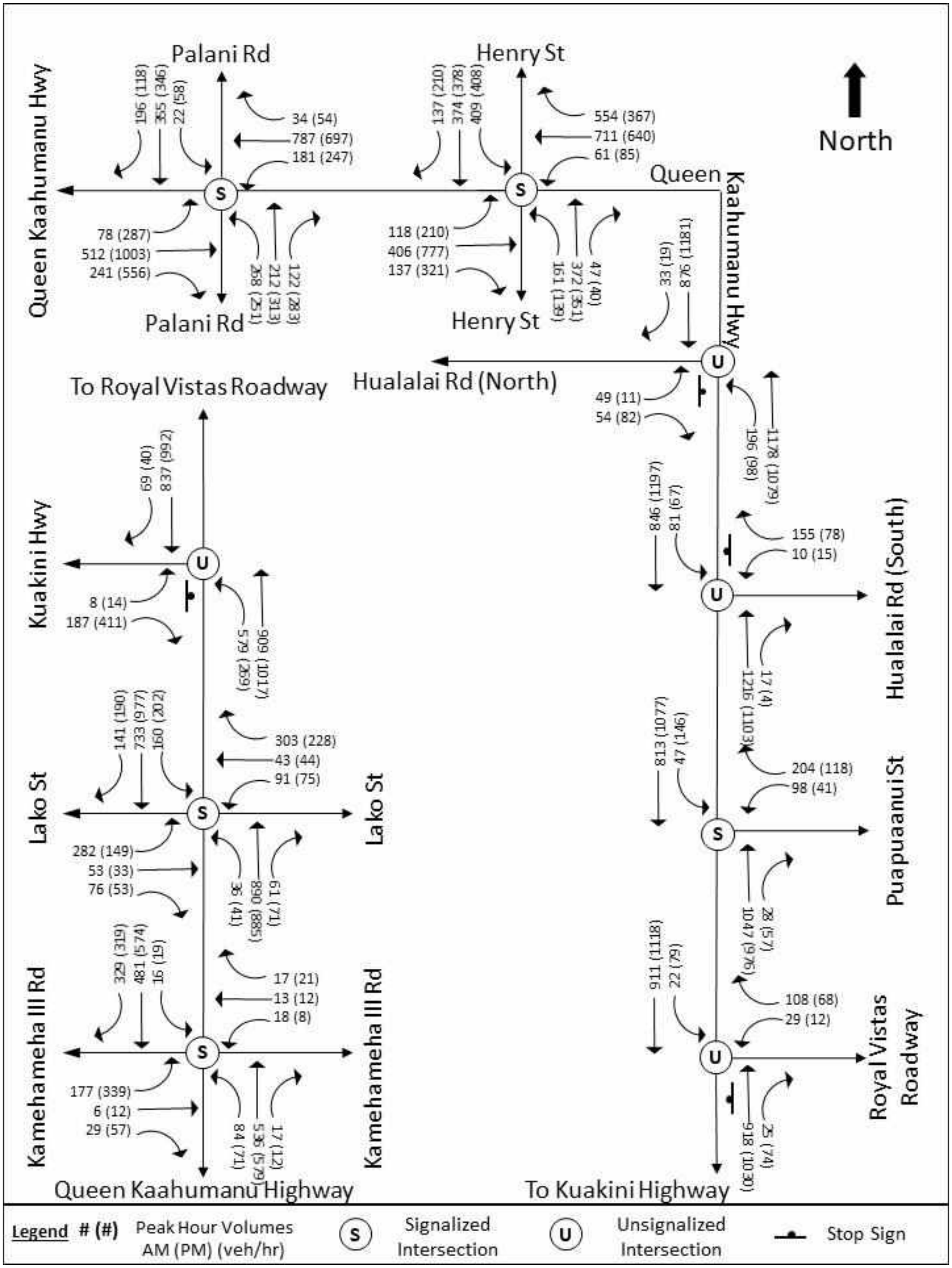

Figure 15: Future 2029 Without Project Peak Hour Volumes

C. Future 2029 Intersection Traffic Operation Analysis

1. Future 2029 Without Project Intersection LOS

The 2029 Without Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours.

1. Queen Kaahumanu Highway and Palani Road. Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.
2. Queen Kaahumanu Highway and Henry Street. Overall Intersection LOS = C/D (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.
3. Queen Kaahumanu Highway and Hualalai Road (North)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 2.20 and 0.37 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
4. Queen Kaahumanu Highway and Hualalai Road (South)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.28 and 0.47 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The westbound right turn also operates at LOS F (v/c of .74) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
5. Queen Kaahumanu Highway and Puapuaanui Street. Overall Intersection LOS = B/B (AM/PM)
   The southbound left turn operates at LOS E during the AM and PM peak hour. The westbound left turn operates at LOS E during the PM peak hour. These delays are due to the cycle length. The left turn volumes are low and should clear every cycle.
6. Queen Kaahumanu Highway and Kuakini Highway
   At the unsignalized intersection of Queen Kaahumanu Highway with Kuakini Highway, eastbound left turning movement has LOS F (v/c of 2.87 and 0.79 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
7. Queen Kaahumanu Highway and Lako Street. Overall Intersection LOS = D/C (AM/PM)
   At the signalized intersection of Queen Kaahumanu Highway with Lako Street, the eastbound left turn operates at LOS E during the AM peak hour. This delay is attributed to the high eastbound left turn volume, and the split phasing for the Lako Street approaches. The southbound left also operates at LOS E during the AM peak hour. All other movements at Lako Street operates at LOS D or better during both peak hours.
8. Queen Kaahumanu Highway and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)

All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

Tables 19 and 20 show the expected vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Synchro output is in Appendix F.

Table 19: Future 2029 Without Project Intersection Level of Service

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Palani Rd (overall)	**24.9**	**-**	**C**	**28.3**	**-**	**C**
Queen Kaahumanu EB Left	39.8	0.49	D	40.7	0.77	D
Queen Kaahumanu EB Through	15.7	0.35	B	20.7	0.65	C
Queen Kaahumanu WB Left	39.8	0.69	D	41.6	0.75	D
Queen Kaahumanu WB Through	15.7	0.47	B	18.5	0.47	B
Palani NB Left	38.3	0.74	D	42.0	0.75	D
Palani NB Through	25.5	0.26	C	28.9	0.43	C
Palani SB Left	48.5	0.51	D	51.3	0.73	D
Palani SB Through	34.2	0.67	C	34.3	0.64	C
Queen Kaahumanu Hwy & Henry St (overall)	**34.0**	**0.67**	**C**	**35.2**	**0.71**	**D**
Queen Kaahumanu EB Left	47.6	0.58	D	53.1	0.74	D
Queen Kaahumanu EB Through	27.2	0.40	C	31.0	0.65	C
Queen Kaahumanu EB Right	23.9	0.09	C	24.8	0.21	C
Queen Kaahumanu WB Left	47.3	0.42	D	53.8	0.60	D
Queen Kaahumanu WB Through	34.0	0.67	C	34.2	0.64	C
Queen Kaahumanu WB Right	29.4	0.34	C	28.5	0.23	C
Henry NB Left	35.9	0.49	D	36.7	0.44	D
Henry NB Left-Through	37.4	0.62	D	38.4	0.60	D
Henry NB Right	31.6	0.03	C	33.0	0.03	C
Henry SB Left	39.9	0.75	D	42.1	0.78	D
Henry SB Left-Through-Right	35.6	0.72	D	35.8	0.72	D
Queen Kaahumanu Hwy & Hualalai (N) (overall)	**20.8**	**-**	**-**	**1.4**	**-**	**-**
Queen Kaahumanu NB Left	11.6	0.26	B	12.0	0.16	B
Hualalai EB Left	893.5	2.20	F	177.1	0.37	F
Queen Kaahumanu Hwy & Hualalai (S) (overall)	**5.1**	**-**	**-**	**2.3**	**-**	**-**
Queen Kaahumanu SB Left	12.5	0.15	B	11.4	0.11	B
Hualalai WB Left	133.6	0.28	F	187.7	0.47	F
Hualalai WB Right	56.7	0.74	F	24.1	0.30	C

Table 20: Future 2029 Without Project Intersection Level of Service (continued)

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Puapuaanui St (overall)	**10.9**	**-**	**B**	**11.3**	**-**	**B**
Queen Kaahumanu SB Left	62.3	0.74	E	55.9	0.82	E
Queen Kaahumanu WB Through	3.9	0.55	A	3.6	0.63	A
Puapuaanui WB Left	54.9	0.78	D	56.5	0.65	E
Puapuaanui WB Right	9.8	0.72	A	10.6	0.70	B
Queen Kaahumanu Hwy & Kuakini Hwy (overall)	**16.1**	**-**	**-**	**4.3**	**-**	**-**
Queen Kaahumanu NB Left	25.0	0.79	C	13.6	0.40	B
Kuakini EB Left	2938.5	2.87	F	429.8	0.79	F
Queen Kaahumanu Hwy & Lako St (overall)	**43.7**	**-**	**D**	**28.7**	**-**	**C**
Queen Kaahumanu NB Left	15.5	0.14	B	17.4	0.21	B
Queen Kaahumanu NB Through	51.3	0.99	D	25.1	0.85	C
Queen Kaahumanu SB Left	56.6	0.87	E	21.0	0.67	C
Queen Kaahumanu SB Through	23.7	0.77	C	29.5	0.92	C
Lako EB Left	67.3	0.91	E	44.7	0.78	D
Lako EB Through-Right	34.2	0.16	C	35.7	0.17	D
Lako WB Left	51.7	0.68	D	46.3	0.65	D
Lako WB Through-Right	45.5	0.34	D	41.6	0.40	D
Queen Kaahumanu Hwy & Kam III Rd (overall)	**18.8**	**-**	**B**	**24.7**	**-**	**C**
Queen Kaahumanu NB Left	42.7	0.79	D	48.8	0.78	D
Queen Kaahumanu NB Through	14.3	0.62	B	20.0	0.69	C
Queen Kaahumanu SB Left	42.5	0.47	D	46.6	0.50	D
Queen Kaahumanu SB Through	11.3	0.30	B	15.7	0.39	B
Kamehameha EB Left-Through	32.0	0.75	C	37.5	0.86	D
Kamehameha WB Left-Through-Right	42.8	0.69	D	46.8	0.64	D

2. Future 2029 With Project Intersection LOS

The 2029 With Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours.

1. Queen Kaahumanu Highway and Palani Road. Overall Intersection LOS = C/C (AM/PM)
   All movements at the signalized intersections of Queen Kaahumanu Highway with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.
2. Queen Kaahumanu Highway and Henry Street. Overall Intersection LOS = C/D (AM/PM)
   The westbound left turn operates at LOS E during the PM peak hour. The overall delay and LOS have gradually gotten worse due to the increase in background volume and the trip generated by Royal Vistas. The westbound left during the PM peak hour has a volume of 85 vehicles. This volume will clear the intersection in 1 cycle. The delay increases from 53.8 seconds without the project, to 57 seconds with the project. The Royal Vistas traffic volume causes a slight increase in

the overall delay. Other factors that increase the delay are the increase in background volume and the split phase. All other movements at the signalized intersections of Queen Kaahumanu Highway with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

3. Queen Kaahumanu Highway and Hualalai Road (North)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 2.93 and 0.45 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
4. Queen Kaahumanu Highway and Hualalai Road (South)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.35 and 0.57 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The westbound right turn also operates at LOS F (v/c of 0.86) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
5. Queen Kaahumanu Highway and Puapuaanui Street. Overall Intersection LOS = B/B (AM/PM)
   The southbound left turn operates at LOS E during the AM and PM peak hour. The westbound left turn operates at LOS E during the PM peak hour. These delays are due to the cycle length. The left turn volumes are low and should clear every cycle.
6. Queen Kaahumanu Highway and Royal Vistas Roadway
   At the proposed unsignalized intersection of Queen Kaahumanu Highway and the Royal Vistas Roadway, the southbound left turn movement from Queen Kaahumanu Highway into Royal Vistas Roadway functions well, with minimal delay, an average of 12 to 13 seconds during both peak hours. The westbound left turning movement has LOS F (v/c of 0.53 and 0.48 respectively) during both AM (29 vehicles) and PM (12 vehicles) peak hours due to high through volumes on Queen Kaahumanu Highway. Phase 2 left turns exiting Royal Vistas are expected to use Lako Street to access Queen Kaahumanu Highway. The intersection functions acceptably, with an average of 3.1 seconds of delay per vehicle in the AM peak hour and 2.3 seconds of delay per vehicle in the PM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
7. Queen Kaahumanu Highway and Kuakini Highway
   At the unsignalized intersection of Queen Kaahumanu Highway with Kuakini Highway, eastbound left turning movement has LOS F (v/c of 0.89 during the PM peak hour) and long delays during both AM and PM peak hour are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
8. Queen Kaahumanu Highway and Lako Street. Overall Intersection LOS = D/C (AM/PM)
   At the signalized intersection of Queen Kaahumanu Highway with Lako Street, eastbound left operates at LOS F (v/c of 0.96) during the AM peak hour. The westbound left operates at LOS E during the AM peak hour. The eastbound left and westbound left operate at LOS E during the PM peak hour. This delay is attributed to the high volume and the split phasing for the Lako Street

approaches. All other movements at Lako Street operate at LOS D or better during both peak hours.

9. Queen Kaahumanu Highway and Kamehameha III Road. Overall Intersection LOS = C
The westbound approach operates at LOS E during the AM peak hour. During the PM peak hour, the westbound approach, the northbound left, and the southbound left operate at LOS E. All other movements during both peak hours operate at LOS D or better.

Tables 21 and 22 show the expected vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Synchro output is in Appendix G.

Table 21: Future 2029 With Project Intersection Level of Service

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Palani Rd (overall)	**24.8**	**-**	**C**	**28.4**	**-**	**C**
Queen Kaahumanu EB Left	39.8	0.49	D	40.8	0.77	D
Queen Kaahumanu EB Through	15.7	0.35	B	21.2	0.67	C
Queen Kaahumanu WB Left	39.7	0.69	D	41.8	0.75	D
Queen Kaahumanu WB Through	16.1	0.50	B	18.8	0.48	B
Palani NB Left	38.3	0.74	D	42.0	0.75	D
Palani NB Through	25.5	0.26	C	29.0	0.43	C
Palani SB Left	48.5	0.51	D	51.8	0.74	D
Palani SB Through	34.2	0.67	C	343.0	0.64	C
Queen Kaahumanu Hwy & Henry St (overall)	**34.7**	**0.70**	**C**	**35.9**	**0.73**	**D**
Queen Kaahumanu EB Left	48.0	0.58	D	53.9	0.74	D
Queen Kaahumanu EB Through	27.5	0.41	C	32.4	0.69	C
Queen Kaahumanu EB Right	24.0	0.09	C	25.1	0.21	C
Queen Kaahumanu WB Left	47.7	0.45	D	57.0	0.64	E
Queen Kaahumanu WB Through	36.7	0.75	D	35.6	0.68	D
Queen Kaahumanu WB Right	29.9	0.37	C	29.0	0.24	C
Henry NB Left	36.1	0.49	D	37.0	0.40	D
Henry NB Left-Through	37.5	0.62	D	38.8	0.60	D
Henry NB Right	31.7	0.03	C	33.3	0.03	C
Henry SB Left	39.9	0.75	D	42.4	0.78	D
Henry SB Left-Through-Right	35.7	0.73	D	32.0	0.73	D
Queen Kaahumanu Hwy & Hualalai (N) (overall)	**28.5**	**-**	**-**	**1.6**	**-**	**-**
Queen Kaahumanu NB Left	12.0	0.29	B	12.7	0.18	B
Hualalai EB Left	1310.5	2.93	F	237.0	0.45	F

Table 22: Future 2029 With Project Intersection Level of Service (continued)

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Hualalai (S) (overall)	**6.8**	**-**	**-**	**2.7**	**-**	**-**
Queen Kaahumanu SB Left	13.4	0.17	B	11.9	0.12	B
Hualalai WB Left	173.5	0.35	F	251.0	0.57	F
Hualalai WB Right	83.5	0.86	F	26.7	0.33	D
Queen Kaahumanu Hwy & Puapuaanui St (overall)	**12.6**	**-**	**B**	**12.5**	**-**	**B**
Queen Kaahumanu SB Left	78.0	0.78	E	69.0	0.84	E
Queen Kaahumanu WB Through	3.9	0.56	A	3.8	0.67	A
Puapuaanui WB Left	65.9	0.80	D	72.2	0.74	E
Puapuaanui WB Right	11.4	0.77	B	11.1	0.72	B
Queen Kaahumanu Hwy & Kona Vista Rdwy (overall)	**3.1**	**-**	**-**	**2.3**	**-**	**-**
Queen Kaahumanu SB Left	10.4	0.04	B	11.7	0.14	B
Kona Vista WB Left	118.2	0.53	F	228.2	0.48	F
Kona Vista WB Right	24.9	0.40	C	25.2	0.29	D
Queen Kaahumanu Hwy & Kuakini Hwy (overall)	**21.8**	**-**	**-**	**4.6**	**-**	**-**
Queen Kaahumanu NB Left	27.4	0.82	D	13.7	0.40	B
Kuakini EB Left	*	-	F	507.5	0.89	F
Queen Kaahumanu Hwy & Lako St (overall)	**43.4**	**-**	**D**	**28.0**	**-**	**C**
Queen Kaahumanu NB Left	16.6	0.13	B	17.7	0.18	B
Queen Kaahumanu NB Through	42.8	0.94	D	23.9	0.82	C
Queen Kaahumanu SB Left	50.2	0.84	D	23.9	0.68	C
Queen Kaahumanu SB Through	23.8	0.74	C	24.1	0.85	C
Lako EB Left	88.4	0.96	F	60.4	0.83	E
Lako EB Through-Right	41.9	0.17	D	45.7	0.17	D
Lako WB Left	62.1	0.75	E	59.3	0.71	E
Lako WB Through-Right	53.6	0.33	D	52.7	0.41	D
Queen Kaahumanu Hwy & Kam III Rd (overall)	**20.8**	**-**	**C**	**27.9**	**-**	**C**
Queen Kaahumanu NB Left	52.9	0.79	D	57.3	0.78	E
Queen Kaahumanu NB Through	12.6	0.55	B	21.4	0.67	C
Queen Kaahumanu SB Left	54.6	0.50	D	57.0	0.52	E
Queen Kaahumanu SB Through	11.0	0.27	B	16.7	0.36	B
Kamehameha EB Left-Through	43.3	0.79	D	45.9	0.88	D
Kamehameha WB Left-Through-Right	61.8	0.79	E	60.1	0.71	E

*delay exceeds 1,000 seconds per vehicle

3. 2029 Traffic Signal Warrant

Peak-Hour volume traffic signal warrants were evaluated for the 2029 with and without project scenarios. Table 23 shows the Peak-Hour warrant analysis in 2029 with and without the project. Traffic Signal Warrant analysis can be found in Appendix J.

1. Queen Kaahumanu Highway and Hualalai Road (North)
   This intersection passes the Peak-Hour warrant in the AM and PM peak hour with and without the project.
2. Queen Kaahumanu Highway and Hualalai Road (South)
   This intersection passes the Peak-Hour warrant in the AM peak hour with and without the project.
3. Queen Kaahumanu Highway and Kuakini Highway
   This intersection passes the Peak-Hour warrant in the AM and PM peak hour with and without the project.

Table 23: 2029 Peak-Hour Warrant

2029 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	857	181	YES	1110	93	YES
Hualalai (S)	1111	81	YES	1038	67	NO
Kuakini	885	571	YES	980	268	YES
2029 With Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	876	196	YES	1181	98	YES
Hualalai (S)	1216	81	YES	1103	67	NO
Kuakini	810	579	YES	980	271	YES

4. 2029 With Project Segment LOS

Arterial LOS was analyzed in Synchro on Queen Kaahumanu Highway from Hualalai (north) to Lako Street. Where signalized intersections are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities. For Urban Street Facilities, through-vehicle travel speed is used to analyze vehicular LOS. Analysis worksheets can be found in Appendix G. The arterial LOS can be found in Table 24.

This segment of Queen Kaahumanu Highway operates at LOS C in northbound direction and LOS B in the southbound direction during the AM and PM peak hours, respectively, satisfying the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding “acceptable level of service” for transportation facilities.

Table 24: 2029 with Project Segment LOS

	Northbound		Southbound	
	Speed (mph)	LOS	Speed (mph)	LOS
AM Peak Hour	18.6	C	25.2	B
PM Peak Hour	20.4	C	24.5	B

V. Long-Term (2039)

A. Surrounding Area Conditions

No other significant developments or future construction projects are expected in the surrounding area that would significantly affect the roadway geometrics or traffic volumes at the study intersections. This is based on research completed on October 10, 2019 at the State of Hawaii Office of Environmental Quality Control (OEQC) website and the Statewide Transportation Improvements Program (STIP).

B. Volumes

1. Future 2039 Without Project Volumes

The project study area within Kona has been experiencing modest growth. HDOT ADT counts on Queen Kaahumanu Highway between Nani Kailua Drive and Hualalai Road didn't show any increase in vehicular volumes from 2015 to 2016. However, the 2035 Federal Aid Highways Long Range Transportation Plan forecasts average daily traffic in Kona on Hawaii Belt Road to be 41,900 vehicles in 2020 and 48,000 vehicles in 2035. This is approximately equal to a 1% annual growth rate over 15 years in the Kona area.

Since there is a scope for development and to acknowledge all other projects which are in planning stage, a background growth rate of 1% per year was assumed, to account for additional traffic at the study intersections. The estimated future volumes without the project for the future year 2039 are shown in Figure 16.

2. Project Related Volumes

Phase 1 and Phase 2 will be completed by 2024 and 2029, respectively. The trips generated and distributed by Phase 1 and Phase 2 will not change.

3. Future 2039 With Project Volumes

Project related trips from Phase 1 (Figure 9) and Phase 2 (Figure 13 and Figure 14) were added to the Future 2039 Without Project volumes (Figure 16) to estimate Future 2039 With Project peak hour volumes (see Figure 17).

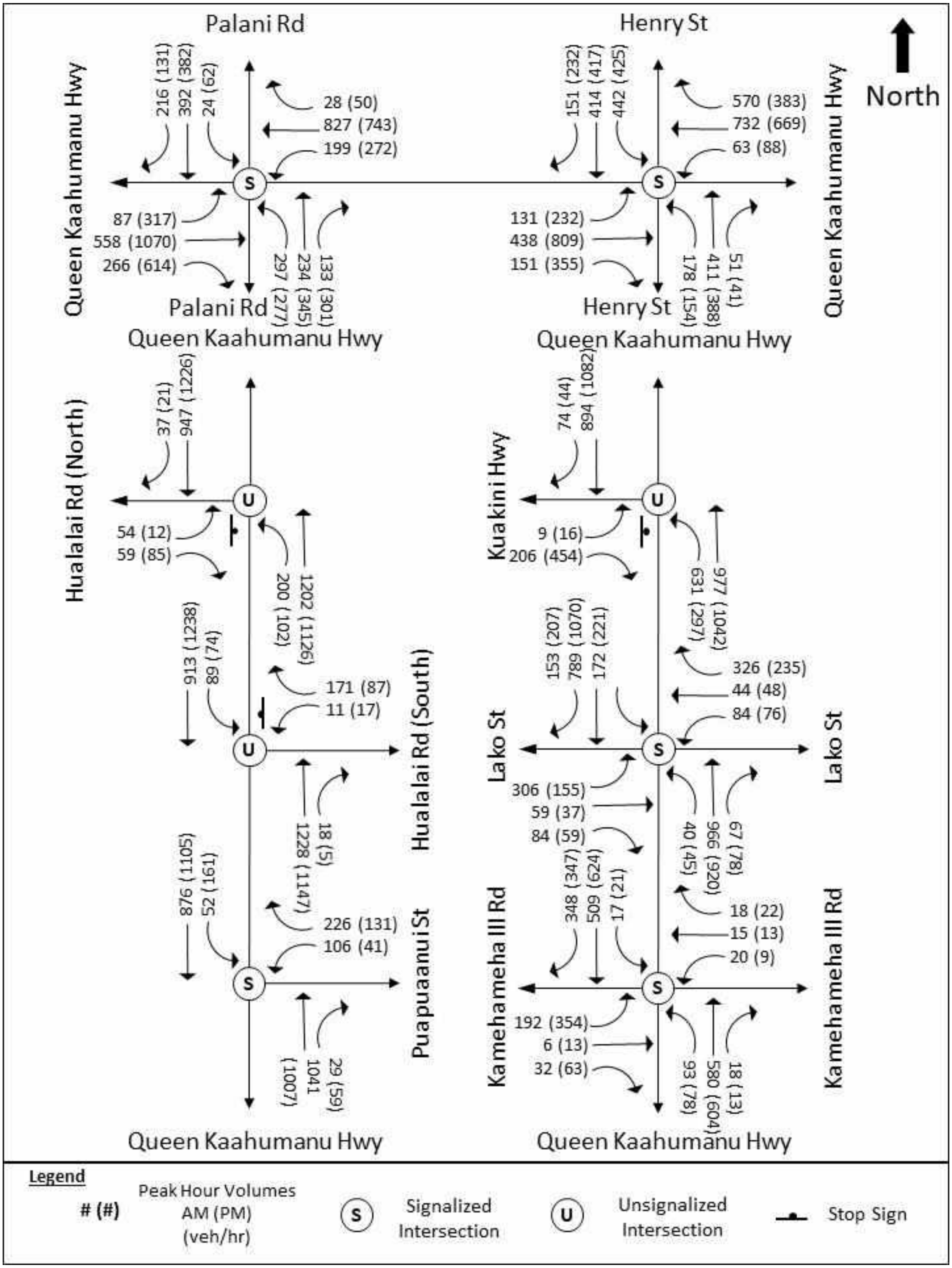

Figure 16: Future 2039 Without Project Peak Hour Volumes

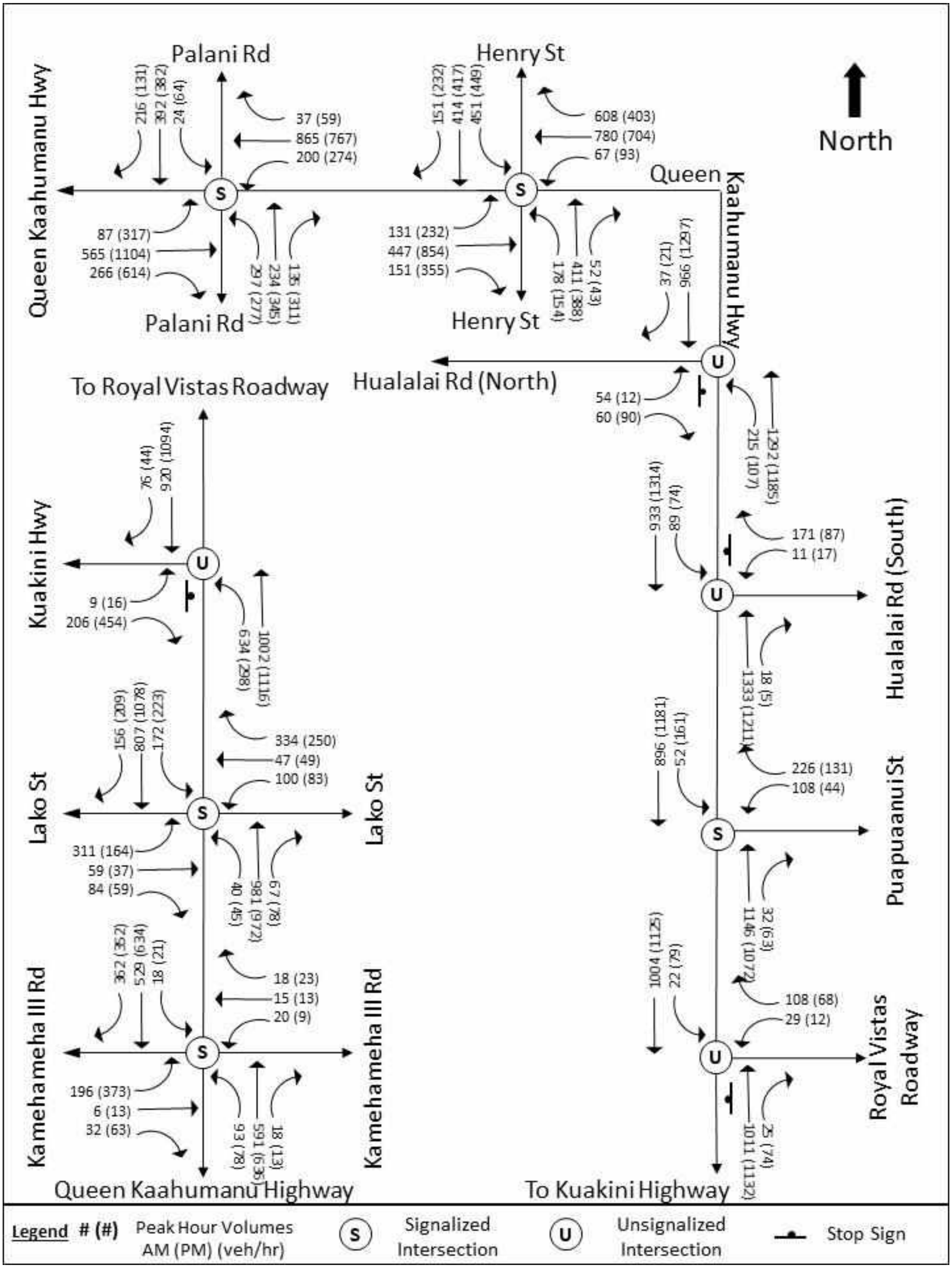

Figure 17: Future 2039 With Project Peak Hour Volumes

C. Future 2039 Intersection Traffic Operation Analysis

1. Future 2039 Without Project Intersection LOS

1. The 2039 Without Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours. NOTE: 2039 Future projections assume 1% annual growth rate for 20 years, which is a conservative assumption. Tables 25 and 26 show the existing vehicular delay and level of service at each intersection. Queen Kaahumanu Highway and Palani Road. Overall Intersection LOS = C/C.
   The PM southbound left turn operates at LOS E. At 62 vehicles in the PM peak hour, this results in about 1 vehicle per minute. This movement should clear every cycle. The increase in delay is based on the increase of the background traffic volume.
2. Queen Kaahumanu Highway and Henry Street. Overall Intersection LOS = D/D.
   The PM eastbound and westbound left turns operate at LOS E. The overall delay and LOS have gradually gotten worse due to the increase in background growth rate. The increase in delay is based on the increase in background volumes.
3. Queen Kaahumanu Highway and Hualalai Road (North)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Street (north), the delay at this intersection is 41 seconds per vehicle. This is due to the high delay in the eastbound left turn volume. The eastbound left turning movement has LOS F (v/c of 0.59 during the PM peak hour) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
4. Queen Kaahumanu Highway and Hualalai Road (South)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.46 and 0.76 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The westbound right turn also operates at LOS F (v/c of 0.97) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
5. Queen Kaahumanu Highway and Puapuaanui Street. Overall Intersection LOS = B/B.
   The southbound left turns operate at LOS E during both peak hours. The westbound left turn operates at LOS E during the PM peak hour. These delays are due to the cycle length. The left turn volumes are low and should clear every cycle.
6. Queen Kaahumanu Highway and Kuakini Highway
   At the unsignalized intersection of Queen Kaahumanu Highway with Kuakini Highway, eastbound left turning movement has LOS F and long delays during the AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
7. Queen Kaahumanu Highway and Lako Street. Overall Intersection LOS = E/D.
   At the signalized intersection of Queen Kaahumanu Highway with Lako Street, the eastbound left turn, northbound through, and southbound left turn operate at LOS F (v/c of 1.01, 1.1, and 0.99

respectively). The PM southbound through operates at LOS F (v/c of 1.03). The delay increase is caused by the volumes generated by the background volume and the split phasing.

8. Queen Kaahumanu Highway and Kamehameha III Road. Overall Intersection LOS = C/B.
   All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

Tables 25 and 26 show the expected vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Synchro output is in Appendix G.

Table 25: Future 2039 Without Project Intersection Level of Service

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Palani Rd (overall)	**26.3**	**-**	**C**	**31.1**	**-**	**C**
Queen Kaahumanu EB Left	41.4	0.53	D	44.2	0.80	D
Queen Kaahumanu EB Through	17.7	0.40	B	24.6	0.74	C
Queen Kaahumanu WB Left	40.8	0.71	D	45.3	0.78	D
Queen Kaahumanu WB Through	17.9	0.54	B	21.1	0.54	C
Palani NB Left	39.7	0.77	D	45.8	0.78	D
Palani NB Through	25.3	0.27	C	29.2	0.44	C
Palani SB Left	49.6	0.53	D	55.2	0.78	E
Palani SB Through	34.6	0.69	C	35.1	0.67	D
Queen Kaahumanu Hwy & Henry St (overall)	**37.5**	**0.74**	**D**	**38.9**	**0.78**	**D**
Queen Kaahumanu EB Left	53.9	0.67	D	65.5	0.84	E
Queen Kaahumanu EB Through	29.9	0.46	C	35.6	0.74	D
Queen Kaahumanu EB Right	25.7	0.10	C	26.8	0.23	C
Queen Kaahumanu WB Left	50.0	0.49	D	62.2	0.69	E
Queen Kaahumanu WB Through	40.8	0.80	D	39.0	0.73	D
Queen Kaahumanu WB Right	32.7	0.42	C	30.6	0.25	C
Henry NB Left	37.2	0.52	D	37.6	0.46	D
Henry NB Left-Through	38.9	0.65	D	39.9	0.64	D
Henry NB Right	32.2	0.04	C	33.4	0.03	C
Henry SB Left	43.4	0.79	D	46.0	0.82	D
Henry SB Left-Through-Right	37.8	0.77	D	37.8	0.77	D
Queen Kaahumanu Hwy & Hualalai (N) (overall)	**41.0**	**-**	**-**	**2.1**	**-**	**-**
Queen Kaahumanu NB Left	12.7	0.32	B	13.1	0.19	B
Hualalai EB Left	*	-	F	316.3	0.59	F
Queen Kaahumanu Hwy & Hualalai (S) (overall)	**9.2**	**-**	**-**	**3.7**	**-**	**-**
Queen Kaahumanu SB Left	13.7	0.19	B	12.3	0.13	B
Hualalai WB Left	229.1	0.46	F	345.7	0.76	F
Hualalai WB Right	109.5	0.97	F	30.3	0.39	D

*delay exceeds 1,000 seconds per vehicle

Table 26: Future 2039 Without Project Intersection Level of Service (continued)

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Puapuaanui St (overall)	**13.0**	**-**	**B**	**13.3**	**-**	**B**
Queen Kaahumanu SB Left	64.1	0.78	E	58.4	0.83	E
Queen Kaahumanu WB Through	4.8	0.62	A	4.6	0.70	A
Puapuaanui WB Left	54.5	0.79	D	57.1	0.67	E
Puapuaanui WB Right	13.0	0.80	B	13.8	0.79	B
Queen Kaahumanu Hwy & Kuakini Hwy (overall)	**11.3**	**-**	**-**	**8.6**	**-**	**-**
Queen Kaahumanu NB Left	46.0	0.95	E	15.8	0.48	C
Kuakini EB Left	*	-	-	*	-	F
Queen Kaahumanu Hwy & Lako St (overall)	**64.6**	**-**	**E**	**48.8**	**-**	**D**
Queen Kaahumanu NB Left	18.2	0.19	B	22.6	0.32	C
Queen Kaahumanu NB Through	85.1	1.10	F	44.8	0.98	D
Queen Kaahumanu SB Left	93.0	0.99	F	57.0	0.90	E
Queen Kaahumanu SB Through	29.4	0.85	C	52.9	1.03	F
Lako EB Left	92.7	1.01	F	46.1	0.80	D
Lako EB Through-Right	34.6	0.19	C	36.5	0.18	D
Lako WB Left	51.6	0.70	D	47.7	0.67	D
Lako WB Through-Right	45.3	0.35	D	42.8	0.41	D
Queen Kaahumanu Hwy & Kam III Rd (overall)	**20.4**	**-**	**C**	**28.3**	**-**	**B**
Queen Kaahumanu NB Left	42.0	0.79	D	51.0	0.78	D
Queen Kaahumanu NB Through	17.0	0.70	B	25.7	0.78	C
Queen Kaahumanu SB Left	42.6	0.48	D	47.9	0.51	D
Queen Kaahumanu SB Through	12.6	0.35	B	17.8	0.44	B
Kamehameha EB Left-Through	32.1	0.76	C	41.9	0.88	D
Kamehameha WB Left-Through-Right	44.7	0.73	D	49.3	0.68	D

*delay exceeds 1,000 seconds per vehicle

2. Future 2039 With Project Intersection LOS

Existing intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours.

1. Queen Kaahumanu Highway and Palani Road. Overall Intersection LOS = C/C.
   All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.
2. Queen Kaahumanu Highway and Henry Street. Overall Intersection LOS = D/D.
   All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

3. Queen Kaahumanu Highway and Hualalai Road (North)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Street (north), the delay at this intersection is 50.6 seconds per vehicle, a slight increase from the 2039 Without Project scenario. The eastbound left turning movement has LOS F (v/c of 0.73 in the PM peak hour) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
4. Queen Kaahumanu Highway and Hualalai Road (South)
   At the unsignalized intersection of Queen Kaahumanu Highway with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.56 and 0.97 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Queen Kaahumanu Highway. The westbound right turn also operates at LOS F (v/c of 1.14) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
5. Queen Kaahumanu Highway and Puapuaanui Street. Overall Intersection LOS = B/B.
   The southbound left turns operate at LOS F (v/c of 0.78 and 0.87, respectively) during the AM and PM peak hours. The westbound left turn operates at LOS F (v/c of 0.77) during the PM peak hour. These delays are due to the cycle length. The left turn volumes are low and should clear every cycle.
6. Queen Kaahumanu Highway and Royal Vistas Roadway
   At the proposed unsignalized intersection of Queen Kaahumanu Highway and the Royal Vistas Roadway, the southbound left turn movement from Queen Kaahumanu Highway into Royal Vistas Roadway functions well, with minimal delay, an average of 11 to 13 seconds during both peak hours. The westbound left turning movement has LOS F (v/c of 0.70 and 0.69 respectively) during both AM (29 vehicles) and PM (12 vehicles) peak hours are due to high through volumes on Queen Kaahumanu Highway. Phase 2 left turns exiting Royal Vistas are expected to use Lako Street to access Queen Kaahumanu Highway. The intersection functions acceptably, with an average of 4.1 seconds of delay per vehicle in the AM peak hour and 2.9 seconds of delay per vehicle in the PM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
7. Queen Kaahumanu Highway and Kuakini Highway
   At the unsignalized intersection of Queen Kaahumanu Highway with Kuakini Highway, the eastbound left turning movement has LOS F during the AM and PM peak hours. The northbound left turn operates at LOS F (v/c 0.98) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.
8. Queen Kaahumanu Highway and Lako Street. Overall Intersection LOS = E/D.
   The overall intersection operates at LOS E during the AM peak hour and LOS D during the PM peak hour. The delay is due to the increase in background volume, the traffic generated by Royal Vistas, and the split phasing. During the AM peak hour, the eastbound left turn, northbound through, and southbound left turn operate at LOS F (v/c of 1.04, 1.05, and 1.11 respectively). The PM eastbound left turn operates at LOS F (v/c of 0.87).
9. Queen Kaahumanu Highway and Kamehameha III Road. Overall Intersection LOS = C/C.

All movements at the signalized intersections of Queen Kaahumanu Highway with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

Tables 27 and 28 show the expected vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Synchro output is in Appendix I.

Table 27: Future 2039 With Project Intersection Level of Service

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Palani Rd (overall)	**26.3**	**-**	**C**	**31.3**	**-**	**C**
Queen Kaahumanu EB Left	41.4	0.53	D	44.3	0.80	D
Queen Kaahumanu EB Through	17.8	0.41	B	25.4	0.77	C
Queen Kaahumanu WB Left	40.8	0.71	D	45.5	0.78	D
Queen Kaahumanu WB Through	18.3	0.56	B	21.4	0.56	C
Palani NB Left	39.7	0.77	D	45.8	0.78	D
Palani NB Through	25.3	0.27	C	29.3	0.44	C
Palani SB Left	49.6	0.53	D	54.7	0.77	D
Palani SB Through	34.6	0.69	C	35.1	0.67	D
Queen Kaahumanu Hwy & Henry St (overall)	**38.6**	**0.76**	**D**	**40.2**	**0.80**	**D**
Queen Kaahumanu EB Left	53.9	0.67	D	64.6	0.84	E
Queen Kaahumanu EB Through	30.2	0.47	C	41.4	0.84	D
Queen Kaahumanu EB Right	25.8	0.10	C	28.1	0.23	C
Queen Kaahumanu WB Left	50.6	0.51	D	51.3	0.56	D
Queen Kaahumanu WB Through	44.3	0.85	D	42.4	0.80	D
Queen Kaahumanu WB Right	35.0	0.51	D	31.4	0.26	C
Henry NB Left	37.2	0.52	D	37.3	0.46	D
Henry NB Left-Through	38.9	0.65	D	39.6	0.63	D
Henry NB Right	32.2	0.04	C	33.2	0.03	C
Henry SB Left	43.4	0.79	D	44.6	0.82	D
Henry SB Left-Through-Right	38.0	0.78	D	37.2	0.77	D
Queen Kaahumanu Hwy & Hualalai (N) (overall)	**50.6**	**-**	**-**	**2.5**	**-**	**-**
Queen Kaahumanu NB Left	13.2	0.35	B	13.9	0.21	B
Hualalai EB Left	*	-	F	425.9	0.73	F
Queen Kaahumanu Hwy & Hualalai (S) (overall)	**13.1**	**-**	**-**	**4.6**	**-**	**-**
Queen Kaahumanu SB Left	14.8	0.21	B	12.8	0.14	B
Hualalai WB Left	308.6	0.56	F	495.2	0.97	F
Hualalai WB Right	168.4	1.14	F	34.3	0.43	D

*delay exceeds 1,000 seconds per vehicle

Table 28: Future 2039 With Project Intersection Level of Service (continued)

Intersection	AM			PM		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
Queen Kaahumanu Hwy & Puapuaanui St (overall)	**15.7**	**-**	**B**	**15.3**	**-**	**B**
Queen Kaahumanu SB Left	91.4	0.78	F	82.9	0.87	F
Queen Kaahumanu WB Through	4.9	0.62	A	4.6	0.72	A
Puapuaanui WB Left	65.6	0.81	E	84.3	0.77	F
Puapuaanui WB Right	16.1	0.85	B	14.0	0.78	B
Queen Kaahumanu Hwy & Kona Vista Rdwy (overall)	**4.1**	**-**	**-**	**2.9**	**-**	**-**
Queen Kaahumanu SB Left	10.9	0.04	B	12.5	0.15	B
Kona Vista WB Left	190.1	0.70	F	375.9	0.69	F
Kona Vista WB Right	30.1	0.46	D	29.9	0.34	D
Queen Kaahumanu Hwy & Kuakini Hwy (overall)	**12.7**	**-**	**-**	**9.3**	**-**	**-**
Queen Kaahumanu NB Left	52.8	0.98	F	16.1	0.49	C
Kuakini EB Left	*	-	-	*	-	F
Queen Kaahumanu Hwy & Lako St (overall)	**65.7**	**-**	**E**	**37.0**	**-**	**D**
Queen Kaahumanu NB Left	20.1	0.19	C	25.9	0.26	C
Queen Kaahumanu NB Through	72.4	1.05	F	29.0	0.86	C
Queen Kaahumanu SB Left	141.3	1.11	F	46.1	0.87	D
Queen Kaahumanu SB Through	29.2	0.83	C	30.6	0.91	C
Lako EB Left	109.6	1.04	F	85.9	0.87	F
Lako EB Through-Right	42.1	0.19	D	55.7	0.19	E
Lako WB Left	62.3	0.76	E	73.0	0.76	E
Lako WB Through-Right	53.6	0.34	D	64.5	0.44	E
Queen Kaahumanu Hwy & Kam III Rd (overall)	**22.5**	**-**	**C**	**33.1**	**-**	**C**
Queen Kaahumanu NB Left	53.6	0.80	D	66.8	0.79	E
Queen Kaahumanu NB Through	14.9	0.61	B	25.8	0.71	C
Queen Kaahumanu SB Left	55.9	0.51	E	67.8	0.56	E
Queen Kaahumanu SB Through	12.4	0.31	B	19.8	0.39	B
Kamehameha EB Left-Through	44.4	0.81	D	53.5	0.90	D
Kamehameha WB Left-Through-Right	60.4	0.78	E	73.2	0.77	E

*delay exceeds 1,000 seconds per vehicle

3. 2039 Traffic Signal Warrant

Table 29 shows the Peak-Hour warrant analysis in 2039 with and without the project. The Traffic Signal Warrant analysis can be found in Appendix J.

1. Queen Kaahumanu Highway and Hualalai Road (North)
   This intersection passes the Peak-Hour warrant in the AM and PM peak hour with and without the project.

2. Queen Kaahumanu Highway and Hualalai Road (South)
   This intersection passes the Peak-Hour warrant in the AM peak hour with and without the project.
3. Queen Kaahumanu Highway and Kuakini Highway
   This intersection passes the Peak-Hour warrant in the AM and PM peak hour with and without the project.

Table 29: 2039 Peak-Hour Warrant

2039 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	947	200	YES	1226	102	YES
Hualalai (S)	1228	89	YES	1147	74	NO
Kuakini	894	631	YES	1082	297	YES
2039 With Project	**Peak Hour Warrant**					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	966	215	YES	1297	107	YES
Hualalai (S)	1333	89	YES	1212	74	NO
Kuakini	894	639	YES	1082	300	YES

4. 2039 With Project Segment LOS

Arterial LOS was analyzed in Synchro on Queen Kaahumanu Highway from Hualalai (north) to Lako Street. Where signalized intersections are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities. For Urban Street Facilities, through-vehicle travel speed is used to analyze vehicular LOS. Analysis worksheets can be found in Appendix I. The arterial LOS can be found in Table 30.

This segment of Queen Kaahumanu Highway operates at LOS D in the northbound direction and LOS B in the southbound direction in the AM peak hour. During the PM peak hour, both directions operate at LOS C. The arterial LOS for the AM and PM peak hours satisfies the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding “acceptable level of service” for transportation facilities.

Table 30: 2039 with Project Segment LOS

	Northbound		Southbound	
	Speed (mph)	LOS	Speed (mph)	LOS
AM Peak Hour	15.6	D	24.2	B
PM Peak Hour	18.6	C	23.6	C

VI. SUMMARY AND RECOMMENDATIONS

The *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (July 2014) includes improvements to Kuakini Highway from Henry Street to Kamehameha III Road. Kuakini Highway will be widened by 2 travel lanes and include bicycle facilities and sidewalks. This project would have a significant impact on traffic operations. The installation of bike facilities and pedestrian facilities may lead to an increase in bicycle and pedestrian traffic, in which case bicycle and pedestrian safety will need to be further analyzed. Due to the difficulty of crossing a 4-lane roadway with a posted speed limit of 45 MPH, stop-controlled intersections may need to be signalized or converted to roundabouts.

Based on the existing traffic volumes and future projections of Royal Vistas on the surrounding roadways, the following system-wide intersection improvements are recommended for consideration by Hawaii County and HDOT:

1. Queen Kaahumanu Highway and Palani Road
   Signal timing should be monitored and updated to ensure that left turn queues clear every cycle.
2. Queen Kaahumanu Highway and Henry Street
   Signal timing should be monitored and updated to ensure that left turn queues clear every cycle. Henry Street approaches currently operate in split phases. Changing the split phasing to protected left turn phases on Henry Street will allow more green time on the major through movements, lowering the overall delay of the intersection.
3. Queen Kaahumanu Highway and Hualalai Road (North)
   Based on the 2019 traffic volumes, this intersection passes the Four-Hour warrant. This intersection passed the Peak-Hour warrant in the 2019 AM peak hour and for all peak hours in all future scenarios. Future traffic should be monitored, and a traffic signal or roundabout should be installed if needed, but priority should be given to keeping Queen Kaahumanu Highway traffic moving and not installing a traffic signal if not warranted by 4- or 8-hour warrants. The overall delay at this intersection is 41.0 and 50.6 seconds per vehicle in the 2039 AM peak hour, without and with the project, respectively. When the delay experienced by drivers reaches this level, the eastbound drivers are likely to find alternative routes.
4. Queen Kaahumanu Highway and Hualalai Road (South)
   As the westbound left turn delay gets worse, drivers may decide to use Puapuaanui Street to access Queen Kaahumanu Highway in the southbound direction. Based on the existing volumes, this intersection did not pass the Four-Hour warrant or the Peak-Hour warrant. This intersection did pass the Peak-Hour warrant for all future AM peak hour scenarios. Future traffic should be monitored.
5. Queen Kaahumanu Highway and Puapuaanui Street
   Signal timing should be monitored and adjusted as needed to increase the probability that queues on Queen Kaahumanu Highway can clear the intersection in 1 cycle.
6. Queen Kaahumanu Highway and Royal Vistas Roadway
   This intersection will function acceptably through the full Phase 1 buildout. Before any Phase 2 residences are occupied, it is recommended that the connection to Kekuanao'a Place is completed so that Royal Vistas Phase 2 'left out' traffic can access the Lako Street traffic signal.
7. Queen Kaahumanu Highway and Kuakini Highway

This intersection passes the Four-Hour warrant and Peak-Hour warrants during all peak hours for all scenarios. Future traffic should be monitored, and a traffic signal or roundabout should be installed if needed. The northbound left turn movement is very heavy (300-600 veh/hour by 2039 with project), which will be nearly at capacity. The westbound left turn, while small, is already over capacity in 2019 and will be far over capacity by 2039. Royal Vistas traffic has very little effect on this intersection.

8. Queen Kaahumanu Highway and Lako Street
   The Lako Street intersection operates at LOS E/D (AM/PM) with or without the Royal Vistas project in the 2039 scenario. Lako Street currently has split phasing (sequential rather than concurrent) on the Lako Street approaches. Changing the phasing from split to protected left turns would help lower the delay. This intersection would also improve significantly if Queen Kaahumanu Highway is widened to 4 lanes as in the 2035 Transportation Plan.
9. Queen Kaahumanu Highway and Kamehameha III Road
   Signal timing should be monitored and updated as needed.

Arterial LOS was analyzed in Synchro on Queen Kaahumanu Highway from Hualalai (north) to Lako Street. Where signalized intersections are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities. For Urban Street Facilities, through-vehicle travel speed is used to analyze vehicular LOS. This segment of Queen Kaahumanu Highway operates at LOS D or better for each scenario in the AM and PM peak hours. The arterial LOS satisfies the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding “acceptable level of service” for transportation facilities.

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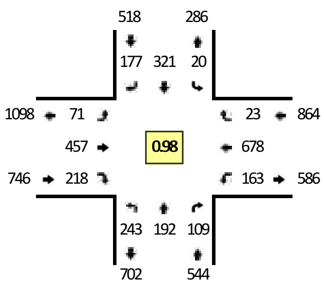
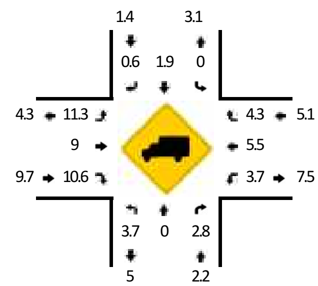
Appendix A

24-Hour and Peak Period Turn Movement Traffic Counts

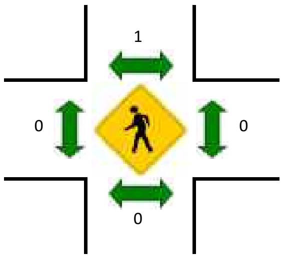
LOCATION: Palani Rd -- Hawaii Belt Rd **QC JOB #:** 14972601
CITY/STATE: Hawaii, HI **DATE:** Tue, Apr 30 2019

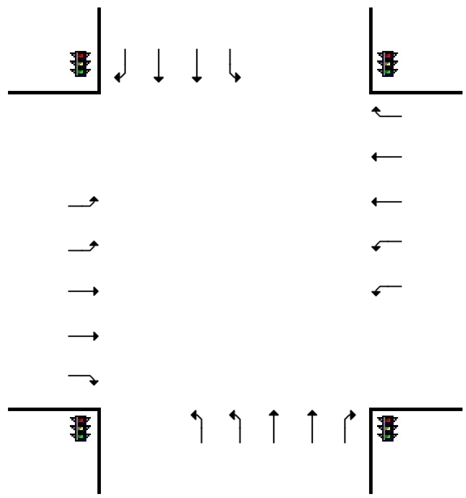


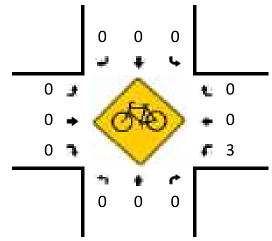
Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

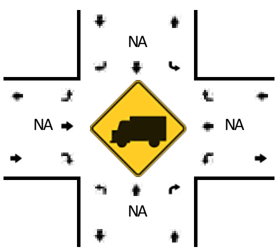


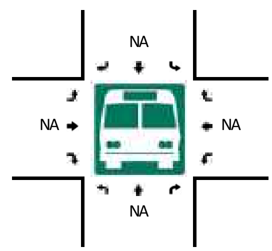
Quality Counts
DATA THAT DRIVES COMMUNITIES











15-Min Count Period Beginning At	Palani Rd (Northbound)				Palani Rd (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:45 AM	48	18	28	0	7	57	28	0	17	76	31	0	48	175	2	0	535	
7:00 AM	51	35	26	1	5	55	17	0	11	91	38	0	36	179	3	0	548	
7:15 AM	51	39	27	0	4	78	33	1	20	122	38	0	41	157	1	0	612	
7:30 AM	54	51	26	0	8	91	38	0	13	131	58	0	40	163	11	0	684	2379
7:45 AM	63	55	28	0	1	80	49	0	23	102	59	0	45	144	7	0	656	2500
8:00 AM	68	39	29	0	7	70	51	0	12	111	53	0	44	184	3	0	671	2623
8:15 AM	58	34	27	0	5	61	29	0	22	129	51	0	38	223	5	0	682	2693
8:30 AM	55	48	35	0	8	69	28	0	25	136	75	0	61	187	4	0	731	2740

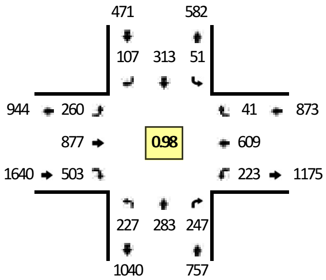
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	216	204	104	0	32	364	152	0	52	524	232	0	160	652	44	0	2736
Heavy Trucks	8	0	0		0	8	0		4	52	28		0	28	0		128
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Type of peak hour being reported: User-Defined | Method for determining peak hour: Total Entering Volume

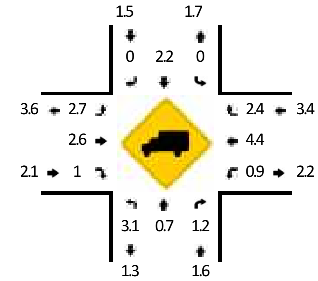
LOCATION: Palani Rd -- Hawaii Belt Rd | **QC JOB #:** 14972602

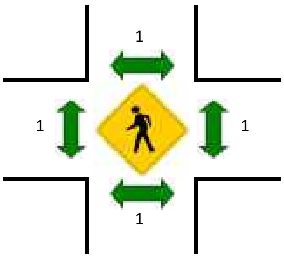
CITY/STATE: Hawaii, HI | **DATE:** Tue, Apr 30 2019

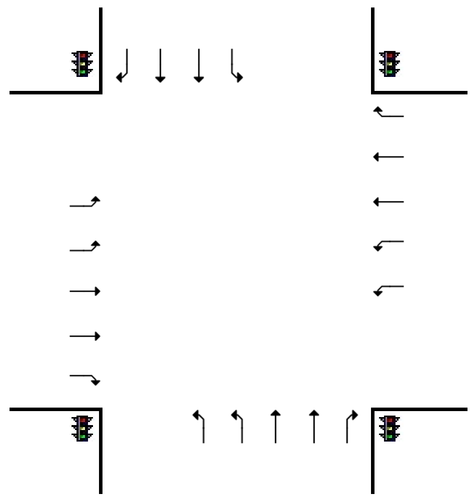


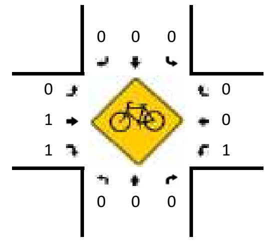
Peak-Hour: 3:45 PM -- 4:45 PM

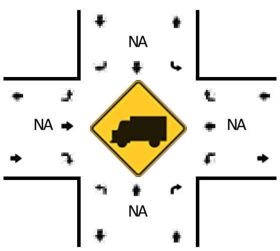
Peak 15-Min: 3:45 PM -- 4:00 PM

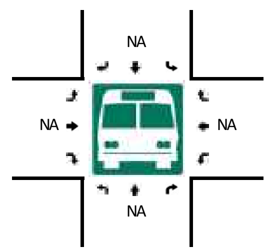












15-Min Count Period Beginning At	Palani Rd (Northbound) Left	Thru	Right	U	Palani Rd (Southbound) Left	Thru	Right	U	Hawaii Belt Rd (Eastbound) Left	Thru	Right	U	Hawaii Belt Rd (Westbound) Left	Thru	Right	U	Total	Hourly Totals
3:00 PM	66	67	66	0	10	102	35	1	52	189	93	0	54	184	18	0	937	
3:15 PM	56	76	61	0	13	84	29	0	46	175	115	1	55	156	8	0	875	
3:30 PM	77	61	59	0	15	94	27	0	53	193	114	0	52	158	4	0	907	
3:45 PM	55	82	65	0	21	93	29	0	55	198	131	1	56	154	11	0	951	3670
4:00 PM	52	57	48	1	9	74	27	0	80	227	129	0	56	172	9	0	941	3674
4:15 PM	73	69	61	0	12	79	32	0	60	213	134	0	56	138	6	0	933	3732
4:30 PM	46	75	73	0	9	67	19	0	63	239	109	1	55	145	15	0	916	3741
4:45 PM	59	71	63	0	16	94	37	0	65	176	123	0	52	114	17	0	887	3677
5:00 PM	67	79	57	1	11	69	36	0	63	225	111	2	47	155	8	1	932	3668
5:15 PM	64	68	66	0	4	91	34	0	66	176	101	0	63	142	8	0	883	3618
5:30 PM	47	75	55	0	3	66	19	0	46	166	94	0	57	120	8	0	756	3458
5:45 PM	51	88	50	0	7	59	13	0	38	164	69	1	41	101	9	0	691	3262

Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	220	328	260	0	84	372	116	0	220	792	524	4	224	616	44	0	3804
Heavy Trucks	16	0	4		0	8	0		12	20	8		0	44	0		112
Pedestrians		0				4				4				4			12
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

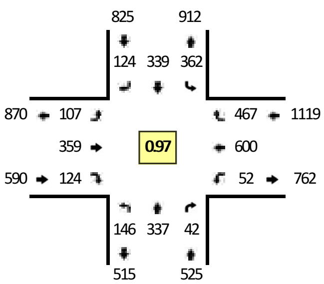
Report generated on 5/13/2019 3:06 PM

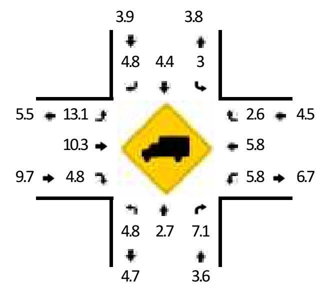
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

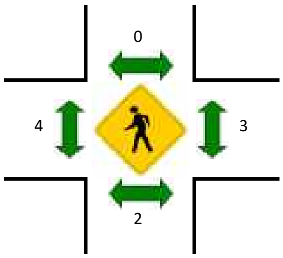
Type of peak hour being reported: User-Defined — Method for determining peak hour: Total Entering Volume

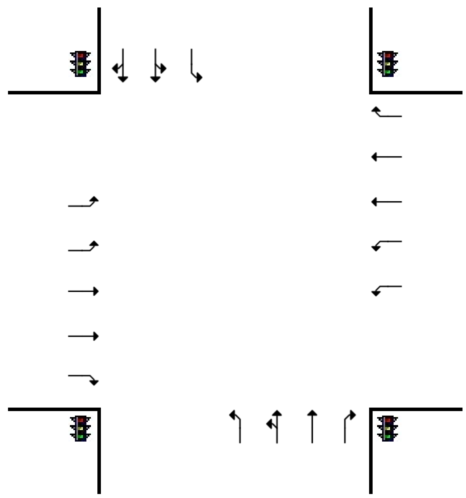
LOCATION: Henry St -- Hawaii Belt Rd — **QC JOB #:** 14972603
CITY/STATE: Hawaii, HI — **DATE:** Tue, Apr 30 2019

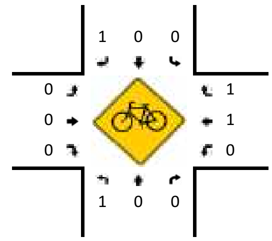
Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 8:15 AM -- 8:30 AM

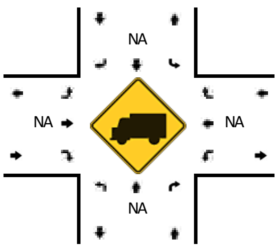


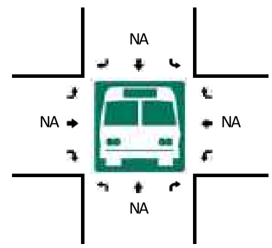












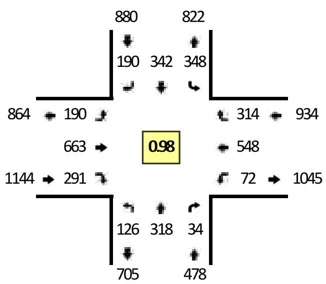
15-Min Count Period Beginning At	Henry St (Northbound)				Henry St (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:45 AM	31	57	5	0	77	48	26	0	16	77	23	0	13	162	103	0	638	
7:00 AM	32	40	13	0	109	69	20	0	19	86	16	0	7	170	89	0	670	
7:15 AM	44	81	8	0	112	78	25	0	27	107	18	0	8	138	132	0	778	
7:30 AM	24	81	7	0	78	68	35	0	32	105	40	0	14	160	124	0	768	2854
7:45 AM	34	82	7	0	82	93	31	1	23	79	27	0	14	142	110	0	725	2941
8:00 AM	40	83	15	0	86	85	26	0	27	93	30	0	15	165	117	0	782	3053
8:15 AM	50	81	12	0	89	77	37	0	25	97	37	0	19	184	86	0	794	3069
8:30 AM	46	68	14	0	84	63	40	0	45	90	35	0	16	163	91	0	755	3056

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	200	324	48	0	356	308	148	0	100	388	148	0	76	736	344	0	3176
Heavy Trucks	4	16	4		12	8	0		0	36	16		4	44	20		164
Pedestrians		0				0				12				4			16
Bicycles	0	0	0		0	0	0		0	0	0		0	0	2		2
Railroad																	
Stopped Buses																	

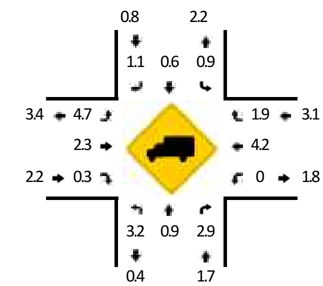
Comments:

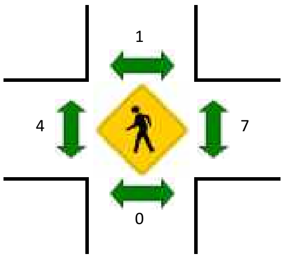
Report generated on 5/13/2019 3:10 PM — SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

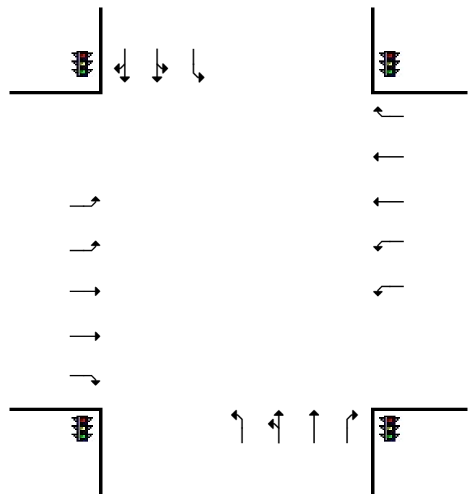
LOCATION: Henry St -- Hawaii Belt Rd **QC JOB #:** 14972604
CITY/STATE: Hawaii, HI **DATE:** Tue, Apr 30 2019

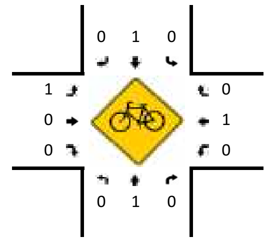


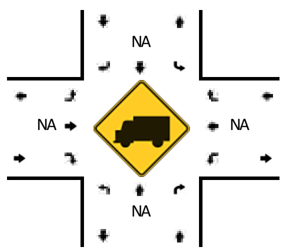
Peak-Hour: 3:45 PM -- 4:45 PM
Peak 15-Min: 3:45 PM -- 4:00 PM

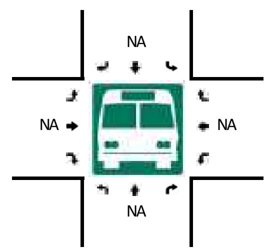












15-Min Count Period Beginning At	Henry St (Northbound)				Henry St (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	43	74	9	0	91	93	61	0	48	148	51	0	8	152	85	0	863	
3:15 PM	29	95	9	0	110	83	52	0	46	156	54	0	18	143	76	0	871	
3:30 PM	42	85	20	0	84	73	41	0	56	156	58	0	29	145	82	0	871	
3:45 PM	31	72	12	0	99	80	51	0	45	182	67	0	17	147	74	0	877	3482
4:00 PM	36	71	7	0	80	94	54	0	40	161	69	0	14	127	73	0	826	3445
4:15 PM	29	88	6	0	88	70	34	0	51	164	73	0	25	148	84	0	860	3434
4:30 PM	30	87	9	0	81	98	51	0	54	156	82	0	16	126	83	0	873	3436
4:45 PM	28	80	6	0	87	80	47	0	55	168	64	0	10	119	85	0	829	3388
5:00 PM	30	85	7	0	87	82	54	0	40	154	72	0	8	123	80	0	822	3384
5:15 PM	23	88	13	0	78	78	55	0	49	162	51	0	12	127	80	0	816	3340
5:30 PM	27	63	8	0	82	61	45	0	41	150	36	0	12	118	53	0	696	3163
5:45 PM	18	76	4	0	78	68	27	0	48	143	40	0	5	101	77	0	685	3019

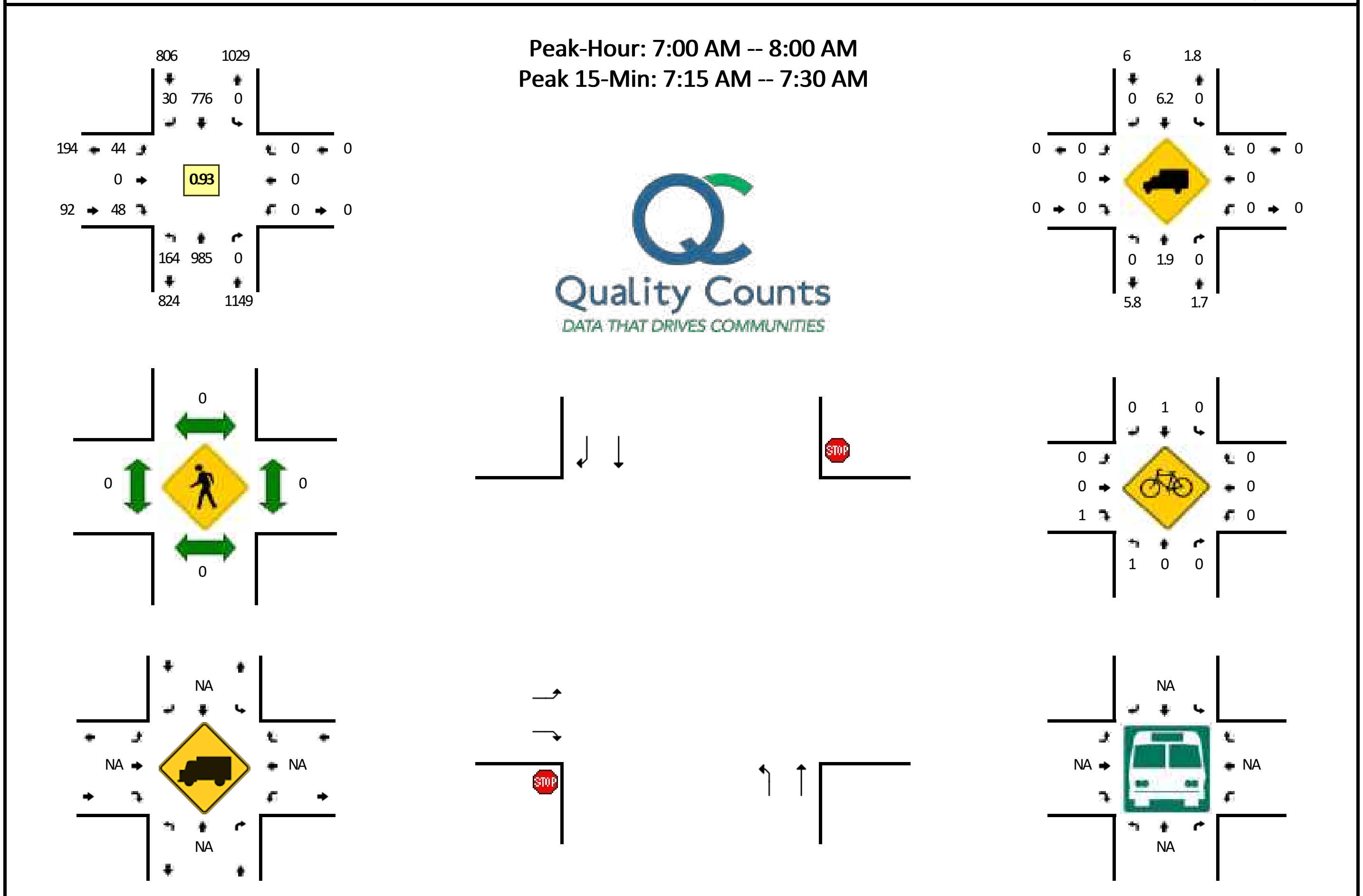
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	124	288	48	0	396	320	204	0	180	728	268	0	68	588	296	0	3508
Heavy Trucks	8	0	0		4	4	0		4	12	0		0	36	0		68
Pedestrians		0				0				8				12			20
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/13/2019 3:06 PM SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: System Peak | Method for determining peak hour: Total Entering Volume

LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Northern Most) | **QC JOB #:** 15039901
CITY/STATE: Kailua, HI | **DATE:** Thu, Aug 29 2019



15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Northern Most) (Eastbound)				Hualalai Rd (Northern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	28	239	0	0	0	190	4	0	5	0	6	0	0	0	0	0	472	
7:15 AM	36	263	0	0	0	212	11	0	9	0	18	0	0	0	0	0	549	
7:30 AM	32	260	0	0	0	198	8	0	24	0	14	0	0	0	0	0	536	
7:45 AM	68	223	0	0	0	176	7	0	6	0	10	0	0	0	0	0	490	2047
8:00 AM	38	229	0	0	0	164	4	0	0	0	7	0	0	0	0	0	442	2017
8:15 AM	36	232	0	0	0	168	3	0	2	0	13	0	0	0	0	0	454	1922
8:30 AM	34	231	0	1	0	178	1	0	0	0	16	1	0	0	0	0	462	1848
8:45 AM	37	254	0	0	0	182	2	0	0	0	12	0	0	0	0	0	487	1845

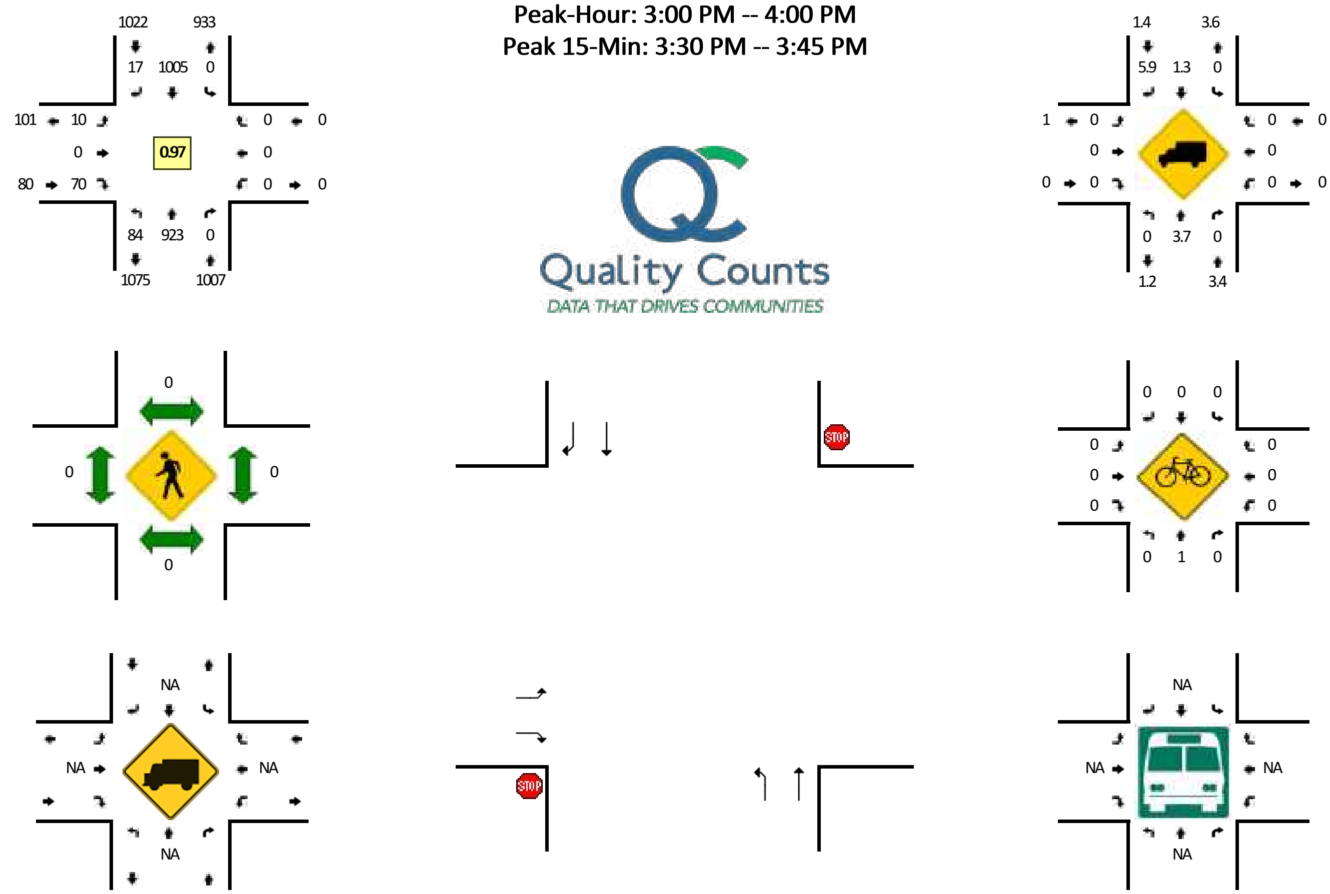
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	144	1052	0	0	0	848	44	0	36	0	72	0	0	0	0	0	2196
Heavy Trucks	0	24	0		0	40	0		0	0	0		0	0	0		64
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/12/2019 10:40 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Northern Most) **QC JOB #:** 15039902
CITY/STATE: Kailua, HI **DATE:** Thu, Aug 29 2019

Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:30 PM -- 3:45 PM



15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Northern Most) (Eastbound)				Hualalai Rd (Northern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	27	219	0	0	0	247	5	0	3	0	24	0	0	0	0	0	525	
3:15 PM	9	227	0	0	0	259	4	0	4	0	18	0	0	0	0	0	521	
3:30 PM	22	261	0	0	0	242	3	0	0	0	18	0	0	0	0	0	546	
3:45 PM	26	216	0	0	0	257	5	0	3	0	10	0	0	0	0	0	517	2109
4:00 PM	14	205	0	0	0	268	4	0	1	0	31	0	0	0	0	0	523	2107
4:15 PM	22	221	0	0	0	226	4	0	3	0	23	0	0	0	0	0	499	2085
4:30 PM	14	198	0	0	0	200	2	0	5	0	21	0	0	0	0	0	440	1979
4:45 PM	24	218	0	0	0	232	1	0	5	0	27	0	0	0	0	0	507	1969
5:00 PM	12	178	0	0	0	257	6	0	3	0	30	0	0	0	0	0	486	1932
5:15 PM	17	209	0	0	0	252	2	0	4	0	29	0	0	0	0	0	513	1946
5:30 PM	16	195	0	0	0	225	3	0	0	0	11	0	0	0	0	0	450	1956
5:45 PM	13	141	0	0	0	252	3	0	0	0	16	0	0	0	0	0	425	1874

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	88	1044	0	0	0	968	12	0	0	0	72	0	0	0	0	0	2184
Heavy Trucks	0	56	0		0	8	0		0	0	0		0	0	0		64
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

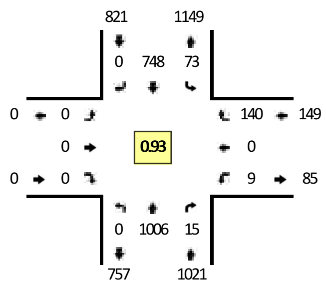
Comments:

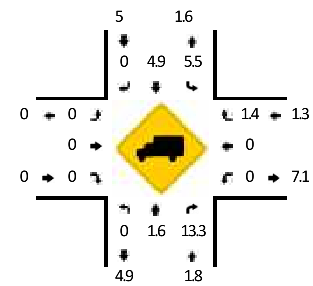
Report generated on 9/12/2019 10:43 AM SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

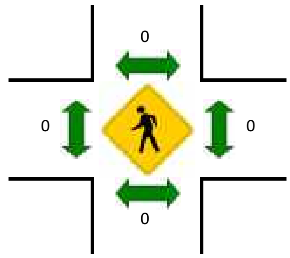
Type of peak hour being reported: System Peak | Method for determining peak hour: Total Entering Volume

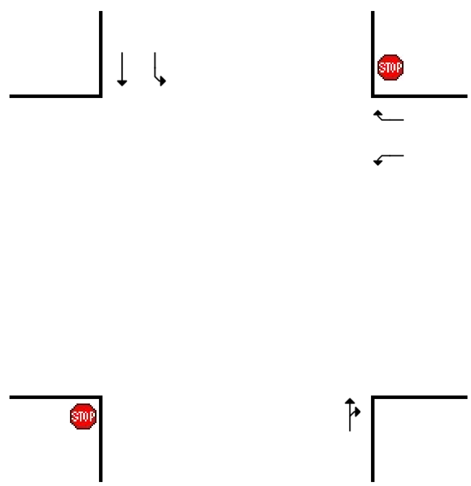
LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Southern Most) **QC JOB #:** 15039911
CITY/STATE: Kailua, HI **DATE:** Thu, Aug 29 2019

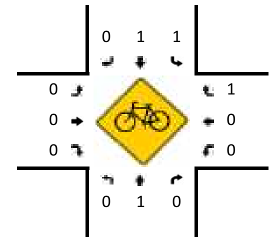
Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

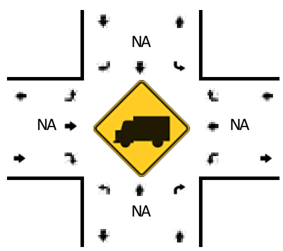


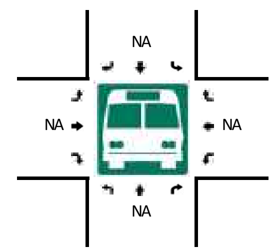












15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Southern Most) (Eastbound)				Hualalai Rd (Southern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	241	3	0	9	183	0	0	0	0	0	0	0	0	12	0	448	
7:15 AM	0	267	3	0	23	191	0	3	0	0	0	0	1	0	35	0	523	
7:30 AM	0	267	8	0	23	193	0	0	0	0	0	0	7	0	37	0	535	
7:45 AM	0	231	1	0	15	181	0	0	0	0	0	0	1	0	56	0	485	1991
8:00 AM	0	239	0	0	5	172	0	1	0	0	0	0	2	0	20	0	439	1982
8:15 AM	0	260	1	0	5	172	0	0	0	0	0	0	1	0	13	0	452	1911
8:30 AM	0	249	1	0	5	192	0	0	0	0	0	0	2	0	17	0	466	1842
8:45 AM	0	282	0	0	11	177	0	0	0	0	0	0	1	0	10	0	481	1838

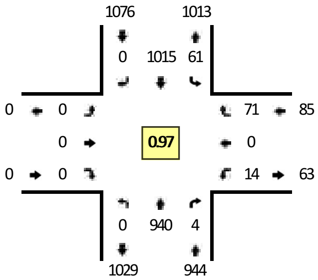
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1068	32	0	92	772	0	0	0	0	0	0	28	0	148	0	2140
Heavy Trucks	0	4	4		8	32	0		0	0	0		0	0	4		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		1	0	0		0	0	0		0	0	1		2
Railroad																	
Stopped Buses																	

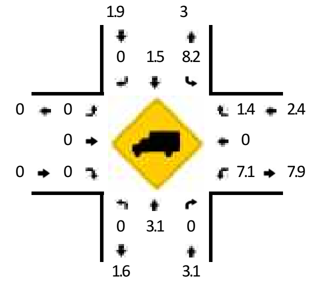
Comments:

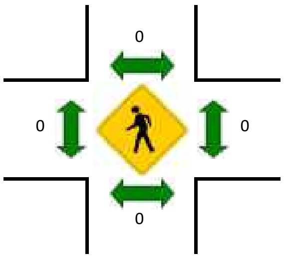
Report generated on 9/12/2019 10:40 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

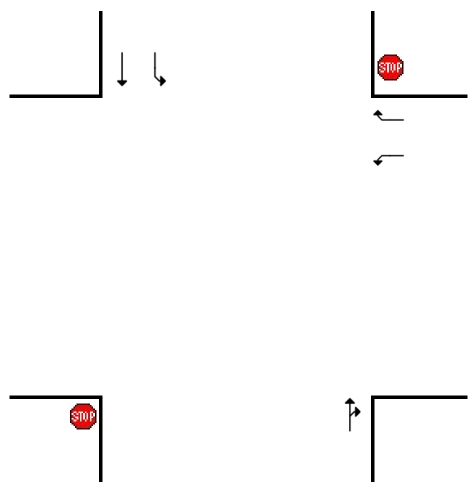
LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Southern Most) **QC JOB #:** 15039912
CITY/STATE: Kailua, HI **DATE:** Thu, Aug 29 2019

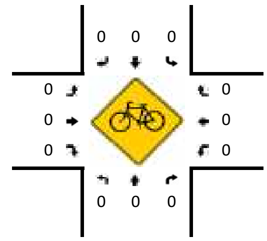
Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:00 PM -- 3:15 PM

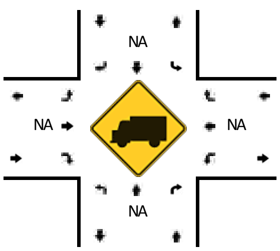


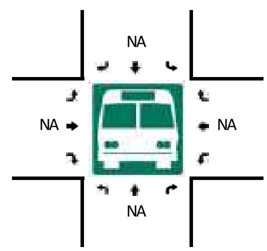












15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Southern Most) (Eastbound)				Hualalai Rd (Southern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	242	0	0	14	258	0	1	0	0	0	0	5	0	21	0	541	
3:15 PM	0	217	2	0	17	266	0	0	0	0	0	0	4	0	13	0	519	
3:30 PM	0	259	1	0	14	246	0	0	0	0	0	0	1	0	19	0	540	
3:45 PM	0	222	1	0	14	245	0	1	0	0	0	0	4	0	18	0	505	2105
4:00 PM	0	202	0	0	25	272	0	0	0	0	0	0	1	0	11	0	511	2075
4:15 PM	0	242	1	0	10	244	0	0	0	0	0	0	2	0	6	0	505	2061
4:30 PM	0	207	2	0	14	206	0	0	0	0	0	0	1	0	11	0	441	1962
4:45 PM	0	213	5	0	15	250	0	0	0	0	0	0	0	0	14	0	497	1954
5:00 PM	0	199	1	0	18	265	0	0	0	0	0	0	0	0	12	0	495	1938
5:15 PM	0	205	0	0	25	256	0	0	0	0	0	0	1	0	16	0	503	1936
5:30 PM	0	198	1	0	6	246	0	0	0	0	0	0	2	0	5	0	458	1953
5:45 PM	0	163	1	0	7	247	0	1	0	0	0	0	0	0	2	0	421	1877

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	968	0	0	56	1032	0	4	0	0	0	0	20	0	84	0	2164
Heavy Trucks	0	12	0		4	20	0		0	0	0		0	0	0		36
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

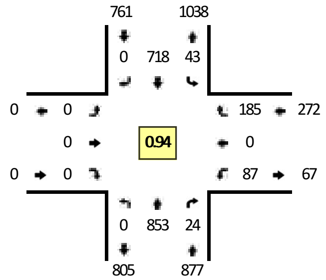
Comments:

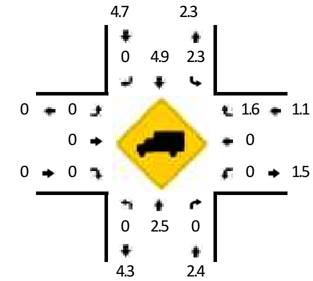
Type of peak hour being reported: System Peak | Method for determining peak hour: Total Entering Volume

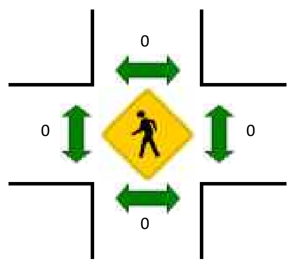
LOCATION: Queen Kaahumanu Hwy -- Puapuaanui St | **QC JOB #:** 15039905

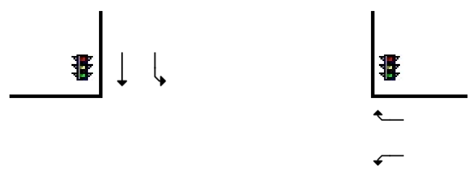
CITY/STATE: Kailua, HI | **DATE:** Thu, Aug 29 2019

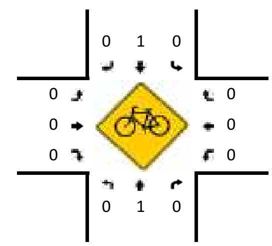
Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:15 AM -- 7:30 AM

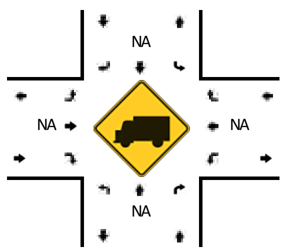


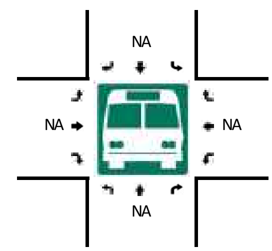












15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Puapuaanui St (Eastbound)				Puapuaanui St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	224	5	0	12	171	0	0	0	0	0	0	11	0	27	0	450	
7:15 AM	0	246	3	0	8	184	0	0	0	0	0	0	20	0	48	0	509	
7:30 AM	0	209	4	0	12	188	0	0	0	0	0	0	28	0	48	0	489	
7:45 AM	0	174	12	0	11	175	0	0	0	0	0	0	28	0	62	0	462	1910
8:00 AM	0	218	10	0	9	165	0	0	0	0	0	0	18	0	39	0	459	1919
8:15 AM	0	213	15	0	19	154	0	0	0	0	0	0	9	0	30	0	440	1850
8:30 AM	0	220	11	0	16	179	0	0	0	0	0	0	11	0	31	0	468	1829
8:45 AM	0	245	11	0	14	159	0	0	0	0	0	0	17	0	23	0	469	1836

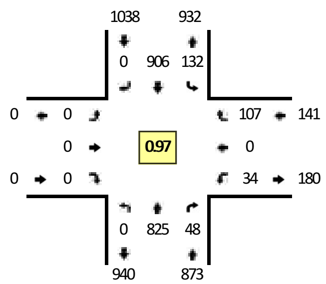
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	984	12	0	32	736	0	0	0	0	0	0	80	0	192	0	2036
Heavy Trucks	0	20	0		4	20	0		0	0	0		0	0	8		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

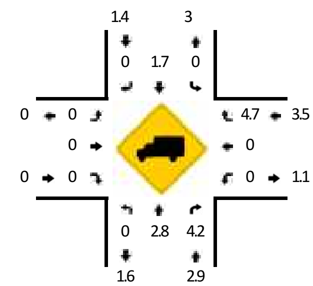
Report generated on 9/12/2019 10:40 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

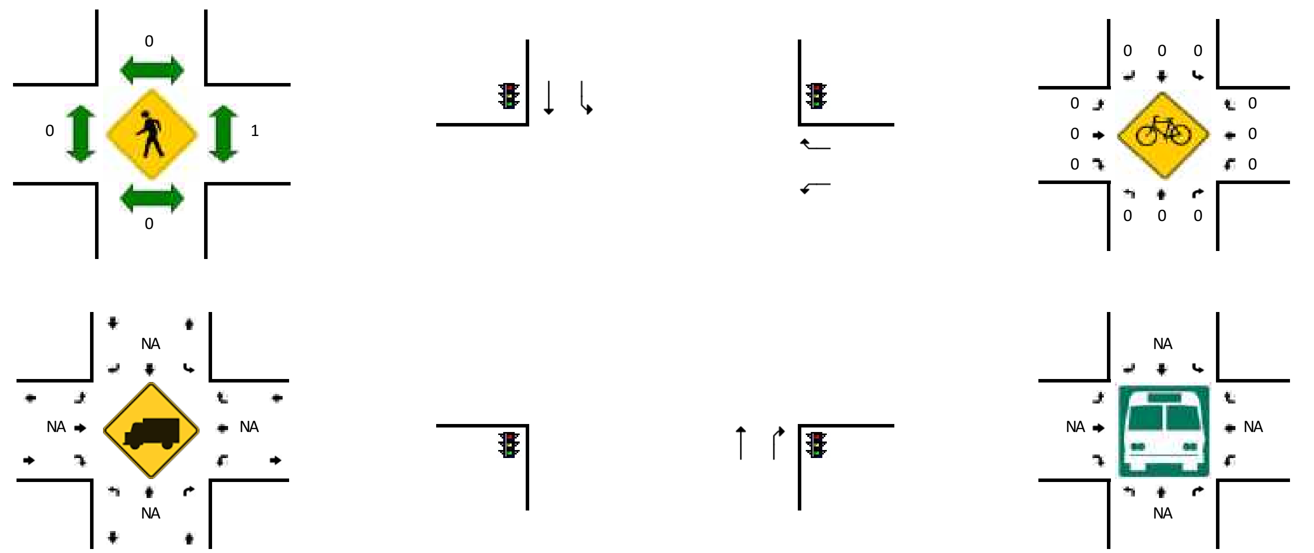
LOCATION: Queen Kaahumanu Hwy -- Puapuaanui St
CITY/STATE: Kailua, HI

QC JOB #: 15039906
DATE: Thu, Aug 29 2019



Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:30 PM -- 3:45 PM





15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Puapuaanui St (Eastbound)				Puapuaanui St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	199	14	0	37	231	0	0	0	0	0	0	7	0	23	0	511	
3:15 PM	0	205	14	0	27	243	0	0	0	0	0	0	12	0	23	0	524	
3:30 PM	0	230	12	0	37	213	0	0	0	0	0	0	9	0	27	0	528	
3:45 PM	0	191	8	0	31	219	0	0	0	0	0	0	6	0	34	0	489	2052
4:00 PM	0	192	7	0	34	235	0	0	0	0	0	0	12	0	16	0	496	2037
4:15 PM	0	207	15	0	38	209	0	0	0	0	0	0	11	0	35	0	515	2028
4:30 PM	0	187	10	0	22	192	0	0	0	0	0	0	4	0	12	0	427	1927
4:45 PM	0	208	15	0	30	217	0	0	0	0	0	0	13	0	29	0	512	1950
5:00 PM	0	159	7	0	49	218	0	0	0	0	0	0	4	0	17	0	454	1908
5:15 PM	0	195	11	0	36	219	0	0	0	0	0	0	7	0	23	0	491	1884
5:30 PM	0	177	16	0	24	220	0	0	0	0	0	0	10	0	22	0	469	1926
5:45 PM	0	131	8	0	29	221	0	0	0	0	0	0	7	0	23	0	419	1833

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	920	48	0	148	852	0	0	0	0	0	0	36	0	108	0	2112
Heavy Trucks	0	28	4		0	0	0		0	0	0		0	0	12		44
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Type of peak hour being reported: User-Defined

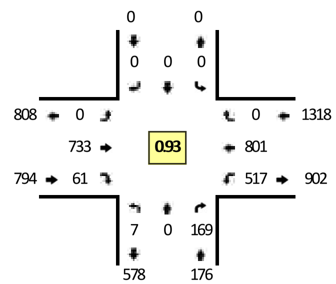
Method for determining peak hour: Total Entering Volume

LOCATION: Kuakini Hwy -- Hawaii Belt Rd

CITY/STATE: Hawaii, HI

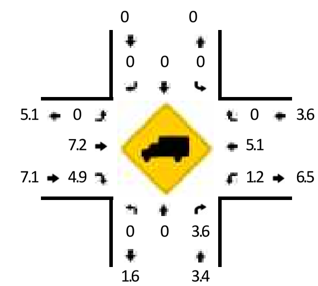
QC JOB #: 14972605

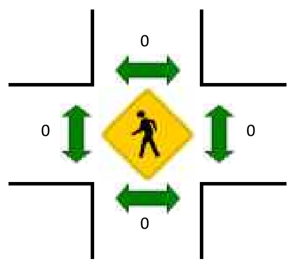
DATE: Tue, Apr 30 2019

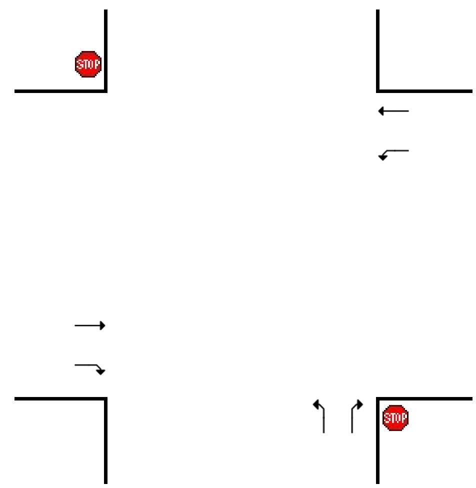


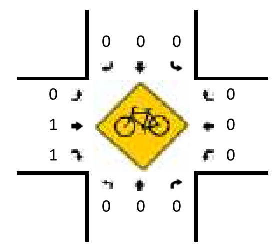
Peak-Hour: 7:20 AM -- 8:20 AM

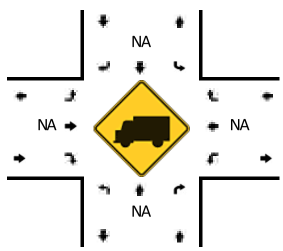
Peak 15-Min: 7:30 AM -- 7:45 AM

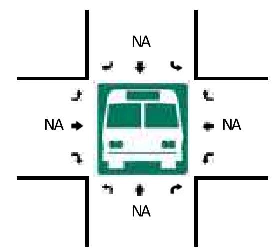












15-Min Count Period Beginning At	Kuakini Hwy (Northbound) Left	Thru	Right	U	Kuakini Hwy (Southbound) Left	Thru	Right	U	Hawaii Belt Rd (Eastbound) Left	Thru	Right	U	Hawaii Belt Rd (Westbound) Left	Thru	Right	U	Total	Hourly Totals
6:45 AM	2	0	37	0	0	0	0	0	0	158	0	0	71	244	0	0	512	
7:00 AM	0	0	34	0	0	0	0	0	0	206	3	0	65	240	0	0	548	
7:15 AM	3	0	45	0	0	0	0	0	0	204	12	0	85	234	0	0	583	
7:30 AM	3	0	44	0	0	0	0	0	0	208	17	0	114	218	0	0	604	2247
7:45 AM	1	0	46	0	0	0	0	0	0	150	20	0	189	156	0	0	562	2297
8:00 AM	1	0	36	0	0	0	0	0	0	163	12	0	118	207	0	0	537	2286
8:15 AM	0	0	35	0	0	0	0	0	0	178	12	0	90	233	0	0	548	2251
8:30 AM	2	0	55	0	0	0	0	0	0	192	12	0	70	230	0	0	561	2208

Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	12	0	176	0	0	0	0	0	0	832	68	0	456	872	0	0	2416
Heavy Trucks	0	0	8		0	0	0		0	56	8		0	24	0		96
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	1	1		0	0	0		2
Railroad																	
Stopped Buses																	

Comments:

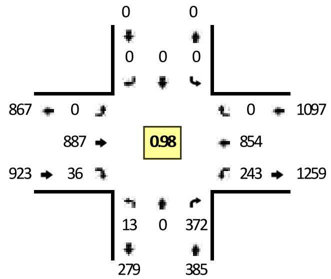
Report generated on 5/13/2019 3:10 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined   Method for determining peak hour: Total Entering Volume

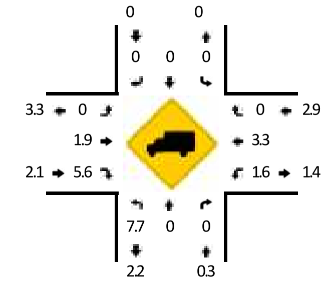
LOCATION: Kuakini Hwy -- Hawaii Belt Rd   **QC JOB #:** 14972606

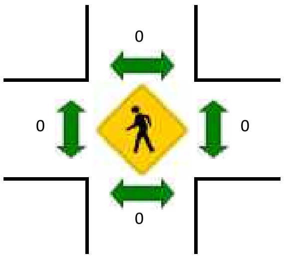
CITY/STATE: Hawaii, HI   **DATE:** Tue, Apr 30 2019

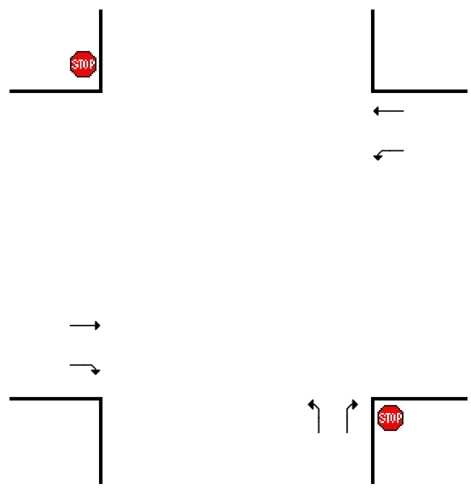


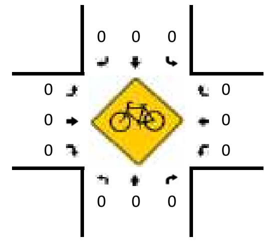
Peak-Hour: 3:45 PM -- 4:45 PM

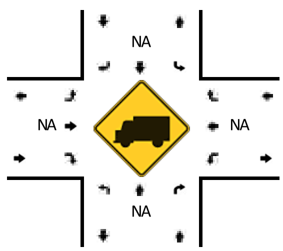
Peak 15-Min: 4:15 PM -- 4:30 PM

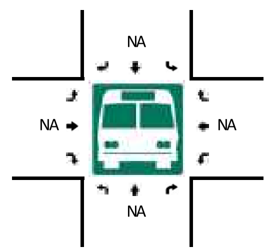












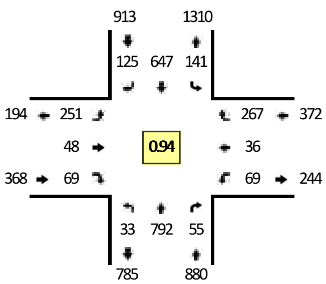
15-Min Count Period Beginning At	Kuakini Hwy (Northbound)				Kuakini Hwy (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	5	0	76	0	0	0	0	0	0	221	13	0	60	227	0	0	602	
3:15 PM	6	0	75	0	0	0	0	0	0	234	19	0	59	213	0	0	606	
3:30 PM	3	0	86	0	0	0	0	0	0	203	15	0	48	217	0	0	572	
3:45 PM	0	0	78	0	0	0	0	0	0	223	8	0	57	217	0	0	583	2363
4:00 PM	3	0	87	0	0	0	0	0	0	229	10	0	60	216	0	0	605	2366
4:15 PM	4	0	101	0	0	0	0	0	0	221	16	0	55	214	0	0	611	2371
4:30 PM	6	0	106	0	0	0	0	0	0	214	2	0	71	207	0	0	606	2405
4:45 PM	1	0	112	0	0	0	0	0	0	208	7	0	78	225	0	0	631	2453
5:00 PM	2	0	108	0	0	0	0	0	0	225	9	0	66	181	0	1	592	2440
5:15 PM	1	0	97	0	0	0	0	0	0	219	11	0	39	171	0	0	538	2367
5:30 PM	0	0	102	0	0	0	0	0	0	223	7	0	54	134	0	0	520	2281
5:45 PM	2	0	76	0	0	0	0	0	0	203	13	0	58	176	0	0	528	2178

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	0	404	0	0	0	0	0	0	884	64	0	220	856	0	0	2444
Heavy Trucks	0	0	0		0	0	0		0	16	8		4	28	0		56
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

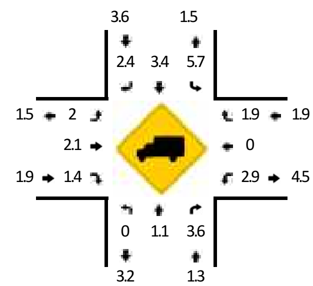
Comments:

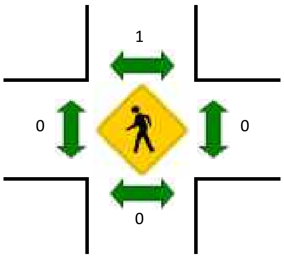
Report generated on 5/13/2019 3:06 PM   SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

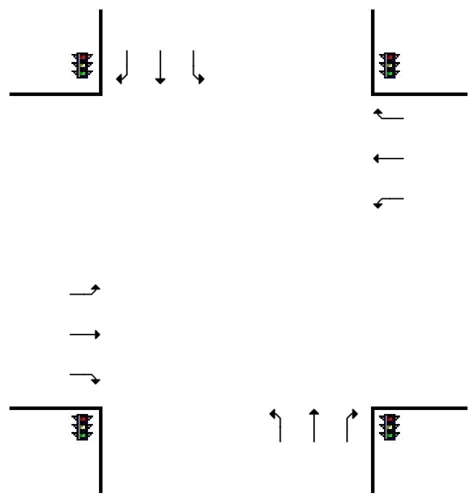
LOCATION: Kuakini Hwy -- Lako St | **QC JOB #:** 15039907
CITY/STATE: Holualoa, HI | **DATE:** Thu, Aug 29 2019

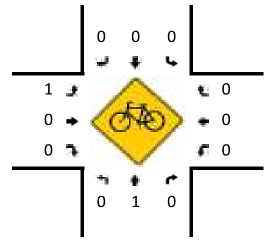


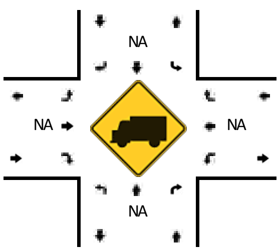
Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:45 AM -- 8:00 AM

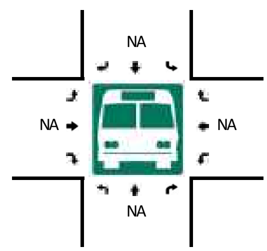










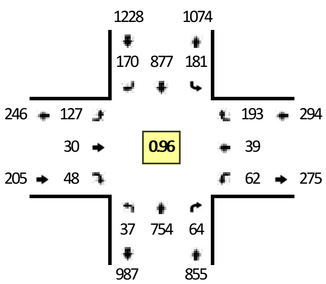


15-Min Count Period Beginning At	Kuakini Hwy (Northbound)				Kuakini Hwy (Southbound)				Lako St (Eastbound)				Lako St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	13	221	15	0	34	152	28	0	41	4	13	0	9	6	53	0	589	
7:15 AM	8	188	14	0	36	154	35	0	66	9	21	0	17	7	61	0	616	
7:30 AM	6	202	15	0	34	171	36	0	67	11	19	0	16	10	67	0	654	
7:45 AM	6	181	11	0	37	170	26	0	77	24	16	0	27	13	86	0	674	2533
8:00 AM	3	206	17	0	37	145	24	0	55	18	11	0	13	7	65	0	601	2545
8:15 AM	6	219	12	0	19	165	16	0	44	6	6	0	14	12	51	0	570	2499
8:30 AM	4	220	16	0	30	180	22	0	42	9	10	0	15	6	70	0	624	2469
8:45 AM	9	216	20	0	36	150	28	0	35	10	9	0	13	8	64	0	598	2393

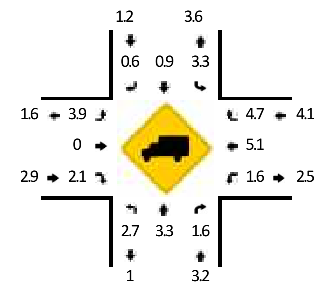
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	24	724	44	0	148	680	104	0	308	96	64	0	108	52	344	0	2696
Heavy Trucks	0	8	4		16	40	4		0	0	0		0	0	8		80
Pedestrians		0				0				0				0			0
Bicycles	0	1	0		0	0	0		1	0	0		0	0	0		2
Railroad																	
Stopped Buses																	

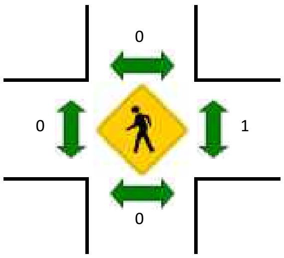
Comments:

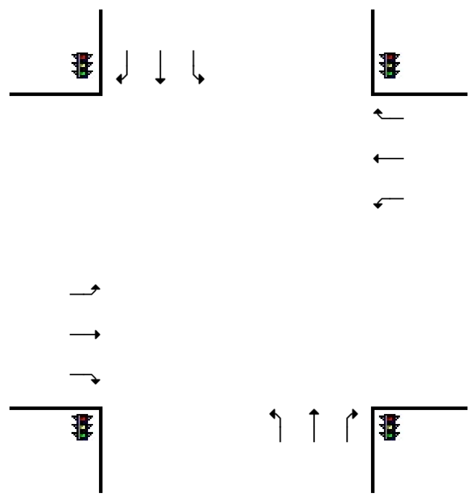
LOCATION: Kuakini Hwy -- Lako St
CITY/STATE: Holualoa, HI
QC JOB #: 15039908
DATE: Thu, Aug 29 2019

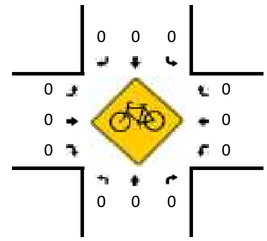


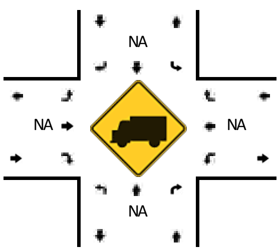
Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:15 PM -- 3:30 PM

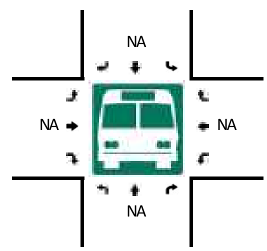












15-Min Count Period Beginning At	Kuakini Hwy (Northbound)				Kuakini Hwy (Southbound)				Lako St (Eastbound)				Lako St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	13	190	20	0	42	216	38	0	27	5	10	0	23	9	51	0	644	
3:15 PM	7	192	18	0	51	243	45	0	28	8	14	0	12	9	46	0	673	
3:30 PM	12	196	17	0	41	211	41	0	39	8	7	0	16	11	63	0	662	
3:45 PM	5	176	9	0	47	207	46	0	33	9	17	0	11	10	33	0	603	2582
4:00 PM	13	181	12	0	57	220	33	0	33	10	12	0	17	8	35	0	631	2569
4:15 PM	19	201	22	0	51	223	60	0	25	9	14	0	21	11	43	0	699	2595
4:30 PM	10	177	20	0	42	202	39	0	31	10	7	0	20	8	41	0	607	2540
4:45 PM	12	199	22	0	52	240	41	0	30	10	7	0	18	8	36	0	675	2612
5:00 PM	10	168	20	0	30	225	57	0	31	6	8	0	7	8	39	0	609	2590
5:15 PM	12	177	13	0	55	242	53	0	28	11	13	0	10	10	34	0	658	2549
5:30 PM	6	167	9	0	60	209	44	0	20	11	6	0	11	11	38	0	592	2534
5:45 PM	5	136	12	0	32	215	50	0	28	15	10	0	13	7	23	0	546	2405

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	28	768	72	0	204	972	180	0	112	32	56	0	48	36	184	0	2692
Heavy Trucks	0	16	0		4	8	0		16	0	0		0	0	12		56
Pedestrians		0				0				0				4			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

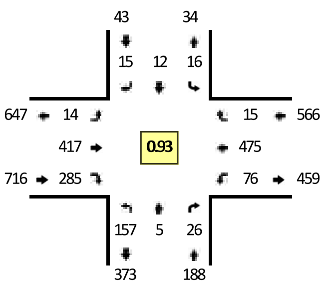
Comments:

Report generated on 9/12/2019 10:43 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

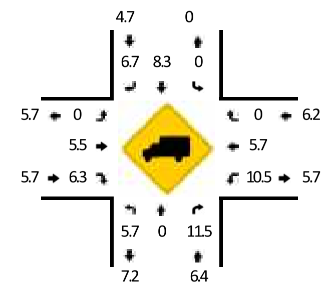
Type of peak hour being reported: User-Defined | Method for determining peak hour: Total Entering Volume

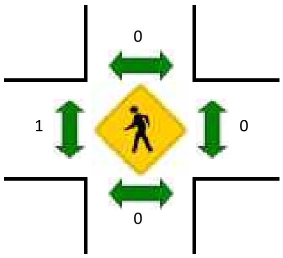
LOCATION: Kamehameha III Rd -- Hawaii Belt Rd | **QC JOB #:** 14972607
CITY/STATE: Hawaii, HI | **DATE:** Tue, Apr 30 2019

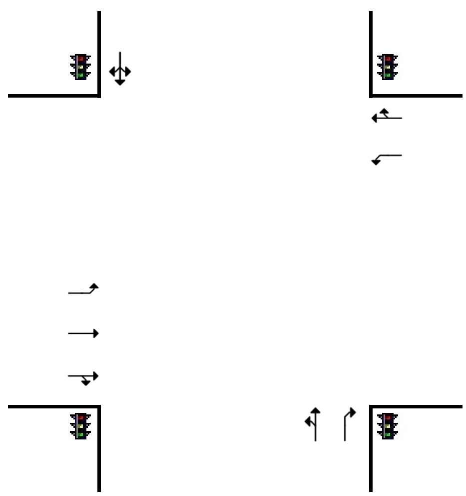


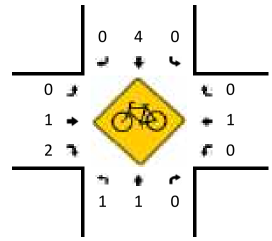
Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

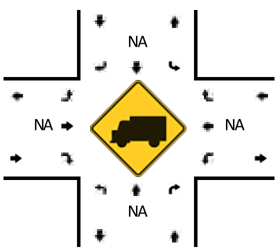
Quality Counts
DATA THAT DRIVES COMMUNITIES

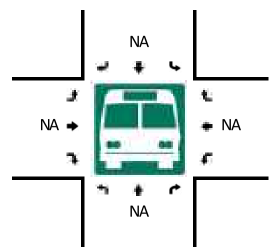












15-Min Count Period Beginning At	Kamehameha III Rd (Northbound)				Kamehameha III Rd (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:45 AM	33	0	2	0	5	1	1	0	3	88	48	0	11	170	3	0	365	
7:00 AM	41	0	0	0	1	2	2	0	3	117	41	0	5	156	3	0	371	
7:15 AM	38	2	5	0	3	2	2	0	4	133	59	0	6	125	2	0	381	
7:30 AM	36	1	10	0	8	4	6	0	4	111	88	0	22	107	3	0	400	1517
7:45 AM	37	2	6	0	4	2	3	0	5	93	78	0	25	99	6	0	360	1512
8:00 AM	41	1	6	0	1	4	4	0	3	84	58	0	17	124	4	0	347	1488
8:15 AM	51	1	7	0	3	4	3	0	1	82	61	0	20	152	3	0	388	1495
8:30 AM	34	1	10	0	2	2	4	0	2	96	55	0	7	115	1	0	329	1424

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	144	4	40	0	32	16	24	0	16	444	352	0	88	428	12	0	1600
Heavy Trucks	0	0	8		0	0	0		0	32	4		24	24	0		92
Pedestrians		0				0				4				0			4
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

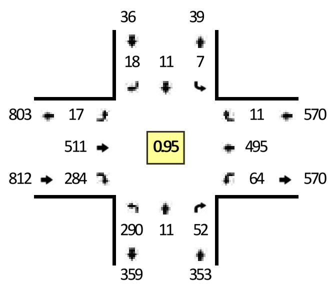
Report generated on 5/13/2019 3:10 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

Method for determining peak hour: Total Entering Volume

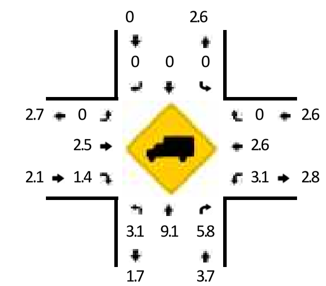
LOCATION: Kamehameha III Rd -- Hawaii Belt Rd **QC JOB #:** 14972608

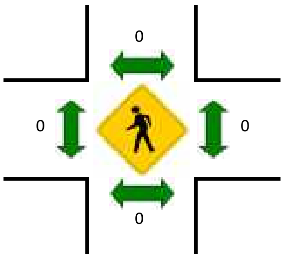
CITY/STATE: Hawaii, HI **DATE:** Tue, Apr 30 2019

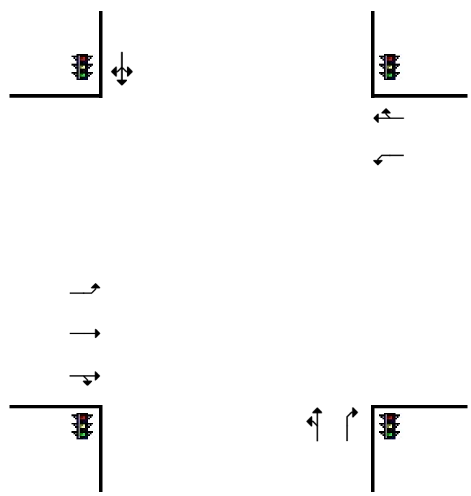


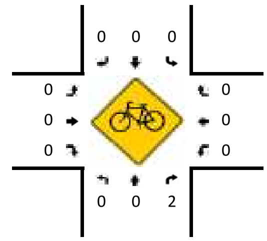
Peak-Hour: 3:45 PM -- 4:45 PM

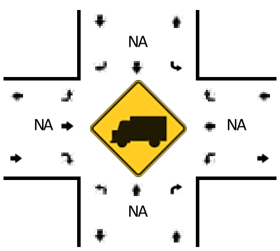
Peak 15-Min: 4:30 PM -- 4:45 PM

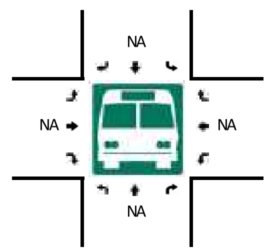












15-Min Count Period Beginning At	Kamehameha III Rd (Northbound)				Kamehameha III Rd (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	75	3	14	0	4	2	6	0	6	129	60	0	16	143	3	0	461	
3:15 PM	47	10	22	0	4	6	5	0	5	140	71	0	25	131	3	0	469	
3:30 PM	65	6	21	0	1	1	5	0	4	122	70	0	14	139	4	0	452	
3:45 PM	74	4	12	0	2	2	6	0	6	112	78	0	18	114	3	0	431	1813
4:00 PM	78	1	12	0	1	6	4	0	4	124	74	0	17	118	2	0	441	1793
4:15 PM	68	5	12	0	0	3	5	0	1	134	62	0	13	126	4	0	433	1757
4:30 PM	70	1	16	0	4	0	3	0	6	141	70	0	16	137	2	0	466	1771
4:45 PM	72	3	14	0	2	4	4	0	5	105	50	0	18	115	2	0	394	1734
5:00 PM	48	4	25	0	0	3	2	0	5	123	90	0	23	119	1	0	443	1736
5:15 PM	56	5	19	0	2	4	2	0	3	108	75	0	11	101	1	0	387	1690
5:30 PM	46	3	20	0	1	2	4	0	4	141	71	0	8	81	0	0	381	1605
5:45 PM	36	1	14	0	3	4	2	0	2	116	41	0	9	67	1	0	296	1507

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	280	4	64	0	16	0	12	0	24	564	280	0	64	548	8	0	1864
Heavy Trucks	4	0	4		0	0	0		0	12	4		0	12	0		36
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/13/2019 3:06 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

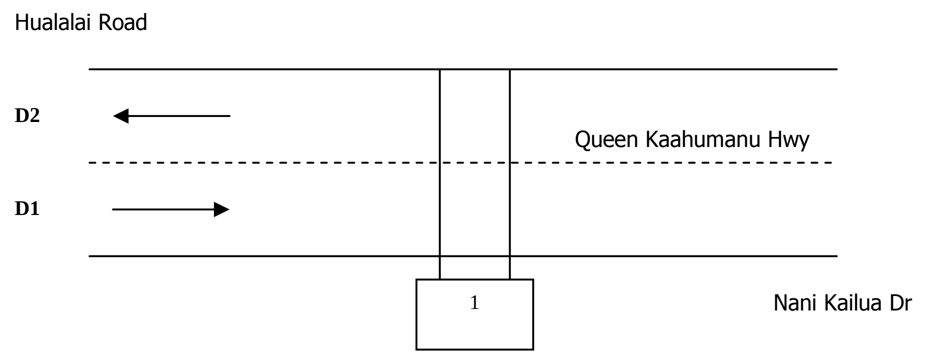
Traffic Data Service

Traffic Station Sketch

N

Island: Hawaii
Area: Kona

Section ID/Station #: B71001112038



Meter #	**File Name**	**GPS**
1. bw67	D0910037_B71001112038	19.63455, -155.9779
2.	D0910038_B71001112038	

Station Description:
Queen Kaahumanu Hwy: Hualalai Road to Nani Kailua Dr

Survey Beginning Date/Time: 9/10/15@ 0000			Survey Ending Date/Time: 9/11/15@ 2400
Survey Method:	Road Tube	Data Type:	Class
Survey Crew:	LM		C1B
Sketch Updated:		By:	SR
Remarks:	1302		

FACILITY NAME	JURI	FUNC CLASS	AREA TYPE	ROUTE NO.	ROUTE MILE
Queen Kaahumanu Hwy		14		0110	

D1= Direction to End — D1: Nani Kailua Dr/ Palani Rd (Rte 190)
D2= Direction to Begin — D2: Hualalai Road / Kamehameha Ave (Rte 19)

Run Date: 2016/05/18

Hawaii Department of Transportation

Highways Division **Highways Planning Survey Section**

2015 Program Count - Summary

Site ID: B71001112038 **Town:** Hawaii **DIR 1:** +MP **DIR 2:** -MP **Final AADT:** 25900

Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** 11

Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 09/10/2015															
12:00-12:15	20	18	38	06:00-06:15	62	184	246	12:00-12:15	203	233	436	06:00-06:15	240	193	433
12:15-12:30	17	5	22	06:15-06:30	95	223	318	12:15-12:30	226	228	454	06:15-06:30	235	168	403
12:30-12:45	19	7	26	06:30-06:45	108	276	384	12:30-12:45	229	244	473	06:30-06:45	226	175	401
12:45-01:00	15	11	26	06:45-07:00	121	284	405	12:45-01:00	217	275	492	06:45-07:00	211	161	372
01:00-01:15	12	3	15	07:00-07:15	168	242	410	01:00-01:15	211	248	459	07:00-07:15	201	129	330
01:15-01:30	8	9	17	07:15-07:30	233	279	512	01:15-01:30	225	213	438	07:15-07:30	177	98	275
01:30-01:45	8	6	14	07:30-07:45	190	278	468	01:30-01:45	217	209	426	07:30-07:45	172	82	254
01:45-02:00	8	11	19	07:45-08:00	184	263	447	01:45-02:00	256	264	520	07:45-08:00	137	78	215
02:00-02:15	6	4	10	08:00-08:15	157	298	455	02:00-02:15	248	254	502	08:00-08:15	134	113	247
02:15-02:30	9	3	12	08:15-08:30	172	273	445	02:15-02:30	254	267	521	08:15-08:30	119	69	188
02:30-02:45	4	4	8	08:30-08:45	136	274	410	02:30-02:45	243	238	481	08:30-08:45	131	77	208
02:45-03:00	4	6	10	08:45-09:00	155	278	433	02:45-03:00	259	271	530	08:45-09:00	93	75	168
03:00-03:15	2	9	11	09:00-09:15	170	229	399	03:00-03:15	261	225	486	09:00-09:15	108	70	178
03:15-03:30	4	8	12	09:15-09:30	153	254	407	03:15-03:30	262	253	515	09:15-09:30	111	55	166
03:30-03:45	8	10	18	09:30-09:45	187	227	414	03:30-03:45	237	239	476	09:30-09:45	108	52	160
03:45-04:00	4	24	28	09:45-10:00	175	273	448	03:45-04:00	244	270	514	09:45-10:00	106	47	153
04:00-04:15	4	23	27	10:00-10:15	162	256	418	04:00-04:15	222	240	462	10:00-10:15	92	41	133
04:15-04:30	12	33	45	10:15-10:30	178	266	444	04:15-04:30	226	248	474	10:15-10:30	93	54	147
04:30-04:45	6	39	45	10:30-10:45	188	263	451	04:30-04:45	249	252	501	10:30-10:45	81	44	125
04:45-05:00	14	69	83	10:45-11:00	202	277	479	04:45-05:00	259	237	496	10:45-11:00	66	39	105
05:00-05:15	14	62	76	11:00-11:15	197	216	413	05:00-05:15	252	194	446	11:00-11:15	61	27	88
05:15-05:30	23	97	120	11:15-11:30	203	197	400	05:15-05:30	233	222	455	11:15-11:30	53	29	82
05:30-05:45	37	127	164	11:30-11:45	210	222	432	05:30-05:45	217	176	393	11:30-11:45	40	24	64
05:45-06:00	40	152	192	11:45-12:00	242	207	449	05:45-06:00	223	196	419	11:45-12:00	37	14	51

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:15 AM to 08:15 AM		
AM - PEAK HR VOLUME	764	1118	1882
AM - K FACTOR (%)			6.86
AM - D (%)	40.60	59.40	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	08:00 AM to 09:00 AM	
AM - PEAK HR VOLUME	775	1123	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	1004	987	1991
PM - K FACTOR (%)			7.26
PM - D (%)	50.43	49.57	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM	03:45 PM to 04:45 PM	
PM - PEAK HR VOLUME	1004	1010	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:15 AM to 08:15 AM		
AM - PEAK HR VOLUME	764	1118	1882
AM - K FACTOR (%)			6.86
AM - D (%)	40.60	59.40	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	02:00 PM to 03:00 PM		
PM - PEAK HR VOLUME	1004	1030	2034
PM - K FACTOR (%)			7.41
PM - D (%)	49.36	50.64	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	1004	1030	2034
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM	10:00 AM to 11:00 AM	
PEAK HR VOLUME	1004	1062	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	4,048	6,039	10,087
AM 12-HR PERIOD (00:00-12:00)	4,346	6,779	11,125
PM 6-HR PERIOD (12:00-18:00)	5,673	5,696	11,369
PM 12-HR PERIOD (12:00-24:00)	8,705	7,610	16,315
24 HOUR PERIOD	13,051	14,389	27,440
D (%)	47.56	52.44	100.00

Run Date: 2016/05/18

Hawaii Department of Transportation

Highways Division **Highways Planning Survey Section**

2015 Program Count - Summary

Site ID: B71001112038 **Town:** Hawaii **DIR 1:** +MP **DIR 2:** -MP **Final AADT:** 25900

Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** 11

Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

DATE : 09/11/2015

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
12:00-12:15	17	6	23	06:00-06:15	69	181	250	12:00-12:15	191	203	394	06:00-06:15	220	159	379
12:15-12:30	10	9	19	06:15-06:30	88	220	308	12:15-12:30	194	214	408	06:15-06:30	204	143	347
12:30-12:45	9	7	16	06:30-06:45	102	254	356	12:30-12:45	218	190	408	06:30-06:45	162	122	284
12:45-01:00	8	5	13	06:45-07:00	136	271	407	12:45-01:00	214	209	423	06:45-07:00	176	130	306
01:00-01:15	7	2	9	07:00-07:15	174	263	437	01:00-01:15	210	202	412	07:00-07:15	173	133	306
01:15-01:30	5	4	9	07:15-07:30	214	287	501	01:15-01:30	230	209	439	07:15-07:30	155	106	261
01:30-01:45	3	2	5	07:30-07:45	195	299	494	01:30-01:45	231	208	439	07:30-07:45	151	87	238
01:45-02:00	2	5	7	07:45-08:00	174	258	432	01:45-02:00	242	192	434	07:45-08:00	139	102	241
02:00-02:15	1	7	8	08:00-08:15	154	280	434	02:00-02:15	210	203	413	08:00-08:15	131	71	202
02:15-02:30	6	5	11	08:15-08:30	188	276	464	02:15-02:30	241	227	468	08:15-08:30	132	72	204
02:30-02:45	4	6	10	08:30-08:45	161	242	403	02:30-02:45	241	229	470	08:30-08:45	145	64	209
02:45-03:00	11	2	13	08:45-09:00	168	237	405	02:45-03:00	230	260	490	08:45-09:00	131	88	219
03:00-03:15	9	10	19	09:00-09:15	196	242	438	03:00-03:15	218	260	478	09:00-09:15	110	54	164
03:15-03:30	5	10	15	09:15-09:30	151	234	385	03:15-03:30	224	265	489	09:15-09:30	97	57	154
03:30-03:45	7	21	28	09:30-09:45	185	264	449	03:30-03:45	220	254	474	09:30-09:45	82	66	148
03:45-04:00	1	18	19	09:45-10:00	170	261	431	03:45-04:00	190	223	413	09:45-10:00	89	30	119
04:00-04:15	7	19	26	10:00-10:15	156	249	405	04:00-04:15	195	218	413	10:00-10:15	74	51	125
04:15-04:30	2	27	29	10:15-10:30	176	267	443	04:15-04:30	219	256	475	10:15-10:30	62	39	101
04:30-04:45	15	45	60	10:30-10:45	168	257	425	04:30-04:45	239	228	467	10:30-10:45	66	39	105
04:45-05:00	12	66	78	10:45-11:00	206	246	452	04:45-05:00	257	249	506	10:45-11:00	51	26	77
05:00-05:15	10	68	78	11:00-11:15	164	243	407	05:00-05:15	253	229	482	11:00-11:15	46	38	84
05:15-05:30	23	102	125	11:15-11:30	204	249	453	05:15-05:30	248	190	438	11:15-11:30	28	26	54
05:30-05:45	33	130	163	11:30-11:45	230	235	465	05:30-05:45	250	199	449	11:30-11:45	30	26	56
05:45-06:00	39	161	200	11:45-12:00	191	230	421	05:45-06:00	215	175	390	11:45-12:00	30	26	56

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2		PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	04:15 PM to 05:15 PM		
AM - PEAK HR VOLUME	757	1107	1864	PM - PEAK HR VOLUME	968	962	1930
AM - K FACTOR (%)			7.13	PM - K FACTOR (%)			7.38
AM - D (%)	40.61	59.39	100.00	PM - D (%)	50.16	49.84	100.00
DIRECTIONAL PEAK				DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	07:15 AM to 08:15 AM		PM - PEAK HR TIME	04:45 PM to 05:45 PM	03:00 PM to 04:00 PM	
AM - PEAK HR VOLUME	757	1124		PM - PEAK HR VOLUME	1008	1002	

AM PERIOD (00:00-12:00)				PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	02:45 PM to 03:45 PM		
AM - PEAK HR VOLUME	757	1107	1864	PM - PEAK HR VOLUME	892	1039	1931
AM - K FACTOR (%)			7.13	PM - K FACTOR (%)			7.38
AM - D (%)	40.61	59.39	100.00	PM - D (%)	46.19	53.81	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	922	919	1841
DIRECTIONAL PEAK			
PEAK HR TIME	01:45 PM to 02:45 PM	09:30 AM to 10:30 AM	
PEAK HR VOLUME	934	1041	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	4,020	6,045	10,065
AM 12-HR PERIOD (00:00-12:00)	4,266	6,782	11,048
PM 6-HR PERIOD (12:00-18:00)	5,380	5,292	10,672
PM 12-HR PERIOD (12:00-24:00)	8,064	7,047	15,111
24 HOUR PERIOD	12,330	13,829	26,159
D (%)	47.13	52.87	100.00

Run Date: 2016/05/19

Hawaii Department of Transportation
Highways Division
Highways Planning Survey Section

Vehicle Classification Data Summary
2015

Site ID: B71001112038 **Route No:** 11 **Date From:** 2015/09/10 0:00

Town: Hawaii **Direction:** +MP **Date To:** 2015/09/11 23:45

Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

Functional Classification: 14 URBAN:PRINCIPAL ARTERIAL - OTHER

REPORT TOTALS - 48 HOURS RECORDED

	VOLUME	%	NUMBER OF AXLES
Cycles	263	0.49%	525
PC	45148	84.23%	90296
2A-4T	7438	13.88%	14876
LIGHT VEHICLE TOTALS	52849	98.60%	105697
	HEAVY VEHICLES		
Bus	85	0.16%	213
SINGLE UNIT TRUCK			
2A-6T	96	0.18%	192
3A-SU	164	0.31%	492
4A-SU	29	0.05%	116
SINGLE-TRAILER TRUCKS			
4A-ST	266	0.50%	1064
5A-ST	50	0.09%	250
6A-ST	30	0.06%	180
MULTI-TRAILER TRUCKS			
5A-MT	12	0.02%	60
6A-MT	1	0.00%	6
7A-MT	15	0.03%	105
HEAVY VEHICLE TOTALS	748	1.40%	2678
CLASSIFIED VEHICLES TOTALS	53597 (A)	100.00%	108375 (B)
UNCLASSIFIED VEHICLES TOTALS	2	0.00%	

AXLE CORRECTION FACTOR (A/C) = 0.989

ROADTUBE EQUIVALENT(B/2) = 54187 (C)

PEAK HOUR VOLUME : 2034 2015/09/10 14:00	PEAK HOUR TRUCK VOLUME	% TOTAL PEAK HOUR VOLUME	24 HOUR TRUCK VOLUME	AADT	% OF AADT	HPMS K-FACTOR (PEAK/AADT) (ITEM 66)
SINGLE UNIT TRUCKS (TYPE 4-7)	10	(65A-1) 0.49%	187	25900	(65A-2) 0.72%	7.85%
COMBINATION (TYPE 8-13)	10	(65B-1) 0.49%	187		(65B-2) 0.72%	7.85%

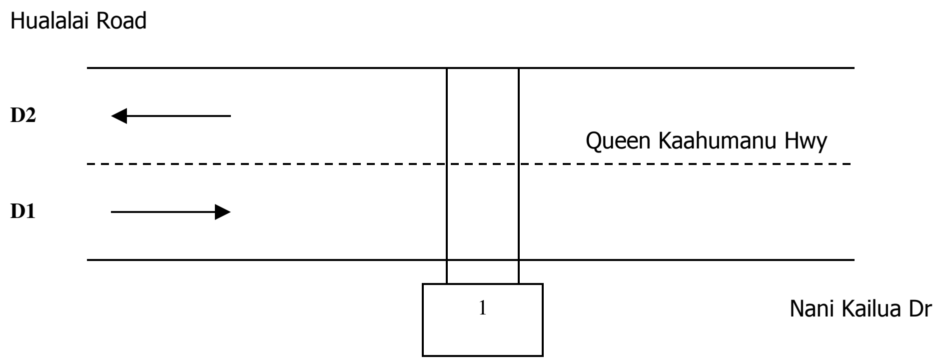
Traffic Data Service

Traffic Station Sketch

N

Island: Hawaii	
Area: Kona	

Section ID/Station #: B71001112038



Meter #	**File Name**	**GPS**
1. bw67	D0503007_B71001112038	19.63455, -155.9779
2.	D0503008_B71001112038	

Station Description:
Queen Kaahumanu Hwy: Hualalai Road to Nani Kailua Dr

Survey Beginning Date/Time: 5/3/16 @ 0000			Survey Ending Date/Time: 5/4/16 @ 2400		
Survey Method:	Road Tube	Data Type:	Class		
Survey Crew:	LM		C1B		
Sketch Updated:		By:	SR		
Remarks:	1302				

FACILITY NAME	JURI	FUNC CLASS	AREA TYPE	ROUTE NO.	ROUTE MILE
Queen Kaahumanu Hwy		11		0110	

D1= Direction to End — D1: Nani Kailua Dr/ Palani Rd (Rte 190)
D2= Direction to Begin — D2: Hualalai Road / Kamehameha Ave (Rte 19)

Run Date: 2017/08/08

Hawaii Department of Transportation

Highways Division — Highways Planning Survey Section

2016 Program Count - Summary

Site ID: B71001112038 **Town:** Hawaii **DIR 1:** +MP **DIR 2:** -MP **Final AADT:** 25800
Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** 11
Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

DATE : 05/03/2016

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
12:00-12:15	19	5	24	06:00-06:15	69	205	274	12:00-12:15	212	188	400	06:00-06:15	194	131	325
12:15-12:30	16	3	19	06:15-06:30	79	226	305	12:15-12:30	220	202	422	06:15-06:30	229	127	356
12:30-12:45	14	5	19	06:30-06:45	117	292	409	12:30-12:45	215	200	415	06:30-06:45	178	138	316
12:45-01:00	7	7	14	06:45-07:00	140	242	382	12:45-01:00	214	205	419	06:45-07:00	184	127	311
01:00-01:15	6	4	10	07:00-07:15	180	270	450	01:00-01:15	234	188	422	07:00-07:15	153	109	262
01:15-01:30	4	2	6	07:15-07:30	211	252	463	01:15-01:30	210	174	384	07:15-07:30	151	106	257
01:30-01:45	9	3	12	07:30-07:45	197	261	458	01:30-01:45	233	191	424	07:30-07:45	168	102	270
01:45-02:00	7	5	12	07:45-08:00	180	262	442	01:45-02:00	225	213	438	07:45-08:00	149	69	218
02:00-02:15	4	6	10	08:00-08:15	144	267	411	02:00-02:15	246	224	470	08:00-08:15	114	69	183
02:15-02:30	7	5	12	08:15-08:30	154	262	416	02:15-02:30	239	217	456	08:15-08:30	111	76	187
02:30-02:45	3	5	8	08:30-08:45	163	258	421	02:30-02:45	245	213	458	08:30-08:45	132	64	196
02:45-03:00	4	5	9	08:45-09:00	149	267	416	02:45-03:00	233	291	524	08:45-09:00	104	55	159
03:00-03:15	5	8	13	09:00-09:15	142	253	395	03:00-03:15	223	260	483	09:00-09:15	95	53	148
03:15-03:30	5	11	16	09:15-09:30	178	230	408	03:15-03:30	258	228	486	09:15-09:30	95	43	138
03:30-03:45	5	17	22	09:30-09:45	179	266	445	03:30-03:45	235	258	493	09:30-09:45	83	52	135
03:45-04:00	6	20	26	09:45-10:00	163	210	373	03:45-04:00	262	246	508	09:45-10:00	103	41	144
04:00-04:15	7	19	26	10:00-10:15	171	198	369	04:00-04:15	249	246	495	10:00-10:15	76	35	111
04:15-04:30	6	27	33	10:15-10:30	161	213	374	04:15-04:30	239	229	468	10:15-10:30	66	35	101
04:30-04:45	6	49	55	10:30-10:45	157	216	373	04:30-04:45	278	209	487	10:30-10:45	46	39	85
04:45-05:00	13	56	69	10:45-11:00	195	198	393	04:45-05:00	236	213	449	10:45-11:00	51	20	71
05:00-05:15	23	73	96	11:00-11:15	214	206	420	05:00-05:15	245	179	424	11:00-11:15	47	23	70
05:15-05:30	26	73	99	11:15-11:30	195	201	396	05:15-05:30	251	166	417	11:15-11:30	58	14	72
05:30-05:45	41	140	181	11:30-11:45	198	243	441	05:30-05:45	260	178	438	11:30-11:45	27	15	42
05:45-06:00	54	180	234	11:45-12:00	187	182	369	05:45-06:00	228	174	402	11:45-12:00	21	9	30

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2		PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	03:15 PM to 04:15 PM		
AM - PEAK HR VOLUME	768	1045	1813	PM - PEAK HR VOLUME	1004	978	1982
AM - K FACTOR (%)			7.08	PM - K FACTOR (%)			7.74
AM - D (%)	42.36	57.64	100.00	PM - D (%)	50.66	49.34	100.00
DIRECTIONAL PEAK				DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	06:30 AM to 07:30 AM		PM - PEAK HR TIME	03:45 PM to 04:45 PM	03:00 PM to 04:00 PM	
AM - PEAK HR VOLUME	768	1056		PM - PEAK HR VOLUME	1028	992	

AM PERIOD (00:00-12:00)				PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	02:45 PM to 03:45 PM		
AM - PEAK HR VOLUME	768	1045	1813	PM - PEAK HR VOLUME	949	1037	1986
AM - K FACTOR (%)			7.08	PM - K FACTOR (%)			7.76
AM - D (%)	42.36	57.64	100.00	PM - D (%)	47.78	52.22	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	963	945	1908
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM	09:00 AM to 10:00 AM	
PEAK HR VOLUME	963	959	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,923	5,680	9,603
AM 12-HR PERIOD (00:00-12:00)	4,220	6,408	10,628
PM 6-HR PERIOD (12:00-18:00)	5,690	5,092	10,782
PM 12-HR PERIOD (12:00-24:00)	8,325	6,644	14,969
24 HOUR PERIOD	12,545	13,052	25,597
D (%)	49.01	50.99	100.00

Run Date: 2017/08/08

Hawaii Department of Transportation

Highways Division — **Highways Planning Survey Section**

2016 Program Count - Summary

Site ID: B71001112038
Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER
Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr
Town: Hawaii
Count Type: CLASS
DIR 1: +MP **DIR 2:** -MP
Counter Type: Tube
Final AADT: 25800
Route No: 11

DATE : 05/04/2016

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
12:00-12:15	13	2	15	06:00-06:15	63	185	248	12:00-12:15	241	185	426	06:00-06:15	209	143	352
12:15-12:30	12	8	20	06:15-06:30	97	255	352	12:15-12:30	253	224	477	06:15-06:30	200	169	369
12:30-12:45	9	4	13	06:30-06:45	122	249	371	12:30-12:45	259	198	457	06:30-06:45	183	139	322
12:45-01:00	12	5	17	06:45-07:00	138	242	380	12:45-01:00	229	219	448	06:45-07:00	187	86	273
01:00-01:15	11	6	17	07:00-07:15	193	278	471	01:00-01:15	227	205	432	07:00-07:15	161	88	249
01:15-01:30	8	1	9	07:15-07:30	197	284	481	01:15-01:30	213	216	429	07:15-07:30	148	102	250
01:30-01:45	6	7	13	07:30-07:45	203	292	495	01:30-01:45	236	202	438	07:30-07:45	141	79	220
01:45-02:00	6	3	9	07:45-08:00	168	265	433	01:45-02:00	213	215	428	07:45-08:00	134	86	220
02:00-02:15	0	6	6	08:00-08:15	148	249	397	02:00-02:15	219	215	434	08:00-08:15	127	70	197
02:15-02:30	5	11	16	08:15-08:30	154	253	407	02:15-02:30	245	236	481	08:15-08:30	130	69	199
02:30-02:45	8	5	13	08:30-08:45	155	233	388	02:30-02:45	226	233	459	08:30-08:45	125	67	192
02:45-03:00	6	3	9	08:45-09:00	147	234	381	02:45-03:00	230	258	488	08:45-09:00	105	65	170
03:00-03:15	7	7	14	09:00-09:15	169	207	376	03:00-03:15	245	220	465	09:00-09:15	127	63	190
03:15-03:30	7	7	14	09:15-09:30	136	231	367	03:15-03:30	262	212	474	09:15-09:30	102	57	159
03:30-03:45	5	17	22	09:30-09:45	197	227	424	03:30-03:45	238	197	435	09:30-09:45	93	50	143
03:45-04:00	3	21	24	09:45-10:00	168	239	407	03:45-04:00	257	217	474	09:45-10:00	92	28	120
04:00-04:15	8	12	20	10:00-10:15	155	214	369	04:00-04:15	256	227	483	10:00-10:15	66	38	104
04:15-04:30	4	40	44	10:15-10:30	167	262	429	04:15-04:30	215	231	446	10:15-10:30	69	30	99
04:30-04:45	11	50	61	10:30-10:45	180	242	422	04:30-04:45	275	221	496	10:30-10:45	63	27	90
04:45-05:00	15	64	79	10:45-11:00	203	191	394	04:45-05:00	260	213	473	10:45-11:00	49	15	64
05:00-05:15	26	75	101	11:00-11:15	202	209	411	05:00-05:15	249	197	446	11:00-11:15	42	14	56
05:15-05:30	21	88	109	11:15-11:30	200	173	373	05:15-05:30	253	175	428	11:15-11:30	57	23	80
05:30-05:45	38	127	165	11:30-11:45	210	207	417	05:30-05:45	251	151	402	11:30-11:45	25	13	38
05:45-06:00	46	178	224	11:45-12:00	228	189	417	05:45-06:00	240	179	419	11:45-12:00	35	8	43

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2		PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	03:45 PM to 04:45 PM		
AM - PEAK HR VOLUME	761	1119	1880	PM - PEAK HR VOLUME	1003	896	1899
AM - K FACTOR (%)			7.32	PM - K FACTOR (%)			7.39
AM - D (%)	40.48	59.52	100.00	PM - D (%)	52.82	47.18	100.00
DIRECTIONAL PEAK				DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	07:00 AM to 08:00 AM		PM - PEAK HR TIME	04:30 PM to 05:30 PM	03:45 PM to 04:45 PM	
AM - PEAK HR VOLUME	761	1119		PM - PEAK HR VOLUME	1037	896	

AM PERIOD (00:00-12:00)				PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	03:45 PM to 04:45 PM		
AM - PEAK HR VOLUME	761	1119	1880	PM - PEAK HR VOLUME	1003	896	1899
AM - K FACTOR (%)			7.32	PM - K FACTOR (%)			7.39
AM - D (%)	40.48	59.52	100.00	PM - D (%)	52.82	47.18	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	920	942	1862
DIRECTIONAL PEAK			
PEAK HR TIME	12:00 PM to 01:00 PM	09:45 AM to 10:45 AM	
PEAK HR VOLUME	982	957	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	4,000	5,610	9,610
AM 12-HR PERIOD (00:00-12:00)	4,287	6,357	10,644
PM 6-HR PERIOD (12:00-18:00)	5,792	5,046	10,838
PM 12-HR PERIOD (12:00-24:00)	8,462	6,575	15,037
24 HOUR PERIOD	12,749	12,932	25,681
D (%)	49.64	50.36	100.00

Run Date: 2017/08/08

Hawaii Department of Transportation
Highways Division
Highways Planning Survey Section

Vehicle Classification Data Summary
2016

Site ID: B71001112038 **Route No:** 11 **Date From:** 2016/05/03 0:00

Town: Hawaii **Direction:** +MP **Date To:** 2016/05/04 23:45

Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

Functional Classification: 14 URBAN:PRINCIPAL ARTERIAL - OTHER

REPORT TOTALS - 48 HOURS RECORDED

	VOLUME	%	NUMBER OF AXLES
Cycles	338	0.66%	677
PC	35846	69.91%	71692
2A-4T	14198	27.69%	28396
LIGHT VEHICLE TOTALS	50382	98.25%	100765
HEAVY VEHICLES			
Bus	234	0.46%	585
SINGLE UNIT TRUCK			
2A-6T	157	0.31%	314
3A-SU	145	0.28%	435
4A-SU	31	0.06%	124
SINGLE-TRAILER TRUCKS			
4A-ST	153	0.30%	612
5A-ST	95	0.19%	475
6A-ST	31	0.06%	186
MULTI-TRAILER TRUCKS			
5A-MT	14	0.03%	70
6A-MT	1	0.00%	6
7A-MT	33	0.06%	231
HEAVY VEHICLE TOTALS	894	1.74%	3038
CLASSIFIED VEHICLES TOTALS	51277 (A)	100.00%	103803 (B)
UNCLASSIFIED VEHICLES TOTALS	1	0.00%	

AXLE CORRECTION FACTOR (A/C) = 0.988

ROADTUBE EQUIVALENT(B/2) = 51901 (C)

PEAK HOUR VOLUME : 1970 2016/05/03 15:00	PEAK HOUR TRUCK VOLUME	% TOTAL PEAK HOUR VOLUME	24 HOUR TRUCK VOLUME	AADT	% OF AADT	HPMS K-FACTOR (PEAK/AADT) (ITEM 66)
SINGLE UNIT TRUCKS (TYPE 4-7)	33	(65A-1) 1.68%	283	25800	(65A-2) 1.10%	7.64%
COMBINATION (TYPE 8-13)	27	(65B-1) 1.37%	163		(65B-2) 0.63%	7.64%

Appendix B

Bus Route Schedule and Map

KONA/HILO BUS SCHEDULE

Operates Monday through Saturday

Effective 3/6/2017

KONA TO HILO

Pujihara store	Honaunau	Capt. Cook Yano Hall	Kealakekua Konawaena	Kainaliu Honalo	Sheraton Keauhou Resort	Ali'i Drive	Kona Commons	Kmart	Ali'i Drive	Matsuyama Store	HCC Palamanui Campus	Waikoloa Pyramid Stone	Four Seasons Resorts	Hilton Waikoloa	Marriott	Orchid @ Mauna Lani	Mauna Lani Bay	Hapuna Prince
5:45	5:55	6:00	6:05	6:10	6:20	6:30	---	6:45	---	6:55	---	7:30	---	---	---	---	---	---
---	---	---	---	---	---	6:35	6:40	6:45	---	---	7:05	---	7:35	8:00	8:05	8:15	8:20	---
---	---	---	---	---	---	---	4:00	4:03	4:13	4:20	---	4:55	---	---	---	---	---	---

Waimea - Pukalani Road Bus Shelter	Honokaa 76 Service Station	Paauilo	Laupahoehoe	Papaaloa	Ninole	Hakalau	Honomu Plantation Store	Pepeekeo	Papaikou	Mooheau Bus Terminal	Aupuni Center	Hilo Shopping Center	UH-Hilo	Hawaii Community College	Prince Kuhio Plaza
7:45	8:30	8:35	8:55	9:00	9:05	9:15	9:25	9:30	9:35	9:45	9:55	9:57	10:00	10:02	10:05
8:50	*9:15	9:20	9:35	9:40	9:45	9:50	---	9:55	10:00	10:05	---	---	---	---	---
5:15	5:45	5:50	6:10	6:15	6:20	6:30	---	6:45	6:50	7:00	---	---	---	---	---

*Honokaa Gym Complex Upper Parking Lot

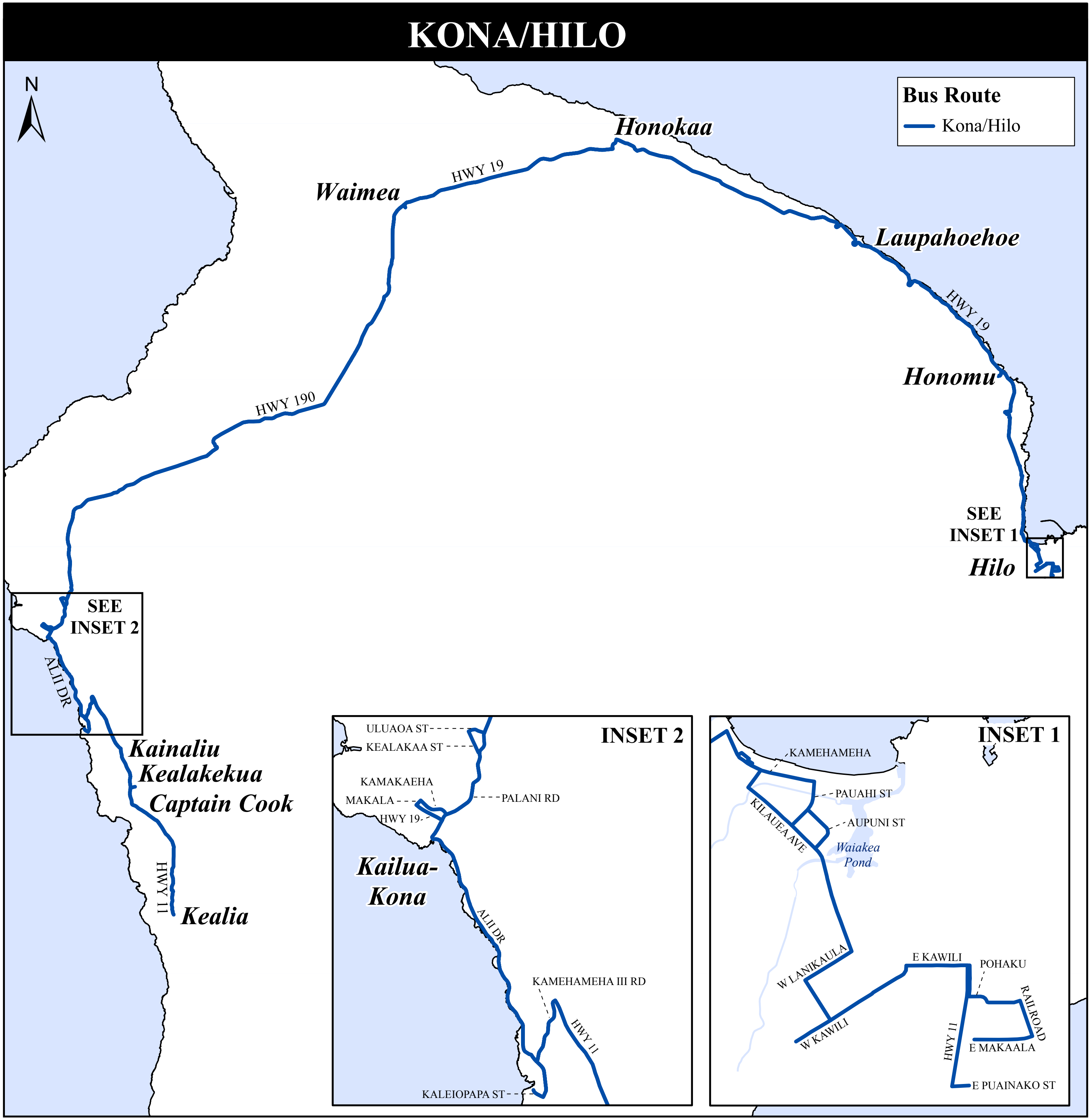
HILO TO KONA

Prince Kuhio Plaza	Hawaii Community College	UH- Hilo	Hilo Shopping Center	Aupuni Center	Mooheau Bus Terminal/*Bayfront Parking Lot	Papaikou	Honomu Plantation Store	Hakalau	Ninole	Papaaloa	Laupahoehoe	Paauilo	Honokaa Blane's Drive Inn	Waimea - Pukalani Road Bus Shelter
---	---	---	---	---	*3:40	3:45	---	4:00	4:05	4:25	4:30	4:45	4:50*	5:10
[illegible]	9:05	9:08	9:10	9:13	9:15	9:25	9:35	9:40	9:45	9:50	9:55	10:05	10:20	10:45
1:10	1:12	1:15	1:17	1:20	1:30	1:40	1:50	1:55	2:00	2:05	2:10	2:25	2:40	3:20

*Honokaa Gym Complex Upper Parking lot

Mauna Kea Beach Resort	Hapuna Prince	Orchid @ Mauna Lani	Mauna Lani Bay	Hilton Waikoloa	Marriott	Waikoloa Pyramid Stone	Matsuyama Store	Kealakehe	Kmart Macy's	Ali'i Drive	Kona Commons	Kmart Macy's	Sheraton Keauhou	Kainaliu Honalo	Kealakekua Konawaena	Capt. Cook Manago Hotel	Honaunau	Kealia Pujihara Store
5:30	5:35	5:40	5:45	5:55	6:00	---	---	---	---	6:35	6:40	6:45	---	---	---	---	---	---
---	---	---	---	---	---	11:05	11:35	---	11:45	---	11:50	---	---	---	---	---	---	---
---	---	---	---	---	---	3:45	4:15	4:20	4:25	4:30	---	---	---*	5:05	(5:10)	5:15	5:20	5:30

BOLD = MORNINGS



COUNTY OF HAWAII
MASS TRANSIT AGENCY
961-8744
KONA TO HILO
BUS SCHEDULE

In consideration of others and for your safety:

1. Shirts and footwear are required.
2. No flammable, explosive or toxic material.
3. No smoking, consumption of food or beverage.
4. Discarding of litter.
5. Expectorating or spitting.
6. The playing of radios, tape players, dvd players, and cell phones are prohibited without headphones.
7. Refrain from horseplaying, yelling or talking loudly.
8. The following items are prohibited unless prior permission is granted:
   a. Bodyboards
9. **$1.00 charge for pets (except service animals) provided they are kept in an enclosed container or cage**
10. **$1.00 charge per item larger than 16" x 10"or more than one item that cannot fit underneath your seat. $1.00 charge for bicycle.**
11. Please utilize designated bus stop zones whenever possible.

How to board the bus:

1. Wait on the proper side of the roadway for the bus.
2. Flag the bus (please call for bus stop information).
3. Wait until the bus makes a complete stop.
4. Boarding will be denied if passengers appear to be intoxicated on liquor or drugs; engaged in activities that violate any other law or ordinance.

How to exit the bus:

1. Before reaching your desired "get off" spot, pull cord located by the window of the bus.
2. Remain seated until the bus comes to a complete stop.
3. Exit from front of bus.

DISCLAIMER: The County of Hawaii will not be responsible for any inconvenience, expense, or damages resulting from the failure to depart or arrive at stated times or for any items brought on the bus.

For more information visit www.heleonbus.org

County of Hawaii is an Equal Opportunity Employer and Provider

7/9/09

Appendix C

Analysis Reports – Existing Conditions (2019)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	457	218	163	678	23	243	192	109	20	321	177
Future Volume (veh/h)	71	457	218	163	678	23	243	192	109	20	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	466	0	166	692	0	248	196	0	20	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	161	1537		249	1656		344	780		40	500	
Arrive On Green	0.05	0.46	0.00	0.07	0.48	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	466	0	166	692	0	248	196	0	20	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.7	6.9	0.0	3.8	10.4	0.0	5.6	3.6	0.0	0.9	6.9	0.0
Cycle Q Clear(g_c), s	1.7	6.9	0.0	3.8	10.4	0.0	5.6	3.6	0.0	0.9	6.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	161	1537		249	1656		344	780		40	500	
V/C Ratio(X)	0.45	0.30		0.67	0.42		0.72	0.25		0.50	0.66	
Avail Cap(c_a), veh/h	251	1537		445	1656		613	2108		123	1714	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.6	13.5	0.0	35.8	13.4	0.0	34.6	25.6	0.0	38.4	32.3	0.0
Incr Delay (d2), s/veh	1.9	0.5	0.0	3.1	0.8	0.0	2.8	0.2	0.0	9.3	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	2.5	0.0	1.6	3.8	0.0	2.4	1.5	0.0	0.5	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.6	14.1	0.0	38.9	14.2	0.0	37.4	25.8	0.0	47.7	33.7	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		538	A		858	A		444	A		348	A
Approach Delay, s/veh		17.3			18.9			32.3			34.5	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.3	21.9	10.3	40.9	12.5	15.7	8.5	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	2.9	5.6	5.8	8.9	7.6	8.9	3.7	12.4
Green Ext Time (p_c), s	0.0	1.3	0.2	3.1	0.5	2.2	0.0	4.9

Intersection Summary	
HCM 6th Ctrl Delay	23.7
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	359	124	52	600	467	146	337	42	362	339	124
Future Volume (vph)	107	359	124	52	600	467	146	337	42	362	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	370	128	54	619	481	151	347	43	373	349	128
RTOR Reduction (vph)	0	0	86	0	0	336	0	0	35	0	23	0
Lane Group Flow (vph)	110	370	42	54	619	145	136	362	8	283	544	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.6	30.6	4.1	28.1	28.1	17.5	17.5	17.5	23.1	23.1	
Effective Green, g (s)	6.6	30.6	30.6	4.1	28.1	28.1	17.5	17.5	17.5	23.1	23.1	
Actuated g/C Ratio	0.07	0.33	0.33	0.04	0.30	0.30	0.19	0.19	0.19	0.25	0.25	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	219	1076	497	145	1025	466	293	627	278	394	785	
v/s Ratio Prot	c0.04	0.11		0.02	c0.18		0.09	c0.11		c0.18	0.17	
v/s Ratio Perm			0.03			0.09			0.01			
v/c Ratio	0.50	0.34	0.08	0.37	0.60	0.31	0.46	0.58	0.03	0.72	0.69	
Uniform Delay, d1	41.8	23.7	21.7	43.3	27.8	25.1	33.7	34.5	31.0	32.1	31.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.8	0.9	0.3	1.6	2.6	1.7	1.2	1.3	0.0	6.2	2.7	
Delay (s)	43.6	24.6	22.0	45.0	30.5	26.9	34.9	35.8	31.0	38.3	34.6	
Level of Service	D	C	C	D	C	C	C	D	C	D	C	
Approach Delay (s)		27.5			29.7			35.2			35.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	31.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	93.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	10.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	48	164	985	776	30
Future Vol, veh/h	44	48	164	985	776	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	52	176	1059	834	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2246	-	835	0	-	0
Stage 1	835	-	-	-	-	-
Stage 2	1411	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 46	0	798	-	-	-
Stage 1	426	0	-	-	-	-
Stage 2	225	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 36	-	797	-	-	-
Mov Cap-2 Maneuver	~ 36	-	-	-	-	-
Stage 1	331	-	-	-	-	-
Stage 2	225	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 429	1.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	797	-	36	-	-	-
HCM Lane V/C Ratio	0.221	-	1.314	-	-	-
HCM Control Delay (s)	10.8	-	$ 429	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.8	-	5	-	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	3.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	140	1006	15	73	748
Future Vol, veh/h	9	140	1006	15	73	748
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1082	16	78	804

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2050	1090	0	0	1082	0
Stage 1	1090	-	-	-	-	-
Stage 2	960	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	61	262	-	-	630	-
Stage 1	322	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	53	262	-	-	630	-
Mov Cap-2 Maneuver	53	-	-	-	-	-
Stage 1	322	-	-	-	-	-
Stage 2	326	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	38.9	0	1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	53	262	630	-
HCM Lane V/C Ratio	-	-	0.183	0.575	0.125	-
HCM Control Delay (s)	-	-	87.5	35.8	11.5	-
HCM Lane LOS	-	-	F	E	B	-
HCM 95th %tile Q(veh)	-	-	0.6	3.3	0.4	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	87	185	853	24	43	718
Future Volume (veh/h)	87	185	853	24	43	718
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826
Adj Flow Rate, veh/h	93	0	907	0	46	764
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	3	2	2	5
Cap, veh/h	120		1409		65	1536
Arrive On Green	0.07	0.00	0.76	0.00	0.04	0.84
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826
Grp Volume(v), veh/h	93	0	907	0	46	764
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826
Q Serve(g_s), s	5.1	0.0	22.7	0.0	2.5	11.3
Cycle Q Clear(g_c), s	5.1	0.0	22.7	0.0	2.5	11.3
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	120		1409		65	1536
V/C Ratio(X)	0.78		0.64		0.71	0.50
Avail Cap(c_a), veh/h	325		1409		117	1536
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.3	0.0	5.6	0.0	47.0	2.1
Incr Delay (d2), s/veh	10.2	0.0	2.3	0.0	13.4	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.0	7.5	0.0	1.4	2.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	55.4	0.0	7.9	0.0	60.4	3.3
LnGrp LOS	E		A		E	A
Approach Vol, veh/h	93	A	907	A		810
Approach Delay, s/veh	55.4		7.9			6.5
Approach LOS	E		A			A

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	8.1	79.4	87.5	11.1
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.5	72.0	83.0	18.0
Max Q Clear Time (g_c+I1), s	4.5	24.7	13.3	7.1
Green Ext Time (p_c), s	0.0	9.3	7.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	9.7
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	7.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	7	169	517	801	733	61
Future Vol, veh/h	7	169	517	801	733	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	8	182	556	861	788	66

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2761	-	788	0	-	0
Stage 1	788	-	-	-	-	-
Stage 2	1973	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	22	0	831	-	-	-
Stage 1	448	0	-	-	-	-
Stage 2	118	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 7	-	831	-	-	-
Mov Cap-2 Maneuver	~ 7	-	-	-	-	-
Stage 1	148	-	-	-	-	-
Stage 2	118	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1035.4	6.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	831	-	7	-	-	-
HCM Lane V/C Ratio	0.669	-	1.075	-	-	-
HCM Control Delay (s)	17.6		$ 1035.4	0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	5.3	-	1.7	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Future Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	303	318		110	116		344	971		258	1016	
Arrive On Green	0.17	0.17	0.00	0.06	0.06	0.00	0.03	0.52	0.00	0.06	0.55	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	14.0	2.2	0.0	3.9	1.9	0.0	0.9	37.7	0.0	3.8	25.5	0.0
Cycle Q Clear(g_c), s	14.0	2.2	0.0	3.9	1.9	0.0	0.9	37.7	0.0	3.8	25.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	303	318		110	116		344	971		258	1016	
V/C Ratio(X)	0.88	0.16		0.66	0.33		0.10	0.87		0.58	0.68	
Avail Cap(c_a), veh/h	336	353		333	353		381	971		270	1016	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	38.7	33.8	0.0	43.8	42.9	0.0	12.7	20.1	0.0	19.0	15.5	0.0
Incr Delay (d2), s/veh	21.5	0.2	0.0	6.7	1.6	0.0	0.1	10.4	0.0	2.9	3.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.8	1.0	0.0	1.9	0.9	0.0	0.3	17.9	0.0	1.7	11.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	60.2	34.1	0.0	50.5	44.5	0.0	12.8	30.4	0.0	21.9	19.2	0.0
LnGrp LOS	E	C		D	D		B	C		C	B	
Approach Vol, veh/h		318	A		111	A		878	A		838	A
Approach Delay, s/veh		56.0			48.4			29.7			19.6	
Approach LOS		E			D			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.2	54.1		20.7	7.5	56.8		10.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	49.6		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	5.8	39.7		16.0	2.9	27.5		5.9				
Green Ext Time (p_c), s	0.0	4.4		0.2	0.0	5.1		0.2				

Intersection Summary			
HCM 6th Ctrl Delay			30.6
HCM 6th LOS			C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	157	5	26	16	12	15	76	475	15	14	417	285
Future Volume (veh/h)	157	5	26	16	12	15	76	475	15	14	417	285
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1722	1781	1781	1781	1752	1811	1811	1870	1811	1811
Adj Flow Rate, veh/h	169	5	0	17	13	16	82	511	16	15	448	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	12	8	8	8	10	6	6	2	6	6
Cap, veh/h	230	7		26	20	24	103	933	29	32	1690	
Arrive On Green	0.13	0.13	0.00	0.04	0.04	0.04	0.06	0.53	0.53	0.02	0.49	0.00
Sat Flow, veh/h	1732	51	1459	598	457	563	1668	1745	55	1781	3532	0
Grp Volume(v), veh/h	174	0	0	46	0	0	82	0	527	15	448	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1618	0	0	1668	0	1800	1781	1721	0
Q Serve(g_s), s	6.2	0.0	0.0	1.9	0.0	0.0	3.2	0.0	12.8	0.6	5.1	0.0
Cycle Q Clear(g_c), s	6.2	0.0	0.0	1.9	0.0	0.0	3.2	0.0	12.8	0.6	5.1	0.0
Prop In Lane	0.97		1.00	0.37		0.35	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	237	0		70	0	0	103	0	962	32	1690	
V/C Ratio(X)	0.73	0.00		0.66	0.00	0.00	0.79	0.00	0.55	0.46	0.27	
Avail Cap(c_a), veh/h	696	0		622	0	0	229	0	962	137	1690	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	0.0	31.3	0.0	0.0	30.7	0.0	10.2	32.3	9.9	0.0
Incr Delay (d2), s/veh	4.4	0.0	0.0	10.2	0.0	0.0	12.8	0.0	2.2	9.9	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	0.0	0.9	0.0	0.0	1.6	0.0	4.3	0.3	1.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	0.0	41.4	0.0	0.0	43.5	0.0	12.4	42.2	10.3	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		174	A		46			609			463	A
Approach Delay, s/veh		32.0			41.4			16.6			11.3	
Approach LOS		C			D			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		13.3	8.6	37.1		7.4	5.7	40.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	9.1	31.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		8.2	5.2	7.1		3.9	2.6	14.8				
Green Ext Time (p_c), s		0.8	0.0	2.7		0.2	0.0	3.0				
Intersection Summary												
HCM 6th Ctrl Delay			17.7									
HCM 6th LOS			B									

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	877	503	223	609	41	227	283	247	51	313	107
Future Volume (veh/h)	260	877	503	223	609	41	227	283	247	51	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	895	0	228	621	0	232	289	0	52	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	357	1578		316	1521		319	691		76	512	
Arrive On Green	0.10	0.45	0.00	0.09	0.43	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	895	0	228	621	0	232	289	0	52	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.0	15.1	0.0	5.2	9.8	0.0	5.3	5.7	0.0	2.3	6.8	0.0
Cycle Q Clear(g_c), s	6.0	15.1	0.0	5.2	9.8	0.0	5.3	5.7	0.0	2.3	6.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	357	1578		316	1521		319	691		76	512	
V/C Ratio(X)	0.74	0.57		0.72	0.41		0.73	0.42		0.68	0.62	
Avail Cap(c_a), veh/h	533	1578		451	1521		448	1838		197	1767	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.0	16.5	0.0	35.5	15.6	0.0	35.5	28.4	0.0	38.0	32.4	0.0
Incr Delay (d2), s/veh	3.1	1.5	0.0	3.2	0.8	0.0	3.6	0.4	0.0	10.3	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	5.9	0.0	2.2	3.8	0.0	2.3	2.4	0.0	1.2	2.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.0	17.9	0.0	38.8	16.4	0.0	39.1	28.8	0.0	48.3	33.6	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		1160	A		849	A		521	A		371	A
Approach Delay, s/veh		22.5			22.4			33.4			35.7	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.9	20.2	11.8	40.5	12.0	16.1	12.9	39.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	4.3	7.7	7.2	17.1	7.3	8.8	8.0	11.8
Green Ext Time (p_c), s	0.0	2.0	0.2	6.0	0.2	2.2	0.4	4.2

Intersection Summary	
HCM 6th Ctrl Delay	26.1
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	663	291	72	548	314	126	318	34	348	342	190
Future Volume (vph)	190	663	291	72	548	314	126	318	34	348	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	677	297	73	559	320	129	324	35	355	349	194
RTOR Reduction (vph)	0	0	197	0	0	228	0	0	29	0	47	0
Lane Group Flow (vph)	194	677	100	73	559	92	116	337	6	302	549	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	32.3	32.3	3.9	27.6	27.6	16.9	16.9	16.9	24.4	24.4	
Effective Green, g (s)	8.6	32.3	32.3	3.9	27.6	27.6	16.9	16.9	16.9	24.4	24.4	
Actuated g/C Ratio	0.09	0.34	0.34	0.04	0.29	0.29	0.18	0.18	0.18	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	300	1196	535	140	1003	451	282	598	271	411	815	
v/s Ratio Prot	c0.06	c0.19		0.02	0.16		0.07	c0.10		c0.19	0.17	
v/s Ratio Perm			0.06			0.06			0.00			
v/c Ratio	0.65	0.57	0.19	0.52	0.56	0.21	0.41	0.56	0.02	0.73	0.67	
Uniform Delay, d1	42.0	25.9	22.3	44.9	28.8	25.7	34.9	35.9	32.5	32.6	32.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.7	1.9	0.8	3.5	2.2	1.0	1.0	1.2	0.0	6.7	2.2	
Delay (s)	46.7	27.8	23.1	48.4	31.0	26.7	35.9	37.1	32.5	39.3	34.2	
Level of Service	D	C	C	D	C	C	D	D	C	D	C	
Approach Delay (s)		29.8			30.9			36.5			35.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	95.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	1					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	70	84	923	1005	17
Future Vol, veh/h	10	70	84	923	1005	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	72	87	952	1036	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2162	-	1036	0	-	0
Stage 1	1036	-	-	-	-	-
Stage 2	1126	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	52	0	671	-	-	-
Stage 1	342	0	-	-	-	-
Stage 2	310	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	45	-	671	-	-	-
Mov Cap-2 Maneuver	45	-	-	-	-	-
Stage 1	298	-	-	-	-	-
Stage 2	310	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	107.3	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	671	-	45	-	-	-
HCM Lane V/C Ratio	0.129	-	0.229	-	-	-
HCM Control Delay (s)	11.2	-	107.3	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.4	-	0.8	-	-	-

Intersection						
Int Delay, s/veh	1.7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	940	4	61	1015
Future Vol, veh/h	14	71	940	4	61	1015
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	969	4	63	1046

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2143	971	0	0	969	0
Stage 1	971	-	-	-	-	-
Stage 2	1172	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	52	307	-	-	688	-
Stage 1	360	-	-	-	-	-
Stage 2	288	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	47	307	-	-	688	-
Mov Cap-2 Maneuver	47	-	-	-	-	-
Stage 1	360	-	-	-	-	-
Stage 2	262	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	35.6	0	0.6
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	47	307	688	-
HCM Lane V/C Ratio	-	-	0.307	0.238	0.091	-
HCM Control Delay (s)	-	-	112.5	20.4	10.8	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	1.1	0.9	0.3	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	34	107	825	48	132	906
Future Volume (veh/h)	34	107	825	48	132	906
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	35	0	851	0	136	934
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	57		1358		168	1634
Arrive On Green	0.03	0.00	0.73	0.00	0.09	0.87
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	35	0	851	0	136	934
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	1.8	0.0	21.6	0.0	7.1	12.0
Cycle Q Clear(g_c), s	1.8	0.0	21.6	0.0	7.1	12.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	57		1358		168	1634
V/C Ratio(X)	0.62		0.63		0.81	0.57
Avail Cap(c_a), veh/h	337		1358		253	1634
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.4	0.0	6.3	0.0	42.2	1.5
Incr Delay (d2), s/veh	10.5	0.0	2.2	0.0	11.0	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	7.4	0.0	3.6	1.5
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	56.0	0.0	8.5	0.0	53.1	3.0
LnGrp LOS	E		A		D	A
Approach Vol, veh/h	35	A	851	A		1070
Approach Delay, s/veh	56.0		8.5			9.4
Approach LOS	E		A			A

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	13.5	74.0	87.5	7.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	13.5	65.0	83.0	18.0
Max Q Clear Time (g_c+I1), s	9.1	23.6	14.0	3.8
Green Ext Time (p_c), s	0.1	8.1	10.2	0.0

Intersection Summary	
HCM 6th Ctrl Delay	9.8
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	2.8					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	13	372	243	854	887	36
Future Vol, veh/h	13	372	243	854	887	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	13	380	248	871	905	37

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2272	-	905	0	-	0
Stage 1	905	-	-	-	-	-
Stage 2	1367	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	43	0	752	-	-	-
Stage 1	385	0	-	-	-	-
Stage 2	230	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	29	-	752	-	-	-
Mov Cap-2 Maneuver	29	-	-	-	-	-
Stage 1	258	-	-	-	-	-
Stage 2	230	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	208.2	2.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	752	-	29	-	-	-
HCM Lane V/C Ratio	0.33	-	0.457	-	-	-
HCM Control Delay (s)	12.1	-	208.2	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.4	-	1.5	-	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Future Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	173	184		102	104		277	1050		373	1119	
Arrive On Green	0.10	0.10	0.00	0.06	0.06	0.00	0.04	0.57	0.00	0.07	0.60	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	6.3	1.3	0.0	3.0	1.8	0.0	0.8	27.2	0.0	3.7	32.8	0.0
Cycle Q Clear(g_c), s	6.3	1.3	0.0	3.0	1.8	0.0	0.8	27.2	0.0	3.7	32.8	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	173	184		102	104		277	1050		373	1119	
V/C Ratio(X)	0.76	0.17		0.64	0.39		0.14	0.75		0.51	0.82	
Avail Cap(c_a), veh/h	370	395		376	385		318	1050		426	1119	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.5	35.2	0.0	39.4	38.8	0.0	12.6	13.9	0.0	12.4	13.5	0.0
Incr Delay (d2), s/veh	6.9	0.4	0.0	6.6	2.4	0.0	0.2	4.9	0.0	1.1	6.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.6	0.0	1.5	0.9	0.0	0.3	11.5	0.0	1.3	13.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.3	35.7	0.0	45.9	41.2	0.0	12.8	18.8	0.0	13.5	20.1	0.0
LnGrp LOS	D	D		D	D		B	B		B	C	
Approach Vol, veh/h		163	A		106	A		824	A		1103	A
Approach Delay, s/veh		42.7			44.1			18.5			19.0	
Approach LOS		D			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.3	52.7		12.9	7.5	55.5		9.4
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.3	47.7		18.0	5.0	51.0		18.0
Max Q Clear Time (g_c+I1), s	5.7	29.2		8.3	2.8	34.8		5.0
Green Ext Time (p_c), s	0.1	5.6		0.3	0.0	6.6		0.2

Intersection Summary	
HCM 6th Ctrl Delay	21.8
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	290	11	52	7	11	18	64	495	11	17	511	284
Future Volume (veh/h)	290	11	52	7	11	18	64	495	11	17	511	284
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1767	1811	1870	1870	1870	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	305	12	0	7	12	19	67	521	12	18	538	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	9	9	6	2	2	2	3	3	3	2	2	2
Cap, veh/h	364	14		11	20	31	89	862	20	37	1592	
Arrive On Green	0.22	0.22	0.00	0.04	0.04	0.04	0.05	0.48	0.48	0.02	0.45	0.00
Sat Flow, veh/h	1622	64	1535	313	537	851	1767	1806	42	1781	3647	0
Grp Volume(v), veh/h	317	0	0	38	0	0	67	0	533	18	538	0
Grp Sat Flow(s),veh/h/ln	1686	0	1535	1702	0	0	1767	0	1848	1781	1777	0
Q Serve(g_s), s	13.4	0.0	0.0	1.6	0.0	0.0	2.8	0.0	15.8	0.7	7.4	0.0
Cycle Q Clear(g_c), s	13.4	0.0	0.0	1.6	0.0	0.0	2.8	0.0	15.8	0.7	7.4	0.0
Prop In Lane	0.96		1.00	0.18		0.50	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	378	0		62	0	0	89	0	882	37	1592	
V/C Ratio(X)	0.84	0.00		0.61	0.00	0.00	0.75	0.00	0.60	0.48	0.34	
Avail Cap(c_a), veh/h	584	0		580	0	0	168	0	882	122	1592	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	0.0	35.5	0.0	0.0	35.1	0.0	14.3	36.2	13.4	0.0
Incr Delay (d2), s/veh	6.4	0.0	0.0	9.4	0.0	0.0	12.1	0.0	3.1	9.5	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	0.0	0.0	0.8	0.0	0.0	1.4	0.0	6.2	0.4	2.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.1	0.0	0.0	44.9	0.0	0.0	47.2	0.0	17.4	45.7	14.0	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		317	A		38			600			556	A
Approach Delay, s/veh		34.1			44.9			20.7			15.0	
Approach LOS		C			D			C			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		21.3	8.3	38.0		7.2	6.1	40.2				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	7.1	33.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		15.4	4.8	9.4		3.6	2.7	17.8				
Green Ext Time (p_c), s		1.4	0.0	3.3		0.1	0.0	2.9				
Intersection Summary												
HCM 6th Ctrl Delay			22.0									
HCM 6th LOS			C									

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Appendix D

Analysis Reports – Future Without Project Conditions (2024)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	75	480	229	171	713	24	255	202	115	21	337	186
Future Volume (veh/h)	75	480	229	171	713	24	255	202	115	21	337	186
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	77	490	0	174	728	0	260	206	0	21	344	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	164	1512		257	1634		355	807		41	518	
Arrive On Green	0.05	0.45	0.00	0.08	0.47	0.00	0.10	0.23	0.00	0.02	0.15	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	77	490	0	174	728	0	260	206	0	21	344	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.9	7.6	0.0	4.0	11.3	0.0	6.0	3.8	0.0	0.9	7.4	0.0
Cycle Q Clear(g_c), s	1.9	7.6	0.0	4.0	11.3	0.0	6.0	3.8	0.0	0.9	7.4	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	164	1512		257	1634		355	807		41	518	
V/C Ratio(X)	0.47	0.32		0.68	0.45		0.73	0.26		0.51	0.66	
Avail Cap(c_a), veh/h	247	1512		440	1634		605	2081		122	1692	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.1	14.2	0.0	36.2	14.1	0.0	34.9	25.5	0.0	38.8	32.5	0.0
Incr Delay (d2), s/veh	2.1	0.6	0.0	3.1	0.9	0.0	2.9	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	2.8	0.0	1.7	4.2	0.0	2.6	1.6	0.0	0.5	3.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.2	14.8	0.0	39.3	14.9	0.0	37.8	25.7	0.0	48.1	34.0	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		567	A		902	A		466	A		365	A
Approach Delay, s/veh		18.1			19.6			32.5			34.8	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	22.8	10.6	40.7	12.9	16.2	8.6	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	2.9	5.8	6.0	9.6	8.0	9.4	3.9	13.3
Green Ext Time (p_c), s	0.0	1.4	0.2	3.3	0.5	2.4	0.0	5.2

Intersection Summary	
HCM 6th Ctrl Delay	24.3
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	112	377	130	55	631	491	153	354	44	380	356	130
Future Volume (vph)	112	377	130	55	631	491	153	354	44	380	356	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	115	389	134	57	651	506	158	365	45	392	367	134
RTOR Reduction (vph)	0	0	91	0	0	356	0	0	36	0	22	0
Lane Group Flow (vph)	115	389	43	57	651	150	142	381	9	298	573	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.6	30.6	4.1	28.1	28.1	18.1	18.1	18.1	24.1	24.1	
Effective Green, g (s)	6.6	30.6	30.6	4.1	28.1	28.1	18.1	18.1	18.1	24.1	24.1	
Actuated g/C Ratio	0.07	0.32	0.32	0.04	0.30	0.30	0.19	0.19	0.19	0.25	0.25	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	215	1058	488	142	1008	458	298	638	283	405	806	
v/s Ratio Prot	c0.04	0.12		0.02	c0.19		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.10			0.01			
v/c Ratio	0.53	0.37	0.09	0.40	0.65	0.33	0.48	0.60	0.03	0.74	0.71	
Uniform Delay, d1	42.7	24.7	22.4	44.2	29.1	26.0	34.2	35.1	31.3	32.5	32.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	1.0	0.4	1.9	3.2	1.9	1.2	1.5	0.0	6.8	3.0	
Delay (s)	45.2	25.7	22.8	46.1	32.3	27.9	35.4	36.6	31.3	39.3	35.2	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		28.6			31.1			35.9			36.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	94.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	14.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	46	50	172	1035	816	32
Future Vol, veh/h	46	50	172	1035	816	32
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	49	54	185	1113	877	34

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2361	-	878	0	-	0
Stage 1	878	-	-	-	-	-
Stage 2	1483	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 39	0	769	-	-	-
Stage 1	406	0	-	-	-	-
Stage 2	208	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 30	-	768	-	-	-
Mov Cap-2 Maneuver	~ 30	-	-	-	-	-
Stage 1	308	-	-	-	-	-
Stage 2	208	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 603.1	1.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	768	-	30	-	-	-
HCM Lane V/C Ratio	0.241	-	1.649	-	-	-
HCM Control Delay (s)	11.2	-	$ 603.1	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.9	-	5.7	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	147	1057	16	77	786
Future Vol, veh/h	9	147	1057	16	77	786
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	158	1137	17	83	845

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2157	1146	0	0	1137	0
Stage 1	1146	-	-	-	-	-
Stage 2	1011	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	52	243	-	-	600	-
Stage 1	303	-	-	-	-	-
Stage 2	352	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	45	243	-	-	600	-
Mov Cap-2 Maneuver	45	-	-	-	-	-
Stage 1	303	-	-	-	-	-
Stage 2	303	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	47.3	0	1.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	45	243	600	-
HCM Lane V/C Ratio	-	-	0.215	0.65	0.138	-
HCM Control Delay (s)	-	-	105.7	43.7	12	-
HCM Lane LOS	-	-	F	E	B	-
HCM 95th %tile Q(veh)	-	-	0.7	4	0.5	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	91	194	897	25	45	755
Future Volume (veh/h)	91	194	897	25	45	755
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826
Adj Flow Rate, veh/h	97	0	954	0	48	803
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	3	2	2	5
Cap, veh/h	125		1404		66	1532
Arrive On Green	0.07	0.00	0.76	0.00	0.04	0.84
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826
Grp Volume(v), veh/h	97	0	954	0	48	803
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826
Q Serve(g_s), s	5.3	0.0	25.5	0.0	2.6	12.5
Cycle Q Clear(g_c), s	5.3	0.0	25.5	0.0	2.6	12.5
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	125		1404		66	1532
V/C Ratio(X)	0.78		0.68		0.73	0.52
Avail Cap(c_a), veh/h	324		1404		117	1532
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.2	0.0	6.0	0.0	47.1	2.3
Incr Delay (d2), s/veh	9.9	0.0	2.7	0.0	14.1	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	0.0	8.5	0.0	1.4	2.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	55.2	0.0	8.7	0.0	61.3	3.6
LnGrp LOS	E		A		E	A
Approach Vol, veh/h	97	A	954	A		851
Approach Delay, s/veh	55.2		8.7			6.8
Approach LOS	E		A			A

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	8.2	79.3	87.5	11.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.5	72.0	83.0	18.0
Max Q Clear Time (g_c+I1), s	4.6	27.5	14.5	7.3
Green Ext Time (p_c), s	0.0	10.2	7.6	0.1

Intersection Summary	
HCM 6th Ctrl Delay	10.2
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	9.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	7	178	543	842	770	64
Future Vol, veh/h	7	178	543	842	770	64
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	8	191	584	905	828	69

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2901	-	828	0	-	0
Stage 1	828	-	-	-	-	-
Stage 2	2073	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	17	0	803	-	-	-
Stage 1	429	0	-	-	-	-
Stage 2	105	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 5	-	803	-	-	-
Mov Cap-2 Maneuver	~ 5	-	-	-	-	-
Stage 1	117	-	-	-	-	-
Stage 2	105	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1546.3	8	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	803	-	5	-	-	-
HCM Lane V/C Ratio	0.727	-	1.505	-	-	-
HCM Control Delay (s)	20.4		$ 1546.3	0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	6.5	-	1.8	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	264	50	73	73	38	281	35	832	58	148	680	131
Future Volume (veh/h)	264	50	73	73	38	281	35	832	58	148	680	131
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	281	53	0	78	40	0	37	885	0	157	723	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	314	330		115	122		313	955		225	1003	
Arrive On Green	0.18	0.18	0.00	0.07	0.07	0.00	0.03	0.51	0.00	0.06	0.54	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	281	53	0	78	40	0	37	885	0	157	723	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	15.0	2.3	0.0	4.2	2.0	0.0	0.9	42.7	0.0	4.1	28.5	0.0
Cycle Q Clear(g_c), s	15.0	2.3	0.0	4.2	2.0	0.0	0.9	42.7	0.0	4.1	28.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	314	330		115	122		313	955		225	1003	
V/C Ratio(X)	0.89	0.16		0.68	0.33		0.12	0.93		0.70	0.72	
Avail Cap(c_a), veh/h	330	347		328	347		346	955		231	1003	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	39.1	33.9	0.0	44.4	43.3	0.0	13.9	22.1	0.0	21.5	16.8	0.0
Incr Delay (d2), s/veh	24.6	0.2	0.0	6.7	1.5	0.0	0.2	16.0	0.0	8.7	4.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.6	1.1	0.0	2.0	1.0	0.0	0.4	21.6	0.0	2.3	12.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	63.7	34.1	0.0	51.1	44.9	0.0	14.1	38.0	0.0	30.1	21.3	0.0
LnGrp LOS	E	C		D	D		B	D		C	C	
Approach Vol, veh/h		334	A		118	A		922	A		880	A
Approach Delay, s/veh		59.0			49.0			37.1			22.9	
Approach LOS		E			D			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.5	54.1		21.6	7.7	57.0		10.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	49.6		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	6.1	44.7		17.0	2.9	30.5		6.2				
Green Ext Time (p_c), s	0.0	2.7		0.1	0.0	5.2		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			35.4
HCM 6th LOS			D

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	165	5	27	17	13	16	80	499	16	15	438	300
Future Volume (veh/h)	165	5	27	17	13	16	80	499	16	15	438	300
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1722	1781	1781	1781	1752	1811	1811	1870	1811	1811
Adj Flow Rate, veh/h	177	5	0	18	14	17	86	537	17	16	471	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	12	8	8	8	10	6	6	2	6	6
Cap, veh/h	239	7		27	21	25	108	924	29	34	1665	
Arrive On Green	0.14	0.14	0.00	0.04	0.04	0.04	0.06	0.53	0.53	0.02	0.48	0.00
Sat Flow, veh/h	1735	49	1459	595	462	562	1668	1745	55	1781	3532	0
Grp Volume(v), veh/h	182	0	0	49	0	0	86	0	554	16	471	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1618	0	0	1668	0	1800	1781	1721	0
Q Serve(g_s), s	6.6	0.0	0.0	2.0	0.0	0.0	3.4	0.0	14.0	0.6	5.5	0.0
Cycle Q Clear(g_c), s	6.6	0.0	0.0	2.0	0.0	0.0	3.4	0.0	14.0	0.6	5.5	0.0
Prop In Lane	0.97		1.00	0.37		0.35	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	246	0		72	0	0	108	0	953	34	1665	
V/C Ratio(X)	0.74	0.00		0.68	0.00	0.00	0.79	0.00	0.58	0.47	0.28	
Avail Cap(c_a), veh/h	689	0		616	0	0	226	0	953	136	1665	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	0.0	31.5	0.0	0.0	30.9	0.0	10.7	32.5	10.3	0.0
Incr Delay (d2), s/veh	4.3	0.0	0.0	10.6	0.0	0.0	12.2	0.0	2.6	9.6	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	0.0	1.0	0.0	0.0	1.6	0.0	4.8	0.3	1.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	0.0	42.1	0.0	0.0	43.1	0.0	13.3	42.1	10.8	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		182	A		49			640			487	A
Approach Delay, s/veh		32.0			42.1			17.3			11.8	
Approach LOS		C			D			B			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		13.8	8.9	36.9		7.5	5.8	40.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	9.1	31.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		8.6	5.4	7.5		4.0	2.6	16.0				
Green Ext Time (p_c), s		0.9	0.0	2.9		0.2	0.0	3.2				

Intersection Summary			
HCM 6th Ctrl Delay			18.2
HCM 6th LOS			B

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	273	922	529	234	640	43	239	297	260	54	329	112
Future Volume (veh/h)	273	922	529	234	640	43	239	297	260	54	329	112
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	279	941	0	239	653	0	244	303	0	55	336	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	369	1553		325	1493		330	717		78	530	
Arrive On Green	0.11	0.44	0.00	0.09	0.43	0.00	0.10	0.20	0.00	0.04	0.15	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	279	941	0	239	653	0	244	303	0	55	336	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.5	16.7	0.0	5.5	10.8	0.0	5.7	6.1	0.0	2.5	7.3	0.0
Cycle Q Clear(g_c), s	6.5	16.7	0.0	5.5	10.8	0.0	5.7	6.1	0.0	2.5	7.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	369	1553		325	1493		330	717		78	530	
V/C Ratio(X)	0.76	0.61		0.73	0.44		0.74	0.42		0.71	0.63	
Avail Cap(c_a), veh/h	524	1553		444	1493		440	1808		194	1739	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.4	17.5	0.0	36.0	16.5	0.0	36.0	28.5	0.0	38.6	32.7	0.0
Incr Delay (d2), s/veh	3.9	1.8	0.0	4.1	0.9	0.0	4.5	0.4	0.0	11.2	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	6.5	0.0	2.4	4.2	0.0	2.5	2.6	0.0	1.3	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.3	19.2	0.0	40.1	17.4	0.0	40.5	28.9	0.0	49.8	33.9	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		1220	A		892	A		547	A		391	A
Approach Delay, s/veh		23.8			23.5			34.0			36.2	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	21.0	12.2	40.5	12.4	16.7	13.3	39.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	4.5	8.1	7.5	18.7	7.7	9.3	8.5	12.8
Green Ext Time (p_c), s	0.0	2.1	0.2	6.1	0.2	2.3	0.4	4.4

Intersection Summary	
HCM 6th Ctrl Delay	27.1
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	697	306	76	576	330	132	334	36	366	359	200
Future Volume (vph)	200	697	306	76	576	330	132	334	36	366	359	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	204	711	312	78	588	337	135	341	37	373	366	204
RTOR Reduction (vph)	0	0	208	0	0	241	0	0	30	0	46	0
Lane Group Flow (vph)	204	711	104	78	588	96	121	355	7	317	580	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	32.2	32.2	3.9	27.5	27.5	17.4	17.4	17.4	25.4	25.4	
Effective Green, g (s)	8.6	32.2	32.2	3.9	27.5	27.5	17.4	17.4	17.4	25.4	25.4	
Actuated g/C Ratio	0.09	0.33	0.33	0.04	0.28	0.28	0.18	0.18	0.18	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	295	1176	526	138	985	443	286	607	275	422	836	
v/s Ratio Prot	c0.06	c0.20		0.02	0.17		0.08	c0.10		c0.20	0.18	
v/s Ratio Perm			0.07			0.06			0.00			
v/c Ratio	0.69	0.60	0.20	0.57	0.60	0.22	0.42	0.58	0.02	0.75	0.69	
Uniform Delay, d1	42.9	27.0	23.1	45.7	29.9	26.5	35.3	36.4	32.8	32.8	32.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.8	2.3	0.8	5.2	2.7	1.1	1.0	1.4	0.0	7.4	2.5	
Delay (s)	49.7	29.3	24.0	50.9	32.6	27.6	36.3	37.9	32.8	40.2	34.8	
Level of Service	D	C	C	D	C	C	D	D	C	D	C	
Approach Delay (s)		31.4			32.3			37.1			36.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	33.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	96.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	74	88	970	1056	18
Future Vol, veh/h	11	74	88	970	1056	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	11	76	91	1000	1089	19

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2271	-	1089	0	-	0
Stage 1	1089	-	-	-	-	-
Stage 2	1182	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	44	0	641	-	-	-
Stage 1	323	0	-	-	-	-
Stage 2	291	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	38	-	641	-	-	-
Mov Cap-2 Maneuver	38	-	-	-	-	-
Stage 1	277	-	-	-	-	-
Stage 2	291	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	135.9	1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	641	-	38	-	-	-
HCM Lane V/C Ratio	0.142	-	0.298	-	-	-
HCM Control Delay (s)	11.5	-	135.9	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.5	-	1	-	-	-

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	75	988	4	64	1067
Future Vol, veh/h	15	75	988	4	64	1067
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	15	77	1019	4	66	1100

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2253	1021	0	0	1019	0
Stage 1	1021	-	-	-	-	-
Stage 2	1232	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	44	287	-	-	658	-
Stage 1	340	-	-	-	-	-
Stage 2	269	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	40	287	-	-	658	-
Mov Cap-2 Maneuver	40	-	-	-	-	-
Stage 1	340	-	-	-	-	-
Stage 2	242	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	42.3	0	0.6
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	40	287	658	-
HCM Lane V/C Ratio	-	-	0.387	0.269	0.1	-
HCM Control Delay (s)	-	-	143.3	22.1	11.1	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	1.3	1.1	0.3	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	36	112	867	50	139	952
Future Volume (veh/h)	36	112	867	50	139	952
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	37	0	894	0	143	981
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	58		1348		176	1632
Arrive On Green	0.03	0.00	0.73	0.00	0.10	0.87
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	37	0	894	0	143	981
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	2.0	0.0	24.2	0.0	7.5	13.4
Cycle Q Clear(g_c), s	2.0	0.0	24.2	0.0	7.5	13.4
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	58		1348		176	1632
V/C Ratio(X)	0.63		0.66		0.81	0.60
Avail Cap(c_a), veh/h	337		1348		253	1632
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.4	0.0	6.9	0.0	42.0	1.6
Incr Delay (d2), s/veh	10.8	0.0	2.6	0.0	12.4	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	8.5	0.0	3.9	1.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	56.2	0.0	9.4	0.0	54.4	3.3
LnGrp LOS	E		A		D	A
Approach Vol, veh/h	37	A	894	A		1124
Approach Delay, s/veh	56.2		9.4			9.8
Approach LOS	E		A			A

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	13.9	73.6	87.5	7.6
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	13.5	65.0	83.0	18.0
Max Q Clear Time (g_c+I1), s	9.5	26.2	15.4	4.0
Green Ext Time (p_c), s	0.1	8.8	11.3	0.0

Intersection Summary	
HCM 6th Ctrl Delay	10.5
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	14	391	255	898	932	38
Future Vol, veh/h	14	391	255	898	932	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	14	399	260	916	951	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2387	-	951	0	-	0
Stage 1	951	-	-	-	-	-
Stage 2	1436	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	36	0	722	-	-	-
Stage 1	366	0	-	-	-	-
Stage 2	212	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	23	-	722	-	-	-
Mov Cap-2 Maneuver	23	-	-	-	-	-
Stage 1	234	-	-	-	-	-
Stage 2	212	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 302.1	2.8	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	722	-	23	-	-	-
HCM Lane V/C Ratio	0.36	-	0.621	-	-	-
HCM Control Delay (s)	12.8	-	$ 302.1	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.6	-	1.8	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	133	32	50	65	41	203	39	792	67	190	922	179
Future Volume (veh/h)	133	32	50	65	41	203	39	792	67	190	922	179
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	139	33	0	68	43	0	41	825	0	198	960	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	180	192		105	108		242	1037		343	1109	
Arrive On Green	0.10	0.10	0.00	0.06	0.06	0.00	0.04	0.56	0.00	0.07	0.59	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	139	33	0	68	43	0	41	825	0	198	960	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	6.6	1.4	0.0	3.2	2.0	0.0	0.8	30.4	0.0	4.0	37.0	0.0
Cycle Q Clear(g_c), s	6.6	1.4	0.0	3.2	2.0	0.0	0.8	30.4	0.0	4.0	37.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	180	192		105	108		242	1037		343	1109	
V/C Ratio(X)	0.77	0.17		0.65	0.40		0.17	0.80		0.58	0.87	
Avail Cap(c_a), veh/h	367	391		373	382		281	1037		389	1109	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.6	35.3	0.0	39.6	39.0	0.0	14.5	15.1	0.0	14.4	14.7	0.0
Incr Delay (d2), s/veh	6.8	0.4	0.0	6.5	2.4	0.0	0.3	6.3	0.0	1.6	9.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	0.6	0.0	1.6	0.9	0.0	0.3	13.2	0.0	1.8	16.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.5	35.7	0.0	46.1	41.4	0.0	14.8	21.4	0.0	16.0	23.8	0.0
LnGrp LOS	D	D		D	D		B	C		B	C	
Approach Vol, veh/h		172	A		111	A		866	A		1158	A
Approach Delay, s/veh		42.8			44.3			21.1			22.5	
Approach LOS		D			D			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.5	52.6		13.3	7.6	55.5		9.6				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.3	47.7		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	6.0	32.4		8.6	2.8	39.0		5.2				
Green Ext Time (p_c), s	0.1	5.5		0.3	0.0	5.9		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			24.5									
HCM 6th LOS			C									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	305	12	55	7	12	19	67	520	12	18	537	298
Future Volume (veh/h)	305	12	55	7	12	19	67	520	12	18	537	298
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1767	1811	1870	1870	1870	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	321	13	0	7	13	20	71	547	13	19	565	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	9	9	6	2	2	2	3	3	3	2	2	2
Cap, veh/h	379	15		11	21	32	91	849	20	39	1566	
Arrive On Green	0.23	0.23	0.00	0.04	0.04	0.04	0.05	0.47	0.47	0.02	0.44	0.00
Sat Flow, veh/h	1620	66	1535	298	553	851	1767	1805	43	1781	3647	0
Grp Volume(v), veh/h	334	0	0	40	0	0	71	0	560	19	565	0
Grp Sat Flow(s),veh/h/ln	1686	0	1535	1702	0	0	1767	0	1848	1781	1777	0
Q Serve(g_s), s	14.4	0.0	0.0	1.8	0.0	0.0	3.0	0.0	17.5	0.8	8.0	0.0
Cycle Q Clear(g_c), s	14.4	0.0	0.0	1.8	0.0	0.0	3.0	0.0	17.5	0.8	8.0	0.0
Prop In Lane	0.96		1.00	0.17		0.50	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	394	0		64	0	0	91	0	869	39	1566	
V/C Ratio(X)	0.85	0.00		0.63	0.00	0.00	0.78	0.00	0.64	0.49	0.36	
Avail Cap(c_a), veh/h	574	0		571	0	0	165	0	869	119	1566	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.8	0.0	0.0	36.1	0.0	0.0	35.6	0.0	15.3	36.8	14.1	0.0
Incr Delay (d2), s/veh	7.9	0.0	0.0	9.7	0.0	0.0	13.4	0.0	3.7	9.3	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	0.0	0.0	0.9	0.0	0.0	1.6	0.0	7.0	0.4	2.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.7	0.0	0.0	45.7	0.0	0.0	49.0	0.0	19.0	46.1	14.8	0.0
LnGrp LOS	D	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		334	A		40			631			584	A
Approach Delay, s/veh		35.7			45.7			22.4			15.8	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	2	3	4	6	7	8
Phs Duration (G+Y+Rc), s	22.3	8.4	38.0	7.4	6.2	40.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	25.9	7.1	33.5	25.5	5.1	35.5
Max Q Clear Time (g_c+I1), s	16.4	5.0	10.0	3.8	2.8	19.5
Green Ext Time (p_c), s	1.4	0.0	3.5	0.1	0.0	3.0

Intersection Summary	
HCM 6th Ctrl Delay	23.3
HCM 6th LOS	C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Appendix E

Analysis Reports – Future With Project Conditions (2024)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	75	484	229	172	734	29	255	202	116	21	337	186
Future Volume (veh/h)	75	484	229	172	734	29	255	202	116	21	337	186
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	77	494	0	176	749	0	260	206	0	21	344	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	164	1509		259	1634		355	807		41	518	
Arrive On Green	0.05	0.45	0.00	0.08	0.47	0.00	0.10	0.23	0.00	0.02	0.15	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	77	494	0	176	749	0	260	206	0	21	344	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.9	7.6	0.0	4.1	11.8	0.0	6.0	3.8	0.0	0.9	7.4	0.0
Cycle Q Clear(g_c), s	1.9	7.6	0.0	4.1	11.8	0.0	6.0	3.8	0.0	0.9	7.4	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	164	1509		259	1634		355	807		41	518	
V/C Ratio(X)	0.47	0.33		0.68	0.46		0.73	0.26		0.51	0.66	
Avail Cap(c_a), veh/h	247	1509		440	1634		605	2081		122	1692	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.1	14.3	0.0	36.2	14.2	0.0	34.9	25.5	0.0	38.8	32.5	0.0
Incr Delay (d2), s/veh	2.1	0.6	0.0	3.1	0.9	0.0	2.9	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	2.8	0.0	1.7	4.3	0.0	2.6	1.6	0.0	0.5	3.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.2	14.9	0.0	39.3	15.1	0.0	37.8	25.7	0.0	48.1	34.0	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		571	A		925	A		466	A		365	A
Approach Delay, s/veh		18.1			19.7			32.5			34.8	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	22.8	10.6	40.7	12.9	16.2	8.6	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	2.9	5.8	6.1	9.6	8.0	9.4	3.9	13.8
Green Ext Time (p_c), s	0.0	1.4	0.2	3.3	0.5	2.4	0.0	5.4

Intersection Summary	
HCM 6th Ctrl Delay	24.2
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	112	382	130	57	658	512	153	354	45	385	356	130
Future Volume (vph)	112	382	130	57	658	512	153	354	45	385	356	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	115	394	134	59	678	528	158	365	46	397	367	134
RTOR Reduction (vph)	0	0	91	0	0	373	0	0	37	0	21	0
Lane Group Flow (vph)	115	394	43	59	678	155	142	381	9	298	579	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.5	30.5	4.1	28.0	28.0	18.1	18.1	18.1	24.7	24.7	
Effective Green, g (s)	6.6	30.5	30.5	4.1	28.0	28.0	18.1	18.1	18.1	24.7	24.7	
Actuated g/C Ratio	0.07	0.32	0.32	0.04	0.29	0.29	0.19	0.19	0.19	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	214	1049	484	141	999	454	296	635	282	412	821	
v/s Ratio Prot	c0.04	0.12		0.02	c0.20		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.10			0.01			
v/c Ratio	0.54	0.38	0.09	0.42	0.68	0.34	0.48	0.60	0.03	0.72	0.70	
Uniform Delay, d1	42.9	25.1	22.7	44.5	29.7	26.5	34.5	35.3	31.5	32.2	32.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.6	1.0	0.4	2.0	3.7	2.0	1.2	1.5	0.0	6.2	2.8	
Delay (s)	45.5	26.1	23.1	46.5	33.4	28.5	35.7	36.9	31.5	38.4	34.8	
Level of Service	D	C	C	D	C	C	D	D	C	D	C	
Approach Delay (s)		29.0			32.0			36.1			36.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	95.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	17.7					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	46	51	180	1086	827	32
Future Vol, veh/h	46	51	180	1086	827	32
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	49	55	194	1168	889	34

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2446	-	890	0	-	0
Stage 1	890	-	-	-	-	-
Stage 2	1556	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 34	0	761	-	-	-
Stage 1	401	0	-	-	-	-
Stage 2	191	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 25	-	760	-	-	-
Mov Cap-2 Maneuver	~ 25	-	-	-	-	-
Stage 1	298	-	-	-	-	-
Stage 2	191	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 789.5	1.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	760	-	25	-	-	-
HCM Lane V/C Ratio	0.255	-	1.978	-	-	-
HCM Control Delay (s)	11.3	-	$ 789.5	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1	-	6.1	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	4.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	147	1117	16	77	798
Future Vol, veh/h	9	147	1117	16	77	798
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	158	1201	17	83	858

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2234	1210	0	0	1201	0
Stage 1	1210	-	-	-	-	-
Stage 2	1024	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	47	223	-	-	567	-
Stage 1	282	-	-	-	-	-
Stage 2	347	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	40	223	-	-	567	-
Mov Cap-2 Maneuver	40	-	-	-	-	-
Stage 1	282	-	-	-	-	-
Stage 2	296	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	56.8	0	1.1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	40	223	567	-
HCM Lane V/C Ratio	-	-	0.242	0.709	0.146	-
HCM Control Delay (s)	-	-	121.6	52.8	12.4	-
HCM Lane LOS	-	-	F	F	B	-
HCM 95th %tile Q(veh)	-	-	0.8	4.6	0.5	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	92	194	957	27	45	767
Future Volume (veh/h)	92	194	957	27	45	767
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826
Adj Flow Rate, veh/h	98	0	1018	0	48	816
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	3	2	2	5
Cap, veh/h	126		1403		66	1531
Arrive On Green	0.07	0.00	0.76	0.00	0.04	0.84
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826
Grp Volume(v), veh/h	98	0	1018	0	48	816
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826
Q Serve(g_s), s	5.4	0.0	29.4	0.0	2.6	12.9
Cycle Q Clear(g_c), s	5.4	0.0	29.4	0.0	2.6	12.9
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	126		1403		66	1531
V/C Ratio(X)	0.78		0.73		0.73	0.53
Avail Cap(c_a), veh/h	324		1403		117	1531
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.2	0.0	6.5	0.0	47.2	2.3
Incr Delay (d2), s/veh	9.9	0.0	3.3	0.0	14.2	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	0.0	9.9	0.0	1.4	2.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	55.1	0.0	9.8	0.0	61.3	3.7
LnGrp LOS	E		A		E	A
Approach Vol, veh/h	98	A	1018	A		864
Approach Delay, s/veh	55.1		9.8			6.9
Approach LOS	E		A			A

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	8.2	79.3	87.5	11.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.5	72.0	83.0	18.0
Max Q Clear Time (g_c+I1), s	4.6	31.4	14.9	7.4
Green Ext Time (p_c), s	0.0	11.4	7.9	0.1

Intersection Summary	
HCM 6th Ctrl Delay	10.8
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	11.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	7	178	543	856	797	66
Future Vol, veh/h	7	178	543	856	797	66
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	8	191	584	920	857	71

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2945	-	857	0	-	0
Stage 1	857	-	-	-	-	-
Stage 2	2088	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	16	0	783	-	-	-
Stage 1	416	0	-	-	-	-
Stage 2	104	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 4	-	783	-	-	-
Mov Cap-2 Maneuver	~ 4	-	-	-	-	-
Stage 1	106	-	-	-	-	-
Stage 2	104	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, $	1998.6	8.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	783	-	4	-	-	-
HCM Lane V/C Ratio	0.746	-	1.882	-	-	-
HCM Control Delay (s)	21.8		$ 1998.6	0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	6.9	-	1.9	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	267	50	73	73	38	284	35	841	58	152	699	135
Future Volume (veh/h)	267	50	73	73	38	284	35	841	58	152	699	135
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	284	53	0	78	40	0	37	895	0	162	744	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	316	332		115	122		298	952		218	1002	
Arrive On Green	0.18	0.18	0.00	0.07	0.07	0.00	0.03	0.51	0.00	0.06	0.54	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	284	53	0	78	40	0	37	895	0	162	744	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	15.2	2.3	0.0	4.2	2.0	0.0	0.9	43.9	0.0	4.3	30.0	0.0
Cycle Q Clear(g_c), s	15.2	2.3	0.0	4.2	2.0	0.0	0.9	43.9	0.0	4.3	30.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	316	332		115	122		298	952		218	1002	
V/C Ratio(X)	0.90	0.16		0.68	0.33		0.12	0.94		0.74	0.74	
Avail Cap(c_a), veh/h	329	345		326	345		331	952		222	1002	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	39.2	33.9	0.0	44.5	43.5	0.0	14.4	22.5	0.0	21.9	17.2	0.0
Incr Delay (d2), s/veh	25.3	0.2	0.0	6.7	1.5	0.0	0.2	17.9	0.0	12.3	5.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.8	1.1	0.0	2.0	1.0	0.0	0.4	22.6	0.0	2.5	13.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	64.5	34.1	0.0	51.3	45.1	0.0	14.6	40.4	0.0	34.2	22.2	0.0
LnGrp LOS	E	C		D	D		B	D		C	C	
Approach Vol, veh/h		337	A		118	A		932	A		906	A
Approach Delay, s/veh		59.7			49.2			39.4			24.3	
Approach LOS		E			D			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.7	54.1		21.8	7.7	57.1		10.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	49.6		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	6.3	45.9		17.2	2.9	32.0		6.2				
Green Ext Time (p_c), s	0.0	2.1		0.1	0.0	5.3		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			36.9
HCM 6th LOS			D

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	167	5	27	17	13	16	80	505	16	15	449	307
Future Volume (veh/h)	167	5	27	17	13	16	80	505	16	15	449	307
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1722	1781	1781	1781	1752	1811	1811	1870	1811	1811
Adj Flow Rate, veh/h	180	5	0	18	14	17	86	543	17	16	483	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	12	8	8	8	10	6	6	2	6	6
Cap, veh/h	243	7		27	21	25	108	922	29	34	1661	
Arrive On Green	0.14	0.14	0.00	0.04	0.04	0.04	0.06	0.53	0.53	0.02	0.48	0.00
Sat Flow, veh/h	1735	48	1459	595	462	561	1668	1745	55	1781	3532	0
Grp Volume(v), veh/h	185	0	0	49	0	0	86	0	560	16	483	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1618	0	0	1668	0	1800	1781	1721	0
Q Serve(g_s), s	6.7	0.0	0.0	2.0	0.0	0.0	3.4	0.0	14.3	0.6	5.7	0.0
Cycle Q Clear(g_c), s	6.7	0.0	0.0	2.0	0.0	0.0	3.4	0.0	14.3	0.6	5.7	0.0
Prop In Lane	0.97		1.00	0.37		0.35	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	250	0		72	0	0	108	0	951	34	1661	
V/C Ratio(X)	0.74	0.00		0.68	0.00	0.00	0.79	0.00	0.59	0.47	0.29	
Avail Cap(c_a), veh/h	688	0		614	0	0	226	0	951	135	1661	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	0.0	31.6	0.0	0.0	31.0	0.0	10.8	32.6	10.5	0.0
Incr Delay (d2), s/veh	4.3	0.0	0.0	10.6	0.0	0.0	12.2	0.0	2.7	9.6	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	0.0	1.0	0.0	0.0	1.6	0.0	5.0	0.3	1.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	0.0	42.2	0.0	0.0	43.1	0.0	13.5	42.2	10.9	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		185	A		49			646			499	A
Approach Delay, s/veh		32.0			42.2			17.5			11.9	
Approach LOS		C			D			B			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		13.9	8.9	36.9		7.5	5.8	40.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	9.1	31.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		8.7	5.4	7.7		4.0	2.6	16.3				
Green Ext Time (p_c), s		0.9	0.0	2.9		0.2	0.0	3.2				

Intersection Summary		
HCM 6th Ctrl Delay		18.3
HCM 6th LOS		B

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	61	849	14	13	846
Future Vol, veh/h	29	61	849	14	13	846
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	585	695	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	66	923	15	14	920

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1871	923	0	0	923	0
Stage 1	923	-	-	-	-	-
Stage 2	948	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	79	327	-	-	740	-
Stage 1	387	-	-	-	-	-
Stage 2	377	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	77	327	-	-	740	-
Mov Cap-2 Maneuver	77	-	-	-	-	-
Stage 1	387	-	-	-	-	-
Stage 2	370	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	38.8	0	0.2
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	77	327	740	-
HCM Lane V/C Ratio	-	-	0.409	0.203	0.019	-
HCM Control Delay (s)	-	-	81	18.8	10	-
HCM Lane LOS	-	-	F	C	A	-
HCM 95th %tile Q(veh)	-	-	1.6	0.7	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	273	941	529	235	654	48	239	297	265	55	329	112
Future Volume (veh/h)	273	941	529	235	654	48	239	297	265	55	329	112
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	279	960	0	240	667	0	244	303	0	56	336	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	369	1552		326	1493		330	715		78	530	
Arrive On Green	0.11	0.44	0.00	0.09	0.43	0.00	0.10	0.20	0.00	0.04	0.15	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	279	960	0	240	667	0	244	303	0	56	336	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.5	17.1	0.0	5.5	11.0	0.0	5.7	6.1	0.0	2.5	7.3	0.0
Cycle Q Clear(g_c), s	6.5	17.1	0.0	5.5	11.0	0.0	5.7	6.1	0.0	2.5	7.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	369	1552		326	1493		330	715		78	530	
V/C Ratio(X)	0.76	0.62		0.74	0.45		0.74	0.42		0.71	0.63	
Avail Cap(c_a), veh/h	524	1552		444	1493		440	1808		194	1738	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.4	17.6	0.0	36.0	16.6	0.0	36.0	28.5	0.0	38.6	32.7	0.0
Incr Delay (d2), s/veh	3.9	1.9	0.0	4.2	1.0	0.0	4.5	0.4	0.0	11.4	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	6.7	0.0	2.4	4.3	0.0	2.5	2.6	0.0	1.3	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.3	19.5	0.0	40.2	17.6	0.0	40.5	28.9	0.0	50.0	34.0	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		1239	A		907	A		547	A		392	A
Approach Delay, s/veh		23.9			23.6			34.1			36.2	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	21.0	12.2	40.5	12.4	16.7	13.3	39.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	4.5	8.1	7.5	19.1	7.7	9.3	8.5	13.0
Green Ext Time (p_c), s	0.0	2.1	0.2	6.2	0.2	2.3	0.4	4.4

Intersection Summary	
HCM 6th Ctrl Delay	27.2
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	722	306	79	596	341	132	334	37	379	359	200
Future Volume (vph)	200	722	306	79	596	341	132	334	37	379	359	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	204	737	312	81	608	348	135	341	38	387	366	204
RTOR Reduction (vph)	0	0	209	0	0	249	0	0	31	0	44	0
Lane Group Flow (vph)	204	737	103	81	608	99	121	355	7	321	592	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	32.2	32.2	3.9	27.5	27.5	17.4	17.4	17.4	25.6	25.6	
Effective Green, g (s)	8.6	32.2	32.2	3.9	27.5	27.5	17.4	17.4	17.4	25.6	25.6	
Actuated g/C Ratio	0.09	0.33	0.33	0.04	0.28	0.28	0.18	0.18	0.18	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	295	1173	524	137	983	442	285	606	275	424	841	
v/s Ratio Prot	c0.06	c0.21		0.02	0.18		0.08	c0.10		c0.20	0.19	
v/s Ratio Perm			0.07			0.06			0.00			
v/c Ratio	0.69	0.63	0.20	0.59	0.62	0.22	0.42	0.59	0.02	0.76	0.70	
Uniform Delay, d1	43.0	27.4	23.2	45.8	30.2	26.6	35.4	36.5	32.9	32.9	32.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.8	2.6	0.8	6.7	2.9	1.2	1.0	1.5	0.0	7.5	2.7	
Delay (s)	49.8	30.0	24.1	52.5	33.2	27.8	36.4	38.0	32.9	40.4	35.0	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		31.7			32.9			37.2			36.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	97.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	1.3					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	77	91	1004	1096	18
Future Vol, veh/h	11	77	91	1004	1096	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	11	79	94	1035	1130	19

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2353	-	1130	0	-	0
Stage 1	1130	-	-	-	-	-
Stage 2	1223	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	39	0	618	-	-	-
Stage 1	308	0	-	-	-	-
Stage 2	278	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	33	-	618	-	-	-
Mov Cap-2 Maneuver	33	-	-	-	-	-
Stage 1	261	-	-	-	-	-
Stage 2	278	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	163.1	1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	618	-	33	-	-	-
HCM Lane V/C Ratio	0.152	-	0.344	-	-	-
HCM Control Delay (s)	11.9	-	163.1	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.5	-	1.1	-	-	-

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	75	1025	4	64	1110
Future Vol, veh/h	15	75	1025	4	64	1110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	15	77	1057	4	66	1144

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2335	1059	0	0	1057	0
Stage 1	1059	-	-	-	-	-
Stage 2	1276	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	39	273	-	-	636	-
Stage 1	326	-	-	-	-	-
Stage 2	256	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	35	273	-	-	636	-
Mov Cap-2 Maneuver	35	-	-	-	-	-
Stage 1	326	-	-	-	-	-
Stage 2	229	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	48.2	0	0.6
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	35	273	636	-
HCM Lane V/C Ratio	-	-	0.442	0.283	0.104	-
HCM Control Delay (s)	-	-	172.6	23.3	11.3	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	1.5	1.1	0.3	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	38	112	904	52	139	995
Future Volume (veh/h)	38	112	904	52	139	995
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	39	0	932	0	143	1026
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	60		1347		176	1630
Arrive On Green	0.03	0.00	0.73	0.00	0.10	0.87
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	39	0	932	0	143	1026
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	2.1	0.0	26.4	0.0	7.5	14.8
Cycle Q Clear(g_c), s	2.1	0.0	26.4	0.0	7.5	14.8
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	60		1347		176	1630
V/C Ratio(X)	0.65		0.69		0.81	0.63
Avail Cap(c_a), veh/h	337		1347		253	1630
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.4	0.0	7.2	0.0	42.1	1.7
Incr Delay (d2), s/veh	11.1	0.0	2.9	0.0	12.5	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	9.3	0.0	3.9	2.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	56.5	0.0	10.1	0.0	54.5	3.6
LnGrp LOS	E		B		D	A
Approach Vol, veh/h	39	A	932	A		1169
Approach Delay, s/veh	56.5		10.1			9.8
Approach LOS	E		B			A

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	13.9	73.6				87.5		7.7
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	13.5	65.0				83.0		18.0
Max Q Clear Time (g_c+I1), s	9.5	28.4				16.8		4.1
Green Ext Time (p_c), s	0.1	9.4				12.5		0.0

Intersection Summary	
HCM 6th Ctrl Delay	10.8
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	14	391	255	939	944	38
Future Vol, veh/h	14	391	255	939	944	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	14	399	260	958	963	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2441	-	963	0	-	0
Stage 1	963	-	-	-	-	-
Stage 2	1478	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	33	0	715	-	-	-
Stage 1	361	0	-	-	-	-
Stage 2	203	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	21	-	715	-	-	-
Mov Cap-2 Maneuver	21	-	-	-	-	-
Stage 1	230	-	-	-	-	-
Stage 2	203	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 344.6	2.8	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	715	-	21	-	-	-
HCM Lane V/C Ratio	0.364	-	0.68	-	-	-
HCM Control Delay (s)	12.9	-	$ 344.6	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.7	-	1.9	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	32	50	65	41	210	39	821	67	192	930	181
Future Volume (veh/h)	138	32	50	65	41	210	39	821	67	192	930	181
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	144	33	0	68	43	0	41	855	0	200	969	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	185	198		105	108		234	1032		322	1105	
Arrive On Green	0.11	0.11	0.00	0.06	0.06	0.00	0.04	0.56	0.00	0.07	0.59	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	144	33	0	68	43	0	41	855	0	200	969	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	6.9	1.4	0.0	3.2	2.0	0.0	0.8	32.8	0.0	4.0	38.0	0.0
Cycle Q Clear(g_c), s	6.9	1.4	0.0	3.2	2.0	0.0	0.8	32.8	0.0	4.0	38.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	185	198		105	108		234	1032		322	1105	
V/C Ratio(X)	0.78	0.17		0.65	0.40		0.18	0.83		0.62	0.88	
Avail Cap(c_a), veh/h	365	390		371	381		272	1032		366	1105	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.6	35.2	0.0	39.7	39.1	0.0	15.0	15.8	0.0	15.9	15.0	0.0
Incr Delay (d2), s/veh	6.9	0.4	0.0	6.5	2.4	0.0	0.4	7.7	0.0	2.6	9.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	0.6	0.0	1.6	0.9	0.0	0.3	14.5	0.0	2.1	17.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.5	35.5	0.0	46.2	41.5	0.0	15.3	23.5	0.0	18.5	24.9	0.0
LnGrp LOS	D	D		D	D		B	C		B	C	
Approach Vol, veh/h		177	A		111	A		896	A		1169	A
Approach Delay, s/veh		42.8			44.4			23.1			23.8	
Approach LOS		D			D			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.6	52.5		13.6	7.6	55.5		9.6				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.3	47.7		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	6.0	34.8		8.9	2.8	40.0		5.2				
Green Ext Time (p_c), s	0.1	5.3		0.3	0.0	5.6		0.3				

Intersection Summary		
HCM 6th Ctrl Delay		25.9
HCM 6th LOS		C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	315	12	55	7	12	20	67	538	12	18	542	301
Future Volume (veh/h)	315	12	55	7	12	20	67	538	12	18	542	301
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1767	1811	1870	1870	1870	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	332	13	0	7	13	21	71	566	13	19	571	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	9	9	6	2	2	2	3	3	3	2	2	2
Cap, veh/h	389	15		11	20	33	91	842	19	39	1551	
Arrive On Green	0.24	0.24	0.00	0.04	0.04	0.04	0.05	0.47	0.47	0.02	0.44	0.00
Sat Flow, veh/h	1622	64	1535	290	539	870	1767	1807	41	1781	3647	0
Grp Volume(v), veh/h	345	0	0	41	0	0	71	0	579	19	571	0
Grp Sat Flow(s),veh/h/ln	1686	0	1535	1699	0	0	1767	0	1848	1781	1777	0
Q Serve(g_s), s	15.0	0.0	0.0	1.8	0.0	0.0	3.0	0.0	18.7	0.8	8.3	0.0
Cycle Q Clear(g_c), s	15.0	0.0	0.0	1.8	0.0	0.0	3.0	0.0	18.7	0.8	8.3	0.0
Prop In Lane	0.96		1.00	0.17		0.51	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	404	0		65	0	0	91	0	862	39	1551	
V/C Ratio(X)	0.85	0.00		0.64	0.00	0.00	0.78	0.00	0.67	0.49	0.37	
Avail Cap(c_a), veh/h	569	0		564	0	0	163	0	862	118	1551	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.9	0.0	0.0	36.4	0.0	0.0	36.0	0.0	15.9	37.1	14.5	0.0
Incr Delay (d2), s/veh	8.8	0.0	0.0	9.9	0.0	0.0	13.4	0.0	4.2	9.3	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.8	0.0	0.0	0.9	0.0	0.0	1.6	0.0	7.6	0.4	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.7	0.0	0.0	46.3	0.0	0.0	49.3	0.0	20.1	46.5	15.2	0.0
LnGrp LOS	D	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		345	A		41			650			590	A
Approach Delay, s/veh		36.7			46.3			23.3			16.2	
Approach LOS		D			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		22.9	8.5	38.0		7.4	6.2	40.3				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	7.1	33.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		17.0	5.0	10.3		3.8	2.8	20.7				
Green Ext Time (p_c), s		1.4	0.0	3.5		0.1	0.0	3.0				

Intersection Summary		
HCM 6th Ctrl Delay		24.1
HCM 6th LOS		C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	1.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	39	912	41	45	988
Future Vol, veh/h	12	39	912	41	45	988
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	585	695	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	42	991	45	49	1074

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2163	991	0	0	991	0
Stage 1	991	-	-	-	-	-
Stage 2	1172	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	52	299	-	-	698	-
Stage 1	359	-	-	-	-	-
Stage 2	294	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	48	299	-	-	698	-
Mov Cap-2 Maneuver	48	-	-	-	-	-
Stage 1	359	-	-	-	-	-
Stage 2	273	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	39.4	0	0.5
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	48	299	698	-
HCM Lane V/C Ratio	-	-	0.272	0.142	0.07	-
HCM Control Delay (s)	-	-	105.9	19	10.5	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	0.9	0.5	0.2	-

Arterial Level of Service: NB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	41.2	75.9	117.1	0.32	10.0	F
Puapuaanui St	III	30	107.6	15.5	123.1	0.90	26.2	B
Total	III		148.8	91.4	240.2	1.22	18.3	C

Arterial Level of Service: SB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	5.6	99.9	0.79	28.3	B
Lako Street	III	30	107.6	31.9	139.5	0.90	23.1	C
Total	III		201.9	37.5	239.4	1.68	25.3	B

Arterial Level of Service: NB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	41.2	46.5	87.7	0.32	13.3	E
Puapuaanui St	III	30	107.6	17.1	124.7	0.90	25.9	B
Total	III		148.8	63.6	212.4	1.22	20.7	C

Arterial Level of Service: SB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	5.9	100.2	0.79	28.2	B
Lako Street	III	30	107.6	38.1	145.7	0.90	22.1	C
Total	III		201.9	44.0	245.9	1.68	24.6	B

Appendix F

Analysis Reports – Future Without Project Conditions (2029)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	78	505	241	180	749	25	268	212	120	22	355	196
Future Volume (veh/h)	78	505	241	180	749	25	268	212	120	22	355	196
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	80	515	0	184	764	0	273	216	0	22	362	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	165	1481		267	1612		367	836		43	538	
Arrive On Green	0.05	0.44	0.00	0.08	0.47	0.00	0.11	0.24	0.00	0.02	0.15	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	80	515	0	184	764	0	273	216	0	22	362	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	2.0	8.3	0.0	4.3	12.4	0.0	6.3	4.0	0.0	1.0	7.8	0.0
Cycle Q Clear(g_c), s	2.0	8.3	0.0	4.3	12.4	0.0	6.3	4.0	0.0	1.0	7.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	165	1481		267	1612		367	836		43	538	
V/C Ratio(X)	0.49	0.35		0.69	0.47		0.74	0.26		0.51	0.67	
Avail Cap(c_a), veh/h	244	1481		434	1612		597	2053		120	1669	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.6	15.0	0.0	36.6	14.8	0.0	35.3	25.4	0.0	39.3	32.7	0.0
Incr Delay (d2), s/veh	2.2	0.6	0.0	3.2	1.0	0.0	3.0	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	3.0	0.0	1.8	4.6	0.0	2.7	1.7	0.0	0.5	3.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.8	15.7	0.0	39.8	15.8	0.0	38.3	25.5	0.0	48.5	34.2	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		595	A		948	A		489	A		384	A
Approach Delay, s/veh		18.9			20.5			32.6			35.0	
Approach LOS		B			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.5	23.7	10.9	40.5	13.3	16.8	8.7	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	3.0	6.0	6.3	10.3	8.3	9.8	4.0	14.4
Green Ext Time (p_c), s	0.0	1.5	0.2	3.4	0.5	2.5	0.0	5.4

Intersection Summary	
HCM 6th Ctrl Delay	24.9
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	397	137	57	633	516	161	372	46	400	374	137
Future Volume (vph)	118	397	137	57	633	516	161	372	46	400	374	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3347	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3347	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	122	409	141	59	653	532	166	384	47	412	386	141
RTOR Reduction (vph)	0	0	97	0	0	379	0	0	38	0	22	0
Lane Group Flow (vph)	122	409	44	59	653	153	149	401	9	313	604	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.4	30.4	4.1	27.9	27.9	18.9	18.9	18.9	25.5	25.5	
Effective Green, g (s)	6.6	30.4	30.4	4.1	27.9	27.9	18.9	18.9	18.9	25.5	25.5	
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.29	0.29	0.20	0.20	0.20	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	211	1029	475	139	980	445	305	652	290	419	835	
v/s Ratio Prot	c0.04	0.12		0.02	c0.19		0.10	c0.12		c0.20	0.19	
v/s Ratio Perm			0.03			0.10			0.01			
v/c Ratio	0.58	0.40	0.09	0.42	0.67	0.34	0.49	0.62	0.03	0.75	0.72	
Uniform Delay, d1	43.8	26.1	23.5	45.2	30.4	27.3	34.7	35.7	31.6	32.7	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.8	1.1	0.4	2.1	3.6	2.1	1.2	1.7	0.0	7.1	3.1	
Delay (s)	47.6	27.2	23.9	47.3	34.0	29.4	35.9	37.4	31.6	39.9	35.6	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		30.2			32.6			36.6			37.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	96.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	20.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	49	53	181	1088	857	33
Future Vol, veh/h	49	53	181	1088	857	33
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	53	57	195	1170	922	35

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2483	-	923	0	-	0
Stage 1	923	-	-	-	-	-
Stage 2	1560	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 33	0	740	-	-	-
Stage 1	387	0	-	-	-	-
Stage 2	190	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 24	-	739	-	-	-
Mov Cap-2 Maneuver	~ 24	-	-	-	-	-
Stage 1	284	-	-	-	-	-
Stage 2	190	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 893.5	1.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	739	-	24	-	-	-
HCM Lane V/C Ratio	0.263	-	2.195	-	-	-
HCM Control Delay (s)	11.6	-	$ 893.5	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.1	-	6.6	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	5.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	155	1111	17	81	826
Future Vol, veh/h	10	155	1111	17	81	826
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	11	167	1195	18	87	888

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2266	1204	0	0	1195	0
Stage 1	1204	-	-	-	-	-
Stage 2	1062	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	45	224	-	-	570	-
Stage 1	284	-	-	-	-	-
Stage 2	332	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	38	224	-	-	570	-
Mov Cap-2 Maneuver	38	-	-	-	-	-
Stage 1	284	-	-	-	-	-
Stage 2	281	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	61.4	0	1.1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	38	224	570	-
HCM Lane V/C Ratio	-	-	0.283	0.744	0.153	-
HCM Control Delay (s)	-	-	133.6	56.7	12.5	-
HCM Lane LOS	-	-	F	F	B	-
HCM 95th %tile Q(veh)	-	-	0.9	5.1	0.5	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	96	204	942	27	47	793	
Future Volume (veh/h)	96	204	942	27	47	793	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826	
Adj Flow Rate, veh/h	102	0	1002	0	50	844	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	2	2	3	2	2	5	
Cap, veh/h	131		1397		67	1527	
Arrive On Green	0.07	0.00	0.75	0.00	0.04	0.84	
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826	
Grp Volume(v), veh/h	102	0	1002	0	50	844	
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826	
Q Serve(g_s), s	5.6	0.0	28.8	0.0	2.8	14.0	
Cycle Q Clear(g_c), s	5.6	0.0	28.8	0.0	2.8	14.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	131		1397		67	1527	
V/C Ratio(X)	0.78		0.72		0.74	0.55	
Avail Cap(c_a), veh/h	323		1397		117	1527	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00	
Uniform Delay (d), s/veh	45.2	0.0	6.6	0.0	47.3	2.5	
Incr Delay (d2), s/veh	9.7	0.0	3.2	0.0	15.0	1.4	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	2.8	0.0	9.8	0.0	1.5	3.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	54.9	0.0	9.8	0.0	62.3	3.9	
LnGrp LOS	D		A		E	A	
Approach Vol, veh/h	102	A	1002	A		894	
Approach Delay, s/veh	54.9		9.8			7.2	
Approach LOS	D		A			A	
Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	8.2	79.3				87.5	11.8
Change Period (Y+Rc), s	4.5	4.5				4.5	4.5
Max Green Setting (Gmax), s	6.5	72.0				83.0	18.0
Max Q Clear Time (g_c+I1), s	4.8	30.8				16.0	7.6
Green Ext Time (p_c), s	0.0	11.1				8.4	0.2

Intersection Summary		
HCM 6th Ctrl Delay		10.9
HCM 6th LOS		B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	16.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	8	187	571	885	810	67
Future Vol, veh/h	8	187	571	885	810	67
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	9	201	614	952	871	72

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3051	-	871	0	-	0
Stage 1	871	-	-	-	-	-
Stage 2	2180	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	14	0	774	-	-	-
Stage 1	410	0	-	-	-	-
Stage 2	93	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 3	-	774	-	-	-
Mov Cap-2 Maneuver	~ 3	-	-	-	-	-
Stage 1	85	-	-	-	-	-
Stage 2	93	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 2938.5	9.8	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	774	-	3	-	-	-
HCM Lane V/C Ratio	0.793	-	2.867	-	-	-
HCM Control Delay (s)	25	-	$ 2938.5	0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	8.2	-	2.2	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	277	53	76	76	40	295	36	875	61	156	715	138
Future Volume (veh/h)	277	53	76	76	40	295	36	875	61	156	715	138
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	295	56	0	81	43	0	38	931	0	166	761	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	325	341		119	126		281	941		191	993	
Arrive On Green	0.18	0.18	0.00	0.07	0.07	0.00	0.03	0.50	0.00	0.06	0.53	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	295	56	0	81	43	0	38	931	0	166	761	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	16.0	2.5	0.0	4.4	2.2	0.0	1.0	48.6	0.0	4.8	31.9	0.0
Cycle Q Clear(g_c), s	16.0	2.5	0.0	4.4	2.2	0.0	1.0	48.6	0.0	4.8	31.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	325	341		119	126		281	941		191	993	
V/C Ratio(X)	0.91	0.16		0.68	0.34		0.14	0.99		0.87	0.77	
Avail Cap(c_a), veh/h	325	341		323	341		313	941		191	993	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	39.5	34.0	0.0	45.0	43.9	0.0	15.3	24.3	0.0	24.3	18.1	0.0
Incr Delay (d2), s/veh	27.8	0.2	0.0	6.7	1.6	0.0	0.2	27.0	0.0	32.3	5.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.4	1.1	0.0	2.1	1.1	0.0	0.4	27.0	0.0	3.6	14.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	67.3	34.2	0.0	51.7	45.5	0.0	15.5	51.3	0.0	56.6	23.7	0.0
LnGrp LOS	E	C		D	D		B	D		E	C	
Approach Vol, veh/h		351	A		124	A		969	A		927	A
Approach Delay, s/veh		62.0			49.5			49.9			29.6	
Approach LOS		E			D			D			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.9	54.1		22.5	7.7	57.3		11.1				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	49.6		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	6.8	50.6		18.0	3.0	33.9		6.4				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	5.2		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			43.7									
HCM 6th LOS			D									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	6	29	18	13	17	84	525	17	15	461	315
Future Volume (veh/h)	173	6	29	18	13	17	84	525	17	15	461	315
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1722	1781	1781	1781	1752	1811	1811	1870	1811	1811
Adj Flow Rate, veh/h	186	6	0	19	14	18	90	565	18	16	496	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	12	8	8	8	10	6	6	2	6	6
Cap, veh/h	249	8		27	20	26	114	915	29	34	1638	
Arrive On Green	0.14	0.14	0.00	0.05	0.05	0.05	0.07	0.52	0.52	0.02	0.48	0.00
Sat Flow, veh/h	1728	56	1459	602	444	570	1668	1744	56	1781	3532	0
Grp Volume(v), veh/h	192	0	0	51	0	0	90	0	583	16	496	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1616	0	0	1668	0	1800	1781	1721	0
Q Serve(g_s), s	7.0	0.0	0.0	2.1	0.0	0.0	3.6	0.0	15.4	0.6	6.0	0.0
Cycle Q Clear(g_c), s	7.0	0.0	0.0	2.1	0.0	0.0	3.6	0.0	15.4	0.6	6.0	0.0
Prop In Lane	0.97		1.00	0.37		0.35	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	258	0		74	0	0	114	0	944	34	1638	
V/C Ratio(X)	0.75	0.00		0.69	0.00	0.00	0.79	0.00	0.62	0.47	0.30	
Avail Cap(c_a), veh/h	683	0		609	0	0	224	0	944	134	1638	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	0.0	31.8	0.0	0.0	31.1	0.0	11.3	32.8	10.9	0.0
Incr Delay (d2), s/veh	4.3	0.0	0.0	11.0	0.0	0.0	11.6	0.0	3.0	9.6	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	0.0	0.0	1.0	0.0	0.0	1.7	0.0	5.4	0.3	1.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	0.0	42.8	0.0	0.0	42.7	0.0	14.3	42.5	11.3	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		192	A		51			673			512	A
Approach Delay, s/veh		32.0			42.8			18.1			12.3	
Approach LOS		C			D			B			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		14.3	9.1	36.7		7.6	5.8	40.0
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		25.9	9.1	31.5		25.5	5.1	35.5
Max Q Clear Time (g_c+I1), s		9.0	5.6	8.0		4.1	2.6	17.4
Green Ext Time (p_c), s		0.9	0.1	3.0		0.2	0.0	3.3

Intersection Summary	
HCM 6th Ctrl Delay	18.8
HCM 6th LOS	B

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	287	969	556	246	673	45	251	313	273	56	346	118
Future Volume (veh/h)	287	969	556	246	673	45	251	313	273	56	346	118
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	293	989	0	251	687	0	256	319	0	57	353	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	381	1527		336	1466		340	743		78	548	
Arrive On Green	0.11	0.43	0.00	0.10	0.42	0.00	0.10	0.21	0.00	0.04	0.15	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	293	989	0	251	687	0	256	319	0	57	353	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.9	18.4	0.0	5.9	11.8	0.0	6.0	6.5	0.0	2.6	7.8	0.0
Cycle Q Clear(g_c), s	6.9	18.4	0.0	5.9	11.8	0.0	6.0	6.5	0.0	2.6	7.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	381	1527		336	1466		340	743		78	548	
V/C Ratio(X)	0.77	0.65		0.75	0.47		0.75	0.43		0.73	0.64	
Avail Cap(c_a), veh/h	516	1527		437	1466		433	1779		191	1710	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.9	18.6	0.0	36.5	17.5	0.0	36.5	28.6	0.0	39.2	33.0	0.0
Incr Delay (d2), s/veh	4.8	2.1	0.0	5.1	1.1	0.0	5.5	0.4	0.0	12.0	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	7.3	0.0	2.6	4.6	0.0	2.7	2.7	0.0	1.4	3.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.7	20.7	0.0	41.6	18.5	0.0	42.0	28.9	0.0	51.3	34.3	0.0
LnGrp LOS	D	C		D	B		D	C		D	C	
Approach Vol, veh/h		1282	A		938	A		575	A		410	A
Approach Delay, s/veh		25.3			24.7			34.8			36.7	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.2	21.9	12.6	40.5	12.7	17.3	13.7	39.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	4.6	8.5	7.9	20.4	8.0	9.8	8.9	13.8
Green Ext Time (p_c), s	0.0	2.2	0.2	6.2	0.2	2.5	0.3	4.5

Intersection Summary	
HCM 6th Ctrl Delay	28.3
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	732	321	80	605	347	139	351	38	384	378	210
Future Volume (vph)	210	732	321	80	605	347	139	351	38	384	378	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3383	1537	1610	3193	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3383	1537	1610	3193	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	214	747	328	82	617	354	142	358	39	392	386	214
RTOR Reduction (vph)	0	0	221	0	0	255	0	0	32	0	45	0
Lane Group Flow (vph)	214	747	107	82	617	99	128	372	7	333	614	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	32.2	32.2	3.9	27.5	27.5	18.1	18.1	18.1	26.2	26.2	
Effective Green, g (s)	8.6	32.2	32.2	3.9	27.5	27.5	18.1	18.1	18.1	26.2	26.2	
Actuated g/C Ratio	0.09	0.33	0.33	0.04	0.28	0.28	0.18	0.18	0.18	0.27	0.27	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	291	1158	518	136	970	436	293	622	282	428	850	
v/s Ratio Prot	c0.06	c0.21		0.02	0.18		0.08	c0.11		c0.21	0.19	
v/s Ratio Perm			0.07			0.06			0.00			
v/c Ratio	0.74	0.65	0.21	0.60	0.64	0.23	0.44	0.60	0.03	0.78	0.72	
Uniform Delay, d1	43.8	28.2	23.9	46.5	31.1	27.3	35.6	36.8	32.9	33.4	32.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	2.8	0.9	7.3	3.2	1.2	1.0	1.6	0.0	8.7	3.0	
Delay (s)	53.1	31.0	24.8	53.8	34.2	28.5	36.7	38.4	33.0	42.1	35.8	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		33.1			33.8			37.6			37.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	98.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	1.4					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	77	93	1020	1110	19
Future Vol, veh/h	11	77	93	1020	1110	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	11	79	96	1052	1144	20

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2388	-	1144	0	-	0
Stage 1	1144	-	-	-	-	-
Stage 2	1244	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	37	0	611	-	-	-
Stage 1	304	0	-	-	-	-
Stage 2	272	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	31	-	611	-	-	-
Mov Cap-2 Maneuver	31	-	-	-	-	-
Stage 1	256	-	-	-	-	-
Stage 2	272	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	177.1	1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	611	-	31	-	-	-
HCM Lane V/C Ratio	0.157	-	0.366	-	-	-
HCM Control Delay (s)	12	-	177.1	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.6	-	1.2	-	-	-

Intersection						
Int Delay, s/veh	2.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	78	1038	4	67	1121
Future Vol, veh/h	15	78	1038	4	67	1121
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	15	80	1070	4	69	1156

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2366	1072	0	0	1070	0
Stage 1	1072	-	-	-	-	-
Stage 2	1294	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	37	268	-	-	629	-
Stage 1	322	-	-	-	-	-
Stage 2	251	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	33	268	-	-	629	-
Mov Cap-2 Maneuver	33	-	-	-	-	-
Stage 1	322	-	-	-	-	-
Stage 2	223	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	50.5	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	33	268	629	-
HCM Lane V/C Ratio	-	-	0.469	0.3	0.11	-
HCM Control Delay (s)	-	-	187.7	24.1	11.4	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	1.6	1.2	0.4	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	38	118	911	53	146	1001
Future Volume (veh/h)	38	118	911	53	146	1001
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	39	0	939	0	151	1032
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	60		1338		184	1630
Arrive On Green	0.03	0.00	0.72	0.00	0.10	0.87
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	39	0	939	0	151	1032
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	2.1	0.0	27.2	0.0	7.9	15.0
Cycle Q Clear(g_c), s	2.1	0.0	27.2	0.0	7.9	15.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	60		1338		184	1630
V/C Ratio(X)	0.65		0.70		0.82	0.63
Avail Cap(c_a), veh/h	337		1338		253	1630
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.4	0.0	7.5	0.0	41.8	1.7
Incr Delay (d2), s/veh	11.1	0.0	3.1	0.0	14.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	9.7	0.0	4.2	2.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	56.5	0.0	10.6	0.0	55.9	3.6
LnGrp LOS	E		B		E	A
Approach Vol, veh/h	39	A	939	A		1183
Approach Delay, s/veh	56.5		10.6			10.3
Approach LOS	E		B			B

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	14.3	73.2	87.5	7.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	13.5	65.0	83.0	18.0
Max Q Clear Time (g_c+I1), s	9.9	29.2	17.0	4.1
Green Ext Time (p_c), s	0.1	9.4	12.7	0.0

Intersection Summary	
HCM 6th Ctrl Delay	11.3
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	4.3					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	14	411	268	943	980	40
Future Vol, veh/h	14	411	268	943	980	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	14	419	273	962	1000	41

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2508	-	1000	0	-	0
Stage 1	1000	-	-	-	-	-
Stage 2	1508	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	30	0	692	-	-	-
Stage 1	347	0	-	-	-	-
Stage 2	196	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	18	-	692	-	-	-
Mov Cap-2 Maneuver	18	-	-	-	-	-
Stage 1	210	-	-	-	-	-
Stage 2	196	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 429.8	3	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	692	-	18	-	-	-
HCM Lane V/C Ratio	0.395	-	0.794	-	-	-
HCM Control Delay (s)	13.6	-	$ 429.8	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.9	-	2.1	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	33	53	68	43	213	41	833	71	200	969	188
Future Volume (veh/h)	140	33	53	68	43	213	41	833	71	200	969	188
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	146	34	0	71	45	0	43	868	0	208	1009	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	187	200		109	112		206	1024		312	1099	
Arrive On Green	0.11	0.11	0.00	0.06	0.06	0.00	0.04	0.55	0.00	0.07	0.59	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	146	34	0	71	45	0	43	868	0	208	1009	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	7.0	1.4	0.0	3.4	2.1	0.0	0.9	34.2	0.0	4.3	41.9	0.0
Cycle Q Clear(g_c), s	7.0	1.4	0.0	3.4	2.1	0.0	0.9	34.2	0.0	4.3	41.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	187	200		109	112		206	1024		312	1099	
V/C Ratio(X)	0.78	0.17		0.65	0.40		0.21	0.85		0.67	0.92	
Avail Cap(c_a), veh/h	364	388		369	379		243	1024		352	1099	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.8	35.3	0.0	39.8	39.2	0.0	16.9	16.4	0.0	16.9	16.0	0.0
Incr Delay (d2), s/veh	6.9	0.4	0.0	6.4	2.3	0.0	0.5	8.7	0.0	4.1	13.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	0.7	0.0	1.7	1.0	0.0	0.4	15.4	0.0	2.5	19.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.7	35.7	0.0	46.3	41.6	0.0	17.4	25.1	0.0	21.0	29.5	0.0
LnGrp LOS	D	D		D	D		B	C		C	C	
Approach Vol, veh/h		180	A		116	A		911	A		1217	A
Approach Delay, s/veh		43.0			44.4			24.7			28.1	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.8	52.4		13.8	7.7	55.5		9.8
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.3	47.7		18.0	5.0	51.0		18.0
Max Q Clear Time (g_c+I1), s	6.3	36.2		9.0	2.9	43.9		5.4
Green Ext Time (p_c), s	0.1	5.0		0.3	0.0	4.2		0.3

Intersection Summary	
HCM 6th Ctrl Delay	28.7
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	320	12	57	8	12	20	71	547	12	19	564	314
Future Volume (veh/h)	320	12	57	8	12	20	71	547	12	19	564	314
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1767	1811	1870	1870	1870	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	337	13	0	8	13	21	75	576	13	20	594	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	9	9	6	2	2	2	3	3	3	2	2	2
Cap, veh/h	393	15		12	20	33	96	840	19	40	1537	
Arrive On Green	0.24	0.24	0.00	0.04	0.04	0.04	0.05	0.46	0.46	0.02	0.43	0.00
Sat Flow, veh/h	1623	63	1535	324	527	851	1767	1807	41	1781	3647	0
Grp Volume(v), veh/h	350	0	0	42	0	0	75	0	589	20	594	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1701	0	0	1767	0	1848	1781	1777	0
Q Serve(g_s), s	15.4	0.0	0.0	1.9	0.0	0.0	3.2	0.0	19.4	0.9	8.8	0.0
Cycle Q Clear(g_c), s	15.4	0.0	0.0	1.9	0.0	0.0	3.2	0.0	19.4	0.9	8.8	0.0
Prop In Lane	0.96		1.00	0.19		0.50	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	408	0		65	0	0	96	0	859	40	1537	
V/C Ratio(X)	0.86	0.00		0.64	0.00	0.00	0.78	0.00	0.69	0.50	0.39	
Avail Cap(c_a), veh/h	564	0		560	0	0	162	0	859	117	1537	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	28.1	0.0	0.0	36.7	0.0	0.0	36.1	0.0	16.3	37.4	15.0	0.0
Incr Delay (d2), s/veh	9.4	0.0	0.0	10.1	0.0	0.0	12.7	0.0	4.4	9.2	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.0	0.0	0.0	0.9	0.0	0.0	1.7	0.0	7.9	0.5	3.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	37.5	0.0	0.0	46.8	0.0	0.0	48.8	0.0	20.7	46.6	15.7	0.0
LnGrp LOS	D	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		350	A		42			664			614	A
Approach Delay, s/veh		37.5			46.8			23.9			16.7	
Approach LOS		D			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		23.2	8.7	38.0		7.5	6.2	40.5
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		25.9	7.1	33.5		25.5	5.1	35.5
Max Q Clear Time (g_c+I1), s		17.4	5.2	10.8		3.9	2.9	21.4
Green Ext Time (p_c), s		1.4	0.0	3.7		0.1	0.0	3.0

Intersection Summary	
HCM 6th Ctrl Delay	24.7
HCM 6th LOS	C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Appendix G

Analysis Reports – Future With Project Conditions (2029)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	78	512	241	181	787	34	268	212	122	22	355	196
Future Volume (veh/h)	78	512	241	181	787	34	268	212	122	22	355	196
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	80	522	0	185	803	0	273	216	0	22	362	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	165	1480		268	1612		367	836		43	538	
Arrive On Green	0.05	0.44	0.00	0.08	0.47	0.00	0.11	0.24	0.00	0.02	0.15	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	80	522	0	185	803	0	273	216	0	22	362	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	2.0	8.4	0.0	4.3	13.2	0.0	6.3	4.0	0.0	1.0	7.8	0.0
Cycle Q Clear(g_c), s	2.0	8.4	0.0	4.3	13.2	0.0	6.3	4.0	0.0	1.0	7.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	165	1480		268	1612		367	836		43	538	
V/C Ratio(X)	0.49	0.35		0.69	0.50		0.74	0.26		0.51	0.67	
Avail Cap(c_a), veh/h	244	1480		434	1612		597	2053		120	1669	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.6	15.1	0.0	36.6	15.0	0.0	35.3	25.4	0.0	39.3	32.7	0.0
Incr Delay (d2), s/veh	2.2	0.7	0.0	3.2	1.1	0.0	3.0	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	3.1	0.0	1.9	4.9	0.0	2.7	1.7	0.0	0.5	3.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.8	15.7	0.0	39.7	16.1	0.0	38.3	25.5	0.0	48.5	34.2	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		602	A		988	A		489	A		384	A
Approach Delay, s/veh		18.9			20.5			32.6			35.0	
Approach LOS		B			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.5	23.7	10.9	40.5	13.3	16.8	8.7	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	3.0	6.0	6.3	10.4	8.3	9.8	4.0	15.2
Green Ext Time (p_c), s	0.0	1.5	0.2	3.5	0.5	2.5	0.0	5.7

Intersection Summary	
HCM 6th Ctrl Delay	24.8
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	406	137	61	711	554	161	372	47	409	374	137
Future Volume (vph)	118	406	137	61	711	554	161	372	47	409	374	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3347	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3347	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	122	419	141	63	733	571	166	384	48	422	386	141
RTOR Reduction (vph)	0	0	97	0	0	407	0	0	39	0	21	0
Lane Group Flow (vph)	122	419	44	63	733	164	149	401	9	316	612	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.4	30.4	4.1	27.9	27.9	18.9	18.9	18.9	25.7	25.7	
Effective Green, g (s)	6.6	30.4	30.4	4.1	27.9	27.9	18.9	18.9	18.9	25.7	25.7	
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.29	0.29	0.19	0.19	0.19	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	210	1027	474	139	978	444	304	651	289	422	840	
v/s Ratio Prot	c0.04	0.13		0.02	c0.22		0.10	c0.12		c0.20	0.19	
v/s Ratio Perm			0.03			0.11			0.01			
v/c Ratio	0.58	0.41	0.09	0.45	0.75	0.37	0.49	0.62	0.03	0.75	0.73	
Uniform Delay, d1	43.9	26.3	23.6	45.4	31.4	27.6	34.8	35.8	31.7	32.7	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.0	1.2	0.4	2.3	5.3	2.4	1.2	1.7	0.0	7.1	3.2	
Delay (s)	48.0	27.5	24.0	47.7	36.7	29.9	36.1	37.5	31.7	39.9	35.7	
Level of Service	D	C	C	D	D	C	D	D	C	D	D	
Approach Delay (s)		30.4			34.4			36.7			37.1	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	97.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	28.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	49	54	196	1178	876	33
Future Vol, veh/h	49	54	196	1178	876	33
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	53	58	211	1267	942	35

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2632	-	943	0	-	0
Stage 1	943	-	-	-	-	-
Stage 2	1689	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 26	0	727	-	-	-
Stage 1	379	0	-	-	-	-
Stage 2	164	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 18	-	726	-	-	-
Mov Cap-2 Maneuver	~ 18	-	-	-	-	-
Stage 1	268	-	-	-	-	-
Stage 2	164	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1310.5	1.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	726	-	18	-	-	-
HCM Lane V/C Ratio	0.29	-	2.927	-	-	-
HCM Control Delay (s)	12		$ 1310.5	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.2	-	7.1	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	6.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	155	1216	17	81	846
Future Vol, veh/h	10	155	1216	17	81	846
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	11	167	1308	18	87	910

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2401	1317	0	0	1308	0
Stage 1	1317	-	-	-	-	-
Stage 2	1084	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	37	193	-	-	516	-
Stage 1	250	-	-	-	-	-
Stage 2	324	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	31	193	-	-	516	-
Mov Cap-2 Maneuver	31	-	-	-	-	-
Stage 1	250	-	-	-	-	-
Stage 2	269	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	89	0	1.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	31	193	516	-
HCM Lane V/C Ratio	-	-	0.347	0.864	0.169	-
HCM Control Delay (s)	-	-	173.5	83.5	13.4	-
HCM Lane LOS	-	-	F	F	B	-
HCM 95th %tile Q(veh)	-	-	1.1	6.4	0.6	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	98	204	1047	30	47	813
Future Volume (veh/h)	98	204	1047	30	47	813
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826
Adj Flow Rate, veh/h	104	0	1114	0	50	865
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	3	2	2	5
Cap, veh/h	130		1446		64	1557
Arrive On Green	0.07	0.00	0.78	0.00	0.04	0.85
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826
Grp Volume(v), veh/h	104	0	1114	0	50	865
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826
Q Serve(g_s), s	6.9	0.0	40.1	0.0	3.4	16.0
Cycle Q Clear(g_c), s	6.9	0.0	40.1	0.0	3.4	16.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	130		1446		64	1557
V/C Ratio(X)	0.80		0.77		0.78	0.56
Avail Cap(c_a), veh/h	265		1446		96	1557
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	55.1	0.0	7.4	0.0	57.7	2.5
Incr Delay (d2), s/veh	10.7	0.0	4.0	0.0	20.2	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	0.0	14.2	0.0	1.9	4.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	65.9	0.0	11.4	0.0	78.0	3.9
LnGrp LOS	E		B		E	A
Approach Vol, veh/h	104	A	1114	A		915
Approach Delay, s/veh	65.9		11.4			8.0
Approach LOS	E		B			A

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	8.9	98.6				107.5		13.3
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	6.5	92.0				103.0		18.0
Max Q Clear Time (g_c+I1), s	5.4	42.1				18.0		8.9
Green Ext Time (p_c), s	0.0	14.6				8.8		0.1

Intersection Summary		
HCM 6th Ctrl Delay		12.6
HCM 6th LOS		B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	21.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	8	187	574	910	837	69
Future Vol, veh/h	8	187	574	910	837	69
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	9	201	617	978	900	74

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3112	-	900	0	-	0
Stage 1	900	-	-	-	-	-
Stage 2	2212	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	13	0	755	-	-	-
Stage 1	397	0	-	-	-	-
Stage 2	89	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 2	-	755	-	-	-
Mov Cap-2 Maneuver	~ 2	-	-	-	-	-
Stage 1	73	-	-	-	-	-
Stage 2	89	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 4556.6	10.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	755	-	2	-	-	-
HCM Lane V/C Ratio	0.817	-	4.301	-	-	-
HCM Control Delay (s)	27.4		$ 4556.6	0	-	-
HCM Lane LOS	D	-	F	A	-	-
HCM 95th %tile Q(veh)	8.9	-	2.3	-	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	282	53	76	92	43	303	36	890	61	160	734	142
Future Volume (veh/h)	282	53	76	92	43	303	36	890	61	160	734	142
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	300	56	0	98	46	0	38	947	0	170	781	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	313	329		131	139		291	1008		202	1055	
Arrive On Green	0.18	0.18	0.00	0.07	0.07	0.00	0.03	0.54	0.00	0.06	0.57	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	300	56	0	98	46	0	38	947	0	170	781	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	19.9	3.0	0.0	6.5	2.8	0.0	1.1	56.3	0.0	5.1	37.3	0.0
Cycle Q Clear(g_c), s	19.9	3.0	0.0	6.5	2.8	0.0	1.1	56.3	0.0	5.1	37.3	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	313	329		131	139		291	1008		202	1055	
V/C Ratio(X)	0.96	0.17		0.75	0.33		0.13	0.94		0.84	0.74	
Avail Cap(c_a), veh/h	313	329		275	291		312	1008		221	1055	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	48.6	41.7	0.0	54.0	52.3	0.0	16.4	25.6	0.0	27.1	19.1	0.0
Incr Delay (d2), s/veh	39.8	0.2	0.0	8.1	1.4	0.0	0.2	17.1	0.0	23.0	4.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.2	1.4	0.0	3.2	1.4	0.0	0.5	28.5	0.0	3.9	16.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	88.4	41.9	0.0	62.1	53.6	0.0	16.6	42.8	0.0	50.2	23.8	0.0
LnGrp LOS	F	D		E	D		B	D		D	C	
Approach Vol, veh/h		356	A		144	A		985	A		951	A
Approach Delay, s/veh		81.1			59.4			41.7			28.5	
Approach LOS		F			E			D			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.6	68.6		25.4	8.1	72.2		13.3				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.5	64.1		20.9	5.0	67.6		18.5				
Max Q Clear Time (g_c+I1), s	7.1	58.3		21.9	3.1	39.3		8.5				
Green Ext Time (p_c), s	0.1	3.3		0.0	0.0	6.5		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			43.4
HCM 6th LOS			D

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	177	6	29	18	13	17	84	536	17	16	481	329
Future Volume (veh/h)	177	6	29	18	13	17	84	536	17	16	481	329
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.94	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1722	1781	1781	1781	1752	1811	1811	1870	1811	1811
Adj Flow Rate, veh/h	190	6	0	19	14	18	90	576	18	17	517	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	12	8	8	8	10	6	6	2	6	6
Cap, veh/h	240	8		24	18	23	114	1052	33	34	1905	
Arrive On Green	0.14	0.14	0.00	0.04	0.04	0.04	0.07	0.60	0.60	0.02	0.55	0.00
Sat Flow, veh/h	1729	55	1459	600	442	568	1668	1745	55	1781	3532	0
Grp Volume(v), veh/h	196	0	0	51	0	0	90	0	594	17	517	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1610	0	0	1668	0	1800	1781	1721	0
Q Serve(g_s), s	9.6	0.0	0.0	2.8	0.0	0.0	4.8	0.0	17.7	0.9	7.1	0.0
Cycle Q Clear(g_c), s	9.6	0.0	0.0	2.8	0.0	0.0	4.8	0.0	17.7	0.9	7.1	0.0
Prop In Lane	0.97		1.00	0.37		0.35	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	248	0		65	0	0	114	0	1085	34	1905	
V/C Ratio(X)	0.79	0.00		0.79	0.00	0.00	0.79	0.00	0.55	0.50	0.27	
Avail Cap(c_a), veh/h	527	0		454	0	0	266	0	1085	104	1905	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.7	0.0	0.0	43.0	0.0	0.0	41.5	0.0	10.6	43.9	10.6	0.0
Incr Delay (d2), s/veh	5.6	0.0	0.0	18.8	0.0	0.0	11.4	0.0	2.0	10.7	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	0.0	0.0	1.5	0.0	0.0	2.2	0.0	6.3	0.5	2.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	43.3	0.0	0.0	61.8	0.0	0.0	52.9	0.0	12.6	54.6	11.0	0.0
LnGrp LOS	D	A		E	A	A	D	A	B	D	B	
Approach Vol, veh/h		196	A		51			684			534	A
Approach Delay, s/veh		43.3			61.8			17.9			12.3	
Approach LOS		D			E			B			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		17.0	10.7	54.6		8.1	6.2	59.0
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		26.7	14.4	45.4		25.5	5.3	54.5
Max Q Clear Time (g_c+I1), s		11.6	6.8	9.1		4.8	2.9	19.7
Green Ext Time (p_c), s		0.9	0.1	3.4		0.2	0.0	3.9

Intersection Summary			
HCM 6th Ctrl Delay			20.8
HCM 6th LOS			C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	3.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	108	918	25	22	911
Future Vol, veh/h	29	108	918	25	22	911
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	585	695	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	117	998	27	24	990

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2036	998	0	0	998	0
Stage 1	998	-	-	-	-	-
Stage 2	1038	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	62	296	-	-	693	-
Stage 1	357	-	-	-	-	-
Stage 2	341	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	60	296	-	-	693	-
Mov Cap-2 Maneuver	60	-	-	-	-	-
Stage 1	357	-	-	-	-	-
Stage 2	329	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	44.6	0	0.2
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	60	296	693	-
HCM Lane V/C Ratio	-	-	0.525	0.397	0.035	-
HCM Control Delay (s)	-	-	118.2	24.9	10.4	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	2.1	1.8	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	287	1003	556	248	697	54	251	313	283	58	346	118
Future Volume (veh/h)	287	1003	556	248	697	54	251	313	283	58	346	118
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	293	1023	0	253	711	0	256	319	0	59	353	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	381	1526		337	1466		340	741		80	547	
Arrive On Green	0.11	0.43	0.00	0.10	0.42	0.00	0.10	0.21	0.00	0.04	0.15	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	293	1023	0	253	711	0	256	319	0	59	353	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.9	19.3	0.0	5.9	12.3	0.0	6.0	6.5	0.0	2.7	7.8	0.0
Cycle Q Clear(g_c), s	6.9	19.3	0.0	5.9	12.3	0.0	6.0	6.5	0.0	2.7	7.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	381	1526		337	1466		340	741		80	547	
V/C Ratio(X)	0.77	0.67		0.75	0.48		0.75	0.43		0.74	0.64	
Avail Cap(c_a), veh/h	515	1526		436	1466		433	1777		191	1709	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.9	18.8	0.0	36.5	17.6	0.0	36.5	28.6	0.0	39.2	33.0	0.0
Incr Delay (d2), s/veh	4.9	2.4	0.0	5.2	1.1	0.0	5.6	0.4	0.0	12.6	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	7.7	0.0	2.7	4.8	0.0	2.7	2.7	0.0	1.4	3.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.8	21.2	0.0	41.8	18.8	0.0	42.0	29.0	0.0	51.8	34.3	0.0
LnGrp LOS	D	C		D	B		D	C		D	C	
Approach Vol, veh/h		1316	A		964	A		575	A		412	A
Approach Delay, s/veh		25.6			24.8			34.8			36.8	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.2	21.8	12.6	40.5	12.7	17.3	13.7	39.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	4.7	8.5	7.9	21.3	8.0	9.8	8.9	14.3
Green Ext Time (p_c), s	0.0	2.2	0.2	6.2	0.2	2.5	0.3	4.7

Intersection Summary	
HCM 6th Ctrl Delay	28.4
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	777	321	85	640	367	139	351	40	408	378	210
Future Volume (vph)	210	777	321	85	640	367	139	351	40	408	378	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3383	1537	1610	3194	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3383	1537	1610	3194	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	214	793	328	87	653	374	142	358	41	416	386	214
RTOR Reduction (vph)	0	0	221	0	0	270	0	0	34	0	42	0
Lane Group Flow (vph)	214	793	107	87	653	104	128	372	7	341	633	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	32.2	32.2	3.9	27.5	27.5	18.1	18.1	18.1	26.8	26.8	
Effective Green, g (s)	8.6	32.2	32.2	3.9	27.5	27.5	18.1	18.1	18.1	26.8	26.8	
Actuated g/C Ratio	0.09	0.33	0.33	0.04	0.28	0.28	0.18	0.18	0.18	0.27	0.27	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	289	1151	514	135	964	433	291	618	281	435	864	
v/s Ratio Prot	c0.06	c0.22		0.03	0.19		0.08	c0.11		c0.21	0.20	
v/s Ratio Perm			0.07			0.07			0.00			
v/c Ratio	0.74	0.69	0.21	0.64	0.68	0.24	0.44	0.60	0.03	0.78	0.73	
Uniform Delay, d1	44.1	29.0	24.2	46.9	31.8	27.7	35.9	37.1	33.2	33.4	32.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.8	3.4	0.9	10.1	3.8	1.3	1.1	1.7	0.0	9.0	3.2	
Delay (s)	53.9	32.4	25.1	57.0	35.6	29.0	37.0	38.8	33.3	42.4	36.1	
Level of Service	D	C	C	E	D	C	D	D	C	D	D	
Approach Delay (s)		34.1			35.1			38.0			38.2	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	35.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	99.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	1.6					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	82	98	1079	1181	19
Future Vol, veh/h	11	82	98	1079	1181	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	11	85	101	1112	1218	20

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2532	-	1218	0	-	0
Stage 1	1218	-	-	-	-	-
Stage 2	1314	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	30	0	572	-	-	-
Stage 1	280	0	-	-	-	-
Stage 2	251	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	25	-	572	-	-	-
Mov Cap-2 Maneuver	25	-	-	-	-	-
Stage 1	230	-	-	-	-	-
Stage 2	251	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	237	1.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	572	-	25	-	-	-
HCM Lane V/C Ratio	0.177	-	0.454	-	-	-
HCM Control Delay (s)	12.6	-	237	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.6	-	1.4	-	-	-

Intersection						
Int Delay, s/veh	2.7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	78	1103	4	67	1197
Future Vol, veh/h	15	78	1103	4	67	1197
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	15	80	1137	4	69	1234

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2511	1139	0	0	1137	0
Stage 1	1139	-	-	-	-	-
Stage 2	1372	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	30	245	-	-	593	-
Stage 1	298	-	-	-	-	-
Stage 2	230	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	27	245	-	-	593	-
Mov Cap-2 Maneuver	27	-	-	-	-	-
Stage 1	298	-	-	-	-	-
Stage 2	203	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	62.9	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	27	245	593	-
HCM Lane V/C Ratio	-	-	0.573	0.328	0.116	-
HCM Control Delay (s)	-	-	251	26.7	11.9	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	1.8	1.4	0.4	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	41	118	976	57	146	1077
Future Volume (veh/h)	41	118	976	57	146	1077
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	42	0	1006	0	151	1110
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	57		1392		180	1665
Arrive On Green	0.03	0.00	0.75	0.00	0.10	0.89
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	42	0	1006	0	151	1110
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	2.7	0.0	34.2	0.0	9.6	18.5
Cycle Q Clear(g_c), s	2.7	0.0	34.2	0.0	9.6	18.5
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	57		1392		180	1665
V/C Ratio(X)	0.74		0.72		0.84	0.67
Avail Cap(c_a), veh/h	277		1392		239	1665
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	55.5	0.0	7.9	0.0	51.1	1.7
Incr Delay (d2), s/veh	16.7	0.0	3.3	0.0	17.9	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	12.6	0.0	5.2	2.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	72.2	0.0	11.1	0.0	69.0	3.8
LnGrp LOS	E		B		E	A
Approach Vol, veh/h	42	A	1006	A		1261
Approach Delay, s/veh	72.2		11.1			11.7
Approach LOS	E		B			B

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	16.2	91.3				107.5		8.2
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	15.5	83.0				103.0		18.0
Max Q Clear Time (g_c+I1), s	11.6	36.2				20.5		4.7
Green Ext Time (p_c), s	0.1	11.4				15.5		0.0

Intersection Summary	
HCM 6th Ctrl Delay	12.5
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	4.6					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	14	411	269	1017	992	40
Future Vol, veh/h	14	411	269	1017	992	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	14	419	274	1038	1012	41

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2598	-	1012	0	-	0
Stage 1	1012	-	-	-	-	-
Stage 2	1586	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	26	0	685	-	-	-
Stage 1	342	0	-	-	-	-
Stage 2	179	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	16	-	685	-	-	-
Mov Cap-2 Maneuver	16	-	-	-	-	-
Stage 1	205	-	-	-	-	-
Stage 2	179	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 507.5	2.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	685	-	16	-	-	-
HCM Lane V/C Ratio	0.401	-	0.893	-	-	-
HCM Control Delay (s)	13.7	-	$ 507.5	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.9	-	2.2	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	149	33	53	75	44	228	41	885	71	202	977	190
Future Volume (veh/h)	149	33	53	75	44	228	41	885	71	202	977	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	155	34	0	78	46	0	43	922	0	210	1018	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	187	200		110	113		234	1125		307	1191	
Arrive On Green	0.11	0.11	0.00	0.06	0.06	0.00	0.03	0.61	0.00	0.06	0.64	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	155	34	0	78	46	0	43	922	0	210	1018	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	9.7	1.8	0.0	4.8	2.7	0.0	1.0	43.4	0.0	4.8	48.4	0.0
Cycle Q Clear(g_c), s	9.7	1.8	0.0	4.8	2.7	0.0	1.0	43.4	0.0	4.8	48.4	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	187	200		110	113		234	1125		307	1191	
V/C Ratio(X)	0.83	0.17		0.71	0.41		0.18	0.82		0.68	0.85	
Avail Cap(c_a), veh/h	283	302		288	295		255	1125		374	1191	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	48.8	45.3	0.0	51.3	50.3	0.0	17.3	17.2	0.0	20.1	16.1	0.0
Incr Delay (d2), s/veh	11.6	0.4	0.0	8.0	2.3	0.0	0.4	6.7	0.0	3.8	7.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.9	0.0	2.4	1.3	0.0	0.5	19.1	0.0	3.4	21.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	60.4	45.7	0.0	59.3	52.7	0.0	17.7	23.9	0.0	23.9	24.1	0.0
LnGrp LOS	E	D		E	D		B	C		C	C	
Approach Vol, veh/h		189	A		124	A		965	A		1228	A
Approach Delay, s/veh		57.8			56.8			23.6			24.0	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.6	72.1		16.4	8.2	75.5		11.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	11.3	64.7		18.0	5.0	71.0		18.0				
Max Q Clear Time (g_c+I1), s	6.8	45.4		11.7	3.0	50.4		6.8				
Green Ext Time (p_c), s	0.2	7.3		0.3	0.0	8.8		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			28.0
HCM 6th LOS			C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	339	12	57	8	12	21	71	579	12	19	574	319
Future Volume (veh/h)	339	12	57	8	12	21	71	579	12	19	574	319
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1767	1811	1870	1870	1870	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	357	13	0	8	13	22	75	609	13	20	604	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	9	9	6	2	2	2	3	3	3	2	2	2
Cap, veh/h	406	15		11	18	31	96	915	20	38	1680	
Arrive On Green	0.25	0.25	0.00	0.04	0.04	0.04	0.05	0.51	0.51	0.02	0.47	0.00
Sat Flow, veh/h	1626	59	1535	316	513	869	1767	1810	39	1781	3647	0
Grp Volume(v), veh/h	370	0	0	43	0	0	75	0	622	20	604	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1698	0	0	1767	0	1849	1781	1777	0
Q Serve(g_s), s	20.2	0.0	0.0	2.4	0.0	0.0	4.0	0.0	24.0	1.1	10.4	0.0
Cycle Q Clear(g_c), s	20.2	0.0	0.0	2.4	0.0	0.0	4.0	0.0	24.0	1.1	10.4	0.0
Prop In Lane	0.96		1.00	0.19		0.51	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	421	0		60	0	0	96	0	935	38	1680	
V/C Ratio(X)	0.88	0.00		0.71	0.00	0.00	0.78	0.00	0.67	0.52	0.36	
Avail Cap(c_a), veh/h	578	0		452	0	0	164	0	935	95	1680	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	34.6	0.0	0.0	45.8	0.0	0.0	44.8	0.0	17.7	46.4	16.1	0.0
Incr Delay (d2), s/veh	11.3	0.0	0.0	14.4	0.0	0.0	12.6	0.0	3.7	10.5	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.4	0.0	0.0	1.2	0.0	0.0	2.0	0.0	10.0	0.6	3.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.9	0.0	0.0	60.1	0.0	0.0	57.3	0.0	21.4	57.0	16.7	0.0
LnGrp LOS	D	A		E	A	A	E	A	C	E	B	
Approach Vol, veh/h		370	A		43			697			624	A
Approach Delay, s/veh		45.9			60.1			25.3			18.0	
Approach LOS		D			E			C			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		28.4	9.7	49.8		7.9	6.6	53.0
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		32.9	8.9	44.7		25.5	5.1	48.5
Max Q Clear Time (g_c+I1), s		22.2	6.0	12.4		4.4	3.1	26.0
Green Ext Time (p_c), s		1.7	0.0	4.0		0.1	0.0	3.8

Intersection Summary	
HCM 6th Ctrl Delay	27.9
HCM 6th LOS	C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	68	1031	74	79	1118
Future Vol, veh/h	12	68	1031	74	79	1118
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	585	695	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	74	1121	80	86	1215

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2508	1121	0	0	1121	0
Stage 1	1121	-	-	-	-	-
Stage 2	1387	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	31	251	-	-	623	-
Stage 1	311	-	-	-	-	-
Stage 2	232	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	27	251	-	-	623	-
Mov Cap-2 Maneuver	27	-	-	-	-	-
Stage 1	311	-	-	-	-	-
Stage 2	200	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	55.7	0	0.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	27	251	623	-
HCM Lane V/C Ratio	-	-	0.483	0.294	0.138	-
HCM Control Delay (s)	-	-	228.2	25.2	11.7	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	1.5	1.2	0.5	-

Arterial Level of Service: NB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	41.2	71.0	112.2	0.32	10.4	E
Puapuaanui St	III	30	107.6	16.7	124.3	0.90	26.0	B
Total	III		148.8	87.7	236.5	1.22	18.6	C

Arterial Level of Service: SB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	5.8	100.1	0.79	28.2	B
Lako Street	III	30	107.6	32.4	140.0	0.90	23.0	C
Total	III		201.9	38.2	240.1	1.68	25.2	B

Arterial Level of Service: NB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	41.2	48.8	90.0	0.32	13.0	E
Puapuaanui St	III	30	107.6	18.1	125.7	0.90	25.7	B
Total	III		148.8	66.9	215.7	1.22	20.4	C

Arterial Level of Service: SB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	6.2	100.5	0.79	28.1	B
Lako Street	III	30	107.6	39.2	146.8	0.90	22.0	C
Total	III		201.9	45.4	247.3	1.68	24.5	B

Appendix H

Analysis Reports – Future Without Project Conditions (2039)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	87	558	266	199	827	28	297	234	133	24	392	216
Future Volume (veh/h)	87	558	266	199	827	28	297	234	133	24	392	216
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	89	569	0	203	844	0	303	239	0	24	400	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	167	1420		285	1565		394	900		45	579	
Arrive On Green	0.05	0.42	0.00	0.08	0.45	0.00	0.12	0.25	0.00	0.03	0.16	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	89	569	0	203	844	0	303	239	0	24	400	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	2.3	9.9	0.0	4.9	14.9	0.0	7.3	4.5	0.0	1.1	8.9	0.0
Cycle Q Clear(g_c), s	2.3	9.9	0.0	4.9	14.9	0.0	7.3	4.5	0.0	1.1	8.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	167	1420		285	1565		394	900		45	579	
V/C Ratio(X)	0.53	0.40		0.71	0.54		0.77	0.27		0.53	0.69	
Avail Cap(c_a), veh/h	237	1420		421	1565		579	1993		117	1620	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	38.8	16.8	0.0	37.5	16.5	0.0	36.0	25.1	0.0	40.4	33.2	0.0
Incr Delay (d2), s/veh	2.6	0.8	0.0	3.3	1.3	0.0	3.7	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	3.7	0.0	2.1	5.7	0.0	3.2	1.9	0.0	0.6	3.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.4	17.7	0.0	40.8	17.9	0.0	39.7	25.3	0.0	49.6	34.6	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		658	A		1047	A		542	A		424	A
Approach Delay, s/veh		20.9			22.3			33.3			35.5	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.6	25.8	11.5	40.0	14.2	18.2	8.9	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	3.1	6.5	6.9	11.9	9.3	10.9	4.3	16.9
Green Ext Time (p_c), s	0.0	1.7	0.2	3.8	0.5	2.8	0.0	5.9

Intersection Summary	
HCM 6th Ctrl Delay	26.3
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	131	438	151	63	732	570	178	411	51	442	414	151
Future Volume (vph)	131	438	151	63	732	570	178	411	51	442	414	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	135	452	156	65	755	588	184	424	53	456	427	156
RTOR Reduction (vph)	0	0	109	0	0	408	0	0	42	0	22	0
Lane Group Flow (vph)	135	452	47	65	755	180	166	442	11	347	670	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.4	30.4	4.1	27.9	27.9	20.5	20.5	20.5	27.6	27.6	
Effective Green, g (s)	6.6	30.4	30.4	4.1	27.9	27.9	20.5	20.5	20.5	27.6	27.6	
Actuated g/C Ratio	0.07	0.30	0.30	0.04	0.28	0.28	0.20	0.20	0.20	0.27	0.27	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	203	991	458	134	944	429	318	682	303	437	870	
v/s Ratio Prot	c0.04	0.14		0.02	c0.22		0.11	c0.13		c0.22	0.21	
v/s Ratio Perm			0.03			0.12			0.01			
v/c Ratio	0.67	0.46	0.10	0.49	0.80	0.42	0.52	0.65	0.04	0.79	0.77	
Uniform Delay, d1	45.9	28.4	25.3	47.2	33.8	29.7	35.7	36.7	32.1	33.9	33.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.0	1.5	0.5	2.8	7.1	3.0	1.5	2.1	0.0	9.6	4.3	
Delay (s)	53.9	29.9	25.7	50.0	40.8	32.7	37.2	38.9	32.2	43.4	37.8	
Level of Service	D	C	C	D	D	C	D	D	C	D	D	
Approach Delay (s)		33.4			37.9			37.9			39.7	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	37.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	41

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	54	59	200	1202	947	37
Future Vol, veh/h	54	59	200	1202	947	37
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	58	63	215	1292	1018	40

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2741	-	1019	0	-	0
Stage 1	1019	-	-	-	-	-
Stage 2	1722	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 22	0	681	-	-	-
Stage 1	348	0	-	-	-	-
Stage 2	158	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 15	-	680	-	-	-
Mov Cap-2 Maneuver	~ 15	-	-	-	-	-
Stage 1	238	-	-	-	-	-
Stage 2	158	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1804.9	1.8	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	680	-	15	-	-	-
HCM Lane V/C Ratio	0.316	-	3.871	-	-	-
HCM Control Delay (s)	12.7		$ 1804.9	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.4	-	8.1	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	9.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	171	1228	18	89	913
Future Vol, veh/h	11	171	1228	18	89	913
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	12	184	1320	19	96	982

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2504	1330	0	0	1320	0
Stage 1	1330	-	-	-	-	-
Stage 2	1174	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	32	189	-	-	511	-
Stage 1	247	-	-	-	-	-
Stage 2	294	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	26	189	-	-	511	-
Mov Cap-2 Maneuver	26	-	-	-	-	-
Stage 1	247	-	-	-	-	-
Stage 2	239	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	116.7	0	1.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	26	189	511	-
HCM Lane V/C Ratio	-	-	0.455	0.973	0.187	-
HCM Control Delay (s)	-	-	229.1	109.5	13.7	-
HCM Lane LOS	-	-	F	F	B	-
HCM 95th %tile Q(veh)	-	-	1.4	8	0.7	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	106	226	1041	29	52	876
Future Volume (veh/h)	106	226	1041	29	52	876
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826
Adj Flow Rate, veh/h	113	0	1107	0	55	932
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	3	2	2	5
Cap, veh/h	143		1382		71	1515
Arrive On Green	0.08	0.00	0.75	0.00	0.04	0.83
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826
Grp Volume(v), veh/h	113	0	1107	0	55	932
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826
Q Serve(g_s), s	6.2	0.0	37.7	0.0	3.1	17.8
Cycle Q Clear(g_c), s	6.2	0.0	37.7	0.0	3.1	17.8
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	143		1382		71	1515
V/C Ratio(X)	0.79		0.80		0.78	0.62
Avail Cap(c_a), veh/h	321		1382		116	1515
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.2	0.0	8.1	0.0	47.6	3.0
Incr Delay (d2), s/veh	9.3	0.0	5.0	0.0	16.5	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	0.0	13.5	0.0	1.7	4.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	54.5	0.0	13.0	0.0	64.1	4.8
LnGrp LOS	D		B		E	A
Approach Vol, veh/h	113	A	1107	A		987
Approach Delay, s/veh	54.5		13.0			8.1
Approach LOS	D		B			A

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	8.5	79.0				87.5		12.5
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	6.5	72.0				83.0		18.0
Max Q Clear Time (g_c+I1), s	5.1	39.7				19.8		8.2
Green Ext Time (p_c), s	0.0	12.5				10.1		0.2

Intersection Summary		
HCM 6th Ctrl Delay		13.0
HCM 6th LOS		B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	11.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	206	631	977	894	74
Future Vol, veh/h	9	206	631	977	894	74
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	10	222	678	1051	961	80

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3368	-	961	0	-	0
Stage 1	961	-	-	-	-	-
Stage 2	2407	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 9	0	716	-	-	-
Stage 1	371	0	-	-	-	-
Stage 2	71	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	0	-	716	-	-	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	20	-	-	-	-	-
Stage 2	71	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		18.1	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	716	-	-	-	-	-
HCM Lane V/C Ratio	0.948	-	-	-	-	-
HCM Control Delay (s)	46	-	-	0	-	-
HCM Lane LOS	E	-	-	A	-	-
HCM 95th %tile Q(veh)	13.8	-	-	-	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	306	59	84	84	44	326	40	966	67	172	789	153
Future Volume (veh/h)	306	59	84	84	44	326	40	966	67	172	789	153
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	326	63	0	89	47	0	43	1028	0	183	839	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	323	339		128	135		228	935		184	983	
Arrive On Green	0.18	0.18	0.00	0.07	0.07	0.00	0.03	0.50	0.00	0.06	0.53	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	326	63	0	89	47	0	43	1028	0	183	839	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	18.0	2.8	0.0	4.9	2.4	0.0	1.1	49.6	0.0	6.3	38.5	0.0
Cycle Q Clear(g_c), s	18.0	2.8	0.0	4.9	2.4	0.0	1.1	49.6	0.0	6.3	38.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	323	339		128	135		228	935		184	983	
V/C Ratio(X)	1.01	0.19		0.70	0.35		0.19	1.10		0.99	0.85	
Avail Cap(c_a), veh/h	323	339		321	339		255	935		184	983	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	40.6	34.4	0.0	44.9	43.8	0.0	17.8	24.8	0.0	28.1	20.0	0.0
Incr Delay (d2), s/veh	52.2	0.3	0.0	6.7	1.5	0.0	0.4	60.3	0.0	64.8	9.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.5	1.3	0.0	2.4	1.2	0.0	0.5	36.0	0.0	7.8	18.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	92.7	34.6	0.0	51.6	45.3	0.0	18.2	85.1	0.0	93.0	29.4	0.0
LnGrp LOS	F	C		D	D		B	F		F	C	
Approach Vol, veh/h		389	A		136	A		1071	A		1022	A
Approach Delay, s/veh		83.3			49.4			82.4			40.8	
Approach LOS		F			D			F			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.9	54.1		22.5	8.0	57.0		11.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	49.6		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	8.3	51.6		20.0	3.1	40.5		6.9				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	4.5		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			64.6
HCM 6th LOS			E

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	192	6	32	20	15	18	93	580	18	17	509	348
Future Volume (veh/h)	192	6	32	20	15	18	93	580	18	17	509	348
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1722	1781	1781	1781	1752	1811	1811	1870	1811	1811
Adj Flow Rate, veh/h	206	6	0	22	16	19	100	624	19	18	547	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	12	8	8	8	10	6	6	2	6	6
Cap, veh/h	271	8		30	22	26	126	897	27	38	1580	
Arrive On Green	0.16	0.16	0.00	0.05	0.05	0.05	0.08	0.51	0.51	0.02	0.46	0.00
Sat Flow, veh/h	1733	50	1459	626	455	540	1668	1747	53	1781	3532	0
Grp Volume(v), veh/h	212	0	0	57	0	0	100	0	643	18	547	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1621	0	0	1668	0	1800	1781	1721	0
Q Serve(g_s), s	7.9	0.0	0.0	2.4	0.0	0.0	4.1	0.0	18.7	0.7	7.1	0.0
Cycle Q Clear(g_c), s	7.9	0.0	0.0	2.4	0.0	0.0	4.1	0.0	18.7	0.7	7.1	0.0
Prop In Lane	0.97		1.00	0.39		0.33	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	279	0		78	0	0	126	0	925	38	1580	
V/C Ratio(X)	0.76	0.00		0.73	0.00	0.00	0.79	0.00	0.70	0.48	0.35	
Avail Cap(c_a), veh/h	669	0		598	0	0	220	0	925	131	1580	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.9	0.0	0.0	32.4	0.0	0.0	31.4	0.0	12.7	33.4	12.0	0.0
Incr Delay (d2), s/veh	4.2	0.0	0.0	12.3	0.0	0.0	10.6	0.0	4.3	9.1	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	0.0	0.0	1.2	0.0	0.0	1.9	0.0	6.9	0.4	2.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.1	0.0	0.0	44.7	0.0	0.0	42.0	0.0	17.0	42.6	12.6	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		212	A		57			743			565	A
Approach Delay, s/veh		32.1			44.7			20.4			13.6	
Approach LOS		C			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		15.3	9.7	36.2		7.8	6.0	40.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	9.1	31.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		9.9	6.1	9.1		4.4	2.7	20.7				
Green Ext Time (p_c), s		1.0	0.1	3.3		0.2	0.0	3.5				

Intersection Summary			
HCM 6th Ctrl Delay			20.4
HCM 6th LOS			C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	317	1070	614	272	743	50	277	345	301	62	382	131
Future Volume (veh/h)	317	1070	614	272	743	50	277	345	301	62	382	131
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	323	1092	0	278	758	0	283	352	0	63	390	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	406	1472		358	1409		362	798		81	585	
Arrive On Green	0.12	0.42	0.00	0.10	0.40	0.00	0.11	0.22	0.00	0.05	0.16	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	323	1092	0	278	758	0	283	352	0	63	390	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	7.9	22.5	0.0	6.8	14.2	0.0	6.9	7.4	0.0	3.0	8.9	0.0
Cycle Q Clear(g_c), s	7.9	22.5	0.0	6.8	14.2	0.0	6.9	7.4	0.0	3.0	8.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	406	1472		358	1409		362	798		81	585	
V/C Ratio(X)	0.80	0.74		0.78	0.54		0.78	0.44		0.78	0.67	
Avail Cap(c_a), veh/h	497	1472		421	1409		418	1715		184	1649	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.0	21.2	0.0	37.7	19.6	0.0	37.6	28.8	0.0	40.7	33.8	0.0
Incr Delay (d2), s/veh	7.2	3.4	0.0	7.6	1.5	0.0	8.2	0.4	0.0	14.5	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	9.3	0.0	3.2	5.7	0.0	3.3	3.1	0.0	1.6	3.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.2	24.6	0.0	45.3	21.1	0.0	45.8	29.2	0.0	55.2	35.1	0.0
LnGrp LOS	D	C		D	C		D	C		E	D	
Approach Vol, veh/h		1415	A		1036	A		635	A		453	A
Approach Delay, s/veh		29.1			27.6			36.6			37.9	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.4	23.9	13.4	40.5	13.6	18.7	14.7	39.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	5.0	9.4	8.8	24.5	8.9	10.9	9.9	16.2
Green Ext Time (p_c), s	0.0	2.5	0.2	5.7	0.2	2.7	0.3	4.8

Intersection Summary	
HCM 6th Ctrl Delay	31.1
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	232	809	355	88	669	383	154	388	41	425	417	232
Future Volume (vph)	232	809	355	88	669	383	154	388	41	425	417	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	237	826	362	90	683	391	157	396	42	434	426	237
RTOR Reduction (vph)	0	0	248	0	0	286	0	0	34	0	45	0
Lane Group Flow (vph)	237	826	114	90	683	105	141	412	8	369	683	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	32.0	32.0	3.9	27.3	27.3	19.5	19.5	19.5	28.3	28.3	
Effective Green, g (s)	8.6	32.0	32.0	3.9	27.3	27.3	19.5	19.5	19.5	28.3	28.3	
Actuated g/C Ratio	0.08	0.31	0.31	0.04	0.27	0.27	0.19	0.19	0.19	0.28	0.28	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	282	1113	498	131	931	419	305	648	294	448	888	
v/s Ratio Prot	c0.07	c0.23		0.03	0.20		0.09	c0.12		c0.23	0.21	
v/s Ratio Perm			0.07			0.07			0.01			
v/c Ratio	0.84	0.74	0.23	0.69	0.73	0.25	0.46	0.64	0.03	0.82	0.77	
Uniform Delay, d1	45.9	31.2	25.7	48.3	33.9	29.2	36.5	37.8	33.4	34.4	33.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	19.6	4.5	1.1	13.9	5.1	1.4	1.1	2.0	0.0	11.7	4.1	
Delay (s)	65.5	35.6	26.8	62.2	39.0	30.6	37.6	39.9	33.4	46.0	37.8	
Level of Service	E	D	C	E	D	C	D	D	C	D	D	
Approach Delay (s)		38.4			38.0			38.9			40.5	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	101.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	12	85	102	1126	1226	21
Future Vol, veh/h	12	85	102	1126	1226	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	12	88	105	1161	1264	22

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2635	-	1264	0	-	0
Stage 1	1264	-	-	-	-	-
Stage 2	1371	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	26	0	550	-	-	-
Stage 1	266	0	-	-	-	-
Stage 2	236	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	21	-	550	-	-	-
Mov Cap-2 Maneuver	21	-	-	-	-	-
Stage 1	215	-	-	-	-	-
Stage 2	236	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 316.3	1.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	550	-	21	-	-	-
HCM Lane V/C Ratio	0.191	-	0.589	-	-	-
HCM Control Delay (s)	13.1	-	$ 316.3	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.7	-	1.7	-	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	3.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	17	87	1147	5	74	1238
Future Vol, veh/h	17	87	1147	5	74	1238
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	18	90	1182	5	76	1276

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2613	1185	0	0	1182	0
Stage 1	1185	-	-	-	-	-
Stage 2	1428	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	26	230	-	-	570	-
Stage 1	284	-	-	-	-	-
Stage 2	216	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	23	230	-	-	570	-
Mov Cap-2 Maneuver	23	-	-	-	-	-
Stage 1	284	-	-	-	-	-
Stage 2	187	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	81.9	0	0.7
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	23	230	570	-
HCM Lane V/C Ratio	-	-	0.762	0.39	0.134	-
HCM Control Delay (s)	-	-	$ 345.7	30.3	12.3	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	2.2	1.7	0.5	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	41	131	1007	59	161	1105
Future Volume (veh/h)	41	131	1007	59	161	1105
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	42	0	1038	0	166	1139
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	63		1320		200	1628
Arrive On Green	0.04	0.00	0.71	0.00	0.11	0.87
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	42	0	1038	0	166	1139
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	2.2	0.0	35.0	0.0	8.7	19.2
Cycle Q Clear(g_c), s	2.2	0.0	35.0	0.0	8.7	19.2
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	63		1320		200	1628
V/C Ratio(X)	0.67		0.79		0.83	0.70
Avail Cap(c_a), veh/h	336		1320		252	1628
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.5	0.0	9.0	0.0	41.5	2.0
Incr Delay (d2), s/veh	11.7	0.0	4.8	0.0	16.9	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	13.0	0.0	4.7	2.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	57.1	0.0	13.8	0.0	58.4	4.6
LnGrp LOS	E		B		E	A
Approach Vol, veh/h	42	A	1038	A		1305
Approach Delay, s/veh	57.1		13.8			11.4
Approach LOS	E		B			B

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.2	72.3				87.5		7.9
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	13.5	65.0				83.0		18.0
Max Q Clear Time (g_c+I1), s	10.7	37.0				21.2		4.2
Green Ext Time (p_c), s	0.1	10.5				16.1		0.0

Intersection Summary			
HCM 6th Ctrl Delay			13.3
HCM 6th LOS			B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	8.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	16	454	297	1042	1082	44
Future Vol, veh/h	16	454	297	1042	1082	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	16	463	303	1063	1104	45

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2773	-	1104	0	-	0
Stage 1	1104	-	-	-	-	-
Stage 2	1669	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	20	0	632	-	-	-
Stage 1	309	0	-	-	-	-
Stage 2	163	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 10	-	632	-	-	-
Mov Cap-2 Maneuver	~ 10	-	-	-	-	-
Stage 1	161	-	-	-	-	-
Stage 2	163	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1041	3.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	632	-	10	-	-	-
HCM Lane V/C Ratio	0.48	-	1.633	-	-	-
HCM Control Delay (s)	15.8	-	$ 1041	0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	2.6	-	2.9	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	155	37	59	76	48	235	45	920	78	221	1070	207
Future Volume (veh/h)	155	37	59	76	48	235	45	920	78	221	1070	207
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	161	39	0	79	50	0	47	958	0	230	1115	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	202	215		118	121		147	979		256	1087	
Arrive On Green	0.11	0.11	0.00	0.07	0.07	0.00	0.04	0.53	0.00	0.09	0.58	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	161	39	0	79	50	0	47	958	0	230	1115	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	8.1	1.7	0.0	3.9	2.4	0.0	1.1	45.5	0.0	6.8	52.5	0.0
Cycle Q Clear(g_c), s	8.1	1.7	0.0	3.9	2.4	0.0	1.1	45.5	0.0	6.8	52.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	202	215		118	121		147	979		256	1087	
V/C Ratio(X)	0.80	0.18		0.67	0.41		0.32	0.98		0.90	1.03	
Avail Cap(c_a), veh/h	349	373		355	364		177	979		256	1087	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	39.0	36.1	0.0	41.2	40.5	0.0	21.3	20.8	0.0	25.7	18.9	0.0
Incr Delay (d2), s/veh	7.1	0.4	0.0	6.4	2.3	0.0	1.2	23.9	0.0	31.2	34.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.8	0.8	0.0	1.9	1.1	0.0	0.5	24.3	0.0	4.7	30.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	46.1	36.5	0.0	47.7	42.8	0.0	22.6	44.8	0.0	57.0	52.9	0.0
LnGrp LOS	D	D		D	D		C	D		E	F	
Approach Vol, veh/h		200	A		129	A		1005	A		1345	A
Approach Delay, s/veh		44.2			45.8			43.7			53.6	
Approach LOS		D			D			D			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.8	52.2		14.9	8.0	57.0		10.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.3	47.7		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	8.8	47.5		10.1	3.1	54.5		5.9				
Green Ext Time (p_c), s	0.0	0.1		0.4	0.0	0.0		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			48.8									
HCM 6th LOS			D									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	354	13	63	9	13	22	78	604	13	21	624	347
Future Volume (veh/h)	354	13	63	9	13	22	78	604	13	21	624	347
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1767	1811	1870	1870	1870	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	373	14	0	9	14	23	82	636	14	22	657	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	9	9	6	2	2	2	3	3	3	2	2	2
Cap, veh/h	423	16		13	21	34	105	817	18	43	1479	
Arrive On Green	0.26	0.26	0.00	0.04	0.04	0.04	0.06	0.45	0.45	0.02	0.42	0.00
Sat Flow, veh/h	1624	61	1535	333	518	850	1767	1809	40	1781	3647	0
Grp Volume(v), veh/h	387	0	0	46	0	0	82	0	650	22	657	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1701	0	0	1767	0	1848	1781	1777	0
Q Serve(g_s), s	17.7	0.0	0.0	2.1	0.0	0.0	3.7	0.0	23.9	1.0	10.7	0.0
Cycle Q Clear(g_c), s	17.7	0.0	0.0	2.1	0.0	0.0	3.7	0.0	23.9	1.0	10.7	0.0
Prop In Lane	0.96		1.00	0.20		0.50	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	439	0		68	0	0	105	0	835	43	1479	
V/C Ratio(X)	0.88	0.00		0.68	0.00	0.00	0.78	0.00	0.78	0.51	0.44	
Avail Cap(c_a), veh/h	542	0		539	0	0	156	0	835	113	1479	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	28.6	0.0	0.0	38.1	0.0	0.0	37.3	0.0	18.7	38.8	16.8	0.0
Incr Delay (d2), s/veh	13.4	0.0	0.0	11.2	0.0	0.0	13.7	0.0	7.1	9.1	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.5	0.0	0.0	1.1	0.0	0.0	1.9	0.0	10.4	0.5	4.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.9	0.0	0.0	49.3	0.0	0.0	51.0	0.0	25.7	47.9	17.8	0.0
LnGrp LOS	D	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		387	A		46			732			679	A
Approach Delay, s/veh		41.9			49.3			28.6			18.8	
Approach LOS		D			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		25.5	9.3	38.0		7.7	6.4	40.8				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	7.1	33.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		19.7	5.7	12.7		4.1	3.0	25.9				
Green Ext Time (p_c), s		1.2	0.0	4.0		0.2	0.0	2.8				

Intersection Summary		
HCM 6th Ctrl Delay		28.3
HCM 6th LOS		C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Appendix I

Analysis Reports – Future With Project Conditions (2039)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	87	565	266	200	865	37	297	234	135	24	392	216
Future Volume (veh/h)	87	565	266	200	865	37	297	234	135	24	392	216
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	89	577	0	204	883	0	303	239	0	24	400	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	167	1419		286	1565		394	900		45	579	
Arrive On Green	0.05	0.42	0.00	0.08	0.45	0.00	0.12	0.25	0.00	0.03	0.16	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	89	577	0	204	883	0	303	239	0	24	400	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	2.3	10.1	0.0	4.9	15.8	0.0	7.3	4.5	0.0	1.1	8.9	0.0
Cycle Q Clear(g_c), s	2.3	10.1	0.0	4.9	15.8	0.0	7.3	4.5	0.0	1.1	8.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	167	1419		286	1565		394	900		45	579	
V/C Ratio(X)	0.53	0.41		0.71	0.56		0.77	0.27		0.53	0.69	
Avail Cap(c_a), veh/h	237	1419		421	1565		579	1993		117	1620	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	38.8	16.9	0.0	37.5	16.8	0.0	36.0	25.1	0.0	40.4	33.2	0.0
Incr Delay (d2), s/veh	2.6	0.9	0.0	3.3	1.5	0.0	3.7	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	3.8	0.0	2.1	6.0	0.0	3.2	1.9	0.0	0.6	3.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.4	17.8	0.0	40.8	18.3	0.0	39.7	25.3	0.0	49.6	34.6	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		666	A		1087	A		542	A		424	A
Approach Delay, s/veh		20.9			22.5			33.3			35.5	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.6	25.8	11.6	40.0	14.2	18.2	8.9	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	3.1	6.5	6.9	12.1	9.3	10.9	4.3	17.8
Green Ext Time (p_c), s	0.0	1.7	0.2	3.8	0.5	2.8	0.0	6.1

Intersection Summary	
HCM 6th Ctrl Delay	26.3
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	131	447	151	67	780	608	178	411	52	451	414	151
Future Volume (vph)	131	447	151	67	780	608	178	411	52	451	414	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	135	461	156	69	804	627	184	424	54	465	427	156
RTOR Reduction (vph)	0	0	109	0	0	408	0	0	43	0	21	0
Lane Group Flow (vph)	135	461	47	69	804	219	166	442	11	349	678	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.3	30.3	4.1	27.8	27.8	20.5	20.5	20.5	27.7	27.7	
Effective Green, g (s)	6.6	30.3	30.3	4.1	27.8	27.8	20.5	20.5	20.5	27.7	27.7	
Actuated g/C Ratio	0.07	0.30	0.30	0.04	0.28	0.28	0.20	0.20	0.20	0.28	0.28	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	203	988	456	134	941	427	318	682	303	439	873	
v/s Ratio Prot	c0.04	0.14		0.02	c0.24		0.11	c0.13		c0.22	0.21	
v/s Ratio Perm			0.03			0.14			0.01			
v/c Ratio	0.67	0.47	0.10	0.51	0.85	0.51	0.52	0.65	0.04	0.79	0.78	
Uniform Delay, d1	45.9	28.6	25.3	47.3	34.5	30.7	35.7	36.7	32.1	33.8	33.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.0	1.6	0.5	3.3	9.8	4.3	1.5	2.1	0.0	9.6	4.4	
Delay (s)	53.9	30.2	25.8	50.6	44.3	35.0	37.2	38.9	32.2	43.4	38.0	
Level of Service	D	C	C	D	D	D	D	D	C	D	D	
Approach Delay (s)		33.5			40.7			37.9			39.8	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	100.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	50.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	54	60	215	1292	966	37
Future Vol, veh/h	54	60	215	1292	966	37
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	58	65	231	1389	1039	40

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2891	-	1040	0	-	0
Stage 1	1040	-	-	-	-	-
Stage 2	1851	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 18	0	669	-	-	-
Stage 1	341	0	-	-	-	-
Stage 2	136	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 12	-	668	-	-	-
Mov Cap-2 Maneuver	~ 12	-	-	-	-	-
Stage 1	223	-	-	-	-	-
Stage 2	136	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 2351.6	1.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	668	-	12	-	-	-
HCM Lane V/C Ratio	0.346	-	4.839	-	-	-
HCM Control Delay (s)	13.2		$ 2351.6	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.5	-	8.4	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	13.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	171	1333	18	89	933
Future Vol, veh/h	11	171	1333	18	89	933
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	12	184	1433	19	96	1003

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2638	1443	0	0	1433	0
Stage 1	1443	-	-	-	-	-
Stage 2	1195	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	26	~ 162	-	-	462	-
Stage 1	217	-	-	-	-	-
Stage 2	287	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	21	~ 162	-	-	462	-
Mov Cap-2 Maneuver	21	-	-	-	-	-
Stage 1	217	-	-	-	-	-
Stage 2	227	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	176.9	0	1.3
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	21	162	462	-
HCM Lane V/C Ratio	-	-	0.563	1.135	0.207	-
HCM Control Delay (s)	-	-	$ 308.6	168.4	14.8	-
HCM Lane LOS	-	-	F	F	B	-
HCM 95th %tile Q(veh)	-	-	1.6	9.8	0.8	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	108	226	1146	32	52	896
Future Volume (veh/h)	108	226	1146	32	52	896
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826
Adj Flow Rate, veh/h	115	0	1219	0	55	953
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	3	2	2	5
Cap, veh/h	142		1428		71	1546
Arrive On Green	0.08	0.00	0.77	0.00	0.04	0.85
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826
Grp Volume(v), veh/h	115	0	1219	0	55	953
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826
Q Serve(g_s), s	7.7	0.0	53.6	0.0	3.7	20.4
Cycle Q Clear(g_c), s	7.7	0.0	53.6	0.0	3.7	20.4
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	142		1428		71	1546
V/C Ratio(X)	0.81		0.85		0.78	0.62
Avail Cap(c_a), veh/h	264		1428		81	1546
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	55.1	0.0	9.4	0.0	57.9	3.0
Incr Delay (d2), s/veh	10.5	0.0	6.7	0.0	33.5	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	20.1	0.0	2.3	5.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	65.6	0.0	16.1	0.0	91.4	4.9
LnGrp LOS	E		B		F	A
Approach Vol, veh/h	115	A	1219	A		1008
Approach Delay, s/veh	65.6		16.1			9.6
Approach LOS	E		B			A

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	9.3	98.2	107.5	14.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	93.0	103.0	18.0
Max Q Clear Time (g_c+I1), s	5.7	55.6	22.4	9.7
Green Ext Time (p_c), s	0.0	16.4	10.8	0.2

Intersection Summary	
HCM 6th Ctrl Delay	15.7
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	12.7					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	206	634	1002	921	76
Future Vol, veh/h	9	206	634	1002	921	76
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	10	222	682	1077	990	82

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3431	-	990	0	-	0
Stage 1	990	-	-	-	-	-
Stage 2	2441	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 8	0	698	-	-	-
Stage 1	360	0	-	-	-	-
Stage 2	68	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	0	-	698	-	-	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	~ 8	-	-	-	-	-
Stage 2	68	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		20.5	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	698	-	-	-	-	-
HCM Lane V/C Ratio	0.977	-	-	-	-	-
HCM Control Delay (s)	52.8	-	-	0	-	-
HCM Lane LOS	F	-	-	A	-	-
HCM 95th %tile Q(veh)	15	-	-	-	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	311	59	84	100	47	334	40	981	67	176	808	157
Future Volume (veh/h)	311	59	84	100	47	334	40	981	67	176	808	157
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	331	63	0	106	50	0	43	1044	0	187	860	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	319	335		140	148		232	990		168	1039	
Arrive On Green	0.18	0.18	0.00	0.08	0.08	0.00	0.03	0.53	0.00	0.06	0.56	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	331	63	0	106	50	0	43	1044	0	187	860	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	21.5	3.4	0.0	7.1	3.0	0.0	1.3	63.5	0.0	7.5	45.6	0.0
Cycle Q Clear(g_c), s	21.5	3.4	0.0	7.1	3.0	0.0	1.3	63.5	0.0	7.5	45.6	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	319	335		140	148		232	990		168	1039	
V/C Ratio(X)	1.04	0.19		0.76	0.34		0.19	1.05		1.11	0.83	
Avail Cap(c_a), veh/h	319	335		287	304		250	990		168	1039	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	49.2	41.8	0.0	54.1	52.3	0.0	19.7	28.2	0.0	37.8	21.7	0.0
Incr Delay (d2), s/veh	60.3	0.3	0.0	8.1	1.3	0.0	0.4	44.2	0.0	103.4	7.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.9	1.6	0.0	3.4	1.5	0.0	0.5	39.1	0.0	9.9	21.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	109.6	42.1	0.0	62.3	53.6	0.0	20.1	72.4	0.0	141.3	29.2	0.0
LnGrp LOS	F	D		E	D		C	F		F	C	
Approach Vol, veh/h		394	A		156	A		1087	A		1047	A
Approach Delay, s/veh		98.8			59.5			70.4			49.2	
Approach LOS		F			E			E			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.0	68.0		26.0	8.3	71.7		14.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.5	63.5		21.5	5.0	66.0		19.5				
Max Q Clear Time (g_c+I1), s	9.5	65.5		23.5	3.3	47.6		9.1				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	6.4		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			65.7									
HCM 6th LOS			E									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	196	6	32	20	15	18	93	591	18	18	529	362
Future Volume (veh/h)	196	6	32	20	15	18	93	591	18	18	529	362
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.94	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1722	1781	1781	1781	1752	1811	1811	1870	1811	1811
Adj Flow Rate, veh/h	211	6	0	22	16	19	100	635	19	19	569	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	12	8	8	8	10	6	6	2	6	6
Cap, veh/h	260	7		28	21	24	125	1035	31	37	1850	
Arrive On Green	0.15	0.15	0.00	0.05	0.05	0.05	0.08	0.59	0.59	0.02	0.54	0.00
Sat Flow, veh/h	1734	49	1459	623	453	538	1668	1748	52	1781	3532	0
Grp Volume(v), veh/h	217	0	0	57	0	0	100	0	654	19	569	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1615	0	0	1668	0	1800	1781	1721	0
Q Serve(g_s), s	11.0	0.0	0.0	3.3	0.0	0.0	5.5	0.0	21.8	1.0	8.6	0.0
Cycle Q Clear(g_c), s	11.0	0.0	0.0	3.3	0.0	0.0	5.5	0.0	21.8	1.0	8.6	0.0
Prop In Lane	0.97		1.00	0.39		0.33	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	267	0		73	0	0	125	0	1066	37	1850	
V/C Ratio(X)	0.81	0.00		0.78	0.00	0.00	0.80	0.00	0.61	0.51	0.31	
Avail Cap(c_a), veh/h	493	0		439	0	0	222	0	1066	97	1850	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	38.6	0.0	0.0	44.3	0.0	0.0	42.6	0.0	12.2	45.4	12.0	0.0
Incr Delay (d2), s/veh	5.9	0.0	0.0	16.2	0.0	0.0	10.9	0.0	2.6	10.5	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	0.0	1.6	0.0	0.0	2.6	0.0	8.0	0.5	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.4	0.0	0.0	60.4	0.0	0.0	53.6	0.0	14.9	55.9	12.4	0.0
LnGrp LOS	D	A		E	A	A	D	A	B	E	B	
Approach Vol, veh/h		217	A		57			754			588	A
Approach Delay, s/veh		44.4			60.4			20.0			13.8	
Approach LOS		D			E			C			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		18.5	11.5	54.9		8.7	6.5	60.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	12.5	48.1		25.5	5.1	55.5				
Max Q Clear Time (g_c+I1), s		13.0	7.5	10.6		5.3	3.0	23.8				
Green Ext Time (p_c), s		0.9	0.1	3.8		0.2	0.0	4.4				
Intersection Summary												
HCM 6th Ctrl Delay			22.5									
HCM 6th LOS			C									

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	4.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	108	1011	25	22	1004
Future Vol, veh/h	29	108	1011	25	22	1004
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	585	695	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	117	1099	27	24	1091

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2238	1099	0	0	1099	0
Stage 1	1099	-	-	-	-	-
Stage 2	1139	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	47	258	-	-	635	-
Stage 1	319	-	-	-	-	-
Stage 2	305	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	45	258	-	-	635	-
Mov Cap-2 Maneuver	45	-	-	-	-	-
Stage 1	319	-	-	-	-	-
Stage 2	293	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	64	0	0.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	45	258	635	-
HCM Lane V/C Ratio	-	-	0.7	0.455	0.038	-
HCM Control Delay (s)	-	-	190.1	30.1	10.9	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	2.7	2.2	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	317	1104	614	274	767	59	277	345	311	64	382	131
Future Volume (veh/h)	317	1104	614	274	767	59	277	345	311	64	382	131
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	323	1127	0	280	783	0	283	352	0	65	390	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	406	1471		359	1409		362	792		84	585	
Arrive On Green	0.12	0.42	0.00	0.10	0.40	0.00	0.11	0.22	0.00	0.05	0.16	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	323	1127	0	280	783	0	283	352	0	65	390	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	7.9	23.6	0.0	6.8	14.9	0.0	6.9	7.4	0.0	3.1	8.9	0.0
Cycle Q Clear(g_c), s	7.9	23.6	0.0	6.8	14.9	0.0	6.9	7.4	0.0	3.1	8.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	406	1471		359	1409		362	792		84	585	
V/C Ratio(X)	0.80	0.77		0.78	0.56		0.78	0.44		0.77	0.67	
Avail Cap(c_a), veh/h	497	1471		421	1409		417	1714		184	1648	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.0	21.5	0.0	37.7	19.8	0.0	37.6	28.9	0.0	40.7	33.8	0.0
Incr Delay (d2), s/veh	7.2	3.9	0.0	7.8	1.6	0.0	8.2	0.4	0.0	14.0	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	9.8	0.0	3.2	6.0	0.0	3.3	3.1	0.0	1.7	3.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.3	25.4	0.0	45.5	21.4	0.0	45.8	29.3	0.0	54.7	35.1	0.0
LnGrp LOS	D	C		D	C		D	C		D	D	
Approach Vol, veh/h		1450	A		1063	A		635	A		455	A
Approach Delay, s/veh		29.6			27.7			36.7			37.9	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.6	23.7	13.5	40.5	13.6	18.7	14.7	39.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	5.1	9.4	8.8	25.6	8.9	10.9	9.9	16.9
Green Ext Time (p_c), s	0.0	2.5	0.2	5.5	0.2	2.7	0.3	4.9

Intersection Summary	
HCM 6th Ctrl Delay	31.3
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	232	854	355	93	704	403	154	388	43	449	417	232
Future Volume (vph)	232	854	355	93	704	403	154	388	43	449	417	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3194	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3194	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	237	871	362	95	718	411	157	396	44	458	426	237
RTOR Reduction (vph)	0	0	255	0	0	305	0	0	36	0	42	0
Lane Group Flow (vph)	237	871	107	95	718	106	141	412	8	376	703	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	29.8	29.8	5.0	26.2	26.2	19.5	19.5	19.5	28.9	28.9	
Effective Green, g (s)	8.6	29.8	29.8	5.0	26.2	26.2	19.5	19.5	19.5	28.9	28.9	
Actuated g/C Ratio	0.08	0.29	0.29	0.05	0.26	0.26	0.19	0.19	0.19	0.29	0.29	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	283	1042	466	169	898	404	307	651	296	459	912	
v/s Ratio Prot	c0.07	c0.25		0.03	0.21		0.09	c0.12		c0.23	0.22	
v/s Ratio Perm			0.07			0.07			0.01			
v/c Ratio	0.84	0.84	0.23	0.56	0.80	0.26	0.46	0.63	0.03	0.82	0.77	
Uniform Delay, d1	45.6	33.4	27.0	47.0	35.0	29.8	36.2	37.6	33.2	33.7	33.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	18.9	7.9	1.1	4.2	7.4	1.6	1.1	2.0	0.0	10.9	4.1	
Delay (s)	64.6	41.4	28.1	51.3	42.4	31.4	37.3	39.6	33.2	44.6	37.2	
Level of Service	E	D	C	D	D	C	D	D	C	D	D	
Approach Delay (s)		41.8			39.4			38.6			39.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	40.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	101.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	2.5					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	12	90	107	1185	1297	21
Future Vol, veh/h	12	90	107	1185	1297	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	12	93	110	1222	1337	22

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2779	-	1337	0	-	0
Stage 1	1337	-	-	-	-	-
Stage 2	1442	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	21	0	516	-	-	-
Stage 1	245	0	-	-	-	-
Stage 2	218	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	17	-	516	-	-	-
Mov Cap-2 Maneuver	17	-	-	-	-	-
Stage 1	193	-	-	-	-	-
Stage 2	218	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 425.9	1.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	516	-	17	-	-	-
HCM Lane V/C Ratio	0.214	-	0.728	-	-	-
HCM Control Delay (s)	13.9	-	$ 425.9	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.8	-	1.9	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	4.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	17	87	1212	5	74	1314
Future Vol, veh/h	17	87	1212	5	74	1314
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	18	90	1249	5	76	1355

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2759	1252	0	0	1249	0
Stage 1	1252	-	-	-	-	-
Stage 2	1507	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	21	210	-	-	537	-
Stage 1	263	-	-	-	-	-
Stage 2	197	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	18	210	-	-	537	-
Mov Cap-2 Maneuver	18	-	-	-	-	-
Stage 1	263	-	-	-	-	-
Stage 2	169	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	109.6	0	0.7
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	18	210	537	-
HCM Lane V/C Ratio	-	-	0.974	0.427	0.142	-
HCM Control Delay (s)	-	-	$ 495.2	34.3	12.8	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	2.5	2	0.5	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	44	131	1072	63	161	1181
Future Volume (veh/h)	44	131	1072	63	161	1181
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	45	0	1105	0	166	1218
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	58		1412		191	1686
Arrive On Green	0.03	0.00	0.76	0.00	0.11	0.90
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	45	0	1105	0	166	1218
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	3.4	0.0	48.0	0.0	12.5	25.2
Cycle Q Clear(g_c), s	3.4	0.0	48.0	0.0	12.5	25.2
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	58		1412		191	1686
V/C Ratio(X)	0.77		0.78		0.87	0.72
Avail Cap(c_a), veh/h	235		1412		241	1686
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	65.5	0.0	9.6	0.0	60.0	1.9
Incr Delay (d2), s/veh	18.8	0.0	4.4	0.0	22.9	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	18.6	0.0	6.9	4.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	84.3	0.0	14.0	0.0	82.9	4.6
LnGrp LOS	F		B		F	A
Approach Vol, veh/h	45	A	1105	A		1384
Approach Delay, s/veh	84.3		14.0			14.0
Approach LOS	F		B			B

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	19.1	108.4				127.5		9.0
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	18.5	100.0				123.0		18.0
Max Q Clear Time (g_c+I1), s	14.5	50.0				27.2		5.4
Green Ext Time (p_c), s	0.2	14.3				20.6		0.1

Intersection Summary	
HCM 6th Ctrl Delay	15.3
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	9.3					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	16	454	298	1116	1094	44
Future Vol, veh/h	16	454	298	1116	1094	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	16	463	304	1139	1116	45

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2863	-	1116	0	-	0
Stage 1	1116	-	-	-	-	-
Stage 2	1747	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	18	0	626	-	-	-
Stage 1	305	0	-	-	-	-
Stage 2	149	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 9	-	626	-	-	-
Mov Cap-2 Maneuver	~ 9	-	-	-	-	-
Stage 1	157	-	-	-	-	-
Stage 2	149	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1188.2	3.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	626	-	9	-	-	-
HCM Lane V/C Ratio	0.486	-	1.814	-	-	-
HCM Control Delay (s)	16.1		$ 1188.2	0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	2.7	-	3	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	164	37	59	83	49	250	45	972	78	223	1078	209
Future Volume (veh/h)	164	37	59	83	49	250	45	972	78	223	1078	209
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	171	39	0	86	51	0	47	1012	0	232	1123	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	196	209		114	116		184	1172		266	1240	
Arrive On Green	0.11	0.11	0.00	0.06	0.06	0.00	0.03	0.63	0.00	0.06	0.66	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	171	39	0	86	51	0	47	1012	0	232	1123	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	13.2	2.6	0.0	6.5	3.7	0.0	1.3	60.7	0.0	6.1	69.5	0.0
Cycle Q Clear(g_c), s	13.2	2.6	0.0	6.5	3.7	0.0	1.3	60.7	0.0	6.1	69.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	196	209		114	116		184	1172		266	1240	
V/C Ratio(X)	0.87	0.19		0.76	0.44		0.26	0.86		0.87	0.91	
Avail Cap(c_a), veh/h	230	245		234	239		195	1172		352	1240	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	60.0	55.3	0.0	63.2	61.9	0.0	25.2	20.5	0.0	29.5	19.5	0.0
Incr Delay (d2), s/veh	25.9	0.4	0.0	9.8	2.6	0.0	0.7	8.5	0.0	16.6	11.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.3	1.3	0.0	3.3	1.8	0.0	0.8	27.6	0.0	6.3	31.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	85.9	55.7	0.0	73.0	64.5	0.0	25.9	29.0	0.0	46.1	30.6	0.0
LnGrp LOS	F	E		E	E		C	C		D	C	
Approach Vol, veh/h		210	A		137	A		1059	A		1355	A
Approach Delay, s/veh		80.3			69.8			28.9			33.2	
Approach LOS		F			E			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	91.2		19.9	8.7	95.5		13.3				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	15.1	80.9		18.0	5.0	91.0		18.0				
Max Q Clear Time (g_c+I1), s	8.1	62.7		15.2	3.3	71.5		8.5				
Green Ext Time (p_c), s	0.4	8.2		0.2	0.0	10.0		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			37.0									
HCM 6th LOS			D									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	373	13	63	9	13	23	78	636	13	21	634	352
Future Volume (veh/h)	373	13	63	9	13	23	78	636	13	21	634	352
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1767	1811	1870	1870	1870	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	393	14	0	9	14	24	82	669	14	22	667	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	9	9	6	2	2	2	3	3	3	2	2	2
Cap, veh/h	437	16		12	18	31	104	936	20	39	1706	
Arrive On Green	0.27	0.27	0.00	0.04	0.04	0.04	0.06	0.52	0.52	0.02	0.48	0.00
Sat Flow, veh/h	1627	58	1535	325	506	867	1767	1811	38	1781	3647	0
Grp Volume(v), veh/h	407	0	0	47	0	0	82	0	683	22	667	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1698	0	0	1767	0	1849	1781	1777	0
Q Serve(g_s), s	26.8	0.0	0.0	3.2	0.0	0.0	5.3	0.0	32.6	1.4	13.8	0.0
Cycle Q Clear(g_c), s	26.8	0.0	0.0	3.2	0.0	0.0	5.3	0.0	32.6	1.4	13.8	0.0
Prop In Lane	0.97		1.00	0.19		0.51	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	453	0		61	0	0	104	0	956	39	1706	
V/C Ratio(X)	0.90	0.00		0.77	0.00	0.00	0.79	0.00	0.71	0.56	0.39	
Avail Cap(c_a), veh/h	614	0		376	0	0	160	0	956	79	1706	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	40.6	0.0	0.0	55.0	0.0	0.0	53.4	0.0	21.3	55.7	19.2	0.0
Incr Delay (d2), s/veh	13.0	0.0	0.0	18.2	0.0	0.0	13.4	0.0	4.6	12.1	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.6	0.0	0.0	1.7	0.0	0.0	2.7	0.0	14.1	0.7	5.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.5	0.0	0.0	73.2	0.0	0.0	66.8	0.0	25.8	67.8	19.8	0.0
LnGrp LOS	D	A		E	A	A	E	A	C	E	B	
Approach Vol, veh/h		407	A		47			765			689	A
Approach Delay, s/veh		53.5			73.2			30.2			21.4	
Approach LOS		D			E			C			C	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		35.4	11.3	59.7		8.6	7.0	64.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		41.9	10.4	54.2		25.5	5.1	59.5				
Max Q Clear Time (g_c+I1), s		28.8	7.3	15.8		5.2	3.4	34.6				
Green Ext Time (p_c), s		2.1	0.0	4.6		0.2	0.0	4.5				

Intersection Summary	
HCM 6th Ctrl Delay	33.1
HCM 6th LOS	C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	68	1132	74	79	1225
Future Vol, veh/h	12	68	1132	74	79	1225
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	585	695	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	74	1230	80	86	1332

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2734	1230	0	0	1230	0
Stage 1	1230	-	-	-	-	-
Stage 2	1504	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	22	217	-	-	567	-
Stage 1	276	-	-	-	-	-
Stage 2	203	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	19	217	-	-	567	-
Mov Cap-2 Maneuver	19	-	-	-	-	-
Stage 1	276	-	-	-	-	-
Stage 2	172	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	81.8	0	0.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	19	217	567	-
HCM Lane V/C Ratio	-	-	0.686	0.341	0.151	-
HCM Control Delay (s)	-	-	$ 375.9	29.9	12.5	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	1.9	1.4	0.5	-

Arterial Level of Service: NB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	41.2	111.1	152.3	0.32	7.7	F
Puapuaanui Street	III	30	107.6	21.2	128.8	0.90	25.0	B
Total	III		148.8	132.3	281.1	1.22	15.6	D

Arterial Level of Service: SB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui Street	III	30	94.3	7.0	101.3	0.79	27.9	B
Lako Street	III	30	107.6	41.7	149.3	0.90	21.6	C
Total	III		201.9	48.7	250.6	1.68	24.2	B

Arterial Level of Service: NB Queen Kaahumanu Hwy

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	41.2	65.6	106.8	0.32	10.9	E
Puapuaanui St	III	30	107.6	21.8	129.4	0.90	24.9	B
Total	III		148.8	87.4	236.2	1.22	18.6	C

Arterial Level of Service: SB Queen Kaahumanu Hwy

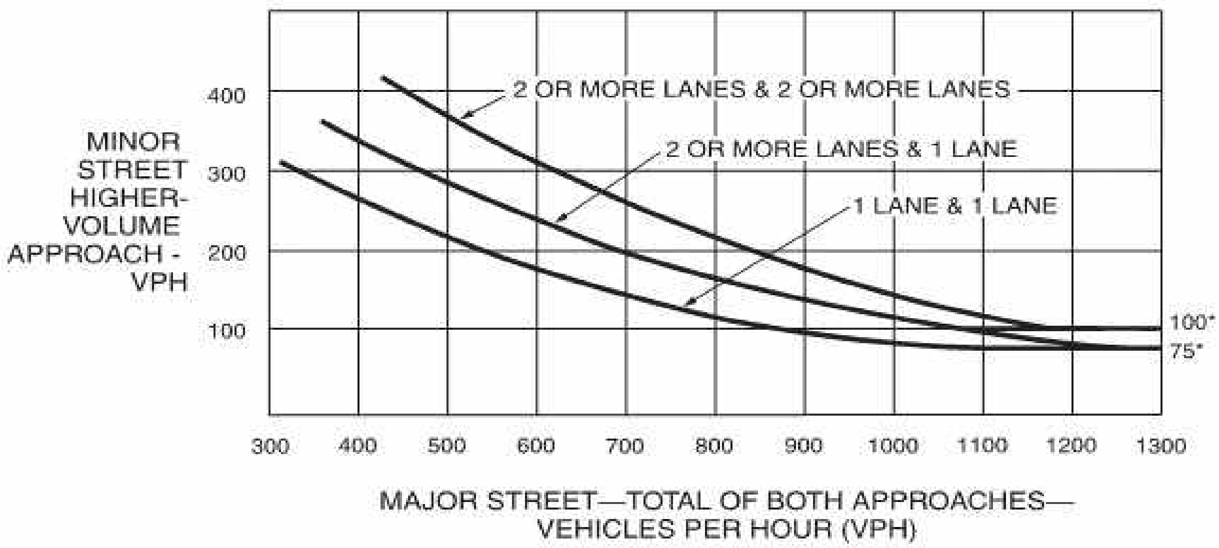
Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	7.3	101.6	0.79	27.8	B
Lako Street	III	30	107.6	47.5	155.1	0.90	20.8	C
Total	III		201.9	54.8	256.7	1.68	23.6	C

Appendix J

Traffic Signal Warrant Analysis

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



Option:

13 At an intersection with a high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the "minor-street" volume and the corresponding single direction of opposing traffic on the major street as the "major-street" volume.

For all unsignalized intersections, minor approach is QK left turn onto minor street
For all unsignalized intersections, major approach is QK opposing thru

Use 1 Lane & 1 Lane

Existing	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	776	164	YES	1005	84	NO
Hualalai (S)	1006	73	NO	940	61	NO
Kuakini	733	517	YES	887	243	YES

2024 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	816	172	YES	1056	88	YES
Hualalai (S)	1057	77	YES	988	64	NO
Kuakini	842	543	YES	932	255	YES

2024 With Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	827	180	YES	1096	91	YES
Hualalai (S)	1117	77	YES	1025	64	NO
KV Roadway	819	13	NO	912	45	NO
Kuakini	856	543	YES	944	255	YES

2029 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	857	181	YES	1110	93	YES
Hualalai (S)	1111	81	YES	1038	67	NO
Kuakini	885	571	YES	980	268	YES

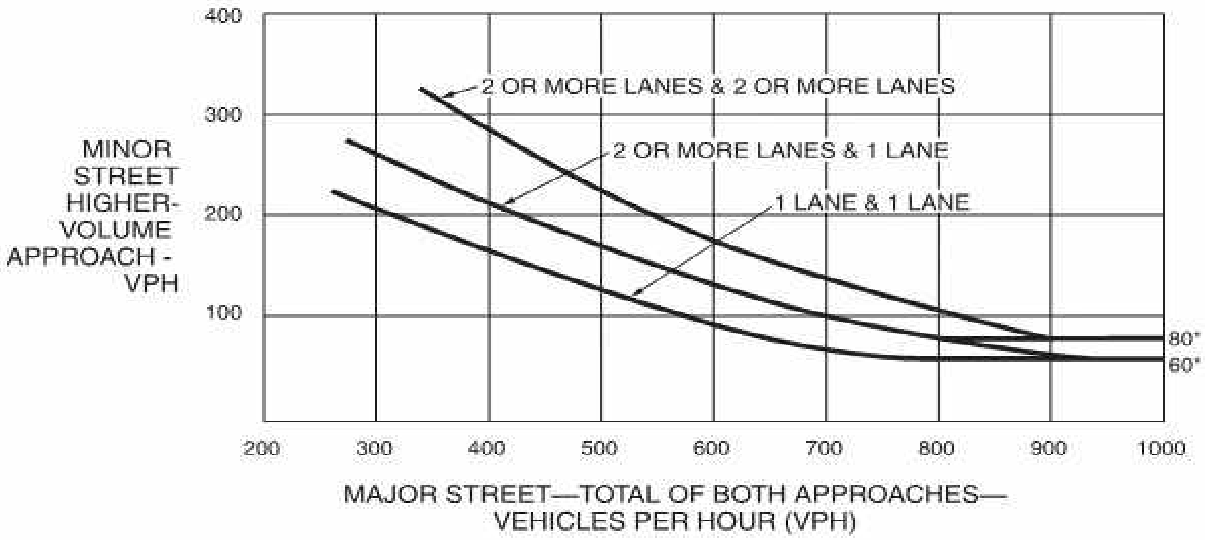
2029 With Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	876	196	YES	1181	98	YES
Hualalai (S)	1216	81	YES	1103	67	NO
Kuakini	810	579	YES	980	271	YES

2039 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	947	200	YES	1226	102	YES
Hualalai (S)	1228	89	YES	1147	74	NO
Kuakini	894	631	YES	1082	297	YES

2039 With Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	966	215	YES	1297	107	YES
Hualalai (S)	1333	89	YES	1212	74	NO
Kuakini	894	639	YES	1082	300	YES

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



Option:

13 At an intersection with a high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the "minor-street" volume and the corresponding single direction of opposing traffic on the major street as the "major-street" volume.

Use 1 Lane & 1 Lane

Existing - Hualalai (N)	4-Hour Warrant		
	Major	Minor	Warrant?
6:45-7:45 AM	776	164	YES
7:45-8:45 AM	692	145	YES
3:00-4:00 PM	1005	84	YES
4:00-5:00 PM	926	74	YES
5:00-6:00 PM	986	58	NO
Existing - Hualalai (S)	4-Hour Warrant		
	Major	Minor	Warrant?
6:45-7:45 AM	1006	70	YES
7:45-8:45 AM	1030	26	NO
3:00-4:00 PM	940	59	NO
4:00-5:00 PM	864	64	NO
5:00-6:00 PM	765	56	NO
Existing - Kuakini	4-Hour Warrant		
	Major	Minor	Warrant?
6:45-7:45 AM	776	335	YES
7:45-8:45 AM	683	467	YES
3:00-4:00 PM	881	224	YES
4:00-5:00 PM	872	264	YES
5:00-6:00 PM	870	217	YES

APPENDIX 3: Biological Survey Results

Botanical Survey and Vertebrate Fauna Assessment TMK 3-7-6-21: parcels 16, 17, 18 & 19 (78.324 acres) North Kona District, Island of Hawai‘i

By Ron Terry, Ph.D.
Geometrician Associates, LLC
September 2017

Introduction

This biological survey was prepared for Richard Wheelock, Member, KV3 LLC, to inventory the existing biological environment, assess the potential for biological impacts from proposed development in the survey area, and devise mitigation measures to avoid or minimize any impacts. The land in question ("the survey area") consists of four parcels situated mauka of Queen Ka‘ahumanu Highway, north of the Lako Street intersection, as shown in Figure 1. Two of the parcels are owned by KV3 LLC and are planned for residential and associated uses. The other two parcels are linear drainage ditches owned by the County of Hawai‘i.

The objectives of the botanical survey component of this survey were to 1) describe the vegetation; 2) list all species encountered; 3) determine the likelihood of the presence of rare, threatened or endangered (RTE) plant species; and 4) identify the locations of any RTE individuals found. The area was surveyed by Ron Terry in September 2017. Plant species were identified in the field and, as necessary, collected and keyed out in the laboratory. Special attention was given to the possible presence of any federally listed (USFWS 2017) threatened or endangered plant species, although the habitat did not indicate a high potential for their presence.

The work also included a faunal survey restricted to a tally of birds and introduced mammals, reptiles, or amphibians observed during the botanical fieldwork, as well as one additional one-hour bird observation. The field survey also assessed the general value of the habitat areas for native birds. Although there were no radar or ultrasound observations conducted that might have detected the endangered Hawaiian hoary bat, the general value of the habitat for the Hawaiian hoary bat was evaluated.

Generally not included in the survey was assessment of invertebrates, but the area was searched for the principal plant species in the area known to support the larvae and pupae of the endangered Blackburn's sphinx moth (*Manduca blackburnii*), the one listed endangered insect that is potentially present.

Vegetation: Influences and Previous Studies

The geologic substrate for most of the survey area is soil-covered pahoehoe lava flows from Hualālai dated between 5,000 and 10,000 years ago (Wolfe and Morris 1996). The soil here is classified as Waiaha medial silt loam, 2-10 or 10 to 20 percent slopes, depending on location. This soil forms on ash-covered pahoehoe flows and has a 10-25-inch depth to bedrock. It well drained but also has a high runoff potential (Sato et al

1973). The survey area varies in elevation from 330 to 690 feet above sea level, and receives an average annual rainfall of about 35-38 inches, increasing in the mauka direction (Giambelluca et al 2013).

The pre-human vegetation was likely Lowland Dry/Mesic Forest (per Gagne and Cuddihy 1990). This consisted of an open canopy forest dominated by a wide variety of trees, shrubs, herbs, vines and ferns. It likely had a diverse cover of native dry-forest trees and shrubs including lama (*Diospyros sandwicensis*) and alahe‘e (*Psydrax odoratum*), with a number of other species perhaps including now rare trees such as wiliwili (*Erythrina sandwicensis*), halapepe (*Pleomele sandwicensis*) and uhiuhi (*Mezoneuron kavaiense*). However, the general landscape of the Kailua-Kona area has been radically altered by centuries of settlements, over a century of grazing, and particularly by the development since 1960 of hotels, condominiums, resort homes, commercial facilities and associated infrastructure. Even on properties that experienced no development, introduced plants, animals and pests profoundly altered the biota. Prominent species in the survey area’s elevational zone now include the aliens haole koa (*Leucaena leucocephala*), opiuma (*Pithecellobium dulce*), and guinea grass (*Megathyrsus maximus*).

Although the survey area never underwent modern development except on its margins, archaeological studies (SCS 2016) indicate that it was used prior to Western contact for a variety of activities, leaving features associated with agriculture, habitation, burial, and transportation. In more recent times, the survey area was part of a large former cattle ranch and agricultural area started in the early 1900s. The lower portion of the project area is still used to pasture cattle, and extensive fencing, cattle walls, several corrals and cattle chutes are present. The project area and surrounding lands were bulldozed sometime between the 1940s and 1970s. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push piles. Archaeologists confirmed that the linear bands evident in aerial imagery are bulldozer-cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths.

RTE plants are well known from certain areas at this elevational zone in Kona, but, with few exceptions, they are generally found further to the north in slightly drier areas with more recent lava (Geometrician Associates 2004, 2005, 2007, 2009a, 2009b, 2014a, 2014b; Gerrish 2006, 2007a, 2007b, 2008, 2009). RTE plants noted in the surveys above in the Kealakehe to Palama Nui area include the endangered plants uhiuhi, ko‘oko‘olau (*Bidens micrantha* ssp. *ctenophylla*), halapepe (*Pleomele hawaiiensis*), wahine noho kula (*Isodendrion pyrifolium* – now extinct in the wild) and *Fimbristylis hawaiiensis*; the rare plants ‘ohe makai (*Polyscias sandwicensis* and maiapilo (*Capparis sandwichiana*) (both of which we also found to the south on the most recent lava in Kahalu‘u); and the increasingly uncommon wiliwili. No surveys that we have conducted mauka of Kuakini Highway between Palani Road and Honalo – an area with abundant soil that has led to intensive farming, ranching and settlement – have found any RTE plants.

In terms of RTE fauna, the most likely candidate would be the endangered Hawaiian hawk (*Buteo solitarius*). This wide-ranging raptor nests in large trees and forages in forests, farms and even residential neighborhoods, and is seen throughout forested areas of the island. Klavitter (2000) and Gorresen et al. (2008) summarized hawk sightings around the island, finding instances in this area of Kona, but at generally low densities. According to one study: “Both native and exotic trees are used for nesting, but the majority of nests are built in mature ‘ōhi`a trees. Other nest trees include lama, koa, kōlea, eucalyptus, common ironwood, Christmas berry, coconut, macadamia nut, and mango” (USDA-NRCS 2007).

A number of other RTE birds are fairly unlikely to be found in the survey area. The Hawaiian goose or nēnē (*Branta sandvicensis*) is an endemic, federally listed endangered species that is only occasionally observed in urban Kona, although it is more abundant at Big Island Country Club in the Kekaha region of Kona. Some endangered Hawaiian petrels (*Pterodroma sandwichensis* or ‘*ua‘u*) and band-rumped storm-petrels (*Oceanodroma castro*), as well as threatened Newell’s shearwaters (*Puffinus auricularis newelli*), may overfly the area between the months of June and October. All three of these pelagic seabird species nest high in the mountains in burrows. There is no suitable nesting habitat for any of these seabird species within or near the survey area. The primary cause of mortality in all these seabird species in Hawai‘i is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds may collide with manmade structures. If they are not killed outright, the dazed or injured birds are easy targets for feral mammals (Banko 1980; Day et al 2003). Although not an RTE species, the Hawaiian endemic sub-species of the short-eared owl or pueo (*Asio flammeus sandwichensis*), a protected migratory bird, nests and hunts in tall grasslands and shrublands and could conceivably be occasionally present on the survey area.

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the only native Hawaiian land mammal, is found in most areas on the island of Hawai‘i and has been observed in the thorny forests of Kona. Hawaiian hoary bats are vulnerable to disturbance during the summer pupping season.

Finally, the one endangered insect found in many parts of Kona is the Blackburn’s sphinx moth (*Manduca blackburnii*). It is generally associated with drier environments and ‘a‘a substrates. The native host plant aiea (*Nothocestrum* spp.) is extremely rare, but a substitute host, the prolific weed tree tobacco (*Nicotiana glauca*), quickly colonizes dry, disturbed lava flows. Neither host was considered likely to be within the survey area.

In general, we concluded that the probability of encountering RTE plant or animal species in the survey area was low, because of substrate, topography, elevation, history of grazing and evidence of prior surveys.

Vegetation: Results

Our survey found two vegetation types that were distinguished primarily by management regimes (see Figure 2 for photos). The upper half of the survey area contains very few cattle and is intensely overgrown with guinea grass (Figure 2a). The area could be described as a scattered forest or thick savanna, dominated by koa haole, opiuma and monkeypod (*Samanea saman*). These four plants compose most of the biomass and cover in this area. The lower half is moderately grazed and has a very similar but slightly more diverse tree flora, with kiawe (*Prosopis pallida*), klu (*Acacia farnesiana*), and several other non-native trees (Figure 2c). The understory contains a great diversity of non-native grasses, herbs, shrubs and vines, along with a very few natives, including ‘uhaloa (*Waltheria indica*) and ‘ilima (*Sida fallax*).

Although a highly intermittent stream traverses the property, no aquatic or true riparian vegetation is present (Figure 2b).

Flora and Rare, Threatened or Endangered Plants

All plant species found in the survey area during the survey are listed in Table 1. Of the 65 species detected, five were indigenous (native to the Hawaiian Islands and elsewhere) and none were endemic (found only in the Hawaiian Islands). All native plants found are very common throughout the island of Hawai‘i and the State, and no rare, threatened or endangered plant species were present. No tree tobacco, significant for its role as a potential host for an endangered moth, was found in the survey area.

Online maps from the U.S. Fish and Wildlife Service (USFWS) depict no critical habitat on or near the survey area (http://ecos.fws.gov/ecp/report/table/critical-habitat.html accessed September 2017).

Birds

The 15 species of birds detected during the survey were all non-native and typical of those found in similar areas of lowland disturbed habitat in Kona (Table 2). Most common were spotted dove (*Streptopelia chinensis*), northern cardinal (*Cardinalis cardinalis*), cattle egret (*Bubulcus ibis*) and parakeet (*Aratinga* sp.), Japanese white-eye (*Zosterops japonicus*) and house finch (*Carpodacus mexicanus*). No native birds were detected, and it is generally poor habitat for most native birds. The short-eared owl may utilize the survey area for foraging. The trees in the survey area are generally too short to serve as typical Hawaiian hawk nests, but it probably forages at least occasionally in the area.

Hawaiian Hoary Bat

Hawaiian hoary bats may very well utilize the survey area, as they have been observed in surrounding and similar areas. This survey took place in daylight, did not use any detection equipment, and was not designed to detect bats. However, the Hawaiian hoary bat should be presumed to be present. Bats may forage for flying insects over portions of the survey area on a seasonal basis, and they may find some of the larger shrubs and trees suitable nesting habitat.

Introduced Mammals, Reptiles, and Amphibians

The only live mammals seen during the survey were cattle (*Bos taurus*), feral pigs (*Sus scrofa* – which were abundant in the survey area), and small Indian mongooses (*Herpestes a. auropunctatus*). It is likely that feral cats (*Felis catus*), mice (*Mus* spp.), rats (*Rattus* spp.) and domestic dogs, (*Canis f. familiaris*) are occasionally present. There are no native terrestrial reptiles or amphibians in Hawaiʻi. The only reptile observed during the survey was the day gecko (*Phelsuma* sp.). It is likely that other species of gecko as well as anoles and skinks are present. No amphibians were seen or heard. None of these alien mammals or reptiles have conservation value and all are deleterious to native flora and fauna.

Impacts and Mitigation Measures

As discussed above, no threatened or endangered plant species as listed by the U.S. Fish and Wildlife Service (2017) appear to be present in the survey area, nor are there uniquely valuable habitats. No existing or proposed federally designated critical plant (or animal) habitat is present in the survey area. There appears to be no potential to adversely affect RTE plant species.

If the project incorporates additional outdoor lighting, it may attract threatened and endangered Hawaiian seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these threatened and endangered seabirds due to interaction with outdoor lighting, no construction using unshielded equipment maintenance lighting should be permitted after dark between the months of April and October. All additional permanent lighting should conform to the Hawaiʻi County Outdoor Lighting Ordinance (Hawaiʻi County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

The endangered Hawaiian hoary bat is vulnerable to disturbance while roosting with its juveniles in the pupping season. To minimize impacts, it is recommended that woody plants taller than 15 feet should not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

No tree tobacco, the principal current host for the endangered Blackburn's sphinx moth, was observed during our surveys. Because of the weedy, extremely fast-growing and spreading nature of the plant after landclearing and the difficult process necessary to determine if pupae are present in the ground under the plant after larvae have finished their life cycle, it is recommended that the landowner/developer prevent any infestations from growing. Although it is advisable to consult DLNR and or USFWS before removing any plants, juvenile plants less than two feet tall are not generally utilized by the larvae and may be safely removed, subject to discussions with these agencies.

Report Limitations

No biological survey of a large area can claim to have detected every species present. Some plant species are cryptic in juvenile or even mature stages of their life cycle. Dry conditions can render almost undetectable plants that extended rainfall may later invigorate and make obvious. Thick brush can obscure even large, healthy specimens. Birds utilize different patches of habitat during different times of the day and seasons, and only long-term study can determine the exact species composition. The findings of this survey must therefore be interpreted with proper caution; in particular, there is no warranty as to the absence of any particular species.

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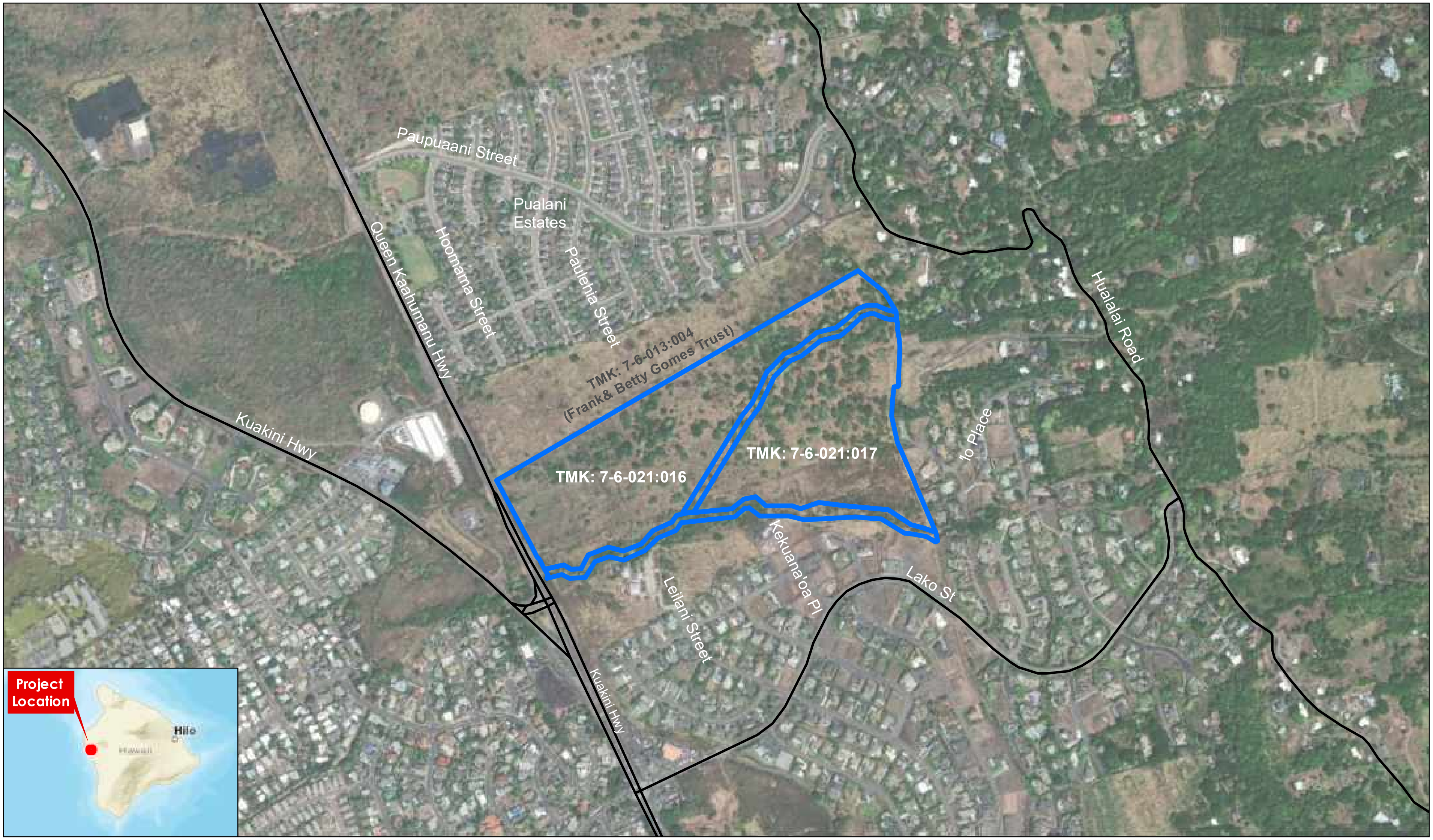

Legend

Project Site

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Kona Three LLC
Royal VIstas Development Project

Kona, HI
NAD 1983 StatePlane Hawaii 1 FIPS 5101 Feet

Survey Area Map

DRAWN BY: CJ	1ST REVIEW: JT	2ND REVIEW: ML
DATE: 5/19/2020	PROJECT NO: 185804638	

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Figure 2. Survey Area Photos

2a. Dense guinea grass/opiuma vegetation of mauka half ▲

▼ 2b. Natural drainageway

Figure 2. Survey Area Photos

2c. Semi-open vegetation of makai half ▲

▼ 2d. Corral and surrounding vegetation

Table 1. Plant Species Observed in Survey Area

Scientific Name	Family	Common Name	Life Form	Status*
FERNS:				
Nephrolepis multiflora	Nephrolepidaceae	Sword Fern	Herb	A
Phymatosorus grossus	Polypodiaceae	Maile Scented Fern	Herb	A
Pteris cretica	Pteridaceae	‘Oali	Fern	I
FLOWERING PLANTS:				
Abutilon grandifolium	Malvaceae	Hairy Abutilon	Herb	A
Acacia farnesiana	Fabaceae	Klu	Shrub	A
Aleurites moluccana	Euphorbiaceae	Kukui	Tree	P
Amaranthus viridis	Amaranthaceae	Slender Amaranth	Herb	A
Bidens alba	Asteraceae	Beggar’s Tick	Herb	A
Bidens cynapiifolia	Asteraceae	Blue Bidens	Herb	A
Bidens pilosa	Asteraceae	Beggar’s Tick	Herb	A
Buddleia asiatica	Scrophulariaceae	Buddleia	Shrub	A
Caesalpinia decapetala	Fabaceae	Wait-a-bit	Vine	A
Chamaecrista nictitans	Fabaceae	Partridge Pea	Pea	A
Chamaesyce hirta	Euphorbiaceae	Garden Spurge	Herb	A
Chamaesyce hypericifolia	Euphorbiaceae	Graceful Spurge	Herb	A
Chloris barbata	Poaceae	Swollen Fingergrass	Herb	A
Coccinia grandis	Cucurbitaceae	Ivy Gourd	Vine	A
Crotalaria sp.	Fabaceae	Rattlebox	Herb	A
Cynodon dactylon	Poaceae	Bermuda Grass	Herb	A
Desmanthus virgatus	Fabaceae	Slender Mimosa	Shrub	A
Desmodium incanum	Fabaceae	Desmodium	Vine	A
Digitaria ciliaris	Poaceae	Crabgrass	Herb	A
Digitaria insularis	Poaceae	Sourgrass	Herb	A
Digitaria setigera	Poaceae	Crabgrass	Herb	A
Dysphania carinata	Chenopodiaceae	Dysphania	Herb	A
Eleusine indica	Poaceae	Goose Grass	Herb	A
Eragrostis tenella	Poaceae	Lovegrass	Herb	A
Hyptis pectinata	Lamiaceae	Comb Hyptis	Shrub	A
Indigofera suffruticosa	Fabaceae	Indigo	Shrub	A
Ipomoea obscura	Convolvulaceae	Obscure Morning Glory	Vine	A
Kalanchoe pinnata	Crassulaceae	Air Plant	Herb	A
Lantana camara	Verbenaceae	Lantana	Shrub	A
Leonotis nepetifolia	Lamiaceae	Lion’s Ear	Herb	A
Leucaena leucocephala	Fabaceae	Haole Koa	Shrub	A
Malvastrum coromandelianum	Malvaceae	False Mallow	Shrub	A
Megathyrsus maximus	Poaceae	Guinea Grass	Herb	A
Melinis repens	Poaceae	Natal Red Top	Herb	A
Merremia tuberosa	Convolvulaceae	Woodrose	Vine	A
Mimosa pudica	Fabaceae	Sensitive Plant	Herb	A
Momordica charantia	Cucurbitaceae	Bitter Gourd	Vine	A

Table 1, continued				
Scientific Name	**Family**	**Common Name**	**Life Form**	**Status***
Paederia foetida	Rubiaceae	Maile Pilau	Vine	A
Parthenium hysterophorus	Asteraceae	Santa Maria	Herb	A
Passiflora edulis	Passifloraceae	Lilikoi	Vine	A
Phyllanthus debilis	Euphorbiaceae	Niruri	Herb	A
Pithecellobium dulce	Fabaceae	Dulce	Tree	A
Plumbago auriculata	Plumbaginaceae	Leadwort	Shrub	A
Plumbago zeylanica	Plumbaginaceae	'Ilie'e	Herb	I
Portulaca pilosa	Portulacaceae	Hairy Pigweed	Herb	A
Prosopis pallida	Fabaceae	Kiawe	Tree	A
Psidium guajava	Myrtaceae	Common Guava	Tree	A
Rivina humilis	Phytolaccaceae	Coral Berry	Herb	A
Ricinus communis	Euphorbiaceae	Castor Bean	Shrub	A
Schinus terebinthifolius	Anacardiaceae	Christmas Berry	Shrub	A
Samanea saman	Fabaceae	Monkeypod	Tree	A
Senna occidentalis	Fabaceae	Coffee Senna	Shrub	A
Sida fallax	Malvaceae	Ilima	Shrub	I
Sida rhombifolia	Malvaceae	Sida	Herb	A
Sida spinosa	Malvaceae	Sida	Herb	A
Sonchus oleraceus	Asteraceae	Sow Thistle	Herb	A
Solanum americanum	Solanaceae	Popolo	Herb	I
Solanum seaforthianum	Solanaceae	Vining Solanum	Herb	A
Spathodea campanulata	Bignoniaceae	African Tulip	Tree	A
Thevetia peruviana	Apocynaceae	Be-Still Tree	Tree	A
Thunbergia fragrans	Acanthaceae	White Thunbergia	Vine	A
Triumfetta rhomboidea	Tiliaceae	Bur Bush	Shrub	A
Waltheria indica	Sterculiaceae	'Uhaloa	Shrub	I

* A=Alien E=Endemic I=Indigenous PI= Polynesian END=Federal and State Listed Endangered (none)

Table 2. Bird Species Observed in Survey Area

Scientific name	**Common name**	**Status**
Acridotheres tristis	Common Myna	Alien Resident
Aratinga sp.	Parakeet	Alien Resident
Bubulcus ibis	Cattle Egret	Alien Resident
Cardinalis cardinalis	Northern Cardinal	Alien Resident
Carpodacus mexicanus	House Finch	Alien Resident
Francolinus pondecerianus	Black Francolin	Alien Resident
Geopelia striata	Zebra Dove	Alien Resident
Leiothrix lutea	Red-billed Leiothrix	Alien Resident
Lonchura punctulata	Nutmeg Mannikin	Alien Resident
Padda oryzivora	Java Sparrow	Alien Resident
Passer domesticus	House Sparrow	Alien Resident
Serinus mozambicus	Yellow-Fronted Canary	Alien Resident
Sicalis flaveola	Saffron Finch	Alien Resident
Streptopelia chinensis	Spotted Dove	Alien Resident
Zosterops japonicus	Japanese White-eye	Alien Resident

APPENDIX 4: Cultural Impact Assessment

SCS #2409 CIA-1

A CULTURAL IMPACT ASSESSMENT FOR A 78.122-ACRE PROPERTY IN HŌLUALOA 1ST AHUPUA‘A, NORTH KONA DISTRICT, HAWAI‘I ISLAND, HAWAI‘I [TMK: (3) 7-6-021:016-019]

Prepared By:

Glenn G. Escott, M.A.

Thomas Dols, M.A.

JUNE 2020

DRAFT

Prepared for:

Kona Three, LLC

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INTRODUCTION

At the request of property owner Kona Three, LLC, Scientific Consultant Services, Inc. (SCS) conducted a Cultural Impact Assessment (CIA) of a 76.121 acres of land TMK: (3) 7-6-021:016, 017, 018, and 019 located in Hōlualoa 1st Ahupuaʻa, North Kona District, Island of Hawaiʻi, Hawaiʻi (Figure 1 through Figure 4). The owner is proposing to develop the property and contracted the CIA as part of an Environmental Assessment (EA) as required for County of Hawaiʻi Planning Department permit applications. The point of contact (owner) for the project is Mr. Richard Wheelock. The owner's mailing address is 101 Hualālai Street Hilo, HI 96720. Mr. Wheelock can also be contacted by email at richard@eastwestrealty.org or by phone at 808-753-3167.

The Constitution of the State of Hawaiʻi clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of native Hawaiians. Article XII, Section 7 requires the State to "protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupuaʻa* tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778" (2000). In spite of the establishment of the foreign concept of private ownership and western-style government, Kamehameha III (Kauikeaouli) preserved the people's traditional right to subsistence.

As a result, in 1850 the Hawaiian Government confirmed the traditional access rights to native Hawaiian *ahupuaʻa* tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawaiʻi Revised Statutes (HRS) 7-1. In 1992, the State of Hawaiʻi Supreme Court, reaffirmed HRS 7-1 and expanded it to include, "native Hawaiian rights…may extend beyond the *ahupuaʻa* in which a native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner" (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

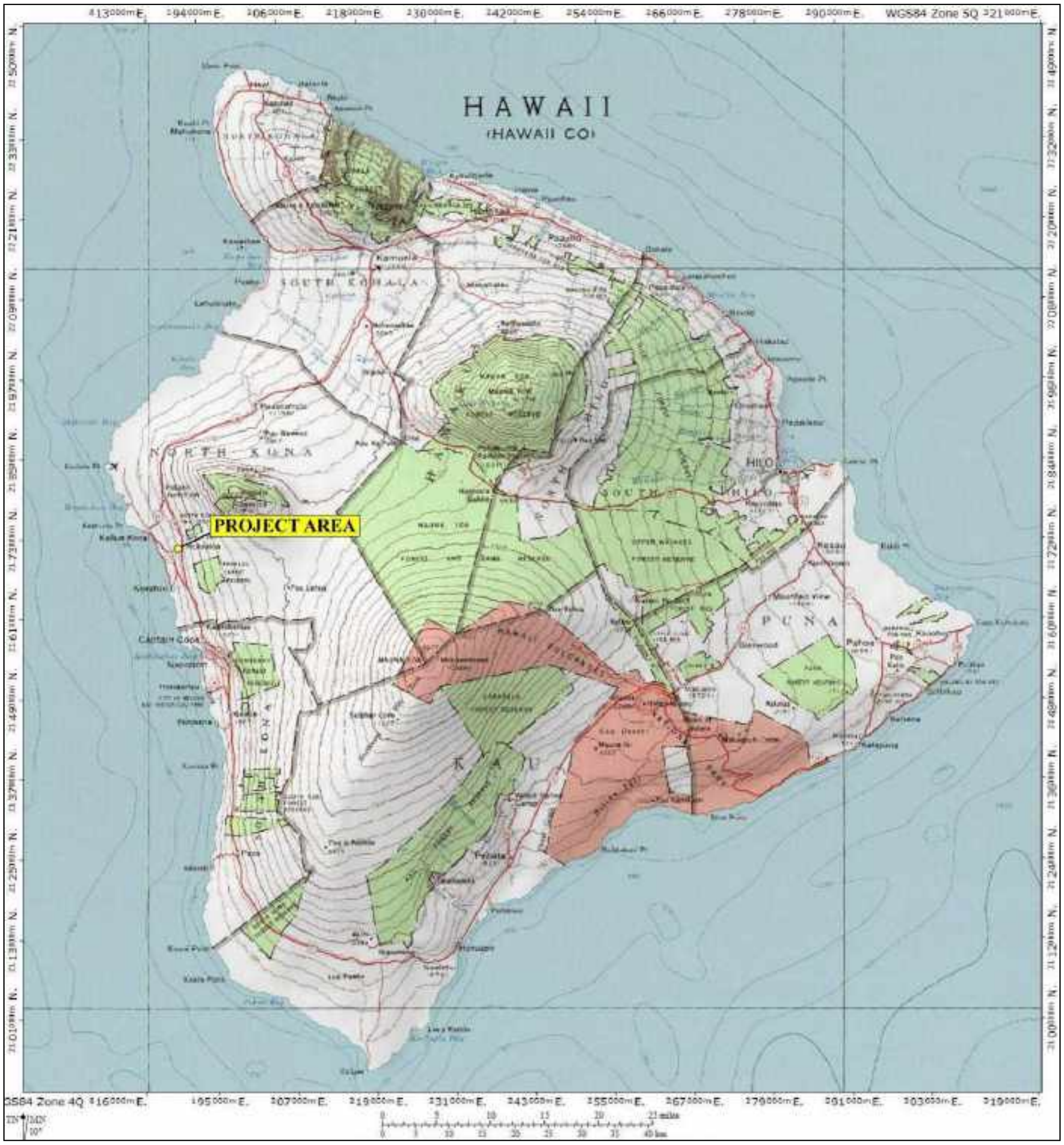

Figure 1: 5,500 K-Series Map of Hawai'i Showing Location of Project Area (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

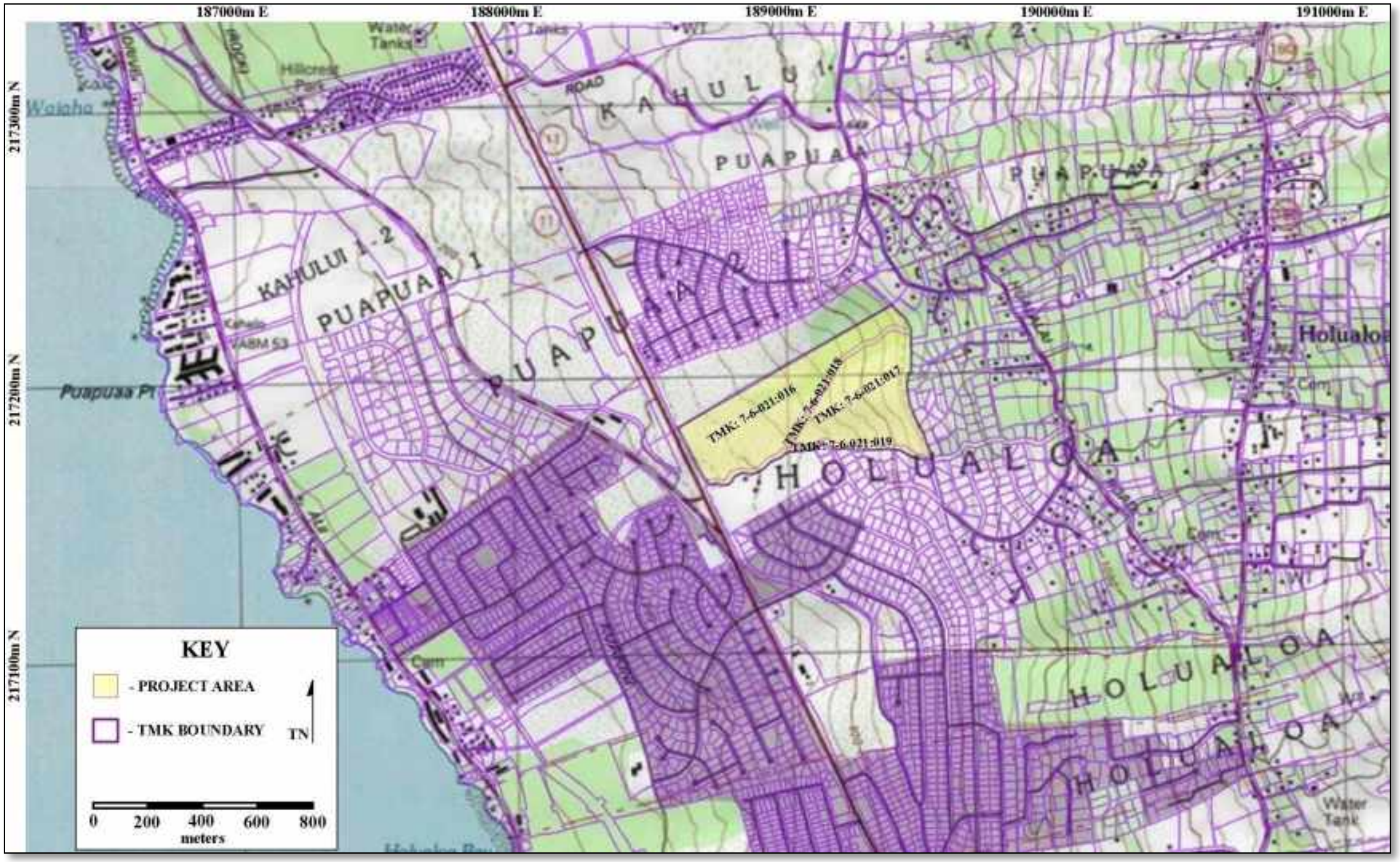

Figure 2: 7.5-Minute Series USGS Topographic Map Showing the Location of Project Areas and TMK Parcels (Kealakekua Quadrangle. ESRI, 2013. Data Sources: National Geographic and County of Hawai‘i Planning Department, 2019).

Figure 3: Aerial Photograph Showing Project Area, Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (ESRI, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

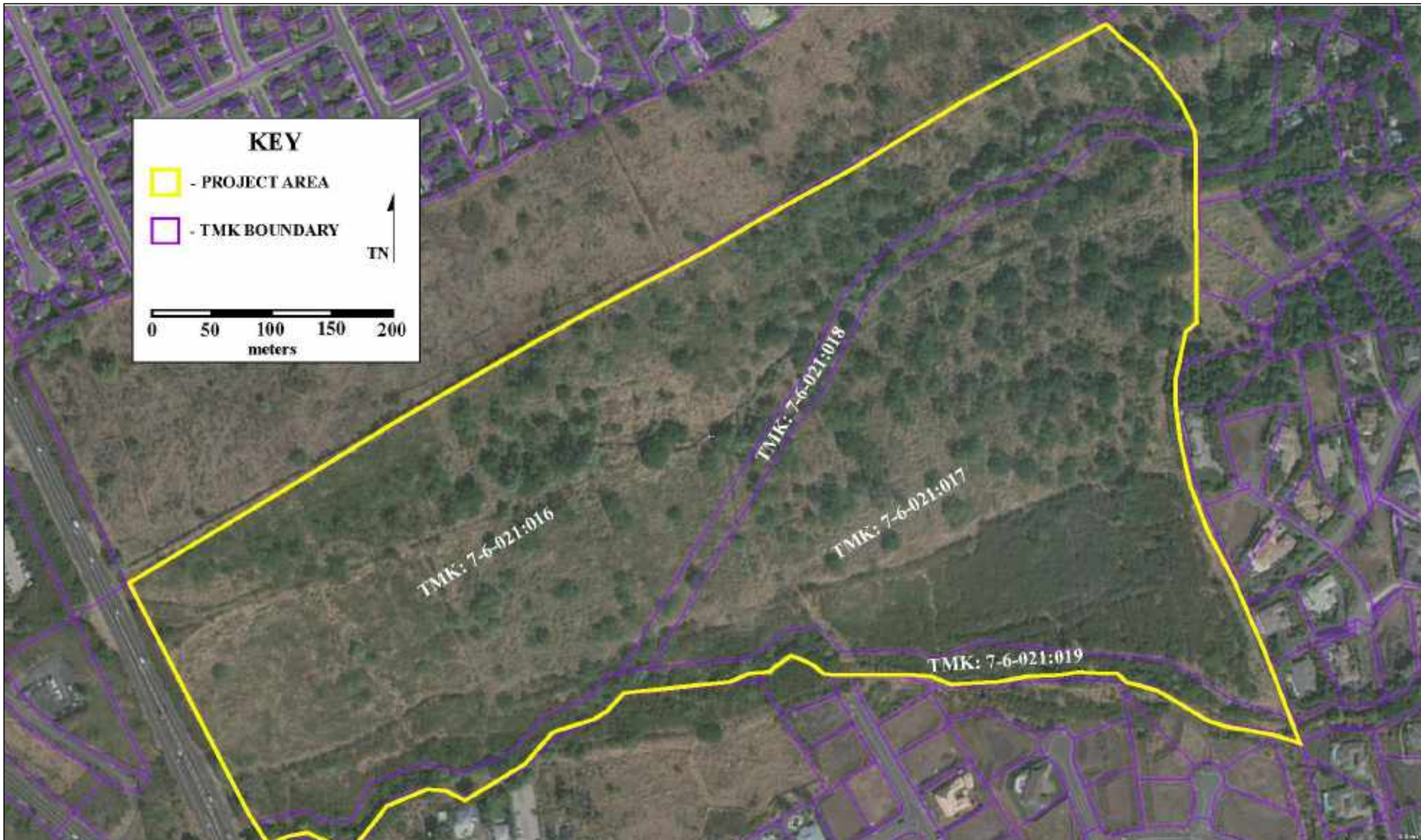

Figure 4: Aerial Photograph Close-Up Showing Project Area, Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (ESRI, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

Act 50, enacted by the Legislature of the State of Hawaii (2000) with House Bill 2895, relating to Environmental Impact Statements, proposes that:

> …there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawai‘i’s culture, and traditional and customary rights… [H.B. NO. 2895].

Act 50 requires state agencies and other developers to assess the effects of proposed land use or shoreline developments on the “cultural practices of the community and State” as part of the HRS Chapter 343 environmental review process (2001).

Its purpose has broadened, “to promote and protect cultural beliefs, practices and resources of native Hawaiians [and] other ethnic groups, and it also amends the definition of ‘significant effect’ to be re-defined as “the sum of effects on the quality of the environment including actions that are…contrary to the State’s environmental policies…or adversely affect the economic welfare, social welfare, or cultural practices of the community and State” (H.B. 2895, Act 50, 2000).

Thus, Act 50 requires an assessment of cultural practices to be included in the Environmental Assessments and the Environmental Impact Statements, and to be taken into consideration during the planning process. The concept of geographical expansion is recognized by using, as an example, “the broad geographical area, e.g. district or *ahupua‘a*” (OEQC 1997). It was decided that the process should identify ‘anthropological’ cultural practices, rather than ‘social’ cultural practices. For example, *limu* (edible seaweed) gathering would be considered an anthropological cultural practice, while a modern-day marathon would be considered a social cultural practice. According to the Guidelines for Assessing Cultural Impacts established by the Hawaii State Office of Environmental Quality Control:

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both manmade and natural, which support such cultural beliefs (OEQC 1997).

This Cultural Impact Assessment involves evaluating the probability of impacts on identified cultural resources, including values, rights, beliefs, objects, records, properties, and stories occurring within the project area and its vicinity (H.B. 2895, Act 50, 2000).

METHODOLOGY

This Cultural Impact Assessment was prepared in accordance with the methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 1997). In outlining the "Cultural Impact Assessment Methodology", the OEQC states: …information may be obtained through scoping, community meetings, ethnographic interviews and oral histories… (1997).

The report contains archival and documentary research, as well as communication with organizations having knowledge of the project area, its cultural resources, and its practices and beliefs. This Cultural Impact Assessment was prepared in accordance with the methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 1997). The assessment concerning cultural impacts should address, but not be limited to, the following matters:

(1) a discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints of limitations with might have affected the quality of the information obtained;

(2) a description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken;

(3) ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained;

(4) biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area;

(5) a discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken, as well as the particular perspective of the authors, if appropriate, any opposing views,

and any other relevant constraints, limitations or biases;

(6) a discussion concerning the cultural resources, practices and beliefs identified, and for the resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site;

(7) a discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project;

(8) an explanation of confidential information that has been withheld from public disclosure in the assessment;

(9) a discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs;

(10) an analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place, and;

(11) the inclusion of bibliography of references, and attached records of interviews, which were allowed to be disclosed.

Based on the inclusion of the above information, assessments of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

ARCHIVAL RESEARCH

Archival research focused on a historical documentary study involving both published and unpublished sources. These included legendary accounts of native and early foreign writers; early historical journals and narratives; historic maps and land records such as Land Commission Awards, Royal Patent Grants, and Boundary Commission records; historic accounts, and previous archaeological project reports.

INTERVIEW METHODOLOGY

Interviews are conducted in accordance with applicable state laws and guidelines. Individuals and/or groups who have knowledge of traditional practices and beliefs associated with a project area or who know of historical properties within a project area are sought for consultation. Individuals who have particular knowledge of traditions passed down from preceding generations and a personal familiarity with the project area are invited to share their relevant information. Often people are recommended for their expertise, and indeed, organizations, such as Hawaiian Civic Clubs, the Island Branch of Office of Hawaiian Affairs (OHA), historical societies, Island Trail clubs, and Planning Commissions are depended upon for their recommendations of suitable informants. These groups are invited to contribute their input, and suggest further avenues of inquiry, as well as specific individuals to interview.

If knowledgeable individuals are identified, personal interviews are sometimes taped and then transcribed. These draft transcripts are returned to each of the participants for their review and comments. After corrections are made, each individual signs a release form, making the information available for this study. When telephone interviews occur, a summary of the information is often sent for correction and approval, or dictated by the informant and then incorporated into the document. Key topics discussed with the interviewees vary from project to project, but usually include: personal association to the *ahupuaʻa*, land use in the project's vicinity; knowledge of traditional trails, gathering areas, water sources, religious sites; place names and their meanings; stories that were handed down concerning special places or events in the vicinity of the project area; evidence of previous activities identified while in the project vicinity.

In this case, letters with maps and descriptions of the project area were sent to individuals and organizations whose jurisdiction includes knowledge of the area with an invitation for consultation. Consultation was sought from Jordan Kea Calpito, SHPD Burial Sites Specialist; Kamakana Ferreira, OHA Compliance Officer; Nicole Lui, cultural descendant, Sean Naleimaile, State Historic Preservation Division (SHPD) Hawaiʻi Island Archaeologist; Kekoa Nezara, Kona Hawaiian Civic Club President; Shane Nelson, OHA West Hawaiʻi Representative; and J, Curtis Tyler III, cultural descendant. Consultation was also conducted via telephone with Gregg Kashiwa who served as the project property manager for parcels 016 and 017 in the early 1980s.

Public notices (Appendix A) were placed in the December 2019 issue of the Office of Hawaiian Affairs (OHA) Ka Wai Ola Newspaper. Public notices were also published in the Honolulu Star-Advertiser, and the West Hawaiʻi Today on November 17th, 20th and 21st.

If cultural resources are identified based on the information received from these organizations and/or additional informants, an assessment of the potential effects on the identified cultural resources in the project area and recommendations for mitigation of these effects can be proposed. Public notices were not published in local and/or regional publications.

PROJECT AREA NATURAL ENVIRONMENT

The current project area consists of undeveloped land used as cattle pasture for several decades. Prior to that, coffee was grown in the northeast quadrant of the project area. The project area is situated on fairly steeply sloping land with level areas in between elevation breaks. The project area is between 360 and 660 feet (110 to 201 meters) above mean sea level (amsl). The project area lands are part of a large former cattle ranch and agricultural area that was started in the early 1900s. The project area is still used to pasture cattle. The project area lands were bulldozed sometime between the 1940s and 1970s. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push pile (see Figure 4). Pedestrian survey confirmed the linear bands in the aerial photographs are bulldozer-cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths. The former Kona Sugar Company railroad bed is present along the eastern edge of the project area.

The project area ground surface is a Hualālai lava flow dating between 5,000 and 10,000 years before present (ybp) (Wolfe and Morris 1996). Soil in the project area is Punaluʻu Series (rPYD series) extremely rocky peat with six to twenty percent slopes (Sato 1973:48). The majority of the project area has been bulldozed in the past and the present ground surface is rocky soil.

Rainfall in the project area is very low, less than thirty inches per year. Parcel 018 and Parcel 019 are seasonal gulches that drain rainfall down slope to the west. This region is extremely dry, hot, and somewhat barren except for thick California grass (*Urochloa mutica*), Guinea grass (*Megathyrsus maximus*), and some *koa haole* (*Leucaena leucocephala*), *kiawe* (*Prosopis pallida*), and *kukui* nut (*Aleurites moluccana*) trees (Starr Environmental 2016).

HISTORICAL AND CULTURAL CONTEXTS

Kona is divided into two sections: North Kona or *Kona ʻākau*, and; South Kona, or *Kona hema* (Maly 1996). *Kona ʻākau* was further subdivided into north (called *Kekaha-wai-ʻole-o-na-Kona*) and south (called *Konakaiʻōpua*) areas, with the division between the two at the *ahupuaʻa* of Keahuolu. The project area is in Hōlualoa 1st Ahupuaʻa (Figure 5) within the area of *Kona kaiʻōpua* in *Kona ʻākau*. Hōlualoa means (literally) "long sled course" (Pukui *et al*. 1974:48). Hōlualoa 1st is a traditional *ahupuaʻa* stretching from the ocean to the foot of Hualālai in the uplands. The coastline of Hōlualoa 1st Ahupuaʻa is primarily low rock cliffs.

Very little is recorded of Hōlualoa Ahupuaʻa in traditional oral accounts. *The Heart Stirring Legend of Ka-Miki*, published in the Hawaiian language newspaper *Ka Hoku o Hawaii* and translated by Maly (1993) contains the only description of Hōlualoa. The legend is set in the 13th century but also reflects more recent influences (Maly and Maly 2002:17).

According to the narrative,

> The lands of Hōlualoa were named for the chief of that name; both Hōlualoa and Puapuaʻa were high chiefs, who controlled the lands from mountain to sea, which bear their names… Kaluaokalani served as a priest of Hōlualoa at the temple of Pākiha. This *heiau* was near the contest field of Hōlualoa… The lands of this region are named for various *aliʻi*, all of whom were related. When the chief Hōlualoa took up the challenge against Kepakaʻiliʻula on behalf of the Kona chiefs, Hōlualoa called upon his god *Kālaipāhoa* to assist him in his battle… Hōlualoa was the first chief to call upon the god *Kālaipāhoa*, and this was the beginning of this god's use by the chiefs of Hawaiʻi [Maly 1993:208-209].

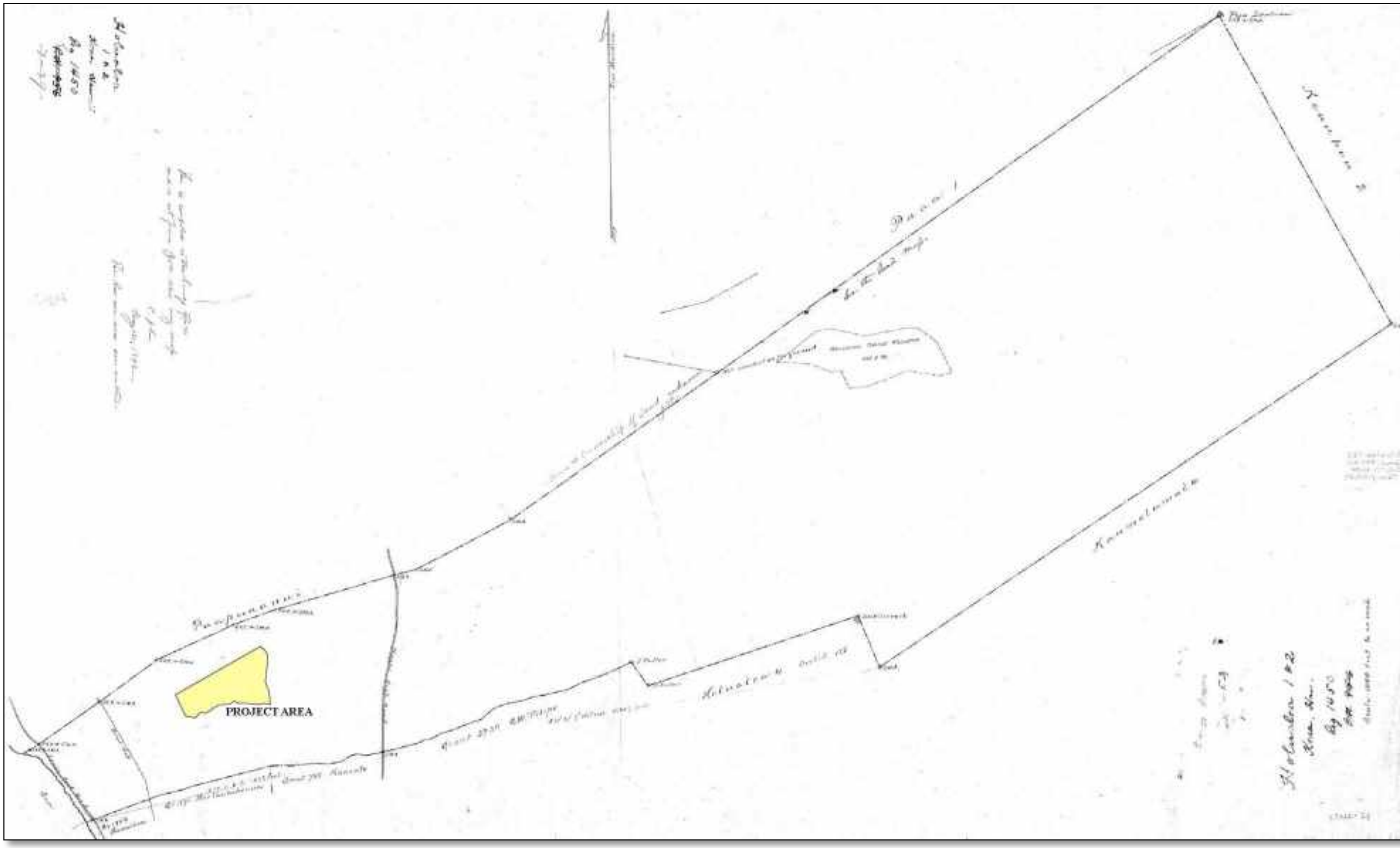

Figure 5: Map of Hōlualoa 1st and 2nd Ahupuaʻa Showing Location of Project Area in Red Border (Alexander 1855).

PRE-CONTACT ERA

Hōlualoa, Kona, and much of the leeward side of Hawaiʻi Island, while well populated at the time of European Contact, were settled later than the windward side. This in part may be due to the fertile land, numerous streams, and abundant rainfall on the windward side (Maly 1996:3). Many archaeologists believe that Hawaiʻi Island was first settled around A.D. 1,000 by people sailing from the Marquesas (Athens et al. 2014; Dye 2011; Kahn et al. 2014; Kirch 2011; Kirch and McCoy 2007; McCoy 2005 and 2007; Mulrooney et al. 2011; Reith et al. 2011; Wilmhurst et al. 2011a and 2011b).

During early settlement of the leeward side permanent habitations were established in Kona concentrated along the shoreline and lowland slopes (Cordy 1981, 1995; Schilt 1984). Informal fields were cleared at higher elevations where rainfall was higher. Between AD 1200 and 1400, habitation and agriculture expanded across the slopes and coastal area of Hualālai (Burtchard 1995; Cordy 1995). The initial construction of the Kona Field System (KFS) began approximately between AD 1400 to 1600 (Schilt 1984). The development of these extensive formal walled fields coincides with a dramatic population increase and with the development of the stratified chiefdom structure which is reflected through large residential complexes and *heiau* (Burtchard 1995; Cordy 1981; Haun *et al*. 1998; Hommon 1986; Schilt 1984). Thus, there was a need to expand the previously limited agricultural base. The royal centers and larger heiau were in place by AD 1600 to 1800 which reflect the growth in power of the rulers and chiefs in the region (Barrera 1971; Hammatt and Folk 1980). Royal centers are located at Kailua, Hōlualoa, Kahaluʻu, Kealakekua, and Hōnaunau (Cordy 1995).

The region of Hōlualoa developed into a royal center in the late 1600s to early 1700s under the reigns of Keakamahana (reigned 1680-1700) and Keakealaniwahine (reigned 1700-1720) (Cordy 2000:244). Many *ʻaliʻi* and *konohiki* residences and numerous religious sites are known to have existed here. The majority of the heiau and royal residences were constructed along or near the coast, most notably at Kamoa Point south of the project area. The royal center at Hōlualoa was eclipsed in the second half of the 1700s by the royal center in the Kahaluʻu and Keauhou region.

THE KONA FIELD SYSTEM

The Kona Field System extends north at least to Kau Ahupuaʻa and south to Hōnaunau, west from the coastline and east to the forested slopes of Hualālai (Cordy 1995). During his travels in 1823, William Ellis noted the extensive field system divided with "low stone walls, made of fragments of lava", producing "bananas, sweet potatoes, mountain taro, tapa trees, melons and sugar cane" and "flourishing luxuriantly in every direction" (Handy and Handy 1940:114 and 162). Many of the archaeological projects conducted within Kona deal with components of the Kona Field System (Cordy 1995; Newman 1970; Schilt 1984).

The *kula* zone of the Kona Field System is from sea level to 150 m amsl. This zone is associated with habitations along the shoreline and cultivation of sweet potatoes (*uala*), paper mulberry (*wauke*), and gourds (*ipu*). Clearing mounds, planting depressions, planting mounds, planting terraces, and modified outcrops are common agricultural features in the *kula* zone (Hammatt and Clark 1980; Hammatt and Folk 1980; Haun *et al*. 1998; Schilt 1984). Permanent habitation including royal and high chiefly centers as well as non-agricultural activities such as fishing, ceremonies and burial practices were usually concentrated along the shoreline zone portion of the *kula* zone.

The higher elevation zones are the *kaluʻulu zone, ʻapaʻa* zone and the *ʻamaʻu* zone. The current project area is in the *kaluʻulu* zone. This wetter region is above 150 m amsl where bread fruit, sweet potatoes (*Ipomoea batatas*), *ki*, (*Cordyline fruticosa*) *wauke* (*Broussonetia papyrifera*), *karo* (*Colocasia esculenta*), sugar cane (*Saccharum* sp.), and other arboreal crops were grown (Kelly 1983, Menzies 1920). The *ʻapaʻa* zone is above the *kaluʻulu* zone. Hawaiians cultivated melons, sweet potatoes, *ti*, bananas, *taro*, *wauke* and sugar cane in fields with low stone walls. The highest zone, the *ʻamaʻu* zone, was used to grow bananas and plantains in walled fields. The *ʻapaʻa* zone and the *ʻamaʻu* zone were also used to collect timber and catch birds therefore temporary habitations were constructed.

POST-CONTACT ERA

During the post-contact era, the Kona Field System was exploited and the planting of coffee, sugar, sisal, citrus, and cotton took over original Hawaiian crops until eventually the land was used for cattle pasture. The first cattle and sheep were brought to the island by Vancouver in 1793 and 1794 (Vancouver 1967). Horses, mules, oxen, goats, and donkeys were brought shortly after. Feral cattle, sheep, and goats overran agricultural fields by 1813 to 1815 (Ellis 1963: 291; Wilkes 1970: 204). By 1848, in the Kona District, a Great Wall (the Kuakini Wall) was constructed from Lanihau to ʻŌnouli to keep them away from homes and agricultural areas (Maly and Maly 2001:286). Formal cattle ranching began in the Kona region in the mid-1800s.

The Kona landscape evolved rapidly with the turn of the century. The rapid growth of the sugar industry produced the Kona Sugar Company in 1899. A railroad was built in 1901 to help sustain this influx in produce. It was later used to haul lumber and freight along with the sugarcane. The rail line was seven miles long and extended from Hōlualoa to Kaʻawaloa (Figure 6). Cotton, tobacco, and sisal were grown in the dryer lands below the railroad (Kelly 1983).

The changing subsistence and trade regimes developed by incoming European and American settlers, as well as other historical factors, caused a depopulation of the coastal areas of Kona. Ranches were established at middle and upper elevations, and farms were established in the uplands where rainfall was higher and the temperatures were cooler. Cattle ranching and clearing for sugar cane and coffee removed many of the endemic species of plants. The suite of vegetation that existed prior to the pre-Contact era were replaced by *koa haole* (*Leucaena leucocephala*), *kiawe* (*Prosopis pallida*), and other newly introduced invasive plant species.

Figure 6: Portion of 15-Minute Series USGS Topographic Map Showing Location of Railroad and Project Area (USGS 1928).

Schools, churches, stores, and other businesses were also established in the uplands. During the late 1800s and early 1900s, coastal Kona was no longer the densely populated sociopolitical center it once was. It became a small cluster of houses along the trail from Kailua Bay to Keauhou (Tomonari-Tuggle 1993:15). Homesteads, ranches, and plantations developed in the uplands during this period as reflected in the pattern of Land Commission Awards (LCA) and Land Grants (LG) recorded during the Māhele (Escott and Escott 2018).

The project area is just *makai* (west) of most of the land commission awards and is at the same elevation as portions of the land grants in the region. Based on historic documents, the project area and surrounding lands were likely being used for subsistence and commercial agriculture, as well as for cattle pasture from the mid to late 1800s. The project area might have been used later than surrounding lands because of its steep slopes and very rocky soil, but based on aerial photographs, the project area was bulldozed sometime around the 1950s through the 1970s in preparation for commercial agriculture.

THE MĀHELE

The Land Commission awarded the majority of Hōlualoa 1st and 2nd Ahupuaʻa to Victoria Kamāmalu Kaʻahumanu IV, *Kuhina Nui* of Hawaiʻi Island and Crown Princess of Hawaiʻi as Land Commission Award (LCA) Number 7713, ʻApana 43 (Figure 7). Several smaller LCA and LG properties were also recorded in the upland region of Hōlualoa 1st and 2nd Ahupuaʻa (Figure 8). Twenty four Land Commission awards were recorded in Hōlualoa 1st Ahupuaʻa, the ahupuaʻa where the project area is located (Table 1).

A portion of LCA #3660 to John G. Munn makes up a thin strip of land located through the center of the current project area. With the notable exception of LCA #3660 and a few other large LCAs, the average award was 2.8 acres, most (n=16) were for less than 3.0 acres. Three Land Grants (LG #1592, 1602, and 3630) were also recorded in Hōlualoa 1st and 2nd Ahupuaʻa. LG #1592 was a 25.0-acre parcel sold to Kealalio and LG #3630 was a 38.2-acre parcel sold to W.H. Cromwell. Almost all of the awards and grants were used as subsistence and commercial farm land, and some were used to pasture cattle (Escott and Escott 2018).

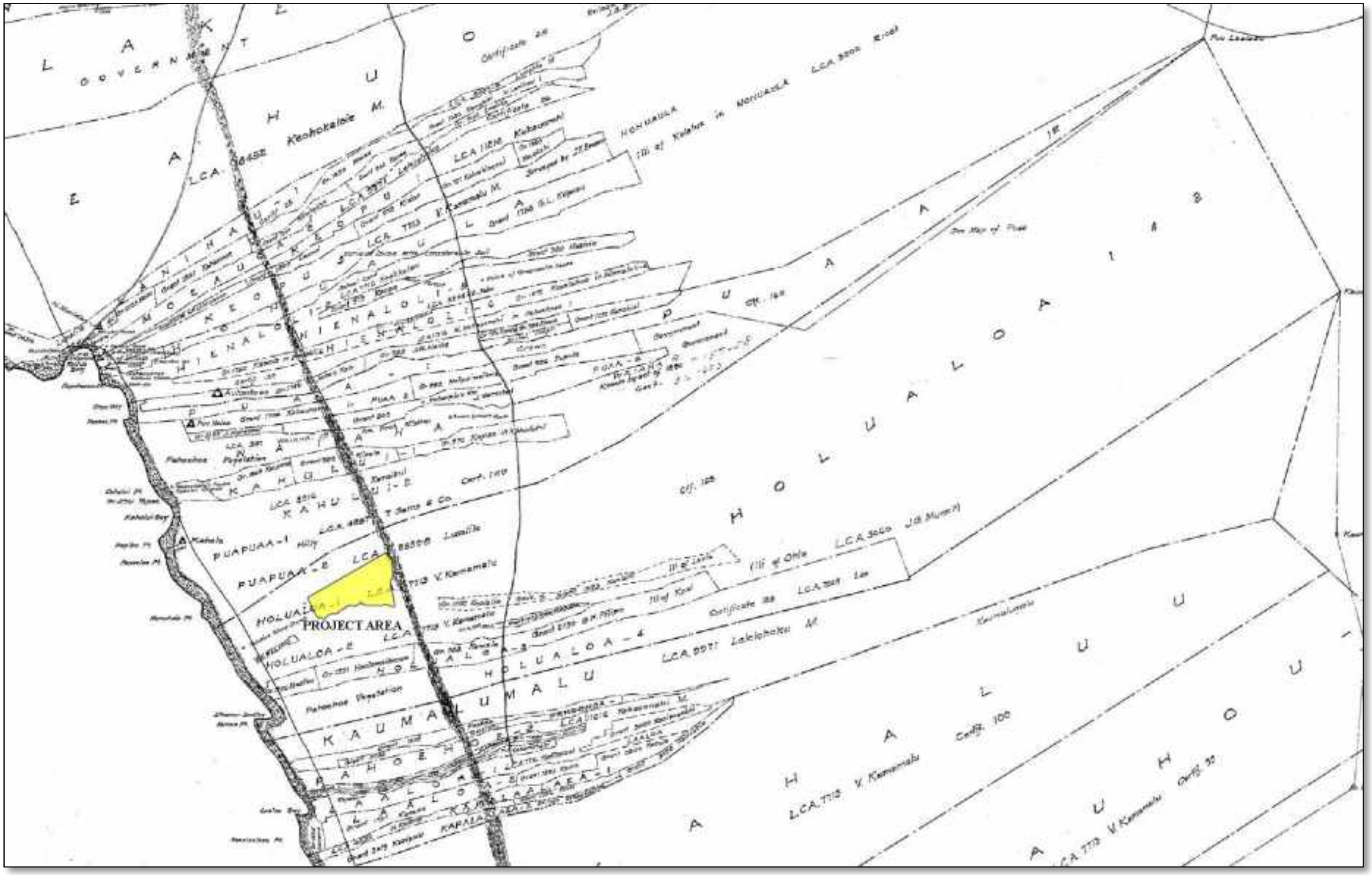

Figure 7: Portion of Kailua Section, North Kona Map Showing Location of LCA 7713 and Project Area in Red Border (Aki 1952).

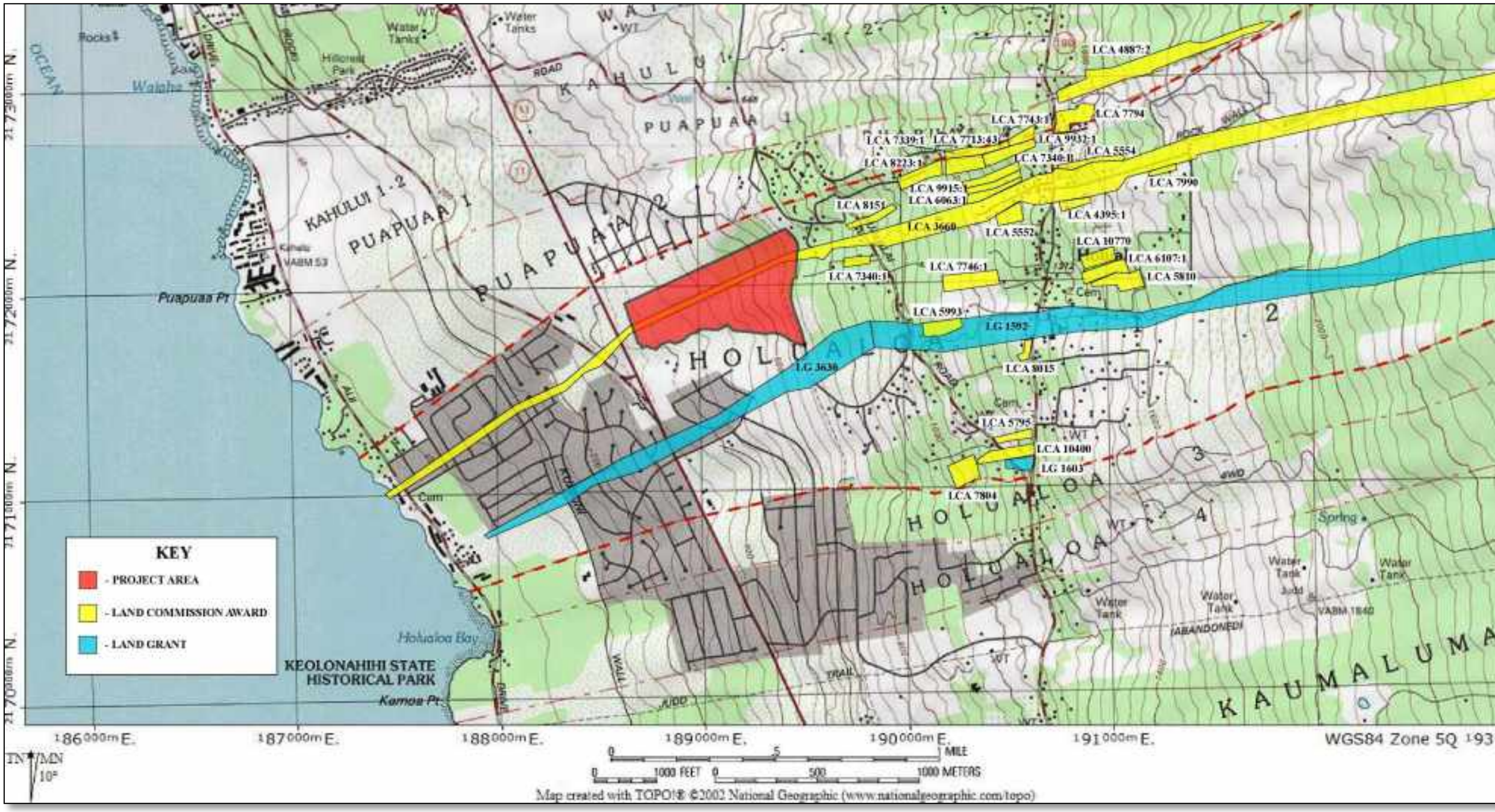

Figure 8: 7.5-Minute Series USGS Topographic Map Showing Location of Land Commission Awards, Land Grants, and the Project Area (National Geographic Topo!, 2003, Kailua Quad. Data Sources: National Geographic Society, USGS).

Table 1: Land Commission Awards Recorded in Hōlualoa 1st and 2nd Ahupua'a.

LCA#	AWARDED TO	AHUPUA'A	ACRES
3660	John G. Munn	Hōlualoa 1st	111.5
4395	Kekoi	Hōlualoa 1st	1.7
5552	Kauila	Hōlualoa 1st	1.9
5554	Keawekolohe	Hōlualoa 1st	11.27
5795	Keliikanakaole	Hōlualoa 2nd	2.2
5810	Kaopukauila	Hōlualoa 1st	1.74
5993	Leipalapala	Hōlualoa 2nd	2.0
6063	Hāna	Hōlualoa 1st	2.9
6107	Naai	Hōlualoa 1st	3.94
7339	Kuaana	Hōlualoa 1st	4.15
7340	Kama 2	Hōlualoa 1st	2.5
7340:B	Kama 1	Hōlualoa 1st	1.3
7443	Kalimapaa	Hōlualoa 1st	1.94
7713	Kamamalu	Hōlualoa 1st & Hōlualoa 2nd	Large
7746	Kamahalo	Hōlualoa 1st	5.0
7794	Kauakini	Hōlualoa 1st	1.8
7990	Pupuka	Hōlualoa 1st	1.1
8015	Aipo	Hōlualoa 2nd	1.4
8151	Hehena	Hōlualoa 1st	2.3
8223	Ikaiaka	Hōlualoa 1st	3.5
9915	Limahana	Hōlualoa 1st	2.42
9932	Lumaawe	Hōlualoa 1st	2.98
10770	Puuone	Hōlualoa 1st	3.06
10400	Naaimakaohi	Hōlualoa 1st & Hōlualoa 2nd	3.5

PREVIOUS ARCHAEOLOGICAL STUDIES

There are at least 26 previous archaeological reports for lands near the current project area, including studies in Puapuaʻa 2nd and Hōlualoa 1st, 2nd, and 3rd Ahupuaʻa (Table 4 and Figure 9). The studies were conducted from the coast to roughly 1,460 ft amsl and encompass the *kula* region (0-500 ft), the *kaluʻulu* region (500-1,000 ft), and the lower portions of the *ʻāpaʻa* region (1,000-2,500 ft). Results of the previous archaeological studies are summarized below by elevation: studies numbered 1 through 15 in Table 2 and Figure 9 are situated from the coast to Queen Kaʻahumanu Highway (0-360 ft amsl), studies 16 through 21 are located from above the Queen Kaʻahumanu Highway to just below Hualālai Road (306-760 ft amsl), and studies 22 through 24 are above Hualālai Road to just above Māmalahoa Highway (1,100-1,460 ft amsl).

Table 2: Inventory of Previous Archaeological Investigations.

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
1	Landrum et al. 1990	Archaeological Inventory Survey	N/A	46 Sites
1	Calis et al. 2004	Archaeological Data Recovery	N/A	10 Sites
2	Carlson & Rosendahl 1990	Archaeological Inventory Survey	65	64 Sites
3	Haun et al. 1998	Archaeological Inventory Survey	15	31 Sites
4	Hammatt & Folk 1981	Archaeological Survey	20	20 Sites
4	Hammatt et al. 1986	Archaeological Survey & Excavations	20	21 Sites
5	Haun & Henry 2001	Archaeological Data Recovery	1.59	1 Site
6	Escott 2013	Archaeological Inventory Survey	1.962	2 Sites
7	Sinoto 1979	Archaeological Reconnaissance Survey	6	Rock Walls
8	Hammatt 1979b	Archaeological Survey	22	3 Sites
9	Hammatt 1979c	Archaeological Survey	23	39 Sites
10	Conolly & Gunness 1979	Archaeological Reconnaissance Survey	46.8	80 Sites
10	Hammatt 1979a	Archaeological Inventory Survey	46.8	11 Sites
10	Hammatt 1980	Archaeological Survey & Excavation	103	88 Sites
11	Nelson et al. 205	Archaeological Inventory Survey	28	22 Sites
12	Rosendhal 1978	Archaeological Reconnaissance Survey	2.5	1 Site

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
12	Soehren 1980a	Archaeological Reconnaissance Survey	n/a	7 Sites
12	Wolforth et al. 2000	Archaeological Inventory Survey	8	7 Sites
13	Barrera 1995	Archaeological Reconnaissance Survey	17	3 + several ag. mounds
13	Haun & Henry 2000	Archaeological Inventory Survey	17	12 (104 Features, 82 of Which Were Agricultural)
14	Rosendahl 1989	Archaeological Field Inspection	6	Modified Outcrops
15	Schilt 1984	Archaeological Study	17	134 Sites
16	Walker & Rosendahl 1988	Archaeological Reconnaissance Survey	104	67 Sites
16	Graves & Goodfellow 1993	Archaeological Data Recovery	104	58 Sites
16	Maly & Rosendahl 2006	Archaeological Preservation Plan	104	67 Sites
17	Hammatt et al. 1992	Archaeological Survey	174	71 Sites
18	Soehren 1980b	Archaeological Reconnaissance Survey	16	1 Site
19	Rechtman 2006	Archaeological Inventory Survey	1.008	2 Sites
20	Rosendahl 1988	Archaeological Reconnaissance Survey	17	17 Sites
20	Fager & Graves 1993	Archaeological Inventory Survey	17	17 Sites
21	Dircks et al. 2013	Archaeological Inventory Survey	10.266	1 Site (149 Historic to Modern Farming Features)
22	Desilets et al. 2004	Archaeological Inventory Survey	11.7	1 Homestead Features
23	Rechtman 2013		29	24 Sites
24	Clark & Rechtman 2006	Archaeological Inventory Survey	2.7	6 Historic Era Sites
25	Escott & Escott 2018	Archaeological Inventory Survey	5.0	22 Pre-Contact and Historic Era Sites
26	Escott & Escott 2020	Archaeological Inventory Survey	73.122	18 Pre-Contact and Historic Era Sites 1 Isolated Find (Petroglyph)

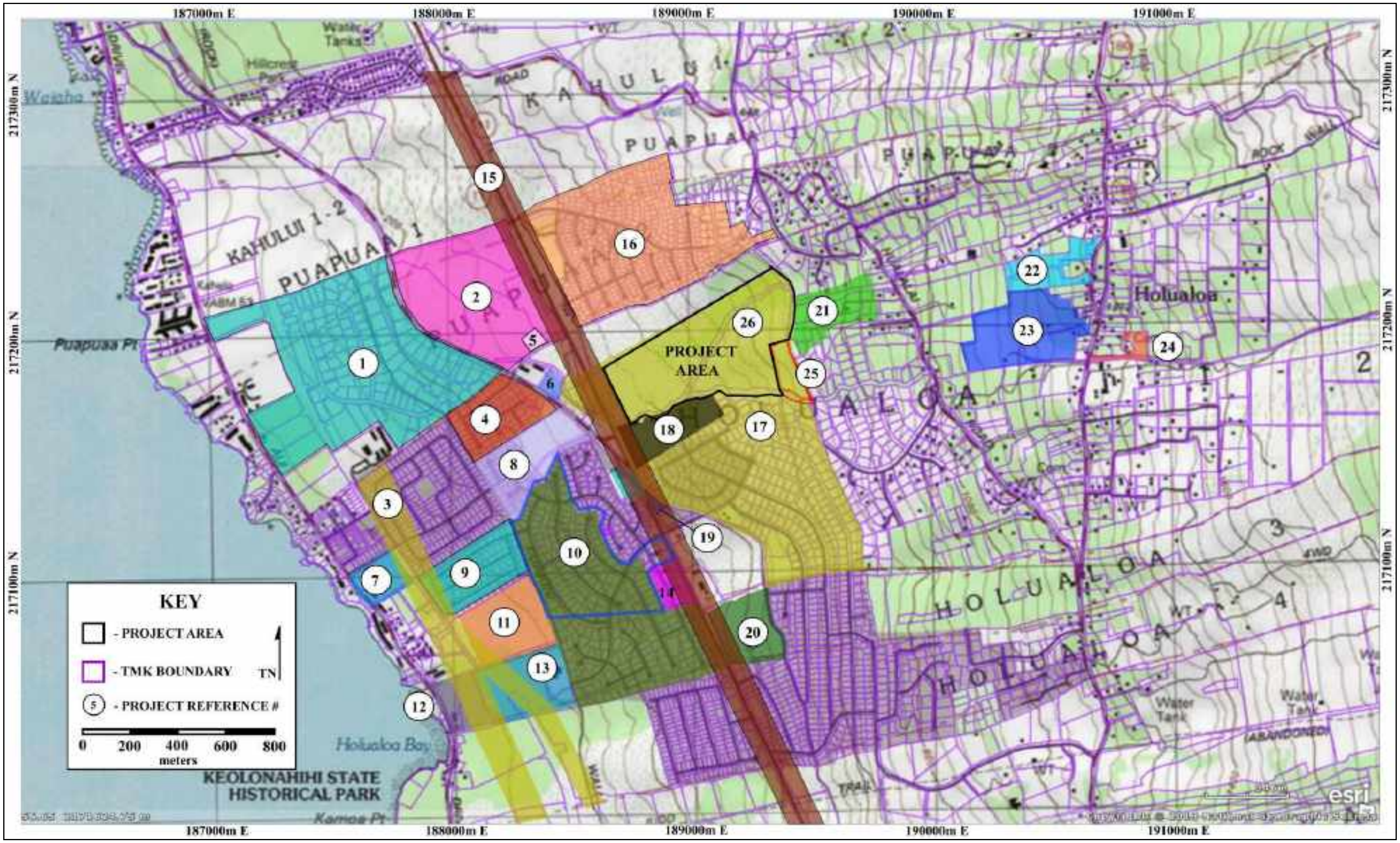

Figure 9: 7.5-Minute Series USGS Topographic Map Showing Location of Previous Archaeological Studies and Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

REGIONAL PREVIOUS ARCHAEOLOGICAL STUDIES

1. Landrum et al. 1990, and Calis et al. 2004. PHRI, Inc. conducted an archaeological inventory survey (Landrum et al. 1990) and SCS, Inc. conducted data recovery investigations (Calis et al. 2004) at the Kahakai development project. The project area is located within the lower elevations of Puapuaʻa 2nd Ahupuaʻa. Pre-Contact era to early post-Contact era cave shelters, agricultural rock clearing mounds, burials, shrines, and a possible heiau were identified during the AIS study. A heiau complex, several burials, and five permanent habitation sites were recommended for preservation. All of the preservation sites are near the coast.

2. Carleson and Rosendahl 1990. PHRI, Inc. conducted an archaeological inventory survey of 65 acres between Kuakini and Queen Kaʻahumanu highways in Puapuaʻa 2nd Ahupuaʻa. Their study recorded 64 archaeological sites including pre-Contact era habitation, agricultural, and burial sites. Seven sites were assessed as significant and recommended for preservation (Carleson and Rosendahl 1990: 34).

3. Haun et al. 1998. PHRI, Inc. conducted an archaeological inventory survey of the proposed Aliʻi Drive corridor through several ahupuaʻa. Numerous pre-Contact era site complexes were recorded in Puapuaʻa 2nd and Hōlualoa 1st through 4th Ahupuaʻa. The site complexes included a large number of agricultural features, as well as habitation, burial, and ceremonial features.

4. Hammatt and Folk 1981, and Hammatt et al. 1986. Two archaeological surveys were conducted on a 20-acre parcel of below Kuakini Highway. The first study recorded 20 sites, and the second recorded 21 sites. None of the sites were recommended for preservation (Hammatt and Folk 1981: ii, and Hammatt et al. 1986: 87). The report also recommended that the single documented burial be relocated.

5. Haun & Henry 2001. Haun and Associates conducted an archaeological data recovery study at a c-shaped enclosure located on 1.59 acres of land below Queen Kaʻahumanu Highway

6. Escott 2013. SCS conducted an archaeological study on1.962 acres of land near the intersection of Kuakini and Queen Kaʻahumanu highways. Two historic era ranch walls were recorded during the study.

7. Sinoto 1979. Aki Sinoto recorded several Historic era ranch rock walls on a six acre parcel of land just mauka of Ali‘i Drive.

8. Hammatt 1979b. The Archaeological Research Center, Inc. conducted an archaeological survey of 22 acres just south of Kuakini Highway. Three archaeological sites were recorded during the study. None of the sites were recommended for preservation (Hammatt 1979b: ii, and 10).

9. Hammatt 1979c. The Archaeological Research Center, Inc. conducted an archaeological survey of 23 acres located in the near coastal portion of Hōlualoa 1st and 2nd Ahupua‘a. Thirty nine archaeological sites were recorded during the study. The report recommended that all burials, including a known cemetery site be relocated (Hammatt 1979a: 5). None of the remaining sites (pre-Contact era habitation and agriculture sites) were recommended for preservation in place.

10. Conolly and Gunness 1979, and Hammatt 1979a and 1980. The Archaeological Research Center, Inc. conducted an archaeological survey of 103 acres within the near coastal portions of Hōlualoa 1st through 4th Ahupua‘a (Hammatt 1980). One hundred and thirty six archaeological sites were recorded on the project area. They included pre-Contact era habitation, agriculture, burial, and a ceremonial sites. The Hammatt report recommended that a heiau (Site 6661) was significant and should be preserved in place (Hammatt 1980: 4). The report also recommended that the single documented burial be relocated to the perimeter of heiau (Site 6661) and preserved. No other sites were recommended for preservation.

11. Nelson et al. 2005. An archaeological inventory survey was conducted by Rechtman Consulting on 28.0 acres located in the near coastal portion of Hōlualoa 2nd Ahupua‘a. A total of 22 sites containing 150 features were recorded. The sites were primarily pre-Contact era agricultural and habitation sites, though five burial sites, a possible heiau, and a trail were also documented within the project area.

12. Rosendahl 1978, Soehren 1980a, Wolforth et al. 2000. PHRI conducted an archaeological inventory survey of eight acres of coastal Hōlualoa 3rd Ahupua‘a and recorded seven archaeological sites including three Historic era rock walls, three residential sites, and Hikapaia Heiau.

13. Barrera 1995, Haun & Henry 2000. Barrera (1995) recorded a possible burial platform, two habitation site, agricultural rock clearing mounds and modified outcrops during a reconnaissance survey of 17 acres in near coastal Hōlualoa 2nd Ahupuaʻa. Haun and Associates conducted an archaeological inventory survey of the property and recorded 12 sites with 104 features (Haun and Henry 2000:14). The majority of features (n=82) were pre-Contact era agricultural rock clearing mounds. Eleven permanent habitation and one temporary habitation feature were also recorded during the study.

14. Rosendahl 1989. PHRI conducted an archaeological field inspection of 6.0 acres of land just below Queen Kaʻahumanu Highway in Hōlualoa 2nd Ahupuaʻa. Several modified outcrops were recorded in the letter report. There were no other archaeological features identified on the project area.

15. Schilt 1984. The Bishop Museum conducted an archaeological study of the Kuakini Highway Realignment Project located roughly along present day Queen Kaʻahumanu Highway and recorded 39 sites Puapuaʻa 2nd and Hōlualoa 1st and 2nd Ahupuaʻa. Twenty two of the sites were pre-Contact to early post-Contact era agricultural gardens and modified outcrops (rock clearing). There were also traditional habitation platforms and trails, as well as Historic era roads and walls recorded during the study.

16. Walker and Rosendahl 1988, Graves and Goodfellow 1993, and Maly and Rosendahl 2006. An archaeological reconnaissance survey (Walker and Rosendahl 1988), an archaeological data recovery study (Graves and Goodfellow 1993), and an archaeological preservation plan (Maly and Rosendahl 2006) were conducted by PHRI, Inc. for 104 acres in the upland region of Puapuaʻa 2nd Ahupuaʻa. A total of 67 sites were documented within the project area, including traditional (KFS) sites, temporary habitation sites, three burials, and a *heiau*. The archaeological preservation plan recommended that the three burials be relocated to the *heiau* site, and that the *heiau* be preserved as a formal historic preservation area (Maly and Rosendahl 2006).

17. Hammatt et al. 1992. An archaeological survey was conducted by Cultural Surveys Hawaiʻi on 174 acres of land in the upland region of Hōlualoa 1st, 2nd, and 3rd Ahupuaʻa. The project area lands had been heavily bulldozed during the modern era for ranching and agricultural purposes. Despite the bulldozing, seventy one sites were recorded during the study, including temporary habitation features, rock walls, agricultural features, and

three burial sites. Many of the sites were determined to be associated with Historic era ranching and agriculture.

18. Soehren 1980b. Soehren conducted an archaeological reconnaissance survey of 16.0 acres above Queen Kaʻahumanu Highway in the inland region of Hōlualoa 1st Ahupuaʻa (Soehren 1980b). A single enclosure was identified during the survey.

19. Rechtman 2006. An archaeological inventory survey was conducted by Rechtman Consulting, LLC on a roughly one-acre parcel located *makai* of Queen Kaʻahumanu Highway in Hōlualoa 2nd Ahupuaʻa. Two rock walls were recorded on the project area. The report recommended no further work at the wall sites.

20. M. Rosendahl 1988, Fager & Graves 1993. Fager and Graves (1993) conducted an archaeological inventory survey of 17.0 acres just mauka of Queen Kaʻahumanu Highway in Hōlualoa 3rd Ahupuaʻa. Seventeen sites containing 27 pre-Contact to early post-Contact era agricultural features, including rock mounds, modified outcrops, C-shaped enclosures, terraces, walls, and rock enclosures, were recorded.

21. Dircks et al. 2013. Rechtman Consulting conducted an archaeological inventory survey of 10.266 acres of land located between 840 and 920 ft amsl in Hōlualoa 1st and 2nd Ahupuaʻa. One Historic era to modern era homestead/agriculture site (Miyose Farm) containing 149 features was recorded during the survey.

22. Desilets et al. 2004. Desilets et al. (2004) conducted an archaeological inventory survey of 11.7 acres of land in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. A single site associated with Historic era and modern era homesteads, commercial agriculture (coffee), and ranching was recorded. Features included rock walls, roads, coffee terraces, and buildings.

23. Rechtman 2013. Rechtman Consulting conducted and archaeological inventory survey of 29 acres of land located in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. Twenty four sites were recorded. The majority of the sites were associated with Historic era and modern era homesteads, commercial agriculture. Features included rock walls, roads, and remnants of structures. A single pre-Contact era to early post-Contact era residential and agricultural site was also recorded.

24. Clark & Rechtman 2006. Rechtman Consulting conducted an archaeological inventory survey of 2.7 acres of land located in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. Six sites were recorded, including five ranch walls and an area of coffee terraces.

A number of conclusions can be made from the previous archaeological studies. A primary conclusion is that the majority of habitation features, especially permanent habitation features, are located from the coast to about 360 ft amsl, below the present day Queen Kaʻahumanu Highway. The same is true of ceremonial features, burials, and, to a lesser extent, agricultural features. The density of agricultural features and habitation features, mostly temporary habitation features, in the upland regions between 360 ft amsl and 700 ft amsl is much lower than the site density in the coastal *kula* and lower *kaluʻulu* regions of the KFS. The pre-Contact traditional Hawaiian settlement and agricultural patterns are strongly oriented to the *kula* and lower *kaluʻulu* regions.

Even though cattle ranching and commercial agriculture may have removed some archaeological sites from the ground surface in the *kaluʻulu* region, there appear to be fewer sites than at lower elevations. The majority of sites in the *kaluʻulu* region are KFS agricultural sites including rock clearing mounds, modified outcrops, garden enclosures, and low garden walls. Within the lands of the current project, it is clear that ranching and commercial agricultural practices have removed and damaged many of the pre-Contact era sites from the ground surface (see the Hammatt et al. 1992 summary below). Moreover, many of the sites identified near the current project area are associated with Historic era ranching and commercial agriculture.

A second conclusion is that the establishment of Historic era homesteads, ranches, and commercial agriculture seems to have removed, or obscured, the majority of pre-Contact era sites in the upper *kaluʻulu* and lower *ʻāpaʻa* regions. It might be that pre-Contact uses in these regions did not involve the construction of large or permanent features, as in the lower regions of Kona. It is also likely that Historic era ranching and commercial agriculture in the lower *ʻāpaʻa* region have caused large scale land alterations through the use of bulldozers for pasture and garden. It is possible that traditional features were disassembled to build rock walls and coffee terraces.

CURRENT PROJECT AREA SPECIFIC PREVIOUS ARCHAEOLOGY

26. Hammatt et al. 1992. Lands of the current AIS study were subject to an AIS study conducted by Hammatt et al. (1992). That study encompassed 66.039 acres of land within the current project area located between 320 to 690 feet (98 to 210 meters) amsl [TMK: (3) 7-6-021:016 and 017] (see Figure 9, Project #17). The current project area is located within the northern portion of the Hammatt et al. (1992) project area.

Twenty one archaeological sites and two areas of bulldozed modern planting "terraces" were recorded in the AIS report (Figure 10 and Table 3). Eight of the 21 archaeological sites (SIHP #50-10-37-10015, #50-10-37-10017, #50-10-37-10018, #50-10-37-10020, #50-10-37-10031, #50-10-37-10033, #50-10-37-10034, and #50-10-37-10049, hereafter abbreviated to the last five digits) were recorded by CSH in tabular format only. Written descriptions of the remaining 13 sites are in the CSH AIS report. Excavations were conducted at ten of the 13 sites. The AIS report included plan view figures for four of the 13 sites. At the request of SHPD, additional site documentation for Sites 10011, 10012, 10031, 10049, and 10071 was submitted to SHPD in a letter report (Hammatt and Shideler 2007).

Six of the sites were determined to be pre-Contact era, four associated with habitation, one with agriculture, and one single feature site (Site 10012) contained two burials. Fifteen of the sites were determined to be Historic era sites, the majority associated with coffee agriculture and cattle ranching. Two Historic era habitation sites were also documented in the AIS study.

The burials at Site 10012 were removed and reinterred off-project prior to 1983. The site was further excavated to ensure that all *iwi* had been removed. The site was then back-filled and leveled by bulldozer.

The AIS recommended no further work at all 21 sites documented in the current project area. The Hammatt and Shideler (2007) letter report repeated the AIS recommendation that "all surface sites in the area were documented" in the AIS report and that "significant material from the study area has been recovered and that further investigation would be of minimum productivity" (Hammatt and Shideler 2007:11). However, the authors recommended that the sites should be located to document their current conditions and to document the sites to prevailing SHPD AIS standards.

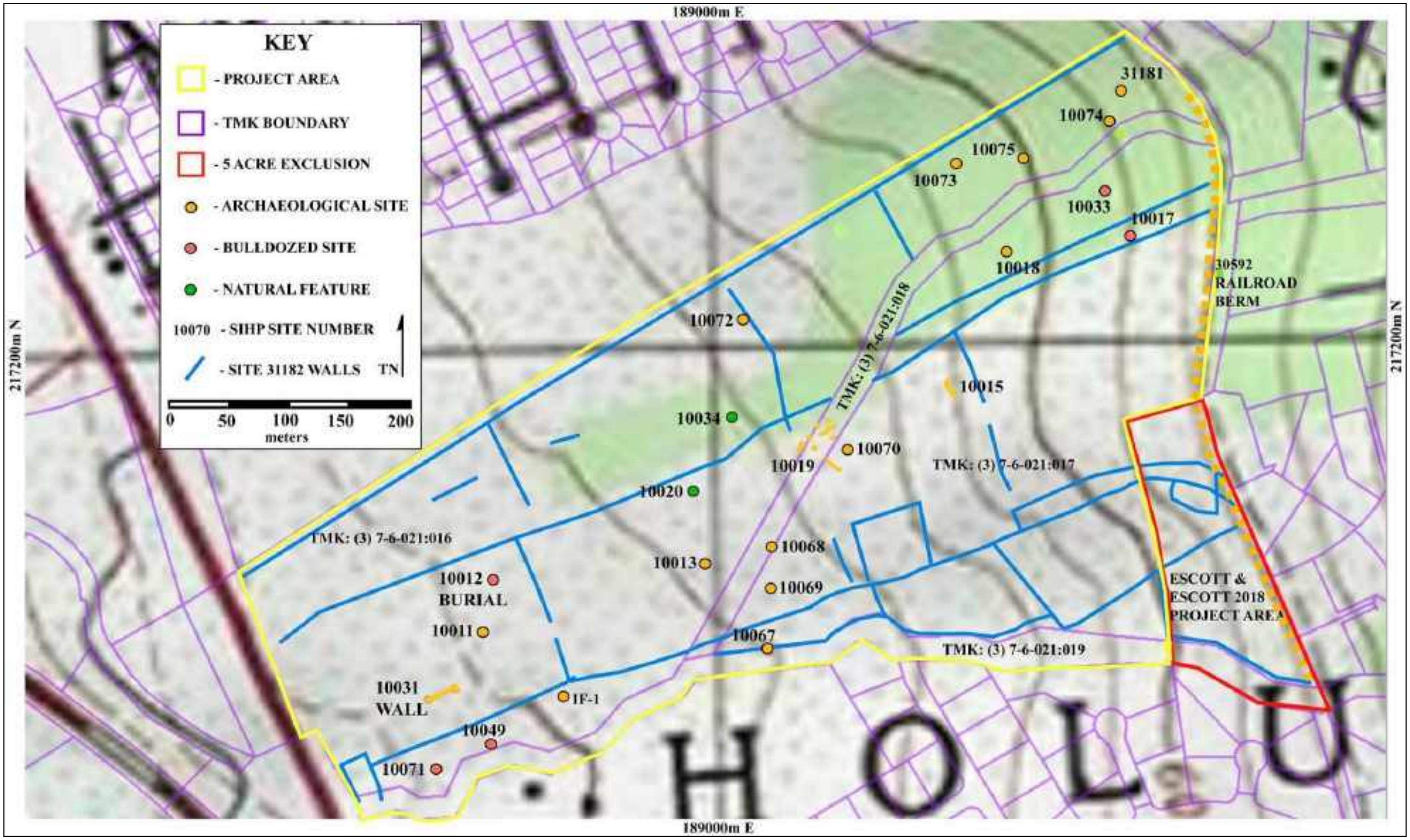

Figure 10: 7.5-Minute Series USGS Topographic Map Showing Location of Northern Portion of Hammatt et al. (1992) Sites and Current Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

Table 3: Inventory of Previously Recorded Archaeological Sites (Hammatt et al. 1992; Hammatt and Shideler 2007).

SIHP #	CSH SITE#	TYPE	FUNCTION	AGE	EXCAVATION	CULTURAL MATERIAL
10011	9	Platform	Ag. Clearing	Prehistoric	1.5 m long trench	3 cowrie shells
10012	10	Platform & Wall	Burial	Prehistoric	Entire Feature	Burial reinterred off-project
10013	11	Enclosure & Lava Tube	Habitation	Prehistoric	4.5 m square total	Fire features & Prehistoric artifacts
10015	13	Terrace	Road Bed	Historic		
10017	15	Platform	Cattle Ramp	Historic		
10018	16	Enclosure	Habitation	Historic		
10019	17	6 Rock Mounds	Ag. Clearing	Historic	3 1.0 m wide trenches	Metal File
10020	18	Platform	Ag. Clearing	Historic		
10031	110	Enclosure Wall	Agriculture	Historic		
10033	112	Planting Complex	Coffee Ag	Historic		
10034	113	Platform	Ag. Clearing	Historic		
10049	216	Terraces	Agriculture	Historic		
10067	232	Terraces	Habitation	Prehistoric	1.0 X 1.0 m	VG & a small amount of midden & fire feature
10068	233	Enclosure	Habitation	Prehistoric	0.5 X 0.25 m	small amount of midden
10069	234	Modified Bluff/Platform	Habitation	Historic	0.5 X 0.5 m	VG & a small amount of midden
10070	235	U-Shape Enclosure	Agriculture	Historic	1.0 X 0.5 m	No artifacts
10071	237	Platform	Habitation	Prehistoric		
10072	238	Modified Bluff	Ag. Clearing	Historic	7.0 m square total	No arts Small amount of MS in TU-2
10073	239	Platforms	Ranching/Ag.	Historic		
10074	240	Enclosure	Coffee Work Shed	Historic	1.25 m square total	1 VG, little MS, historic artifacts
10075	241	Enclosure	Pig Pen	Historic		

In a letter to the County of Hawaiʻi Department of Planning dated July 30, 2018, (Log. No. 2018.00878 Doc. No. 1807SN01), SHPD requested a new pedestrian survey to identify all archaeological historic properties present on the project area, and to update previous archaeological documentation to include site plans for each site with site boundaries and areas impacted by bulldozing, photographs of all sites and features, an assessment of their integrity, and site significance.

25. Escott & Escott 2018. SCS conducted an archaeological inventory survey on a 5.0-acre portion of Parcel 017 in the southeast portion of the current project area (Escott and Escott 2018) and recorded twenty-two new archaeological sites within the project area (Table 4 and Figure 11). Fifteen of the sites are single-feature sites. The remaining seven agricultural sites contained two to seven features. A majority of the sites are agricultural terraces and complexes dating to the pre-Contact era to the Historic era. The agricultural complexes are located in the lower *kaluʻulu* zone, between 600 and 700 feet (182 to 213 meters) amsl.

Three of the ranch walls (Site 30595, 30601, and 3065) are the primary dividers of the five-acre project area. These Historic era walls have typical characteristics of ranch walls including cobble core fill and bi-faced inward sloping walls toward the top. They are approximately 1.0 meter tall. Site 30602 and Site 30603 are Historic era ranching and agricultural enclosures constructed along wall Site 30595 and wall Site 30601. These two wall sites are constructed onto the west edge of the Site 30592 railroad berm and post-date the railroad berm.

The northern third of the project area only has two sites (Site 30591 and 30956). Site 30591 is an agricultural complex with six terraces. Portions of the sites were bulldozed in the early Modern era. Both sites date to pre-Contact to early Historic era. The terraces reflect Kona Field System features but are roughly constructed that more closely resemble Historic era commercial agriculture. Site 30956 is a rectangular Historic style hearth.

The middle one third of the project area between wall sites 30595 and 30605 is within the bulldozed "terraces" portion of the project area. Site 30593 is a pre-Contact era to early post-Contact era lava tube burial. The burial will be preserved in place in accordance with a Burial Site Component of a Preservation Plan. Site 30594 is an agricultural terrace complex that resembles the Kona Field System but is more roughly constructed. Artifacts recovered from subsurface testing at Site 30604 suggest it is a Historic era agricultural terrace.

The southern third of the project area, south of wall Site 30605, contained six primarily agricultural sites (Site 30598, 30600, 30606, 30607, 30610, and 30611) and four Historic era sites (Site 30599, 30608, 30609, and 30612) with functions other than agriculture. The agricultural features included rock walls (Site 30598 and30606), terraces (Site 30600 and 30610), and agricultural complexes with terraces (Site 30607 and 30610). The non-agricultural features included three enclosures (Site 30599, 30608, and 30609), and a refuse disposal area lava blister (Site 30612). The cluster of these sites indicates their use for Historic era commercial agriculture.

Twenty-nine shovel probes and two excavation units tested the sites. Marine shell fragments, a basalt flake and volcanic-glass flakes recovered during testing indicate that Hawaiians likely used the area for limited agricultural purposes. However, the agricultural terraces more closely resemble the remains of Historic era commercial agriculture.

All 22 sites identified during the current AIS study were assessed significant under criterion “d” as they are likely to yield information important to history. The railroad berm is also significant under criteria “a” and “c” as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. The railroad berm was recommended for preservation with preservation measures outlined in an archaeological preservation plan (Escott and Mello 2019b). The rest of the sites require no further work.

The burial is also significant under criterion “e” as it has important value to Hawaiian people and people of other ethnic backgrounds in the state. The burial was recommended for preservation in place with preservation treatments outlined in a Burial Site Component of a Preservation Plan (Escott and Mello 2019a).

Table 4: Inventory of Archaeological Sites Identified on the AIS Project Area (Escott and Escott 2018).

Site #	Site Type	Features	Site Function	Age	Testing
30591	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30592	Railroad Bed and Berm	1	Transportation	Historic Era	
30593	Lava Tube Burial	1	Burial	Pre-Contact to Early Post-Contact Era	
30594	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1 & 2
30595	Rock Wall	1	Ranching	Historic Era	
30596	Hearth	1	Food Preparation	Historic Era	TU-1
30597	Rock Wall	1	Ranching	Historic Era	
30598	Rock Wall	1	Agriculture/Ranching	Pre-Contact to Historic Era	
30599	Platform & Enclosure	2	Ranching/Agriculture	Historic Era	SP-1 & 2, TU-1
30600	Terrace	1	Agriculture	Historic Era	SP-1
30601	Rock Wall	1	Ranching	Historic Era	
30602	Enclosure	1	Ranching/Agriculture	Historic Era	SP-1, 2, 3 & 4
30603	Enclosure	4	Ranching/Agriculture	Historic Era	SP-1 & 2
30604	Agricultural Complex	4	Agriculture	Pre-Contact to Historic Era	SP-1
30605	Rock Wall	1	Ranching/Agriculture	Historic Era	
30606	Rock Wall	1	Ranching/Agriculture	Pre-Contact to Historic Era	
30607	Agricultural Complex	7	Agriculture	Pre-Contact to Historic Era	SP-1 to SP-10
30608	Enclosure	1	Structure	Historic Era	
30609	Enclosure	1	Structure	Historic Era	
30610	Terrace	1	Agriculture	Pre-Contact to Historic Era	SP-1
30611	Agricultural Complex	3	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30612	Lava Blister	1	Refuse Dump	Historic Era	

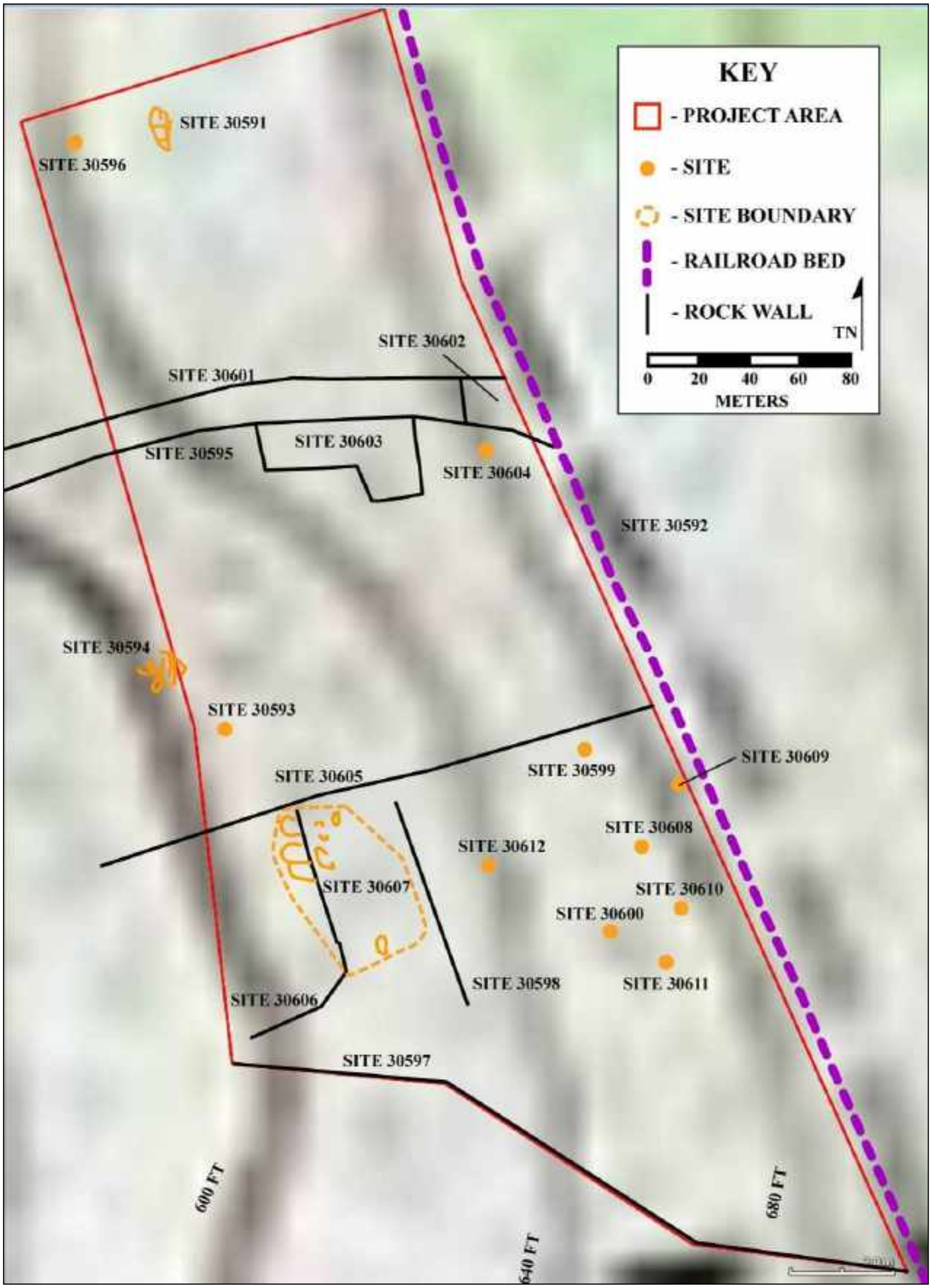

Figure 11: 7.5-Minute Series USGS Topographic Map Showing Locations of Escott and Escott (2018) AIS Project Area Archaeological Sites (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

26. Escott & Escott 2020. SCS conducted an archaeological inventory survey on a 73.122-acre portion of the current project area in Parcel 016, 017 (por.), 018, and 019 to identify all archaeological historic properties present on the project area, and to update previous archaeological documentation (see Figure 10).

Seventeen of the twenty-one sites previously identified in Hammatt et al. (1992) were located during the course of the archaeological inventory survey study (Figure 10 and Table 5). Two of the previously documented sites (Site 10020 and Site 10034) relocated by SCS are natural bedrock outcrops and one site former burial site (Site 10012). The burials at Site 10012 were reinterred off-project in 1983.

The four remaining previously documented sites (Sites 10017, 10033, 10049, and 10071) were bulldozed prior to the SCS fieldwork and the remains of the sites are no longer present on the ground surface. Three previously undocumented sites were also recorded, including a portion of the railroad berm (Site 30592), a small coffee shed enclosure (31181), and several ranch walls (31182). A single petroglyph on a loose cobble was recorded as Isolated Find 1 (IF-1).

A total of 21 sites, 17 previously documented and four newly documented, were identified on the project area and are documented in this report. Two of the sites (Site 10020 and Site 10034) were determined to be natural geological features. Six of the sites were determined to be pre-Contact era, three associated with habitation, one with agriculture, a single petroglyph site, and one single feature site (Site 10012) formerly contained two burials. Twelve of the sites were determined to be Historic era sites, the majority associated with coffee agriculture and cattle ranching. Two Historic era habitation sites were also documented in the AIS study. One site (Site 10015) was determined to be a short segment of modern bulldozer road.

The burials at Site 10012 were removed and reinterred off-project prior to 1983. The site was further excavated to ensure that all *iwi* had been removed. The site was then back-filled and leveled by bulldozer.

Table 5: Inventory of Escott & Escott (2020) Archaeological Sites.

SIHP#	TYPE	FUNCTION	AGE
10011	Platform	Ag. Clearing	Pre-Contact
10012	Platform & Wall	Burial	Prehistoric
10013	Enclosure & Lava Tube	Habitation	Pre-Contact
10015	Bulldozer Road	Transportation	Modern
10017	Platform	Cattle Ramp	Historic
10018	Enclosure	Agricultural	Historic
10019	6 Rock Mounds	Ag. Clearing	Historic
10020	Bedrock Outcrop	Geological Feature	Natural
10031	Enclosure Wall	Agriculture	Historic
10033	Planting Complex	Coffee Ag	Historic
10034	Bedrock Outcrop	Geological Feature	Natural
10049	Terraces	Agriculture	Historic
10067	Terraces	Habitation	Prehistoric
10068	Enclosure	Habitation	Prehistoric
10069	Modified Bluff/Platform	Habitation	Historic
10070	U-Shape Enclosure	Agriculture	Historic
10071	Platform	Habitation	Prehistoric
10072	Modified Bluff	Ag. Clearing	Pre-Contact
10073	Platforms	Ranching/Ag.	Historic
10074	Enclosure	Coffee Work Shed	Historic
10075	Enclosure	Pig Pen	Historic
30592	Railroad Berm	Transportation	Historic
IF-1	Petroglyph	Marker	Prehistoric
31181	Enclosure	Coffee Work Shed	Historic
31182	Rock Walls	Ranching & Agri	Historic

* Site numbers are preceded by the prefix 50-10-37-.

CULTURAL INFORMANT INTERVIEWS

Consultation was sought from Jordan Kea Calpito, SHPD Burial Sites Specialist; Kamakana Ferreira, OHA Compliance Officer; Nicole Lui, cultural descendant, Sean Naleimaile, State Historic Preservation Division (SHPD) Hawai‘i Island Archaeologist; Kekoa Nezara, Kona Hawaiian Civic Club President; Shane Nelson, OHA West Hawai‘i Representative; and J, Curtis Tyler III, cultural descendant (Table 4). Consultation was also conducted via telephone with Gregg Kashiwa who served as project property manager for parcels 016 and 017 in the early 1980s.

Table 4: Individuals Responses to CIA Consultation Request.

Name	Affiliation	Responded	Has Knowledge	Cultural Practices
Jordan Kea Calpito	SHPD Burial Sites Specialist	No	-	-
Kamakana Ferreira	OHA Compliance Officer	No	-	-
Gregg Kashiwa	Former Property Manager	Yes	Yes	No
Nicloe Lui	Cultural Descendant	Yes	Yes	No
Sean Naleimaile	SHPD Archaeologist	No	-	-
Kekoa Nazara	Kona Hawaiian Civic Club	Yes	Some	No
Shane Nelson	OHA West Hawai‘i Rep.	No	-	-
J. Curtis Tyler III	Cultural Descend	Yes	Yes	No

GREGG KASHIWA CONSULTATION

Gregg Kashiwa was interviewed by phone on April 19, 2016. Mr. Kashiwa was the project property manager for parcels 016 and 017 in the early 1980s and was present during AIS work documented in the Hammatt et al. (1992). He is originally from O‘ahu but lived in Kona for several decades. Mr. Kashiwa remembered that the 5-acre portion of Parcel 017 in the southeast portion of the project area was excluded from the original AIS because the property owners were planning to give the five acres to a group to use as an agricultural preserve. The five acres and the property below (to the west) had already been bulldozed for agricultural use. Mr. Kashiwa knew that there were ranch walls and Historic era agricultural features on the project area, but did not know how they were used, as they were no longer in use during his time in Kona. He also remembered the old railroad bed and berm and that there was a small railroad stop along the track just south of the project area.

SUMMARY

The "level of effort undertaken" to identify potential effect by a project to cultural resources, places or beliefs (OEQC 1997) has not been officially defined and is left up to the investigator. A good faith effort can mean contacting agencies by letter, interviewing people who may be affected by the project or who know its history, research identifying sensitive areas and previous land use, holding meetings in which the public is invited to testify, notifying the community through the media, and other appropriate strategies based on the type of project being proposed and its impact potential.

In the case of the present parcel, consultation was sought from Jordan Kea Calpito, SHPD Burial Sites Specialist; Kamakana Ferreira, OHA Compliance Officer; Nicole Lui, cultural descendant, Sean Naleimaile, State Historic Preservation Division (SHPD) Hawaiʻi Island Archaeologist; Kekoa Nezara, Kona Hawaiian Civic Club President; Shane Nelson, OHA West Hawaiʻi Representative; and J, Curtis Tyler III, cultural descendant. Consultation was also conducted via telephone with Gregg Kashiwa who served as project property manager for parcels 016 and 017 in the early 1980s.

Public notices (see Appendix A) were placed in the December 2019 issue of the Office of Hawaiian Affairs (OHA) Ka Wai Ola Newspaper. Public notices were also published in the Honolulu Star-Advertiser, and the West Hawaiʻi Today on November 17th, 20th and 21st.

Historical and cultural source materials were extensively used and can be found listed in the References Cited portion of the report. Such scholars as Iʻi, Kamakau, Chinen, Kameʻeleihiwa, Fornander, Kuykendall, Kelly, Handy and Handy, Pukuʻi and Elbert, Thrum, and Cordy have contributed, and continue to contribute to our knowledge and understanding of Hawaiʻi, past and present. The works of these and other authors were consulted and incorporated in the report where appropriate. Land use document research was supplied by the Waihona ʻAina 2007 Data Base.

CIA INQUIRY RESPONSE

As suggested in the "Guidelines for Accessing Cultural Impacts" (OEQC 1997), CIAs incorporating personal interviews should include ethnographic and oral history interview procedures, circumstances attending the interviews, as well as the results of this consultation. It is also permissible to include organizations with individuals familiar with cultural practices and features associated with the project area.

As stated above, consultation was sought from the Office of Hawaiian Affairs, the SHPD Burial Sites Branch, the SHPD Archaeology Branch, families associated with Kaloa 5th Ahupuaʻa, and long-time Kona residents.

There were no responses to the public notices published in the OHA Ka Wai Ola, West Hawaiʻi Today or the Honolulu Star-Advertiser newspapers. J. Curtis Tyler III, Nicole Lui and Greg Kashiwa did provide information concerning lands of Hōlualoa 1st Ahupuaʻa. There were no past or ongoing cultural practices identified with lands of the current project area.

An analysis of the potential effect of the proposed construction of residences on cultural resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place is a requirement of the OEQC (No. 10, 1997). Based on historical research and responses from the above listed contacts, it is reasonable to conclude that, there will be no traditional cultural practices affected and there will be no direct adverse effect upon cultural practices or beliefs in the broader project area region.

CULTURAL ASSESSMEMNT

Based on the results of an Archaeological Assessment of the project area, the results of previous archaeological studies, as well as organizational response, individual cultural informant responses, and archival research, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to gathering, access or other customary activities will not be affected by development activities on this parcel. The proposed project is not a location for past or ongoing cultural practices. The proposed undertaking will not produce adverse effects to any native Hawaiian cultural practices within the project area or in the broader region.

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APPENDIX A: PUBLIC NOTICES AND AFFIDAVITS

HOLUALOA

Information requested by Scientific Consultant Services, Inc. of past and ongoing cultural practices on 76.122 acres of land in Hōlualoa 1st Ahupua'a, North Kona District, Island of Hawai'i, TMK: (3) 7-6-021:016, 017, 018 and 019. Please respond within 30 days to Glenn Escott at (808) 938-0968 or at ggescott@ yahoo.com.

December 2019 Ka Wai Ola Public Notice.

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
CULTURAL IMPACT ASSESSMENT NOTICE - WHEELOCK, KAILUA KONA HI

STATE OF HAWAII)
) SS.
City and County of Honolulu)

Doc. Date: NOV 21 2019 # Pages: 1

Notary Name: COLLEEN E. SORANAKA First Judicial Circuit

Doc. Description: Affidavit of Publication

NOV 21 2019

Notary Signature Date

COLLEEN E. SORANAKA NOTARY PUBLIC No. 90-263 STATE OF HAWAII

Lisa Sakakida being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the

Honolulu Star-Advertiser	3	times on:
11/17, 11/20, 11/21/2019		
MidWeek	0	times on:
The Garden Island	0	times on:
Hawaii Tribune-Herald	0	times on:
West Hawaii Today	0	times on:
Other Publications:	0	times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Lisa Sakakida

Subscribed to and sworn before me this 21 day of November A.D. 20 19

Colleen E. Soranaka, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Jan 06 2020

Ad # 0001245900

COLLEEN E. SORANAKA NOTARY PUBLIC No. 90-263 STATE OF HAWAII

ICSP NO.:

CULTURAL IMPACT ASSESSMENT NOTICE

Information requested by Scientific Consultant Services Inc of past and ongoing cultural practices on 76.122 acres of land in Honuaino 1st Ahupua'a, North Kona District, Island of Hawaii, TMK: (3) 7-6-021: 016, 017, 018 and 019. Please respond within 30 days to Glenn Escott at (808) 938-0968 or at gescott@yahoo.com.
(SA1245900 11/17, 11/20, 11/21/19)

November 2019 Honolulu Star-Advertiser Public Notice.

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
CULTURAL IMPACT ASSESSMENT NOTICE - WHEELOCK, KAILUA KONA III

STATE OF HAWAII)
) SS.
City and County of Honolulu)

Doc. Date: NOV 21 2019 # Pages: 1
Notary Name: COLLEEN E. SORANAKA First Judicial Circuit
Doc. Description: Affidavit of Publication

NOV 21 2019
Notary Signature Date

COLLEEN E. SORANAKA
NOTARY PUBLIC
No. 90-263
STATE OF HAWAII

Lisa Sakakida being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the

Honolulu Star-Advertiser	0	times on:
MidWeek	0	times on:
The Garden Island	0	times on:
Hawaii Tribune-Herald	0	times on:
West Hawaii Today	3	times on:

11/17, 11/20, 11/21/2019

Other Publications: 0 times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Lisa Sakakida

Subscribed to and sworn before me this 21 day of November A.D. 20 19

Colleen E. Soranaka, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Jan 06 2020

Ad # 0001245902

COLLEEN E. SORANAKA
NOTARY PUBLIC
No. 90-263
STATE OF HAWAII

CULTURAL IMPACT ASSESSMENT NOTICE

Information requested by Scientific Consultant Services, Inc. of past and ongoing cultural practices on 76.122 acres of land in Holualoa 1st Ahupua'a, North Kona District, Island of Hawai'i, TMK: (3) 7-6-021: 016, 017, 018 and 019. Please respond within 30 days to Glenn Escott at (808) 938-0968 or at ggescott@yahoo.com.
(WHT1245902 11/17, 11/20, 11/21/19)

ICSP NO.:

November 2019 West Hawai'i Today Public Notice.

APPENDIX 5: Archaeological Inventory Survey Reports

SCS Project Number 1871-2

ARCHAEOLOGICAL INVENTORY SURVEY REPORT FOR 5.0 ACRES LOCATED IN HŌLUALOA 1ST AHUPUA‘A, NORTH KONA DISTRICT, HAWAI‘I ISLAND, HAWAI‘I [TMK: (3) 7-6-021:017 POR.]

Prepared By:

Glenn G. Escott, M.A.
&
Suzan Escott, B.A.

MAY 2018
FINAL

Prepared for:
East West Realty
700 Bishop St. Suite 1000
Honolulu, HI 96813-4112

SCIENTIFIC CONSULTANT SERVICES Inc.

1347 Kapi‘olani Boulevard, Suite 408 Honolulu, HI 96814
Hawai‘i Island Office: PO Box 155 Kea‘au, HI 96749

ABSTRACT

At the request of property owner Kona Three, LLC, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey (AIS) of a 5.0-acre portion of land TMK: (3)-7-6-021:017 located in Hōlualoa 1st Ahupua‘a, North Kona District, Island of Hawai‘i, Hawai‘i. The owner is proposing to develop the property and contracted the archaeological study in anticipation of County of Hawai‘i Planning Department application requirements. The owner’s contact mailing address is 181 Kalanianaole Street Hilo, HI 96720-4703.

Prior to fieldwork, a search of geological maps, aerial photos, historical maps, historical documents, and archaeological reports was conducted. A pedestrian survey and site recording were conducted in March and April 2016 by Joe Farrugia, B.A., Suzan Escott, B.A, Tomasi Patolo, B.A., and Glenn Escott, M.A. A series of north/south transects spaced 2.0 to 4.0 meters apart were walked across the entire project area. Ground cover consisted of tall California and Guinea grass, *koa haole*, *kiawe*, and several *kukui* nut trees. Ground visibility was fair to poor.

The project area lands were used for cattle ranching and commercial agriculture from the early 1900s until the present. The majority of the project area has been bulldozed. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push pile. Pedestrian survey confirmed the linear bands in the aerial photographs are bulldozer- cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths.

Twenty two newly identified archaeological sites were recorded during the course of the archaeological inventory survey study. The sites are primarily agricultural terraces associated with pre-Contact era to Historic era agriculture. Several rock walls and enclosures are associated with Historic era agriculture and ranching. A pre-Contact era to later post-Contact era lava tube burial and a portion of the old railroad berm were also recorded.

All 22 sites identified during the current AIS study were assessed significant under criterion “d” as they are likely to yield information important to history. The railroad berm is also significant under criteria “a” and “c” as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. The burial is also significant criterion “e” as it has important value to Hawaiian people and people of other ethnic backgrounds in the state. The burial is recommended for preservation in place with preservation treatments to be outlined in a Burial Site Component of a Preservation Plan (BSCPP). The railroad berm is recommended for preservation with preservation measures to be outlined in an archaeological preservation.

Archaeological monitoring is recommended for initial grubbing within the five-acre project area and for any proposed ground disturbance in the vicinity of Site 30592 and Site 30593 to ensure interim construction preservation measures are in place and to prevent disturbance of the two archaeological sites.

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INTRODUCTION

At the request of East West Realty, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey (AIS) of a 5.0-acre portion of TMK: (3)-7-6-021:017 located in Hōlualoa 1st Ahupuaʻa, North Kona District, Island of Hawaiʻi, Hawaiʻi (Figure 1 and Figure 2). The owner is proposing to develop the property and contracted the archaeological study as in anticipation of County of Hawaiʻi Planning Department application requirements. The project area is bounded on the north and west by undeveloped cattle pasture, on the south by a seasonal gulch, and on the west by developed residential and farm land (Figure 3). The project area lands were used for cattle pasture and agriculture from the early 1900s to the present. The property is owned by Kona Three, LLC. The owner's mailing address is 181 Kalanianaole Street Hilo, HI 96720-4703.

METHODS

The archaeological inventory survey was undertaken in accordance with Hawaiʻi Administrative Rules 13§13-284 and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports contained in Hawaiʻi Administrative Rules 13§13-276.

ARCHIVAL METHODS

In addition to referencing available resources at SCS, archival research was conducted in the State Historic Preservation Division (SHPD) report database and library facility (Hilo, HI), the Hawaiʻi County land records office, the *Waihona ʻAina Mahele* database website, Ulukau database website, the Papakilo database website, the Hawaiian collections holdings at the University of Hawaiʻi-Hilo Library, and the Hawaii State Library system. Archival work consisted of research on the history and archaeology of the project area, as well as specific searches of previous archaeological studies in and around the current project area. Historic land use data, land ownership, maps, and narrative information were obtained from the Hawaiʻi County land records office, Hawaiian internet sites, and the University of Hawaiʻi, Hilo.

FIELD METHODS

Inventory survey field work was conducted March and April 2012 (140 Man-hours total) by Joe Farrugia, B.A.; Tomasi Patolo, B.A.; Suzan Escott, B.A.; and Glenn

Escott, M.A. Glenn Escott provided overall project direction and is the principal investigator for this study.

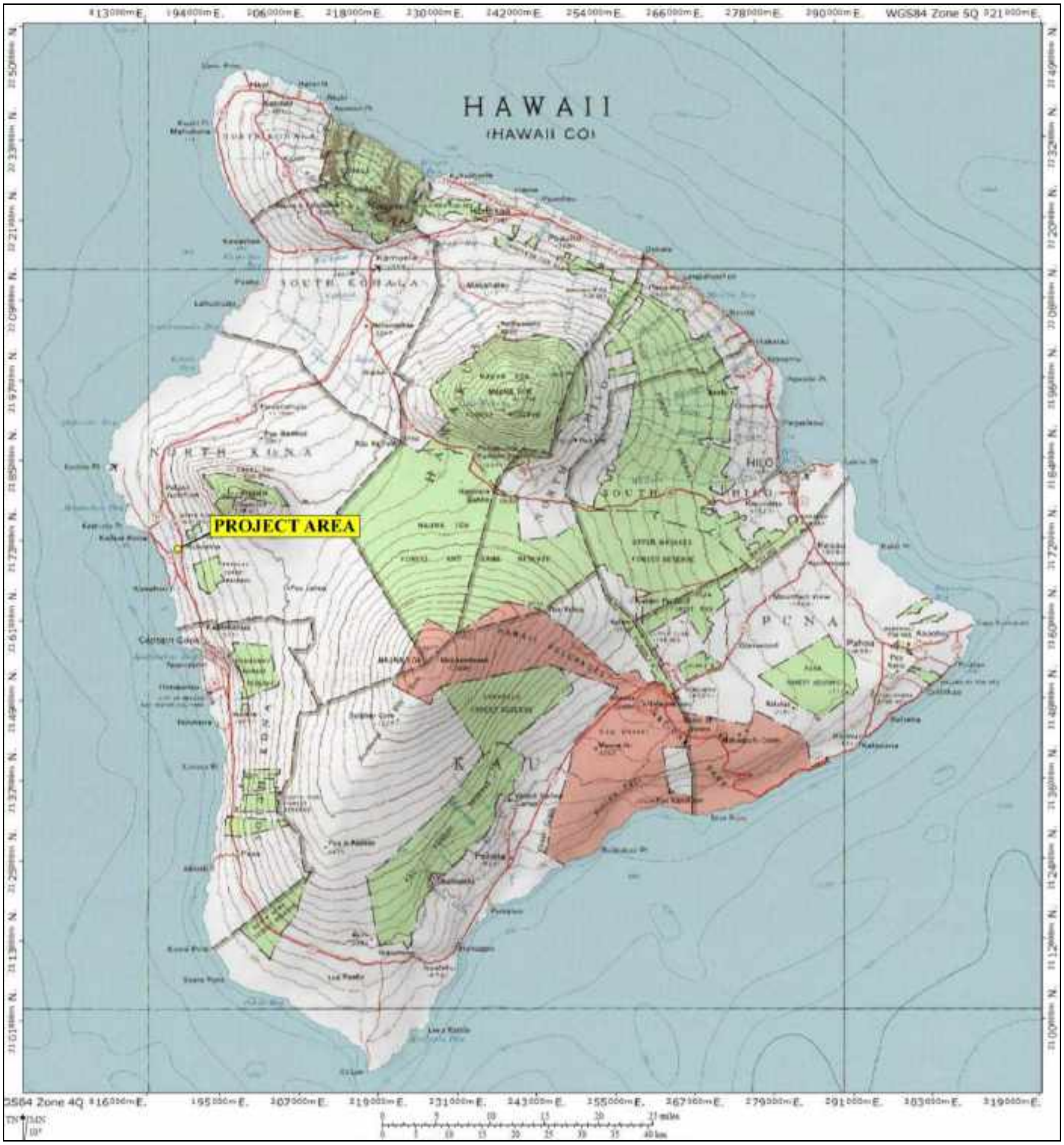

Figure 1: 5,500 K-Series Map of Hawai'i Island Showing Location of Project Area (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

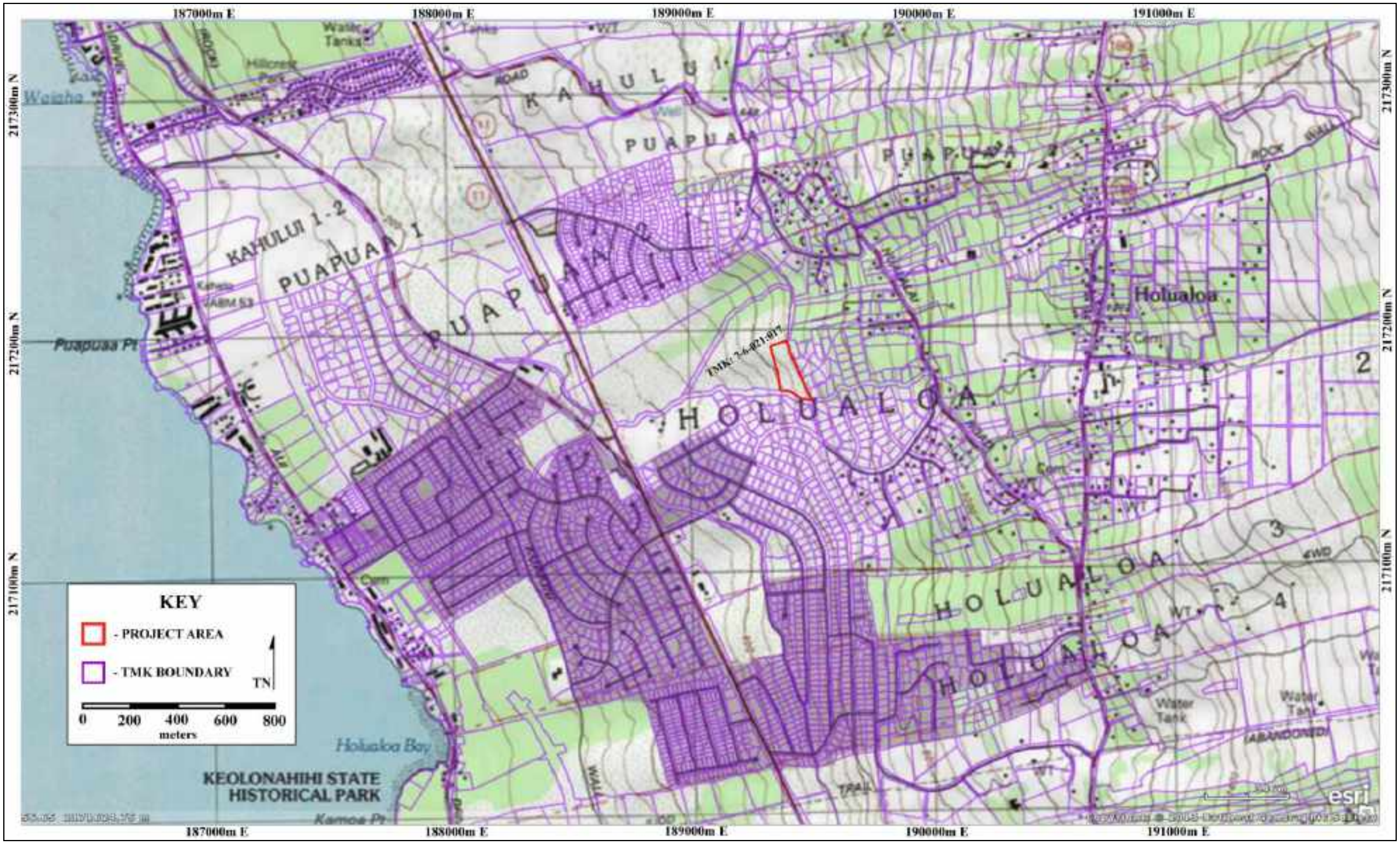

Figure 2: 7.5-Minute Series USGS Topographic Map Showing Location of Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

Figure 3: Aerial Photograph Showing Project Area (within Red Boundary), Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (Google Earth, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

There were three main field components to the Inventory Survey process: pedestrian survey of the entire project area; plotting located sites on a project area map with Global Position System (GPS) Universal Transverse Mercator (UTM) units (Zone 5 North) using WSGS84 datum; and individual site mapping and recording. A series of north/south transects spaced 2.0 to 4.0 meters apart were walked across the entire project area. Ground cover consisted of tall California and Guinea grass, koa haole, kiawe, and a few kukui trees. Ground visibility was fair to poor.

Site boundaries were determined by the aerial extent of features and by feature function and temporal association. Features that were in close proximity to each other and that appeared to have functional and temporal associations suggesting they were constructed and used as a functional set of features--those features were included together as a single site. Features that were beyond twenty to thirty meters away from each other, or that were constructed at very different times, or for different very purposes, were separated into individual sites. Age determinations were expressed in terms of recognized formal eras including pre-Contact era (before 1778), early post-Contact era (1778-1850), Historic era (1851-1965), and Modern era (post-1965). Age was interpreted on the bases of feature construction and artifacts recovered from excavations.

Features at eleven of the twenty two sites were selected for test excavation to determine site function, construction method, and age. Two types of hand excavations, shovel probes (SP) and test units (TU), were used depending on the size of features, percentage to be excavated, percentage of screening, and overall goals of excavation. A total of 29 shovel probes and two test-units were excavated at eleven sites (Table 1).

Table 1: Inventory of Subsurface Testing.

Site #	Site Type	Features	Site Function	Testing
30591	Agricultural Complex	6	Agriculture	SP-1, 2, 3
30594	Agricultural Complex	6	Agriculture	SP-1 & 2
30596	Hearth	1	Food Preparation	TU-1
30599	Platform & Enclosure	2	Ranching/Agriculture	SP-1 & 2, TU-1
30600	Terrace	1	Agriculture	SP-1
30602	Enclosure	1	Ranching/Agriculture	SP-1, 2, 3 & 4
30603	Enclosure	4	Ranching/Agriculture	SP-1 & 2
30604	Agricultural Complex	4	Agriculture	SP-1
30607	Agricultural Complex	7	Agriculture	SP-1 to SP-10
30610	Terrace	1	Agriculture	SP-1
30611	Agricultural Complex	3	Agriculture	SP-1, 2, 3

Test-units were excavated as 0.5 x 1.0 meter or 1.0 x 1.0 meter units, dug in natural stratigraphic layers. These were excavated at features that were thought to have a high potential to yield functional and temporal diagnostic artifacts, and used where vertical control would contribute to this data. Shovel probes (SP) were units that were roughly 0.4 x 0.4 meters square, and were used to examine stratigraphy, and assess the presence or absence of cultural deposits. Test-unit and shovel probe excavations were screened for cultural material through 1/8th inch mesh. Stratigraphic profiles were drawn for test-units.

Disarticulated human skeletal remains were identified within a lava tube during the field survey. The skeletal elements were partially covered in shallow sediment. Sediment was cleared in small increments from a partially covered pelvis to aid in identification. SHPD was notified and approved of the clearing of sediment from the pelvis.

Cultural material was recorded by type on standard SCS excavation forms and collected. Soil colors were recorded using Munsell color charts, soil composition was recorded with the aid of the U.S. Department of Agriculture Soil Survey Manual on standard soil stratigraphy forms, and profiles were drawn. Overview photographs were taken of individual site features, sites, excavations, and the project area using a 1.0 meter measuring tape.

LABORATORY METHODS

Inventory of midden and artifacts collected from the test excavations were weighed and analyzed by layer of provenience within each excavation unit. Appendix A contains a tabular inventory of all artifacts collected during archaeological excavation. Volcanic-glass and basalt debitage was counted and described in terms of core, primary, secondary, interior, exterior, or non-diagnostic flakes.

For all other artifacts, dimensions, weight, count, and diagnostic characteristics were recorded. All artifact data were tabulated. Field notes, maps, cultural material, and photographs pertaining to this project are currently being curated at the SCS facilities on the Island of Hawai‘i.

ORAL INTERVIEW

Gregg Kashiwa was interviewed by phone on April 19, 2016. Mr. Kashiwa was the project property manager for parcels 016 and 017 in the early 1980s and was present during AIS work documented in the Hammatt et al. (1992). He is originally from O‘ahu but lived in Kona for several decades. Mr. Kishawa remembered that the current 5-acre project area was excluded from the original AIS because the property owners were planning to give the five acres to a group to use as an agricultural preserve. The five acres and the property below (to the west) had already been bulldozed for agricultural use. Mr. Kishawa knew that there were ranch walls and Historic era agricultural features on the project area, but did not know how they were used, as they were no longer in use during his time in Kona. He also remembered the old railroad bed and berm and that there was a small railroad stop along the track just south of the project area.

ENVIRONMENTAL SETTING

The current project area consists of an undeveloped 5.0-acre portion of TMK: (3) 7-6-021:017. The project area is situated on fairly steeply sloping land with level areas in between elevation breaks. The project area is between 600 to 680 feet (183 to 207 meters) above mean sea level (amsl). The project area lands are part of a large former cattle ranch and agricultural area that was started in the early 1900s. The lower portion of the project area is still used to pasture cattle. The project area and surrounding lands were bulldozed sometime between the 1940s and 1970s. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push pile (see Figure 3). Pedestrian survey confirmed the linear bands in the aerial photographs are bulldozer-cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths. The former Kona Sugar Company railroad bed is present along the western edge of the project area.

The project area ground surface is a Hualālai lava flow dating between 5,000 and 10,000 years before present (ybp) (Wolfe and Morris 1996). Soil in the project area is Punalu‘u Series (rPYD series) extremely rocky peat with six to twenty percent slopes (Sato 1973:48). The majority of the project area has been bulldozed in the past and the present ground surface is rocky soil.

Rainfall in the project area is very low, less than thirty inches per year. There is a seasonal gulch along the southern edge of the project area. This region is extremely dry, hot, and somewhat barren except for thick California grass (*Urochloa mutica*), Guinea grass (*Megathyrsus maximus*), and some *koa haole* (*Leucaena leucocephala*), *kiawe* (*Prosopis pallida*), and *kukui* nut (*Aleurites moluccana*) trees (Starr Environmental 2016).

HISTORICAL AND CULTURAL CONTEXTS

Kona is divided into two sections: North Kona or *Kona ʻakau*, and; South Kona, or *Kona hema* (Maly 1996). *Kona ʻakau* was further subdivided into north (called *Kekaha*) and south (called *Konakaiʻōpua*) areas, with the division between the two at the *ahupuaʻa* of Keahuolu. The project area is in Hōlualoa 1st Ahupuaʻa (Figure 4) within the area of *Konakaiʻōpua* in *Kona ʻakau*. Hōlualoa means (literally) "long sled course" (Pukui *et al*. 1974:48). Hōlualoa 1st is a traditional *ahupuaʻa* stretching from the ocean to the foot of Hualālai in the uplands. The coastline of Hōlualoa 1st Ahupuaʻa is primarily low rock cliffs.

Very little is recorded of Hōlualoa Ahupuaʻa in traditional oral accounts. *The Heart Stirring Legend of Ka-Miki*, published in the Hawaiian language newspaper *Ka Hoku o Hawaii* and translated by Maly (1993) contains the only description of Hōlualoa. The legend is set in the 13th century but also reflects more recent influences (Maly and Maly 2002: 17). According to the narrative,

> The lands of Hōlualoa were named for the chief of that name; both Hōlualoa and Puapuaʻa were high chiefs, who controlled the lands from mountain to sea, which bear their names… Kaluaokalani served as a priest of Hōlualoa at the temple of Pākiha. This *heiau* was near the contest field of Hōlualoa… The lands of this region are named for various *aliʻi,* all of whom were related. When the chief Hōlualoa took up the challenge against Kepakaʻiliʻula on behalf of the Kona chiefs, Hōlualoa called upon his god *Kālaipāhoa* to assist him in his battle… Hōlualoa was the first chief to call upon the god *Kālaipāhoa*, and this was the beginning of this gods' use by the chiefs of Hawaiʻi [Maly 1993:208-209].

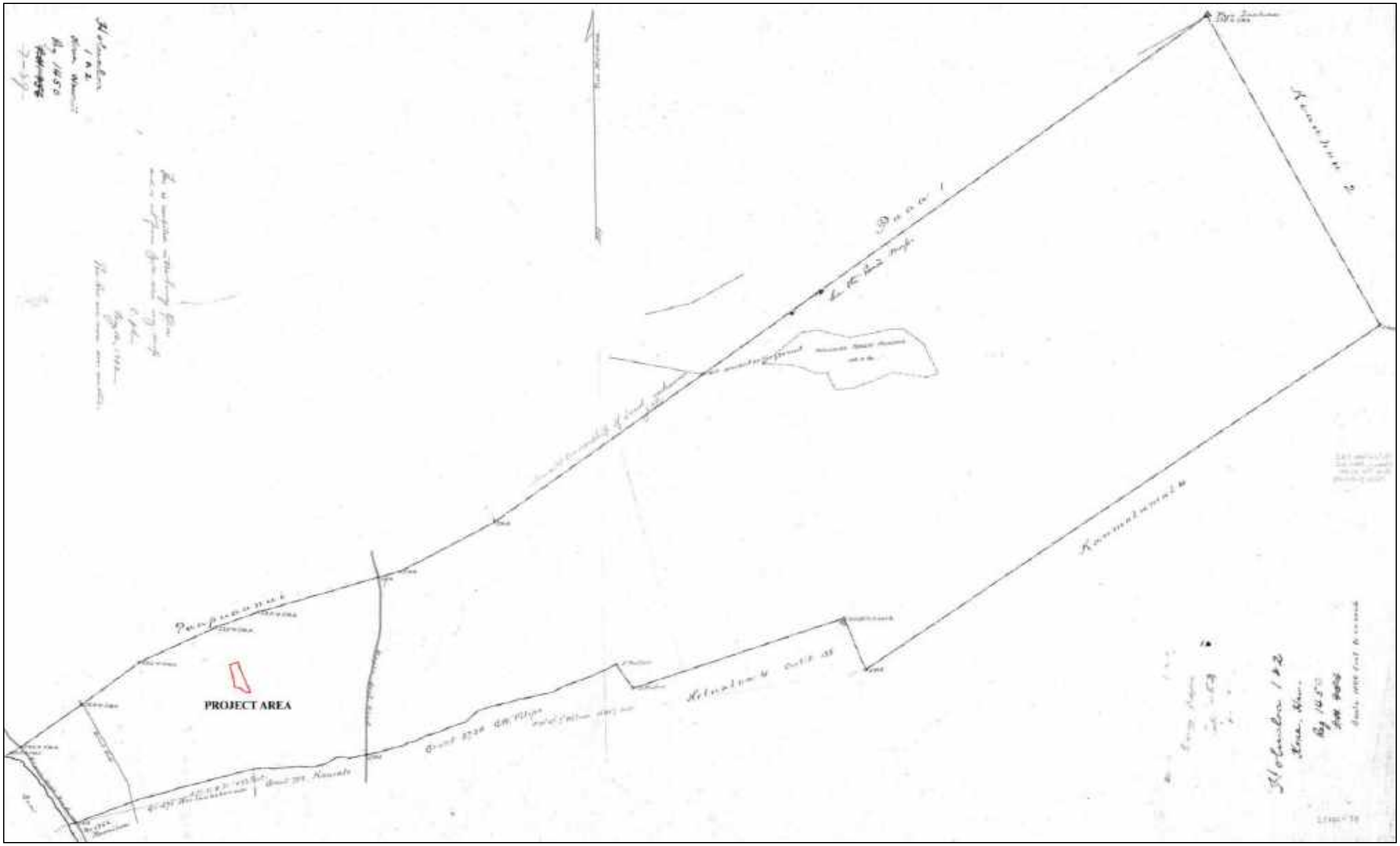

Figure 4: Map of Hōlualoa 1st and 2nd Ahupua‘a Showing Location of Project Area in Red Border (Alexander 1855).

PRE-CONTACT ERA

Hōlualoa, Kona, and much of the leeward side of Hawaiʻi Island, while well populated at the time of European Contact, were settled later than the windward side. Many archaeologists believe that Hawaiʻi Island was first settled around A.D. 1,000 by people sailing from the Marquesas (Athens et al. 2014; Dye 2011; Kahn et al. 2014; Kirch 2011; Kirch and McCoy 2007; McCoy 2005 and 2007; Mulrooney et al. 2011; Reith et al. 2011; Wilmhurst et al. 2011a and 2011b).

An article published in the Journal of Archaeological Science reviewing radiocarbon dates recovered at archaeological sites on the Island of Hawaiʻi suggests that, by relying on only carbon samples from short-lived plant remains, the most reliable dates point to initial Polynesian colonization of Hawaiʻi Island occurring between A.D. 1220 and 1261 (Rieth et al. 2011:2747).

Early settlers founded settlements on the windward shores in likely places such as Waipiʻo, Waimanu, and Hilo Bay. The windward, or *koʻolau* shores receive abundant rainfall and have numerous streams such as the Wailuku, Waiolama, ʻAlenaio, and Wailoa that facilitated agricultural and fishpond production (Maly 1996:3). The windward shores also provide rich benthic and pelagic marine resources.

The dry leeward shores of Hawaiʻi Island presented a very different environment requiring a modified set of subsistence strategies. Archaeologists and historians are uncertain about the exact motives that lead to the establishment and spread of settlements on the leeward side of Hawaiʻi, but some suggest population pressure, dwindling fertile land, growing socio-political stratification, or simply the opportunity for a new start might have lead to new communities developing on the dryer west side of the island (Cordy 2000:130). The process was likely underway soon after initial settlement of Hawaiʻi Island (Cordy 2000).

During this period, areas of permanent habitation were established in Kona (Cordy 1981, 1995; Schilt 1984). Habitation was concentrated along the shoreline and lowland slopes, and informal fields were cleared at higher elevations where rainfall was higher. Agricultural fields and habitation areas expanded across the slopes and coastal area of Hualālai during the period between AD 1200 and 1400 (Burtchard 1995; Cordy 1995).

The development of extensive formal walled fields likely began sometime around AD 1400 to 1600. This period marks the initial construction of the Kona Field System (KFS) (Schilt 1984). The development of the KFS may be, in part, a by-product of the need to extract more subsistence resources from an increasingly limited agricultural base. The population in Kona increased dramatically during this period, as reflected in the abundant radiocarbon dates from habitation structures, shelter caves, and agricultural soils of this period (Burtchard 1995; Haun *et al*. 1998; Schilt 1984). During this period, the stratified chiefdom structure becomes clearly developed in the archaeological record.

Large residential complexes and *heiau* reflect the segregation of places and power for the growing hierarchy of high and lower chiefs, and ceremonial stewards (Cordy 1981; Haun *et al*. 1998; Hommon 1986). The produce from the formal walled fields were distributed to higher chiefs through a hierarchy of lower chiefs responsible for management and collection of the cultivated and wild resources.

By the time of the Competition Period (AD 1600 to 1800), the royal centers and larger *heiau* were in place, reflecting the growth in power of the rulers and chiefs in the region (Barrera 1971; Hammatt and Folk 1980). Resources may have reached their maximum carrying capacity, resulting in social stress between neighboring groups. Hostility between groups is reflected archaeologically with the development of refuge caves during this period (Schilt 1984). This volatile period was probably accompanied by internal rebellion and territorial annexation (Hommon 1986; Kirch 1985). Royal centers are located at Kailua, Hōlualoa, Kahaluʻu, Kealakekua, and Honaunau (Cordy 1995).

The region of Hōlualoa developed into a royal center in the late 1600s to early 1700s under the reigns of Keakamahana (reigned 1680-1700) and Keakealaniwahine (reigned 1700-1720) (Cordy 2000:244). Many *ʻaliʻi* and *konohiki* residences and numerous religious sites are known to have existed here. The majority of the *heiau* and royal residences were constructed along or near the coast, most notably at Kamoa Point south of the project area. The royal center at Hōlualoa was eclipsed in the second half of the 1700s by the royal center in the Kahaluʻu and Keauhou region.

The Kona Field System

During his travels in the region in 1823 William Ellis noted that the area above and south of Kailua was:

> quite a garden compared with that through which they had passed on first leaving the town. It was generally divided into small fields, about fifteen rods square, fenced with low stone walls, made of fragments of lava which had been gathered from the surface of the enclosures. These fields were planted with bananas, sweet potatoes, mountain taro, tapa trees, melons and sugar cane, flourishing luxuriantly in every direction [Handy 1940:114 and 162].

> Rocky lands in the olden days were walled up all around with big and small stones of the patch until there was a wall about 2 feet high and in the enclosure were but weeds of every kind, amaʻu tree ferns and so on, and then topped well with soil taken from the patch itself to enrich it [Handy 1940:147].

These gardens have been studied in some detail, and are often referred to as the "Kona Field System". Many of the archaeological projects conducted within Kona deal with components of the Kona Field System (Cordy 1995; Newman 1970; Schilt 1984). This area extends north at least to Kaʻu Ahupuaʻa and south to Honaunau, west from the coastline and east to the forested slopes of Hualālai (Cordy 1995). A large portion of this area is designated in the Hawaiʻi SIHP (State Inventory of Historic Places) as Site 50-10-37-6601. The basic characteristics and general locations of the zones within the system as presented in Newman (1970) have been confirmed and elaborated on by more intensive and extensive ethnohistorical investigations (Kelly 1983).

The *kula* zone of the Kona Field System is the area from sea level to 150 m amsl. This lower elevation zone is traditionally associated with habitation and the cultivation of sweet potatoes (*uala*), paper mulberry (*wauke*), and gourds (*ipu*). Agricultural features, such as clearing mounds, planting mounds, planting depressions, modified outcrops, and planting terraces, are common throughout much of this zone (Hammatt and Clark 1980; Hammatt and Folk 1980; Haun *et al*. 1998; Schilt 1984).

Dwellings are often scattered throughout the agricultural portion of the *kula*, but they are commonly concentrated along the shoreline subdivision of the *kula* zone (Cordy 1981). The shoreline zone, extending inland approximately 200 m, was used primarily for permanent habitation and other non-agricultural activities, such as canoe storage, ceremonial and burial practices, recreation, and fishing-related activity.

Royal centers and high chiefly centers were also situated within the shoreline of the *kula*. These complexes include dwellings for rulers, chiefs, and the supporting populace, places of refuge, and other structures. Single, or clustered, burials are also situated in the shoreline, and near-shore *kula* (Han *et al*. 1986; Hammatt and Clark 1980; Hammatt and Meeker 1979). Burials occur in caves, within finely built platforms, cruder rock mounds, and houses in the shoreline, and are more often in the near-shore *kula* (Cordy 1995; Han *et al*. 1986; Schilt 1984; Tainter 1973; Tomonari-Tuggle 1993).

The large, and densely populated, royal centers were situated at several locations along the shoreline between Kailua and Honaunau (Cordy 1995; Tomonari-Tuggle 1993). The residential areas, large and small *heiau*, sporting areas, and burial clusters, are present continuously farther inland than the usual 200 meters for the shoreline habitation portion of the *kula*. Consequently, a variety of non-agricultural features are present in the *kula* near royal centers.

The *kalu'ulu* zone above 150 m amsl is a wetter region above the *kula* where bread fruit and other arboreal crops were cultivated (Kelly 1983). Sweet potatoes (*Ipomoea batatas*), *ti*, (*Cordyline fruticosa*) *wauke* (*Broussonetia papyrifera*), *taro* (*Colocasia esculenta*), and sugar cane (*Saccharum* sp.), planted among the arboreal crops, were mulched with grass (Menzies1920:75-76). The current project area is in the *kalu'ulu* zone.

Above the *kalu'ulu* zone, in the *'apa'a* zone, fields with low stone walls were cultivated with bananas, sweet potatoes, *taro*, *wauke*, melons, *ti* and sugar cane. The *'apa'a* zone was notable for fresh water springs. Above the *'apa'a* zone was the *'ama'u* zone where walled fields were created to grow plantains and bananas. Timber from various tree species was collected from the *'apa'a* zone and the *'ama'u* zone. Bird catching and other forest resources extraction activities were conducted in these upper two zones. Temporary habitations were constructed to be used seasonally when working in the uplands.

In the region, people initially moved into coastal settings *and* more upland settings (*e.g.*, the '*āpa'a* agronomic zone) at the same time, essentially ignoring the drier intermediate zone (except, of course, as a throughway between their gardens and the sea). In this way, the first settlers could immediately plant seedlings in the wetter uplands, knowing the crops would succeed. Permanent settlement would have first been restricted to the coast, but the same people would have also been occupying the uplands (at least temporarily) as well. It is only later that the ‘intermediate zone’(and the *kalu‘ulu* agronomic zone), would have been utilized for planting.

POST-CONTACT ERA

The extensive features of the Kona Field System were exploited and altered during the post-contact era. Walls, *kua‘iwi*, springs, and pathways created generations earlier were used and planted with alien cultigens (coffee, cotton, sugar, citrus, and sisal) and ultimately used as pastures for cattle.

Ranching has its roots in the first cattle and sheep brought to the island in 1793 and 1794 by Vancouver. Two cows, three bulls, five ewes, and five rams were released to prosper in the region of Kealakekua in 1794 (Vancouver 1967:(3)11). Kamehameha placed a ten-year *kapu* on the killing of cattle so that they would have the opportunity to multiply. A 486-acre stone corral was built in the uplands of Lehu‘ula-Honua‘ino, above Kāināliu where they were raised (Bowser 1880, cited in Maly and Maly 2001:285).

Two American captains, William Shaler and Richard Cleveland presented two horses to John Young in 1803. Cleveland later returned with more than 200 horses brought from California. Donkeys, mules and oxen were also imported for transportation and hauling. Goats were also brought to the island and left to multiply in the wild.

By 1813 to 1815 cows began overrunning agricultural fields and became a danger to travelers and residents (Ellis 1963: 291; Wilkes 1970: 204). A number of walls were commissioned to keep feral sheep, goats, and cattle out of agricultural areas and away from homes. By 1848, in Kona District a Great Wall (the Kuakini Wall) was constructed from Lanihau to ‘Ōnouli (Maly and Maly 2001:286).

In 1830 Governor Kuakini moved to oversee and improve government cattle by constructing corrals. Liholiho visited the same year to witness strides made in the nascent cattle ranching industry. It was hoped that the exportation of tallow, hides, and salted beef would supplant the defunct Sandalwood trade as a major source of income. Several ventures related to ranching, including tallow making, tanning, saddle making, and blacksmithing were initiated (Bergin 2004: 156). Cowhide was tanned using the astringent bark of local trees (Wilkes 1970: 218). The lion’s share of commercial enterprises on the island involved supplying whaling ships and the local market with beef.

The changing subsistence and trade regimes developed by incoming European and American settlers, as well as other historical factors, caused a depopulation of the coastal areas of Kona. Ranches were established at middle and upper elevations, and farms were established in the uplands where rainfall was higher and the temperatures were cooler. Cattle ranching and clearing for sugar cane and coffee removed many of the endemic species of plants. The suite of vegetation that existed prior to the pre-Contact era were replaced by *koa haole* (*Leucaen*a *leucocephala*), kiawe (*Prosopis pallida*), and other newly introduced invasive plant species.

Schools, churches, stores, and other businesses were also established in the uplands. During the late 1800s and early 1900s, coastal Kona was no longer the densely populated sociopolitical center it once was. It became a small cluster of houses along the trail from Kailua Bay to Keauhou (Tomonari-Tuggle 1993:15). Homesteads, ranches, and plantations developed in the uplands during this period as reflected in the pattern of Land Commission Awards (LCA) and Land Grants (LG) recorded during the Māhele.

THE MĀHELE

With the coming of the Great Māhele (1848), the Alien Land Ownership Act (1850) and the Kuleana Act (1850), the traditional Hawaiian archetype of land-use was essentially deconstructed and replaced with the European concept of fee-simple land ownership. Article IV of the Board of Commissioners to Quiet Land Titles was passed in December 1845 and began the legal process of private land ownership. Through the Māhele of 1847-48 the Alien Land Ownership Act of 1850 and the Kuleana Act of 1850, land was made available for private ownership.

The Māhele established a board of five commissioners to oversee land claims and to issue patents and leases for valid claims. Kauikeaouli (Kamehameha III) established and ratified laws to protect Hawaiian crown lands as foreigners began claiming ownership of land they were granted permission to use for homes and business interests (Daws 1968:111; Kameʻeleihiwa 1992: 169-70, 176; Kelly 1983: 45; Kuykendall 1938(1): 145 footnote 47, 152, 165-6, 170;). Among other things, foreigners were demanding private ownership of land to secure their island investments (Kameʻeleihiwa 1992: 178; Kuykendall 1938(1): 138, 145, 178, 184, 202, 206, 271).

Under the Māhele and subsequent acts (the Kuleana Act of 1850 and the Alien Land Ownership Act of 1850), the lands of the kingdom of Hawai‘i were divided among the king (crown lands), the *ali‘i* and *konohiki*, and the government. Once lands were thus divided and private ownership was instituted, the *maka‘āinana* (commoners), if they had been made aware of the procedures, were able to claim the plots on which they had been cultivating and living as stipulated in the Kuleana Act (1850). These claims, however, could not include any previously cultivated or presently fallow land, *okipu‘u*, stream fisheries, or many other resources traditionally necessary for survival (Kame‘eleihiwa 1992:295; Kelly 1983:45-76; Kirch and Sahlins 1992 vol.1:3, 135-137, and vol.2:2).

The right of claimants to land was based on the written testimony of at least two witnesses who could corroborate the claimant's long-standing occupation and use of the parcel(s) in question. The claimant might have been awarded a patent for the property, subsequently called Land Commission Awards (LCAs) (Chinen 1961:16).

The Land Commission awarded the majority of Hōlualoa 1st and 2nd Ahupua‘a to Victoria Kamāmalu Ka‘ahumanu IV, *Kahina Nui* of Hawai‘i Island and Crown Princess of Hawai‘i as Land Commission Award (LCA) Number 7713, ‘Apana 43 (Figure 5). Several smaller LCA and Land Grant (LG) properties were also recorded in the upland region of Hōlualoa 1st and 2nd Ahupua‘a (Figure 6). Twenty four Land Commission awards were recorded in Hōlualoa 1st Ahupua‘a, the ahupua‘a where the project area is located (see Figure 6 and Table 2).

All but two of the LC awards (LCA #3660to Munn and LCA #7713 to Kamāmalu) were *mauka* (east) of the current project area. With the exception of these LC awards, the average award was 2.8 acres, most (n=16) were for less than 3.0 acres. Three Land Grants (LG #1592, 1602, and 3630) were also recorded in Hōlualoa 1st and 2nd Ahupua‘a. LG #1592 was a 25.0-acre parcel sold to Kealalio and LG #3630 was a 38.2-acre parcel sold to W.H. Cromwell. Almost all of the awards and grants were used as subsistence and commercial farm land, and some were used to pasture cattle.

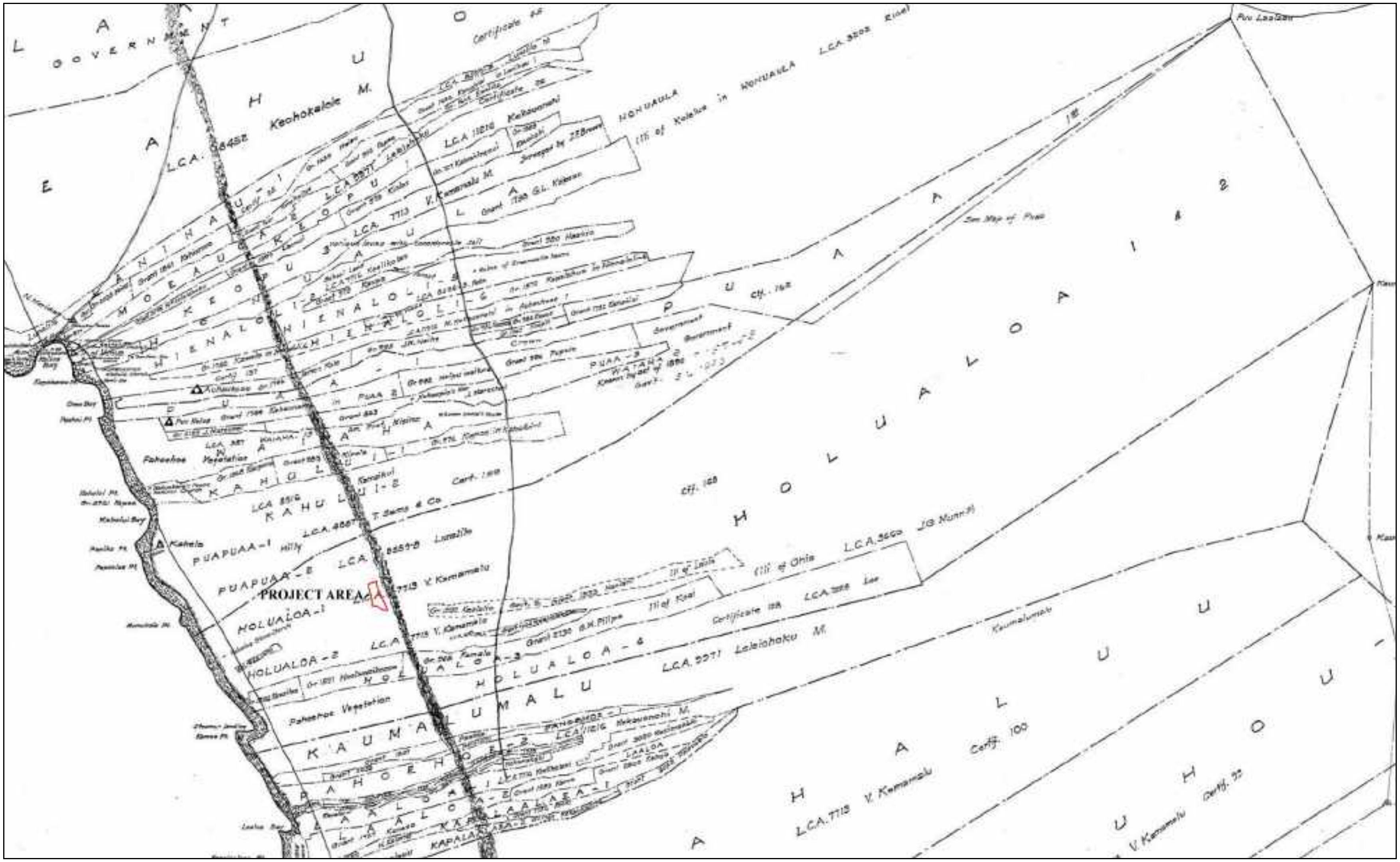

Figure 5: Portion of Kailua Section, North Kona Map Showing Location of LCA 7713 and Project Area in Red Border (Aki 1952).

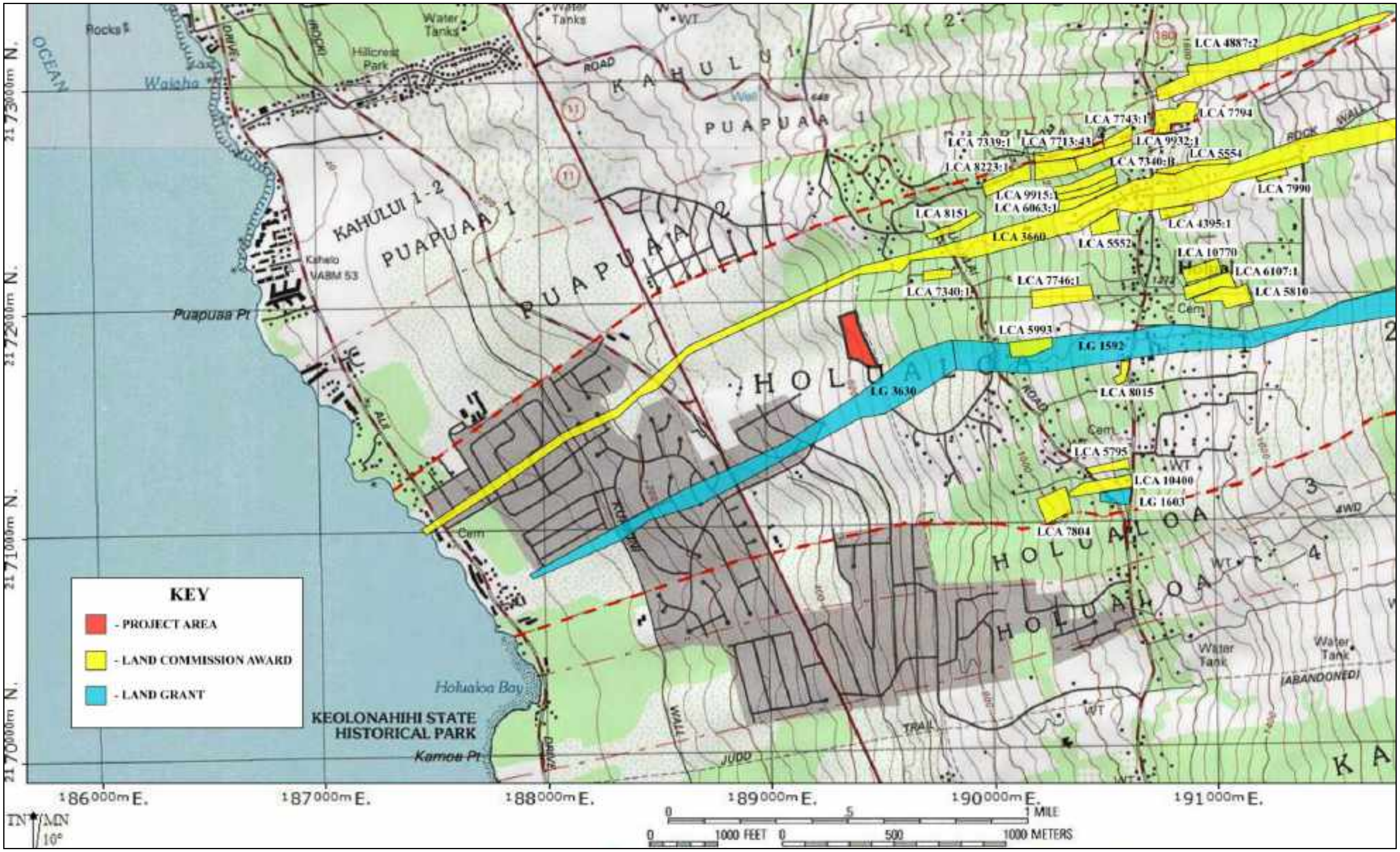

Figure 6: 7.5-Minute Series USGS Topographic Map Showing Location of Land Commission Awards, Land Grants, and the Project Area (National Geographic Topo!, 2003, Kealakekua Quad. Data Sources: National Geographic Society, USGS).

Table 2: Land Commission Awards Recorded in Hōlualoa 1^{st} and 2^{nd} Ahupuaʻa.

LCA#	AWARDED TO	AHUPUAʻA	ACRES
3660	John G. Munn	Hōlualoa 1^{st}	111.5
4395	Kekoi	Hōlualoa 1^{st}	1.7
5552	Kauila	Hōlualoa 1^{st}	1.9
5554	Keawekolohe	Hōlualoa 1^{st}	11.27
5795	Keliikanakaole	Hōlualoa 2^{nd}	2.2
5810	Kaopukauila	Hōlualoa 1^{st}	1.74
5993	Leipalapala	Hōlualoa 2^{nd}	2.0
6063	Hāna	Hōlualoa 1^{st}	2.9
6107	Naai	Hōlualoa 1^{st}	3.94
7339	Kuaana	Hōlualoa 1^{st}	4.15
7340	Kama 2	Hōlualoa 1^{st}	2.5
7340:B	Kama 1	Hōlualoa 1^{st}	1.3
7443	Kalimapaa	Hōlualoa 1^{st}	1.94
7713	Kamamalu	Hōlualoa 1^{st} & Hōlualoa 2^{nd}	Large
7746	Kamahalo	Hōlualoa 1^{st}	5.0
7794	Kauakini	Hōlualoa 1^{st}	1.8
7990	Pupuka	Hōlualoa 1^{st}	1.1
8015	Aipo	Hōlualoa 2^{nd}	1.4
8151	Hehena	Hōlualoa 1^{st}	2.3
8223	Ikaiaka	Hōlualoa 1^{st}	3.5
9915	Limahana	Hōlualoa 1^{st}	2.42
9932	Lumaawe	Hōlualoa 1^{st}	2.98
10770	Puuone	Hōlualoa 1^{st}	3.06
10400	Naaimakaohi	Hōlualoa 1^{st} & Hōlualoa 2^{nd}	3.5

EARLY POST-CONTACT ERA AND HISTORIC ERA

Formal cattle ranching began in the Kona region in the mid-1800s, but wild cattle may have been in the area as early as the late 1700s. The *pā ʻāina* (ʻwalls of the land'), native tenants' wall enclosures, were prevalent in the area, as indicated by their inclusion in many local Māhele testimonies. These were used to mark the boundary of properties and to keep livestock out of crop areas (Kuykendall 1957:318 note 76). Later, cattle ranchers built walls to control their cattle.

> In the early 1840s, cattle were said to be "maintained on the *kula*," a mile from the coast where the ground was "covered with herbage" (Wilkes 1845:4, 95). Cattle, introduced to Kona by Vancouver in 1794, became a nuisance later, when their numbers increased. They fed on the grass of the kula and from time to time on the thatch of Hawaiians' homes and on vegetables in their gardens. The open upland fields, bounded only by low earth and stone walls, were in full cultivation in the 1850s [Kelly 1983:76].

Ranchers leased land below the railroad to graze cattle that they owned (Kelly 1983:111). Higher walls were built in the 1920s and 1930s to control animals. According to Joe Gomes, a longtime rancher in the area,

> Walls about 3 ft high can keep donkeys penned. The usual wall is about 4 ½ ft high and keeps cattle in. For goats you need a wall 6 to 8 ft high. For wild pigs you need a 6 to 8 ft-high wall. They climb over lower walls easily. They come down from the mountains for macadamia nuts and also in mango season for mangoes [Kelly 1983:112].

Sugar was a major crop in Hawaiʻi as early as signing of the Reciprocity Treaty in 1876 (Kelly 1983:90). The sugar industry grew rapidly, and by 1899 the only sugar mill in the Kona area was built by the Kona Sugar Company. Many Chinese worked on the sugar plantations (Kelly 1983:111). They built a railroad in 1901 to haul cane from the fields to their mill site along the Waiʻaha stream, north of the current project area. The stream did not provide enough water to mill cane year round and company failed in 1903. The Kona Sugar Company was bought by James Castel in 1906 and was later purchased by Japanese investors. The Kona Sugar Company continued to operate until 1926.

The railroad was bought by Kona Development Company, and was used for freight, sugarcane and by the Hawaiian Lumber Company. Sugar was grown above the railroad line. The cut sugar was delivered to the tracks with the assistance of gravity, by wire cables and flumes. The rail line was seven miles long and extended from Hōlualoa to Keōpuka (Figure 7).

Cotton was grown on lands below the railroad tracks (Kelly 1983:111). Cotton gins were located south of the project area. Cotton was being picked as late as the 1930s. Other plants grown below the tracks in the dryer lands were sisal and tobacco (Kelly 1983:112).

Traditional Hawaiian subsistence practices, including the rights to collect resources from all ecological zones of one's *ahupuaʻa*, were challenged, restricted, or prevented. As private land owners considered their property off limits to others, cultivation and collection of resources on private land diminished. Individual Hawaiian cultural beliefs, specialized knowledge, and practices associated with the use of the different ecological resource zones also diminished. The development of cattle ranching and commercial crops, such as sugar cane and coffee, removed traditional cultigens and resources from large swaths of the lands of Kona.

The changing subsistence and trade regimes developed by incoming European and American settlers, as well as other historical factors, caused a depopulation of the coastal areas of Kona. Ranches were established at lower elevations and farms were established in the uplands where rainfall was higher and the temperatures were cooler. Schools, churches, stores, and other businesses were also established in the uplands. During the late 1800s and early 1900s, Hōlualoa was no longer the densely populated sociopolitical center it once was. The coastal area of Hōlualoa had become a small cluster of houses along the trail from Kailua Bay to Keauhou.

The project area is just *makai* (west) of the majority of land commission awards and is at the same elevation as portions of the land grants in the region. Based on historic documents, the project area and surrounding lands were likely being used for subsistence and commercial agriculture, as well as for cattle pasture from the mid to late 1800s. The project area might have been used later than surrounding lands because of its steep slopes and very rocky soil, but based on aerial photographs, the project area was bulldozed sometime around the 1950s in preparation for commercial agriculture.

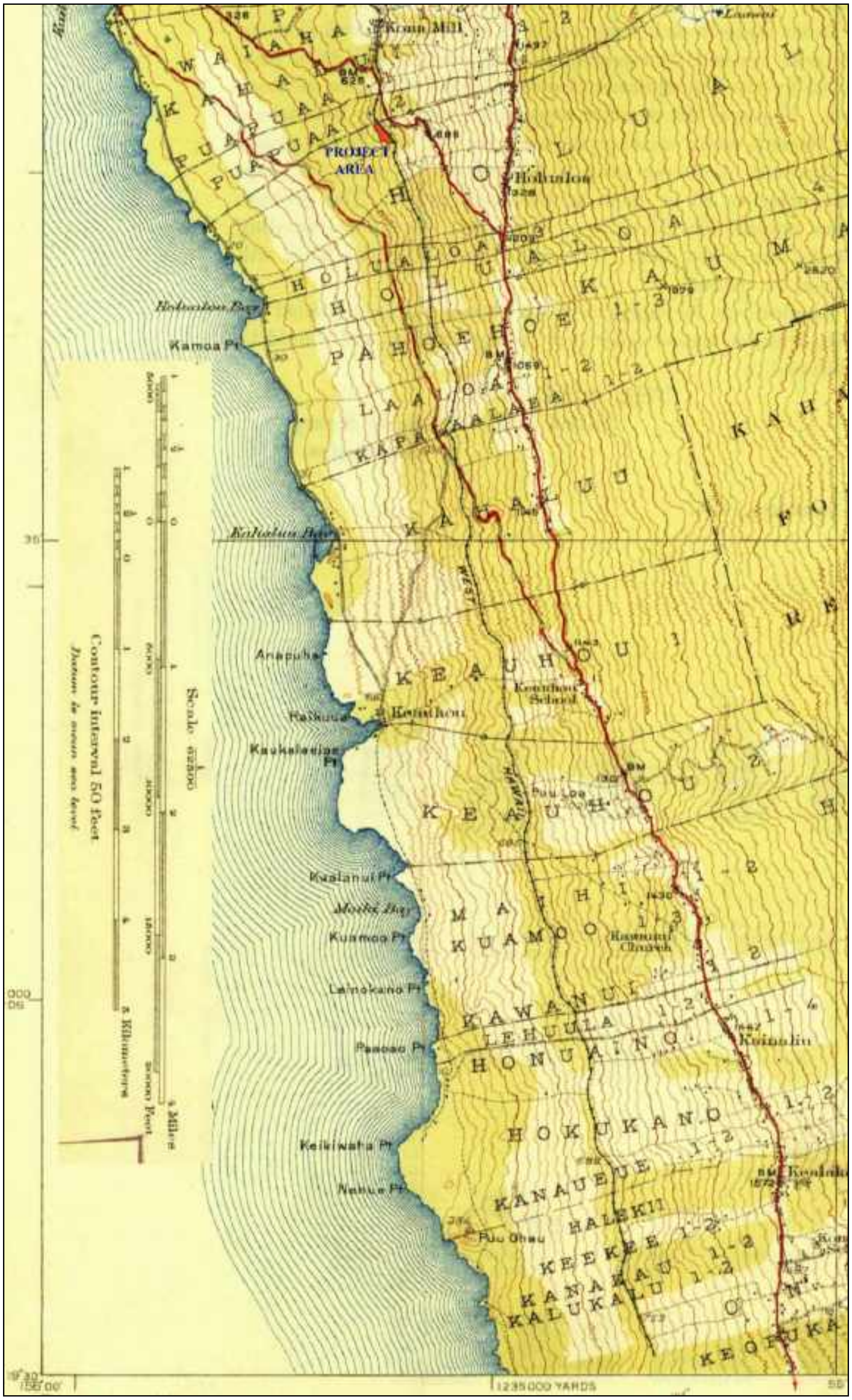

Figure 7: Portion of 15-Minute Series USGS Topographic Map Showing Location of Railroad and Project Area (USGS 1928).

PREVIOUS ARCHAEOLOGICAL STUDIES

There are at least 33 previous archaeological reports for lands near the current project area, including studies in Puapuaʻa 2nd and Hōlualoa 1st, 2nd, and 3rd Ahupuaʻa (Table 4 and Figure 8). The studies were conducted from the coast to roughly 1,460 ft amsl and encompass the *kula* region (0-500 ft), the *kaluʻulu* region (500-1,000 ft), and the lower portions of the *ʻāpaʻa* region (1,000-2,500 ft). Results of the previous archaeological studies are summarized below by elevation: studies numbered 1through 15 in Table 2 and Figure 8 are situated from the coast to Queen Kaʻahumanu Highway (0-360 ft amsl), studies 16 through 21 are located from above the Queen Kaʻahumanu Highway to just below Hualālai Road (306-760 ft amsl), and studies 22 through 24 are above Hualālai Road to just above Māmalahoa Highway (1,100-1,460 ft amsl).

Table 3: Inventory of Previous Archaeological Investigations.

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
1	Landrum et al. 1990	Archaeological Inventory Survey	N/A	46 Sites
1	Calis et al. 2004	Archaeological Data Recovery	N/A	10 Sites
2	Carlson & Rosendahl 1990	Archaeological Inventory Survey	65	64 Sites
3	Haun et al. 1998	Archaeological Inventory Survey	15	31 Sites
4	Hammatt & Folk 1981	Archaeological Survey	20	20 Sites
4	Hammatt et al. 1986	Archaeological Survey & Excavations	20	21 Sites
5	Haun & Henry 2001	Archaeological Data Recovery	1.59	1 Site
6	Escott 2013	Archaeological Inventory Survey	1.962	2 Sites
7	Sinoto 1979	Archaeological Reconnaissance Survey	6	Rock Walls
8	Hammatt 1979b	Archaeological Survey	22	3 Sites
9	Hammatt 1979c	Archaeological Survey	23	39 Sites
10	Conolly & Gunness 1979	Archaeological Reconnaissance Survey	46.8	80 Sites
10	Hammatt 1979a	Archaeological Inventory Survey	46.8	11 Sites
10	Hammatt 1980	Archaeological Survey & Excavation	103	88 Sites
11	Nelson et al. 205	Archaeological Inventory Survey	28	22 Sites
12	Rosendhal 1978	Archaeological Reconnaissance Survey	2.5	1 Site
12	Soehren 1980a	Archaeological	n/a	7 Sites

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
		Reconnaissance Survey		
12	Wolforth et al. 2000	Archaeological Inventory Survey	8	7 Sites
13	Barrera 1995	Archaeological Reconnaissance Survey	17	3 + several ag. mounds
13	Haun & Henry 2000	Archaeological Inventory Survey	17	12 (104 Features, 82 of Which Were Agricultural)
14	Rosendahl 1989	Archaeological Field Inspection	6	Modified Outcrops
15	Schilt 1984	Archaeological Study	17	134 Sites
16	Walker & Rosendahl 1988	Archaeological Reconnaissance Survey	104	67 Sites
16	Graves & Goodfellow 1993	Archaeological Data Recovery	104	58 Sites
16	Maly & Rosendahl 2006	Archaeological Preservation Plan	104	67 Sites
17	Hammatt et al. 1992	Archaeological Survey	174	71 Sites
18	Soehren 1980b	Archaeological Reconnaissance Survey	16	1 Site
19	Rechtman 2006	Archaeological Inventory Survey	1.008	2 Sites
20	Rosendahl 1988	Archaeological Reconnaissance Survey	17	17 Sites
20	Fager & Graves 1993	Archaeological Inventory Survey	17	17 Sites
21	Dircks et al. 2013	Archaeological Inventory Survey	10.266	1 Site (149 Historic to Modern Farming Features)
22	Desilets et al. 2004	Archaeological Inventory Survey	11.7	1 Homestead Features
23	Rechtman 2013		29	24 Sites
24	Clark & Rechtman 2006	Archaeological Inventory Survey	2.7	6 Historic Era Sites

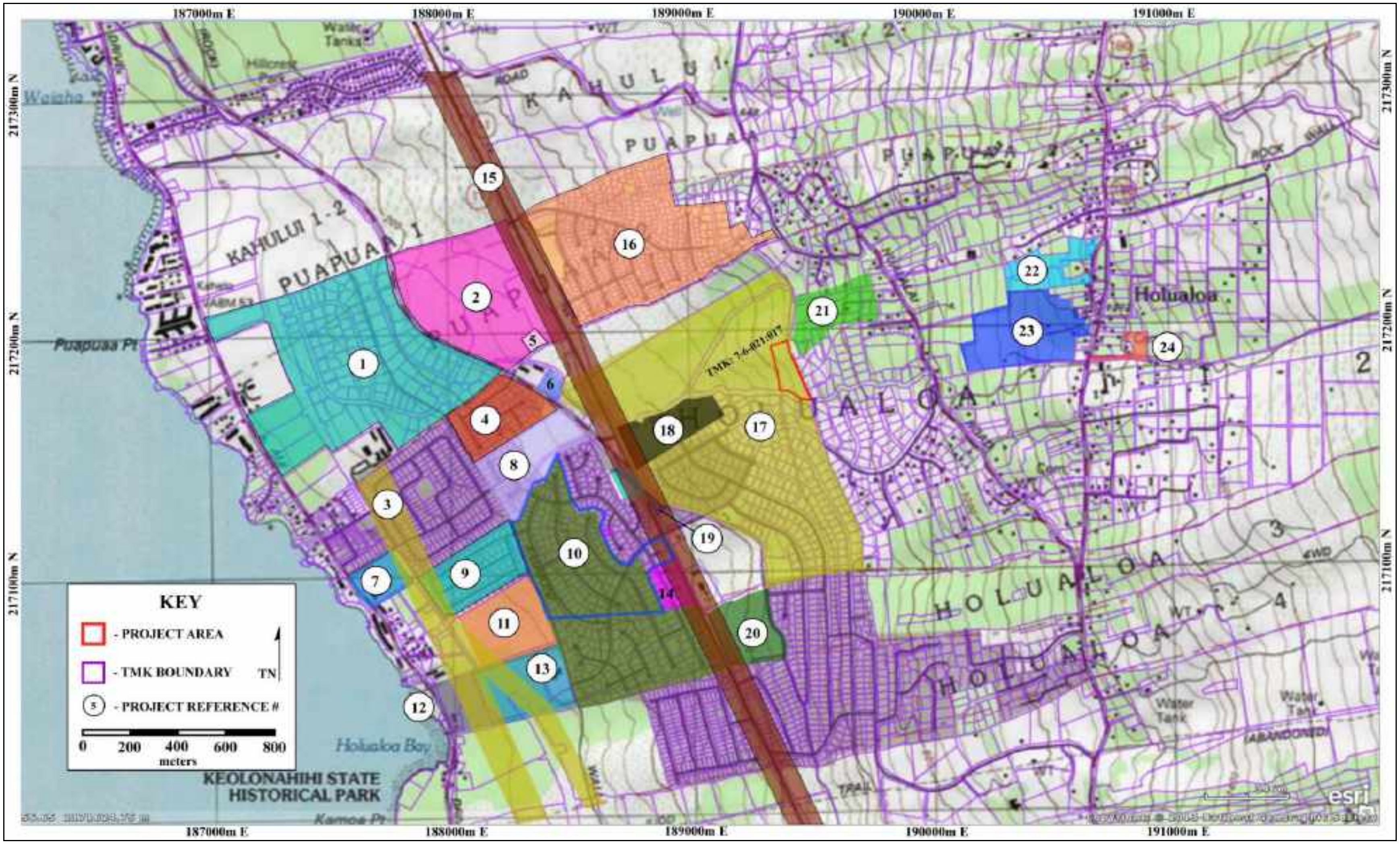

Figure 8: 7.5-Minute Series USGS Topographic Map Showing Location of Previous Archaeological Studies and Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

REGIONAL PREVIOUS ARCHAEOLOGICAL STUDIES

1. Landrum et al. 1990, and Calis et al. 2004. PHRI, Inc. conducted an archaeological inventory survey (Landrum et al. 1990) and SCS, Inc. conducted data recovery investigations (Calis et al. 2004) at the Kahakai development project. The project area is located within the lower elevations of Puapuaʻa 2nd Ahupuaʻa. Pre-Contact era to early post-Contact era cave shelters, agricultural rock clearing mounds, burials, shrines, and a possible heiau were identified during the AIS study. A heiau complex, several burials, and five permanent habitation sites were recommended for preservation. All of the preservation sites are near the coast.

2. Carleson and Rosendahl 1990. PHRI, Inc. conducted an archaeological inventory survey of 65 acres between Kuakini and Queen Kaʻahumanu highways in Puapuaʻa 2nd Ahupuaʻa. Their study recorded 64 archaeological sites including pre-Contact era habitation, agricultural, and burial sites. Seven sites were assessed as significant and recommended for preservation (Carleson and Rosendahl 1990: 34).

3. Haun et al. 1998. PHRI, Inc. conducted an archaeological inventory survey of the proposed Aliʻi Drive corridor through several ahupuaʻa. Numerous pre-Contact era site complexes were recorded in Puapuaʻa 2nd and Hōlualoa 1st through 4th Ahupuaʻa. The site complexes included a large number of agricultural features, as well as habitation, burial, and ceremonial features.

4. Hammatt and Folk 1981, and Hammat et al. 1986. Two archaeological surveys were conducted on a 20-acre parcel of below Kuakini Highway. The first study recorded 20 sites, and the second recorded 21 sites. None of the sites were recommended for preservation (Hammatt and Folk 1981: ii, and Hammatt et al. 1986: 87). The report also recommended that the single documented burial be relocated.

5. Haun & Henry 2001. Haun and Associates conducted an archaeological data recovery study at a c-shaped enclosure located on 1.59 acres of land below Queen Kaʻahumanu Highway

6. Escott 2013. SCS conducted an archaeological study on1.962 acres of land near the intersection of Kuakini and Queen Kaʻahumanu highways. Two historic era ranch walls were recorded during the study.

7. Sinoto 1979. Aki Sinoto recorded several Historic era ranch rock walls on a six acre parcel of land just mauka of Ali‘i Drive.

8. Hammatt 1979b. The Archaeological Research Center, Inc. conducted an archaeological survey of 22 acres just south of Kuakini Highway. Three archaeological sites were recorded during the study. None of the sites were recommended for preservation (Hammatt 1979b: ii, and 10).

9. Hammatt 1979c. The Archaeological Research Center, Inc. conducted an archaeological survey of 23 acres located in the near coastal portion of Hōualoa 1st and 2nd Ahupua‘a. Thirty nine archaeological sites were recorded during the study. The report recommended that all burials, including a known cemetery site be relocated (Hammatt 1979a: 5). None of the remaining sites (pre-Contact era habitation and agriculture sites) were recommended for preservation in place.

10. Conolly and Gunness 1979, and Hammatt 1979a and 1980. The Archaeological Research Center, Inc. conducted an archaeological survey of 103 acres within the near coastal portions of Hōlualoa 1st through 4th Ahupua‘a (Hammatt 1980). One hundred and thirty six archaeological sites were recorded on the project area. They included pre-Contact era habitation, agriculture, burial, and a ceremonial sites. The Hammatt report recommended that a heiau (Site 6661) was significant and should be preserved in place (Hammatt 1980: 4). The report also recommended that the single documented burial be relocated to the perimeter of heiau (Site 6661) and preserved. No other sites were recommended for preservation.

11. Nelson et al. 2005. An archaeological inventory survey was conducted by Rechtman Consulting on 28.0 acres located in the near coastal portion of Hōlualoa 2nd Ahupua‘a. A total of 22 sites containing 150 features were recorded. The sites were primarily pre-Contact era agricultural and habitation sites, though five burial sites, a possible heiau, and a trail were also documented within the project area.

12. Rosendahl 1978, Soehren 1980a, Wolforth et al. 2000. PHRI conducted an archaeological inventory survey of eight acres of coastal Hōlualoa 3rd Ahupua‘a and recorded seven archaeological sites including three Historic era rock walls, three residential sites, and Hikapaia Heiau.

13. Barrera 1995, Haun & Henry 2000. Barrera (1995) recorded a possible burial platform, two habitation site, agricultural rock clearing mounds and modified outcrops during a reconnaissance survey of 17 acres in near coastal Hōlualoa 2nd Ahupuaʻa. Haun and Associates conducted an archaeological inventory survey of the property and recorded 12 sites with 104 features (Haun and Henry 2000:14). The majority of features (n=82) were pre-Contact era agricultural rock clearing mounds. Eleven permanent habitation and one temporary habitation feature were also recorded during the study.

14. Rosendahl 1989. PHRI conducted an archaeological field inspection of 6.0 acres of land just below Queen Kaʻahumanu Highway in Hōlualoa 2nd Ahupuaʻa. Several modified outcrops were recorded in the letter report. There were no other archaeological features identified on the project area.

15. Schilt 1984. The Bishop Museum conducted an archaeological study of the Kuakini Highway Realignment Project located roughly along present day Queen Kaʻahumanu Highway and recorded 39 sites Puapuaʻa 2nd and Hōlualoa 1st and 2nd Ahupuaʻa. Twenty two of the sites were pre-Contact to early post-Contact era agricultural gardens and modified outcrops (rock clearing). There were also traditional habitation platforms and trails, as well as Historic era roads and walls recorded during the study.

16. Walker and Rosendahl 1988, Graves and Goodfellow 1993, and Maly and Rosendahl 2006. An archaeological reconnaissance survey (Walker and Rosendahl 1988), an archaeological data recovery study (Graves and Goodfellow 1993), and an archaeological preservation plan (Maly and Rosendahl 2006) were conducted by PHRI, Inc. for 104 acres in the upland region of Puapuaʻa 2nd Ahupuaʻa. A total of 67 sites were documented within the project area, including traditional (KFS) sites, temporary habitation sites, three burials, and a *heiau*. The archaeological preservation plan recommended that the three burials be relocated to the *heiau* site, and that the *heiau* be preserved as a formal historic preservation area (Maly and Rosendahl 2006).

17. Hammatt et al. 1992. An archaeological survey was conducted by Cultural Surveys Hawaiʻi on 174 acres of land in the upland region of Hōlualoa 1st, 2nd, and 3rd Ahupuaʻa. The project area lands had been heavily bulldozed during the modern era for ranching and agricultural purposes. Despite the bulldozing, seventy one sites were recorded during the study, including temporary habitation features, rock walls, agricultural features, and

three burial sites. Many of the sites were determined to be associated with Historic era ranching and agriculture.

18. Soehren 1980b. Soehren conducted an archaeological reconnaissance survey of 16.0 acres above Queen Kaʻahumanu Highway in the inland region of Hōlualoa 1st Ahupuaʻa (Soehren 1980b).   A single enclosure was identified during the survey.

19. Rechtman 2006. An archaeological inventory survey was conducted by Rechtman Consulting, LLC on a roughly one-acre parcel located *makai* of Queen Kaʻahumanu Highway in Hōlualoa 2nd Ahupuaʻa. Two rock walls were recorded on the project area. The report recommended no further work at the wall sites.

20. M. Rosendahl 1988, Fager & Graves 1993. Fager and Graves (1993) conducted an archaeological inventory survey of 17.0 acres just mauka of Queen Kaʻahumanu Highway in Hōlualoa 3rd Ahupuaʻa. Seventeen sites containing 27 pre-Contact to early post-Contact era agricultural features, including rock mounds, modified outcrops, C-shaped enclosures, terraces, walls, and rock enclosures, were recorded.

21. Dircks et al. 2013. Rechtman Consulting conducted an archaeological inventory survey of 10.266 acres of land located between 840 and 920 ft amsl in Hōlualoa 1st and 2nd Ahupuaʻa. One Historic era to modern era homestead/agriculture site (Miyose Farm) containing 149 features was recorded during the survey.

22. Desilets et al. 2004. Desilets et al. (2004) conducted an archaeological inventory survey of 11.7 acres of land in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. A single site associated with Historic era and modern era homesteads, commercial agriculture (coffee), and ranching was recorded. Features included rock walls, roads, coffee terraces, and buildings.

23. Rechtman 2013. Rechtman Consulting conducted and archaeological inventory survey of 29 acres of land located in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. Twenty four sites were recorded. The majority of the sites were associated with Historic era and modern era homesteads, commercial agriculture. Features included rock walls, roads, and remnants of structures. A single pre-Contact era to early post-Contact era residential and agricultural site was also recorded.

24. Clark & Rechtman 2006. Rechtman Consulting conducted an archaeological inventory survey of 2.7 acres of land located in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. Six sites were recorded, including five ranch walls and an area of coffee terraces.

A number of conclusions can be made from the previous archaeological studies. A primary conclusion is that the majority of habitation features, especially permanent habitation features, are located from the coast to about 360 ft amsl, below the present day Queen Kaʻahumanu Highway. The same is true of ceremonial features, burials, and, to a lesser extent, agricultural features. The density of agricultural features and habitation features, mostly temporary habitation features, in the upland regions between 360 ft amsl and 700 ft amsl is much lower than the site density in the coastal *kula* and lower *kaluʻulu* regions of the KFS. The pre-Contact traditional Hawaiian settlement and agricultural patterns are strongly oriented to the *kula* and lower *kaluʻulu* regions.

Even though cattle ranching and commercial agriculture may have removed some archaeological sites from the ground surface in the *kaluʻulu* region, there appear to be fewer sites than at lower elevations. The majority of sites in the *kaluʻulu* region are KFS agricultural sites including rock clearing mounds, modified outcrops, garden enclosures, and low garden walls. Within the lands of the current project, it is clear that ranching and commercial agricultural practices have removed and damaged many of the pre-Contact era sites from the ground surface (see the Hammatt et al. 1992 summary below). Moreover, many of the sites identified near the current project area are associated with Historic era ranching and commercial agriculture.

A second conclusion is that the establishment of Historic era homesteads, ranches, and commercial agriculture seems to have removed, or obscured, the majority of pre-Contact era sites in the upper *kaluʻulu* and lower *ʻāpaʻa* regions. It might be that pre-Contact uses in these regions did not involve the construction of large or permanent features, as in the lower regions of Kona. It is also likely that Historic era ranching and commercial agriculture in the lower *ʻāpaʻa* region have caused large scale land alterations through the use of bulldozers for pasture and garden. It is possible that traditional features were disassembled to build rock walls and coffee terraces.

CURRENT PROJECT AREA SPECIFIC PREVIOUS ARCHAEOLOGY

Lands of the current AIS study are most closely related to sites identified in the northern portion of the archaeological study conducted by Hammatt et al. (1992). The northern portion of that study encompassed 66.039 acres of land located between 320 to 690 feet (98 to 210 meters) amsl [TMK: (3) 7-6-021:016 and 017] (Figure 9). The current project area is located at the southeastern corner of the northern portion of the Hammatt et al. (1992) project area. In August of 2016, SCS conducted an archaeological sites inspection (Escott 2016) of the 20 previously recorded archaeological sites and the remains of two modern agricultural areas (Table 4) identified in the northern portion of the Hammatt et al. (1992) project area.

The project area and surrounding lands were bulldozed sometime between the 1940s and 1970s. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push pile. Pedestrian survey confirmed that the linear bands in the aerial photographs are bulldozer-cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths.

Seven of the 20 archaeological sites (SIHP #50-10-37-10015, #50-10-37-10017, #50-10-37-10018, #50-10-37-10020, #50-10-37-10033, #50-10-37-10034, and #50-10-37-10049, hereafter abbreviated to the last five digits) were recorded by CSH in tabular format only (Table 2). These are sites identified during the pedestrian survey that were determined to be associated with modern clearing and agricultural activities, or were natural geological features, and no written description or plan maps were generated. Written descriptions of the remaining 13 sites are in the CSH AIS report. Excavations were conducted at ten of the 13 sites. There are plan view figures for four of the 13 sites.

<u>SIHP #10011 (CSH Site 9)</u>

Site 10011 is a rectangular platform on slightly sloping bulldozed pasture land. As described by CSH, the feature has formal construction elements suggesting possible use other than agricultural rock clearing, including larger rocks (small boulders) forming an outer perimeter with smaller rocs (cobbles) forming the interior top surface. The outer perimeter is stacked one to two courses high and is roughly faced along the south side. The top surface of the platform is a slightly uneven and level rock paving.

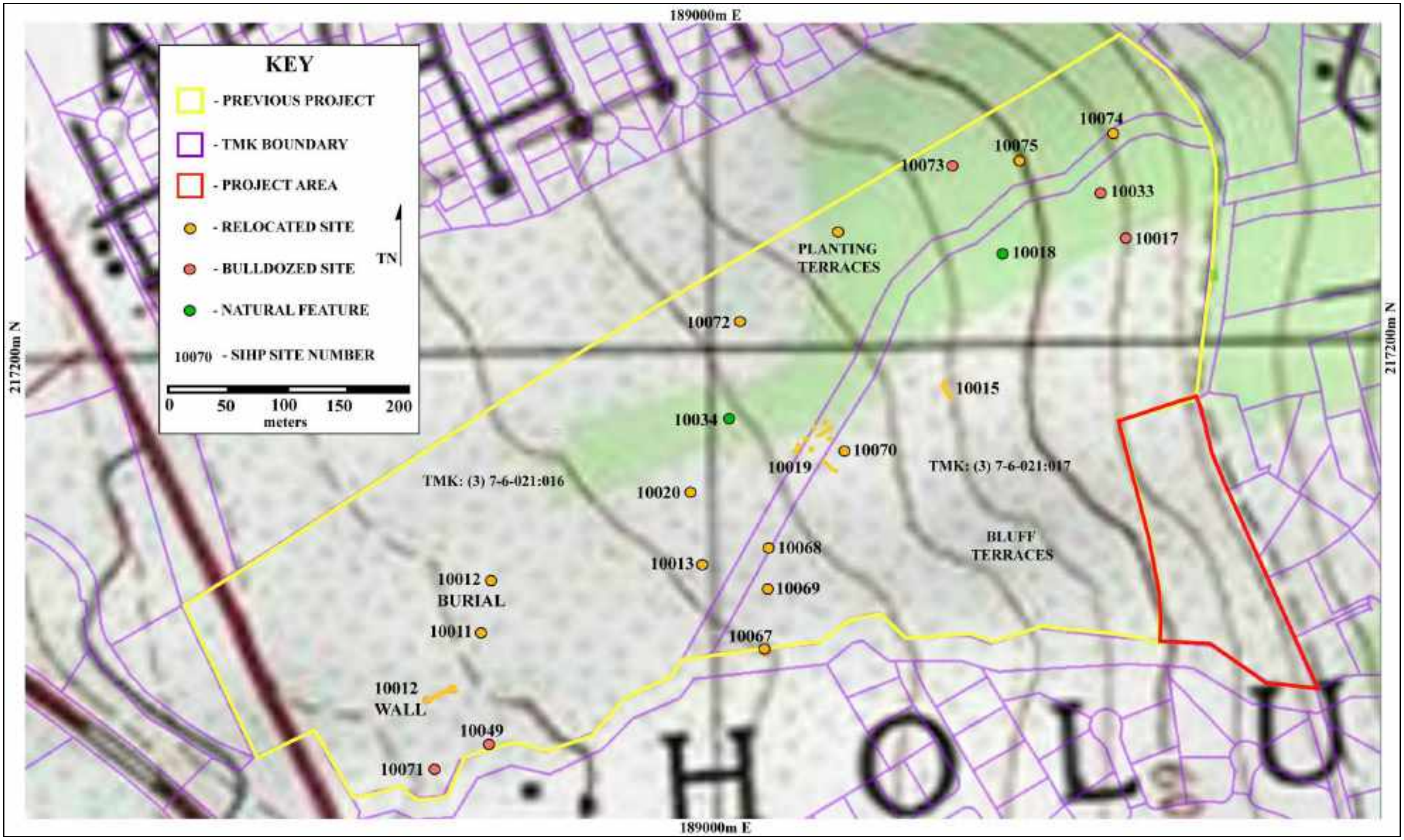

Figure 9: 7.5-Minute Series USGS Topographic Map Showing Location of Northern Portion of Hammatt et al. (1992) Sites and Current Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

Table 4: Inventory of Hammatt et al. (1992) Archaeological Sites Inspection and Assessment Results.

SIHP#	CSH Site#	Type	Function	Age	Excavation	Level of AIS Recording	Site Assessment
10011	9	Platform	Ag. Clearing	Prehistoric	Tested	Description	AIS Site Description Correct
10012	10	Platform & Wall	Burial	Prehistoric	Excavated	Description, Planview, & Profiles	AIS Site Description Correct
10013	11	Enclosure & Lava Tube	Habitation	Prehistoric	Excavated	Description & Planview	AIS Site Description Correct
10015	13	Terrace	Road Bed	Historic	No	Tabular	AIS Site Description Correct
10017	15	Platform	Cattle Ramp	Historic	No	Tabular	Bulldozed – No Longer Present
10018	16	Enclosure	Agricultural	Historic	No	Tabular	Natural Bedrock Outcrop
10019	17	6 Rock Mounds	Ag. Clearing	Historic	Tested	Description	AIS Site Description Correct
10020	18	Platform	Ag. Clearing	Historic	No	Tabular	Natural Bedrock Outcrop
10033	112	Planting Complex	Coffee Ag	Historic	No	Tabular	Bulldozed – No Longer Present
10034	113	Platform	Ag. Clearing	Historic	No	Tabular	AIS Site Description Correct
10049	216	Terraces	Agriculture	Historic	No	Tabular	Bulldozed – No Longer Present
10067	232	Terraces	Habitation	Prehistoric	Tested	Description	AIS Site Description Correct
10068	233	Enclosure	Habitation	Prehistoric	Tested	Description & Planview	AIS Site Description Correct
10069	234	Modified Bluff/Platform	Habitation	Historic	Tested	Description	AIS Site Description Correct
10070	235	U-Shape Enclosure	Agriculture	Historic	Tested	Description	AIS Site Description Correct
10071	237	Platform	Habitation	Prehistoric	No	Description	Relocated - Bulldozed
10072	238	Modified Bluff	Ag. Clearing	Historic	Tested	Description	AIS Site Description Likely Correct
10073	239	Platforms	Ranching/Ag.	Historic	No	Description	Relocated - Bulldozed
10074	240	Enclosure	Coffee Work Shed	Historic	Tested	Description	AIS Site Description Likely Correct
10075	241	Enclosure	Pig Pen	Historic	No	Description, Planview, & Profile	AIS Site Description Likely Correct
		Historic Planting Terraces	Agriculture	Modern	No	On Project Map	AIS Site Description Likely Correct
		Bluff Terraces	Agriculture	Modern	No	On Project Map	AIS Description Correct

CSH excavated a 1.5 m wide trench through the platform and recovered three cowrie shells, suggesting the platform is a rock clearing mound. The location of the trench within the feature, the length of the trench, and the methods used to recover cultural material are not described in the CSH AIS. While the form, construction method, location of the feature suggest it is a temporary habitation feature or a feature used for activities associated with agriculture, the small amount of cultural material recovered from subsurface excavation suggest it is a rock clearing mound. The platform appears to be unaltered and is in good condition.

SIHP #10012 (CSH Site 10)

Site 10012 is a rectangular burial platform (mound) and rock wall segment on slightly sloping bulldozed pasture land. The platform was excavated by CSH and the *iwi* were reinterred at Pu‘uhonua o Hōnaunau National Historic Park (NHP). The platform has been bulldozed and only the base of the feature remains. SCS excavated a 1.0 m by 1.0 m test-unit in the center of the feature during the sites inspection and assessment work (Escott 2016) to determine the presence or absence of *iwi*. The test-unit was excavated to bedrock and all material was screened through 1/8th inch mesh screen. There were no *iwi* fragments and no other cultural material recovered from the excavation. The platform has been bulldozed and is in poor condition.

The L-shape rock wall segment was located approximately 95.0 meters southwest of the burial platform. It is roughly 23.0 m long (NE/SW) by 1.0 m wide and between 0.5 and 0.9 m in height. The wall is constructed of angular and subangular cobbles and small boulders. It is cobble core filled and bi-faced. The wall is partially collapsed in places and is in good condition.

SIHP #10013 (CSH Site 11)

Site 10013 is a roughly square habitation enclosure and a small modified lava tube. The enclosure appears to have been partially bulldozed after the CSH AIS fieldwork was completed, as the wall heights are much lower than those described in the AIS report. Rocks from the bulldozed walls are piled along the edges of the enclosure. The base of the enclosure walls is still evident on the ground surface. The CSH AIS lava tube description was assessed to be correct. The interior of the short lava tube is not modified. Site 10013 has been altered by bulldozing and is in fair to poor condition.

SIHP #10015 (CSH Site 13)

Site 10015 is a modern dirt road bed.

SIHP #10017 (CSH Site 15)

Site 10017 is described in the CSH pedestrian survey summary table as a cattle loading ramp. The area where Site 10017 was plotted on the project map is an area of bulldozed pasture with numerous large bulldozer push piles. CSH determined through consultation with SHPD and Hawaiʻi County Planning that the feature did not warrant a written description in the CSH AIS report. It is possible that the feature was determined to be a bulldozer pile after CSH first identified it, or it might have been bulldozed later. The possible cattle loading ramp (Site 10017) appears to have been bulldozed or was originally a bulldozer push pile.

SIHP #10018 (CSH Site 16)

Site 10018 is described in the CSH pedestrian survey summary table as an enclosure. The area where Site 10018 was plotted on the project map is an area of natural bedrock outcrop surrounding a large tamarind tree. The bare bedrock outcrop encloses a roughly level area of soil. There are no modifications to the outcrop. CSH did not include a site description or map of the enclosure in the AIS report, likely because it was determined to be natural. There are no other archaeological features in the area around the bedrock outcrop. A final possibility is that the Site 10018 feature was bulldozed after the CSH AIS work was completed.

SIHP #10019 (CSH Site 17)

Site 10019 is six rock clearing mounds located along the southeast edge of a seasonal gulch. The presence of a metal file recovered during excavation of one of the mounds suggests the mounds are modern. The rock mounds, appear to have been impacted by flood events, they are partially collapsed, and are in fair to poor condition.

SIHP #10020 (CSH Site 18)

Site 10020 is described in the CSH pedestrian survey summary table as a platform. The area where Site 10020 was plotted on the project map is an area of bulldozed pasture with natural bedrock outcrops and loose rocks. A roughly rectangular pile of natural bedrock boulders was identified at the location of Site 10020. The boulders are naturally occurring bedrock small boulders and cobbles. There is a portion along the west side of the pile that appears to contain bulldozer push from a nearby wall breach. The top of the rock pile is uneven but somewhat level. There is no stacking or facing apparent on the rock pile. The pile is natural, but its roughly rectangular shape and somewhat level top surface make it appear to be a possible archaeological feature. It is likely that CSH added the feature to their pedestrian survey summary table for these reasons. CSH did not include a site description or map of the feature in the AIS report, likely because it was determined to be natural.

SIHP #10033 (CSH Site 112)

Site 10033 is described in the CSH pedestrian survey summary table as a planting complex associated with modern coffee agriculture. There were coffee trees in the area when CSH conducted their AIS fieldwork. The area where Site 10033 was plotted on the project map is an area of bulldozed pasture along the southeast edge of a seasonal gulch. During the current sites inspection, it was apparent that the ground surface in this area has been impacted by flood events and bulldozing. There are no longer coffee trees and there is only a single short wall segment in the area where Site 10033 was previously identified. The planting features are no longer present.

The L-shape wall segment is roughly 5.0 m long (N/S) by 1.0 m wide and is 1.0 m in maximum height. The wall is constructed of angular and subangular cobbles and small boulders. It is cobble core filled and bi-faced. The wall has been bulldozed on both ends and is in fair condition.

SIHP #10034 (CSH Site 113)

Site 10034 was described in the CSH pedestrian survey summary table as a platform (rock mound). It was determined through consultation with SHPD and Hawaiʻi County Planning that the features did not warrant a written description in the CSH AIS report. During the current site inspection, the feature was identified along the north edge of a seasonal gulch. The platform appears to have been bulldozed. Currently, the feature is a roughly 2.5 m long (E/W) by 1.8 m wide by 0.35 m high concentration of rock. The base of the platform appears to be intact in the ground surface. It is possible that the feature was in this state when CSH first identified it, or it might have been bulldozed later. The feature is most likely a rock clearing mound. It has been impacted by bulldozing and is in poor condition.

SIHP #10049 (CSH Site 216)

Site 10049 is described in the CSH pedestrian survey summary table as two linear agricultural terraces. The area where Site 10049 was plotted on the project map is along the bulldozed north bank of a seasonal gulch. During the current sites inspection, it was apparent that the ground surface in this area has been impacted by flood events and bulldozing. Site 10049 has been bulldozed and is no longer present.

SIHP #10067 (CSH Site 232)

Site 10067 is a rock wall and several soil retaining terraces constructed on the sloping north bank of a seasonal gulch. Cultural material recovered from excavations suggests the site is Prehistoric and is likely associated with temporary habitation and agriculture. The site appears to be unaltered and is in good condition.

SIHP #10068 (CSH Site 233)

Site 10068 is a small rectangular enclosure. Cultural material recovered from excavations suggests the site is Prehistoric and is likely associated with temporary habitation. The site has been bulldozed and only the base of the enclosure walls remain, with the exception of the southeast corner which is still intact.

SIHP #10069 (CSH Site 234)

Site 10069 is a modified bluff/platform. Cultural material recovered from excavations suggests that the site is a Prehistoric volcanic-glass tool working site associated with nearby agriculture. The site had been bulldozed prior to the CSH AIS. It is in poor condition.

SIHP #10070 (CSH Site 235)

Site 10070 is U-shaped enclosure. The feature construction, the lack of cultural material recovered from test excavation, and the enclosure's proximity to Historic era agricultural rock clearing mounds all suggest the enclosure is related to Historic era agriculture, most likely coffee growing. The site had been partially bulldozed prior to the CSH AIS. It is in poor condition.

SIHP #10071 (CSH Site 237)

Site 10071 was described in the CSH pedestrian survey summary table as a rectangular platform. The feature was relocated along the north edge of a seasonal gulch during the current site inspection and appears to have been bulldozed after the CSH AIS fieldwork. The feature is now a roughly 5.8 m long (E/W) by 5.0 m wide concentration of loose rocks on the bulldozed level ground surface. There are bulldozer track marks on the loose rocks and on surrounding exposed bedrock. The feature is in poor condition.

<u>SIHP #10072 (CSH Site 238)</u>

Site 10072 includes two large modified outcrops, terraces, rock clearing mounds, and level soil areas. Test excavation of the largest modified outcrop did not contain cultural material. A small amount of sea urchin shell was recovered from additional testing of one of the rock mounds. The CSH AIS interpreted the site as associated with Historic era agriculture. It is possible that based on the feature types and construction method that the site is associated with pre-Contact era agriculture, though the limited subsurface test excavations to date do not support this interpretation. The site appears to be unaltered and is in good condition.

<u>SIHP #10073 (CSH Site 239)</u>

Site 10073 was described in the CSH AIS report as two platforms or cattle loading chutes or ramps. During the current site inspection, the features were identified along the edge of a *mauka-makai* ranch road and appear to be bulldozer push piles. It is possible that the features were in this state when CSH first identified them, or they might have been bulldozed later. The two features at Site 10073 appear to be bulldozer push piles.

<u>SIHP #10074 (CSH Site 240)</u>

Site 10074 is a roughly square rock enclosure likely used as a foundation for an Historic era structure associated with commercial agriculture. Cultural material recorded at the site included both Prehistoric and Historic era artifacts. The site was bulldozed at some point subsequent to the CSH AIS study. All that remains is the partially collapsed portion of what appears to be the southeast corner of the enclosure wall. The site is in poor condition.

<u>SIHP #10075 (CSH Site 241)</u>

Site 10075 is a roughly square rock enclosure interpreted as an Historic era pig pen. The site appears to have been partially bulldozed at some point subsequent to the CSH AIS study. Portions of the wall corners remain although the walls are no longer as high as they were described in the CSH AIS report. The site is in poor condition.

Historic Planting Terraces

The CSH AIS identified an area containing Historic era planting terraces within the northeast portion of Parcel 016. The features were relocated exactly where they were plotted on the CSH AIS project map. The features included rock mounds, linear rock alignments, terraces, modified outcrops, and level soil areas. The features were not subjected to subsurface testing during the CSH AIS. It was likely determined through consultation with SHPD and Hawaiʻi County Planning that the features did not warrant testing or written descriptions. The features might be Historic in age.

Bluff Terraces

The CSH AIS identified an area containing bluff terraces within the southeast portion of Parcel 017. The features were relocated exactly where they were plotted on the CSH AIS project map. The features were not described in the CSH study because it was determined that the features were modern bulldozer push piles. Pedestrian survey of the area during the current sites inspection confirmed that they are bulldozer push piles.

All but three (Site 10017, 10033, and 10049) of the 20 archaeological sites recorded in the CSH AIS are still present on the project area. Two sites (Site 10071 and 10073) were present but bulldozed to the point that a precise assessment was not possible. Although the CSH AIS site descriptions for Site 10071 and 10073 appear likely correct. Two sites (Site 10018 and 10020) were determined to be natural geological features.

Of the 13 sites that were not impacted beyond recognition by bulldozing, ten were determined to be correctly recorded in the CSH AIS report, and three were determined to be likely correctly recorded in the CSH AIS report.

The Historic planting terraces recorded in the northeast portion of Parcel 016 were determined to be likely correctly recorded, and the bluff terraces recorded in the south east portion of Parcel 017 was determined to be correctly recorded in the CSH AIS report.

Based on the CSH AIS report and a February 8, 1993 Gamrex, Inc. letter to SHPD, CSH recorded 20 archaeological sites and two Historic/Modern era agricultural areas during their initial pedestrian survey. These sites were described in tabular format and a pedestrian survey summary was given to SHPD and Hawaiʻi County Planning for review. SHPD and County Planning then made a site visit to consult with CSH on the preliminary site interpretations and the appropriate level of documentation for each site. CSH then returned to selected sites and recorded written descriptions and created site and feature plan maps for sites at which they were required to do so. The remaining sites were either determined to be natural or associated with Historic/Modern era commercial agriculture and no further documentation was required in the AIS report.

Overall, based on the SCS sites inspection and assessment (Escott 2016), the CSH AIS report correctly identified project area archaeological sites and tested, recorded, and interpreted them correctly. All of the Parcel 016 and Parcel 017 archaeological sites documented in the CSH AIS report were recommended for no further work (Hammatt et al. 1984:38). The recommendation was made as "the significant material from the study area has been recovered and further investigation would be of minimum productivity" (Hammatt et al. 1984:38).

The majority of sites (n=14) documented in the northern portion of the Hammatt et al. (1992) project area were interpreted as Historic era ranching and commercial agriculture features. Only six sites were interpreted as pre-Contact era to early post-Contact era, four of them were associated with temporary habitation, one with agricultural rock clearing, and one with burial practices.

EXPECTED ARCHAEOLOGICAL PATTERNS

Based on previous archaeological studies, geological studies, historical research, interviews, and County Planning Department records it is expected that any archaeological sites remaining on the current project area will be related to traditional pre-Contact era agriculture, temporary habitation, burial practices, and to early post-Contact era and Historic era ranching and agricultural activities.

It is likely that many of the pre-Contact to early post-Contact era sites have been removed or disturbed by Historic era and modern ranching and commercial agriculture. This is especially true because the area around the current project era was used as cattle pasture from the Historic era to the present. Additionally, the project area is in a location that was bulldozed sometime between the 1940s and the 1970s in preparation for a commercial agricultural project, most likely coffee growing. Aerial photos clearly show that bulldozer transects were cut north/south across the entire five-acre project area.

Archaeological sites and features that are likely to remain on the project area will likely include pre-Contact era to early post-Contact era rock clearing mounds, terraces, small enclosures, and burials. It is also likely that Historic era and modern features related to ranching and agriculture will also be identified on the project area. These include primarily rock walls constructed to confine cattle.

RESULTS OF FIELDWORK

Twenty two newly identified archaeological sites were recorded during the course of the archaeological inventory survey study (Table 5 and Figure 10). The sites are primarily agricultural complexes and terraces associated with pre-Contact era, through early post-Contact era to Historic era agriculture. Several rock walls and enclosures are associated with Historic era agriculture and ranching. A pre-Contact era to later post-Contact era single lava tube burial was also recorded. A portion of the old railroad berm was also recorded along the eastern edge of the project area. All site numbers are preceded by the prefix #50-10-37-.

SITE 30591	**Agricultural Complex**
FUNCTION:	Agriculture
AGE:	Pre-Contact to Early Post-Contact Era
DIMENSIONS:	20.0 m (N/S) by 9.0 m by 0.95 m in max. height
CONDITION:	Good
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	Shovel Probe Testing (SP-1, SP-2, SP-3)

DESCRIPTION: Site 30591 is an agricultural complex located within the northern portion of the project area, immediately south of the north project area boundary (see Figure 10). The site is situated at 650 ft amsl on a west facing slope, among *koa haole* trees and Guinea grass ground cover.

The complex is six terraces and planting features (Features 1 through 6) constructed on a level area along a west facing slope (Figure 11). The site is approximately 20.0 m in length (N/S) and 9.0 m wide, with a maximum height of 0.95 m. There is a *mauka*/*makai* rock alignment at the center of the site and level terraces extending north and south from the rock alignment. Feature 1 through Feature 4 are south of the alignment and Feature 5 and Feature 6 are north. There are three *pāhoehoe*

Table 5: Inventory of Archaeological Sites Identified on the AIS Project Area.

Site #	Site Type	Features	Site Function	Age	Testing
30591	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30592	Railroad Bed and Berm	1	Transportation	Historic Era	
30593	Lava Tube	1	Burial	Pre-Contact to Early Post-Contact Era	
30594	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1 & 2
30595	Rock Wall	1	Ranching	Historic Era	
30596	Hearth	1	Food Preparation	Historic Era	TU-1
30597	Rock Wall	1	Ranching	Historic Era	
30598	Rock Wall	1	Agriculture/Ranching	Pre-Contact to Historic Era	
30599	Platform & Enclosure	2	Ranching/Agriculture	Historic Era	SP-1 & 2, TU-1
30600	Terrace	1	Agriculture	Historic Era	SP-1
30601	Rock Wall	1	Ranching	Historic Era	
30602	Enclosure	1	Ranching/Agriculture	Historic Era	SP-1, 2, 3 & 4
30603	Enclosure	4	Ranching/Agriculture	Historic Era	SP-1 & 2
30604	Agricultural Complex	4	Agriculture	Pre-Contact to Historic Era	SP-1
30605	Rock Wall	1	Ranching/Agriculture	Historic Era	
30606	Rock Wall	1	Ranching/Agriculture	Pre-Contact to Historic Era	
30607	Agricultural Complex	7	Agriculture	Pre-Contact to Historic Era	SP-1 to SP-10
30608	Enclosure	1	Structure	Historic Era	
30609	Enclosure	1	Structure	Historic Era	
30610	Terrace	1	Agriculture	Pre-Contact to Historic Era	SP-1
30611	Agricultural Complex	3	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30612	Lava Blister	1	Refuse Dump	Historic Era	

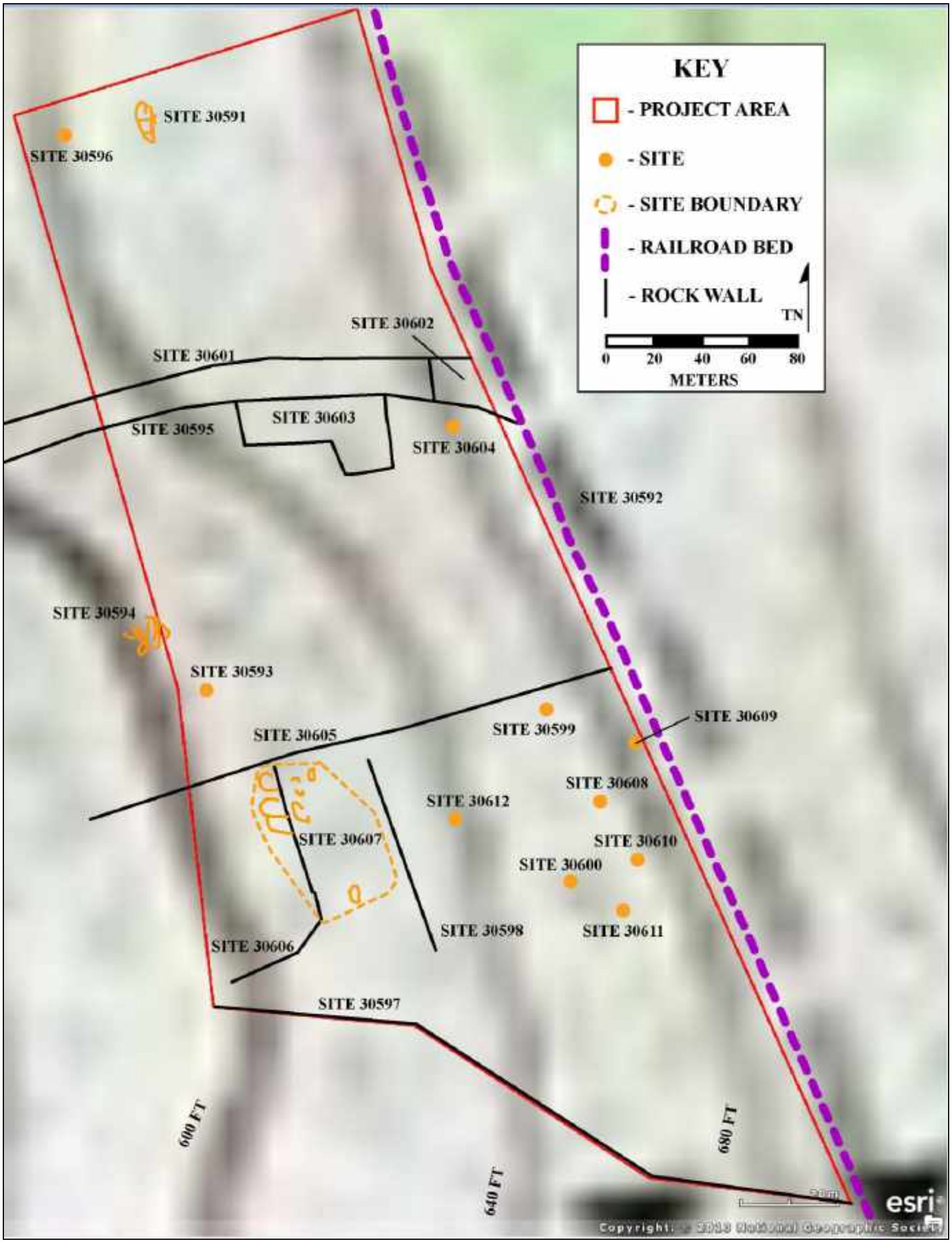

Figure 10: 7.5-Minute Series USGS Topographic Map Showing Locations of Project Area Archaeological Sites (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

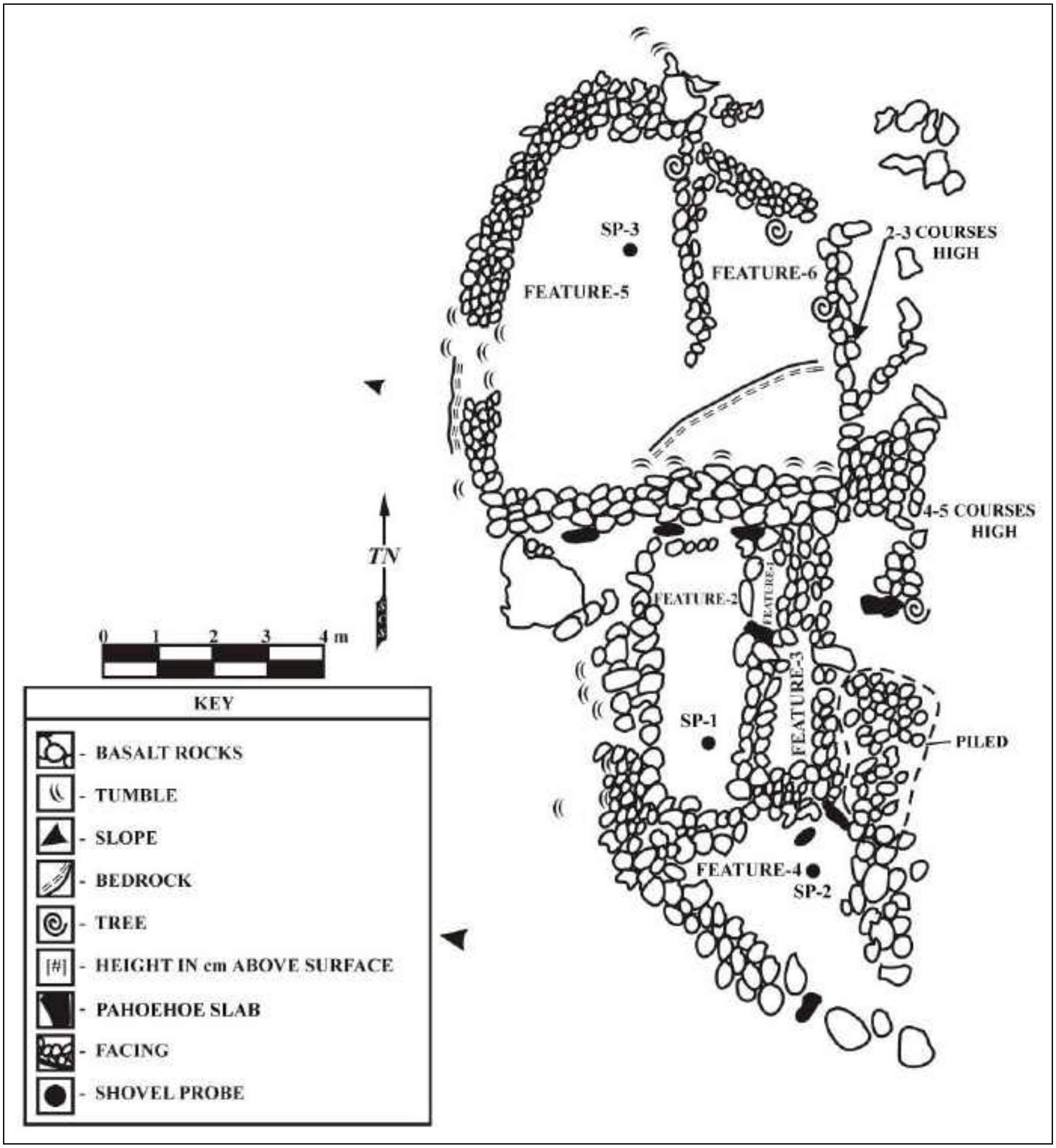

Figure 11: Site 30591 Plan View Map.

slabs along the south side of the central rock alignment that were placed with their longest axis oriented vertically.

Feature 1 is an oval planting feature constructed along the central rock alignment and along the east side of the site (Figure 12). It is constructed of a single course of small basalt boulders and cobbles and is approximately 2.0 m in length (N/S) by 0.70 m wide, with a maximum height of 0.59 m. The feature is collapsed in some areas and is in fair condition.

Feature 2 is a rectangular soil filled terrace located immediately west of Feature 1 (Figure 13). It is constructed along the south side of the central rock alignment. The terrace is approximately 5.5 m in length (N/S) by 2.50 m wide, with a maximum height of 0.68 m. It is constructed of angular and sub angular basalt cobbles and small boulders ranging in size from 0.20 to 0.50 m. The feature is collapsed in some areas and is in fair condition.

Feature 3 is a small rectangular soil filled terrace located immediately south of Feature 1 (Figure 14). The terrace is approximately 3.50 m in length (N/S) and 1.40 m wide, with a maximum height of 0.70 m. It is constructed of angular and sub angular basalt cobbles and small boulders ranging in size from 0.20 to 0.70 m. The feature is collapsed in some areas and is in fair condition.

Feature 4 is a roughly rectangular terrace located immediately south of Feature 2 and Feature 4 (Figure 15). The terrace is approximately 5.0 m in length (NW/SE) by 3.40 m wide, narrowing slightly at the southern terminus, with a maximum height of 0.50 m. It is constructed of angular and sub angular basalt cobbles and small boulders ranging in size from 0.25 to 0.50 m. The feature is collapsed in some areas and is in fair condition.

Feature 5 is a roughly rectangular terrace located in the northwest corner of the site (Figure 16). The terrace is constructed along the northwest side of the central rock alignment. The terrace is approximately 8.0 m in length (N/S) by 4.0 m wide, with a maximum height of 0.70 m. It is constructed of angular and sub angular basalt cobbles and small boulders ranging in size from 0.25 to 0.70 m. The feature is collapsed in some areas, generally where smaller rocks have been utilized, and is in fair condition.

Figure 12: Photograph of Site 30591 Feature 1 Looking Northeast.

Figure 13: Photograph of Site 30591 Feature 2 Looking North.

Figure 14: Photograph of Site 30591 Feature 3 Looking Northeast.

Figure 15: Photograph of Site 30591 Feature 4 Looking Southeast.

Figure 16: Photograph of Site 30591 Feature 5 Looking South.

Feature 6 is a roughly rectangular terrace located in the northeast corner of the site (Figure 17). The terrace is constructed along the northeast side of the central rock alignment. The terrace is approximately 6.1 m in length (N/S) by 3.2 m wide, with a maximum height of 0.55 m. It is constructed of angular and sub angular basalt cobbles and small boulders, some as large as 0.50 m. The feature is collapsed in some areas and is in fair condition.

All of the terrace and planting features at Site 30591 are constructed of roughly piled rock. There is no formal stacking or facing evident in the feature construction. There were no cultural remains identified on the ground surface at the site. There is a fair amount of bulldozer pushed rock piled along the *mauka* (east) side of the site.

Shovel Probe Testing

Three shovel probes (SP) were excavated at Site 30591. The shovel probes were excavated within the soil area of Feature 2, Feature 4 and Feature 5 terraces. The shovel probes were dug to depths ranging from 6.0 to 32.0 cmbs, and terminated on bedrock or large basalt rocks (Table 5). Shovel probe stratigraphy consisted of Layer I (0-13 cmbs) loose (10YR3/2) dark brown fine sandy silt loam overlying Layer II (13-32 cmbs) soft (10YR4/4) dark yellowish brown fine sandy silt. A single fragment of sea urchin spine was identified in SP-1 and was not collected. SP-2 and SP-3 did not contain cultural material.

Table 6: Site 30591 Shovel Probe Results.

Feature	SP#	Depth (cm)	Layers	BOE	Artifacts
2	1	0 - 32 cm	I & II	Basalt Rock	Urchin Spine Fragment
4	2	0 - 6 cm	I	Basalt Rock	-
5	3	0 - 15 cm	I & II	Basalt Rock	-

The piled rock construction of the site and the form of the terrace features suggest the site was constructed to retain soil for agricultural purposes. The lack of cultural material on the ground surface and the small amount of cultural material recovered from the shovel probes at Site 30591 supports the interpretation that the site consists of agricultural planting terraces and a small planting feature. Site 30591 has been slightly impacted by modern bulldozing, is partially collapsed in places, and is in fair to good condition. No further work is recommended at the site.

Figure 17: Photograph of Site 30591 Feature 6 Looking North.

SITE 30592 **Railroad Berm**

FUNCTION: Transportation
AGE: Historic Era
DIMENSIONS: 265.0 m (SE/NW) by 2.50 m by 1.5 m max. height
CONDITION: Good
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: Modern Trash Debris
EXCAVATION: None
DESCRIPTION: Site 30592 is an Historic era railroad berm located along the eastern boundary of the project area (see Figure 10). The railroad berm is approximately 265.0 m in length (SEN/W) and 2.5 m wide within the project area, continuing north and south beyond the project area limits. The railroad bed is a level dirt and rock surface, and the berm is located along the west side of the railroad bed. The berm is a retaining wall constructed of small boulders and large cobbles stacked up to nine courses high (Figure 18). The berm is well faced with fairly tightly fitted natural rock. The rock has not been worked prior to stacking. The berm face slopes slightly toward the east as it approaches the top to prevent collapse.

The surface of the railroad bed has been bulldozed in the fairly recent past, likely during construction of the homes along the east edge of the project area property. Portions of the berm are partially collapsed. There is a fair amount of modern construction debris and refuse along the course of the railroad bed. The railroad berm is in good condition.

SITE 30593 **Lava Tube**

FUNCTION: Burial
AGE: Pre-Contact to Early Post-Contact Era
DIMENSIONS: 60.0 m (E/W) by 9.0 m by 0.95 m in max. height
CONDITION: Good
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: None
EXCAVATION: None
DESCRIPTION: Site 30593 is a Lava tube located at 610 ft amsl along the central western portion of the project area, immediately east of the project area boundary (see Figure 10). The site is situated on a western facing slope, among *koa haole* and trees with Guinea grass ground cover.

Figure 18: Photograph of Site 30592 Looking East.

The skeletal remains of a single individual were identified in a lava tube near the *makai* (west) boundary of the project area. The lava tube can be accessed through two openings, one at the *makai* end of the lava tube and a second, larger opening approximately 20.0 meters *mauka* (east) of the *makai* opening (Figure 19). The lava tube continues east 15.0 meters and east-southeast 25.0 to 30.0 meters from the *mauka* opening. A second tube, connecting to the east-southeast tube, continues west-southwest 30.0 meters.

The *makai* entrance is an approximately 0.9 m long (E/W) by 0.7 m wide hole in the exposed *pāhoehoe* ground surface. The floor of the lava tube is 0.5 to 0.9 cm below the opening and is primarily bare lava with deposits of natural pebbles, small cobbles, and fine sediment washed into the tube from the opening and a second point in the tube approximately 6.0 m east of the opening. The tube slopes gently upward in an easterly direction. Sediment from a collapsed point 6.0 meters into the tube covers the lava tube floor in thicker deposits nearer to the point of collapse.

The distal end of a human femur, talus, metatarsal, and phalange were identified on the surface of the lava tube floor below the *makai* opening. The skeletal elements were small in size and were deteriorated, making positive identification difficult. The ilium of a small human pelvis was identified protruding from the sediment along the south wall of the lava tube, approximately 5.0 m *mauka* of the *makai* opening. Sediment was cleared in small increments to expose one half of a pelvis. Half of the ilium had deteriorated and was no longer present on the pelvis.

More sediment (4.0 to 8.0 cm in thickness) was removed to expose additional human skeletal elements located within close proximity to the pelvis. These included lumbar, thoracic, and cervical vertebrae; ribs; both clavicles and shoulder blades; the left ulna and radius; several phalanges; and two incisors and a molar.

The other half of the pelvis; cranium, mandible, other long bones, and remaining skeletal elements were not located in the limited removal of sediment. If these skeletal elements are buried beneath the sediment on the floor of the lava tube, they may no longer be articulated with the identified skeletal elements. It is possible that they have moved down slope of the *in situ* burial. This is likely, as a calcaneus, tarsals, and metatarsals were identified during a second, more thorough inspection of the lava tube floor under the *makai* opening—a distance of 5.0 m down slope of the burial location. At

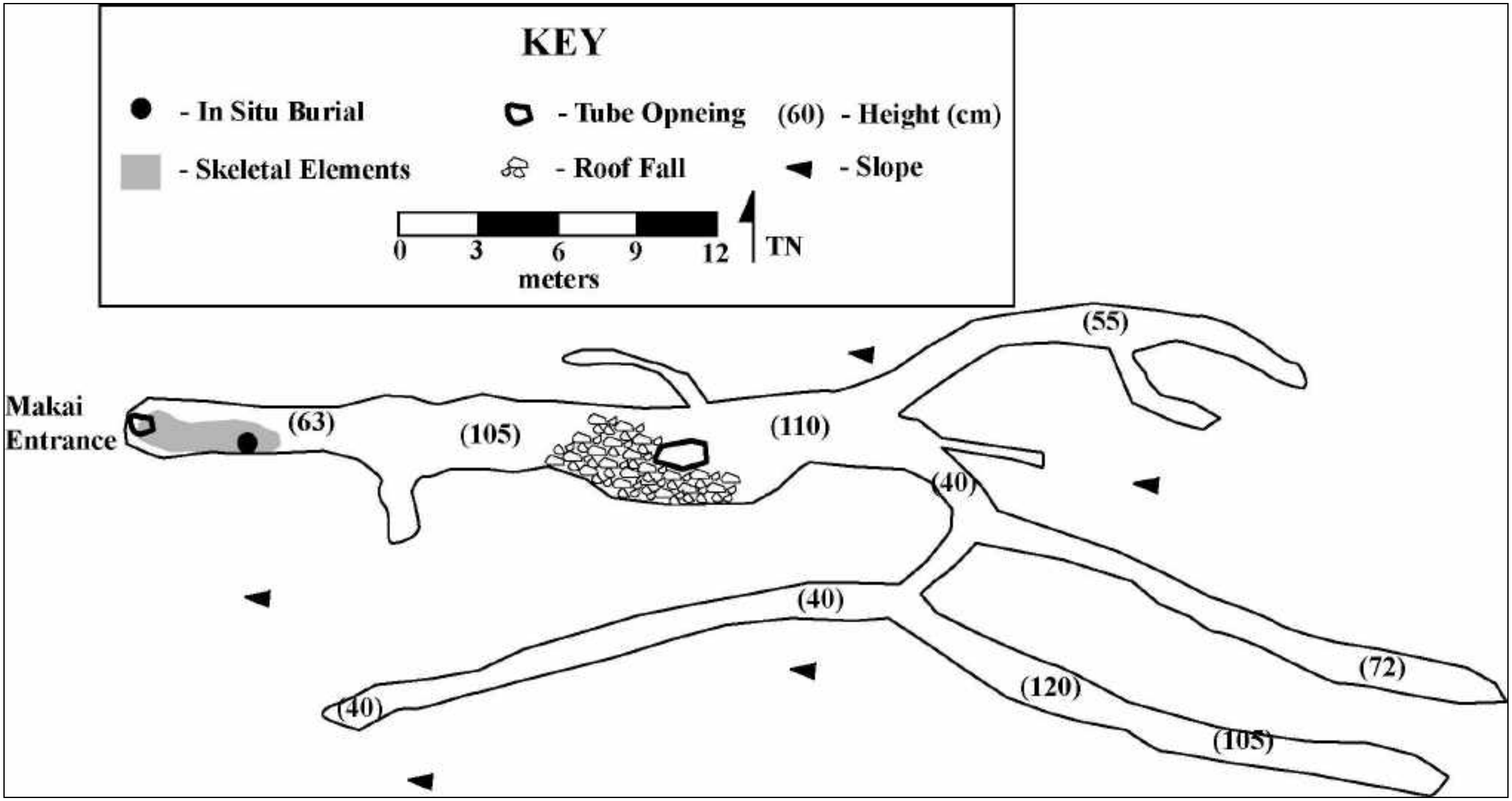

Figure 19: Site 30593 Plan View Sketch Map.

least a portion of the femur and several foot bones have moved down slope of the original burial location.

Based on the limited removal of sediment from the skeletal elements, the burial is of a single individual in a supine position, arms at sides, with head located *mauka* (east) and feet *makai*. The size of the skeletal elements indicates a young adult of small stature or a subadult. The skeletal elements were fairly deteriorated so that sex and age could not be definitively ascertained. The burial appears to be only slightly altered by rainwater runoff flowing through the lava tube and is in good condition. Site 30593 is recommended for preservation.

SITE 30594	**Agricultural Complex**
FUNCTION:	Agriculture
AGE:	Historic Era
DIMENSIONS:	20.0 m (E/W) by 17.0 m by 0.70 m in max. height
CONDITION:	Good
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	Heavy gauge wire, golf balls
EXCAVATION:	Shovel Probe Testing (SP-1, SP-2)

DESCRIPTION: Site 30594 is an agricultural complex located at 600 ft amsl approximately 16.0 meters northwest of Site 30593, along the western project area boundary (see Figure 10). The site is situated on a west facing slope, among *koa haole* and trees with Guinea grass ground cover. The site is in an area of broken bedrock suggestive of an large outcrop or collapsed lava tube. The rock is mostly angular and slabby, though there are also subangular rocks at the site.

The complex is six narrow terraces (Features 1through 6) constructed on a moderately steep west facing slope (Figure 20). The site is approximately 20.0 m in length (E/W) by 17.0 m wide, with a maximum height of 0.70 m. Features 1 through 4 are roughly parallel and are situated with their long axis oriented north/south. Feature 1 is the uppermost terrace along the east side of the site. Feature 5 and Feature 6 are smaller terraces oriented northwest/southeast and are down slope of Features 1 through 4, along the west side of the site.

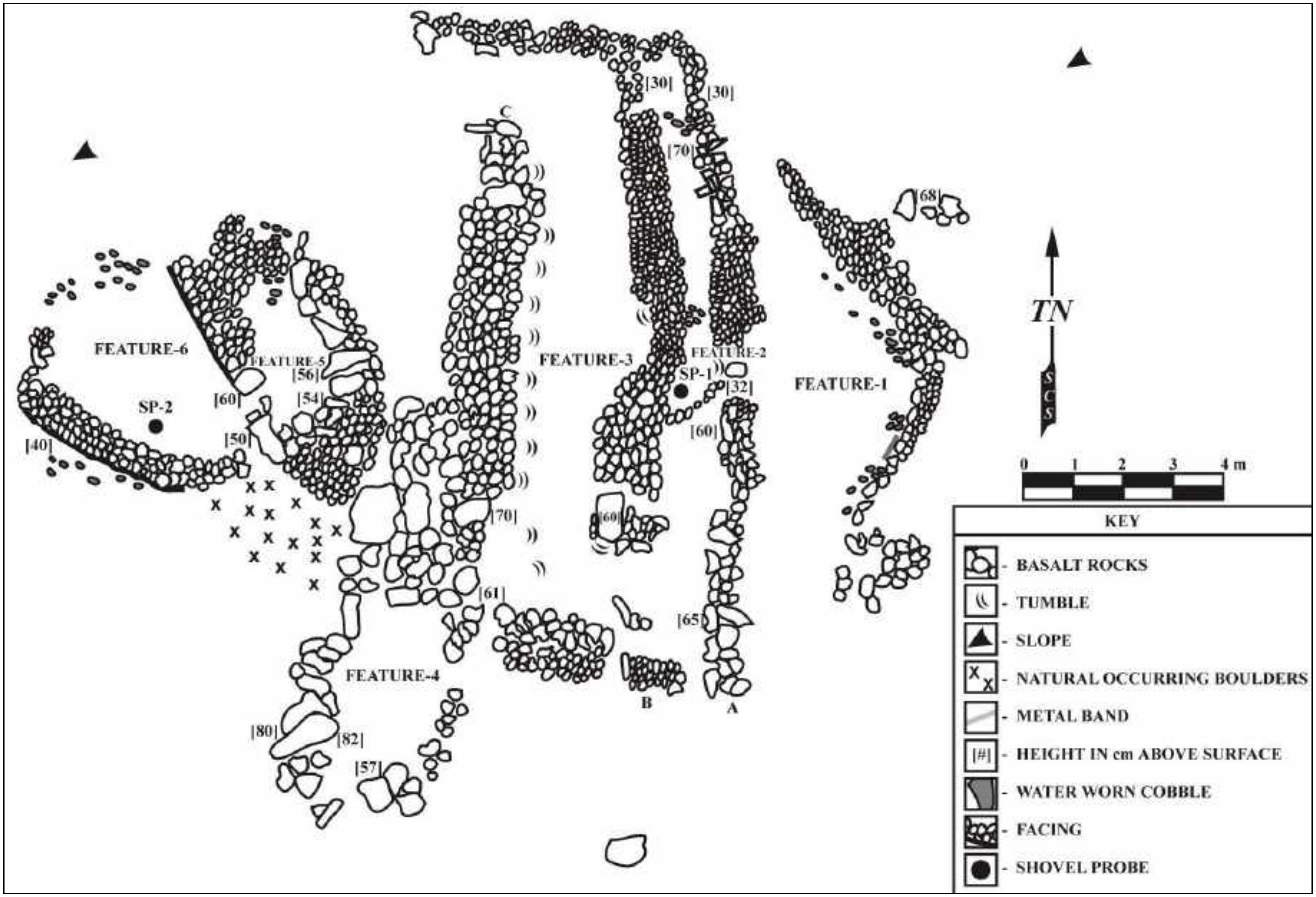

Figure 20: Site 30594 Plan View Map.

Feature 1 is a roughly rectangular soil filled terrace on the east side of the site (Figure 21). It is approximately 10.0 m long by 1.8 m wide, with a maximum height of 0.81 m. There is a retaining wall constructed of piled and stacked angular and subangular small boulders and cobbles along the west side of the level soil terrace. There is no formal facing evident in the retaining wall construction.

There is another pile of rock *mauka* (east) of the soil filled terrace of Feature 1, constructed of piled angular and sub angular basalt cobbles and boulders. There is no formal facing evident in the rock pile. The retaining wall to the west and the rock pile to the east are partially collapsed in some areas. It looks as though Feature 1 has been impacted by bulldozing, especially along the north side of the feature. Feature 1 is in fair condition.

Feature 2 is a linear soil filled terrace located west of Feature 1 (Figure 22). The terrace retaining wall trends N/S, curving down slope at its northern terminus. It is approximately 14.0 m in length by 1.20 m wide, with a maximum height of 0.70 m. The retaining wall of the terrace is constructed of piled angular and subangular basalt cobbles and small boulders ranging in size from 0.40 to 0.75 m. There is no formal facing evident in the terrace construction. It looks as though Feature 1 has been impacted by bulldozing, especially along the north side of the feature. The retaining wall is collapsed in some areas and is in fair condition.

Feature 3 is a linear soil filled terrace situated down slope, to the west, of Feature 2 (Figure 23). The terrace retaining wall trends N/S. It is approximately 14.0 m in length and 1.40 m wide, with a maximum height of 0.70 m. It is constructed of piled angular and sub angular basalt cobbles and small boulders, which range in size from 0.40 to 0.75 m. There is no formal facing evident in the terrace construction. The retaining wall is collapsed in some areas and is in fair condition.

Feature 4 is a rectangular rock and soil filled terrace located on the south end of Feature 3. The terrace retaining wall trends N/S and is approximately 7.0 m in length by 2.90 m wide, with a maximum height of 0.70 m. It is constructed of piled angular and sub angular basalt cobbles and small boulders, which range in size from 0.40 to 0.75 m throughout the southern portion of the feature. The northern portion is composed of larger rock, incorporating what are likely *in situ* boulders that continue south to form portions of the soil filled terrace. The level soil filled terrace at the south

Figure 21: Photograph of Site 30594 Feature 1 on Left and Feature 2 on Right Looking South.

Figure 22: Photograph of Site 30594 Feature 1 in Top Left, Feature 2 at Center, Feature 3 at Far Right, Looking South.

Figure 23: Photograph of Site 30594 Feature 2 on Left and Feature 3 on Right Looking South.

end of the feature is approximately 5.0 m in length and 4.0 m wide, with a maximum height of 0.82 m, and contains rock. There is no formal facing evident in the terrace construction. The feature is collapsed in some areas and is in fair condition.

Feature 5 is a soil filled terrace/enclosure situated down slope, to the west, of Feature 4 (Figure 24). It trends NW/SE, and is roughly oval. It is approximately 5.5 m in length by 3.40 m wide, with a maximum height of 0.60 m. It is constructed of piled and stacked angular and sub angular basalt cobbles and small boulders. The rock is stacked up to four courses high on bedrock along the westernmost perimeter of the feature. The eastern and southeastern portions of the feature incorporate naturally occurring small boulders into the construction. There is no formal facing evident in the terrace construction. Feature 5 is collapsed in some areas and is in fair condition.

Feature 6 is a level soil filled terrace situated down slope, to the west, of Feature 5 (Figure 25). The terrace retaining wall trends NW/SE curving up slope at either end. It is approximately 4.5 m in length by 1.0 m wide, with a maximum height of 0.80 m. It is constructed of angular and sub angular basalt cobbles and small boulders, which are stacked up to three courses high along the westernmost perimeter. There is some very rough facing evident in the terrace construction. The retaining wall is collapsed in some areas and is in fair condition.

A strand of heavy gauge wire and two golf balls were encountered on the ground surface at the site.

<u>Shovel Probe Testing</u>

A total of two shovel probes were excavated within Site 30594 to determine site function and age. The shovel probes were excavated approximately 11.0 m from one another within the soil area of Feature 2 terrace (SP-1) and Feature 6 terrace (SP-2). The shovel probes were dug to depths ranging from 26.0 to 55.0 cmbs and terminated on bedrock or large basalt rocks (Table 6). Shovel probe stratigraphy consisted of three natural stratigraphic layers: Layer I (0-12 cmbs) loose dark brown (10YR3/2) fine sandy silt loam, Layer II (12-38 cmbs) soft brown (10YR4/3) sandy silt, and Layer III (38-55 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. There were no cultural materials recovered from the shovel probes.

Figure 24: Photograph of Site 30594 Feature 5 Looking Northeast.

Figure 25: Photograph of Site 30594 Feature 6 in Foreground and Feature 5 in Background, Looking Northeast.

Table 7: Site 30594 Shovel Probe Results.

SP#	Depth (cm)	Layers	BOE	Artifacts
1	0 - 55 cm	I, II, III	Basalt Rock	-
2	0 - 26 cm	I & II	Basalt Rock	-

The terraces at Site 30594 are fairly crudely constructed and were not constructed with much formal stacking or facing. The Feature 1 through Feature 4 retaining walls resemble linear piles of rock left along the outside edges of a bulldozer transect. The rock appears to be from a large concentration of naturally occurring bedrock on the ground surface, possibly the remains of a collapsed lava tube. However, the features also appear as though they could have been constructed as agricultural terraces, especially Feature 5 and Feature 6. Subsurface testing did not recover any cultural material. Site 30594 is interpreted as a pre-Contact era to Historic era agricultural site. The site has been slightly altered by cattle ranching and agricultural activities, is in fair condition and no further work is recommended.

SITE 30595 **Rock Wall**

FUNCTION: Cattle Ranching

AGE: Historic Era

DIMENSIONS: 90.0 m (E/W) by 1.10 m by 1.31m in max. height

CONDITION: Good

INTEGRITY: Possesses Integrity of Location and Materials

SURFACE ARTIFACTS: None

EXCAVATION: None

DESCRIPTION: Site 30595 is the remains of an Historic era wall located between 630 and 690 ft amsl within the northern portion of the project area (see Figure 10). The wall trends *mauka*/*makai* and is located on west sloping land with *kukui* nut and *koa haole* trees and Guinea grass ground cover. The wall has been breach by bulldozing in several places and portions of the wall continue to the east, beyond the project area.

The wall is constructed of angular and subangular basalt cobbles and small boulders, incorporating boulders as large as 0.60 m at the base (Figure 26). It is bifaced and cobble core filled (Figure 27). The wall is approximately 90.0 m in length (E/W) within the project area, by 1.10 m wide, with a maximum height of 1.31 m. The wall bisects the property east to west, terminating to the east at the Site 30592 railroad berm, where it is attached to the south face of the berm, continuing to the west beyond the

Figure 26: Photograph of Site 30595 Wall Looking North.

Figure 27: Photograph of Site 30595 Wall Collapse Showing Cobble Core Fill, Looking North.

property boundary. A portion of the eastern wall segment, approximately 18.0 m, constitutes the southern boundary of Site 30602 enclosure. There is a 1.0 m breach in the wall for access to the enclosure.

There was no cultural material on the ground surface at the site. Site 30595 is a Historic era wall that has been altered by bulldozing, is partially collapsed in places, and is in fair condition. No further work is recommended at Site 30595.

SITE 30596	**Hearth**
FUNCTION:	Possible Cooking
AGE:	Historic Era
DIMENSIONS:	2.50 m (E/W) by 2.10 m by 0.85 m in max. height
CONDITION:	Good
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	Test Unit (TU-1)

DESCRIPTION: Site 30596 is a hearth located within the northwestern corner of the project area (see Figure 10). The hearth is situated on an exposed bedrock outcrop in a level area, approximately 10.0 m east of the top of a shallow west facing slope. There are *koa haole* and *kukui* nut trees with Guinea grass ground cover throughout the area.

The hearth is constructed on a narrow finger of hollow *pāhoehoe*. The top of the small *pāhoehoe* “tube” is broken open in places. The hearth is constructed within an opening in the top of the small “tube.” It is constructed of cobble and small boulder size *pāhoehoe* slabs positioned in a roughly rectangular configuration around the opening (Figure 28 and Figure 29). The hearth is approximately 2.50 m in length (E/W) and 2.10 m wide, with a maximum height of 0.85 m. There was no cultural material identified on the ground surface at the site.

A 1.0 m by 0.5 m test-unit (TU-1) was excavated in the hearth to determine feature function and age. TU-1 was excavated as two stratigraphic layers (Layer I and Layer II) and terminated on bedrock at 28 cmbs (Figure 30).

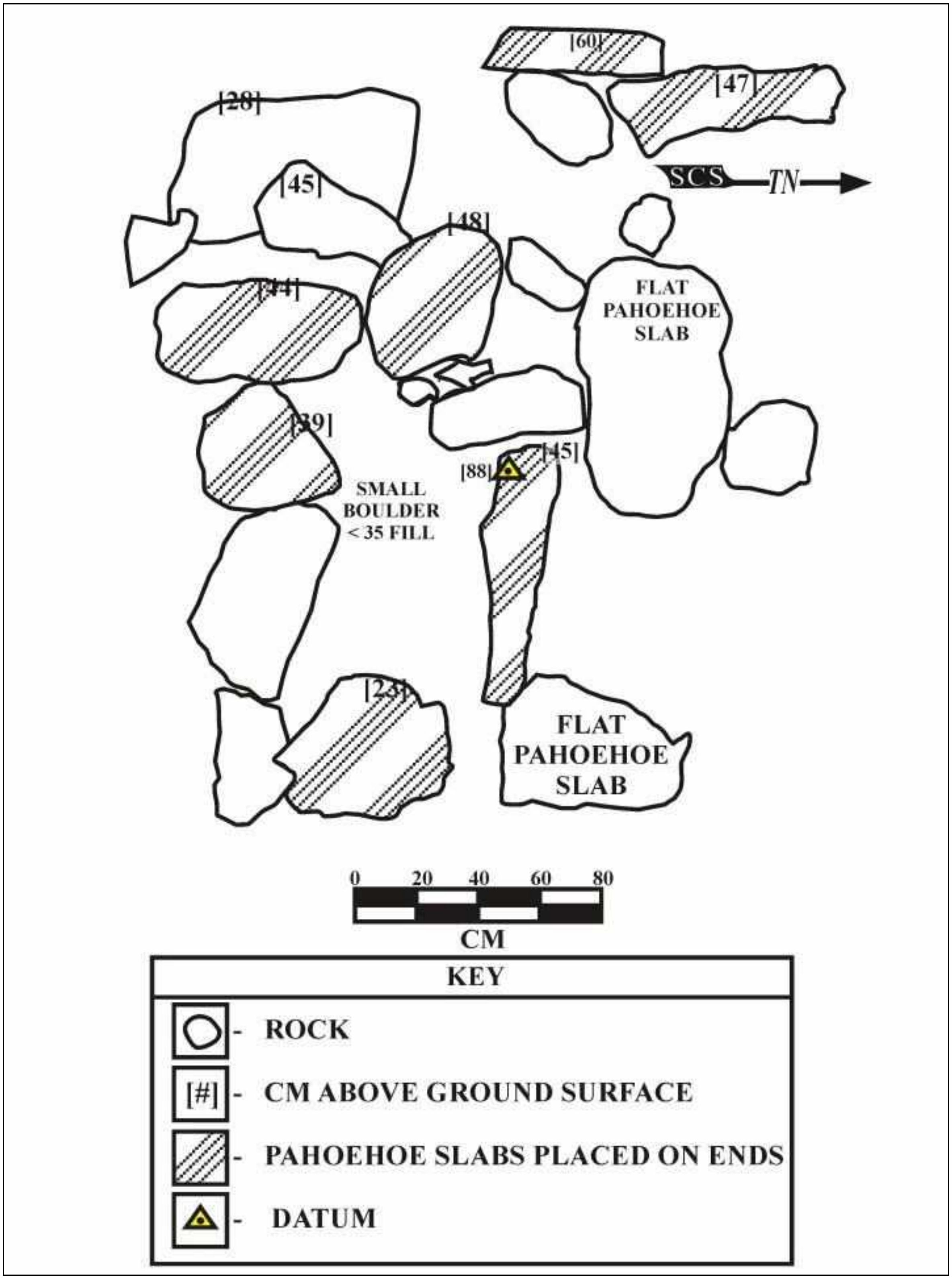

Figure 28: Site 30596 Plan View Map.

Figure 29: Photograph of Site 30596 Hearth Looking West.

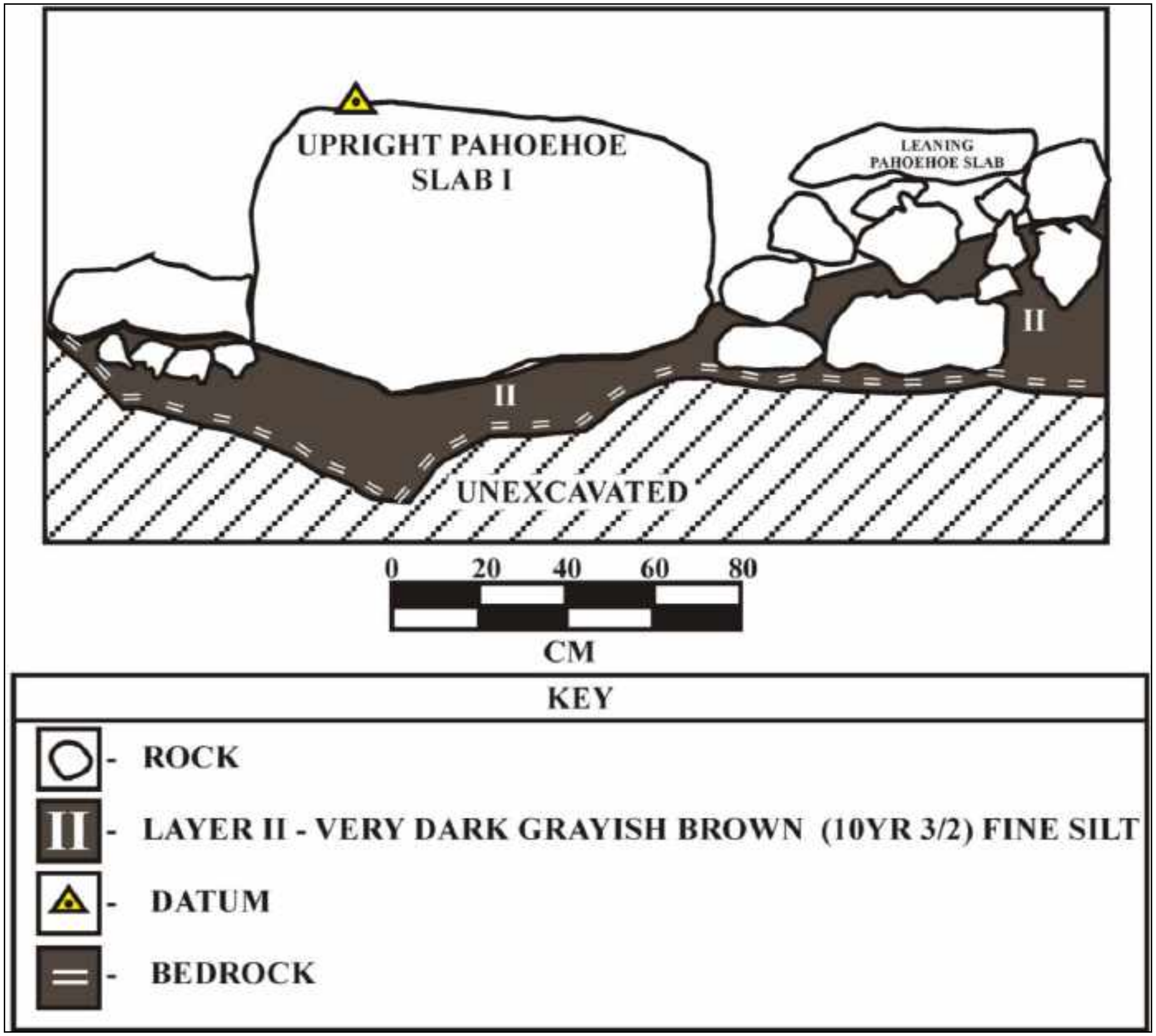

Figure 30: Site 30596 TU-1 North Profile.

Layer I (0-20 cmbs) was loose angular and subangular cobbles and small boulders removed from the center of the hearth. The base of Layer I was roughly even with the top of Layer II (Figure 31).

Layer II (20-40 cmbs) was loose (10YR3/2) very dark grayish brown fine sandy silt with less than 5% gravels and cobbles, and roughly 1% fine rootlets. Layer II terminated on bedrock (Figure 32). A small amount of midden (marine shell, bird bone, rodent bone, and burnt *kukui* nut shell) and charred material was recovered from TU-1, Layer I (see Appendix A). Based on the formal construction of the hearth, it is interpreted as a Historic era fire feature. The hearth appears to be unaltered, is in good condition and no further work is recommended at Site 30596.

SITE 30597	**Rock Wall**
FUNCTION:	Cattle Ranching
AGE:	Historic Era
DIMENSIONS:	145.0 m (E/W) by 0.90 m by 1.30 m in max. height
CONDITION:	Fair
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: Site 30597 is an historic era rock wall located between 590 and 690 amsl along the southern boundary of the project area (see Figure 10). The *mauka*/*makai* wall is constructed along the north side of a seasonal gulch and marks the property boundary. There are *koa haole* and *kukui* nut trees with Guinea grass ground cover throughout the area.

The wall is constructed of stacked angular and subangular basalt cobbles and small boulders, incorporating small boulders as large as 0.50 m at the base (Figure 33). It is bifaced and cobble core filled. The rock wall is approximately 145.0 m long (E/W) where it crosses the project area, by 0.90 m wide, with a maximum height of 1.30 m. The east terminus of the wall is at the east end of the project area. The wall continues downhill beyond the west property boundary. Portions of the wall are no longer present, and may have been removed by flood events. Site 30597 is an Historic era ranch wall, and although it has collapsed in some areas, it is generally in fair condition. There were no cultural remains encountered on the ground surface at the site. Site 30597 appears to be slightly altered, is in fair condition and no further work is recommended.

Figure 31: Photograph of Site 30596 TU-1 Top of Layer II, Looking West.

Figure 32: Photograph of Site 30596 TU-1 Base of Excavation, Looking West.

Figure 33: Photograph of Site 30597 Wall with Gulch in Background, Looking South.

SITE 30598 **Wall**
FUNCTION: Agriculture/Ranching
AGE: Pre-Contact Era to Historic Era
DIMENSIONS: 110.0 m (N/S) by 1.30 m by 0.80 m in max. height
CONDITION: Fair
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: None
EXCAVATION: None
DESCRIPTION: Site 30598 is a segment of a rock wall located between 600 and 690 ft amsl in the southern portion of the project area (see Figure 10). There are *koa haole* and *kukui* nut trees with Guinea grass ground cover throughout the area.

The wall is constructed of piled and stacked angular and subangular basalt small boulders, incorporating small boulders as large as 0.50 m throughout (Figure 34). The wall is roughly faced and is not cobble core filled. The rock wall is approximately 110.0 m long (E/W) where it crosses the project area, by 0.90 m wide, with a maximum height of 1.30 m. The east terminus of the wall is along the east property boundary. The wall continues west beyond the west property boundary. The wall has been impacted by bulldozing and portions of the wall are no longer present. Site 30598 is a pre-Contact era agricultural wall or an Historic era ranch wall, and although it is collapsed in some areas, it is generally in fair condition. There were no cultural remains encountered on the ground surface at the site. No further work is recommended at Site 30598.

SITE 30599 **Platform with Enclosure**
FUNCTION: Agricultural
AGE: Historic Era
DIMENSIONS: 8.0 m (NW/SE) by 6.50 m by 1.40 m in max. height
CONDITION: Fair, Slightly Altered
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: Historic glass and metal
EXCAVATION: Shovel Probe Testing (SP-1, SP-2); Test Unit (TU-1)
DESCRIPTION: Site 30599 is an enclosed platform located at 670 ft amsl within the central eastern portion of the project area (see Figure 10). It is situated on a gentle west facing slope 20 meters west of Site 30592 railroad berm. There are *koa haole* trees and Guinea grass ground cover throughout the area.

Figure 34: Photograph of Site 30598 Wall Overview Looking West.

Site 30599 is a platform (Feature 1) and a roughly rectangular enclosure (Feature 2) measuring 8.0 m long (NW/SE) by 6.50 m wide (Figure 35). The Feature 1 platform is located at the north end of the site and the Feature 2 enclosure extends south from the platform.

The Feature 1 platform is approximately 2.0 m long (N/S) and 1.8 m wide, with a maximum height of 1.40 m. It is constructed of angular and subangular basalt cobbles and small boulders stacked three to four courses high (Figure 36). The outer perimeter of the platform is constructed with larger rocks (small boulder slabs) stacked on their flat sides with their longest edge facing the outer edge of the platform. The interior of the platform is constructed of smaller subangular rocks placed inside the larger perimeter rocks. The north and east sides of the platform are well faced. The west side of the platform is collapsed (Figure 37). The feature construction is similar to Historic era rock clearing mounds and platforms documented in Kona and other places on Hawai‘i Island. A large water worn cobble, corrugated metal roofing, and bottle glass fragments were identified on the Feature 1 platform.

The Feature 2 enclosure is rectangular and measured 5.10 m long (NW/SE) by 4.80 m wide, with a maximum height of 0.35 m. The enclosure walls are constructed of piled small boulders and cobbles, with some roughly stacked, one to two courses wide and one to three course high (Figure 38). The enclosure opens to the south. The interior of the enclosure is level soil. A screw top jar, a Bakelite pot, bottle glass fragments, and two pieces of sheet metal were encountered on the surface at the site (Figure 39).

Two shovel probes and a test-unit (TU-1) were excavated at Site 30599 to determine the function and the age of the two features.

<u>Shovel Probe Testing</u>

Two shovel probes were excavated in the level soil interior of Feature 2. The shovel probes were excavated approximately 4.2 m from one another within the enclosure. They were excavated to depths ranging from 34.0 to 37.0 cmbs and terminating on bedrock or large basalt rocks (Table 7).

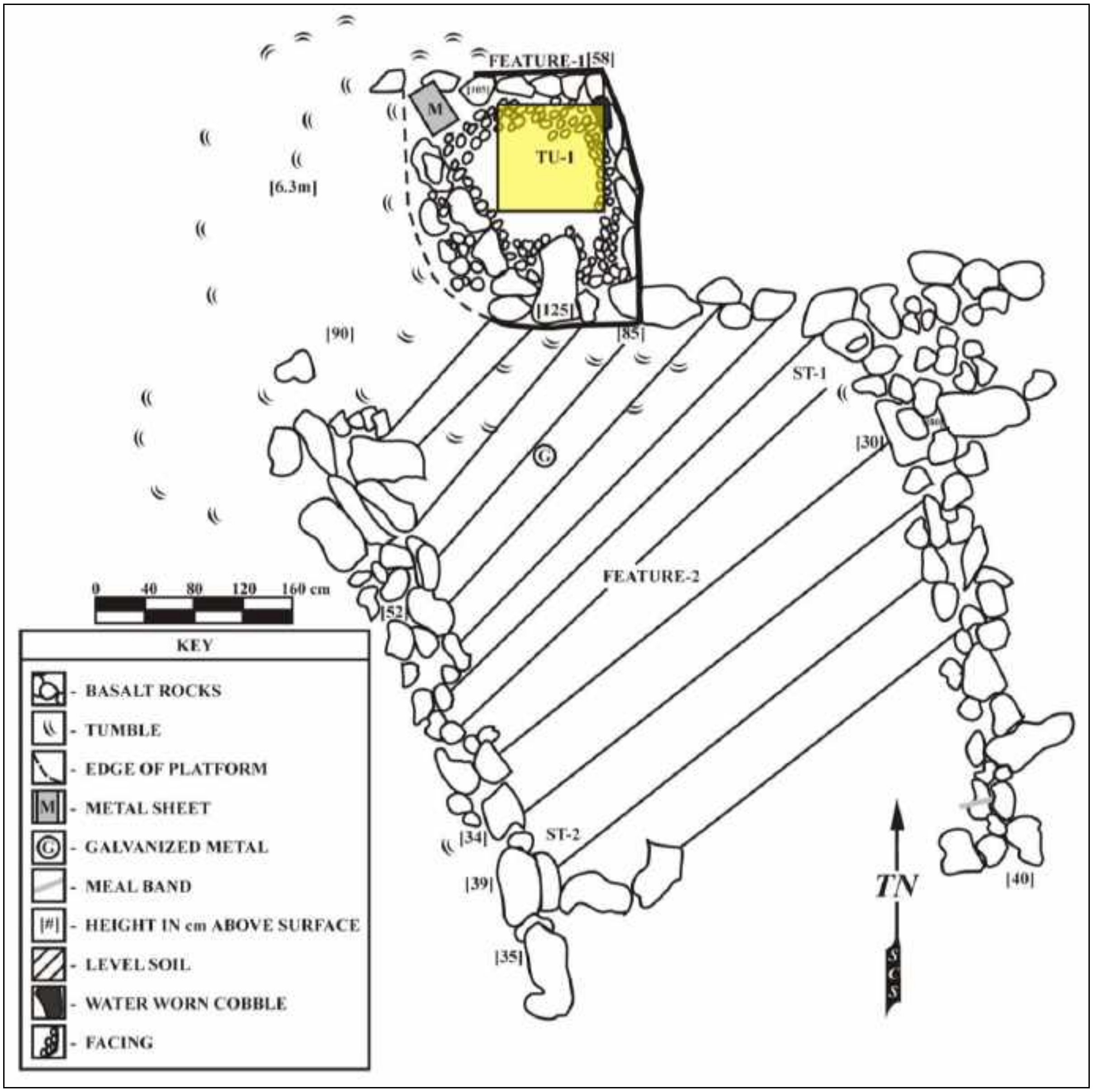

Figure 35: Site 30599 Plan View Map.

Figure 36: Photograph of Site 30599 Feature 1 Platform with Top Cleared of Debris Showing Stacked Stone Construction, Looking West.

Figure 37: Photograph of Site 30599 Feature 1 Platform Showing West Side Collapse, Looking East.

Figure 38: Photograph of Site 30599 Feature 2 Enclosure Looking East.

Figure 39: Photograph of Surface Artifacts Collected at Site 30599.

Table 8: Site 30599 Shovel Probe Results.

SP#	Depth (cm)	Layers	BOE	Artifacts
1	0 - 34 cm	I & II	Basalt Rock	Glass and metal fragments
2	0 - 37 cm	I & II	Basalt Rock	Donkey shoe, glass, metal and plastic fragments

Shovel probe stratigraphy consisted of Layer I (0-14 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (14-37 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-1 contained a single bottle glass fragment, three pane glass fragments, and four rusted metal fragments. SP-2 contained a donkey shoe, a single piece amethyst bottle glass, a piece of plastic, and ten rusted metal fragments, three of which are nail fragments. Artifacts recovered from SP-1 and SP-2 were not collected.

<u>TU-1</u>

TU-1 was a 1.0 m by 1.0 m test-unit excavated in the center of the platform (see Figure 35). TU-1 was excavated as two natural stratigraphic layers to a maximum depth of 1.45 cm below the top surface of the platform and terminated on bedrock (Figure 40).

Layer I (0-90 cmbs) was loose cobbles and small boulders mixed with “O” Horizon organic detritus. A small amount of rusted metal fragments and modern bottle glass were recovered from Layer I.

Layer II (90-145 cmbs) was loose 10YR3/4 dark yellowish brown sandy silt, cobbles and small boulders, and loose bedrock slabs. A small amount of rusted metal fragments, a metal twist top bottle cap, a wire nail, and modern brown and clear bottle glass were recovered from Layer II (see Appendix A). Slabs of bedrock were also removed from the base of TU-1. TU-1 terminated on bedrock (Figure 41).

Site 30599 is interpreted as an Historic era to Modern era commercial agriculture and ranching work area. Base on the platform construction, surface artifacts at the site, and the metal and glass recovered from TU-1, the site was likely constructed in the mid 1900s and was likely used for ranching and/or commercial agricultural activities through the 1960s. Site 30599 is slightly altered (Feature 1 partial collapse) and is in fair condition. No further work is recommended at Site 30599.

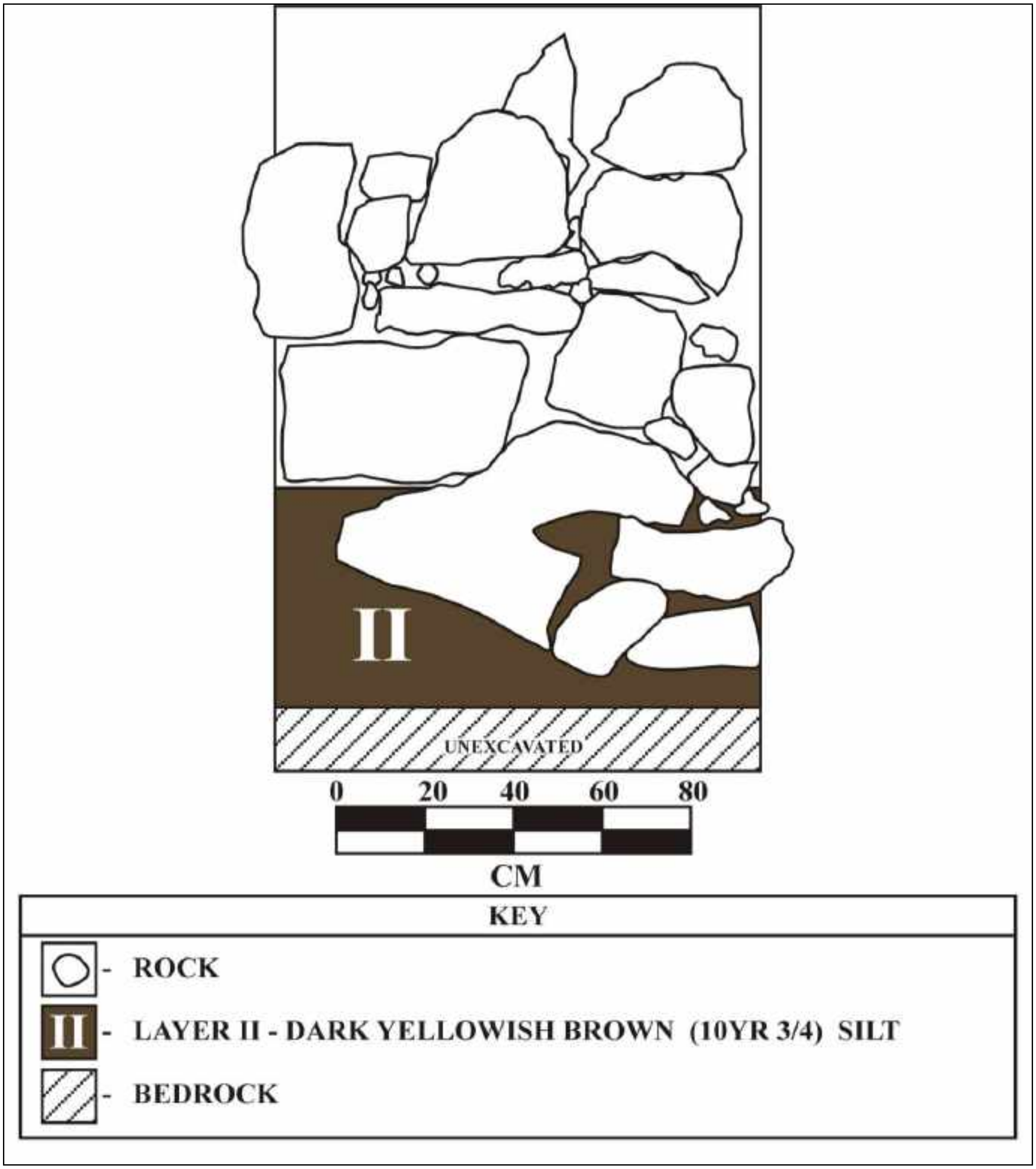

Figure 40: Site 30599 TU-1 South Profile.

Figure 41: Photograph of Site 30599 TU-1 Base of Excavation Looking East.

SITE 30600 **Terrace**

FUNCTION: Agricultural

AGE: Historic Era

DIMENSIONS: 4.0 m (E/W) by 4.30 m by 0.35m in max. height

CONDITION: Good

INTEGRITY: Possesses Integrity of Location and Materials

SURFACE ARTIFACTS: None

EXCAVATION: Shovel Probe Testing (SP-1)

DESCRIPTION: Site 30600 is a three-sided terrace located at 660 ft amsl approximately 35.0 meters south of Site 30599 (see Figure 10). It is situated on a gentle west facing slope with *koa haole* trees and Guinea grass ground cover. The enclosure is constructed of angular and subangular basalt small boulders piled one to two courses high and wide on the ground surface (Figure 42). It is approximately 4.0 m in length (E/W) and 3.30 m wide, with a maximum height of 0.35 m. There were no artifacts identified on the ground surface at the site.

<u>Shovel Probe Testing</u>

A single shovel probe (SP-1) was excavated within the level soil interior of Site 30600 to determine the function and age of the terrace. The shovel probe was excavated to a depth of 30.0 cmbs and terminated on bedrock or a large basalt rock. The shovel probe matrix did not contain cultural material.

Based on the simple construction of the terrace, its size, and the proportionally large number of Historic era sites recorded on the project area, it is likely that Site 30600 is also an Historic era agricultural terrace, possibly associated with coffee growing. Site 30600 appears to be unaltered and is in good condition. No further work is recommended at Site 30600.

Figure 42: Photograph of Site 30600 Looking Southeast.

SITE 30601 **Rock Wall**
FUNCTION: Ranching
AGE: Historic Era
DIMENSIONS: 80.0 m (NW/SE) by 1.20 m by 1.50 m in max. height
CONDITION: Good
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: None
EXCAVATION: None
DESCRIPTION: Site 30601 is an Historic era wall located between 635 and 685 ft amsl within the northern portion of the project area (see Figure 10). The wall is oriented *mauka*/*makai* and is situated 10 meters north of and parallel to the Site 30595 wall (Figure 43). There are *kukui* nut and *koa haole* trees, and Guinea grass ground cover throughout the area.

The wall bisects the property east to west, and is attached to the Site F2 railroad berm to the east. The wall continues west beyond the west project area boundary (see Figure 10). The wall is approximately 80.0 m in long (E/W) where it crosses the project area by 1.20 m wide, with a maximum height of 1.50 m. It is constructed of stacked angular and subangular basalt cobbles and small boulders (Figure 44). The wall is bifaced and cobble core filled and is stacked up to seven courses high in some areas. A portion of the wall to the east, approximately 12.0 m, constitutes the northern boundary of the Site 30602 enclosure. There are sections of the wall which are reinforced with pig and barbed wire fencing attached to T posts. Site 30601 is an Historic era ranch wall, appears to be unaltered, and is in good condition. No further work is recommended at Site 30601.

SITE 30602 **Enclosure**
FUNCTION: Ranching/Agricultural
AGE: Historic Era
DIMENSIONS: 23.0 m (E/W) by 16.0 m by 2.10 m in max. height
CONDITION: Fair
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: Historic era bottle
EXCAVATION: Shovel Probe Testing (SP-1, SP-2, SP-3, SP-4)
DESCRIPTION: Site 30602 is an enclosure located between 680 and 685 ft amsl within the northeastern portion of the project area (see Figure 10). It is situated on a

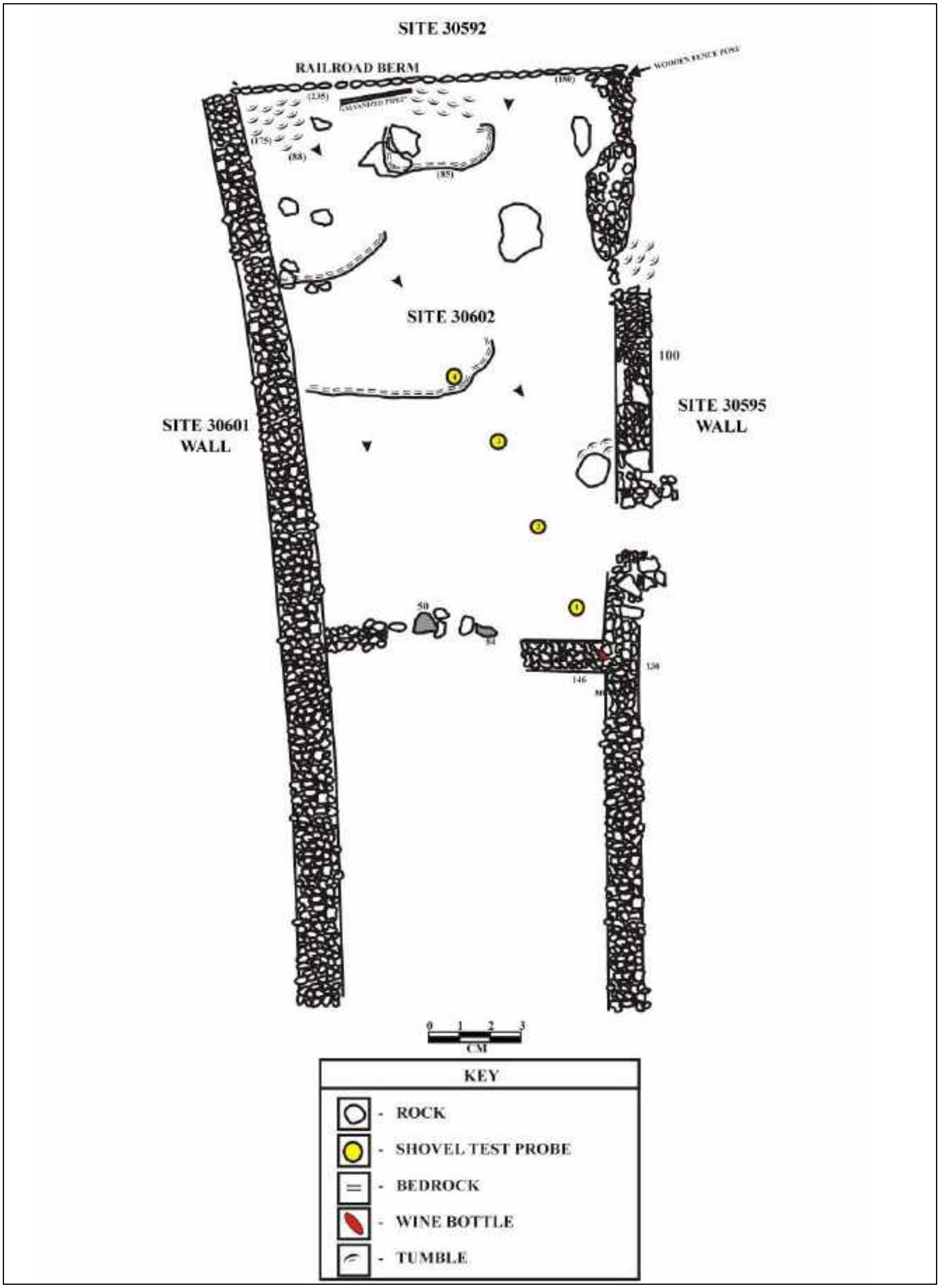

Figure 43: Site 30602 Plan View Map Showing Portions of Site 30592, Site 30595, and Site 30601.

Figure 44: Photograph of Site 30601 Rock Wall Looking North.

gentle *mauka*/*makai* slope, within close proximity to the eastern project area boundary. There are *koa haole* trees with Guinea grass ground cover throughout the area.

The enclosure is formed by utilizing and modifying several existing walls (see Figure 43). It is bounded to the east by a 16.0 m section of Site 30592 railroad berm, to the north by a 21.0 m section of Site 30601 wall, to the south by a 23.0 m section of Site 30595 wall (Figure 45) and to the west by a wall which spans the distance between Site 30601 and Site 30595, approximately 10.0 m. The Site 30602 wall is constructed of stacked angular and subangular basalt cobbles and small boulders. The western boundary wall of the enclosure varies in condition from good to almost nonexistent, with only the southernmost portion of the wall remaining. The intact wall segment is approximately 3.30 m in length and 0.90 m wide, with a maximum height of 1.30 m. There is a aqua colored bottle at the top of the wall segment (Figure 46). All other portions of the Site 30602 west wall have been altered to varying degrees. The mid section is completely gone with the exception of a few rocks, two of which remain in place.

A section of Site 30595 wall has been removed to create an entrance to Site 30602 enclosure interior. Exposed bedrock is visible within in the northeastern portion of the enclosure interior, encompassing approximately one third of the total area. There is a section of galvanized pipe near the base of Site 30592 railroad berm. There is loose rock from collapsed portions of wall, which lie within the interior. The Site 30592 railroad berm portion of the enclosure to the east predates the other walls that form the enclosure and the western enclosure boundary wall is the most recently constructed.

<u>Shovel Probe Testing</u>

A line of four shovel probes spaced roughly 3.0 meters apart were excavated within the level soil interior of the enclosure. The shovel probe line extended from the southwest corner, toward the northeast corner, terminating midway at a bedrock outcrop. The shovel probes were excavated to depths ranging from 27.0 to 60.0 cmbs and terminated on bedrock or large basalt rocks (Table 9).

Figure 45: Photograph of Site 30602 West Wall (Left)and Site 30595 Wall (Right) Looking East.

Figure 46: Photograph of Site 30602 Enclosure Wall and Bottle.

Table 9: Site 30602 Shovel Probe Results.

SP#	Depth (cm)	Layers	BOE	Artifacts
1	0 - 60 cm	I, II, III	Basalt Rock	*Kukui* Nut Shell
2	0 - 60 cm	I, II, III	Basalt Rock	*Kukui* Nut Shell
3	0 - 47 cm	I, II, III	Basalt Rock	-
4	0 - 27 cm	I & II	Basalt Bedrock	-

Two of the four shovel probes contained unburned *kukui* nut shell. No other cultural material was recovered from the shovel probes. There were no cultural remains encountered on the ground surface at the site, with the exception of the bottle and the section of galvanized pipe.

Based on the construction style and the fact that the feature is constructed onto the Site 30592 railroad berm, Site 30602 is interpreted as an Historic era enclosure associated with ranching and commercial agriculture. The feature wall is partially collapsed and is in fair condition. No further work is recommended at Site 30602.

SITE 30603 **Enclosure**

FUNCTION: Ranching/Agricultural

AGE: Historic Era

DIMENSIONS: 35.0 m (NE/SW) by 24.0 m by 1.45 m in max. height

CONDITION: Fair

INTEGRITY: Possesses Integrity of Location and Materials

SURFACE ARTIFACTS: None

EXCAVATION: Shovel Probe Testing (SP-1, SP-2)

DESCRIPTION: Site 30603 is an L-shape enclosure (Feature 1) and three linear terraces (Feature 2, 3, and 4) located between 680 and 685 ft amsl immediately west of Site 30602 (see Figure 10). It is situated on a gentle west facing slope among *koa haole* trees with Guinea grass ground cover.

The L-shape enclosure is constructed onto the south side of the Site 30595 rock wall and is approximately 35.0 m long (NE/SW) by 24.0 m wide (Figure 47). The enclosure walls are roughly 66.0 m long by 1.0 m wide with a maximum height of 1.45 m. The walls are constructed of stacked angular and subangular basalt cobbles and small boulders and is bifaced and cobble core filled (Figures 48, 49, and 50).

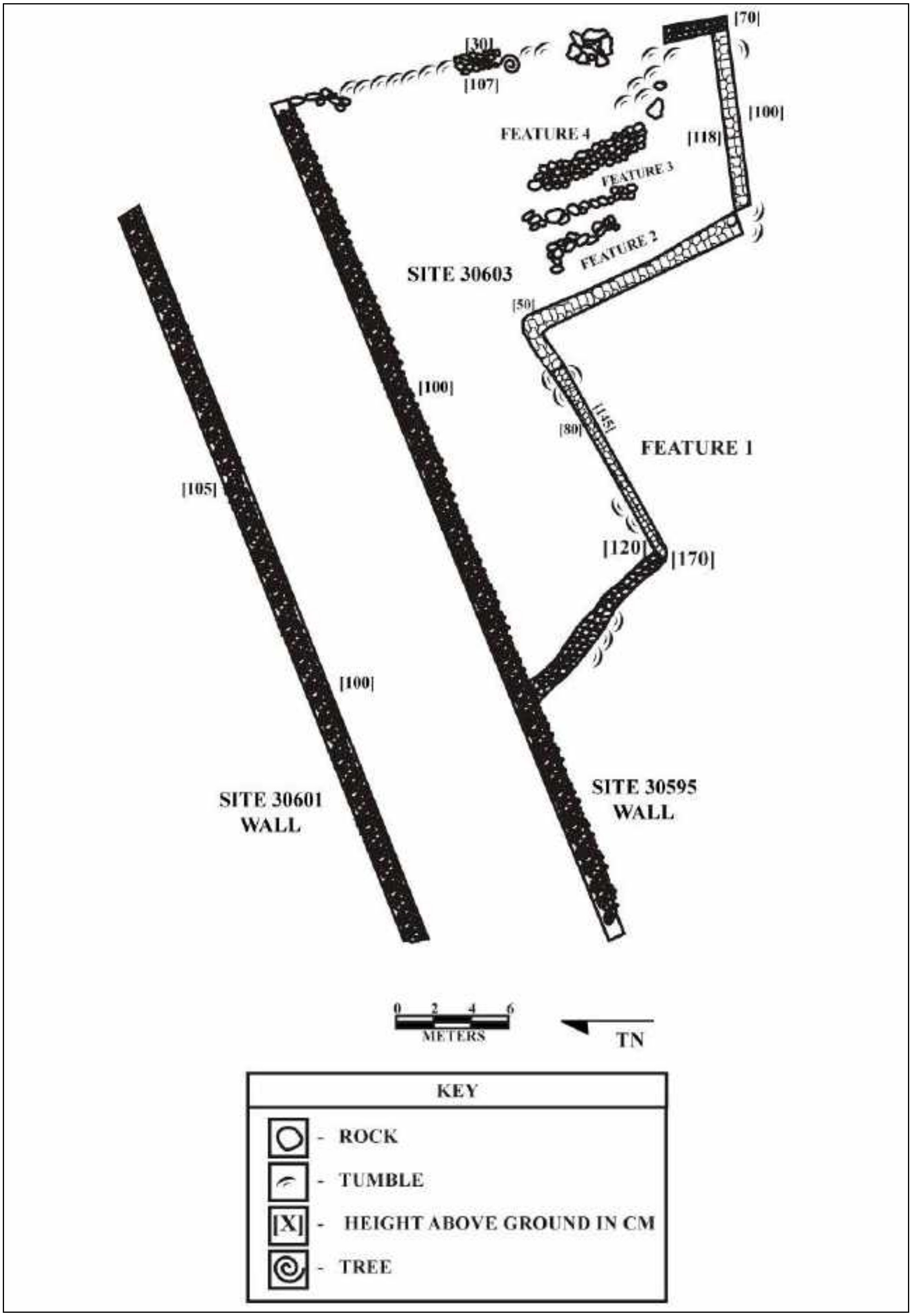

Figure 47: Site 30603 Plan View Map.

Figure 48: Photograph of Site 30603 Southwest Corner of Enclosure Feature 1, Looking Northwest.

Figure 49: Photograph of Site 30603 Western South Wall of Enclosure Feature 1, Looking Southwest.

Figure 50: Photograph of Site 30603 Middle Corner of Enclosure Feature 1, Looking South.

A roughly 35.0 m segment of the Site 30595 rock wall forms the north boundary of the enclosure (Figure 51). The eastern enclosure wall segment is approximately 24.0 m long (NW/SW) and is mostly collapsed. Portions of the southern and western wall segments have also collapsed, although the easternmost segment of the southern wall is still intact.

There are three linear agricultural terraces (Features 2, 3, and 4) within the southeast corner of the enclosure (Figure 52 and Figure 53). The terraces are oriented NW/SE within the rocky soil interior of the enclosure. Feature 2 is furthest *makai* (west) and Feature 4 is furthest *mauka* (east).

The Feature 2 retaining wall is approximately 4.0 m in length and 1.0 m wide, with a maximum height of 0.60 m. The Feature 3 retaining wall is approximately 6.0 m in length and 0.50 m wide, with a maximum height of 0.60 m. The Feature 4 retaining wall is a more substantial construct than the others. It is approximately 7.0 m in length and 1.0 m wide, with a maximum height of 0.90 m. No cultural material was identified on the ground surface at the site.

<u>Shovel Probe Testing</u>

Two shovel probes were excavated within the level soil surfaces of terraces Feature 2 (SP-1) and Feature 3 (SP-2) to determine function and age. The shovel probes were excavated approximately 4.0 m apart, were dug to depths ranging from 30.0 to 36.0 cmbs, and terminated on bedrock or large basalt rocks (Table 9). Shovel probe stratigraphy consisted of Layer I (0-13 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (13-36 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. A small amount of unburned *kukui* nut shell was recovered from SP-2.

Table 10: Site 30603 Shovel Probe Results.

SP#	Depth (cm)	Layers	BOE	Artifacts
1	0 - 30 cm	I & II	Basalt Rock	-
2	0 - 36 cm	I & II	Basalt Rock	*Kukui* Nut Shell

Figure 51: Photograph of Site 30595 Wall Portion of Site 30603 Enclosure Feature 1, Looking North.

Figure 52: Photograph of Site 30603 Feature 2 Terrace Looking Southeast.

Figure 53: Photograph of Site 30603 Feature 2 Terrace (Center) and Feature Retaining Wall (Left), Looking Southeast.

Based on the construction style of the enclosure and the fact that the enclosure walls are constructed onto the Site 30595 wall, and the Site 30595 wall is constructed onto the Site 30592 railroad berm, Site 30603 is interpreted as an Historic era enclosure associated with agriculture and ranching. Site 30603 has been impacted by modern land clearing activities and is in fair condition. No further work is recommended at Site 30603.

SITE 30604 **Agricultural Complex**
FUNCTION: Agricultural
AGE: Pre-Contact Era to Historic Era
DIMENSIONS: 12.0 m (NW/SE) by 5.0 m
CONDITION: Fair
INTEGRITY: Possesses Integrity of Location and Materials SURFACE
ARTIFACTS: None
EXCAVATION: Shovel Probe Testing (SP-1)
DESCRIPTION: Site 30604 is an agricultural complex located at 675 ft amsl 2.0 meters south of Site 30602 (see Figure 10). It is situated on a gentle west facing slope with *koa haole* trees and Guinea grass ground cover throughout the area.

Site 30604 is a planting feature (Feature 1) and three terraces (Features 2, 3, and Feature 4) (Figure 54). Feature 1 is a possible oval planting feature located in the southeast corner of the site. It is constructed of angular basalt cobbles and small boulders piled one to two courses high and two to three courses wide on the ground surface (Figure 55). The feature is approximately 2.50 m in length (E/W) and 2.10 m wide, with a maximum height of 0.60 m. There were no cultural remains on the ground surface at Feature 1.

Feature 2 is a small two-sided terrace located along the northwest edge of Feature 1. The terrace is 2.70 long (NW/SE) by 1.5 m wide. The terrace retaining wall is 2.70 m long by 0.60 m wide and is 0.62 m in maximum height above the ground surface to the southwest. It is constructed of basalt cobbles and small boulders piled up to three courses high on the ground surface (Figure 56). There were no cultural remains on the ground surface at Feature 2.

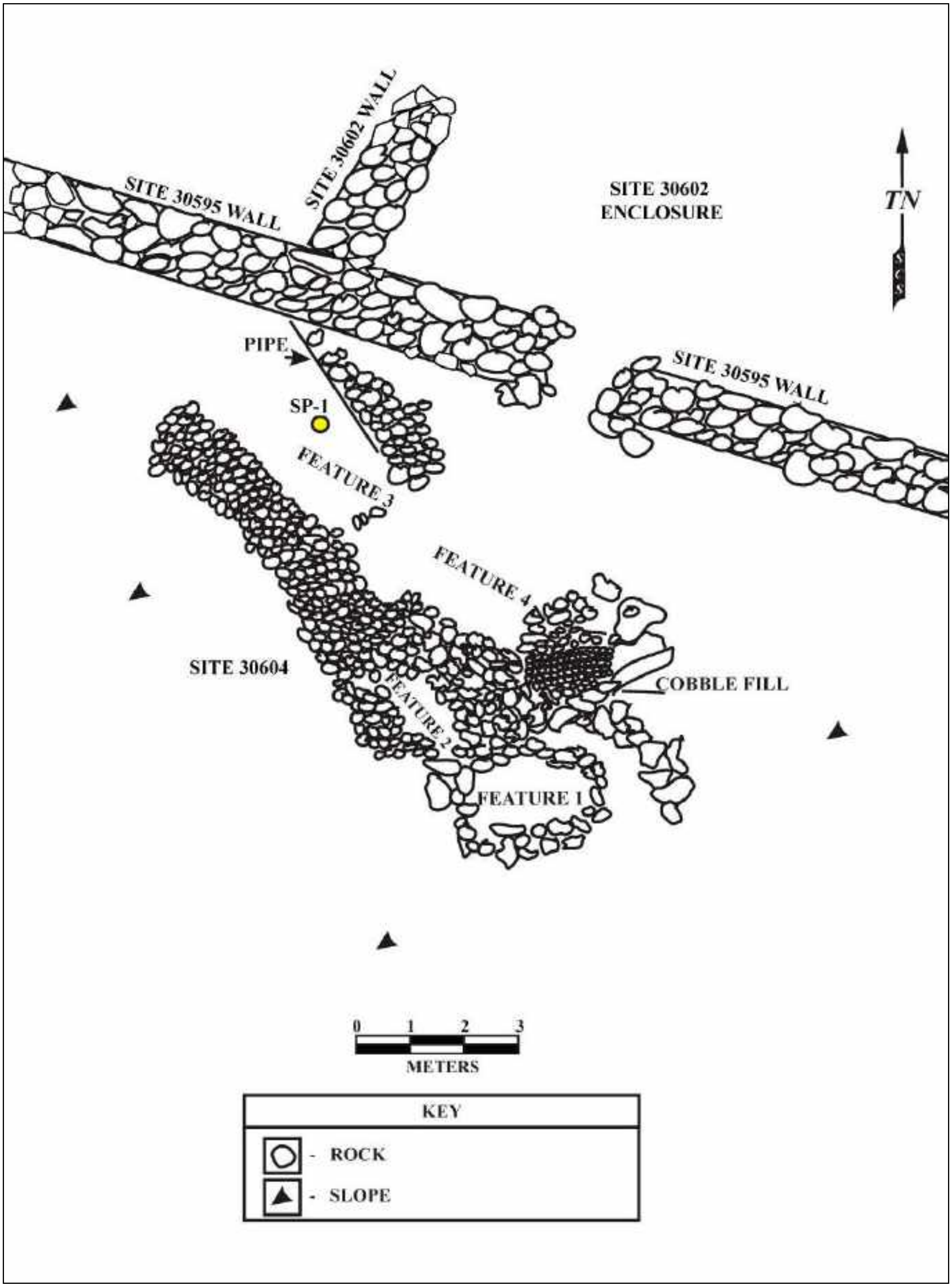

Figure 54: Site 30604 Plan View Map.

Figure 55: Photograph of Site 30604 Feature 1 Looking Southwest.

Figure 56: Photograph of Site 30604 Feature 2 Looking Southeast.

Feature 3 is a linear terrace located along the northwest side of Feature 2. The terrace is 4.80 long (NW/SE) by 3.0 m wide. The terrace retaining wall is 2.70 m long by 1.0 m wide and is 0.85 m in maximum height above the ground surface to the southwest. It is constructed of basalt cobbles and small boulders piled up to three courses high on the ground surface (Figure 57). A section of galvanized pipe is situated along the easternmost portion of the terrace. There were no cultural remains identified at Feature 3.

Shovel Probe Testing

A shovel probe (SP-1) was excavated within the level soil of the Feature 3 terrace to determine function and age. SP-1 was excavated to a depth of 50.0 cmbs and terminated on bedrock or a large basalt rock. Shovel probe stratigraphy consisted of three natural stratigraphic layers: Layer I (0-14 cmbs) loose dark brown (10YR3/2) fine sandy silt loam, Layer II (14-41 cmbs) soft brown (10YR4/3) sandy silt, and Layer III (41-50 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. A railroad spike, a wire nail, and a volcanic-glass flake were recovered from SP-1 (Figure 58). The volcanic-glass flake was collected and the other artifacts were left at the site.

Feature 4 is a two-sided terrace located along the north edge of Feature 1. The terrace is approximately 2.25 m long (NE/SW) by 2.0 m wide, and is 0.80 m in maximum height. It is constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface (Figure 59). There is single strand wire within the western portion of the site.

It is possible that Site 30604 is a pre-Contact to early post-Contact era agricultural site. The single volcanic-glass flake suggests that area might have been used for agricultural and resource gathering. However, the proximity of Site 30604 to Site 30602 and the presence of the railroad spike and wire nail suggest that Site 30604 was definitely used during the Historic era. It is very likely that Site 30604 was an Historic era agricultural site associated with sugarcane or coffee growing.

Figure 57: Photograph of Site 30604 Feature 3 Looking Southeast.

Figure 58: Photograph of Artifacts Recovered from Site 30604, Feature 3, SP-1.

Figure 59: Photograph of Site 30604 Feature 4 Looking South.

SITE 30605	**Rock Wall**
FUNCTION:	Ranching
AGE:	Historic Era
DIMENSIONS:	90. m (E/W) by 0.75 m by 1.0 m in max. height
CONDITION:	Good
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: Site 30605 is an Historic era wall located between 600 and 685 ft amsl through the center of the project area (see Figure 10). The wall trends *mauka*/*makai* across the west facing slope. There are *kukui* nut and *koa haole* trees with Guinea grass ground cover throughout the area.

The wall bisects the property east to west, terminating to the east near the Site 30592 railroad berm and continuing to the west beyond the project area boundary. The wall is constructed of angular and subangular basalt cobbles and small boulders, incorporating some as large as 0.50 m (Figure 60). The wall is approximately 90.0 m long (E/W) where it crosses the project area by 0.75 m wide, with a maximum height of 1.0 m. It is a bifaced, cobble core filled wall and is stacked up to five courses in height. The condition of the wall diminishes near its western terminus where it has collapsed. There were no cultural remains encountered within the area of the site. Site 30605 has been impacted by modern land clearing activities, is partially collapsed in places, and is in good condition. No further work is recommended for Site 30605.

Figure 60: Photograph of Site 30605 Wall Looking Northeast.

SITE 30606	**Rock Wall**
FUNCTION:	Ranching/Agricultural
AGE:	Pre-Contact to Historic Era
DIMENSIONS:	37.0 m (NW/SE) by 1.90 m by 1.30 m in max. height
CONDITION:	Poor
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: Site 30606 is an Historic era wall segment located at 620 ft amsl within the southwestern portion of the project area (see Figure 10). The wall trends northwest/southeast and is situated in an area with *koa haole* trees and Guinea grass ground cover.

The Site 30606 rock wall segment is located between the Site 30605 wall and the Site 30597 wall, and is less formally constructed than either of the two (Figure 61). The wall is approximately 37.0 m in length (NW/SE) and 1.90 m wide, with a maximum height of 1.30 m. Site 30606 is presently a rubble wall consisting of angular and sub angular basalt cobbles piled three to six courses high and three to four courses wide on the ground surface. There is no formal stacking or facing evident in the wall construction, though it might have been a stacked and faced wall that has been disturbed by modern land clearing activities. The majority of the western (downhill) portions of the wall have collapsed, with an increase in collapse in low lying areas. There were no cultural remains identified on the ground surface at the site. Site 30606 is an Historic era rock wall associated with ranching. It has been altered by modern land clearing, is mostly collapsed, and is in poor condition.

Figure 61: Photograph of Site 30606 Rock Wall Looking North.

SITE 30607 **Agricultural Complex**
FUNCTION: Agriculture
AGE: Pre-Contact Era to Historic Era
DIMENSIONS: 55.0 m (NW/SE) by 27.5
CONDITION: Fair
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: None
EXCAVATION: Shovel Probe Testing (SP-1 through SP-10)
DESCRIPTION: Site 30607 is an agricultural complex located between 620 and 630 ft amsl within the southwestern portion of the project area, on a steep west facing slope (see Figure 10). There are *koa haole* trees with Guinea grass ground cover throughout the area.

The Site 30607 agricultural complex includes seven terraces (Feature 1 through Feature 7) located north of wall Site 30597, south of wall Site 30605, west of wall Site 30598 and on both sides of wall Site 30606 (Figure 62). Feature 1 is a three-sided terrace located in the northeast corner of the site. The terrace retaining wall is constructed primarily of angular and subangular basalt cobbles and small boulders piled up to four courses in high (Figure 63). It is approximately 3.70 m in length (N/S) by 1.40 m wide, with a maximum height of 1.05 m. There is no formal stacking or facing in the feature construction. There were no cultural remains on the ground surface at Feature 1.

Shovel Probe Testing

A shovel probe (SP-1) was excavated within the sloping soil interior of Feature 1 to determine function and age. The shovel probe was excavated to a depth of 37.0 cmbs and terminated on bedrock or a large basalt rock. SP-1 stratigraphy was Layer I (0-16 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (16-37 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-1 contained a total of five volcanic-glass fragments and several charcoal fragments.

Feature 2 is a three-sided terrace located within the central western portion of Site 30607. The terrace is situated on a west facing slope and is constructed along the west side of wall Site 30606. The northwest and southwest corners of the terrace are curved and the terrace retaining walls are constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface (Figure 64). There is no formal stacking

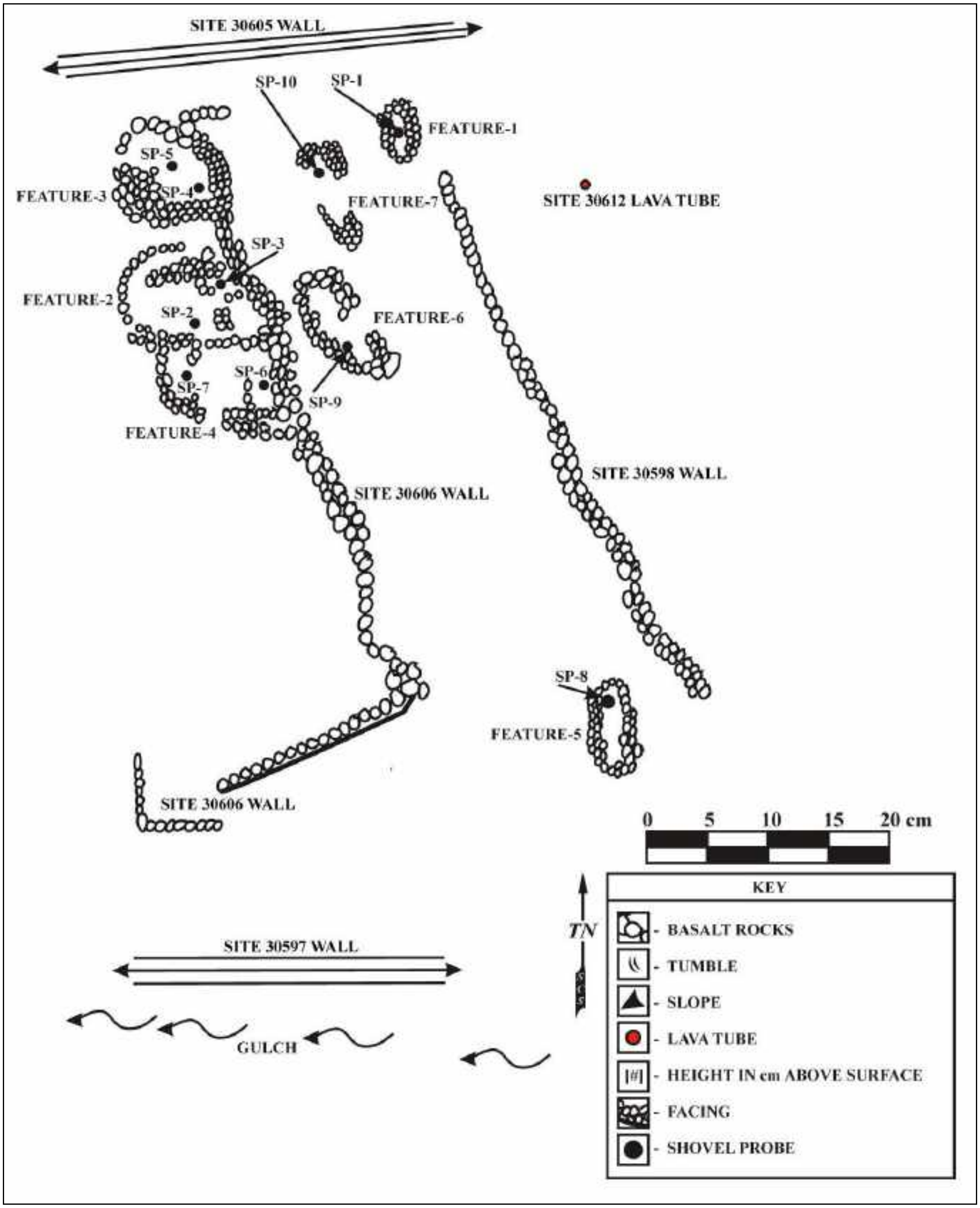

Figure 62: Site 30607 Plan View Map.

Figure 63: Photograph of Site 30607 Feature 1 Terrace Looking Southeast.

Figure 64: Photograph of Site 30607 Feature 2 Terrace (Background) and Site 305956 Wall (Foreground), Looking West.

or facing evident in the feature construction. The terrace is approximately 10.0 m in length (E/W) and 6.0 m wide, with a maximum height of 1.10 m.

There are large quantities of rock within the soil area of the terrace. Piled rock combined with rock which has collapsed from surrounding areas (Site 30606 rubble wall and elsewhere) is approximately 1.10 m in height and 2.10 m wide, dividing the surface of the terrace to form two areas. The westernmost area is approximately 7.5 m in length (E/W) and 5.5 m wide (Figure 65). The easternmost area is an enclosed area formed by rock piled on the surface of the terrace where it abuts Site 30606 (Figure 66). The enclosed area is approximately 5.0 m in length (N/S) and 2.5 m wide. There were no cultural remains at Feature 2.

Shovel Probe Testing

Two shovel probes (SP-2 and SP-3) were excavated within the level soil interior of Feature 2 to determine feature function and age. The shovel probes were excavated approximately 4.5 m from one another, within the western area (SP-2) and the eastern area (SP-3). The shovel probes were excavated to depths ranging from 34.0 to 43.0 cmbs and terminated on bedrock or large basalt rocks (Table 10). Shovel probe stratigraphy consisted of three natural stratigraphic layers: Layer I (0-16 cmbs) loose dark brown (10YR3/2) fine sandy silt loam, Layer II (16-37 cmbs) soft brown (10YR4/3) sandy silt, and Layer III (37-43 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. The shovel probes did not contain cultural material.

Table 11: Site 30607 Feature 2 Shovel Probe Results.

SP#	Depth (cm)	Layers	BOE	Artifacts
2	0 - 43 cm	I, II, III	Basalt Rock	-
3	0 - 34 cm	I & II	Basalt Rock	-

Feature 3 is three-sided terrace located north of Feature 2. The terrace is situated on a west facing slope and is constructed along the west side of wall Site 30606. The northwest and southwest corners of the terrace are curved and the terrace retaining walls are constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface (Figure 67). There is no formal stacking or facing evident in the feature construction. Feature 3 is approximately 7.5 m in length (N/S) and 7.0 m wide, with a maximum height of 0.60 m. The western portion of the terrace retaining wall is mostly collapsed. There were no cultural remains at Feature 3.

Figure 65: Photograph of Site 30607, Feature 2, Western Area Looking East.

Figure 66: Photograph of Site 30607, Feature 2, Eastern Area Looking East.

Figure 67: Photograph of Site 30607, Feature 3 Looking South.

Shovel Probe Testing

Two shovel probes (SP-4 and SP-5) were excavated within the level soil interior of Feature 3. The shovel probes were excavated approximately 2.5 m from one another. The shovel probes were excavated to depths ranging from 48.0 to 54.0 cmbs and terminated on bedrock or large basalt rocks (Table 11). Shovel probe stratigraphy consisted of three natural stratigraphic layers: Layer I (0-14 cmbs) loose dark brown (10YR3/2) fine sandy silt loam, Layer II (14-38 cmbs) soft brown (10YR4/3) sandy silt, and Layer III (38-54 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-4 contained two volcanic glass flakes recovered between 0-15 cmbs, and small charcoal fragments recovered between 15-30 cmbs. SP-5 contained several very small charcoal fragments that were not collected.

Table 12: Site 30607 Feature 3 Shovel Probe Results.

SP#	Depth (cm)	Layers	BOE	Artifacts
4	0 - 54 cm	I, II, III	Basalt Rock	Volcanic glass, Charcoal Fragments
5	0 - 48 cm	I, II, III	Basalt Rock	Charcoal Fragments

Feature 4 is a two-sided terrace located along the south edge of Feature 2. The terrace abuts the west edge of wall Site 30606. It is approximately 10.0 m in length (E/W) and 6.5 m wide, with a maximum height of 0.94 m. The terrace retaining wall is constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface (see Figure 62). There is no formal stacking or facing evident in the feature construction. There is piled rock near the center of the terrace that divides the surface of the terrace into two areas. The easternmost area is enclosed by rock piled near the center of the terrace and by wall Site 30606 (Figure 68). The enclosed area is approximately 5.5 m in length (N/S) and 2.5 m wide. The westernmost portion is approximately 7.5 m in length (E/W) and 5.0 m wide (Figure 69). The south edge of the terrace is partially collapsed. There were no cultural remains at Feature 4.

Shovel Probe Testing

Two shovel probes (SP-6 and SP-7) were excavated within Site 30607 Feature 4 to determine feature function and age. The shovel probes were excavated approximately 4.5 m from one another within the eastern area (SP-6) and the western area (SP-7). The shovel probes were excavated to depths ranging from 32.0 to 55.0 cmbs and terminated on bedrock or large basalt rocks (Table 12).

Figure 68: Photograph of Site 30607 Feature 4 Eastern Area Looking North.

Figure 69: Photograph of Site 30607 Feature 4 Western Area Looking Northwest.

Shovel probe stratigraphy consisted of three natural stratigraphic layers: Layer I (0-12 cmbs) loose dark brown (10YR3/2) fine sandy silt loam, Layer II (12-38 cmbs) soft brown (10YR4/3) sandy silt, and Layer III (38-55 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-7 contained a single fragment of dense crystalline basalt, possibly an unpolished exterior flake.

Table 13: Site 30607 Feature 4 Shovel Probe Results.

SP#	Depth (cm)	Layers	BOE	Artifacts
6	0 - 55 cm	I, II, III	Basalt Rock	-
7	0 - 32 cm	I & II	Basalt Rock	Basalt Debitage

Feature 5 is a three-sided terrace located in the southeast corner of Site 30607 (see Figure 62). The terrace is approximately 7.5 m in length (N/S) and 3.0 m wide, with a maximum height of 1.20 m. The terrace retaining wall is constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface (Figure 70). There is no formal stacking or facing evident in the feature construction. The west terrace retaining wall is collapsed, potentially brought about by *koa haole* tree growth, as well as the steepness of the slope. There were no cultural remains on the ground surface at Feature 5.

Shovel Probe Testing

A shovel probe (SP-8) was excavated within the level soil interior of Feature 5. The shovel probe was excavated to a depth of 30.0 cmbs and terminated on bedrock or a large basalt rock. SP-8 contained several very small charcoal fragments which were not collected.

Feature 6 is a three-sided terrace located east of Feature 2 and Feature 4 (see Figure 62). The terrace retaining wall is angled, situated cross-slope and constructed of angular and subangular basalt boulders piled on the ground surface (Figure 71). The terrace is approximately 7.6 m in length (NW/SE) by 3.5 m wide, with a maximum height of 1.20 m. Portions of the retaining wall to the east ere collapsed. There were no cultural remains identified on the ground surface at Feature 6.

Figure 70: Photograph of Site 30607 Feature 5 Looking South.

Figure 71: Photograph of Site 30607 Feature 6 Looking South.

Shovel Probe Testing

A single shovel probe (SP-9) was excavated within the level soil interior of Feature 6. The shovel probe was excavated to a depth of 33.0 cmbs and terminated on bedrock or a large basalt rock. Shovel probe stratigraphy consisted of Layer I (0-13 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (13-33 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-9 did not contain cultural material.

Site 30607 Feature 7 is a three-sided terrace located west of Feature 1 (see Figure 62). The terrace is situated cross-slope and is constructed of piled angular and subangular basalt boulders piled on the ground surface (Figure 72). There is no formal stacking or facing evident in feature construction. The terrace is 8.60 m in length (NW/SE) by 2.90 m wide, with a maximum height of 0.60 m. There were no cultural remains on the ground surface within the area of Feature 7.

Shovel Probe Testing

A single shovel probe (SP-10) was excavated within the level soil interior of Feature 10. The shovel probe was excavated to a depth of 37.0 cmbs and terminated on bedrock or a large basalt rock. Shovel probe stratigraphy consisted of Layer I (0-14 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (14-37 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-10 contained a single volcanic glass flake and five marine shell fragments which were recovered from 0-15 cmbs.

Site 30607 Summary

Sites 30598 (low piled wall), 30606, (low piled wall), and 30607 (agricultural complex) are all likely components of a single agricultural complex. This interpretation is based on their proximity to each other, their feature construction technique, and the fact that three of the Site 30607 terraces are constructed along the west side of the Site 30606 wall. In addition, it is very likely that the Site 306012 lava blister is also associated with these three sites. The small amount of traditional cultural material recovered from subsurface testing at Site 30607 is typical of traditional pre-Contact to early post-Contact era agricultural features. However, it might be that the artifacts are not directly associated with these features, and that they are related to resource collection prior to the construction of the features.

Figure 72: Photograph of Site 30607 Feature 7 Looking North.

The terrace features themselves are somewhat similar to Kona field System features recorded at projects in the general area of the current project. They differ in that they are more roughly constructed. This might be a function of the available rock in this location—the rock is much larger than that found in other places. However, it seems just as likely, or more likely, that the features were constructed in the Historic era for commercial agriculture. Their somewhat rough and hasty construction is similar to other Historic era agricultural features, most notably coffee terraces, documented at nearby project area. In addition, the presence of the Historic era refuse dump at nearby Site 30612 further suggests the agricultural complex is an Historic era site.

Site 30607 has been altered by ground clearing activities, the features are partially collapsed in places, and the site is in fair condition. No further work is recommended at Site 30607.

SITE 30608	**Enclosure**
FUNCTION:	Temporary Dwelling and Storage
AGE:	Historic Era
DIMENSIONS:	7.5 m (N/S) by 3.3 m by 1.20 m in max. height
CONDITION:	Fair
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: Site 30608 is a rectangular enclosure located at 670 ft amsl within the southeastern portion of the project area, roughly 15.0 m west of the Site 30592 railroad berm (see Figure 10). It is situated on a moderate west facing slope in an area of *koa haole* trees and Guinea grass ground cover.

The enclosure is rectangular and is constructed of angular and subangular basalt cobbles and small boulders, some of which are as large as 0.80 m (Figure 73). The wall is bifaced and cobble core filled. It is approximately 7.50 m in length (N/S) and 3.30 m wide, with a maximum height of 1.20 m. Portions of the walls to the north and southwest have collapsed, suggesting that the enclosure might have been impacted by heavy equipment.

Figure 73: Photograph of Site 30608 Enclosure Looking Southeast.

It is possible that the enclosure was constructed by modifying a wall segment just west of the Site 30592 railroad berm wall. Rocks might have been removed from the ends of the wall to construct two walls (north and south walls) between the wall segment and the railroad berm to the east. The east wall of the enclosure is the railroad berm wall. There is single strand heavy gauge fencing wire within the interior of the feature. Based on construction method and proximity to the railroad berm, it is most likely that Site 30608is the remains of an Historic era structure. The enclosure has been altered by modern land clearing activities and is in fair condition.

SITE 30609	**Enclosure**
FUNCTION:	Temporary Dwelling and Storage
AGE:	Historic Era
DIMENSIONS:	6.6m (N/S) by 4.5 m by 1.20 m in max. height
CONDITION:	Good
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: Site 30609 is a rectangular enclosure located at 680 ft amsl approximately 14.0 meters northeast of Site 30609 (see Figure 10). It is situated on a moderate west facing slope close to the eastern project area boundary and just west of the Site 30592 railroad berm. There are *koa haole* trees and Guinea grass ground cover throughout the area.

The enclosure is rectangular and is constructed of angular and subangular basalt boulders, some of which are as large as 1.05 m (Figure 74 and Figure 75). The wall is bifaced and cobble core filled. It is approximately 6.60 m in length (N/S) and 4.5 m wide, with a maximum height of 1.20 m.

It is possible that the enclosure was constructed by modifying a wall segment just west of the Site 30592 railroad berm wall. Rocks might have been removed from the ends of the wall to construct two walls (north and south walls) between the wall segment and the railroad berm to the east. The east wall of the enclosure is the railroad berm wall.

Portions of the walls to the east have collapsed, indicating that this structure may have been impacted by heavy equipment. Site 30609 is approximately 14.0 m northeast of Site 30608, and is similar in construction. A single strand of heavy gauge fencing wire was found in the interior of this feature also. Based on construction method and proximity to the railroad berm, it is most likely that Site 30609is the remains of an Historic era structure. The enclosure has been altered by modern land clearing activities and is in fair condition.

SITE 30610 **Terrace**
FUNCTION: Agricultural
AGE: Pre-Contact Era Historic Era
DIMENSIONS: 6.75 m (NW/SE) by 3.0 m by 0.40 m in max. height
CONDITION: Fair
INTEGRITY: Possesses Integrity of Location and Materials
SURFACE ARTIFACTS: None
EXCAVATION: Shovel Probe Testing (SP-1)
DESCRIPTION: Site 30610 is a three-sided terrace located at 675 ft amsl within the southeastern portion of the project area (see Figure 10). The site is situated on a west facing slope, to the southwest and down slope of Site 30608, within close proximity to the eastern project area boundary. There are *koa haole* trees and Guinea grass ground cover throughout the area.

The terrace is approximately 6.75 m long (NW/SE) by 3.4 m wide, with a maximum height of 0.40 m (Figure 76). The interior soil surface of the terrace slopes slightly to the west. The terrace retaining wall is constructed of piled angular and subangular basalt cobbles and small boulders, some as large as 0.45 m (Figure 77). Portions of the retaining wall to the southwest may have been removed by modern land clearing activities. There were no cultural remains encountered on the surface in the area of the terrace.

Shovel Probe Testing

A single shovel probe (SP-1) was excavated within the soil filled interior of Site 30610. The shovel probe was excavated to a depth of 22.0 cmbs and terminated on bedrock or a large basalt rock. Shovel probe stratigraphy consisted of Layer I (0-13 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (13-22 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-1 contained several very small fragments of charcoal which were not collected.

Figure 74: Photograph of Site 30609 Enclosure Looking East.

Figure 75: Photograph of Site 30609 Enclosure Looking Northeast.

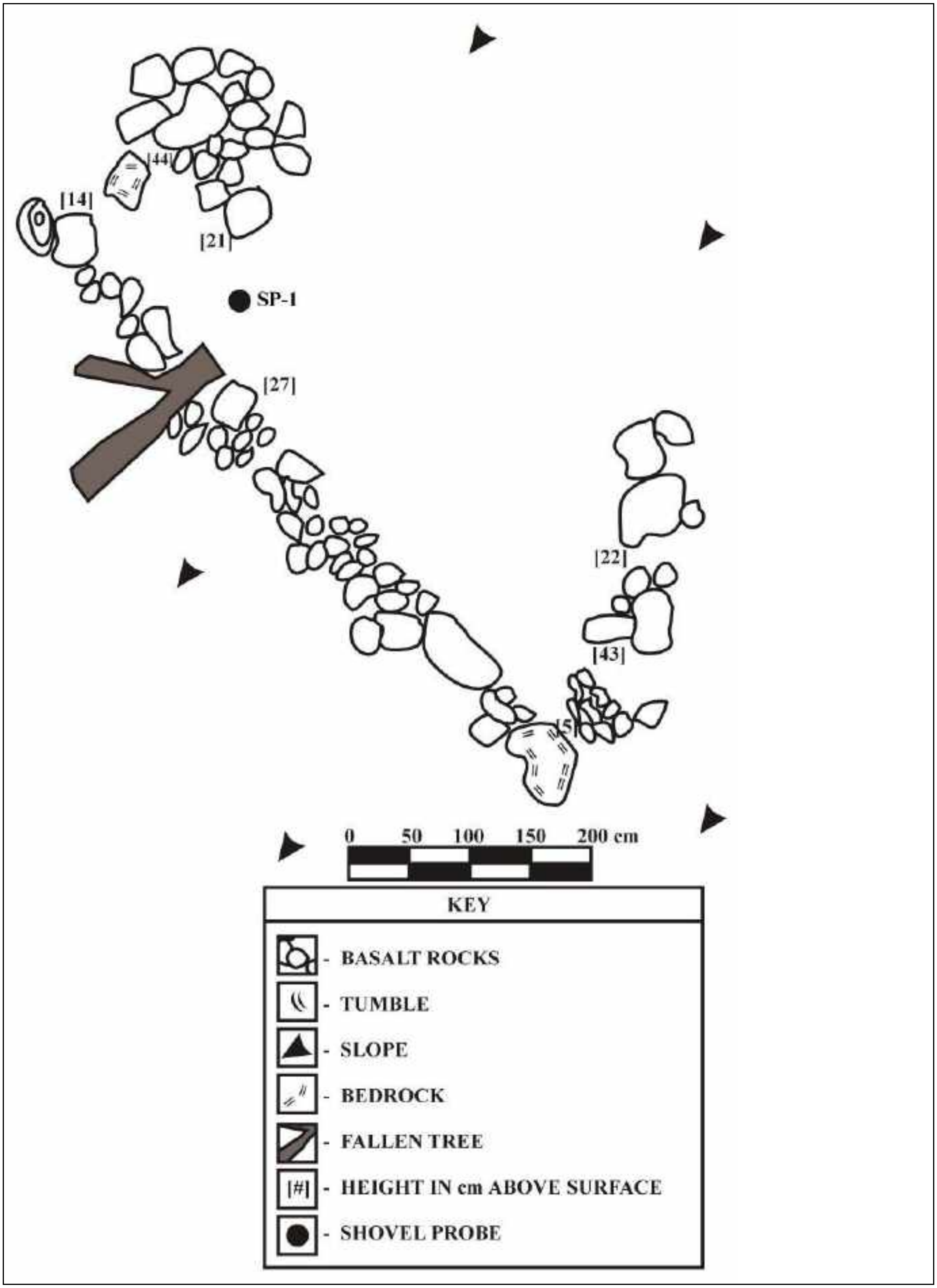

Figure 76: Site 30610 Plan View Map.

Figure 77: Photograph of Site 30610 Terrace Looking Southwest.

SITE 30611	**Agricultural Complex**
FUNCTION:	Agriculture
AGE:	Historic Era
DIMENSIONS:	10.0 m (N/S) by 7.0 m
CONDITION:	Good
INTEGRITY:	Possesses Integrity of Location and Materials
SURFACE ARTIFACTS:	None
EXCAVATION:	Shovel Probe Testing (SP-1, SP-2, and SP-3)

DESCRIPTION: Site 30611 is an agricultural complex located at 670 ft amsl in the southeast portion of the project area (see Figure 10). The site is three terraces (Features, 1, 2, and 3) situated on a west facing slope in an area of *koa haole* and *kukui* nut trees with Guinea grass ground cover.

Feature 1 is located at the northeast end of the site and is a roughly rectangular soil filled terrace approximately 6.5 m long (NW/SE) by 2.0 m wide, with a maximum height of 1.0 m along southwest edge (Figure 78). The terrace retaining wall is constructed of piled angular and subangular basalt cobbles and small boulders, some as large as 0.90 m (Figure 79). There is no formal stacking or facing evident in the feature construction. The northern portion of the terrace has collapsed in several areas. The southern portion is better preserved, where several large somewhat tabular boulders have been incorporated into the construction. There were no cultural remains identified at Feature 1.

Shovel Probe Testing

A shovel probe (SP-1) was excavated within the level soil interior of Feature 1. The shovel probe was excavated to a depth of 29.0 cmbs and terminated on bedrock or a large basalt rock. Shovel probe stratigraphy consisted of Layer I (0-13 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (13-29 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-1 contained a single fragment of rusted metal.

Feature 2 is a two-sided terrace located at the south end of the site. The terrace retaining wall is constructed of piled angular and subangular basalt boulders, some as large as 0.75 m (Figure 80). There is no formal stacking or facing evident in the feature construction. The terrace is approximately 3.5 m in length (NW/SE) and 2.5 m wide,

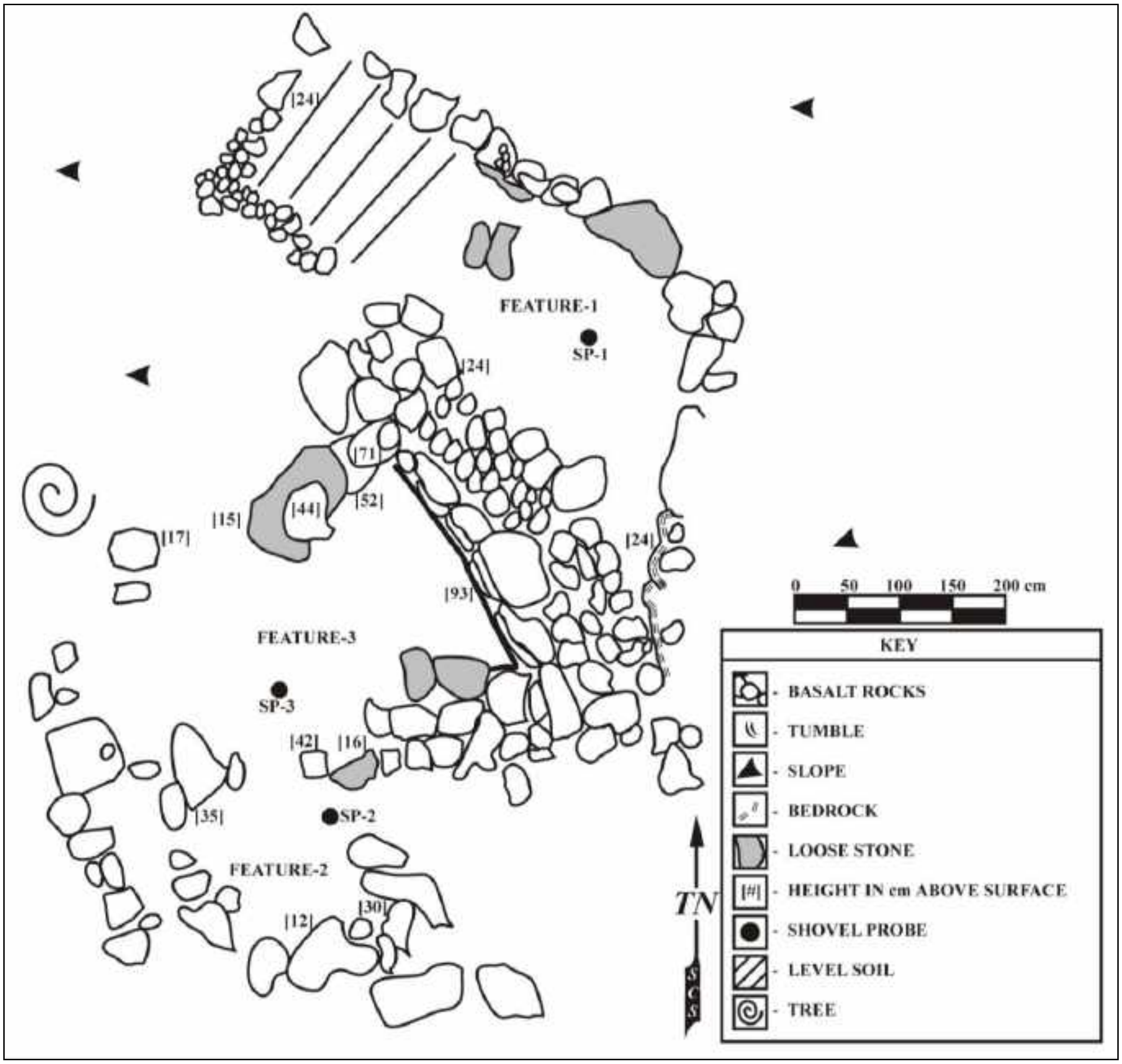

Figure 78: Site 30611 Plan View Map.

Figure 79: Photograph of Site 30611 Feature 1 Looking Southeast.

Figure 80: Photograph of Site 30611 Feature 2 Looking South.

with a maximum height of 0.35 m, the surface of which slopes to the west. There were no cultural remains on the ground surface at Feature 2.

Shovel Probe Testing

A single shovel probe (SP-2) was excavated within the level soil interior of Feature 2. The shovel probe was excavated to a depth of 20.0 cmbs and terminated on bedrock or a large basalt rock. Shovel probe stratigraphy consisted of Layer I (0-12 cmbs) loose dark brown (10YR3/2) fine sandy silt loam overlying Layer II (12-20 cmbs) soft dark yellowish brown (10YR4/4) fine sandy silt. SP-2 did not contain cultural material.

Feature 3 is a roughly rectangular terrace located between Feature 1 and Feature 2 (see Figure 78). The terrace is approximately 3.40 m in length (NW/SE) by 2.25 m wide, with a maximum height of 0.52 m. The terrace retaining wall is constructed of piled angular and subangular basalt cobbles and small boulders, some as large as 0.75 m (Figure 81). A partial wall along the southeastern boundary of the Feature 3 terrace separates it from the Feature 2 terrace, which is situated to the immediate south. The intact portion of wall is 1.50 m, although it likely formerly continued southwest the entire length of the terrace, forming two separate terraces. There were no cultural remains on the ground surface at Feature 3.

Shovel Probe Testing

A single shovel probe (SP-3) was excavated in the level soil interior of Feature 3. The shovel probe was excavated to a depth of 11.0 cmbs and terminated on bedrock or a large basalt rock. Shovel probe stratigraphy consisted of Layer I (0-11 cmbs) loose dark brown (10YR3/2) fine sandy silt loam. SP-3 did not contain cultural material.

Site 30611 Summary

The terrace features at Site 30611 are somewhat similar to Kona field System features recorded at projects in the general area of the current project. They differ in that they are more roughly constructed. This might be a function of the available rock in this location—the rock is much larger than that found in other places. However, it seems just as likely, or more likely, that the features were constructed in the Historic era for commercial agriculture. Their somewhat rough and hasty construction is similar to other Historic era agricultural features, most notably coffee terraces, documented at nearby project area. Site 30611 has been slightly altered by ground clearing activities, the

Figure 81: Photograph of Site 30611 Feature 1 Looking Northeast.

features are partially collapsed in places, and the site is in fair condition. No further work is recommended at Site 30611.

SITE 30612	**Lava Blister**
FUNCTION:	Refuse Disposal Area
AGE:	Historic Era
DIMENSIONS:	3.40 m (NE/SW) by 3.40 m by 1.15 m in max. height
INTEGRITY:	Possesses Integrity of Location and Materials
CONDITION:	Good
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: Site 30612 is a small open lava blister located within the central southern portion of the project area (see Figure 10). The site is situated on a west facing slope approximately 10.0 meters east of wall Site 30598 (see Figure 37). There are *koa haole* trees with Guinea grass ground cover throughout the area.

The lava blister is opening is directly above the blister and measures 1.0 m long (N/S) by 0.65 m wide (Figure 82). The blister is approximately 3.40 m in length (NE/SW) and 3.40 m wide, with a maximum ceiling height of 1.15 m. A fair amount of Historic era refuse is scattered on the floor of the blister. Some of the items collected and photographed included glass bottles, fragments of ceramic and stoneware bowls and plates, rusted solder top cans, a section of corrugated roofing material, cow bones, and various glass and metal fragments (Figures 83, 84, and 85).

Site 30612 is an Historic era refuse disposal area. It is unaltered and in good condition. No further work is recommended for Site 30612.

Figure 82: Photograph of Site 30612 Blister Opening Looking North.

Figure 83: Photograph of Site 30612 Historic Era Bottles and Plateware.

Figure 84: Photograph of Site 30612 Soldered Cans.

Figure 85: Photograph of Site 30612 Historic Era Bottles.

CONCLUSION

DISCUSSION

Twenty two newly identified archaeological sites were recorded during the course of the archaeological inventory survey study. The sites are primarily agricultural terraces associated with pre-Contact era to Historic era agriculture and rock walls and enclosures associated with Historic era agriculture and ranching. A pre-Contact era to later post-Contact era lava tube burial and a portion of the old railroad berm were documented along the western and eastern edge of the project area, respectively.

The five acre project area has three primary divisions created by ranch walls (Site 30595, 30601, and 3065). All three of the walls are Historic era ranch walls and have typical formal characteristics of ranch walls; they are bi-faced, cobble core filled, and their sides slope inward towards the tops of the walls. They are all approximately 1.0 meter in height. Site 30597, located along the south boundary of the property and along the north side of a seasonal gulch, is similarly constructed.

Site 30602 and Site 30603 are enclosures constructed along wall Site 30595 and wall Site 30601. The latter two wall sites are constructed onto the west edge of the Site 30592 railroad berm and post-date the railroad berm. Sites 30602 and 30603 enclosures, as well as the wall sites, appear to be associated with both Historic era ranching and agriculture.

The northern portion of the project area, north of wall Site 30601 is north of the bulldozed “terraces” (see Figure3). It is mostly open grassland that appears to have been bulldozed during the Historic era to early Modern era. There were only two sites (Site 30591 and 30956) recorded in this northern third of the project area. Site 30591 is an agricultural complex with six terraces. Site 30956 is a hearth.

It is possible that the two sites are pre-Contact era to early post-Contact era in age. The terrace features are somewhat similar to Kona field System features recorded at projects in the general area of the current project. They differ in that they are more roughly constructed. This might be a function of the available rock in this location—the rock is much larger than that found in other places. However, it seems just as likely, or more likely, that the features were constructed in the Historic era for commercial agriculture. Their somewhat rough and hasty construction is similar to other Historic era agricultural features, most notably coffee terraces, documented at nearby project area. The hearth at Site 30596 is similar to other Historic era rectangular hearths recoded at sites on Hawai‘i Island.

The middle one third of the project area between wall Site 30595 and 30605 is entirely within the bulldozed “terraces” portion of the project area (see Figure 3). There are three small sites (Site 30593, 30594, and 30604) within the middle third of the project area.   Site 30593 is a pre-Contact era to early post-Contact era lava tube burial. Site 30594 is an agricultural terrace complex. The agricultural terraces at Site 30594 are somewhat similar to Kona field System features, but are much more roughly constructed than the formal cross-slope terraces and *mauka/makai kua‘iwi* walls documented in the KFS. Site 30604, based on artifacts recovered from subsurface testing and the site’s proximity to Site 30602 and 30603, is an Historic era agricultural terrace site.

It is interesting to note that there is a lower site density in the northern two divisions of the project area compared to the site density in the southern one third of the project. The northern two thirds likely were used primarily for cattle pasture. It is also likely that the two wall sites 30595 and 30601 formed a cattle chute or road leading to and from the two enclosures (Site 30602 and Site 30603) and the railroad bed.

The southern third of the project area, south of wall Site 30605, contained six primarily agricultural sites (Site 30598, 30600, 30606, 30607, 30610, and 30611) and four Historic era sites (Site 30599, 30608, 30609, and 30612) with functions other than primarily agricultural growing (see Figure 10). The nonagricultural sites are located closer to the railroad bed. The cluster of all of these sites together in this area seems to suggest that they are part of a Historic era commercial agricultural field. The proximity of this area to the seasonal gulch to the south might have influenced the decision to construct the agricultural features in this area.

All of the agricultural complexes documented in the project area are located between 600 and 700 feet (182 to 213 meters) amsl, within the lower *kalu‘ulu* zone. The region was traditionally used by Hawaiians for growing bread fruit and other arboreal crops, sweet potatoes, *ti*, *wauke* dryland *taro*, and sugarcane.

Volcanic-glass flakes, a basalt flake, and marine shell fragments were recovered in small amounts from subsurface testing, indicating that Hawaiians did pass through and use the project area lands. The lack of temporary habitation features and the fact that there aren’t more formally constructed agricultural terraces and rock clearing mounds suggests that they might not have used the area for extensive cultivation. If so, the agricultural terraces documented during the current study are most likely the remains of Historic era commercial agriculture.

SIGNIFICANCE ASSESSMENTS

Sites identified during this project were assessed for their significance as outlined in Hawai‘i Administrative Rules §13-284-6. To be assessed as significant a site shall possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following five criteria:

(a) It must be associated with events that have made a significant contribution to the broad patterns of our history, or be considered a traditional cultural property.

(b) It must be associated with the lives of persons significant in the past.

(c) It must embody distinctive characteristics of a type, period, or method of construction, or represent a significant and distinguishable entity whose components may lack individual distinction.

(d) It must have yielded or may be likely to yield, information important in prehistory or history.

(e) Have important value to native Hawaiian people or other ethnicities in the state, due to associations with cultural practices and traditional beliefs that were, or still are, carried out.

All of the archaeological sites documented in this report were evaluated for their significance (Table 14). All 22 sites identified during the current AIS study possess integrity of location and materials and were assessed significant under criterion “d” as they are likely to yield information important to prehistory and/or history. All of the sites, with the exception of the railroad berm Site 30592 and the burial Site 30593 provide information important to agricultural pursuits and cattle ranching. They provide data on pre-Contact era through post-Contact era and the Historic era features constructed to grow subsistence crops. They also provide data important to changing land-use as some farmers began to use land for cattle pasture in response to exposure to external trade routes and expanding markets on Hawai‘i Island and O‘ahu.

Table 14: Inventory of Project Area Archaeological Sites, Significance Assessments and Site Recommendations.

Site #	Site Type	Site Function	Age	Significance Criteria	Recommendation
30591	Agricultural Complex	Agriculture	Pre-Contact to Historic Era	d	No Further Work
30592	Railroad Bed and Berm	Transportation	Historic Era	a, c, d	Preservation
30593	Lava Tube	Burial	Pre-Contact to Early Post-Contact Era	d, e	Preservation
30594	Agricultural Complex	Agriculture	Pre-Contact to Historic Era	d	No Further Work
30595	Rock Wall	Ranching	Historic Era	d	No Further Work
30596	Possible Hearth	Food Preparation	Historic Era	d	No Further Work
30597	Rock Wall	Ranching	Historic Era	d	No Further Work
30598	Rock Wall	Agriculture/Ranching	Pre-Contact to Historic Era	d	No Further Work
30599	Platform & Enclosure	Ranching/Agriculture	Historic Era	d	No Further Work
30600	Terrace	Agriculture	Historic Era	d	No Further Work
30601	Rock Wall	Ranching	Historic Era	d	No Further Work
30602	Enclosure	Ranching/Agriculture	Historic Era	d	No Further Work
30603	Enclosure	Ranching/Agriculture	Historic Era	d	No Further Work
30604	Agricultural Complex	Agriculture	Pre-Contact to Historic Era	d	No Further Work
30605	Rock Wall	Ranching/Agriculture	Historic Era	d	No Further Work
30606	Rock Wall	Ranching/Agriculture	Pre-Contact to Historic Era	d	No Further Work
30607	Agricultural Complex	Agriculture	Pre-Contact to Historic Era	d	No Further Work
30608	Enclosure	Dwelling and Storage	Historic Era	d	No Further Work
30609	Enclosure	Dwelling and Storage	Historic Era	d	No Further Work
30610	Terrace	Agriculture	Pre-Contact to Historic Era	d	No Further Work
30611	Agricultural Complex	Agriculture	Pre-Contact to Historic Era	d	No Further Work
30612	Lava Blister	Refuse Dump	Historic Era	d	No Further Work

Ranch wall sites (30592, 30595, 30597, 30598, 30601, 30605 and 30606) and Historic era enclosure sites (30608 and 30609) provide information on how the land was altered and the types of features that were necessary to farming and ranching. Even the Historic era refuse dump (Site 30612) provides data on the types of items were available, useful and necessary to farmers and ranchers.

The railroad berm Site 30592 is also significant under criteria “a” and “c” as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. The burial Site 30593 is also significant criterion “e” as it has important value to Hawaiian people and people of other ethnic backgrounds in the state.

SCS consulted with the Office of Hawaiian Affairs (OHA) Kona representative Shane Nelson to ask for any input regarding Site 30592.

RECOMMENDATIONS

The burial Site 30593 is recommended for preservation in place with preservation treatments to be outlined in a Burial Site Component of a Preservation Plan (BSCPP). The railroad berm Site 30592 is recommended for preservation with preservation measures to be outlined in an archaeological preservation plan.

No further work is recommended for the remaining 20 archaeological sites (Sites 30591and 30594 through 30612). Information recorded for all 22 archaeological sites during the current study has adequately ascertained their function and age. Archaeological monitoring is recommended for initial grubbing within the five-acre project area and for any proposed ground disturbance in the vicinity of Site 30592 and Site 30593 to ensure interim construction preservation measures are in place and to prevent disturbance of the two archaeological sites.

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APPENDIX A: ARTIFACT INVENTORY

Site	**FE #**	**Unit**	**Layer/ Level**	**Depth**	**Identification**	**Weight**	**Count**	**Remarks**
30596	1	TU-1	II	0-28 cmbs	Marine Invertabrate	2.56 g	11	Gastropoda: Cypraea sp.
30596	1	TU-1	II	0-28 cmbs	Marine Invertabrate	1.17 g	4	Gastropoda: Nerita sp.
30596	1	TU-1	II	0-28cmbs	Marine Invertabrate	4.05 g	81	Echnoidea: Non-Diagnostic
30596	1	TU-1	II	0-28 cmbs	Bone	3.89 g	1	Bird
30596	1	TU-1	II	0-28 cmbs	Bone	0.08 g	4	Rodent
30596	1	TU-1	II	0-28 cmbs	Kukui	1.18 g	9	Charred
30596	1	TU-1	II	0-28 cmbs	Carbon	4.92 g	123	
30599	1	TU-1	II	90-145 cmbs	Bottle Glass Fragment	9.01 g	1	Clear
30599	1	TU-1	II	90-145 cmbs	Jar Glass Fragment	2.35 g	1	Brown
30599	1	TU-1	II	90-145 cmbs	Nail Fragments	1.88 g	2	Wire Cut
30599	1	TU-1	II	90-145 cmbs	Bottle Cap	3.77 g	1	Rusted Metal
30599	1	TU-1	II	90-145 cmbs	Jar Lid	7.36 g	3	Rusted Metal
30599	1	TU-1	II	90-145 cmbs	Metal Fragments	48.69	21	Rusted
30599	1	TU-1	II	90-145 cmbs	Carbon	0.38 g	3	
30604	3	SP-1	I & II	0-50 cmbs	Volcanic Glass Flake	0.04 g	1	

Site	FE #	Unit	Layer/ Level	Depth	Identification	Weight	Count	Remarks
30607	1	SP-1	I & II	0-37 cmbs	Volcanic Glass Debitage	3.03 g	5	
30607	1	SP-1	I & II	0-37 cmbs	Carbon	.83 g	30	
30607	3	SP-1	I	0-15 cmbs	Coral Fragments	0.08 g	2	
30607	3	SP-1	I	0-15 cmbs	Volcanic Glass Flake	0.17 g	2	
30607	3	SP-1	II	15-30 cmbs	Carbon	0.06g	7	
30607	4	SP-7	I & II	0-32 cmbs	Basalt Flake	2.14 g	1	

ARCHAEOLOGICAL INVENTORY SURVEY REPORT FOR 76.121 ACRES LOCATED IN HŌLUALOA 1ST AHUPUA‘A, NORTH KONA DISTRICT, HAWAI‘I ISLAND, HAWAI‘I [TMK: (3) 7-6-021:016-019]

Prepared By:

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&
Suzan Escott, B.A.

MAY 2020
DRAFT

Prepared for:
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101 Hualālai Street
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ABSTRACT

At the request of property owner Kona Three, LLC, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey (AIS) of a 76.121 acres of land TMK: (3) 7-6-021:016, 017 (por.), 018, and 019 located in Hōlualoa 1st Ahupuaʻa, North Kona District, Island of Hawaiʻi, Hawaiʻi. The owner is proposing to develop the property and contracted the archaeological study required for an Environmental Assessment (EA) as required for County of Hawaiʻi Planning Department permit applications. The point of contact (owner) for the project is Mr. Richard Wheelock. The owner's mailing address is 101 Hualālai Street Hilo, HI 96720. Mr. Wheelock can also be contacted by email at richard@eastwestrealty.org or by phone at 808-753-3167.

Prior to fieldwork, a search of geological maps, aerial photos, historical maps, historical documents, and archaeological reports was conducted. Pedestrian survey and site recording were conducted throughout 2020 by Joe Farrugia, B.A., Suzan Escott, B.A, Tomasi Patolo, B.A., Nicole Mello, B.A., and Glenn Escott, M.A.

The project area lands were used for cattle ranching and commercial agriculture from the early 1900s until the present. The majority of the project area has been bulldozed. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push pile. Pedestrian survey confirmed the linear bands in the aerial photographs are bulldozer- cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths.

Sixteen archaeological sites were identified and recorded in the project. Fifteen of the sites were previously documented and two sites were previously undocumented (a small coffee shed enclosure Site #50-10-37-31181; ranch walls Site #50-10-37-31182).

Five of the sites were determined to be pre-Contact era habitation and agriculture sites. A single petroglyph (Isolate Find 1) was also recorded. Eleven of the sites were determined to be Historic era sites, the majority associated with cattle ranching and coffee and sugarcane agriculture.

All of the archaeological sites were assessed significant under criterion "d" as they are likely to yield information important to prehistory and/or history. The railroad berm Site 30592 is also significant under criteria "a" and "c" as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. A petroglyph (Isolated Find-1) is also significant criterion "e" as it has important value to Hawaiian people and people of other ethnic backgrounds in the state.

The railroad berm Site 30592 and the petroglyph are recommended for preservation with preservation measures to be outlined in an archaeological preservation. No further work is recommended at the remaining fifteen sites.

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INTRODUCTION

At the request of property owner Kona Three, LLC, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey (AIS) of a 76.121 acres of land TMK: (3) 7-6-021:016, 017 (por.), 018, and 019 located in Hōlualoa 1st Ahupuaʻa, North Kona District, Island of Hawaiʻi, Hawaiʻi (Figure 1 through Figure 4). The owner is proposing to develop the property and contracted the archaeological study required for an Environmental Assessment (EA) as required for County of Hawaiʻi Planning Department permit applications. The point of contact (owner) for the project is Mr. Richard Wheelock. The owner's mailing address is 101 Hualālai Street Hilo, HI 96720. Mr. Wheelock can also be contacted by email at richard@eastwestrealty.org or by phone at 808-753-3167.

METHODS

The archaeological inventory survey was undertaken in accordance with Hawaiʻi Administrative Rules 13§13-284 and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports contained in Hawaiʻi Administrative Rules 13§13-276.

ARCHIVAL METHODS

In addition to referencing available resources at SCS, archival research was conducted in the State Historic Preservation Division (SHPD) report database and library facility (Hilo, HI), the Hawaiʻi County land records office, the *Waihona ʻAina Māhele* database website, Ulukau database website, the Papakilo database website, the Hawaiian collections holdings at the University of Hawaiʻi-Hilo Library, and the Hawaii State Library system. Archival work consisted of research on the history and archaeology of the project area, as well as specific searches of previous archaeological studies in and around the current project area. Historic land use data, land ownership, maps, and narrative information were obtained from the Hawaiʻi County land records office, Hawaiian internet sites, and the University of Hawaiʻi, Hilo.

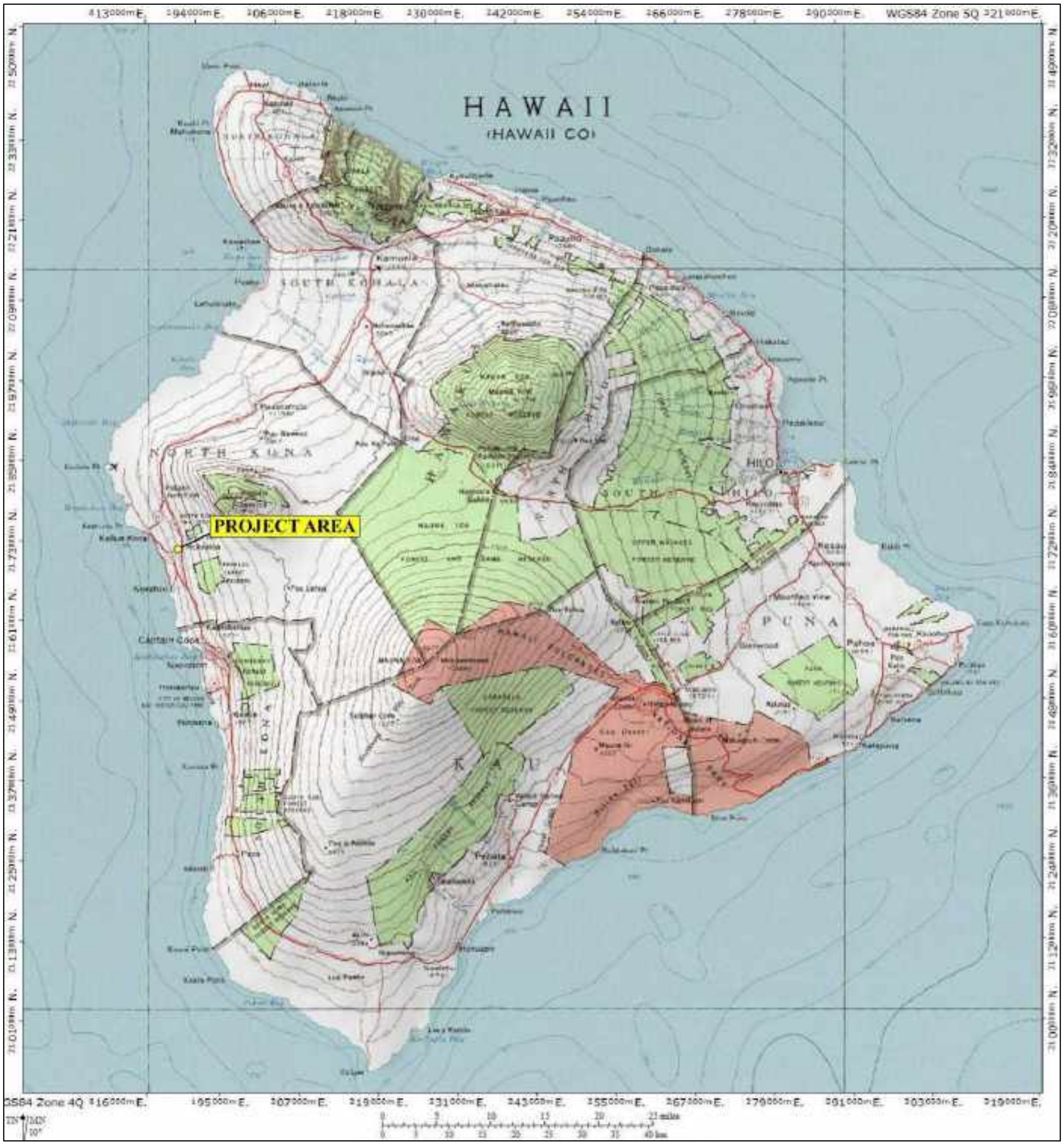

Figure 1: 5,500 K-Series Map of Hawai‘i Island Showing Location of Project Area (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

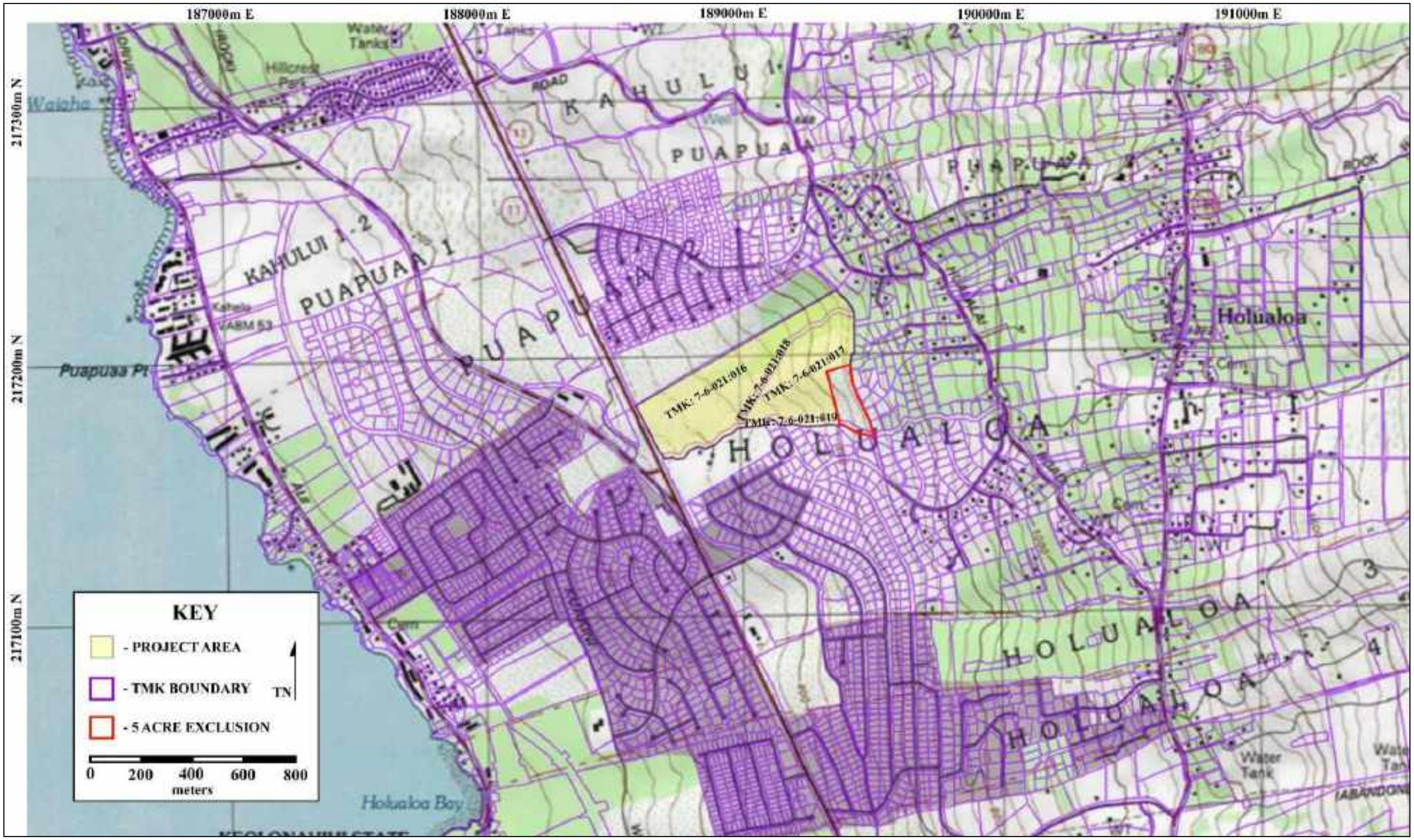

Figure 2: 7.5-Minute Series USGS Topographic Map Showing Location of Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

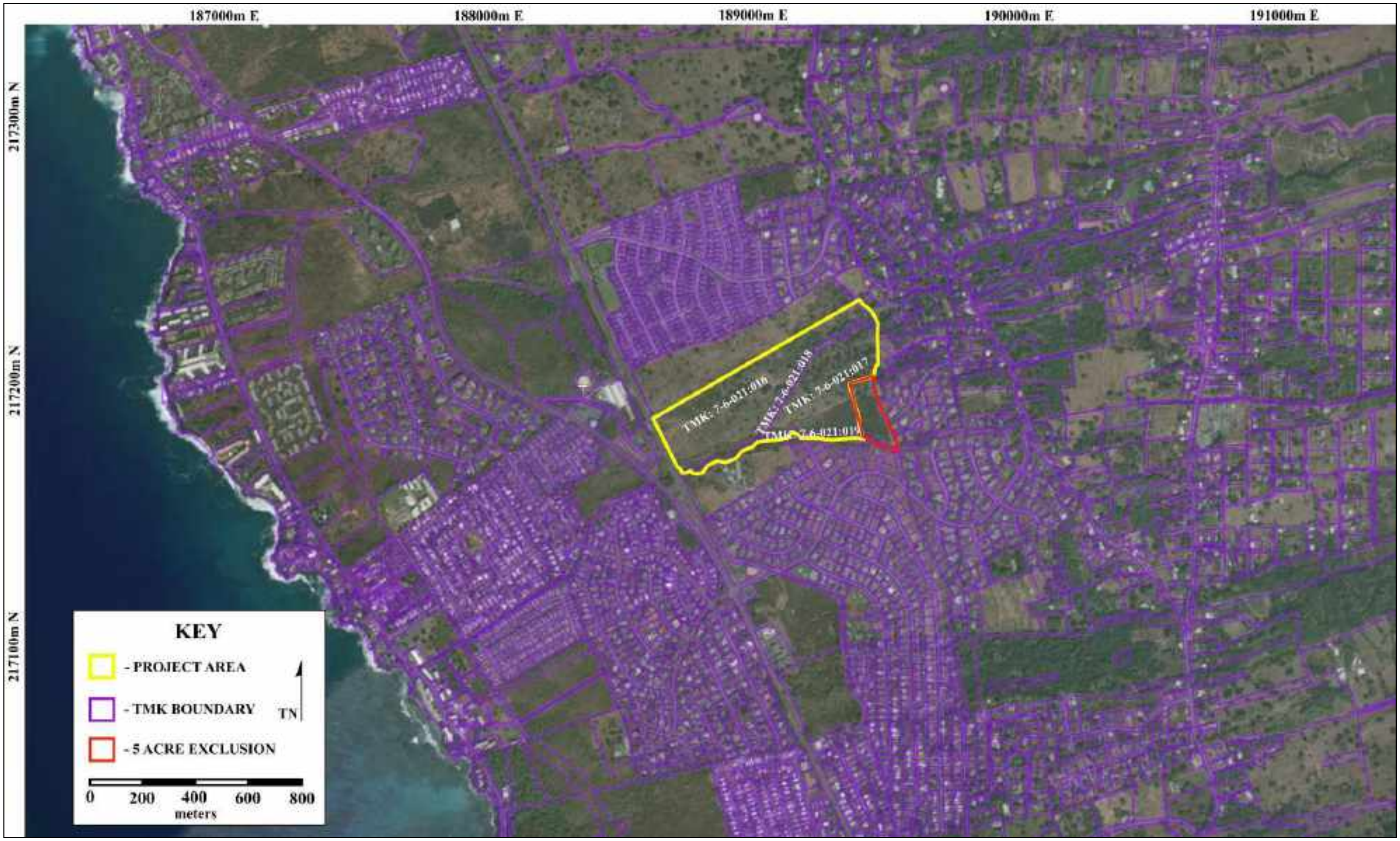

Figure 3: Aerial Photograph Showing Project Area, Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (ESRI, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

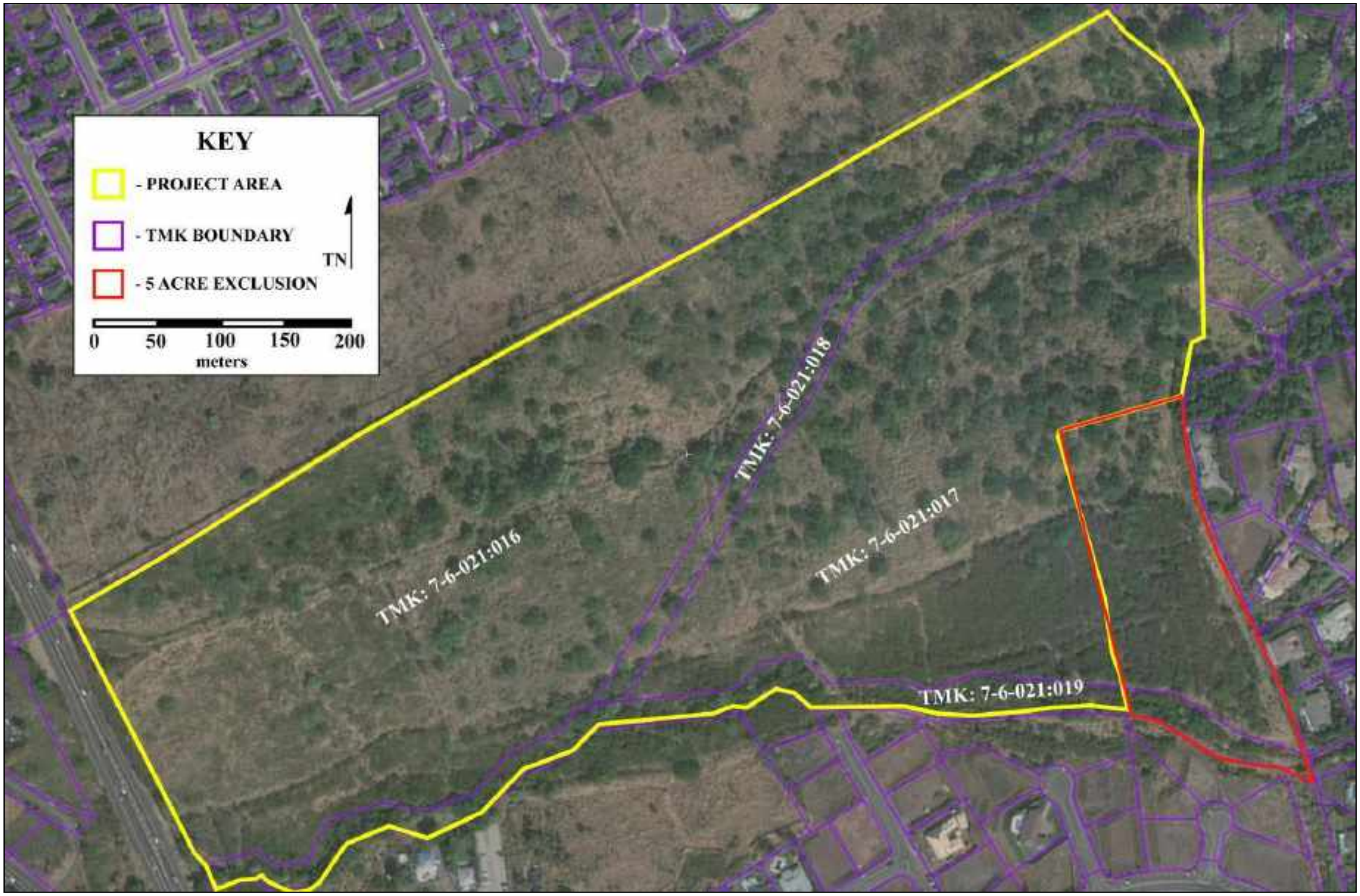

Figure 4: Aerial Photograph Close-Up Showing Project Area, Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (ESRI, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

FIELD METHODS

The archaeological pedestrian survey included: 100% pedestrian survey of the project area, Global Position System (GPS) plotting archaeological sites on USGS and TMK maps; individual site mapping, photographing and recording; and subsurface excavation and recording.

Pedestrian survey and site recording were conducted in throughout 2020 by Joe Farrugia, B.A., Suzan Escott, B.A, Tomasi Patolo, B.A., Nicole Mello, B.A., and Glenn Escott, M.A. A series of north/south transects spaced 2.0 to 4.0 meters apart were walked across the entire project area. Ground cover consisted of tall California and Guinea grass, *koa haole*, *kiawe*, and several *kukui* nut trees. Ground visibility was good. The fieldwork totaled 208 person-hours. Glenn Escott was the Principal Investigator and Project Director.

GPS points for sites were plotted in the field using a Garmin GPSmap 62 hand-held GPS unit. Site points were plotted in ArcGIS using Universal Transverse Mercator (UTM) units (Zone 5 North) and NAD83/WSGS84 datum.

Site boundaries were determined by the aerial extent of features and by feature function and temporal association. Features that were in close proximity to each other and that appeared to have functional and temporal associations suggesting they were constructed and used as a functional set of features--those features were included together as a single site. Features that were beyond twenty to thirty meters away from each other, or that were constructed at very different times, or for different very purposes, were separated into individual sites.

Photographs were taken of sites and features using a 25 cm north arrow scale with 5 cm black and white increments. Representative plan view maps showing the location and morphology of identified sites and features were drafted using tape-and compass mapping techniques. Site documentation included site and feature type, function, construction method, and age. Feature type, function, and age were determined by observing environmental context and topographic location, feature size and shape, construction material, construction methods, and associated artifacts if present.

Table 1: Inventory of Subsurface Test Excavations.

SIHP# *	TYPE	FUNCTION	AGE	CSH EXCAVATIONS	SCS EXCAVATIONS
10011	Platform	Ag./Temp Habitation	Pre-Contact	1.5 m long trench	TU-1 (2.4 X 1.2 m)
10012•	Platform & Wall	Burial	Pre-Contact	Entire Feature	Site No Longer Present
10013	Enclosure & Lava Tube	Habitation	Pre-Contact	4.5 m sq. total	Site Mostly Bulldozed
10017	Platform	Cattle Ramp	Historic	-	Site No Longer Present
10018	Enclosure	Agricultural	Historic	-	Site Mostly Bulldozed
10019	6 Rock Mounds	Ag. Clearing	Historic	3 1.0 m x 1.0 m long trenches	Site Mostly Bulldozed
10031	Enclosure Wall	Agriculture	Historic	-	Site Mostly Bulldozed
10033	Planting Complex	Coffee Ag	Historic	-	Site No Longer Present
10049	Terraces	Agriculture	Historic	-	Site No Longer Present
10067	Terraces	Habitation	Pre-Contact	1.0 X 1.0 m	-
10068	Enclosure	Habitation	Pre-Contact	0.5 X 0.25 m	Site Mostly Bulldozed
10069	Modified Bluff/Platform	Habitation	Historic	0.5 X 0.5 m	Site Mostly Bulldozed
10070	U-Shape Enclosure	Agriculture	Historic	1.0 X 0.5 m	Site Mostly Bulldozed
10071	Platform	Habitation	Pre-Contact	-	Site No Longer Present
10072	Modified Bluff	Ag. Clearing	Pre-Contact	7.0 m square total	Site Mostly Bulldozed
10073	Complex	Ranching/Ag.	Historic	-	TU-1 (2.3 X 1.2 m), TU-2 (1 X1 m)
10074	Enclosure	Coffee Work Shed	Historic	1.25 m sq. total	Site Mostly Bulldozed
10075	Enclosure	Pig Pen	Historic	-	Site Mostly Bulldozed
30592	Railroad Berm	Transportation	Historic	-	-
31181	Enclosure	Coffee Work Shed	Historic	-	Site On Bedrock
31182	Rock Walls	Ranching & Ag.	Historic	-	-

* Site numbers are preceded by the prefix 50-10-37-.
Orange Shading - Site no longer present.
• Burial Site 10012 reinterred off project prior to 1983.

Feature types and functions were selected from a set of recognized formal archaeological types and functions developed within Hawaiian archaeology over many decades of research. Age determinations are expressed in terms of recognized formal eras including pre-Contact era (before 1778), early post-Contact era (1778-1850), Historic era (1851-1965), and Modern era (post-1965). Age was interpreted on the basis of feature dimensions, type, construction, and artifacts recovered from excavations.

Many of the sites identified during the current AIS survey were bulldozed in the past (Table 1). In addition, many sites were previously excavated during the previous Cultural surveys Hawai‘i (CSH) AIS study (Hammatt et al. 1992). Sites that were mostly bulldozed or that did not have sediment deposits, or at which CSH had conducted adequate subsurface excavations to accurately interpret site function and age were not excavated during the current AIS study.

SCS conducted test excavations at two sites (Site #50-10-37-10011 and #50-10-37- 10073, hereafter site numbers are abbreviated to their last five digits) to better determine site function, construction method, and age. Test units (TU) were excavated in features at both sites. A total of 2.88 square meters were excavated in Site 10011 Feature 1. A total of 3.76 square meters

Test-units were excavated at features that had a high potential to yield functional and temporal diagnostic artifacts, and where vertical control would contribute to this data. Test units were placed to expose the base of feature architecture. Test-units were excavated in natural stratigraphic layers and arbitrary 10 cm levels when natural stratigraphic layers were thicker than 10 cm. Sediment excavated from all units was screened for cultural material through 1/8th inch mesh. Stratigraphic profiles were drawn for test units and post-excavation photographs were taken.

Cultural material was recorded by type on standard SCS excavation forms and collected. Soil colors were recorded using Munsell color charts, soil composition was recorded with the aid of the U.S. Department of Agriculture Soil Survey Manual on standard soil stratigraphy forms, and profiles were drawn.

LABORATORY METHODS

Inventory of midden and artifacts collected from the test excavations were weighed and analyzed by layer of provenience within each excavation unit. Weight, count and diagnostic characteristics were recorded for all artifacts. Field notes, maps, cultural material, and photographs pertaining to this project are currently being curated at the SCS facilities on the Island of Hawai‘i.

ORAL INTERVIEW ANDCONSULTATION

Gregg Kashiwa was interviewed by phone on April 19, 2016. Mr. Kashiwa was the project property manager for parcels 016 and 017 in the early 1980s and was present during AIS work documented in the Hammatt et al. (1992). He is originally from O‘ahu but lived in Kona for several decades. Mr. Kashiwa remembered that five acres in the northeast corner of the project area were excluded from the original AIS because the property owners were planning to give the five acres to a group to use as an agricultural preserve. The five acres and much of the current project area had already been bulldozed for agricultural use and for cattle ranching. Mr. Kashiwa knew that there were ranch walls and Historic era agricultural features on the project area, but did not know how they were used, as they were no longer in use during his time in Kona. He also remembered the old railroad bed and berm and that there was a small railroad stop along the track just south of the project area.

Mr. Shane Nelson, the Office of Hawaiian Affairs (OHA) West Hawaii Representative was contacted to consult on the disposition and preservation of Railroad Berm Site 30592.

ENVIRONMENTAL SETTING

The current project area consists of undeveloped land used as cattle pasture for several decades. Prior to that, coffee was grown in the northeast quadrant of the project area. The project area is situated on fairly steeply sloping land with level areas in between elevation breaks. The project area is between 360 and 7000 feet (110 to 213 meters) above mean sea level (amsl). The project area lands are part of a large former cattle ranch and agricultural area that was started in the early 1900s. The project area is still used to pasture cattle. The project area lands were bulldozed sometime between the 1940s and 1970s. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push pile (see Figure 4). Pedestrian survey confirmed the linear bands in the aerial photographs are bulldozer-cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths. The former Kona Sugar Company railroad bed is present along the eastern edge of the project area.

The project area ground surface is a Hualālai lava flow dating between 5,000 and 10,000 years before present (ybp) (Wolfe and Morris 1996). Soil in the project area is Punaluʻu Series (rPYD series) extremely rocky peat with six to twenty percent slopes (Sato 1973:48). The majority of the project area has been bulldozed in the past and the present ground surface is rocky soil.

Rainfall in the project area is very low, less than thirty inches per year. Parcel 018 and Parcel 019 are seasonal gulches that drain rainfall down slope to the west. This project area region is dry, hot, and somewhat barren except for thick California grass (*Urochloa mutica*), Guinea grass (*Megathyrsus maximus*), *koa haole* (*Leucaena leucocephala*), and scattered *kukui* (*Aleurites moluccana*) trees (Starr Environmental 2016). A fairly large number of introduced tree species associated with Historic era ranching and farming are present in the project area, including *kiawe* (*Prosopis pallida*), monkey pod (*Samanea saman*), opiuma (*Pithecellobium dulce*), tamarind (*Tamarindus indica*), coffee (*Coffea arabica*), and bamboo (*Bambusa sp.*).

HISTORICAL AND CULTURAL CONTEXTS

Kona is divided into two sections: North Kona or *Kona ʻakau*, and; South Kona, or *Kona hema* (Maly 1996). *Kona ʻakau* was further subdivided into north (called *Kekaha*) and south (called *Konakaiʻōpua*) areas, with the division between the two at the *ahupuaʻa* of Keahuolu. The project area is in Hōlualoa 1st Ahupuaʻa (see Figure 1 and Figure 2) within the area of *Konakaiʻōpua* in *Kona ʻakau*. Hōlualoa means (literally) "long sled course" (Pukui *et al*. 1974:48). Hōlualoa 1st is a traditional *ahupuaʻa* stretching from the ocean to the foot of Hualālai in the uplands. The coastline of Hōlualoa 1st Ahupuaʻa is primarily low rock cliffs.

Very little is recorded of Hōlualoa Ahupuaʻa in traditional oral accounts. *The Heart Stirring Legend of Ka-Miki*, published in the Hawaiian language newspaper *Ka Hoku o Hawaii* and translated by Maly (1993) contains the only description of Hōlualoa. The legend is set in the 13th century but also reflects more recent influences (Maly and Maly 2002: 17). According to the narrative,

> The lands of Hōlualoa were named for the chief of that name; both Hōlualoa and Puapuaʻa were high chiefs, who controlled the lands from mountain to sea, which bear their names… Kaluaokalani served as a priest of Hōlualoa at the temple of Pākiha. This *heiau* was near the contest field of Hōlualoa… The lands of this region are named for various *aliʻi,* all of whom were related. When the chief Hōlualoa took up the challenge against Kepakaʻiliʻula on behalf of the Kona chiefs, Hōlualoa called upon his god *Kālaipāhoa* to assist him in his battle… Hōlualoa was the first chief to call upon the god *Kālaipāhoa*, and this was the beginning of this gods' use by the chiefs of Hawaiʻi [Maly 1993:208-209].

PRE-CONTACT ERA

Hōlualoa, Kona, and much of the leeward side of Hawaiʻi Island, while well populated at the time of European Contact, were settled later than the windward side. Many archaeologists believe that Hawaiʻi Island was first settled around A.D. 1,000 by people sailing from the Marquesas (Athens et al. 2014; Dye 2011; Kahn et al. 2014; Kirch 2011; Kirch and McCoy 2007; McCoy 2005 and 2007; Mulrooney et al. 2011; Reith et al. 2011; Wilmhurst et al. 2011a and 2011b).

An article published in the Journal of Archaeological Science reviewing radiocarbon dates recovered at archaeological sites on the Island of Hawaiʻi suggests that, by relying on only carbon samples from short-lived plant remains, the most reliable dates point to initial Polynesian colonization of Hawaiʻi Island occurring between A.D. 1220 and 1261 (Rieth et al. 2011:2747).

Early settlers founded settlements on the windward shores in likely places such as Waipiʻo, Waimanu, and Hilo Bay. The windward, or *koʻolau* shores receive abundant rainfall and have numerous streams such as the Wailuku, Waiolama, ʻAlenaio, and Wailoa that facilitated agricultural and fishpond production (Maly 1996:3). The windward shores also provide rich benthic and pelagic marine resources.

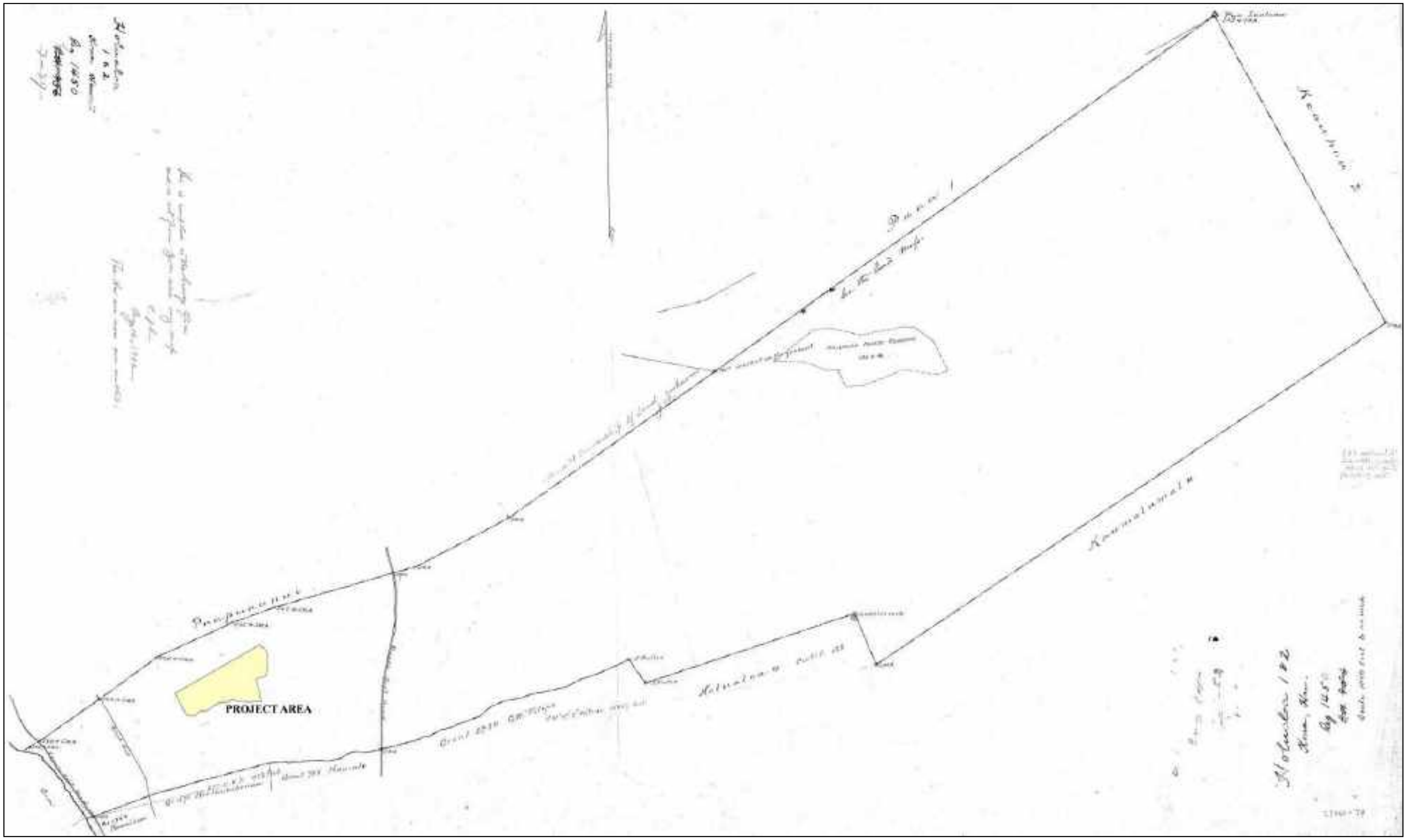

Figure 5: Map of Hōlualoa 1st and 2nd Ahupua‘a Showing Location of Project Area in Yellow (Alexander 1855).

The dry leeward shores of Hawaiʻi Island presented a very different environment requiring a modified set of subsistence strategies. Archaeologists and historians are uncertain about the exact motives that lead to the establishment and spread of settlements on the leeward side of Hawaiʻi, but some suggest population pressure, dwindling fertile land, growing socio-political stratification, or simply the opportunity for a new start might have lead to new communities developing on the dryer west side of the island (Cordy 2000:130). The process was likely underway soon after initial settlement of Hawaiʻi Island (Cordy 2000).

During this period, areas of permanent habitation were established in Kona (Cordy 1981, 1995; Schilt 1984). Habitation was concentrated along the shoreline and lowland slopes, and informal fields were cleared at higher elevations where rainfall was higher. Agricultural fields and habitation areas expanded across the slopes and coastal area of Hualālai during the period between AD 1200 and 1400 (Burtchard 1995; Cordy 1995).

The development of extensive formal walled fields likely began sometime around AD 1400 to 1600. This period marks the initial construction of the Kona Field System (KFS) (Schilt 1984). The development of the KFS may be, in part, a by-product of the need to extract more subsistence resources from an increasingly limited agricultural base. The population in Kona increased dramatically during this period, as reflected in the abundant radiocarbon dates from habitation structures, shelter caves, and agricultural soils of this period (Burtchard 1995; Haun *et al*. 1998; Schilt 1984). During this period, the stratified chiefdom structure becomes clearly developed in the archaeological record.

Large residential complexes and *heiau* reflect the segregation of places and power for the growing hierarchy of high and lower chiefs, and ceremonial stewards (Cordy 1981; Haun *et al*. 1998; Hommon 1986). The produce from the formal walled fields were distributed to higher chiefs through a hierarchy of lower chiefs responsible for management and collection of the cultivated and wild resources.

By the time of the Competition Period (AD 1600 to 1800), the royal centers and larger *heiau* were in place, reflecting the growth in power of the rulers and chiefs in the region (Barrera 1971; Hammatt and Folk 1980). Resources may have reached their maximum carrying capacity, resulting in social stress between neighboring groups. Hostility between groups is reflected archaeologically with the development of refuge caves during this period (Schilt 1984). This volatile period was probably accompanied by internal rebellion and territorial annexation (Hommon 1986; Kirch 1985). Royal centers are located at Kailua, Hōlualoa, Kahaluʻu, Kealakekua, and Honaunau (Cordy 1995).

The region of Hōlualoa developed into a royal center in the late 1600s to early 1700s under the reigns of Keakamahana (reigned 1680-1700) and Keakealaniwahine (reigned 1700-1720) (Cordy 2000:244). Many *ʻaliʻi* and *konohiki* residences and numerous religious sites are known to have existed here. The majority of the *heiau* and royal residences were constructed along or near the coast, most notably at Kamoa Point south of the project area. The royal center at Hōlualoa was eclipsed in the second half of the 1700s by the royal center in the Kahaluʻu and Keauhou region.

The Kona Field System

During his travels in the region in 1823 William Ellis noted that the area above and south of Kailua was:

> quite a garden compared with that through which they had passed on first leaving the town. It was generally divided into small fields, about fifteen rods square, fenced with low stone walls, made of fragments of lava which had been gathered from the surface of the enclosures. These fields were planted with bananas, sweet potatoes, mountain taro, tapa trees, melons and sugar cane, flourishing luxuriantly in every direction [Handy 1940:114 and 162].

> Rocky lands in the olden days were walled up all around with big and small stones of the patch until there was a wall about 2 feet high and in the enclosure were but weeds of every kind, amaʻu tree ferns and so on, and then topped well with soil taken from the patch itself to enrich it [Handy 1940:147].

These gardens have been studied in some detail, and are often referred to as the "Kona Field System". Many of the archaeological projects conducted within Kona deal with components of the Kona Field System (Cordy 1995; Newman 1970; Schilt 1984). This area extends north at least to Kaʻu Ahupuaʻa and south to Honaunau, west from the coastline and east to the forested slopes of Hualālai (Cordy 1995). A large portion of this area is designated in the Hawai‘i SIHP (State Inventory of Historic Places) as Site 50-10-37-6601. The basic characteristics and general locations of the zones within the system as presented in Newman (1970) have been confirmed and elaborated on by more intensive and extensive ethnohistorical investigations (Kelly 1983).

The *kula* zone of the Kona Field System is the area from sea level to 150 m amsl. This lower elevation zone is traditionally associated with habitation and the cultivation of sweet potatoes (*uala*), paper mulberry (*wauke*), and gourds (*ipu*). Agricultural features, such as clearing mounds, planting mounds, planting depressions, modified outcrops, and planting terraces, are common throughout much of this zone (Hammatt and Clark 1980; Hammatt and Folk 1980; Haun *et al*. 1998; Schilt 1984).

Dwellings are often scattered throughout the agricultural portion of the *kula*, but they are commonly concentrated along the shoreline subdivision of the *kula* zone (Cordy 1981). The shoreline zone, extending inland approximately 200 m, was used primarily for permanent habitation and other non-agricultural activities, such as canoe storage, ceremonial and burial practices, recreation, and fishing-related activity.

Royal centers and high chiefly centers were also situated within the shoreline of the *kula*. These complexes include dwellings for rulers, chiefs, and the supporting populace, places of refuge, and other structures. Single, or clustered, burials are also situated in the shoreline, and near-shore *kula* (Han *et al*. 1986; Hammatt and Clark 1980; Hammatt and Meeker 1979). Burials occur in caves, within finely built platforms, cruder rock mounds, and houses in the shoreline, and are more often in the near-shore *kula* (Cordy 1995; Han *et al*. 1986; Schilt 1984; Tainter 1973; Tomonari-Tuggle 1993).

The large, and densely populated, royal centers were situated at several locations along the shoreline between Kailua and Honaunau (Cordy 1995; Tomonari-Tuggle 1993). The residential areas, large and small *heiau*, sporting areas, and burial clusters, are present continuously farther inland than the usual 200 meters for the shoreline habitation portion of the *kula*. Consequently, a variety of non-agricultural features are present in the *kula* near royal centers.

The *kalu‘ulu* zone above 150 m amsl is a wetter region above the *kula* where bread fruit and other arboreal crops were cultivated (Kelly 1983). Sweet potatoes (*Ipomoea batatas*), *ti*, (*Cordyline fruticosa*) *wauke* (*Broussonetia papyrifera*), *taro* (*Colocasia esculenta*), and sugar cane (*Saccharum* sp.), planted among the arboreal crops, were mulched with grass (Menzies1920:75-76). The current project area is in the *kalu'ulu* zone.

Above the *kalu'ulu* zone, in the *'apa'a* zone, fields with low stone walls were cultivated with bananas, sweet potatoes, *taro*, *wauke*, melons, *ti* and sugar cane. The *'apa'a* zone was notable for fresh water springs. Above the *'apa'a* zone was the *'ama'u* zone where walled fields were created to grow plantains and bananas. Timber from various tree species was collected from the *'apa'a* zone and the *'ama'u* zone. Bird catching and other forest resources extraction activities were conducted in these upper two zones. Temporary habitations were constructed to be used seasonally when working in the uplands.

In the region, people initially moved into coastal settings *and* more upland settings (*e.g.*, the '*āpa'a* agronomic zone) at the same time, essentially ignoring the drier intermediate zone (except, of course, as a throughway between their gardens and the sea). In this way, the first settlers could immediately plant seedlings in the wetter uplands, knowing the crops would succeed. Permanent settlement would have first been restricted to the coast, but the same people would have also been occupying the uplands (at least temporarily) as well. It is only later that the 'intermediate zone'(and the *kalu'ulu* agronomic zone), would have been utilized for planting.

POST-CONTACT ERA

The extensive features of the Kona Field System were exploited and altered during the post-contact era. Walls, *kua'iwi*, springs, and pathways created generations earlier were used and planted with alien cultigens (coffee, cotton, sugar, citrus, and sisal) and ultimately used as pastures for cattle.

Ranching has its roots in the first cattle and sheep brought to the island in 1793 and 1794 by Vancouver. Two cows, three bulls, five ewes, and five rams were released to prosper in the region of Kealakekua in 1794 (Vancouver 1967:(3)11). Kamehameha placed a ten-year *kapu* on the killing of cattle so that they would have the opportunity to multiply. A 486-acre stone corral was built in the uplands of Lehu'ula-Honua'ino, above Kāināliu where they were raised (Bowser 1880, cited in Maly and Maly 2001:285).

Two American captains, William Shaler and Richard Cleveland presented two horses to John Young in 1803. Cleveland later returned with more than 200 horses brought from California. Donkeys, mules and oxen were also imported for transportation and hauling. Goats were also brought to the island and left to multiply in the wild.

By 1813 to 1815 cows began overrunning agricultural fields and became a danger to travelers and residents (Ellis 1963: 291; Wilkes 1970: 204). A number of walls were commissioned to keep feral sheep, goats, and cattle out of agricultural areas and away from homes. By 1848, in Kona District a Great Wall (the Kuakini Wall) was constructed from Lanihau to ʻŌnouli (Maly and Maly 2001:286).

In 1830 Governor Kuakini moved to oversee and improve government cattle by constructing corrals. Liholiho visited the same year to witness strides made in the nascent cattle ranching industry. It was hoped that the exportation of tallow, hides, and salted beef would supplant the defunct Sandalwood trade as a major source of income. Several ventures related to ranching, including tallow making, tanning, saddle making, and blacksmithing were initiated (Bergin 2004: 156). Cowhide was tanned using the astringent bark of local trees (Wilkes 1970: 218). The lion's share of commercial enterprises on the island involved supplying whaling ships and the local market with beef.

The changing subsistence and trade regimes developed by incoming European and American settlers, as well as other historical factors, caused a depopulation of the coastal areas of Kona. Ranches were established at middle and upper elevations, and farms were established in the uplands where rainfall was higher and the temperatures were cooler. Cattle ranching and clearing for sugar cane and coffee removed many of the endemic species of plants. The suite of vegetation that existed prior to the pre-Contact era were replaced by *koa haole* (*Leucaen*a *leucocephala*), kiawe (*Prosopis pallida*), and other newly introduced invasive plant species.

Schools, churches, stores, and other businesses were also established in the uplands. During the late 1800s and early 1900s, coastal Kona was no longer the densely populated sociopolitical center it once was. It became a small cluster of houses along the trail from Kailua Bay to Keauhou (Tomonari-Tuggle 1993:15). Homesteads, ranches, and plantations developed in the uplands during this period as reflected in the pattern of Land Commission Awards (LCA) and Land Grants (LG) recorded during the Māhele.

THE MĀHELE

With the coming of the Great Māhele (1848), the Alien Land Ownership Act (1850) and the Kuleana Act (1850), the traditional Hawaiian archetype of land-use was essentially deconstructed and replaced with the European concept of fee-simple land ownership. Article IV of the Board of Commissioners to Quiet Land Titles was passed in December 1845 and began the legal process of private land ownership. Through the Māhele of 1847-48 the Alien Land Ownership Act of 1850 and the Kuleana Act of 1850, land was made available for private ownership.

The Māhele established a board of five commissioners to oversee land claims and to issue patents and leases for valid claims. Kauikeaouli (Kamehameha III) established and ratified laws to protect Hawaiian crown lands as foreigners began claiming ownership of land they were granted permission to use for homes and business interests (Daws 1968:111; Kameʻeleihiwa 1992: 169-70, 176; Kelly 1983: 45; Kuykendall 1938(1): 145 footnote 47, 152, 165-6, 170;). Among other things, foreigners were demanding private ownership of land to secure their island investments (Kameʻeleihiwa 1992: 178; Kuykendall 1938(1): 138, 145, 178, 184, 202, 206, 271).

Under the Māhele and subsequent acts (the Kuleana Act of 1850 and the Alien Land Ownership Act of 1850), the lands of the kingdom of Hawaiʻi were divided among the king (crown lands), the *aliʻi* and *konohiki*, and the government. Once lands were thus divided and private ownership was instituted, the *makaʻāinana* (commoners), if they had been made aware of the procedures, were able to claim the plots on which they had been cultivating and living as stipulated in the Kuleana Act (1850). These claims, however, could not include any previously cultivated or presently fallow land, *okipuʻu*, stream fisheries, or many other resources traditionally necessary for survival (Kameʻeleihiwa 1992:295; Kelly 1983:45-76; Kirch and Sahlins 1992 vol.1:3, 135-137, and vol.2:2).

The right of claimants to land was based on the written testimony of at least two witnesses who could corroborate the claimant's long-standing occupation and use of the parcel(s) in question. The claimant might have been awarded a patent for the property, subsequently called Land Commission Awards (LCAs) (Chinen 1961:16).

The Land Commission awarded the majority of Hōlualoa 1st and 2nd Ahupuaʻa to Victoria Kamāmalu Kaʻahumanu IV, *Kahina Nui* of Hawaiʻi Island and Crown Princess of Hawaiʻi as Land Commission Award (LCA) Number 7713, ʻApana 43 (Figure 6).

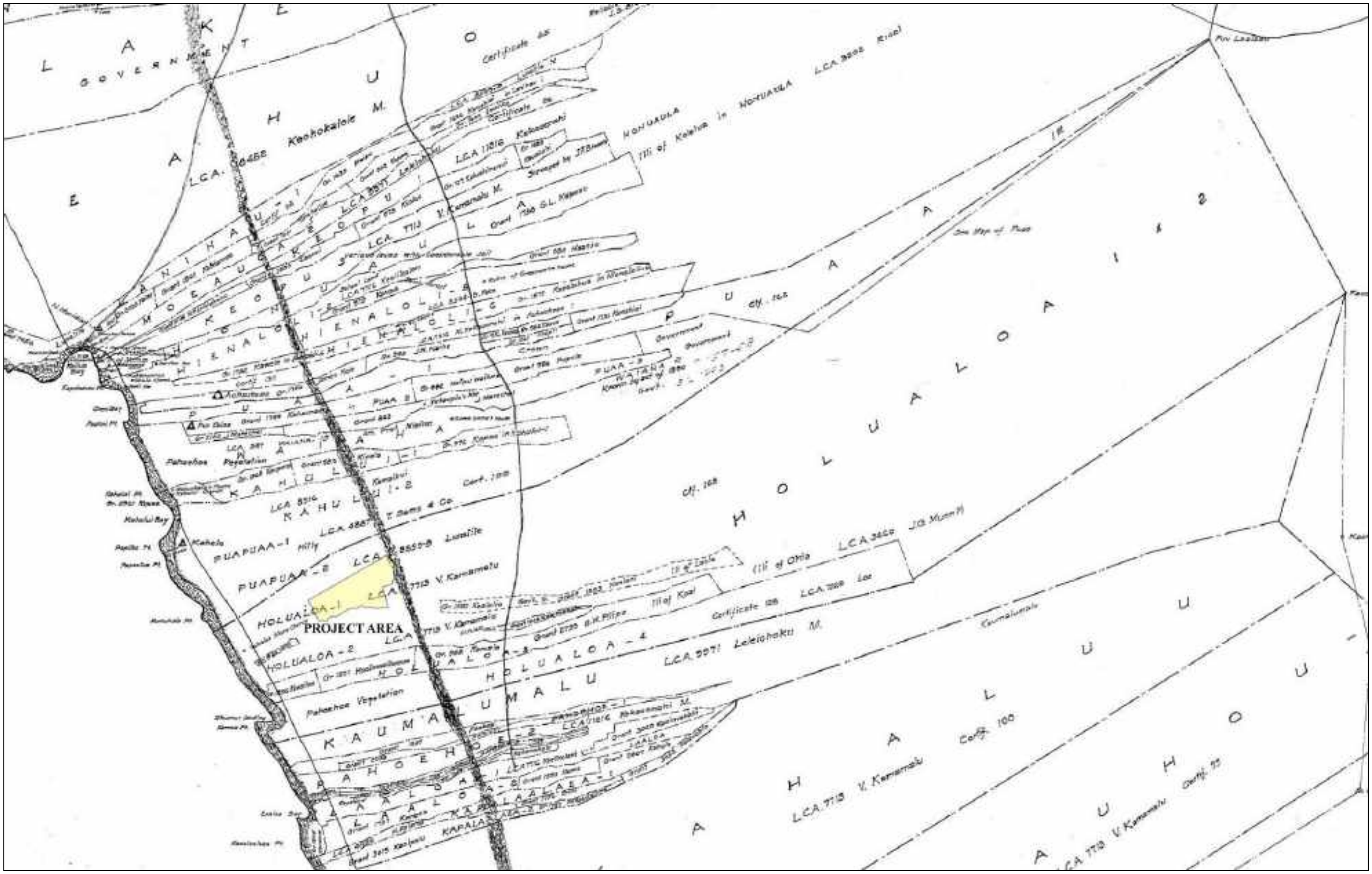

Figure 6: Portion of Kailua Section, North Kona Map Showing Location of LCA 7713 and Project Area in Red Border (Aki 1952).

Several smaller LCA and Land Grant (LG) properties were also recorded in the upland region of Hōlualoa 1st and 2nd Ahupuaʻa (Figure 7). Twenty four Land Commission awards were recorded in Hōlualoa 1st Ahupuaʻa, the ahupuaʻa where the project area is located (see Figure 7 and Table 2).

Table 2: Land Commission Awards Recorded in Hōlualoa 1st and 2nd Ahupuaʻa.

LCA#	AWARDED TO	AHUPUAʻA	ACRES
3660	John G. Munn	Hōlualoa 1st	111.5
4395	Kekoi	Hōlualoa 1st	1.7
5552	Kauila	Hōlualoa 1st	1.9
5554	Keawekolohe	Hōlualoa 1st	11.27
5795	Keliikanakaole	Hōlualoa 2nd	2.2
5810	Kaopukauila	Hōlualoa 1st	1.74
5993	Leipalapala	Hōlualoa 2nd	2.0
6063	Hāna	Hōlualoa 1st	2.9
6107	Naai	Hōlualoa 1st	3.94
7339	Kuaana	Hōlualoa 1st	4.15
7340	Kama 2	Hōlualoa 1st	2.5
7340:B	Kama 1	Hōlualoa 1st	1.3
7443	Kalimapaa	Hōlualoa 1st	1.94
7713	Kamamalu	Hōlualoa 1st & Hōlualoa 2nd	Large
7746	Kamahalo	Hōlualoa 1st	5.0
7794	Kauakini	Hōlualoa 1st	1.8
7990	Pupuka	Hōlualoa 1st	1.1
8015	Aipo	Hōlualoa 2nd	1.4
8151	Hehena	Hōlualoa 1st	2.3
8223	Ikaiaka	Hōlualoa 1st	3.5
9915	Limahana	Hōlualoa 1st	2.42
9932	Lumaawe	Hōlualoa 1st	2.98
10770	Puuone	Hōlualoa 1st	3.06
10400	Naaimakaohi	Hōlualoa 1st & Hōlualoa 2nd	3.5

A portion of LCA #3660 to John G. Munn makes up a thin strip of land located through the center of the current project area. With the notable exception of LCA #3660 and a few other large LCAs, the average award was 2.8 acres, most (n=16) were for less than 3.0 acres. Three Land Grants (LG #1592, 1602, and 3630) were also recorded in Hōlualoa 1st and 2nd Ahupuaʻa. LG #1592 was a 25.0-acre parcel sold to Kealalio and LG #3630 was a 38.2-acre parcel sold to W.H. Cromwell. Almost all of the awards and grants were used as subsistence and commercial farm land, and some were used to pasture cattle (Escott and Escott 2018).

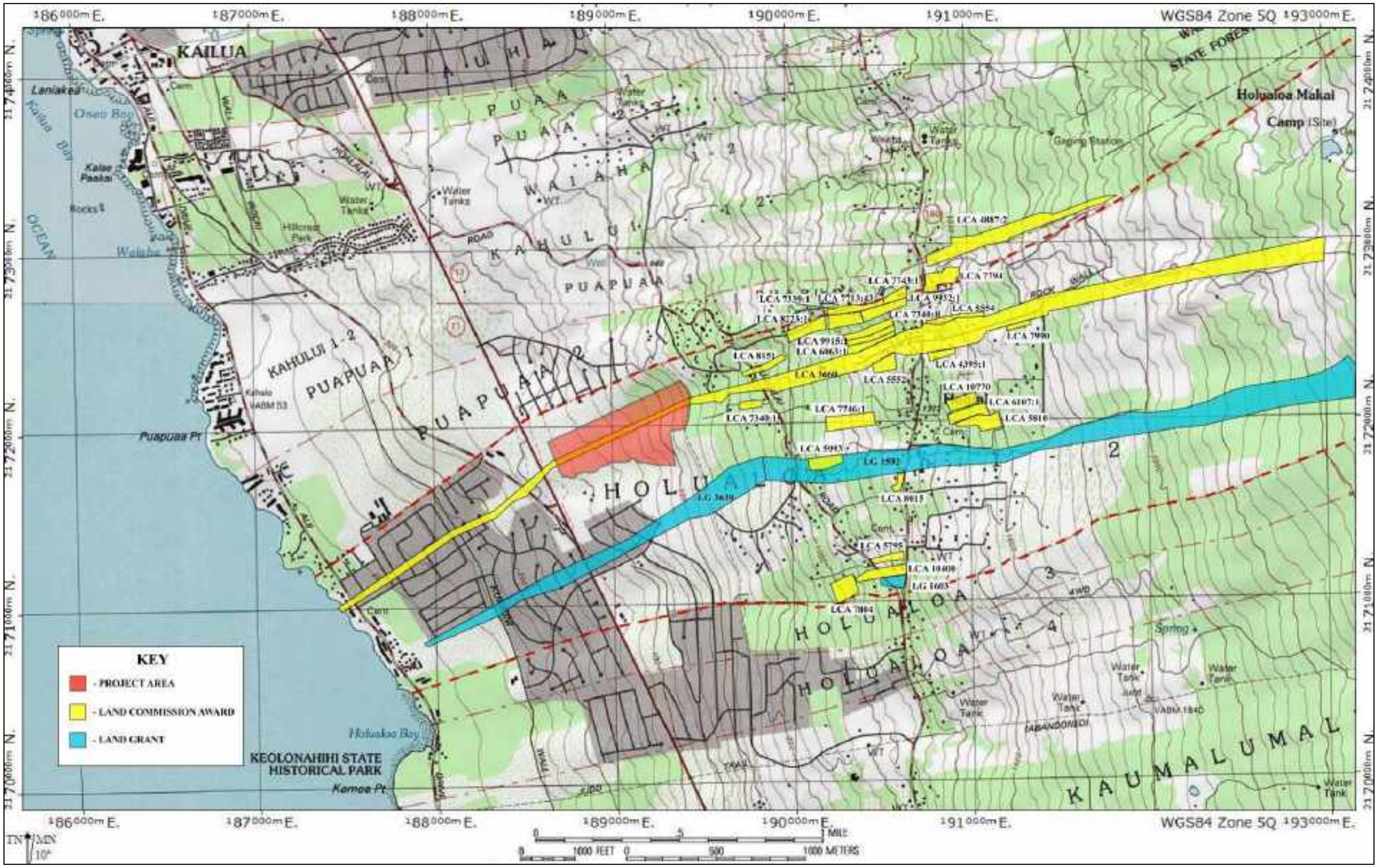

Figure 7: 7.5-Minute Series USGS Topographic Map Showing Location of Land Commission Awards, Land Grants, and the Project Area (National Geographic Topo!, 2003, Kealakekua Quad. Data Sources: National Geographic Society, USGS).

EARLY POST-CONTACT ERA AND HISTORIC ERA

Formal cattle ranching began in the Kona region in the mid-1800s, but wild cattle may have been in the area as early as the late 1700s. The *pā ʻāina* (ʻwalls of the land'), native tenants' wall enclosures, were prevalent in the area, as indicated by their inclusion in many local Māhele testimonies. These were used to mark the boundary of properties and to keep livestock out of crop areas (Kuykendall 1957:318 note 76). Later, cattle ranchers built walls to control their cattle.

> In the early 1840s, cattle were said to be "maintained on the *kula*," a mile from the coast where the ground was "covered with herbage" (Wilkes 1845:4, 95). Cattle, introduced to Kona by Vancouver in 1794, became a nuisance later, when their numbers increased. They fed on the grass of the kula and from time to time on the thatch of Hawaiians' homes and on vegetables in their gardens. The open upland fields, bounded only by low earth and stone walls, were in full cultivation in the 1850s [Kelly 1983:76].

Ranchers leased land below the railroad to graze cattle that they owned (Kelly 1983:111). Higher walls were built in the 1920s and 1930s to control animals. According to Joe Gomes, a longtime rancher in the area,

> Walls about 3 ft high can keep donkeys penned. The usual wall is about 4 ½ ft high and keeps cattle in. For goats you need a wall 6 to 8 ft high. For wild pigs you need a 6 to 8 ft-high wall. They climb over lower walls easily. They come down from the mountains for macadamia nuts and also in mango season for mangoes [Kelly 1983:112].

Sugar was a major crop in Hawaiʻi as early as signing of the Reciprocity Treaty in 1876 (Kelly 1983:90). The sugar industry grew rapidly, and by 1899 the only sugar mill in the Kona area was built by the Kona Sugar Company. Many Chinese worked on the sugar plantations (Kelly 1983:111). They built a railroad in 1901 to haul cane from the fields to their mill site along the Waiʻaha stream, north of the current project area. The stream did not provide enough water to mill cane year round and company failed in 1903. The Kona Sugar Company was bought by James Castel in 1906 and was later purchased by Japanese investors. The Kona Sugar Company continued to operate until 1926.

The railroad was bought by Kona Development Company, and was used for freight, sugarcane and by the Hawaiian Lumber Company. Sugar was grown above the railroad line. The cut sugar was delivered to the tracks with the assistance of gravity, by wire cables and flumes. The rail line was seven miles long and extended from Hōlualoa to Keōpuka (Figure 8).

Cotton was grown on lands below the railroad tracks (Kelly 1983:111). Cotton gins were located south of the project area. Cotton was being picked as late as the 1930s. Other plants grown below the tracks in the dryer lands were sisal and tobacco (Kelly 1983:112).

Traditional Hawaiian subsistence practices, including the rights to collect resources from all ecological zones of one's *ahupuaʻa*, were challenged, restricted, or prevented. As private land owners considered their property off limits to others, cultivation and collection of resources on private land diminished. Individual Hawaiian cultural beliefs, specialized knowledge, and practices associated with the use of the different ecological resource zones also diminished. The development of cattle ranching and commercial crops, such as sugar cane and coffee, removed traditional cultigens and resources from large swaths of the lands of Kona.

The changing subsistence and trade regimes developed by incoming European and American settlers, as well as other historical factors, caused a depopulation of the coastal areas of Kona. Ranches were established at lower elevations and farms were established in the uplands where rainfall was higher and the temperatures were cooler. Schools, churches, stores, and other businesses were also established in the uplands. During the late 1800s and early 1900s, Hōlualoa was no longer the densely populated sociopolitical center it once was. The coastal area of Hōlualoa had become a small cluster of houses along the trail from Kailua Bay to Keauhou.

The project area is just *makai* (west) of the majority of land commission awards and is at the same elevation as portions of the land grants in the region. Based on historic documents, the project area and surrounding lands were likely being used for subsistence and commercial agriculture, as well as for cattle pasture from the mid to late 1800s. The project area might have been used later than surrounding lands because of its steep slopes and very rocky soil, but based on aerial photographs, the project area was bulldozed sometime around the 1950s in preparation for commercial agriculture.

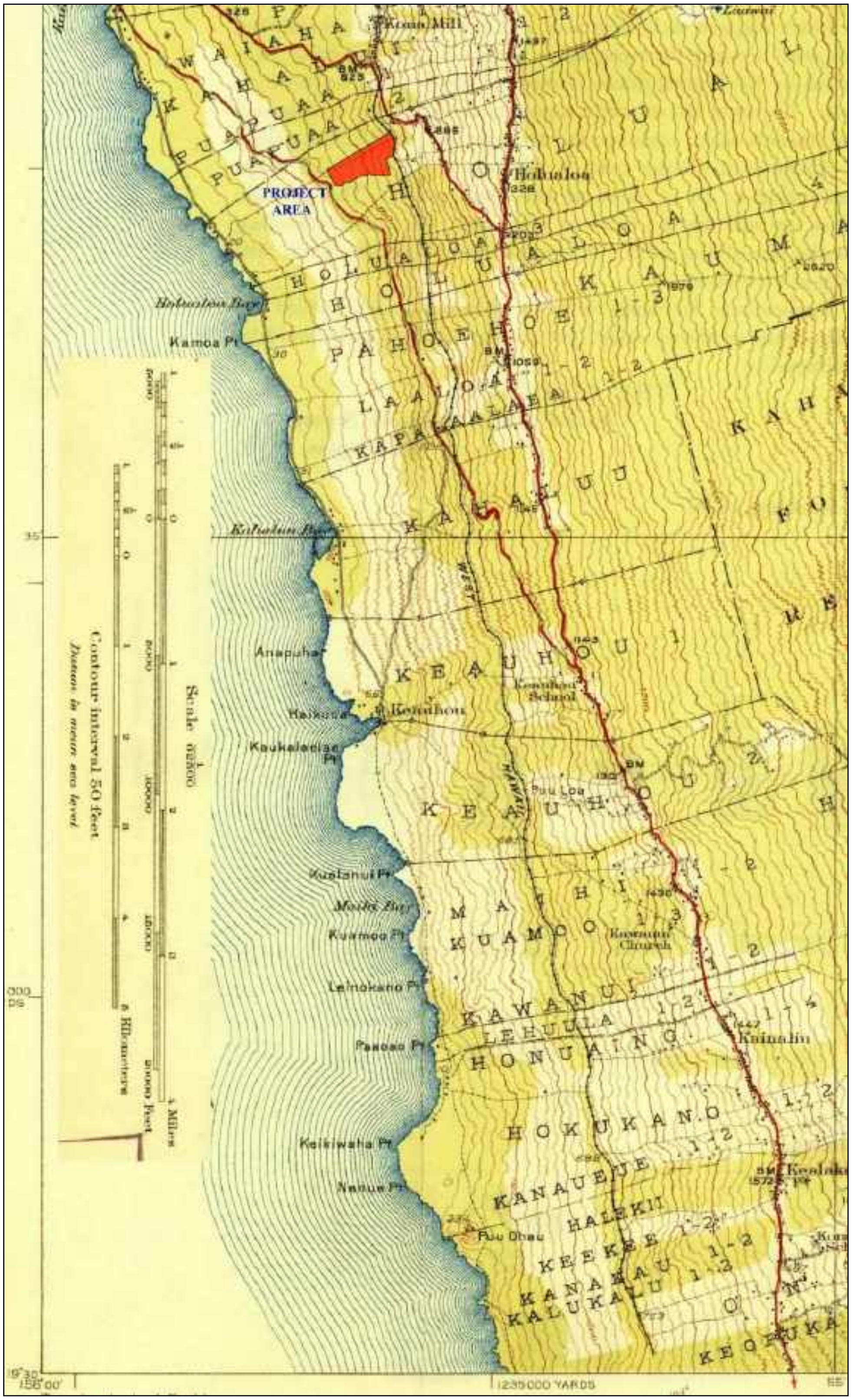

Figure 8: Portion of 15-Minute Series USGS Topographic Map Showing Location of Railroad and Project Area (USGS 1928).

PREVIOUS ARCHAEOLOGICAL STUDIES

There are at least 33 previous archaeological reports for lands near the current project area, including studies in Puapuaʻa 2nd and Hōlualoa 1st, 2nd, and 3rd Ahupuaʻa (Table 4 and Figure 9). The studies were conducted from the coast to roughly 1,460 ft amsl and encompass the *kula* region (0-500 ft), the *kaluʻulu* region (500-1,000 ft), and the lower portions of the *ʻāpaʻa* region (1,000-2,500 ft). Results of the previous archaeological studies are summarized below by elevation: studies numbered 1through 15 in Table 3 and Figure 9 are situated from the coast to Queen Kaʻahumanu Highway (0-360 ft amsl), studies 16 through 21 are located from above the Queen Kaʻahumanu Highway to just below Hualālai Road (306-760 ft amsl), and studies 22 through 24 are above Hualālai Road to just above Māmalahoa Highway (1,100-1,460 ft amsl).

Table 3: Inventory of Previous Archaeological Investigations.

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
1	Landrum et al. 1990	Archaeological Inventory Survey	N/A	46 Sites
1	Calis et al. 2004	Archaeological Data Recovery	N/A	10 Sites
2	Carlson & Rosendahl 1990	Archaeological Inventory Survey	65	64 Sites
3	Haun et al. 1998	Archaeological Inventory Survey	15	31 Sites
4	Hammatt & Folk 1981	Archaeological Survey	20	20 Sites
4	Hammatt et al. 1986	Archaeological Survey & Excavations	20	21 Sites
5	Haun & Henry 2001	Archaeological Data Recovery	1.59	1 Site
6	Escott 2013	Archaeological Inventory Survey	1.962	2 Sites
7	Sinoto 1979	Archaeological Reconnaissance Survey	6	Rock Walls
8	Hammatt 1979b	Archaeological Survey	22	3 Sites
9	Hammatt 1979c	Archaeological Survey	23	39 Sites
10	Conolly & Gunness 1979	Archaeological Reconnaissance Survey	46.8	80 Sites
10	Hammatt 1979a	Archaeological Inventory Survey	46.8	11 Sites
10	Hammatt 1980	Archaeological Survey & Excavation	103	88 Sites
11	Nelson et al. 205	Archaeological Inventory Survey	28	22 Sites
12	Rosendhal 1978	Archaeological Reconnaissance Survey	2.5	1 Site
12	Soehren 1980a	Archaeological	n/a	7 Sites

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
		Reconnaissance Survey		
12	Wolforth et al. 2000	Archaeological Inventory Survey	8	7 Sites
13	Barrera 1995	Archaeological Reconnaissance Survey	17	3 + several ag. mounds
13	Haun & Henry 2000	Archaeological Inventory Survey	17	12 (104 Features, 82 of Which Were Agricultural)
14	Rosendahl 1989	Archaeological Field Inspection	6	Modified Outcrops
15	Schilt 1984	Archaeological Study	17	134 Sites
16	Walker & Rosendahl 1988	Archaeological Reconnaissance Survey	104	67 Sites
16	Graves & Goodfellow 1993	Archaeological Data Recovery	104	58 Sites
16	Maly & Rosendahl 2006	Archaeological Preservation Plan	104	67 Sites
17	Hammatt et al. 1992	Archaeological Survey	174	71 Sites
18	Soehren 1980b	Archaeological Reconnaissance Survey	16	1 Site
19	Rechtman 2006	Archaeological Inventory Survey	1.008	2 Sites
20	Rosendahl 1988	Archaeological Reconnaissance Survey	17	17 Sites
20	Fager & Graves 1993	Archaeological Inventory Survey	17	17 Sites
21	Dircks et al. 2013	Archaeological Inventory Survey	10.266	1 Site (149 Historic to Modern Farming Features)
22	Desilets et al. 2004	Archaeological Inventory Survey	11.7	1 Homestead Features
23	Rechtman 2013		29	24 Sites
24	Clark & Rechtman 2006	Archaeological Inventory Survey	2.7	6 Historic Era Sites
25	Escott & Escott 2018	Archaeological Inventory Surve	5.0	22 Pre-Contact and Historic Era Sites

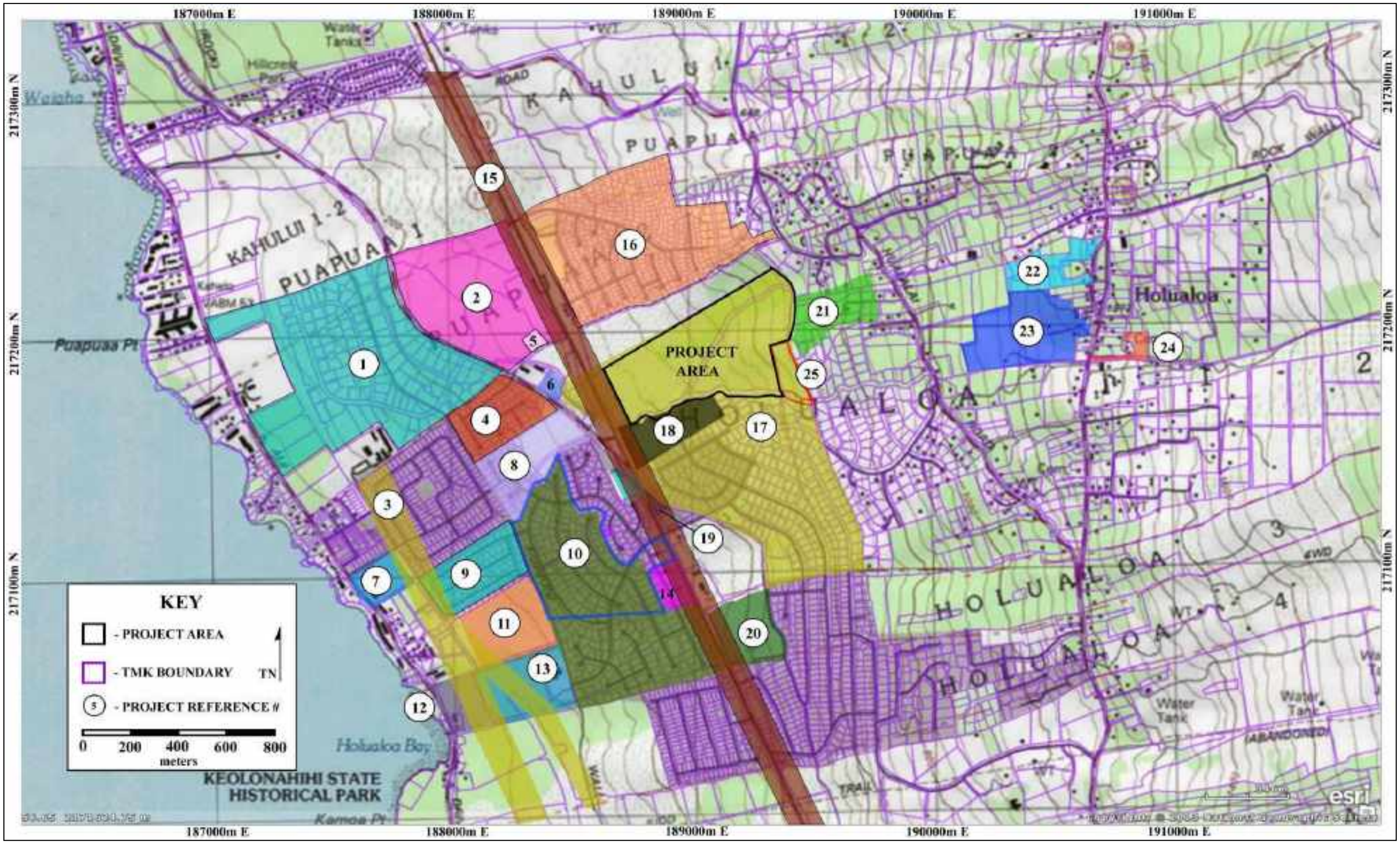

Figure 9: 7.5-Minute Series USGS Topographic Map Showing Location of Previous Archaeological Studies and Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

REGIONAL PREVIOUS ARCHAEOLOGICAL STUDIES

1. Landrum et al. 1990, and Calis et al. 2004. PHRI, Inc. conducted an archaeological inventory survey (Landrum et al. 1990) and SCS, Inc. conducted data recovery investigations (Calis et al. 2004) at the Kahakai development project. The project area is located within the lower elevations of Puapuaʻa 2nd Ahupuaʻa. Pre-Contact era to early post-Contact era cave shelters, agricultural rock clearing mounds, burials, shrines, and a possible heiau were identified during the AIS study. A heiau complex, several burials, and five permanent habitation sites were recommended for preservation. All of the preservation sites are near the coast.

2. Carleson and Rosendahl 1990. PHRI, Inc. conducted an archaeological inventory survey of 65 acres between Kuakini and Queen Kaʻahumanu highways in Puapuaʻa 2nd Ahupuaʻa. Their study recorded 64 archaeological sites including pre-Contact era habitation, agricultural, and burial sites. Seven sites were assessed as significant and recommended for preservation (Carleson and Rosendahl 1990: 34).

3. Haun et al. 1998. PHRI, Inc. conducted an archaeological inventory survey of the proposed Aliʻi Drive corridor through several ahupuaʻa. Numerous pre-Contact era site complexes were recorded in Puapuaʻa 2nd and Hōlualoa 1st through 4th Ahupuaʻa. The site complexes included a large number of agricultural features, as well as habitation, burial, and ceremonial features.

4. Hammatt and Folk 1981, and Hammatt et al. 1986. Two archaeological surveys were conducted on a 20-acre parcel of below Kuakini Highway. The first study recorded 20 sites, and the second recorded 21 sites. None of the sites were recommended for preservation (Hammatt and Folk 1981: ii, and Hammatt et al. 1986: 87). The report also recommended that the single documented burial be relocated.

5. Haun & Henry 2001. Haun and Associates conducted an archaeological data recovery study at a c-shaped enclosure located on 1.59 acres of land below Queen Kaʻahumanu Highway

6. Escott 2013. SCS conducted an archaeological study on1.962 acres of land near the intersection of Kuakini and Queen Kaʻahumanu highways. Two historic era ranch walls were recorded during the study.

7. Sinoto 1979. Aki Sinoto recorded several Historic era ranch rock walls on a six acre parcel of land just mauka of Ali‘i Drive.

8. Hammatt 1979b. The Archaeological Research Center, Inc. conducted an archaeological survey of 22 acres just south of Kuakini Highway. Three archaeological sites were recorded during the study. None of the sites were recommended for preservation (Hammatt 1979b: ii, and 10).

9. Hammatt 1979c. The Archaeological Research Center, Inc. conducted an archaeological survey of 23 acres located in the near coastal portion of Hōlualoa 1st and 2nd Ahupua‘a. Thirty nine archaeological sites were recorded during the study. The report recommended that all burials, including a known cemetery site be relocated (Hammatt 1979a: 5). None of the remaining sites (pre-Contact era habitation and agriculture sites) were recommended for preservation in place.

10. Conolly and Gunness 1979, and Hammatt 1979a and 1980. The Archaeological Research Center, Inc. conducted an archaeological survey of 103 acres within the near coastal portions of Hōlualoa 1st through 4th Ahupua‘a (Hammatt 1980). One hundred and thirty six archaeological sites were recorded on the project area, including pre-Contact era habitation, agriculture, burial, and ceremonial sites. The Hammatt report recommended that a heiau (Site 6661) was significant and should be preserved in place (Hammatt 1980: 4). The report also recommended that the single documented burial be relocated to the perimeter of heiau (Site 6661) and preserved. No other sites were recommended for preservation.

11. Nelson et al. 2005. An archaeological inventory survey was conducted by Rechtman Consulting on 28.0 acres located in the near coastal portion of Hōlualoa 2nd Ahupua‘a. A total of 22 sites containing 150 features were recorded. The sites were primarily pre-Contact era agricultural and habitation sites, though five burial sites, a possible heiau, and a trail were also documented within the project area.

12. Rosendahl 1978, Soehren 1980a, Wolforth et al. 2000. PHRI conducted an archaeological inventory survey of eight acres of coastal Hōlualoa 3rd Ahupua‘a and recorded seven archaeological sites including three Historic era rock walls, three residential sites, and Hikapaia Heiau.

13. Barrera 1995, Haun & Henry 2000. Barrera (1995) recorded a possible burial platform, two habitation site, agricultural rock clearing mounds and modified outcrops during a reconnaissance survey of 17 acres in near coastal Hōlualoa 2nd Ahupuaʻa. Haun and Associates conducted an archaeological inventory survey of the property and recorded 12 sites with 104 features (Haun and Henry 2000:14). The majority of features (n=82) were pre-Contact era agricultural rock clearing mounds. Eleven permanent habitation and one temporary habitation feature were also recorded during the study.

14. Rosendahl 1989. PHRI conducted an archaeological field inspection of 6.0 acres of land just below Queen Kaʻahumanu Highway in Hōlualoa 2nd Ahupuaʻa. Several modified outcrops were recorded in the letter report. There were no other archaeological features identified on the project area.

15. Schilt 1984. The Bishop Museum conducted an archaeological study of the Kuakini Highway Realignment Project located roughly along present day Queen Kaʻahumanu Highway and recorded 39 sites Puapuaʻa 2nd and Hōlualoa 1st and 2nd Ahupuaʻa. Twenty two of the sites were pre-Contact to early post-Contact era agricultural gardens and modified outcrops (rock clearing). There were also traditional habitation platforms and trails, as well as Historic era roads and walls recorded during the study.

16. Walker and Rosendahl 1988, Graves and Goodfellow 1993, and Maly and Rosendahl 2006. An archaeological reconnaissance survey (Walker and Rosendahl 1988), an archaeological data recovery study (Graves and Goodfellow 1993), and an archaeological preservation plan (Maly and Rosendahl 2006) were conducted by PHRI, Inc. for 104 acres in the upland region of Puapuaʻa 2nd Ahupuaʻa. A total of 67 sites were documented within the project area, including traditional (KFS) sites, temporary habitation sites, three burials, and a *heiau*. The archaeological preservation plan recommended that the three burials be relocated to the *heiau* site, and that the *heiau* be preserved as a formal historic preservation area (Maly and Rosendahl 2006).

17. Hammatt et al. 1992. An archaeological survey was conducted by Cultural Surveys Hawaiʻi on 174 acres of land in the upland region of Hōlualoa 1st, 2nd, and 3rd Ahupuaʻa. The project area lands had been heavily bulldozed during the modern era for ranching and agricultural purposes. Despite the bulldozing, seventy one sites were recorded during the study, including temporary habitation features, rock walls, agricultural features, and

three burial sites. Many of the sites were determined to be associated with Historic era ranching and agriculture.

18. Soehren 1980b. Soehren conducted an archaeological reconnaissance survey of 16.0 acres above Queen Ka‘ahumanu Highway in the inland region of Hōlualoa 1st Ahupua‘a (Soehren 1980b).   A single enclosure was identified during the survey.

19. Rechtman 2006. An archaeological inventory survey was conducted by Rechtman Consulting, LLC on a roughly one-acre parcel located *makai* of Queen Ka‘ahumanu Highway in Hōlualoa 2nd Ahupua‘a. Two rock walls were recorded on the project area. The report recommended no further work at the wall sites.

20. M. Rosendahl 1988, Fager & Graves 1993. Fager and Graves (1993) conducted an archaeological inventory survey of 17.0 acres just mauka of Queen Ka‘ahumanu Highway in Hōlualoa 3rd Ahupua‘a. Seventeen sites containing 27 pre-Contact to early post-Contact era agricultural features, including rock mounds, modified outcrops, C-shaped enclosures, terraces, walls, and rock enclosures, were recorded.

21. Dircks et al. 2013. Rechtman Consulting conducted an archaeological inventory survey of 10.266 acres of land located between 840 and 920 ft amsl in Hōlualoa 1st and 2nd Ahupua‘a. One Historic era to modern era homestead/agriculture site (Miyose Farm) containing 149 features was recorded during the survey.

22. Desilets et al. 2004. Desilets et al. (2004) conducted an archaeological inventory survey of 11.7 acres of land in the *‘āpa‘a* region of Hōlualoa 1st Ahupua‘a. A single site associated with Historic era and modern era homesteads, commercial agriculture (coffee), and ranching was recorded. Features included rock walls, roads, coffee terraces, and buildings.

23. Rechtman 2013. Rechtman Consulting conducted and archaeological inventory survey of 29 acres of land located in the *‘āpa‘a* region of Hōlualoa 1st Ahupua‘a. Twenty four sites were recorded. The majority of the sites were associated with Historic era and modern era homesteads, commercial agriculture. Features included rock walls, roads, and remnants of structures. A single pre-Contact era to early post-Contact era residential and agricultural site was also recorded.

24. Clark & Rechtman 2006. Rechtman Consulting conducted an archaeological inventory survey of 2.7 acres of land located in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. Six sites were recorded, including five ranch walls and an area of coffee terraces.

A number of conclusions can be made from the previous archaeological studies. A primary conclusion is that the majority of habitation features, especially permanent habitation features, are located from the coast to about 360 ft amsl, below the present day Queen Kaʻahumanu Highway. The same is true of ceremonial features, burials, and, to a lesser extent, agricultural features. The density of agricultural features and habitation features, mostly temporary habitation features, in the upland regions between 360 ft amsl and 700 ft amsl is much lower than the site density in the coastal *kula* and lower *kaluʻulu* regions of the KFS. The pre-Contact traditional Hawaiian settlement and agricultural patterns are strongly oriented to the *kula* and lower *kaluʻulu* regions.

Even though cattle ranching and commercial agriculture may have removed some archaeological sites from the ground surface in the *kaluʻulu* region, there appear to be fewer sites than at lower elevations. The majority of sites in the *kaluʻulu* region are KFS agricultural sites including rock clearing mounds, modified outcrops, garden enclosures, and low garden walls. Within the lands of the current project, it is clear that ranching and commercial agricultural practices have removed and damaged many of the pre-Contact era sites from the ground surface (see the Hammatt et al. 1992 summary below). Moreover, many of the sites identified near the current project area are associated with Historic era ranching and commercial agriculture.

A second conclusion is that the establishment of Historic era homesteads, ranches, and commercial agriculture seems to have removed, or obscured, the majority of pre-Contact era sites in the upper *kaluʻulu* and lower *ʻāpaʻa* regions. It might be that pre-Contact uses in these regions did not involve the construction of large or permanent features, as in the lower regions of Kona. It is also likely that Historic era ranching and commercial agriculture in the lower *ʻāpaʻa* region have caused large scale land alterations through the use of bulldozers for pasture and garden. It is possible that traditional features were disassembled to build rock walls and coffee terraces.

25. Escott & Escott 2018. SCS conducted an archaeological inventory survey on a 5.0-acre portion of Parcel 017 (Escott and Escott 2018) and recorded twenty-two new archaeological sites within the project area (Table 4 and Figure 10). Fifteen of the sites are single-feature sites. The remaining seven agricultural sites contained two to seven features. A majority of the sites are agricultural terraces and complexes dating to the pre-Contact era to the Historic era. The agricultural complexes are located in the lower *kaluʻulu* zone, between 600 and 700 feet (182 to 213 meters) amsl.

Three of the ranch walls (Site #50-10-37-30595, #50-10-37-30601, and #50-10-37-3065) are the primary dividers of the five-acre project area. All site numbers in this report are preceded by the numerical prefix #50-10-37, and hereafter only the last five digits of the site number is used.

The Historic era walls have typical characteristics of ranch walls including cobble core fill and bi-faced inward sloping walls toward the top. They are approximately 1.0 meter tall. Site 30602 and 30603 are Historic era ranching and agricultural enclosures constructed along wall Site 30595 and wall Site 30601. These two wall sites are constructed onto the west edge of the Site 30592 railroad berm and post-date the railroad berm.

The northern third of the project area only has two sites (Site 30591 and 30956). Site 30591 is an agricultural complex with six terraces. Portions of the sites were bulldozed in the early Modern era. Both sites date to pre-Contact to early Historic era. The terraces reflect Kona Field System features but are roughly constructed that more closely resemble Historic era commercial agriculture. Site 30956 is a rectangular Historic style hearth.

The middle one third of the project area between wall sites 30595 and is within the bulldozed "terraces" portion of the project area. Site is a pre-Contact era to early post-Contact era lava tube burial. The burial will be preserved in place in accordance with a Burial Site Component of a Preservation Plan. Site 30594 is an agricultural terrace complex that resembles the Kona Field System but is more roughly constructed. Artifacts recovered from subsurface testing at Site 30604 suggest it is a Historic era agricultural terrace.

Table 4: Inventory of Archaeological Sites Identified on the AIS Project Area (Escott and Escott 2018).

Site # *	Site Type	Features	Site Function	Age	Testing
30591	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30592	Railroad Bed and Berm	1	Transportation	Historic Era	
30593	Lava Tube Burial	1	Burial	Pre-Contact to Early Post-Contact Era	
30594	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1 & 2
30595	Rock Wall	1	Ranching	Historic Era	
30596	Hearth	1	Food Preparation	Historic Era	TU-1
30597	Rock Wall	1	Ranching	Historic Era	
30598	Rock Wall	1	Agriculture/Ranching	Pre-Contact to Historic Era	
30599	Platform & Enclosure	2	Ranching/Agriculture	Historic Era	SP-1 & 2, TU-1
30600	Terrace	1	Agriculture	Historic Era	SP-1
30601	Rock Wall	1	Ranching	Historic Era	
30602	Enclosure	1	Ranching/Agriculture	Historic Era	SP-1, 2, 3 & 4
30603	Enclosure	4	Ranching/Agriculture	Historic Era	SP-1 & 2
30604	Agricultural Complex	4	Agriculture	Pre-Contact to Historic Era	SP-1
30605	Rock Wall	1	Ranching/Agriculture	Historic Era	
30606	Rock Wall	1	Ranching/Agriculture	Pre-Contact to Historic Era	
30607	Agricultural Complex	7	Agriculture	Pre-Contact to Historic Era	SP-1 to SP-10
30608	Enclosure	1	Structure	Historic Era	
30609	Enclosure	1	Structure	Historic Era	
30610	Terrace	1	Agriculture	Pre-Contact to Historic Era	SP-1
30611	Agricultural Complex	3	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30612	Lava Blister	1	Refuse Dump	Historic Era	

* Site numbers are preceded by the prefix 50-10-37-.

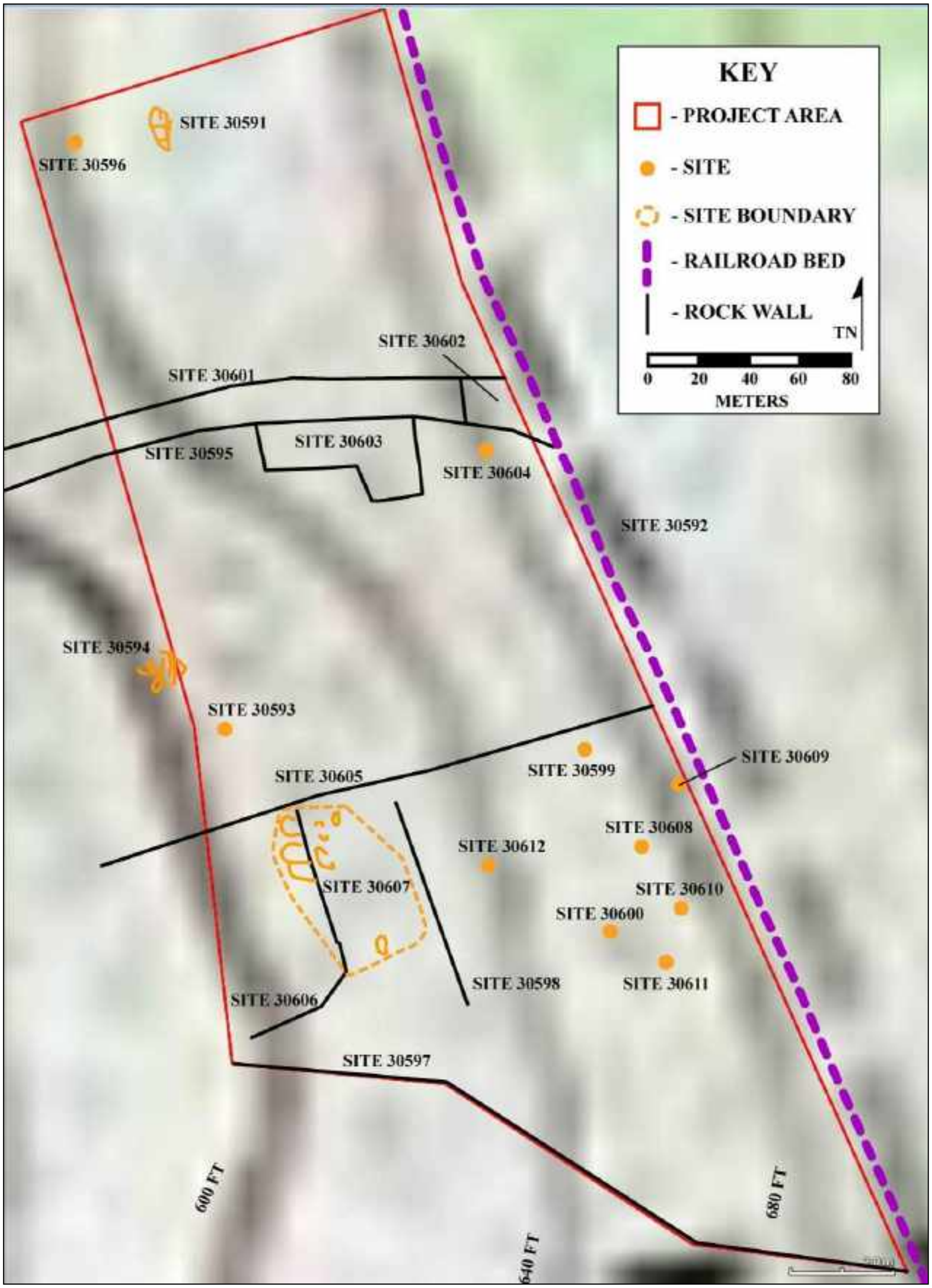

Figure 10: 7.5-Minute Series USGS Topographic Map Showing Locations of Escott and Escott (2018) AIS Project Area Archaeological Sites (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

The southern third of the project area, south of wall Site 30605, contained six primarily agricultural sites (Site 30598, 30600, 30606, 30607, 30610, and 30611) and four Historic era sites (Site 30599, 30608, 30609, and 30612) with functions other than agriculture. The agricultural features included rock walls (Site 30598 and30606), terraces (Site 30600 and 30610), and agricultural complexes with terraces (Site 30607 and 30610). The non-agricultural features included three enclosures (Site 30599, 30608, and 30609), and a refuse disposal area lava blister (Site 30612). The cluster of these sites indicates their use for Historic era commercial agriculture.

Twenty-nine shovel probes and two excavation units tested the sites. Marine shell fragments, a basalt flake and volcanic-glass flakes recovered during testing indicate that Hawaiians likely used the area for limited agricultural purposes. However, the agricultural terraces more closely resemble the remains of Historic era commercial agriculture.

All 22 sites identified during the current AIS study were assessed significant under criterion "d" as they are likely to yield information important to history. The railroad berm is also significant under criteria "a" and "c" as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. The railroad berm was recommended for preservation with preservation measures outlined in an archaeological preservation plan (Escott and Mello 2019b). The rest of the sites require no further work.

The burial is also significant under criterion "e" as it has important value to Hawaiian people and people of other ethnic backgrounds in the state. The burial was recommended for preservation in place with preservation treatments outlined in a Burial Site Component of a Preservation Plan (Escott and Mello 2019a).

CURRENT PROJECT AREA SPECIFIC PREVIOUS ARCHAEOLOGY

Lands of the current AIS study were subject to an AIS study conducted by Hammatt et al. (1992). That study encompassed 66.039 acres of land within the current project area located between 320 to 690 feet (98 to 210 meters) amsl [TMK: (3) 7-6-021:016 and 017] (see Figure 9, Project #17). The current project area is located within the northern portion of the Hammatt et al. (1992) project area.

Twenty one archaeological sites and two areas of bulldozed modern planting "terraces" were recorded in the AIS report (Figure 11 and Table 5). Eight of the 21 archaeological sites (SIHP #50-10-37-10015, #50-10-37-10017, #50-10-37-10018, #50-10-37-10020, #50-10-37-10031, #50-10-37-10033, #50-10-37-10034, and #50-10-37-10049, hereafter abbreviated to the last five digits) were recorded by CSH in tabular format only. Written descriptions of the remaining 13 sites are in the CSH AIS report. Excavations were conducted at ten of the 13 sites. The AIS report included plan view figures for four of the 13 sites. At the request of SHPD, additional site documentation for Sites 10011, 10012, 10031, 10049, and 10071 was submitted to SHPD in a letter report (Hammatt and Shideler 2007).

Six of the sites were determined to be pre-Contact era, four associated with habitation, one with agriculture, and one single feature site (Site 10012) contained two burials. Fifteen of the sites were determined to be Historic era sites, the majority associated with coffee agriculture and cattle ranching. Two Historic era habitation sites were also documented in the AIS study.

The burials at Site 10012 were removed and reinterred off-project prior to 1983 (see Appendix A Reinterment Documentation). The site was further excavated to ensure that all *iwi* had been removed. The site was then back-filled and leveled by bulldozer.

The AIS recommended no further work at all 21 sites documented in the current project area. The Hammatt and Shideler (2007) letter report repeated the AIS recommendation that "all surface sites in the area were documented" in the AIS report and that "significant material from the study area has been recovered and that further investigation would be of minimum productivity" (Hammatt and Shideler 2007:11). However, the authors recommended that the sites should be relocated to document their current conditions and to document the sites to prevailing SHPD AIS standards.

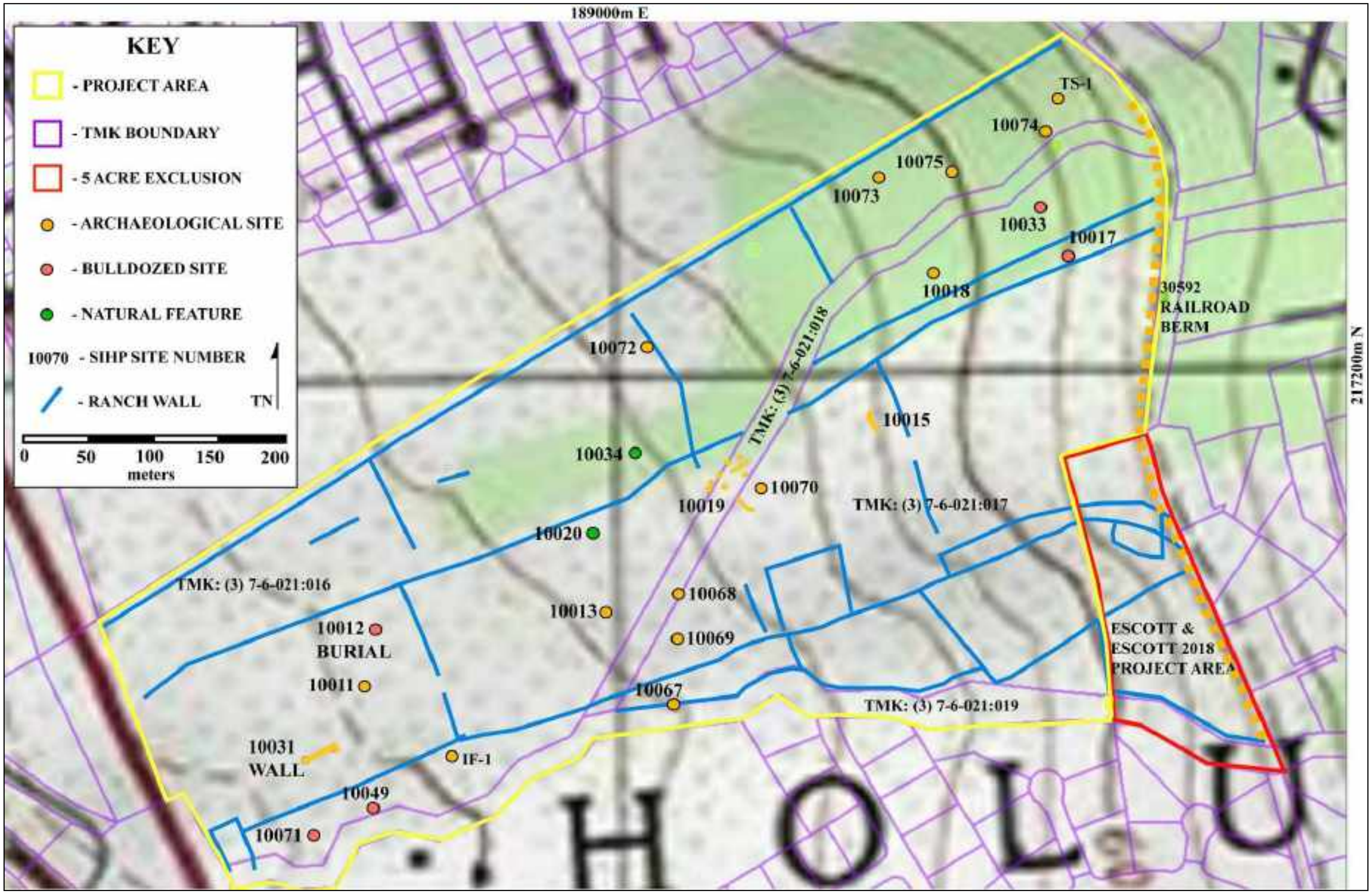

Figure 11: 7.5-Minute Series USGS Topographic Map Showing Location of Northern Portion of Hammatt et al. (1992) Sites and Current Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

Table 5: Inventory of Previously Recorded Archaeological Sites (Hammatt et al. 1992; Hammatt and Shideler 2007).

SIHP# *	CSH SITE#	TYPE	FUNCTION	AGE	DOCUMENTATION	EXCAVATION	CULTURAL MATERIAL
10011	9	Platform	Ag. Clearing	Prehistoric	Description & Planview	1.5 m long trench	3 cowrie shells
10012	10	Platform & Wall	Burial	Prehistoric	Description, Planview, & Profiles	Entire Feature	Burial reinterred off-project
10013	11	Enclosure & Lava Tube	Habitation	Prehistoric	Description & Planview	4.5 m square total	Fire features & Prehistoric artifacts
10015	13	Terrace	Road Bed	Historic	Description		
10017	15	Platform	Cattle Ramp	Historic	Tabular		
10018	16	Enclosure	Habitation	Historic	Description		
10019	17	6 Rock Mounds	Ag. Clearing	Historic	Description	3 1.0 m wide trenches	Metal File
10020	18	Platform	Ag. Clearing	Historic	Description		
10031	110	Enclosure Wall	Agriculture	Historic	Description		
10033	112	Planting Complex	Coffee Ag	Historic	Description		
10034	113	Platform	Ag. Clearing	Historic	Description		
10049	216	Terraces	Agriculture	Historic	Description		
10067	232	Terraces	Habitation	Prehistoric	Description	1.0 X 1.0 m	VG & a small amount of midden & fire feature
10068	233	Enclosure	Habitation	Prehistoric	Description & Planview	0.5 X 0.25 m	small amount of midden
10069	234	Modified Bluff/Platform	Habitation	Historic	Description	0.5 X 0.5 m	VG & a small amount of midden
10070	235	U-Shape Enclosure	Agriculture	Historic	Description	1.0 X 0.5 m	No artifacts
10071	237	Platform	Habitation	Prehistoric	Description		
10072	238	Modified Bluff	Ag. Clearing	Historic	Description	7.0 m square total	No arts Small amount of MS in TU-2
10073	239	Platforms & Enclosure	Ranching/Ag.	Historic	Description	1.0 X 1.0	
10074	240	Enclosure	Coffee Work Shed	Historic	Description	1.25 m square total	1 VG, little MS, historic artifacts
10075	241	Enclosure	Pig Pen	Historic	Description, Planview, & Profile		

* Site numbers are preceded by the prefix 50-10-37-.

In a letter to the County of Hawai‘i Department of Planning dated July 30, 2018, (Log. No. 2018.00878 Doc. No. 2018.00878), SHPD requested a new pedestrian survey to identify all archaeological historic properties present on the project area, and to update previous archaeological documentation to include site plans for each site with site boundaries and areas impacted by bulldozing, photographs of all sites and features, an assessment of their integrity, and site significance.

EXPECTED ARCHAEOLOGICAL PATTERNS

Based on previous archaeological studies, geological studies, historical research, interviews, and County Planning Department records it is expected that any archaeological sites remaining on the current project area will be related to traditional pre-Contact era agriculture, temporary habitation, burial practices, and to early post-Contact era and Historic era ranching and agricultural activities.

It is likely that many of the pre-Contact to early post-Contact era sites have been removed or disturbed by Historic era and modern ranching and commercial agriculture. This is especially true because the area around the current project era was used as cattle pasture and coffee farming from the Historic era to the present. Additionally, the project area is in a location that was bulldozed sometime between the 1940s and the 1970s in preparation for a commercial agricultural project, most likely coffee growing. Aerial photos clearly show that bulldozer transects were cut north/south across the entire five-acre project area.

Archaeological sites and features that are likely to remain on the project area will likely include pre-Contact era to early post-Contact era rock clearing mounds, terraces, small enclosures, platforms, and burials. It is also likely that Historic era and modern features related to ranching and agriculture will also be identified on the project area. These include primarily rock walls constructed to confine cattle.

RESULTS OF FIELDWORK

Seventeen of the twenty one previously identified archaeological sites were located during the course of the archaeological inventory survey study (Figure 12 and Table 6). All site numbers in this report are preceded by the numerical prefix #50-10-37, and are abbreviated to the last five digits. Two of the previously documented sites (Site 10020 and Site 10034) relocated by SCS are natural bedrock outcrops and one site former burial site (Site 10012). The burials at Site 10012 were reinterred off-project in 1993.

The four remaining previously documented sites (Sites 10017, 10033, 10049, and 10071) were bulldozed prior to the SCS fieldwork and the remains of the sites are no longer present on the ground surface. Three previously undocumented sites were also recorded, including a portion of the railroad berm (Site 30592), a small coffee shed enclosure (Site 31181), and several ranch walls (Site 31182). A single petroglyph on a loose cobble was recorded as Isolated Find 1 (IF-1).

A total of 21 sites, 17 previously documented and four newly documented, were identified on the project area and are documented in this report. Two of the sites (Site 10020 and Site 10034) were determined to be natural geological features. Six of the sites were determined to be pre-Contact era, three associated with habitation, one with agriculture, a single petroglyph site, and one single feature site (Site 10012) formerly contained two burials. Twelve of the sites were determined to be Historic era sites, the majority associated with coffee agriculture and cattle ranching. Two Historic era habitation sites were also documented in the AIS study. One site (Site 10015) was determined to be a short segment of modern bulldozer road.

The burials at Site 10012 were removed and reinterred off-project prior to 1993 with the approval of the Hawaiian Island Burial Council (HIBC) and SHPD. The site was further excavated to ensure that all *iwi* had been removed. The site was then back-filled and leveled by bulldozer.

The following site summaries include information from the CSH archaeological studies (Hammatt et al. 1992; Hammatt and Shideler 2007) and new information documented during the current AIS resurvey used to updated site documentation.

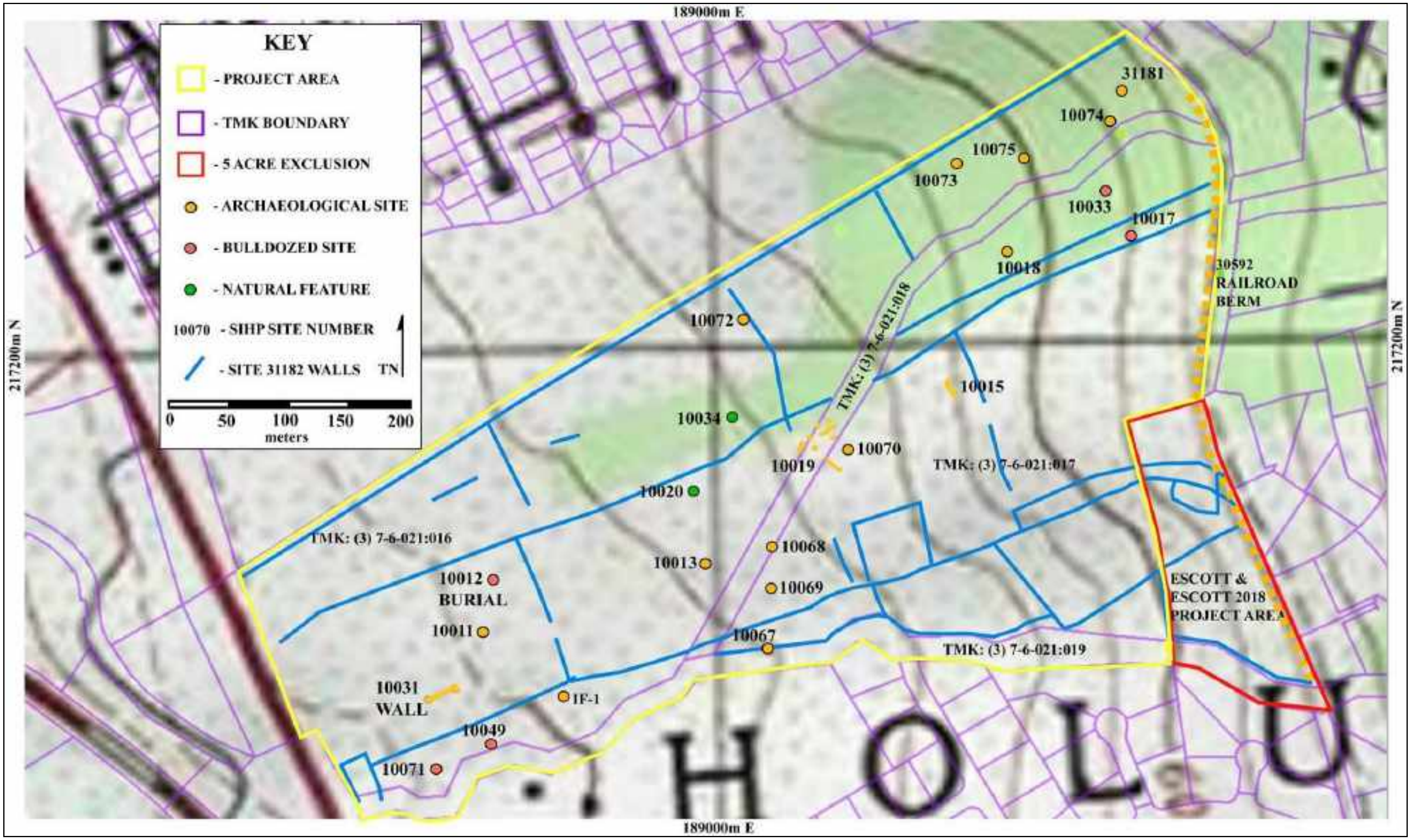

Figure 12: 7.5-Minute Series USGS Topographic Map Showing Location of Archaeological Sites and Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

Table 6: Inventory of Hammatt et al. (1992) Archaeological Sites and Current AIS Results.

SIHP#	TYPE	FUNCTION	AGE	DOCUMENTATION	EXCAVATIONS	DISPOSITION
10011	Platform	Ag./Temp Habitation	Pre-Contact	Description, Plan & Photos	1.5 m long trench, TU-1	Recorded
10012	Platform & Wall	Burial	Pre-Contact	Description, Plan, Profiles & Photos	Entire Feature	Removed – No Longer Present
10013	Enclosure & Lava Tube	Habitation	Pre-Contact	Description, Plan & Photos	4.5 m square total	Recorded
10015	Bulldozed Road	Transportation	Modern	Description	N/A	Modern Road Bed
10017	Platform	Cattle Ramp	Historic	Tabular	N/A	Bulldozed – No Longer Present
10018	Enclosure	Agricultural	Historic	Description	N/A	Partially Bulldozed
10019	6 Rock Mounds	Ag. Clearing	Historic	Description	3 1.0 m x 1.0 m trenches	Recorded
10020	Bedrock Outcrop	Geological Feature	Natural	Description	N/A	Natural – Not an Archaeological Site
10031	Enclosure Wall	Agriculture	Historic	Description & Photos	N/A	Recorded
10033	Planting Complex	Coffee Ag	Historic	Description	N/A	Bulldozed – No Longer Present
10034	Bedrock Outcrop	Geological Feature	Natural	Description	N/A	Natural – Not an Archaeological Site
10049	Terraces	Agriculture	Historic	Description	N/A	Bulldozed – No Longer Present
10067	Terraces	Habitation	Pre-Contact	Description, Plan, & Photos	1.0 X 1.0 m	Recorded
10068	Enclosure	Habitation	Pre-Contact	Description, Plan, & Photos	0.5 X 0.25 m	Mostly Bulldozed
10069	Modified Bluff/Platform	Habitation	Historic	Description & Photos	0.5 X 0.5 m	Recorded
10070	U-Shape Enclosure	Agriculture	Historic	Description, Plan & Photos	1.0 X 0.5 m	Recorded
10071	Platform	Habitation	Pre-Contact	Description	N/A	Bulldozed – No Longer Present
10072	Complex	Ag. Clearing	Pre-Contact	Description, Plan & Photos	7.0 m square total	Recorded
10073	Complex	Ranching/Ag.	Historic	Description, Plan & Photos	TU-1 & TU-2	Recorded
10074	Enclosure	Coffee Work Shed	Historic	Description, Plan & Photos	1.25 m square total	Recorded
10075	Enclosure	Pig Pen	Historic	Description, Plan & Photos	-	Recorded
30592	Railroad Berm	Transportation	Historic	Description, Plan & Photos	N/A	Recorded
IF-1	Petroglyph	Marker	Pre-Contact	Description, Plan & Photos	N/A	Recorded
31181	Enclosure	Coffee Work Shed	Historic	Description, Plan & Pho	-	Recorded
31182	Rock Walls	Ranching & Ag.	Historic	Description, Plan & Pho	N/A	Recorded

* Site numbers are preceded by the prefix 50-10-37-.
Orange Shading - Site no longer present.
Green Shading – Natural geological feature. Not an archaeological site.

SIHP 10011	**Platform**
FUNCTION:	Agricultural Rock Clearing/Temporary Habitation
AGE:	Pre-Contact era
DIMENSIONS:	7.50 m in length by 5.0 m wide by 0.86 m in height (max)
CONDITION:	Fair
INTEGRITY:	Altered: retains integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	CSH 1.5 m trench, SCS TU-1 2.4 m by 1.2 m

DESCRIPTION: SIHP 10011 is a pre Contact era rectangular stone platform located at 405 ft amsl in the southern portion of the project area (see Figure 12). The platform is approximately 7.50 m by 5.0 m wide, with a maximum height of 0.86 m (Figure 13). The platform is constructed of angular and subangular cobbles and small boulders piled and stacked two to three courses high along the perimeter and filled with large pebbles, cobbles and small boulders (Figure 14 and Figure 15). Portions of the perimeter are very roughly faced (Figure 16 and Figure 17). The top surface of the platform is slightly uneven and is paved with large pebbles, cobbles, and small boulders (see Figure 13 and Figure 15). Portions of the north and west sides have collapsed.

The CSH AIS interpreted that the platform to be a prehistoric agricultural rock clearing mound, based on formal construction and size, though they noted that the feature has formal construction elements suggesting possible use other than an agricultural rock clearing.

CSH EXCAVATION RESULTS: CSH excavated a 1.5 m wide trench through the platform (see Figure 13) and recovered three *cowrie* shell fragments. The form, construction method and location of the feature suggest that the feature could be a temporary habitation platform used periodically during agricultural activities. However, the near absence of cultural material recovered from the CSH excavation suggests the platform is a pre-Contact era rock clearing mound.

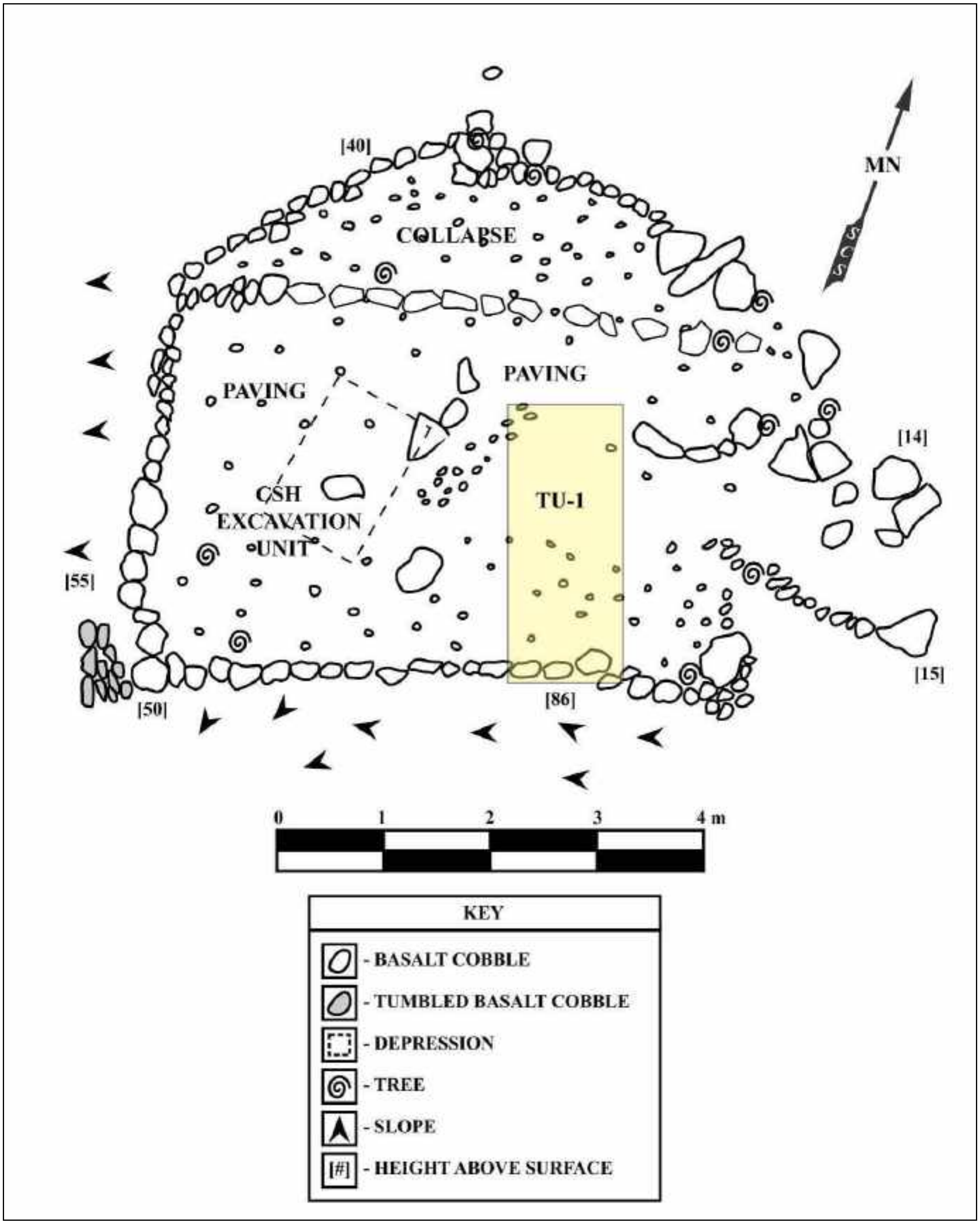

Figure 13: Site 10011 Plan View Map.

Figure 14: Photograph of Site 10011, Looking East.

Figure 15: Photograph of Site 10011 Top Surface, Looking Southwest.

Figure 16: Photograph of Site 10011 South Edge Construction, Looking North.

Figure 17: Photograph of Site 10011 West Edge Construction and Collapse, Looking Northeast.

SCS EXCAVATION RESULTS: SCS excavated a 2.4 m long (N/S) by 1.2 m wide test unit (TU-1) in the southeast quadrant of the platform (see Figure 13). TU-1 was excavated as an architectural layer and three natural stratigraphic layers, and terminated on bedrock (Figure 18 through Figure 20). The natural stratigraphic layers were excavated in arbitrary 10 cm levels.

The Architectural Layer (45 cm maximum thickness) consisted of angular and subangular pebbles, cobbles and small boulders with a small amount of decomposing organic detritus. There were no artifacts, cultural deposits or subsurface features in the architectural layer. The top surface of the architectural layer was a fairly level cobble paving. The architectural layer continued into Layer I and terminated on bedrock approximately 40 cm to 45 cm below the top surface of the feature.

Layer I (0-10 cmbs) was dark brown (10YR3/3) loose sandy silt loam with blocky peds and 40% cobbles, pebbles and small boulders. The rock excavated in Layer I was architectural rock. The architectural layer continued into Layer II below. Layer I terminated on bedrock on the northern half and the southern end of the unit. In the south half of the unit, the base of Layer I terminated on Layer II sediment and was fairly level and clear. There were no artifacts in Layer I.

Layer II (10-26 cmbs) was very dark grayish brown (10YR3/2) soft sandy silt with 30% cobbles and small boulders excavated from the south half of TU-1. The rock excavated in Layer II was architectural rock and fragments of exfoliated bedrock. Layer II was excavated as a 10.0 cm Level 1 and a 6.0 cm Level 2. The bottom portion of Layer II, Level 1 (15-20 cmbs) contained a small amount of charcoal flecking, five small pieces of burnt wood (0.48 grams), a small coral fragment (4.9 g) and two very small fragments of *vana* shell (0.17 g). Layer II, Level 2 did not contain artifacts. Small, thin deposits of very fine Pāhala ash were identified in portions of the base of Layer II. Layer II terminated on bedrock along the southern end of TU-1 and terminated on Layer III sediment near the middle of TU-1. The boundary between Layer II and Layer III was fairly level and clear.

Layer III (26-90 cmbs) was yellowish brown (10YR5/4) loose fine silt with 50% bedrock cobbles excavated near the middle of TU-1. Layer III did not contain artifacts.

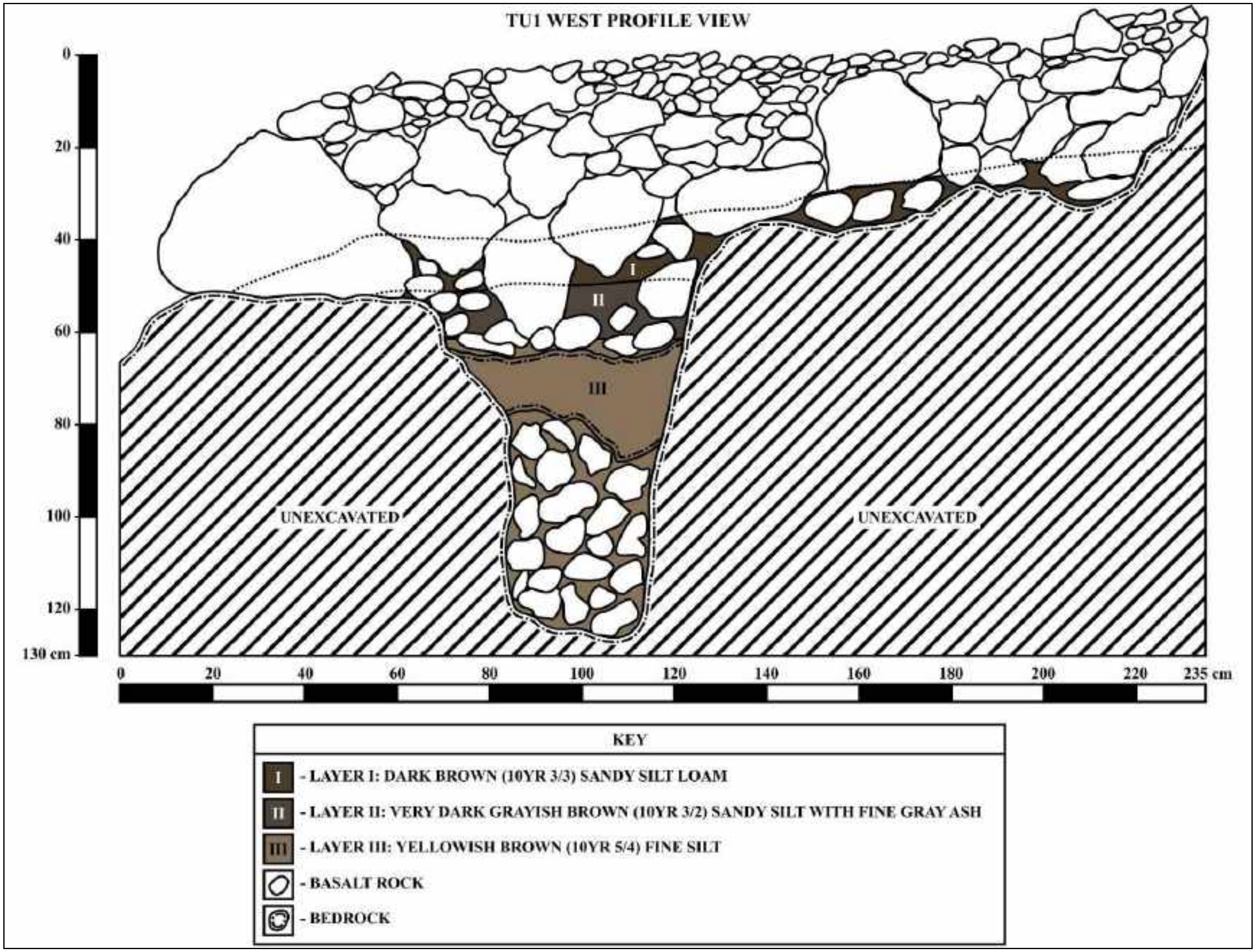

Figure 18: Site 10011 Test Unit 1 West Profile.

Figure 19: Photograph of Site 10011 Test Unit 1 West Profile Looking West.

Figure 20: Photograph of Site 10011 Test Unit 1 Overview Looking Northeast.

Site 10011 was interpreted by CSH as a pre-Contact era agricultural rock clearing mound (ACM) based on the limited amount of cultural material recovered from excavation. TU-1 artifacts recovered during the current AIS study were similar in type and numbers. However, the size and construction of the platform suggest a temporary habitation component. It is possible that the feature was originally constructed by clearing rocks from surrounding agricultural fields and piling them on an exposed bedrock outcrop. However, the completed platform is well constructed with a stacked rock perimeter and level cobble paved surface. The platform is similar to other temporary habitation platforms identified in North Kona.

The small number of artifacts recovered from test excavations suggests the platform had limited use, likely as a location for resting and while conducting seasonal gardening. It is also likely that the platform is a late pre-Contact era, or even early post-Contact era feature that was abandoned soon after completion and use.

The area surrounding Site 10011 has been impacted by grazing cattle and heavy equipment. The platform has been altered by pasture clearing, is partially collapsed and is in fair condition. No further work is recommended at Site 10011.

SIHP 10012	**Former Burial Platform**
FUNCTION:	Burial (Reinterred Elsewhere)
AGE:	Pre Contact era
DIMENSIONS:	26 ft. in long by 12 ft. wide, with a maximum height of 4 ft.
CONDITION:	No longer present
INTEGRITY:	Altered, does not retain integrity
SURFACE ARTIFACTS:	None
EXCAVATION:	Entire feature excavated

DESCRIPTION: SIHP 10012 was an oval shaped platform located at 410 ft amsl approximately 50.0 m north of Site 10011 (see Figure 12). The following description is from Hammatt et al. (1992). The platform was 26 feet long by 12 feet wide with a maximum height of 4 feet (Figure 21). There was no clearly defined level upper surface, paved terrace or rock alignments. The surrounding area was been bulldozed adjacent to the site on all sides except the south side. The site appeared to have been disturbed by this grading and there were rocks bulldozed onto the feature from the north side.

CSH EXCAVATION RESULTS: The upper 2 to 3 feet of rock fill was removed from the mound and a rectangular alignment measuring 12 by 15 feet was exposed. At the base of the rock fill and partially burying the stone alignment was stratum I light brown silt loam containing organic debris containing volcanic glass, bone and coral artifacts, and adze flakes. On the *makai* or west side of the site were two stone cupboards with a corbelled construction. These cupboards measured 2 feet in diameter and the interior spaces were one foot high. They appeared to be contemporaneous with the construction of the rectangular alignment.

After exposing the rectangular alignment and the cupboard, the interior of the rectangular alignment was excavated. Directly underlying Stratum I in the alignment interior and under the cupboards was a second stratum, designated Stratum II. This was a light grey unconsolidated silt loam which contained wood ash and cultural material including stone, shell and bone artifacts and midden. As this stratum was excavated, a 3 foot wide by 5 foot long stone crypt was exposed. The crypt consisted of a rectangular arrangement of squared boulders.

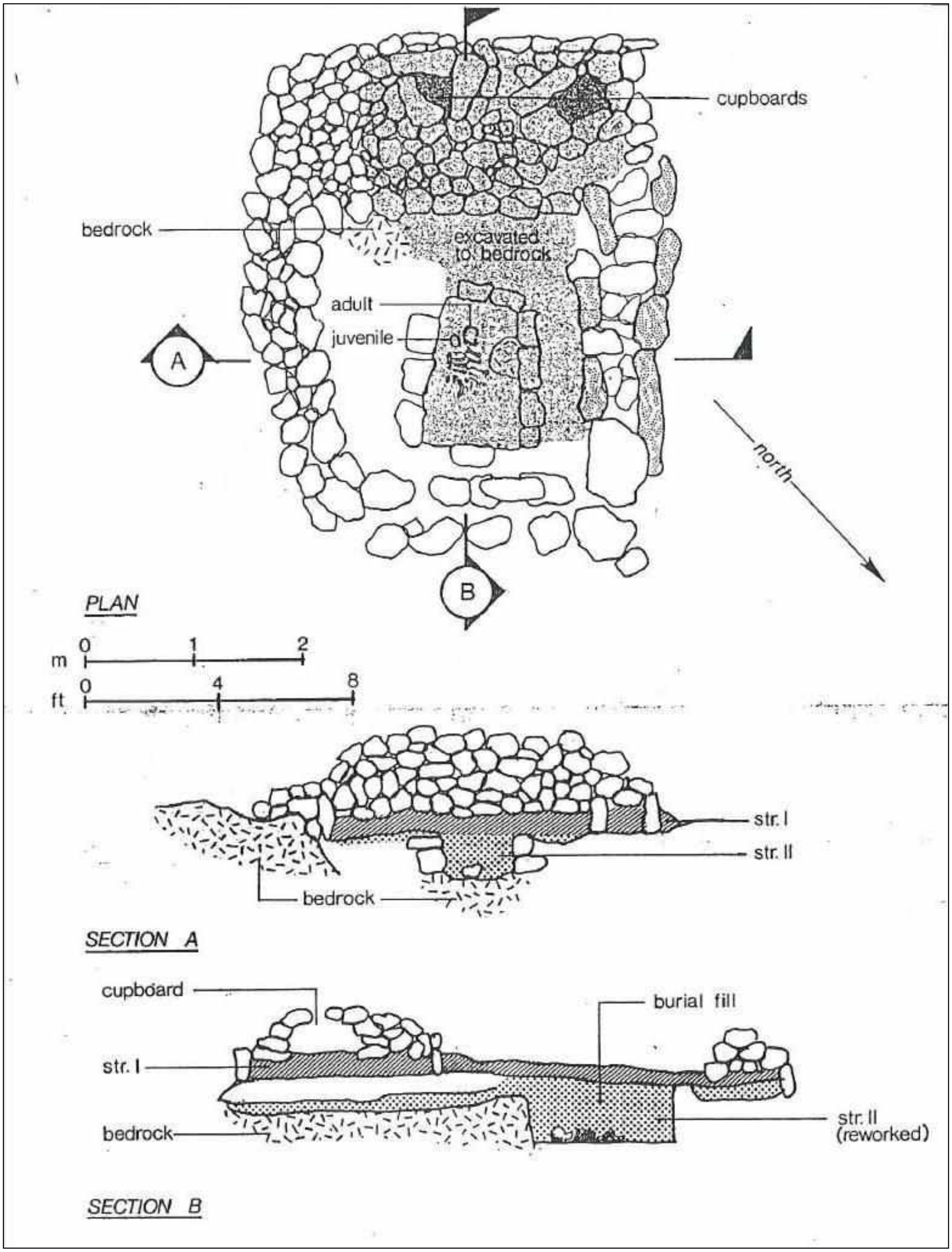

Figure 21: Site 10012 (CSH Site 10) Plan View Map and Excavation Profiles (Hammatt et al. 1992:65).

The crypt fill was removed (Stratum II) and the skeletal remains of two individuals was uncovered at a depth of 2 feet below the top of the crypt and resting directly on bedrock. Two skulls were lying 1 inch apart at the northeast end of the crypt and in both cases were articulated to the vertebrae. The skull on the north side was of an adult female. [Hammatt et al. 1992:64]

The unfused cranial sutures particularly the coronal suture also show a mature but young age. The skull was articulated to the vertebrae and the scapulae, the clavicles and the pelvis were all in articulated position. An examination of the sacrum and hip bone show characteristics of a female. All long bones were absent including tibia, fibulae ulna, radius and humerus. However, the articulated hands and feet had been placed on the pelvis with fingers and toes pointing upwards.

The skeleton of the child immediately to the south was completely articulated and semi flexed. All skeletal parts were present but were in a partially decomposed state. It is clear from the stratigraphic context that both skeletons were buried at the same time. It was not possible to determine the sex of the child. The first molar had partially emerged indicating a child between the age of 4 and 6. There were no anomalies observed in the skeletal parts.

A summary of the stratigraphic events which occurred at the site are as follows:

1. An enclosure was constructed with roughly stacked boulders on 3 sides and a double alignment of vertical slabs on the other.

2. The enclosure was occupied and used for every day work activities and food consumption. This resulted in the deposition of Stratum 11 which includes stone adze fragments and shell and bone artifacts.

3. A stone lined crypt was constructed at the base of the Site and intrusive into the occupation deposits of Stratum ll.

4. Two human skeletons were interred in the crypt, one child (6i~6 years) and one adult female (18-25 years). Before the adult female was interred and while she was still with musculature her long bones were removed and her separated hands and feet were placed on her pelvis.

5. Following the internment of the burial, the crypt was filled and covered with reworked deposits of Stratum ll. The two cupboards were constructed on the *makai* side of the crypt possibly for the purpose of marking the burial site.

6. Stones were piled on the crypt and on the cupboards to create a level living surface and the site was once again occupied resulting in the deposition of Stratum I which filtered through the rock fill.

7. During modern bulldozing of the area around the site rocks were piled on the top and sides giving what was a level platform a mound like appearance.

A radiocarbon sample collected 30-40 cmbs and associated with the burial returned a date of A.D. 1830±50 (Hammatt et al. 1992:107).

The burial platform at Site 10012 was completely excavated and the remains were reinterred off-project (see Appendix A Reinterment Documentation). The excavated site was backfilled and leveled with a bulldozer. The site location was relocated by SCS during the current AIS study. The present ground surface is level bulldozed rock (Figure 22). Site 10012 is no longer present and no further work is recommended.

Figure 22: Photograph of Ground Surface at Former Site 10012, Looking Northwest.

SIHP 10013	**Enclosure & Platforms**
FUNCTION:	Habitation
AGE:	Pre Contact era
DIMENSIONS:	18.3 m long (NW/SE) by 18.3 m wide, 0.9 m max. height
CONDITION:	Poor
INTEGRITY:	Altered: retains integrity of location, setting, materials, and some workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	CSH excavated seven test-units totaling 4.5 square meters

DESCRIPTION: SIHP 10013 is a roughly square pre-Contact era enclosure and a small modified lava tube located approximately 200 meters northeast of Site 10011 (see Figure 12). As indicated in the CSH AIS report and confirmed by SCS during the current AIS study, the enclosure is nearly square (60 feet long NW/SE by 60 feet wide, exterior dimensions) and is constructed roughly level ground (Figure 23).

The enclosure walls range from five (5) feet wide on the *mauka* side to nearly ten (l0) feet wide on the *makai* side where the outside facing is three (3) feet high relative to the exterior ground surface on the *makai* side of the structure. The enclosure walls were probably higher originally but at present they appear to have been knocked down by previous bulldozing operations. The walls are primarily 30 to 50 cm in height above the modern ground surface (Figure 24 and Figure 25).

The walls are constructed of angular and subangular basalt large cobbles and small boulders stacked and piled two to three courses high on the ground surface. They are roughly faced in places. The northwest corner of the enclosure has been bulldozed.

The enclosure interior (measuring 35 feet *mauka-makai* by 45 feet north-south) was predominantly dirt with a rock platform about 20 feet square situated near the center of the interior. Immediately *mauka* (5 feet) of the northeast corner of the enclosure was a low, boulder platform about 15 feet by 20 feet (see Figure 23). The platform appears to have been run over by a bulldozer and is no longer present. There is a one (1) foot square and one (1) feet deep opening in the east corner of the site (see Figure 23 and Trench 7 excavation description below). [Hammatt et al. 1992:68].

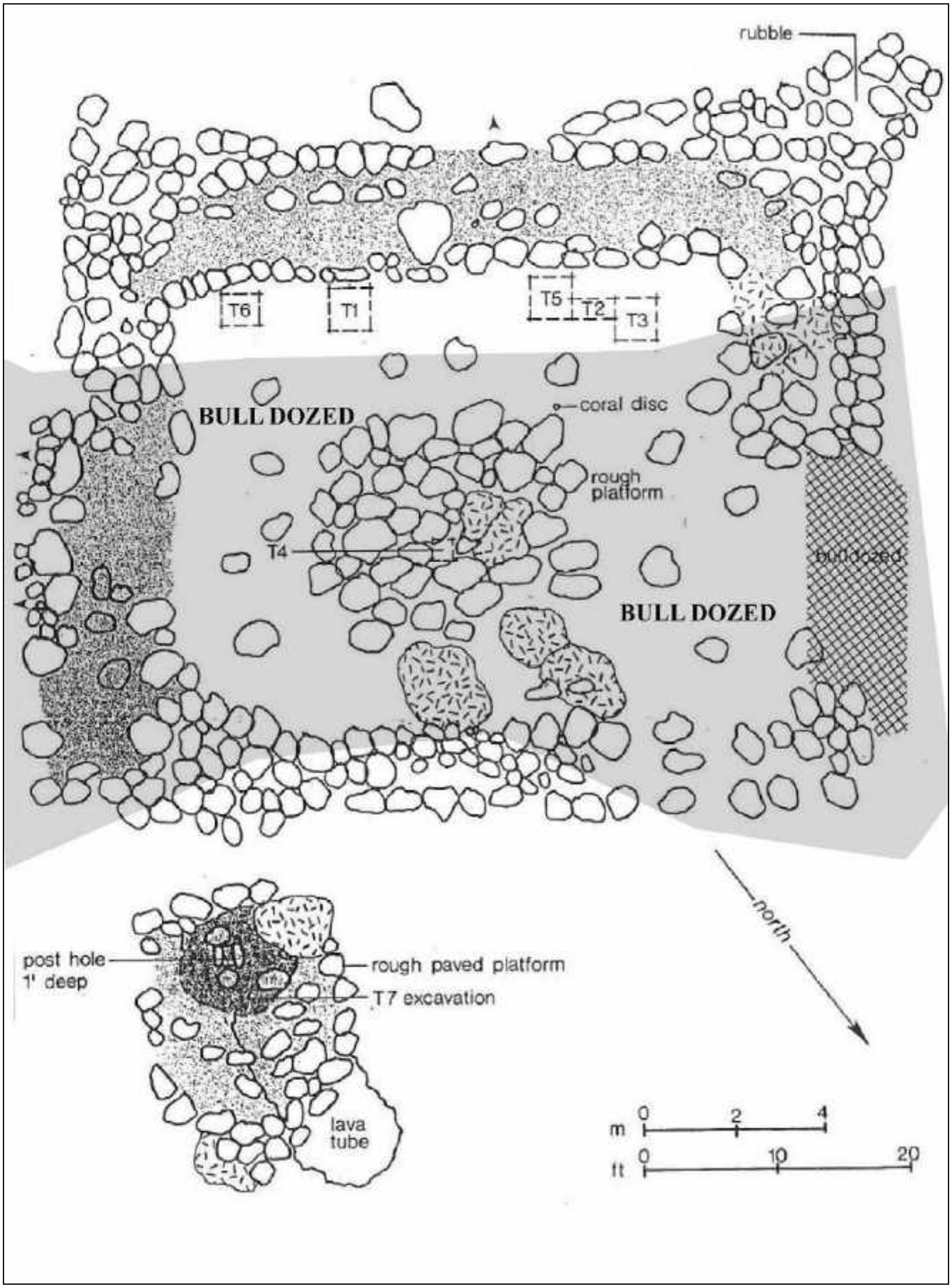

Figure 23: Site 10013 Plan View Map Showing Test Units (Hammatt et al. 1992:69).

Figure 24: Photograph of Site 10013 Enclosure South Corner and West Wall, Looking Northwest.

Figure 25: Photograph of Site 10013 Enclosure South Corner and West Wall, Looking North.

Figure 26: Photograph of Site 10013 Northeast Platform (Left Top Corner) and Tube Opening (Foreground), Looking Northeast.

CSH EXCAVATION RESULTS: Close inspection of the dirt surface in the interior of Site 10013 showed that the *makai* area contained a dark grey to black dirt while in the *mauka* portion the dirt layer was a reddish brown and generally shallow with exposed bedrock. The *makai* portion of the site was chosen for the first excavation on the basis of sediment color (grey to black sediments in sites usually being a good indicator of human activity and potential depth. A total of 4.5 square meters (Trenches l, 2, 3, 5 and 6) were excavated adjacent to the *makai* wall. Trenches l and 6 established the presence of a single cultural layer up to 30 cm. thick overlain by 10 cm. to 20 cm. of modern Al horizon. These two (2) trenches produced six (6) basaltic glass flakes, a polished adze flake and two (2) coral file fragments.

Trenches 2, 3 and 5 adjoin one another and are situated in the northwest corner of the site interior. They defined the limits of a large rock lined hearth area with multiple ash lens contained in it. A substantial amount of midden material was present in the hearth (Refer to Table 8). A total of 33 items listed as artifacts included a one piece bone fish hook fragment, a piece of worked mammal bone, coral file, saw and abrader fragments, *wana* file fragments, polished adze flakes and basaltic glass flakes. Trench 4 was excavated into the platform in the center of the structure. Bedrock was present at a depth of only 20 cm. below the platform surface, that being at the level of the dirt surface of the site in the other trenches. Some midden was present in the gaps in the bedrock and one polished adze flake and one basaltic glass flake were also recovered from trench 4. [Hammatt et al. 1992:68]

A final excavation (Trench 7) was excavated in the platform just *mauka* of the enclosure. This involved removal of rocks to a depth of two (2) meters where a capped off entrance to a lava tube was found. The lava tube five (5) feet wide was accessible for fifteen (15) feet in a mauka direction. It was fully explored and was found to exhibit no signs of human use. A slight flow of cool air through the tube and the absence of cultural material within the tube suggest that its primary function may have been a source of ventilation for the platform built over it. On the basis of size, thickness of the cultural layer, complexity of the structural remains and the variety of cultural items present Site 10013 is a good example of a semi-permanent or permanent occupation site. The two (2) platforms (one inside and one outside of the enclosure) suggest the former presence of pole and thatch structures. The excavations clearly show the primary work area in the site was along the *makai* edge of the enclosure. [Hammatt et al. 1992:71]

Site 10013 has been impacted by heavy equipment prior to and following the CSH AIS study and is in poor condition. The majority of the walls of the enclosure have been impacted by bulldozing although portions of the base of the enclosure walls are visible on the ground surface. No further work is recommended at Site 10013.

SIHP 10015	**Bulldozer Road Segment**
FUNCTION:	Transportation
AGE:	Modern
DIMENSIONS:	12.0 m long (N/S) by 2.4 m wide
CONDITION:	Fair
INTEGRITY:	None, not an archaeological site
SURFACE ARTIFACTS:	None
EXCAVATION:	No

DESCRIPTION: SIHP 10015 is a bulldozer road edge located 560 ft amsl in the center of Parcel 017 (see Figure 12). The site was recorded by CSH as a terrace. SCS relocated the feature and after clearing determined that it is the edge of a bulldozer road cut along a fairly steep slope. The earthen *maka*i edge of the bulldozer road is similar in appearance to an earthen terrace. The feature is not an archaeological site and no further work is recommended.

SIHP 10018	**Enclosure Remnant**
FUNCTION:	Agriculture
AGE:	Historic Era
DIMENSIONS:	5.0 m long (N/S) by 1.0 m wide by 1.0 m height
CONDITION:	Poor
INTEGRITY:	Altered: retains integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	No

DESCRIPTION: SIHP 10018 is a the remains of an enclosure located at 580 ft amsl 120 m northeast of Site 10015 (see Figure 12). The site was recorded by CSH as a rectangular enclosure with core-filled walls 0.6 m (2 to 3 feet) high and 3.0 m by 6.0 m (10 by 20 feet) across the interior dimensions. The walls were 1.8 to 2.4 m. (6 to 8 feet) thick and with much collapsed rubble. Based on the enclosure size and construction, and the presence of numerous coffee trees surrounding the enclosure, CSH interpreted the site to be associated with coffee agriculture.

SCS relocated a remnant of the west wall of the enclosure where it is constructed to abut onto the west side of the Site 31182 Feature 3 wall (Figure 27 and Figure 28). The wall segment is roughly 6.0 m long (N/S) by 1.3 m wide and is 1.4 m in maximum height. The wall is constructed of angular and subangular cobbles and small boulders stacked on the ground surface. The wall is roughly bi-faced and is not core-filled. The north end of the wall has been bulldozed and the north and east enclosure walls have been bulldozed and are no longer present.

Site 10018 was likely an Historic era enclosure likely associated with agriculture or ranching. All but a small portion of the enclosure west wall at Site 10018 has been bulldozed. The remaining wall has been altered by ranching and bulldozing and is badly collapsed. The site is in poor condition, contains very little integrity and no further work is recommended.

SIHP 10019	**Rock Clearing Mounds**
FUNCTION:	Agriculture
AGE:	Historic Era
DIMENSIONS:	5.0 m long (N/S) by 1.0 m wide by 1.0 m height
CONDITION:	Poor
INTEGRITY:	Altered: retains integrity of location and setting
SURFACE ARTIFACTS:	None
EXCAVATION:	No

DESCRIPTION: SIHP 10019 is a complex of six rectangular and oval rock mounds (Features A through F) located between 490 and 500 ft amsl 120 m northeast of Site 10013 (see Figure 12). The rock mounds are located around a seasonal gulch and the site is roughly 20.0 m in diameter. The rock mounds are 2.0 to 3.0 meters in diameter and range in height from 0.6 to 0.9 m. The rock mounds are constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface. Several of the rock mounds were constructed by constructing an outside perimeter of slightly larger rocks and then infilling them with slightly smaller rocks. This type of rock clearing mound construction was commonly used in Historic to modern era coffee and sugarcane fields across Hawai‘i Island.

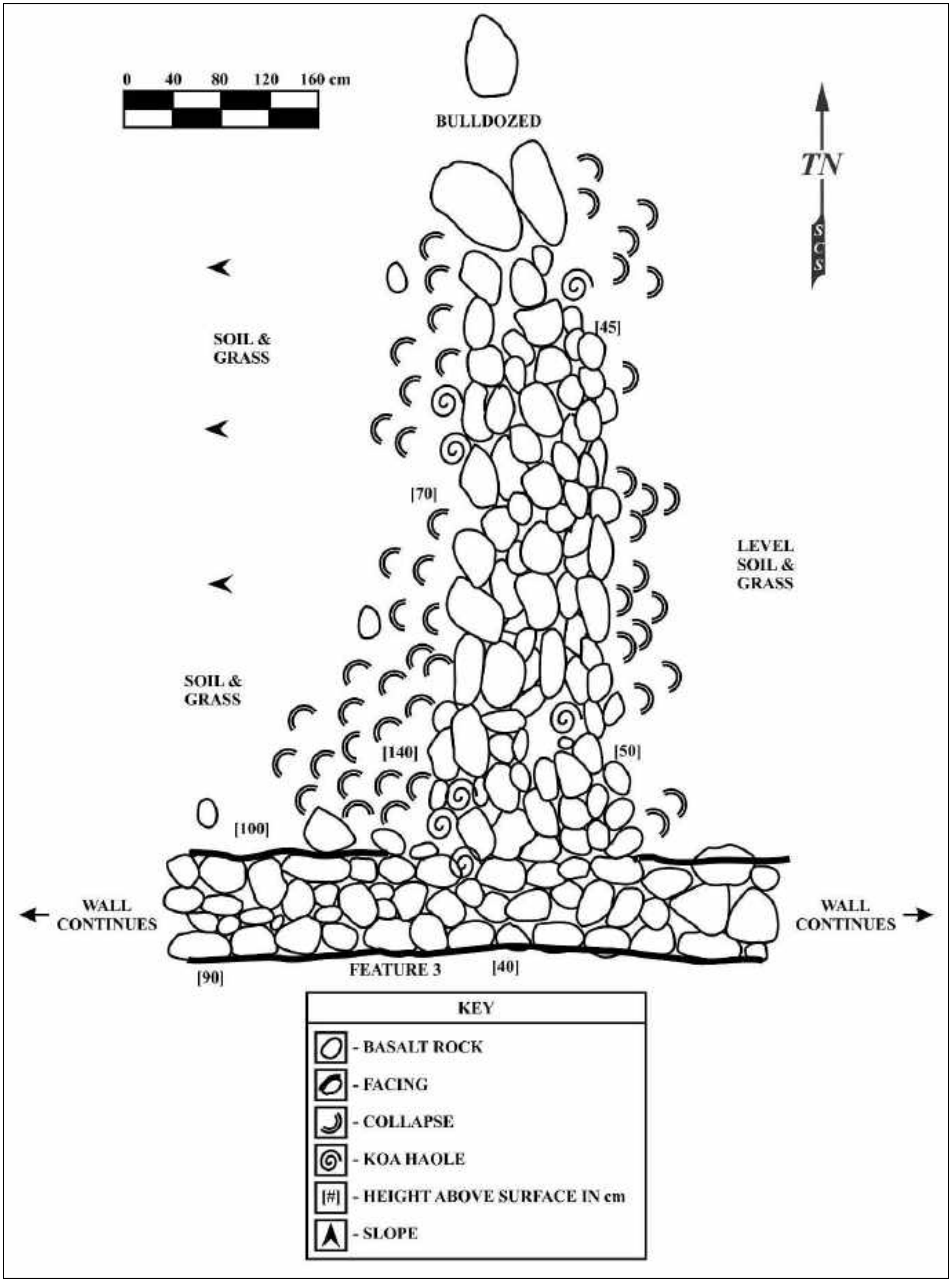

Figure 27: Site 10018 Remnant Enclosure Wall Plan View Map.

Figure 28: Photograph of Site 10018 Enclosure Wall and Site 31181 Feature 3 Ranch Wall Corner Looking Southeast.

CSH EXCAVATION RESULTS: Three of the mounds were cross sectioned by CSH with one meter wide trenches oriented *mauka-makai*. All of the trenches were excavated to bedrock with no midden material or artifacts occurring. However, in the excavation of feature B a rusted metal file was discovered under a large slab at the base of the mound. This find leaves little doubt that this feature is historic in age and this conclusion is applied to all other features in this complex.

Site 10019 was relocated during the current study. The rock mounds are no longer intact and all that remains are scattered concentrations of rocks where the mounds were once located. The rock mounds were either altered by flooding or were knocked over by bulldozing.

The location of the rock mounds adjacent to the stream channel indicates that they are stone agricultural clearing mounds likely constructed by coffee planters (Hammatt et al. 1992:27). Site 10019 has been altered by flooding and bulldozing and is in poor condition. The type, function and age of the rock clearing mounds was determined through feature construction and text excavations, and no further work is recommended for Site 10019.

SIHP 10020	**Bedrock Outcrop**
FUNCTION:	Natural geological feature, not an archaeological site
AGE:	N/A
DIMENSIONS:	2.4 m long by 3.0 m wide
CONDITION:	N/A
INTEGRITY:	N/A
SURFACE ARTIFACTS:	None
EXCAVATION:	No

DESCRIPTION: SIHP 10020 is located at 450 ft amsl approximately 70 m north of Site 10013 (see Figure 12). The site is described in the CSH AIS table as a platform. The area where Site 10020 was plotted on the project map is an area of bulldozed pasture with natural bedrock outcrops and loose rocks. A roughly rectangular pile of natural bedrock boulders was identified at the location of Site 10020. The boulders are naturally occurring bedrock small boulders and cobbles. There is a portion along the west side of the pile that appears to contain bulldozer push from a nearby wall breach. The top of the rock pile is uneven but somewhat level. There is no stacking or facing apparent on the rock pile.

The rock pile is natural, but its roughly rectangular shape and somewhat level top surface make it appear to be a possible archaeological feature. It is likely that CSH added the feature to their pedestrian survey summary table for these reasons. CSH did not include a site description or map of the feature in the AIS report, likely because it was determined to be natural. No further work is recommended at Site 10020.

SIHP 10031	**Enclosure Remnant**
FUNCTION:	Agriculture
AGE:	Historic Era
DIMENSIONS:	12.2 m long (NE/SW) by 2.0 m wide by 0.8 m max. height
CONDITION:	Poor
INTEGRITY:	Altered: retains integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	No

DESCRIPTION: SIHP 10031 is a the remains of an enclosure located between 380 ft and 390 ft amsl near the southeast boundary of the project area (see Figure 12). The site was recorded by CSH as a remnant enclosure wall 12.2 m long (NE/SW). The wall is L-shaped and is likely the northwest side and north corner of an enclosure. Based on the enclosure size and construction, and its location, CSH interpreted the site to be associated with keeping cattle out of an agricultural field (Hammatt and Shideler 2007:10).

SCS relocated the wall and confirmed that the CSH documentation is correct. The L-shape wall segment is roughly 12.2 m long (NE/SW) by 0.6 to 1.0 m wide and is 0.8 m in maximum height. The wall is constructed of angular and subangular cobbles and small boulders piled and stacked on the ground surface (Figure 29). It is cobble and small boulder core filled and roughly bi-faced. The wall has been bulldozed on both ends and the other three sides of the enclosure have all been removed by bulldozing.

All but a small portion of the northwest enclosure wall at Site 10031 has been bulldozed. The site is in poor condition, contains very little integrity and no further work is recommended.

Figure 29: Photograph of Site 10031 Remnant Enclosure Wall, Looking Southeast.

SIHP 10034 **Bedrock Outcrop**

FUNCTION: Natural geological feature, not an archaeological site

AGE: N/A

DIMENSIONS: 2.5 m long by 1.8 m wide

CONDITION: N/A

INTEGRITY: N/A

SURFACE ARTIFACTS: None

EXCAVATION: No

DESCRIPTION: SIHP 10034 is located at 475 ft amsl approximately 55 m northeast of Site 10020 (see Figure 12). The site is described in the CSH AIS table as a platform. The feature was relocated along the north edge of a seasonal gulch during the current AIS fieldwork. The feature is a natural bedrock outcrop roughly 2.5 m long (E/W) by 1.8 m wide by 0.35 m high.

The outcrop is a pile of exfoliated bedrock and is natural, but its shape and somewhat level top surface make it appear to be a possible archaeological feature. It is likely that CSH added the feature to their pedestrian survey summary table for these reasons. CSH did not include a site description or map of the feature in the AIS report, likely because it was determined to be natural. No further work is recommended at Site 10034.

SIHP 10067 **Terraces**

FUNCTION: Habitation

AGE: Pre Contact era

DIMENSIONS: 6.7 m long (E/W) by 5.8 m wide by 0.9 m max. height

CONDITION: Good

INTEGRITY: Altered: retains integrity of location, setting, materials, and workmanship

SURFACE ARTIFACTS: Basalt Flakes

EXCAVATION: CSH 1 X 1 m test unit

DESCRIPTION: SIHP 10067 is three soil retaining terraces located at 440 ft amsl approximately 90 m southeast of Site 10013 (see Figure 12). The terraces are constructed on the south sloping bank of a seasonal gulch. As indicated in the CSH AIS and confirmed by SCS during the current study, the three small terraces are constructed of angular and subangular cobbles and small boulders piled and stacked on the ground surface (Figure 30 and Figure 31).

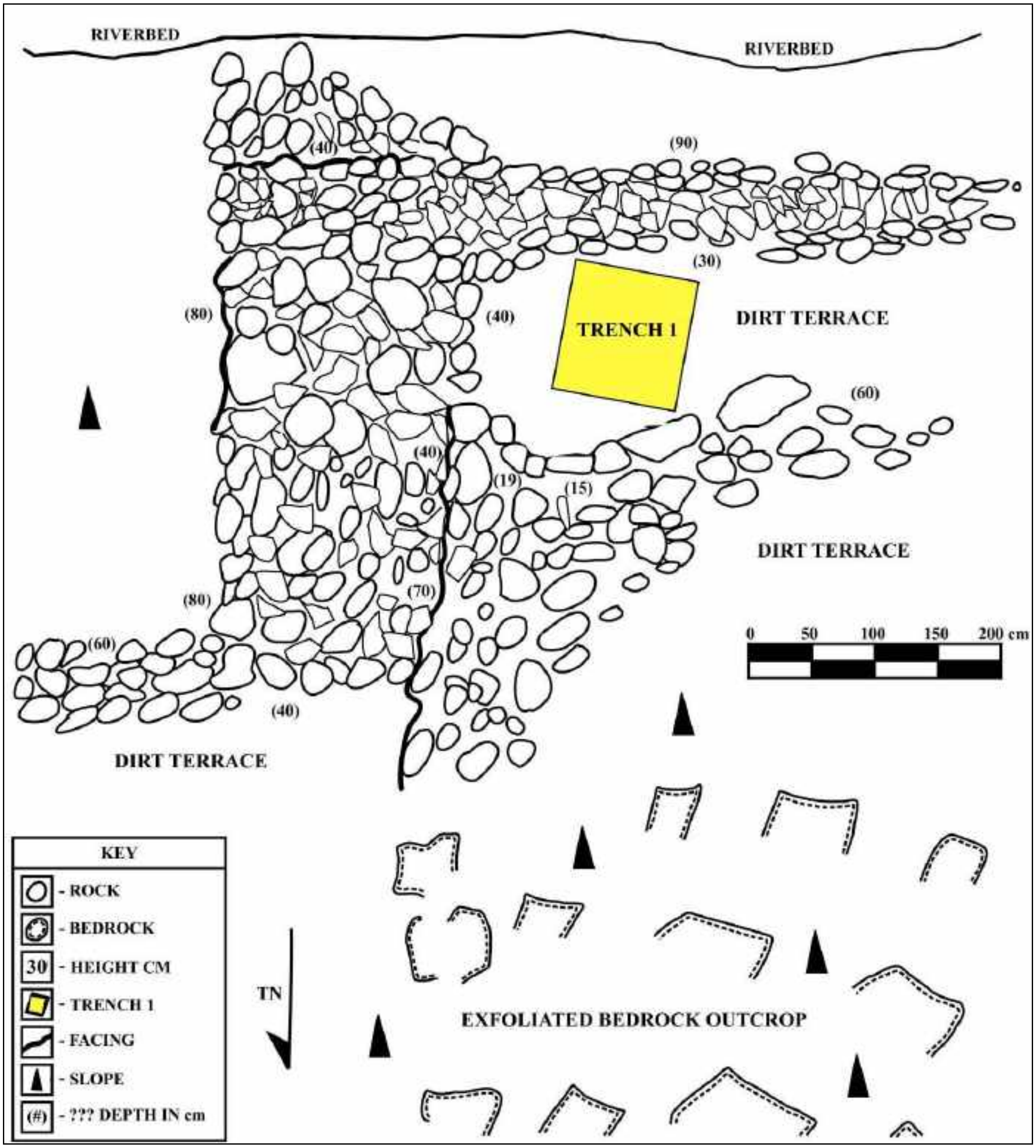

Figure 30: Site 10067 (CSH Site 232) Plan View Map (Hammatt et al. 1992:49**).**

Figure 31: Photograph of Site 10067, North View.

The terraces form three roughly level soil areas (0.9 m to 3.7 m across) along the south slope of a brick-a-brack *pu'u* (hill). Hōlualoa School stream runs along the south flank of the *pu'u*. The southernmost rock ranch wall (Feature 2) at Site 31182 at least sixty (60) feet in length, runs along the north bank of the stream and connects to the terraces. The *mauka* (upslope) corner of the wall serves as the facing for a small black dirt covered terrace where basaltic glass flakes can be observed on the dirt surface.

CSH EXCAVATION RESULTS: A one (1) meter square trench (Trench 1) was excavated in the black dirt covered terrace where basaltic glass flakes were observed. The test unit contained large quantities of basaltic glass flakes (avg. 64 flakes/10 cm. level) to bedrock at a maximum depth of 30 cm. Midden material on the other hand was sparse consisting of some shell fragments and very few pieces of fish and mammal bone. A small hearth lens (30 cm. diameter by 20-30 cm. depth) was excavated in the northwest corner of the test unit. This terrace was clearly used for volcanic glass tool production. Other terraces in the proximity were interpreted as agricultural. [Hammatt et al. 1992:48]

SIHP 10067 is a pre-Contact era site based on cultural material recovered from the excavation, and is likely associated with lithic tool production, possible limited use temporary habitation and agriculture. The site appears to be slightly altered by grazing cattle and is in good condition. No further work is recommended at Site 10067.

SIHP 10068	**Enclosure**
FUNCTION:	Habitation
AGE:	Pre-Contact era
DIMENSIONS:	4.3 m long (NE/SW) by 3.7 m wide by 0.3 m max. height
CONDITION:	Poor
INTEGRITY	Altered: retains integrity of location and setting
SURFACE ARTIFACTS:	None
EXCAVATION:	CSH, 0.5 m X 0.25 m test unit

DESCRIPTION: SIHP 10068 was a rectangular enclosure located at 470 ft amsl approximately 80 meters north of Site 10067 (see Figure 12). Site 10068 was documented in the CSH AIS study as a small rectangular enclosure 4.3 m long by 3.7 m wide with a maximum height of 0.3 m (Figure 32). The internal dimensions were 2.4 m by 1.5 m. The enclosure was constructed of angular and subangular basalt cobbles and small boulders piled and stacked on the ground surface. The walls were core filled and portions of the enclosure walls were faced.

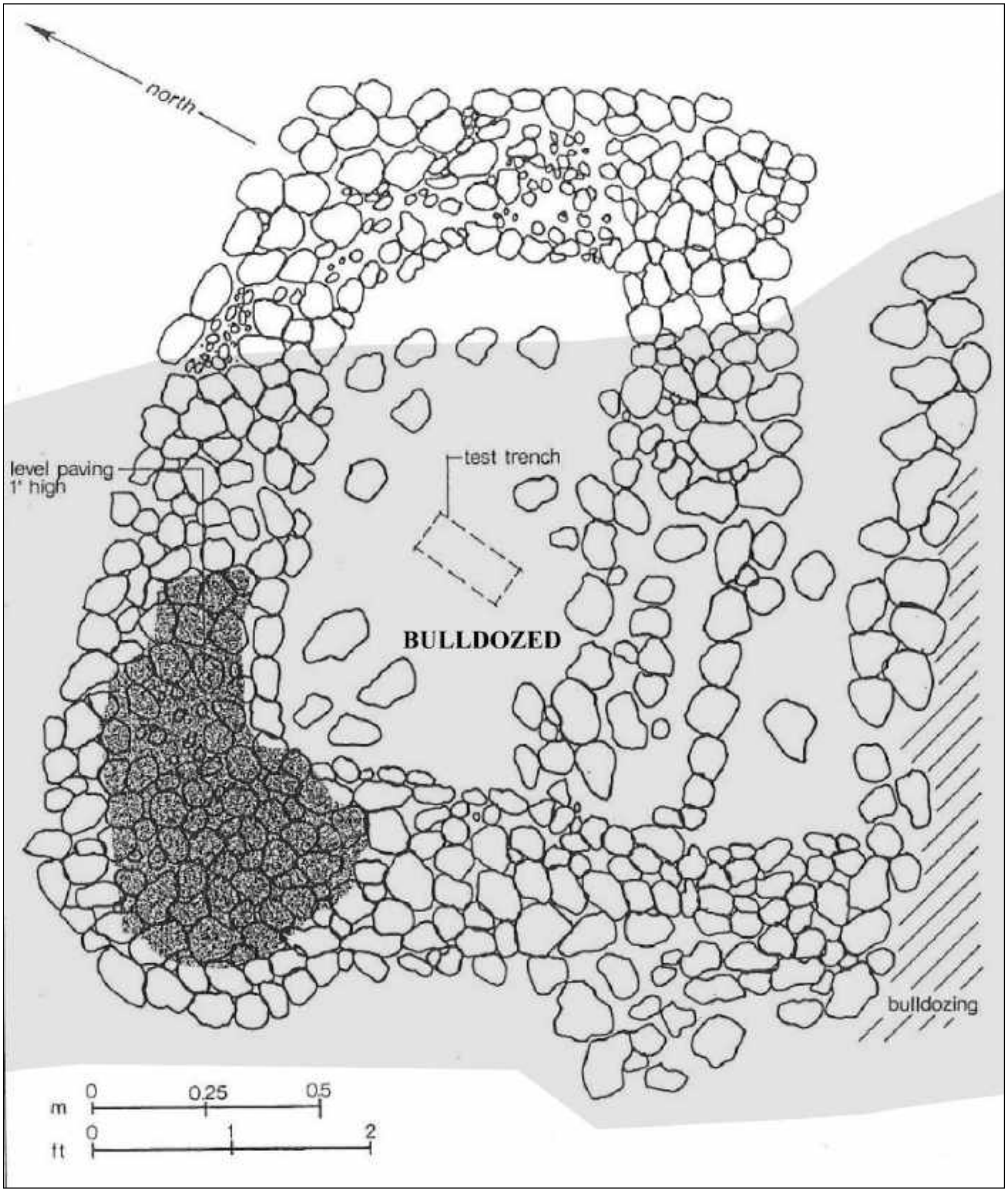

Figure 32: Site 10068 (CSH Site 233) Plan View Map Showing Test Trench (Hammatt et al. 1992:50).

The walls of the enclosure were removed by bulldozing after the CSH fieldwork and prior to the SCS resurvey fieldwork. A roughly 2.0 m long portion of collapsed enclosure wall still remained on the ground surface during the current study (Figure 33).

CSH EXCAVATION RESULTS: A one meter by 50 cm test trench was excavated in the center of the enclosure. The unit was excavated to bedrock at a depth of 35 cm. Although there was no distinct cultural deposit, a small amount of midden material was found including cowrie, *pipipi*, sea urchin and fragments of fishbone. Because of the scarcity of material and the disturbed nature of the deposits, the excavation was discontinued. However, the site probably functioned as a habitation enclosure. [Hammatt et al. 1992:48]

Site 10068 has been altered by bulldozing, is mostly no longer present and is in poor condition. No further work is recommended at Site 10068.

SIHP 10069	**Modified Bluff**
FUNCTION:	Temporary Habitation Associated with Agriculture
AGE:	Pre-Contact era
DIMENSIONS:	15.0 m long (N/S) by 6.0 m wide by 0.6 m max. height
CONDITION:	Poor
INTEGRITY:	Altered: retains integrity of location and setting
SURFACE ARTIFACTS:	None
EXCAVATION:	CSH 0.5 m x 0. 5 m test unit

DESCRIPTION: SIHP 10069 is located at 460 ft amsl approximately 30 m northeast of Site 10067 (see Figure 12). The site is described in the CSH AIS report as a rock platform constructed against the south edge of a bedrock bluff north of Hōlualoa School stream (Figure 34). The bluff top is roughly level with low linear bedrock outcrops. The site appears to have been scraped over during previous bulldozing leaving the rock platform and possible walls along the edge of the bluff collapsed, scattered and in a poor state of preservation. There is also a soil deposit approximately 3.0 m long by 2.1 m wide on the top of the bluff immediately north of the platform that was tested by excavating a 50 cm. square test unit.

Figure 33: Photograph of Site 10068 Bulldozed Remnant Enclosure Wall, Looking Northwest.

Figure 34: Photograph of Site 10069 Remains Looking Northwest.

CSH TEST RESULTS: The 50 cm by 25 cm test unit was excavated as a single stratigraphic soil layer extending to a maximum depth of 22 cm below surface. Midden recovered from the excavation consisted of few shell fragments and very small number of small animal bone fragments. Volcanic glass was relatively abundant (avg. 10 flakes/each in four 5 cm thick levels). A single basalt flake was the only other artifact recovered. The CSH report interpreted the site to be a temporary habitation feature used for tool production associated with nearby agriculture. [Hammatt et al. 1992:51]

Site 10069 was relocated y SCS during the current AIS study. The site has been badly disturbed by bulldozing. The terrace retaining walls consist of dislocated and scattered cobbles and small boulders (Figure 35). Site 10069 was significantly altered by bulldozing and is in poor condition. No further work is recommended at Site 10069.

SIHP 10070	**Enclosure Remnant**
FUNCTION:	Agriculture
AGE:	Historic era
DIMENSIONS:	2.6 m long (N/S) by 2.5 m wide by 1.2 m max. height
CONDITION:	Fair
INTEGRITY	Altered: retains integrity of location, setting and materials and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	CSH 1.0 m x 0.5 unit

DESCRIPTION: SIHP 10070 is a U- shaped enclosure located at 500 ft amsl approximately 15 meters east of Site 10019 (see Figure 12). As indicated in the CSH AIS study and confirmed by SCS during the current study, the enclosure is 2.6 long (N/S) by 2.5 m wide with maximum height of 1.2 m (Figure 36). The eastern side of the enclosure has been impacted by heavy equipment, although the remaining portions of the walls of the structure are well constructed and in good condition (Figure 37).

CSH EXCAVATION RESULTS: A 1.0 m by 0.5 m test unit (Trench 1) was excavated along the interior wall of the enclosure. The unit was excavated to bedrock at a depth of 15 cm. No cultural material was recovered from the excavation. The comparatively new condition of the stonework at the site and its proximity to other historic features (Site 10019) indicate that the enclosure is most likely of recent age and probably associated with historic agricultural activities such as coffee growing or grazing. [Hammatt et al. 1992:51]

Figure 35: Photograph of Site 10069 Remains Showing Bulldozer Disturbance, Looking Northwest.

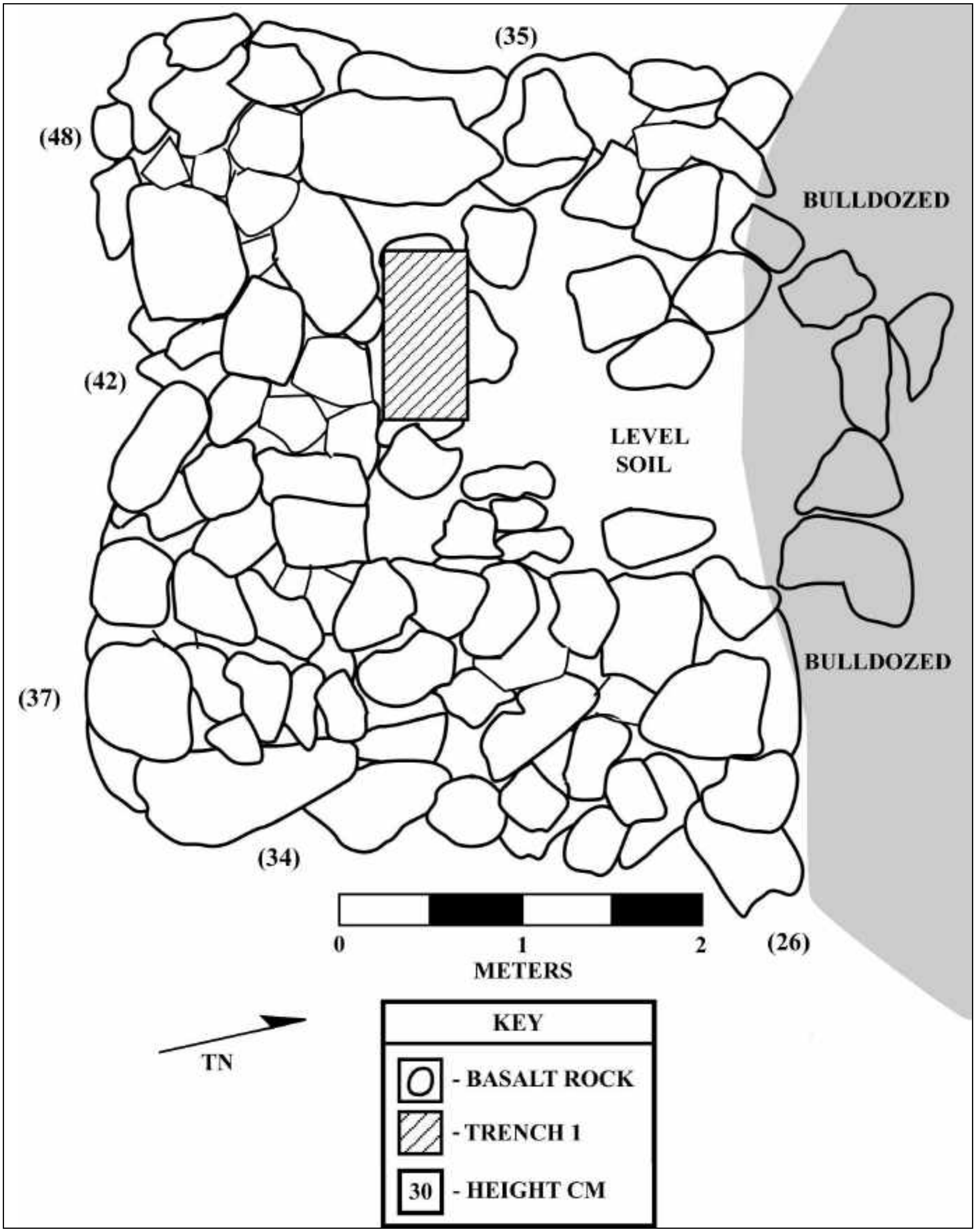

Figure 36: Site 10070 (CSH 235) Plan View Map,

Figure 37: Photograph of Site 10070 Enclosure, Looking West.

Site 10070 was relocated by SCS during the current AIS study. Based on feature type, dimensions, construction, lack of artifacts recovered during excavation, and the features association with rock mounds at Site 10019, it is likely that the Site 10070 enclosure associated with Historic era ranching and coffee agriculture. Site 10070 has been altered by bulldozing and is in fair condition. No further work is recommended at Site 10070.

SIHP 10072	**Complex**
FUNCTION:	Agricultural
AGE:	Late pre-Contact to Historic era
DIMENSIONS:	38.8 m long (N/S) by 36.3 m wide by 1.3 max. height
CONDITION:	Poor
INTEGRITY:	Altered: retains integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	CSH TU-1 and TU-2, 7.0 m square total

DESCRIPTION: SIHP 10072 was a modified bedrock outcrop bluff (Feature 1), a rock mound (Feature 2) and a series of level dirt terraces (Feature 3) located between 480 ft and 490 ft amsl along the central northwest boundary of the project area (see Figure 12 and Figure 38). The site is bounded to the northeast by Site 31182 Feature 9 ranch rock wall (Figure 38). The features were constructed on a fairly steep southerly slope. The Feature 3 terraces were bounded by linear rock mounds and Feature 1 was called a large bluff. Site 10072 was 38.8 m long (NE/SW) by 36.3 m wide with a maximum feature height of 1.3 m.

Feature 1 was a modified exfoliated large bedrock outcrop located at the center of Site 10072 (see Figure 38). The top of the outcrop was relatively level. The modified portion of Feature 3 was roughly 13.0 m long (NE/SW) by 8.7 m wide by 1.6 m in maximum height. The modified portions of Feature 3 were constructed by removing angular and subangular basalt cobbles and small boulders from relatively level areas on the slope of the feature and piling them above and below the level cleared ground surface (Figure 39 through Figure 41). Feature 1 was relocated by SCS during the current study. The CSH feature description and plan view map were correct. TU-1 was excavated by CSH on the level top surface of Feature 3 (see excavation summary below).

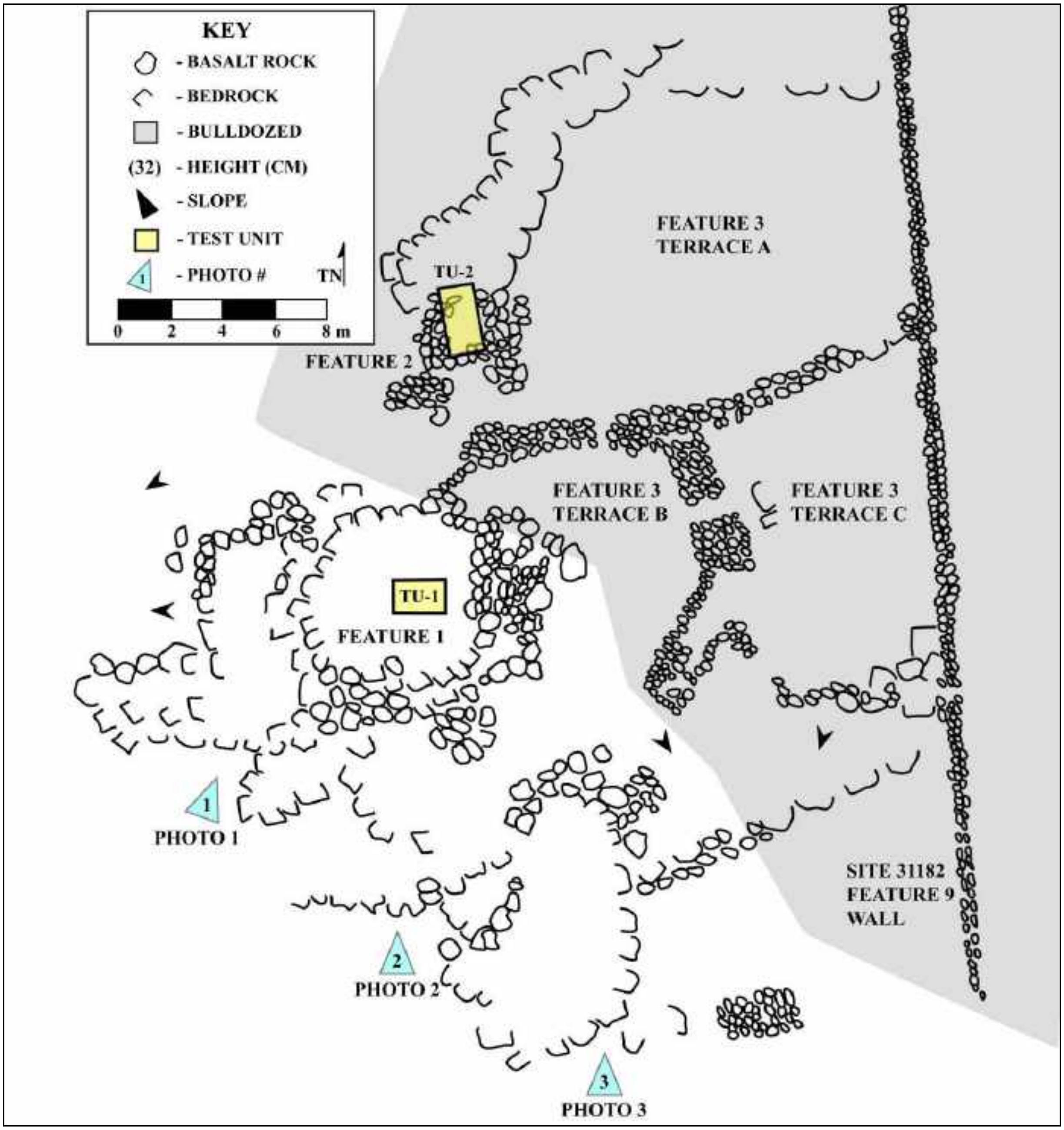

Figure 38: Site 10072 (CSH Site 238) Plan View Map (Hammatt et al. 1992:53).

Feature 2 was a rock clearing mound located 3.3 m north of Feature 1. The rock mound measured 3.7 m long (NE/SW) by 3.3 m wide. The rock mound was constructed of angular and subangular cobbles and small boulders piled and loosely stacked on exposed bedrock. There was no facing evident in the feature construction. TU-2 was excavated by CSH through the north half of the rock mound (see excavation summary below). Feature 2 was bulldozed and was no longer present during the current AIS survey.

Figure 39: Photograph 1 of Site 10072 Feature 3 South Corner of Bluff, Looking Northeast.

Figure 40: Photograph 2 of Site 10072 Feature 3 Southeast Edge Corner of Bluff, Looking North.

Figure 41: Photograph 3 of Site 10072 Feature 3 East Corner of Bluff, Looking North.

Feature 3 was three level soil-filled terraces (Terrace A, B and C) located along the east side of the site (see Figure 38). Feature was 20.0 m long (NE/SW) by 13.8 m wide. Terrace A was bounded on the north by a linear (NW/SE) bedrock outcrop and was bounded on the southeast by a linear (NE/SW) rock mound. There was a roughly oval clearing rock mound (Feature 2) on the south end of the linear bedrock outcrop.

Feature 3, Terrace B and Terrace C were two soil terraces south of Terrace A and along the east side of Site 10072 (see Figure 38). The two terraces were bounded on the west by Feature 1 and by exposed bedrock outcrop to the south. The two terraces were approximately 17.5 m long (NE/SW) by 14.7 m wide. There was a low linear rock mound that divided the two terraces. The upper (east) tier was approximately 1.0 m above the lower tier. The terraces and low liner rock mounds that formed the three terraces were constructed of angular and subangular cobbles and small boulders piled and loosely stacked on exposed bedrock. There was no facing evident in Feature 3 construction.

CSH EXCAVATION RESULTS: Test Unit 1 (1.5 meters by 2 meters) was excavated on the middle of the top of Feature 1 to a depth of 0.5 meters. The unit was excavated as a single stratigraphic layer of basalt cobbles and small boulders, and less than 1 cm of soil. The unit did not contain artifacts or cultural deposits and terminated on bedrock. Based on the structure of the bluff, limited modifications and lack of artifacts, CSH determined that Feature 1 was an exposed bedrock outcrop with small areas of agricultural rock clearing mounds. [Hammatt et al. 1992:51]

Test Unit 2 (2.0 meters by 2.0 meters) was excavated through the middle of Feature 2. The unit was excavated to the base of the feature and contained an architectural layer of angular and subangular cobbles and small boulders and 40 cm of loose sediment. A few small fragments of *cowrie* and *wana* shell were recovered from the excavation. There were no other artifacts or cultural deposits in TU-2. The Feature was most likely an agricultural rock clearing mound.

SCS relocated Site 10072 during the current AIS survey. The north and east portions of the site, including Feature 2 and Feature 3 and the Site 31182 Feature 9 ranch rock wall have been bulldozed and are no longer present. Feature 1 was the only feature remaining. Feature 1 is only slightly altered, is partially collapsed in places and is in fair condition.

Based on the types of features, their construction method and very limited amount of marine shell recovered from subsurface testing at Feature 1 and Feature 2, Site 10072 is most likely a late pre-Contact to Historic era agricultural site. The site has been altered by bulldozing, is in poor condition and no further work is recommended at Site 10072.

SIHP 10073	**Complex**
FUNCTION:	Agricultural
AGE:	Historic Era
DIMENSIONS:	15.0 m long (NW/SE) by 14.0 m wide
CONDITION:	Good
INTEGRITY:	Altered: retains some integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	TU-1 and TU-2

DESCRIPTION: SIHP 10073 is two rock clearing mounds (Feature1 and Feature 2) and an enclosure (Feature 3) located at 575 ft amsl in the northeast quadrant of the project area (see Figure 12). CSH recorded two platforms, one (Feature 1) measuring eight feet high on the downhill (*makai*) side. CSH interpreted the features as historic cattle loading ramps (Hammatt et al. 1992:23). SCS relocated Site 10073 and recorded two rock clearing mounds, Feature 1 and Feature 2, and an enclosure, Feature 3 (Figure 42). The site is approximately 15.0 m long (NW/SE) by 14.0 m wide.

Feature 1 is a platform shaped rock clearing mound constructed on a south slope along the southwest corner of the site (see Figure 42). The rock mound is 5.5 m long (NE/SW) by 5.0 m wide, with a maximum height of 1.40 m. It is constructed of angular and subangular large basalt cobbles and small boulders stacked and piled three to six courses on the ground surface (Figure 43). The top surface is partially paved with small cobbles. The walls are faced. Feature 1 appears to be unaltered and is in good condition.

Feature 2 is a linear rock mound located upslope to the northeast of Feature 1 (see Figure 42). The platform is approximately 6.5 m long (SE/NW) by 3.0 m wide, with a maximum height 0.81 m. Feature 2 is constructed of large basalt cobbles and small boulders piled and stacked two courses high on the ground surface (Figure 44). The southwest side of the platform is roughly faced. Feature 2 appears to be unaltered and is in good condition.

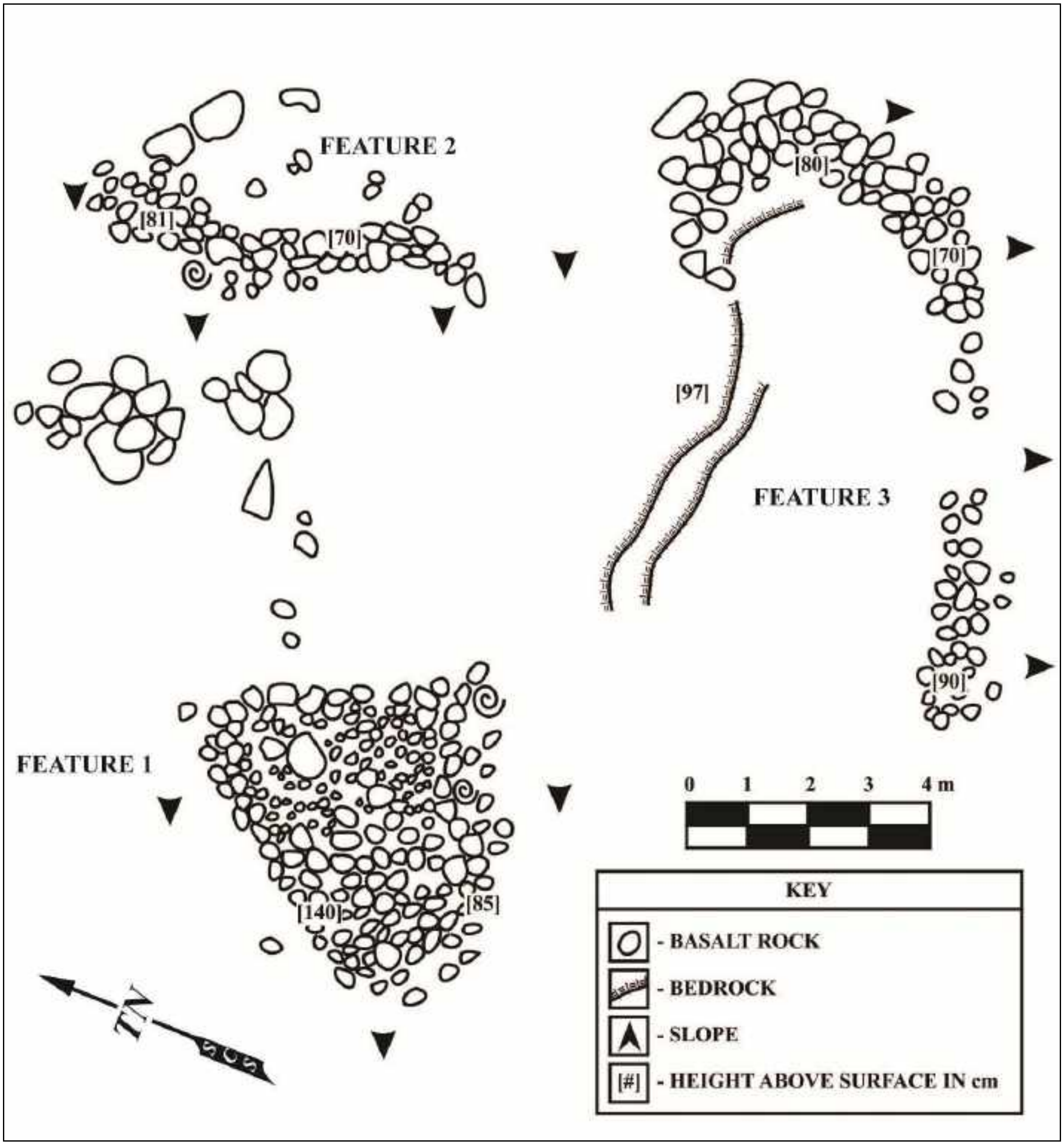

Figure 42: Site 10073 Plan View Map.

Figure 43: Photograph of Site 10073 Feature 1 Platform Looking South.

Figure 44: Photograph of Site 10073 Feature 2 Platform Looking East.

Feature 3 is an enclosure located southeast of Feature 1 and Feature 2 (see Figure 42). The enclosure is approximately 11.0 m Long (NE/SW) by 5.0 m wide, with a maximum height of 97.0 m. The enclosure walls are constructed of angular and subangular basalt cobbles and small boulders piled and stacked one to three courses (0.9 m maximum height) on the ground surface (Figure 45). The interior of the enclosure is primarily pāhoehoe bedrock outcrop with sediment built up along the interior of the enclosure walls. Feature 3 appears to be unaltered and is in good condition.

SCS EXCAVATION RESULTS: SCS excavated a test excavation unit (TU-1) in Feature 1 and a test unit (TU-2) within Feature 3. The test units were excavated to document feature construction and to determine feature function and age through diagnostic artifacts.

TU-1 was a 2.3 m long (NW/SE) by 1.2 m wide test unit (TU-1) excavated in the southeast quadrant of the Feature 1 rock clearing mound (see Figure 42). TU-1 was excavated as an architectural layer and one natural stratigraphic layer, and terminated on bedrock at 97 cm below the top surface of the feature (Figure 46 through Figure 48). The natural stratigraphic layer (Layer I) was not screened in arbitrary 10 cm levels.

The Architectural Layer (38 cm maximum thickness) consisted of angular and subangular cobbles and small boulders with a small amount of decomposing organic detritus. There were no artifacts, cultural deposits or subsurface features in the architectural layer. The top surface of the architectural layer was fairly level cobbles and small boulders. The architectural layer continued into Layer I and terminated on bedrock approximately 75 cm to 100 cm below the top surface of the feature.

Layer I (0-65 cmbs) was very dark grayish brown (10YR3/2) loose sandy silt loam 95% cobbles and small boulders. The rock excavated in Layer I was architectural rock. The architectural layer terminated on bedrock throughout the entire unit. There were no artifacts in Layer I.

Based on feature shape, dimensions, construction, and the absence of artifacts recovered from TU-1, it is likely that Feature 1 is a rock clearing mound. The shape and construction method is similar to Historic era sugarcane rock clearing mounds documented in other parts of Hawaiʻi Island.

Figure 45: Photograph of Site 10073 Feature 3 Enclosure Showing Interior Level Bedrock Outcrop, Looking Southeast.

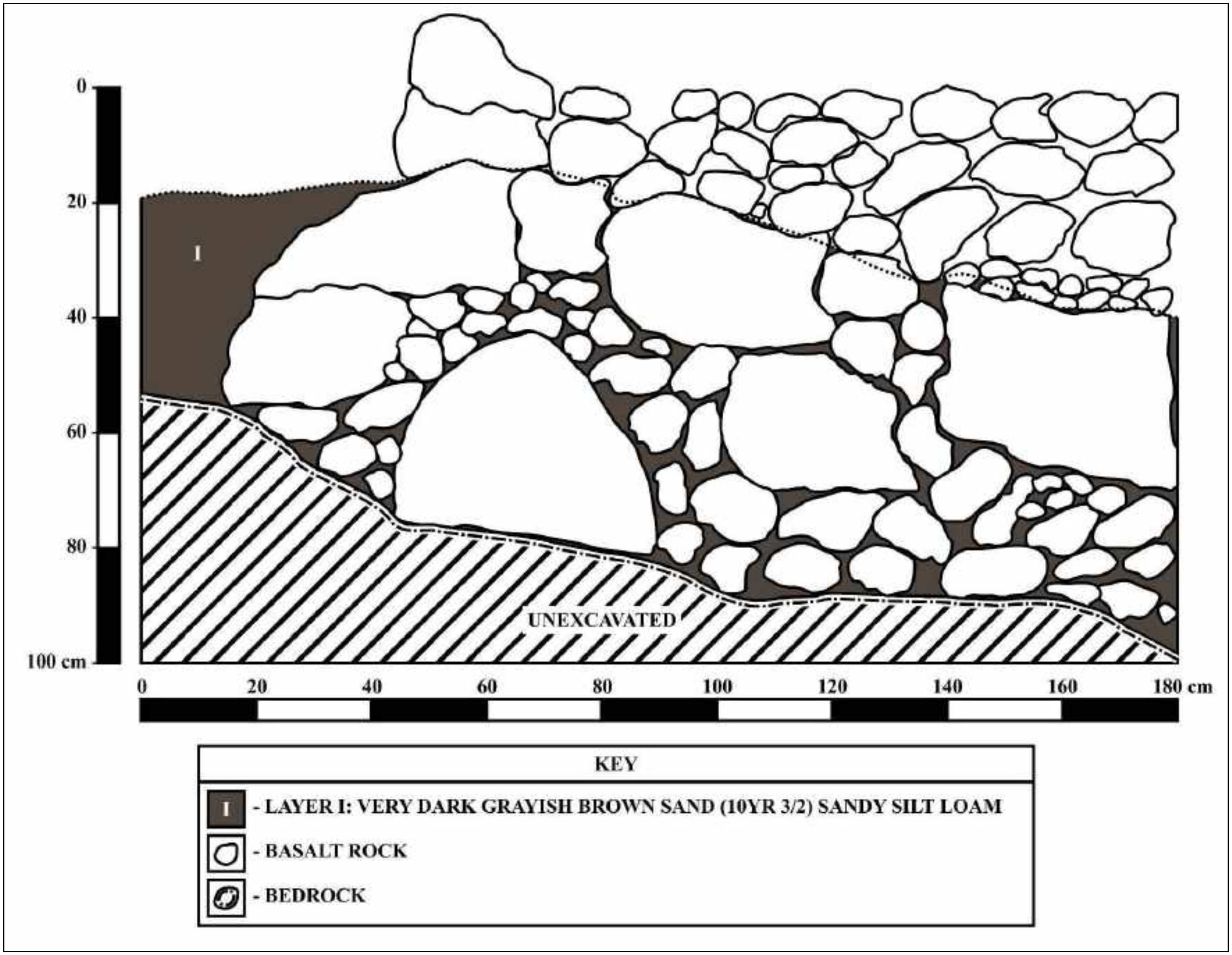

Figure 46: Site 10073, Feature 1, TU-1 Southwest Profile.

Figure 47: Photograph of Site 10073, Feature 1, TU-1 Southwest Profile.

Figure 48: Photograph of Site 10073, Feature 1, TU-1 Northeast and Northwest Profiles.

TU-2 was a 1.0 by 1.0 m test unit excavated within the southern portion of the Feature 3 enclosure (see Figure 42). TU-2 was excavated as four natural stratigraphic layers, and terminated on bedrock at 58 cmbs (Figure 49 through Figure 52). The natural stratigraphic layers were excavated in arbitrary 10 cm levels.

Layer I (0-10 cmbs) was very dark brown (7.5YR2.5/2) loose sandy loam with 1% pebbles and cobbles. Layer I terminated on Layer II sediment below. The boundary between Layer I and Layer II was fairly level and diffuse. There were no artifacts in Layer I.

Layer II (10-28 cmbs) was very dark brown (7.5YR2.5/2) soft sandy loam with 5.0 cm of black (7.5YR2.5/1) sandy silt loam mottling at its base. Layer II contained 5% gravels. Layer II was excavated as a 10.0 cm Level 1 and an 8.0 cm Level 2. Layer II, Level 2 contained a small amount of charcoal flecking and a *cowrie* shell fragment. The base of the enclosure wall architecture was 20-28 cmbs in Layer II, Level 2. Layer II terminated on Layer III sediment below. The boundary between Layer II and Layer III was fairly level and clear.

Layer III (28-40 cmbs) was black (7.5YR2.5/1) soft sandy silt loam with 15% pebbles and cobbles. Layer III did not contain artifacts.

Layer IV (40-58 cmbs) was dark yellowish brown (10YR3/4) soft sandy silt with 5% bedrock cobbles. Layer IV was excavated as two levels, was terminated on bedrock and did not contain artifacts.

The CSH AIS report interpreted Site 10073 to be a Historic era agricultural site. The dimensions, shape, and construction of Feature 1 and Feature 2 are similar to Historic era sugarcane rock clearing mounds documented in other locations on Hawaiʻi Island. The absence of artifacts in test excavation units also suggests Feature 1 and Feature 3 are associated with agricultural use. Site 10073 appears to be unaltered and is in good condition. No further work is recommended at Site 10073.

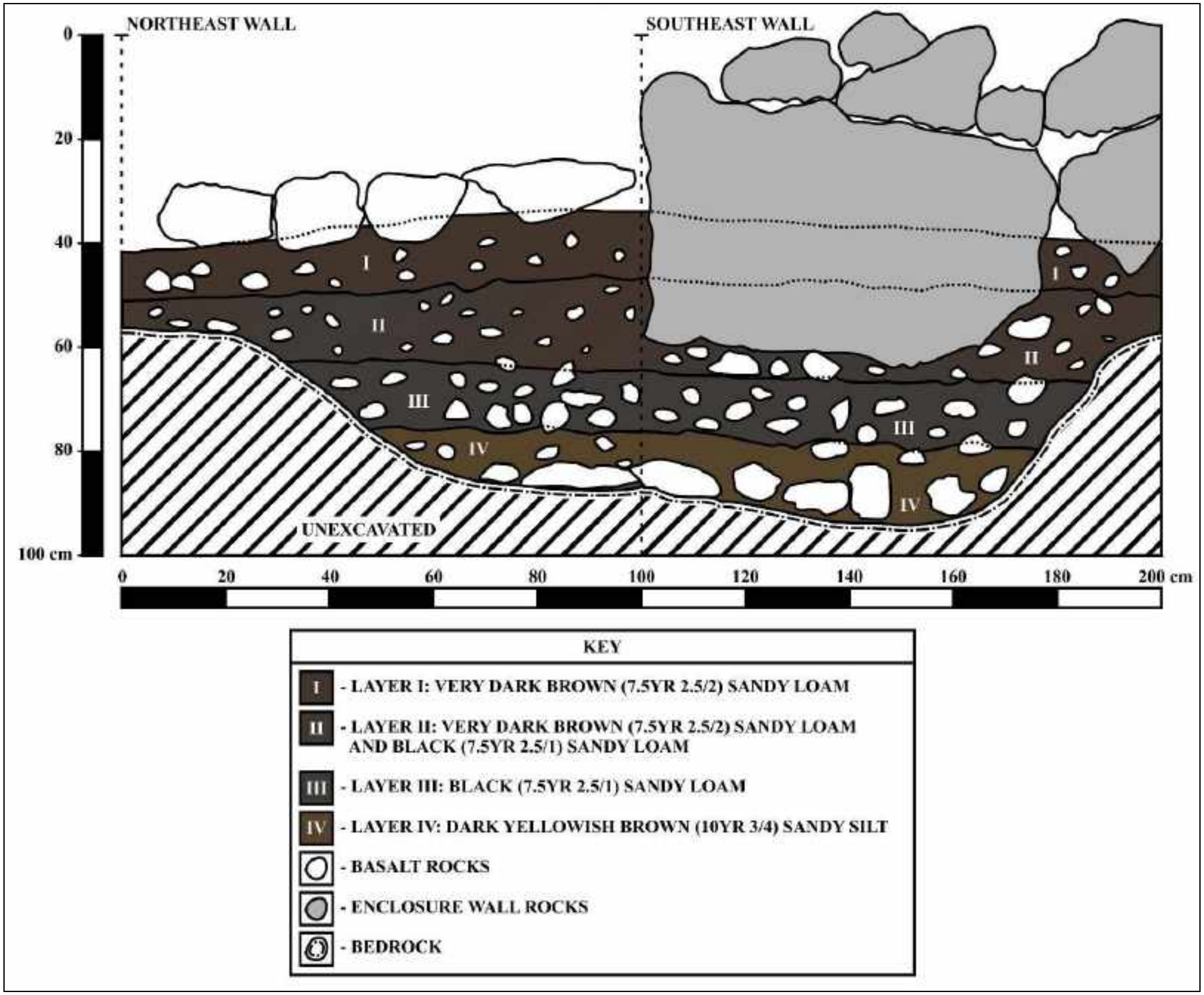

Figure 49: Site 10073, Feature 3, TU-2 Northeast and Southeast Profiles.

Figure 50: Photograph of Site 10073, Feature 3, TU-2 Southeast Profile Showing Base of Architecture.

Figure 51: Photograph of Site 10073, Feature 3, TU-2 Northeast Profile.

Figure 52: Photograph of Site 10073, Feature 3, TU-Bas of Excavation Looking Southeast.

SIHP 10074	**Enclosure Remnant**
FUNCTION:	Coffee Work Shed
AGE:	Historic Era
DIMENSIONS:	16.5 m long (NE/SW) by 15.0 m wide
CONDITION:	Poor
INTEGRITY	Altered: retains minimal integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	Coral abrader and corrugated metal roofing
EXCAVATION:	CSH TU-1 and TU-2, 1.25 m square total

DESCRIPTION: SIHP 10074 was a rectangular enclosure, a low rock wall and collapsed pig pen located at 640 ft amsl roughly 50 meters east of Site 10073 (see Figure 12). The site is on roughly level ground above a seasonal gulch to the southeast. There are several old growth ironwood trees at the site.

The CSH AIS report site plan and description showed an 8.5 m long (NE/SW) by 8.2 m wide by 1.2 m high enclosure along the northeast side of Site 10074 (Figure 53). The enclosure was constructed of angular and subangular basalt cobbles and small boulders stacked on the ground surface. The walls were bi-faced and pebble and cobble core-filled. The exteriors of the walls were neatly faced. The interior of the enclosure was level rocky soil with a remnant low rock wall 3.7 m long (NW/SE) that divided the center of the enclosure. There was a cobble paving between the west enclosure wall and the central dividing wall. The enclosure was likely used as a house foundation and the paved area might have functioned as a lanai outside of the house structure. A coral abrader was located on the surface of the cobble paving.

There is a low rock wall along the southeast and southwest sides of the house enclosure. There was also a C-shape enclosure at the northwest end of the terrace. The rock wall was 19.7 m long total by 0.6 m wide and was constructed of a one to two courses (wide) of large cobbles and small boulders piled and stacked two to three courses high on the ground surface. There was a small rock mound on the southeast end of the wall. The collapsed C-shape enclosure (pig pen) was 4.0 m long (NE/SW) by 3.5 meters wide and opened to the north. The C-shape was constructed of angular and subangular cobbles piled and stacked on the ground surface. No heights were given for the terrace or C-shape.

SCS relocated the site during the current AIS fieldwork. All but a portion of the rock wall (SE and SW segments) has been bulldozed (see Figure 53 and Figure 54). The rock wall matched the CSH AIS description and was also partially collapsed.

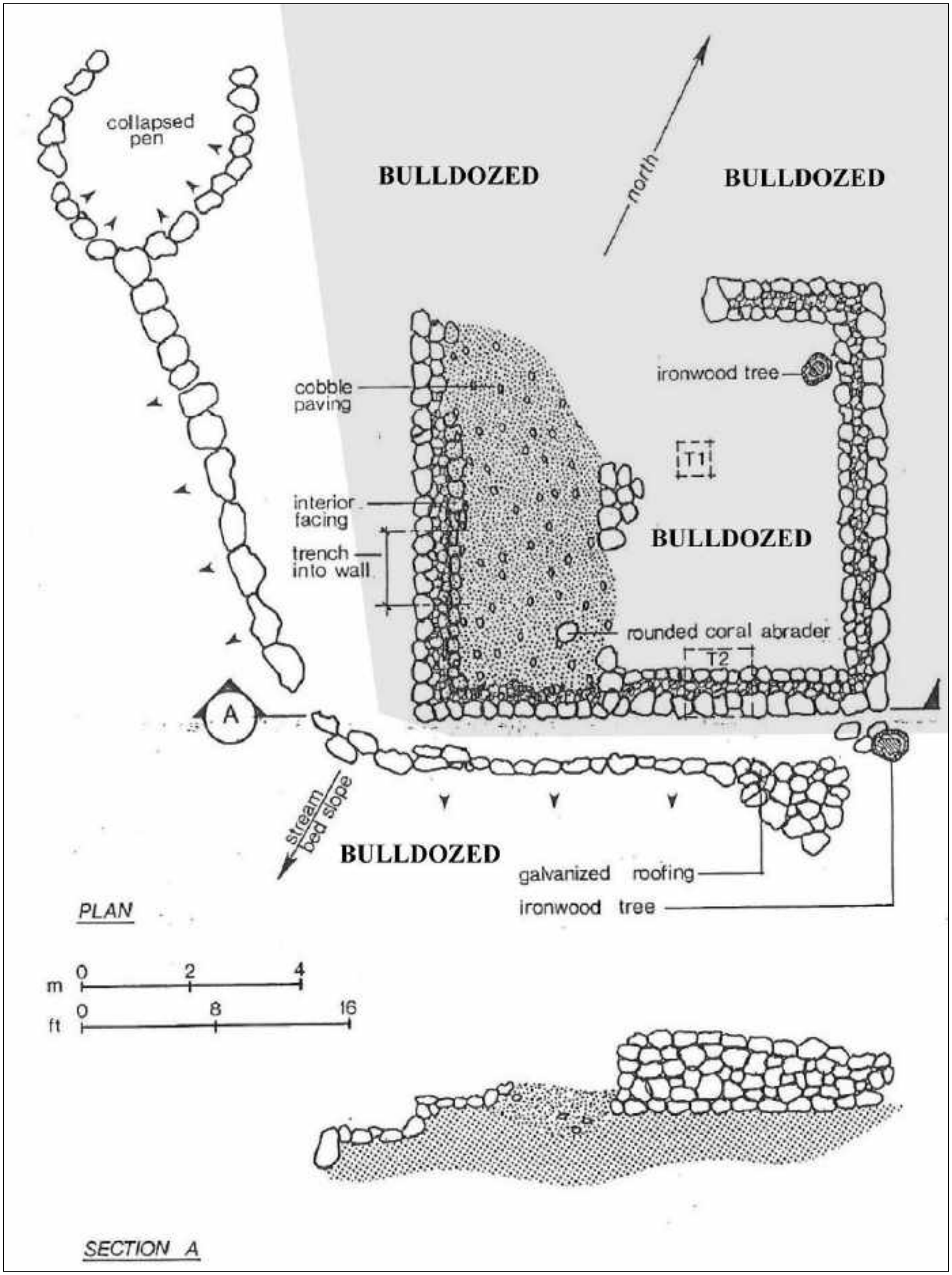

Figure 53: Site 10074 Plan View Map (Adapted from Hammatt et al. 1992:9).

Figure 54: Photograph of Site 10074 Rock Wall, Looking South.

CSH EXCAVATION RESULTS: A 50 cm square test unit (TU-1) was excavated in the soil deposit in the center of the rectangular enclosure. The unit was excavated to sterile Pāhala ash at a depth of 35 cm below the modern ground surface. The trench yielded a few fragments of *cowrie* shell and one volcanic glass flake. CSH suggested that the recovered artifacts were not consistent with what appeared to be the historic age of the foundation. CSH suggested that the artifacts might represent the scattered remains of a prehistoric occupation.

A second test unit (TU-2) was excavated by CSH through the southwest wall of the rectangular enclosure. Artifacts recovered from the wall's architectural layer were fragments of bottle glass, glazed ceramic sherds, wire nails and fragments of redwood. Site 10074 was interpreted as most likely a small dwelling or work shed associated with coffee farming. Coffee trees were identified along the seasonal gulch to the south. [Hammatt et al. 1992:54]

The site was bulldozed at some point after the CSH AIS study. When SCS relocated the site, it was almost completely bulldozed and is in poor condition. All that remains is the partially collapsed portion of what appears to be the southeast corner of the enclosure wall. Site 10074 has been altered by bulldozing, is in poor condition and no further work is recommended at the site.

SIHP 10075	**Enclosure Remnant**
FUNCTION:	Pig Pen
AGE:	Historic Era
DIMENSIONS:	9.0 m long (NW/SE) by 4.6 m wide by 1.8 m max. height
CONDITION:	Poor
INTEGRITY	Altered: retains minimal integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: SIHP 10075 is a large rectangular enclosure remnant located at 630 ft amsl in the north corner of the project area (see Figure 12). The CSH AIS report describes the enclosure as measuring roughly 9.0 m long (NW/SE) by 4.6 m wide with wall height ranging from , long axis oriented north-south, with walls 1.5 m to 1.8 m in height. The northwest wall had a low (one foot high) stone slab "lintel" opening a few feet from the northeast corner of the structure (Hammatt et al. 1992:23).

When SCS relocated Site 10075 during the current AIS study, the northeast and northwest walls had been bulldozed and were no longer present. Only portions of the southeast and southwest walls remained intact. The remaining walls have been impacted by bulldozing and were partially collapsed.

The Site 10075 enclosure remnant is currently 4.75 m long (NW/SE) by 4.6 m wide and has maximum wall heights of 0.58 m (Figure 55). The enclosure walls range from 0.5 to 0.65 m in width. The walls are constructed of angular, subangular and slabby basalt large cobbles and large boulders stacked three to four courses high on the ground surface (Figure 56 and Figure 57). The walls were likely faced in places but are now collapsed. The interior of the enclosure is roughly level rocky soil.

CSH interpreted the enclosure as a Historic era pig pen based on its size, feature construction, wall heights, and their similarities to other Historic era pig pens documented across Hawaiʻi Island. Site 10075 has been altered by bulldozing, in poor condition and no further work is recommended at the site

SIHP 30592	**Railroad Berm**
FUNCTION:	Transportation
AGE:	Historic Era
DIMENSIONS:	300.0 m long (N/S) by 4.0 m wide max. by 5.0 m max. height
CONDITION:	Good
INTEGRITY:	Unaltered: retains integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	Railroad Spike
EXCAVATION:	None

DESCRIPTION: Site 30592 is a segment of the railroad berm located between 680 m and 690 m amsl along the project area east boundary (see Figure 12). The railroad berm continues south off the current project area. The railroad berm is approximately 300.0 m in length (N/S) and between 2.5 m and 4.0 m wide by 5.0 m in maximum height. The railroad bed is a level dirt and rock surface (Figure 58), and the berm is located along the west side of the railroad bed. The berm is a west sloping retaining wall constructed of small boulders and large cobbles stacked up to nine courses high (Figure 59 and Figure 60). The berm is well faced with fairly tightly fitted natural rock. The rock has not been worked prior to stacking. The berm face slopes slightly toward the east as it approaches the top to prevent collapse.

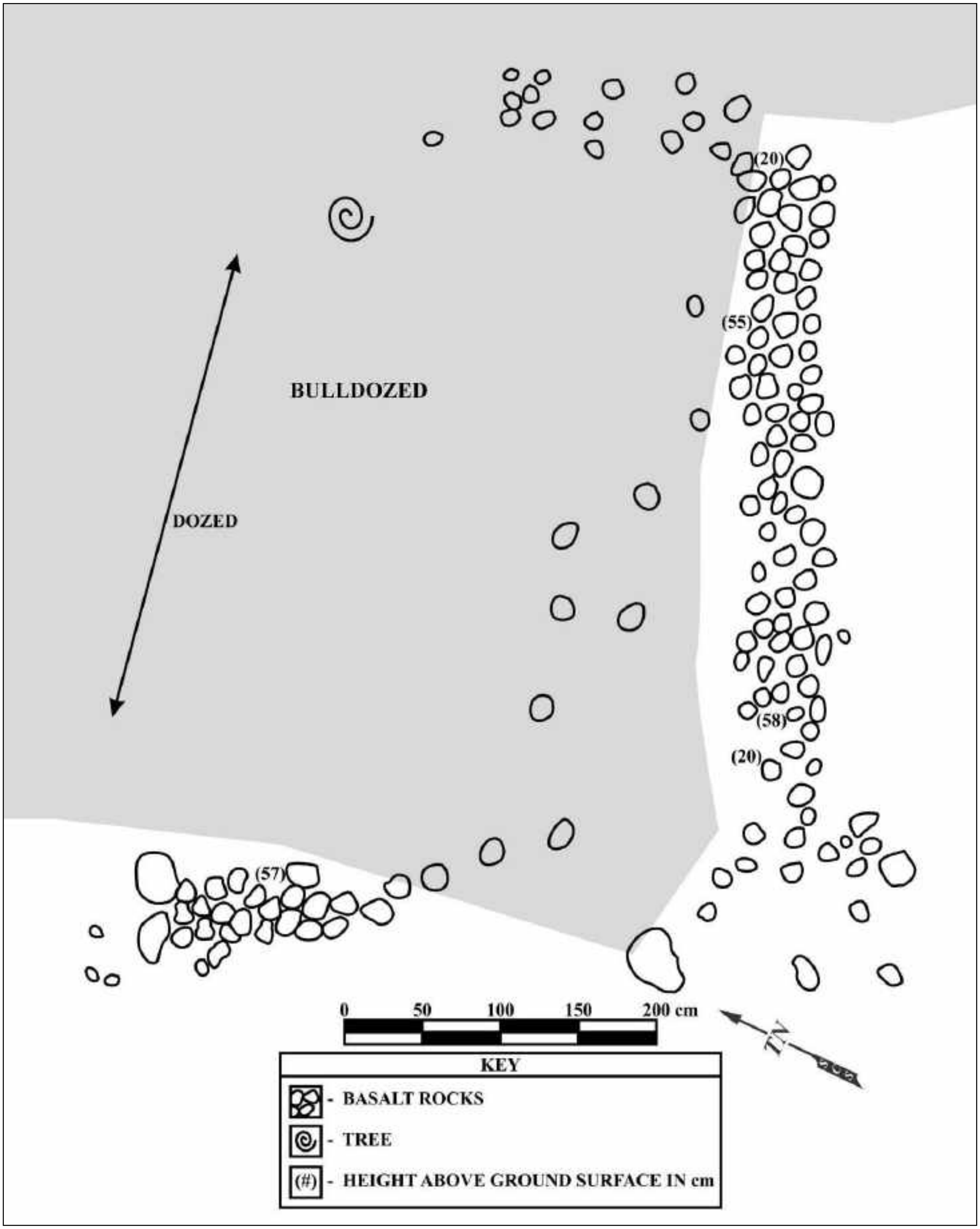

Figure 55: Site 10075 Plan View Map.

Figure 56: Photograph of Site 10075 Enclosure, Looking West.

Figure 57: Photograph of Site 10075 Enclosure Southwest Wall, Looking Southwest.

Figure 58: Photograph of Site 30592 Railroad Berm Rail Bed, Looking South.

Figure 59: Photograph of Site 30592 Railroad Berm Retaining Wall, Looking Southeast.

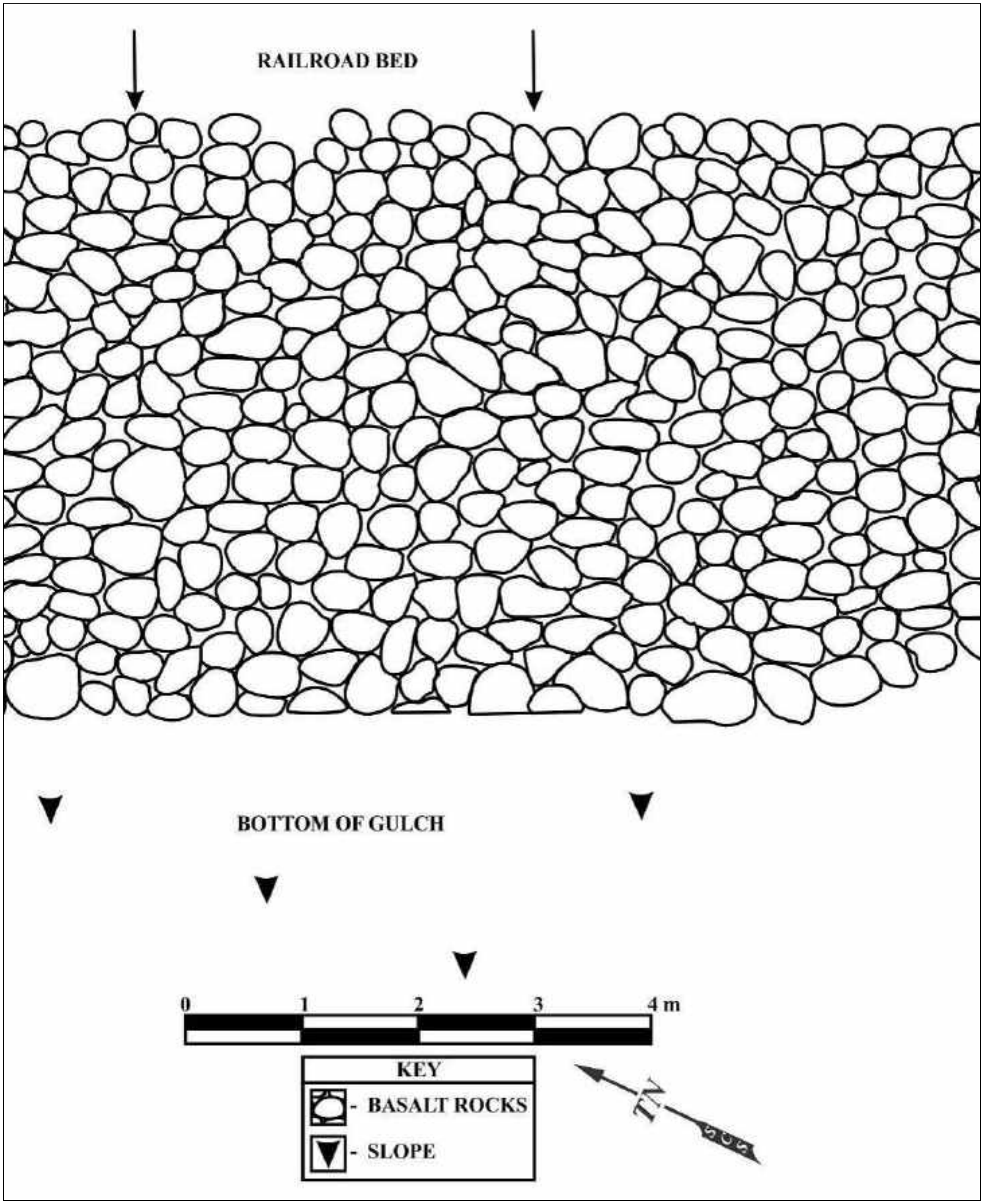

Figure 60: Site 30592 Railroad Berm Retaining Wall Profile.

The retaining wall is approximately 5.0 m high and is constructed of fifteen courses of large basalt cobbles and small boulders. The north end of the berm has been bulldozed roughly 60.0 m south of the northeast corner of the project area. Site 30592 appears to be unaltered and is in good condition. Only the north end of the railroad berm has been altered by bulldozing. Site 30592 is in good condition and is recommended for preservation.

SIHP 31181	**Enclosure Remnant**
FUNCTION:	Habitation
AGE:	Pre Contact Era
DIMENSIONS:	3.40 m long (NW/SE) by 1.24 m wide by 1.10 m max. height
CONDITION:	Poor
INTEGRITY:	Altered: retains minimal integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	Coral Abrader
EXCAVATION:	None

DESCRIPTION: Site 31181 is an enclosure remnant located at 645 ft amsl in the northeast corner of the project area (see Figure 12). The feature is constructed on a fairly level pāhoehoe bedrock outcrop. The feature has been altered by bulldozing and only a portion of the southwestern wall remains intact. The remnant wall as well as the bedrock outcrop on which it rests, are situated in an area that has been heavily dozed (Figure 61). The enclosure remnant is approximately 3.40 m long (NW/SE) by 1.24 m wide by 1.10 m in maximum height. The enclosure is constructed of angular basalt small boulders stacked three to four courses high on the bedrock outcrop (Figure 62). The walls are very roughly faced. The bedrock outcrop which functions as the interior floor of the structure appears to extend beyond the limits of what was once the original structure. A coral abrader fragment was located in the south corner of the enclosure (Figure 63).

Based on the size and construction of the enclosure, it is possible that it was used for pre-Contact era temporary habitation. It will not be possible to test excavate the feature as it is constructed on bedrock. Site 31181 has been altered by bulldozing, is in poor condition and no further work is recommended at the site.

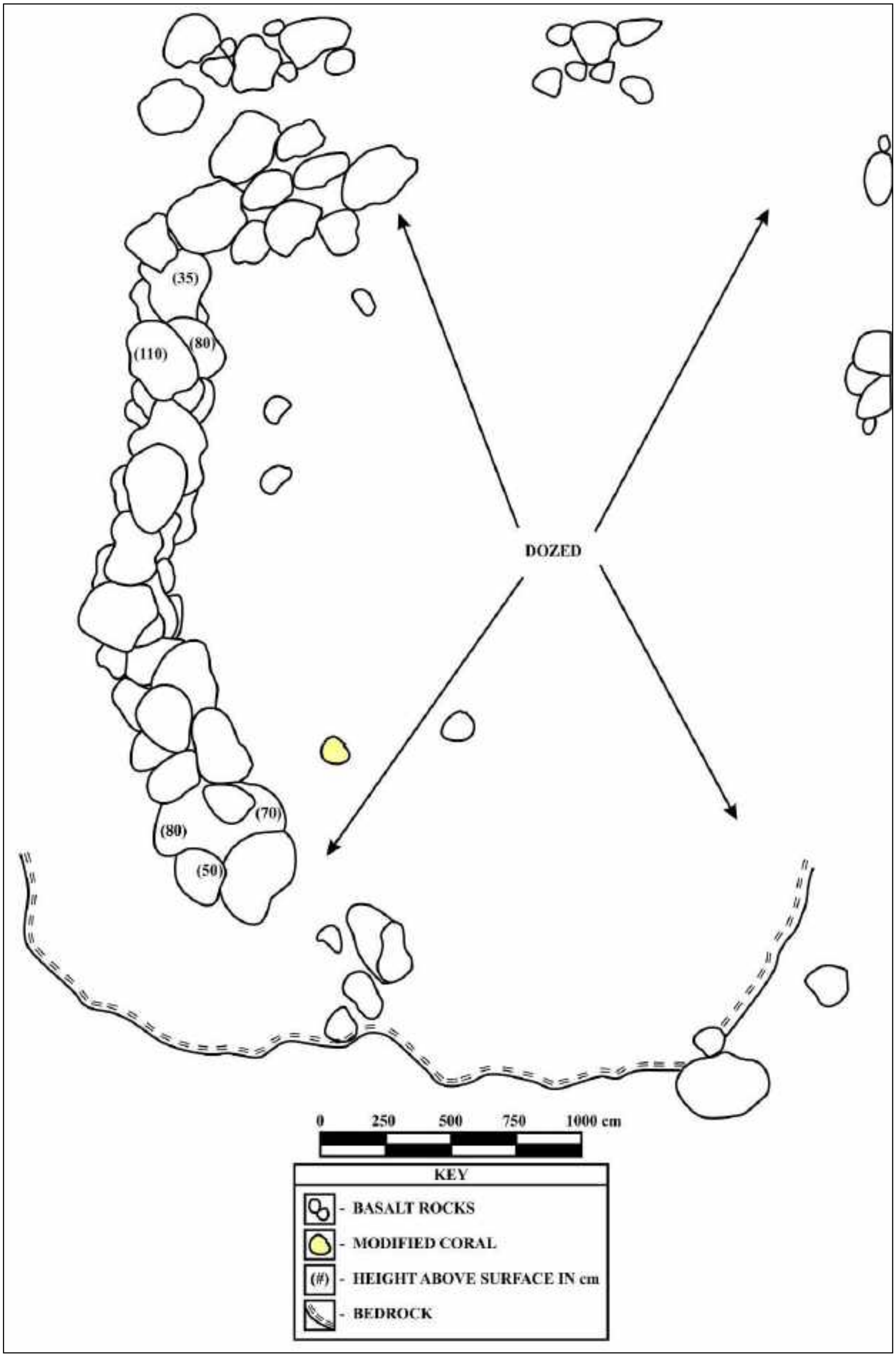

Figure 61: Site 31181 Plan View Map.

Figure 62: Photograph of Site 31181 Enclosure Remnant, Looking Northwest.

Figure 63: Photograph of Coral Abrader Fragment at Site 31181.

SIHP 31182	**Ranch Walls**
FUNCTION:	Ranching and Agriculture
AGE:	Historic Era
DIMENSIONS:	900.0 m long (NE/SW) by 550.0 m wide by 1.20 m max. height
CONDITION:	Fair
INTEGRITY:	Altered: retains minimal integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	Historic to Modern era bottles and cans
EXCAVATION:	None

DESCRIPTION: Site 31182 is the ranch rock walls (Features 1 through 14) that divide the entire project area into paddocks and agricultural fields (Figure 64). They are located between 360 and 700 ft amsl. The majority of rock walls (n=10) are oriented *mauka-makai* (NE/SW) while a smaller number (n=6) of shorter north/south walls create divided spaces within the longer *mauka-makai* walls. There is a small pen in the southwest corner of the project area at the southwest end of wall Feature 4 (Figure 65). The small pen at the southwest end of Feature 4 is either for calves or is a pig pen. The small pen has metal pipe gates to allow access and appears more modern than most of the walls.

There are also three lager corrals, or paddocks (Feature 12, 14, and between those features and wall Feature 5) in the southwest corner of the project area (see Figure 64). Wall Features 1 and 5 are property boundary walls and do not follow LCA or LG boundaries. The northern end of Feature 2 wall and Feature 3 wall appear to be constructed along the boundaries of LCA #3630 to John G. Munn (see Figure 7).

The rock walls are of a very similar construction. They are constructed of angular, subangular and slabby basalt large cobbles and small boulders stacked four to six courses high on the ground surface (Figures 66 through 72). The walls range from four to six courses wide. The outer rocks are placed so that their flattest edges are facing the outside of the wall. The walls are not cobble core filled but are bi-faced. The outsides of the walls slope slightly inward from the base to the top of the walls for stability. There are openings in some of the walls, and some with and metal pipe or wood gates to allow access through the walls. Barbed wire fence has been installed along one side of some of the walls.

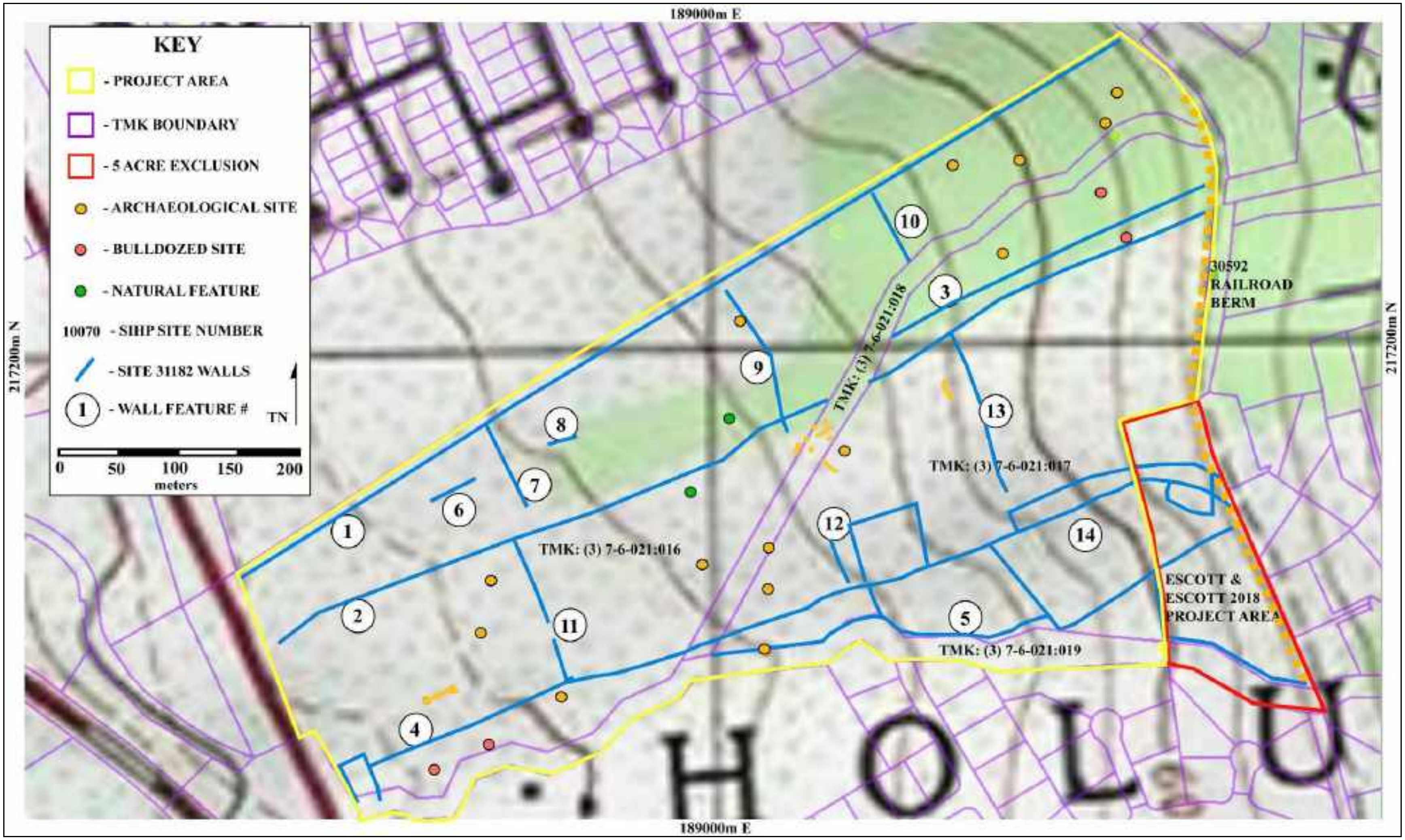

Figure 64: 7.5-Minute Series USGS Topographic Map Showing Location of Site 31182 Ranch Wall Features and Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

Figure 65: Photograph of Site 31182 Feature 4 Pin Pen Looking Southeast.

Figure 66: Photograph of Site 31182 Feature 4 South End Showing Wall Construction, Looking North.

Figure 67: Photograph of Site 31182 Feature 4 South End Showing Wall Construction, Looking North.

Figure 68: Photograph of Site 31182 Feature 4 Showing Top of Wall Construction, Looking Northeast.

Figure 69: Photograph of Site 31182 Feature 2 South End Showing Top of Wall Construction, Looking Northeast.

Figure 70: Photograph of Site 31182 Feature 2 South End Showing Wall Construction, Looking Southeast.

Figure 71: Photograph of Site 31182 Feature 11 Showing Wall Construction, Looking East.

Figure 72: Photograph of Site 31182 Feature 11 North End Showing Top of Wall Construction, Looking North.

Many of the walls have been altered and are either collapsed in places or have had their ends bulldozed or have bulldozer breaches through them, providing new access. The remaining Site 31182 walls have not been altered, are in good condition and no further work is recommended for them.

IF-1	**Isolated Petroglyph**
FUNCTION:	Marker
AGE:	Pre Contact Era
DIMENSIONS:	0.90 m by 0.70 m
CONDITION:	Fair
INTEGRITY:	Altered
SURFACE ARTIFACTS:	None
EXCAVATION:	None

DESCRIPTION: Isolated Find-1 (IF-1) is a petropglyph located at 410 ft amsl along the southwest boundary of the project area (see Figure 12). The single petroglyph is an image of a person etched onto a small basalt boulder (Figure 73) in a bulldozed disturbed area north of a seasonal gulch. The boulder is 0.90 m in length, 0.70 m wide and is not associated with any features (Figure 74). The petroglyph likely depicts a human form, although an interpretation of its significance is difficult as the image has deteriorated.

SCS contacted Shane Nelson, the Office of Hawaiian Affairs West Hawai‘i Representative to consult on the on the final disposition and preservation treatments for the petroglyph. IF-1 appears to be unaltered, is in fair condition and preservation at a nearby protected location on the property is recommended.

Figure 73: Photograph of Site 31181 Petroglyph.

Figure 73: Photograph of Site 31181 Petroglyph.

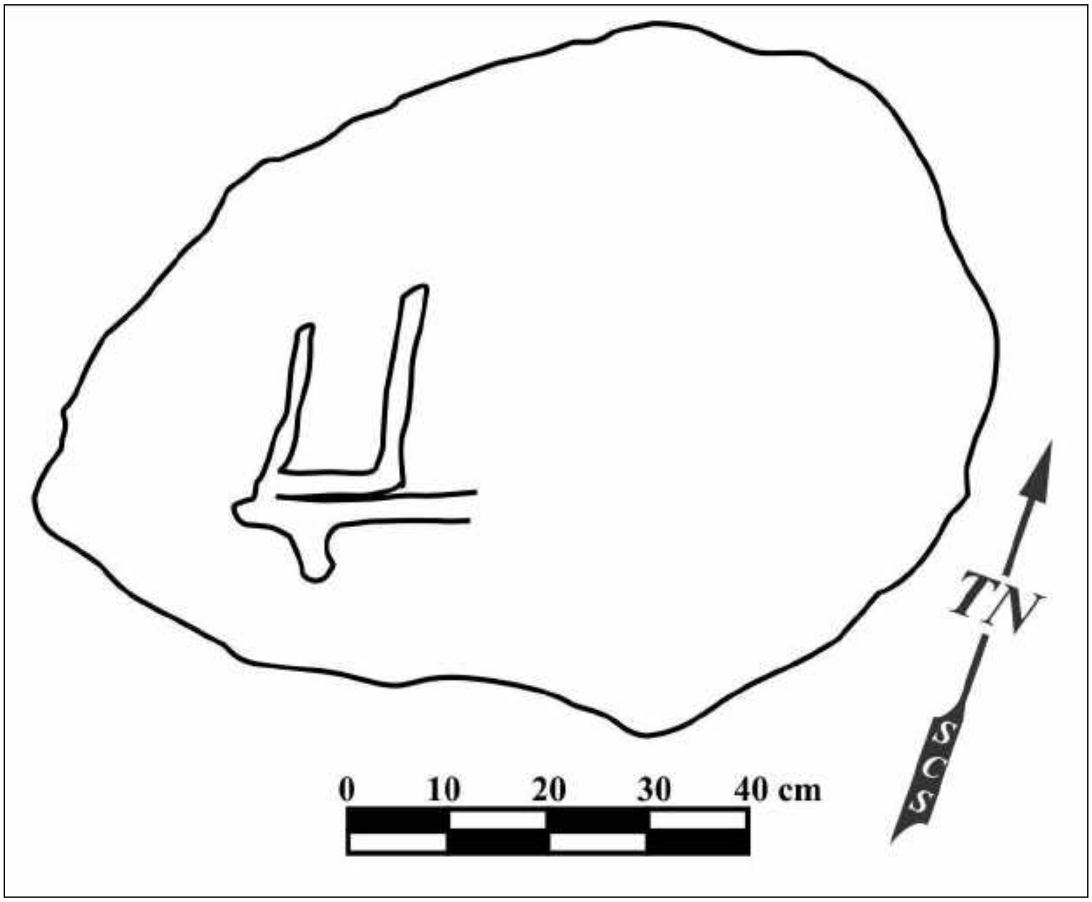

Figure 74: Site 31181 Petroglyph Plan View Drawing.

CONCLUSION

Seventeen archaeological sites were identified and recorded in the project area (Table 7 and Figure 75). Fifteen of the sites were previously documented and two sites were previously undocumented (Site 31181, a small coffee shed enclosure and Site 31182, ranch walls). The location of one of the 17 sites (Site 10012), was relocated, though the burials were reinterred off project and the archaeological features at Site 10012 are no longer present on the ground surface. An isolated petroglyph (IF-1) was also recorded during the current AIS study.

Six of the sites and IF-1 were determined to be pre-Contact era sites, three associated with habitation, one with agriculture, one single feature site (Site 10012) formerly associated with burials, and a single petroglyph. The burials at Site 10012 were removed and reinterred off-project prior to 1983. Eleven of the sites were determined to be Historic era sites, the majority associated with coffee agriculture and cattle ranching. Four of the Historic era sites likely had a habitation component.

Table 7: Inventory of Archaeological Sites in the Current AIS Project Area.

SIHP# *	TYPE	FUNCTION	AGE
10011	Platform	Ag. Clearing/Temp. Habitation	Pre-Contact
10012 •	Platform & Wall	Burial	Pre-Contact
10013	Enclosure & Lava Tube	Habitation	Pre-Contact
10018	Enclosure	Agricultural	Historic
10019	6 Rock Mounds	Ag. Clearing	Historic
10031	Enclosure Wall	Agriculture	Historic
10067	Terraces	Habitation	Pre-Contact
10068	Enclosure	Habitation	Pre-Contact
10069	Modified Bluff/Platform	Habitation	Historic
10070	U-Shape Enclosure	Agriculture	Historic
10072	Complex	Ag. Clearing	Pre-Contact
10073	Complex	Ranching & Ag.	Historic
10074	Enclosure	Coffee Work Shed	Historic
10075	Enclosure	Pig Pen	Historic
30592	Railroad Berm	Transportation	Historic
31181	Enclosure	Coffee Work Shed	Historic
31182	Rock Walls	Ranching & Ag.	Historic
IF-1	Petroglyph	Marker	Pre-Contact

* Site numbers are preceded by the prefix 50-10-37-.
Orange Shading - Site no longer present.
• Burial Site 10012 reinterred off project prior to 1983.

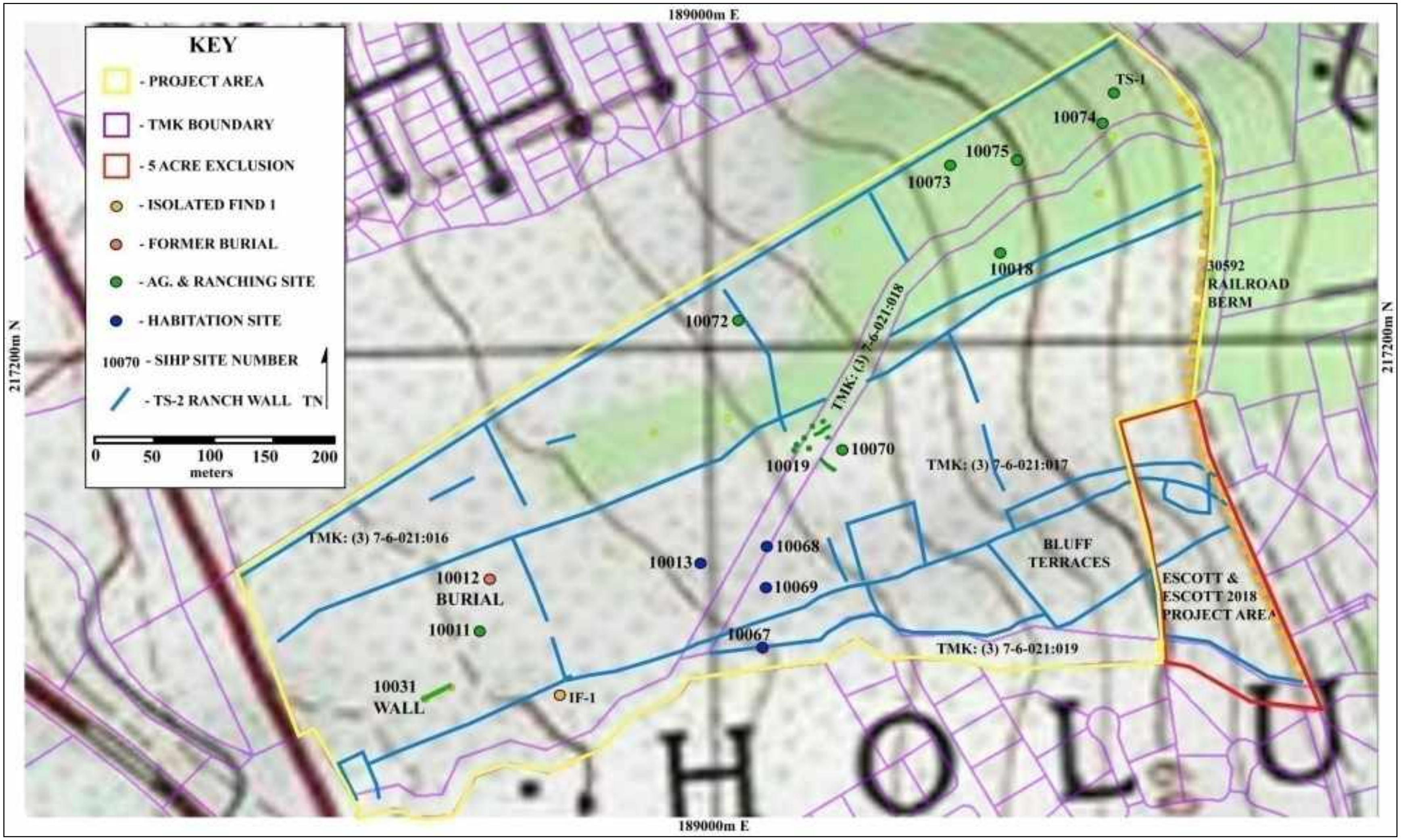

Figure 75: 7.5-Minute Series USGS Topographic Map Showing Location of Archaeological Sites and Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

There is a concentration of Historic era agricultural and livestock sites (Site 10019 10018, 10070, 10073, 10074, 10075, and 31181) located in the northeast quadrant of the project area. The features include rock clearing mounds and enclosures. The sites are clustered along a seasonal gulch. Sites include rock clearing mounds and small enclosures associated with coffee and sugarcane growing.

There are a smaller number of pre-Contact era agricultural sites (Site 10011 and 10072) and temporary habitation sites associated with agriculture (Site 10013, 10067, 10068, and 10069) near the south central portion of the project area. Three of the habitation sites are north of the Hōlualoa School stream located along the south boundary of the project area. Artifacts recovered from test excavations at these sites included a number of volcanic-glass flakes, indicating tool manufacture.

The many Historic era rock walls (Site 31182) are associated with cattle ranching. There are *mauka-makai* walls divide the entire length of the project area into separate paddocks. There are north-south walls that further divide the paddocks into smaller pastures. There are also a series of large corrals in the southwest corner of the project and a small pen in the southeast corner of the project area. Ranchers often move cattle from paddock to paddock to prevent overgrazing. They also pasture yearlings separate from older cattle. Corrals and smaller pens are use for branding, inoculation and to gather cattle for transport to market. There is a dirt ranch road leading to corral Feature 12 that crosses the Hōlualoa School stream.

Given the extensive land Historic era and modern land alteration in the project area, it is difficult to synthesize a clear picture of pre-Contact era site distribution and land use for the project area lands. It is clear that there were pre-Contact agricultural sites and associated temporary habitation sites in the lower and mid-elevation portions of the project area, especially along the stream (seasonal gulch) to the south. The few remaining sites do not provide a good sample to compare with site distribution patterns recorded at less disturbed projects of similar location in Kona.

The project area does provide a fairly complete picture of Historic era cattle ranching and agricultural land use, including information on cattle pasturing, management, care, and transport.

SIGNIFICANCE ASSESSMENTS

Sites identified during this project were assessed for their significance as outlined in Hawai‘i Administrative Rules §13-284-6. To be assessed as significant a site shall possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following five criteria:

(a) It must be associated with events that have made a significant contribution to the broad patterns of our history, or be considered a traditional cultural property.

(b) It must be associated with the lives of persons significant in the past.

(c) It must embody distinctive characteristics of a type, period, or method of construction, or represent a significant and distinguishable entity whose components may lack individual distinction.

(d) It must have yielded or may be likely to yield, information important in prehistory or history.

(e) Have important value to native Hawaiian people or other ethnicities in the state, due to associations with cultural practices and traditional beliefs that were, or still are, carried out.

All of the archaeological sites documented in this report were evaluated for their significance (Table 8). All of the sites identified during the current AIS study possess integrity of location and materials and were assessed significant under criterion “d” as they have yielded or are likely to yield information important to prehistory and/or history. All of the sites, with the exception of the railroad berm Site 30592 and the burial Site 30593 provide information important to pre-Contact era and Historic era agricultural pursuits and cattle ranching. They provide data on pre-Contact era through post-Contact era and the Historic era features constructed for growing subsistence and commercial crops and raising beef for commercial markets. They also provide data important to changing land-use as some farmers began to use land for cattle pasture in response to developing local and external markets on Hawai‘i Island and O‘ahu. The ranch walls, paddocks and corral sites provide information on the ways land was altered and divided to accommodate both farming and ranching.

Table 8: Inventory of Archaeological Sites in the Current AIS Project Area.

SIHP# *	TYPE	FUNCTION	AGE	SIGNIFICANCE CRITERIA	RECOMMENDATION
10011	Platform	Ag. Clearing	Pre-Contact	d	No Further Work
10012 •	Platform & Wall	Burial	Prehistoric	No longer Significant	No Further Work
10013	Enclosure & Lava Tube	Habitation	Pre-Contact	d	No Further Work
10018	Enclosure	Agricultural	Historic	d	No Further Work
10019	6 Rock Mounds	Ag. Clearing	Historic	d	No Further Work
10031	Enclosure Wall	Agriculture	Historic	d	No Further Work
10067	Terraces	Habitation	Prehistoric	d	No Further Work
10068	Enclosure	Habitation	Prehistoric	d	No Further Work
10069	Modified Bluff/Platform	Habitation	Historic	d	No Further Work
10070	U-Shape Enclosure	Agriculture	Historic	d	No Further Work
10072	Modified Bluff	Ag. Clearing	Pre-Contact	d	No Further Work
10073	Complex	Ranching & Ag.	Historic	d	No Further Work
10074	Enclosure	Coffee Work Shed	Historic	d	No Further Work
10075	Enclosure	Pig Pen	Historic	d	No Further Work
30592	Railroad Berm	Transportation	Historic	a, c, d	Preservation In-Place
31181	Enclosure	Coffee Work Shed	Historic	d	No Further Work
31182	Rock Walls	Ranching & Ag.	Historic	d	No Further Work
IF-1	Petroglyph	Marker	Prehistoric	d, e	Preservation

* Site numbers are preceded by the prefix 50-10-37-.
Orange Shading - Site no longer present.
• Burial Site 10012 reinterred off project prior to 1983.

The pre-Contact era agricultural and habitation sites (10011, 10013, 10067, 10068, and 10072) and the petroglyph (IF-1) were assessed significant under criterion “d” as they have yielded or are likely to yield information important to pre-Contact era agriculture and temporary habitation and tool production associated with agricultural pursuits in the region.

The railroad berm Site 30592 is also significant under criteria “a” and “c” as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. SCS consulted with the Office of Hawaiian Affairs (OHA) Kona representative Shane Nelson to ask for any input regarding Site 30592.

RECOMMENDATIONS

The railroad berm Site 30592 is recommended for preservation with preservation measures to be outlined in an archaeological preservation plan. The petroglyph (IF-1) is recommended for preservation in a safe location on the project area, preferably within the Site 30592 railroad berm preservation area.

No further work is recommended for the remaining 16 archaeological sites. Information recorded for all 16 archaeological sites during the current study has adequately ascertained their function and age.

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APPENDIX A: REINTERMENT DOCUMENTATION

Project Planners Hawaii
75-127 Lunapule Road, Suite 14
Kailua-Kona, Hawaii 96740
Telephone: (808) 326-7204
FAX: (808) 329-1202

March 19, 1993

Mr. Edward H. Ayau
State Historic Preservation Division
Department of Land & Natural Resources
State of Hawaii
33 South King Street
6th Floor
Honolulu, Hawaii 96813

Re: Burials
Gamrex, Inc.
Kona Vistas Subdivision
Holualoa, North Kona, Hawaii

Dear Ed:

Pursuant to our phone conversations today regarding the decision of the Burial Council, may I confirm the following. The council has decided that the site located in the South-east corner of the subdivision near Kilohana Street is acceptable for all three (3) burials. A six foot deep hole will be excavated of sufficient size to accomodate a 4'X4'X4' box (of the type used for electrical connections) with no bottom and a cover. The remains will be buried on or about April 1, 1993. The hole will be backfilled over the cover of the box to ground level after reburial. I have asked our contractor to leave a ladder in the hole for you so that you can get down to the box safely.

Gamrex authorizes you to enter on site to the burial area for the services on April 1, 1993, or thereabouts. Please contact me with the exact time and date prior to the ceremony. Please note that you and your council members will be allowed on site at your sole risk and that Gamrex, and or its contractors will not be held liable for any damages and/or injuries should they occur.

Thank you for your assistance in the settlement of this matter. Please contact me when you have set the date for the reburials.

Respectfully,

Gregg Kashiwa

Gregg Kashiwa

cc: Gamrex, Inc.
Isemoto Contracting

JOHN WAIHEE
GOVERNOR OF HAWAII

KEITH AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCE

DEPUTIES

JOHN P. KEPPELER II
DONA L. HANAIKE

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

April 5, 1993

Gamrex, Inc.
Attention: Mr. Gregg Kashiwa
75-127 Lunapule Road, Suite 14
Kailua, Kona, Hawai`i 96740

Re: Reinterment of Hawaiian Skeletal Remains, Tax Map Key 7-6-21:4,9-13,15-17, Hōlualoa, North Kona, Hawai`i

Dear Mr. Kashiwa:

This is to notify you that on the evening of April 1, 1993, the three sets of Hawaiian remains recovered from the above mentioned property were respectfully reinterred. Thank you for your cooperation and assistance throughout this important matter.

If there are any questions, please contact Edward Halealoha Ayau, Esq. at 587-0010.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

c: Edward L.H. Kanahele, Chair, Hawai`i Burial Council

APPENDIX 6: Archaeological Preservation Plan

SCS PROJECT 2252-1

AN ARCHAEOLOGICAL PRESERVATION PLAN FOR SITE #50-10-57-30592 LOCATED IN HŌLUALOA 1st AHUPUA‘A, NORTH KONA DISTRICT, HAWAI‘I ISLAND, HAWAI‘I [TMK: (3) 7-6-021:016-019]

Prepared by:
Glenn Escott, M.A.
and
Nicole A. Mello, M.A.

MAY 2020

DRAFT

Prepared for:
Kona Three, LLC
111 Hualalai St.
Hilo, HI 96720

SCIENTIFIC CONSULTANT SERVICES Inc.
1347 Kapi‘olani Boulevard, Suite 408 Honolulu, HI 96814
Hawai‘i Island Office: PO Box 155 Kea‘au, HI 96749

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INTRODUCTION

As requested by the Hawai‘i State Historic Preservation Division (SHPD) in a letter dated May 31, 2018 (Log No. 2018.01123, Doc No. 1805SN05) (Appendix A), Scientific Consultant Services, Inc. (SCS) produced this Archaeological Preservation Plan (PP) for Site #50-10-37-30592 (hereafter referred to as Site 30592) located on a portion of TMK: (3) 7-6-021: 016-019 in Hōlualoa 1st Ahupua‘a, North Kona District, Island of Hawai‘i, Hawai‘i (Figure 1 through Figure 4, and Figure 14 to Figure 15).

The owner is proposing to develop the property and contracted SCS produce this PP as required for a County of Hawai‘i Planning Department grubbing and grading permit application. Prior to writing the preservation plan, a search of geological maps, aerial photos, historical maps, historical documents, land titles, land-use documents, and previous archaeological reports was conducted. A summary of the research is included in this preservation plan. The preservation plan was prepared in accordance with Hawai‘i Administrative Rules (HAR) §13-277 rules for site archaeological preservation. The property is owned by Kona Three, LLC. The contact person for Kona Three, LLC is Mr. Richard Wheelock. Mr. Wheelock can be reached by phone at (808) 753-3167, and by email at richard@eastwestrealty.org. His mailing address is 700 Bishop Street Honolulu, HI 96813-4112.

ENVIRONMENTAL SETTING

Site 30592 is a portion of the Historic era Kona Sugar Company railroad bed and berm located along the eastern boundary of the project area of an undeveloped portion of TMK: (3) 7-6-021:016-019. The project area is located between 360 and 660 feet (110 to 201 meters) above mean sea level (amsl) on fairly steep sloping land with level areas in between elevation breaks. The land is a small portion of a larger former cattle ranch and agricultural area that was started in the early 1900s. The lower portion of the project area is still used to pasture cattle. The project area and surrounding lands were bulldozed sometime between the 1940s and 1970s. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push pile. Pedestrian survey confirmed the linear bands in the aerial photographs are bulldozer-cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths.

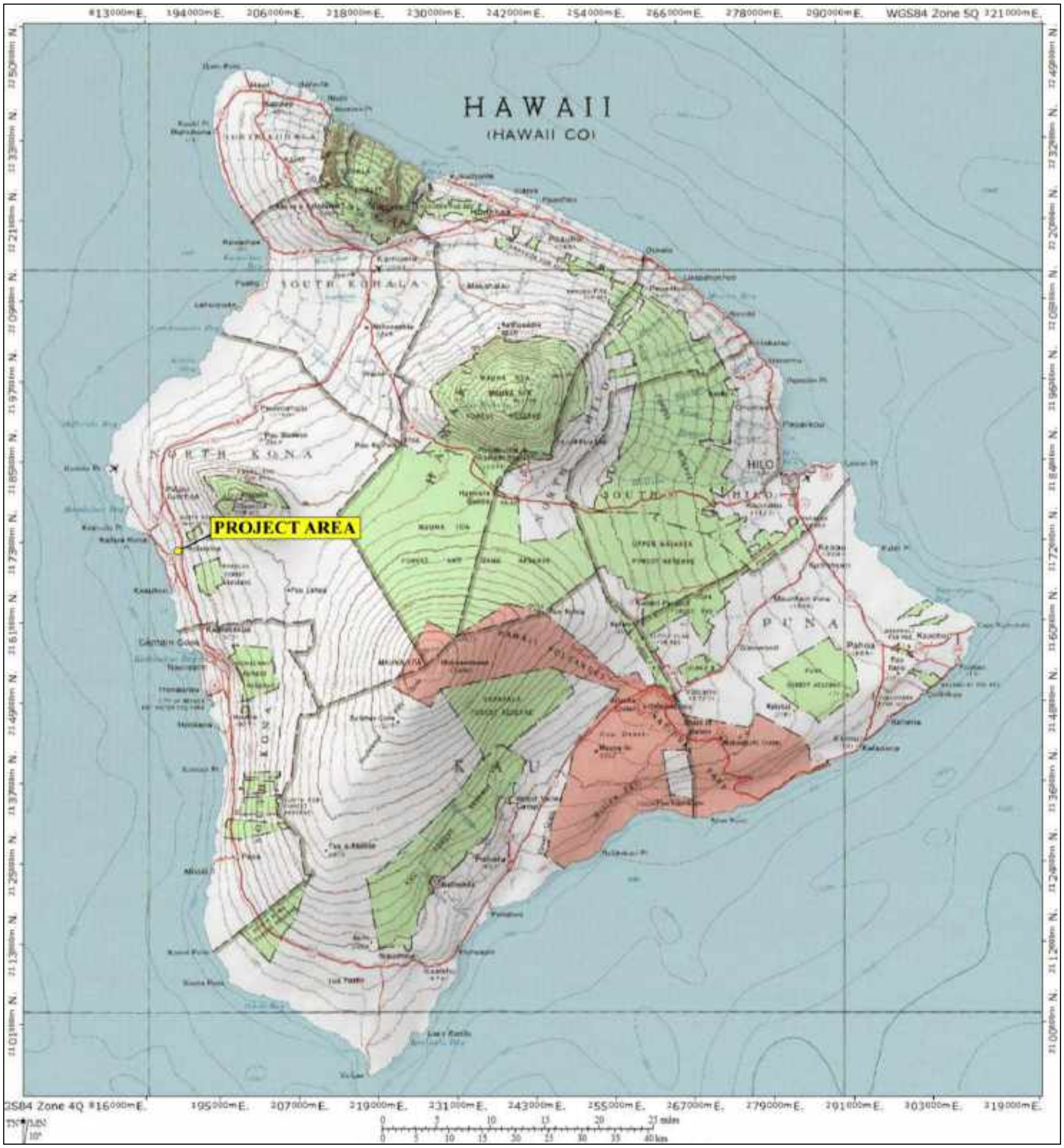

Figure 1: 5,500 K-Series Map of Hawai‘i Island Showing Location of Site Project Area (National Geographic Topo!, 2003. Sources: National Geographic Society, USGS).

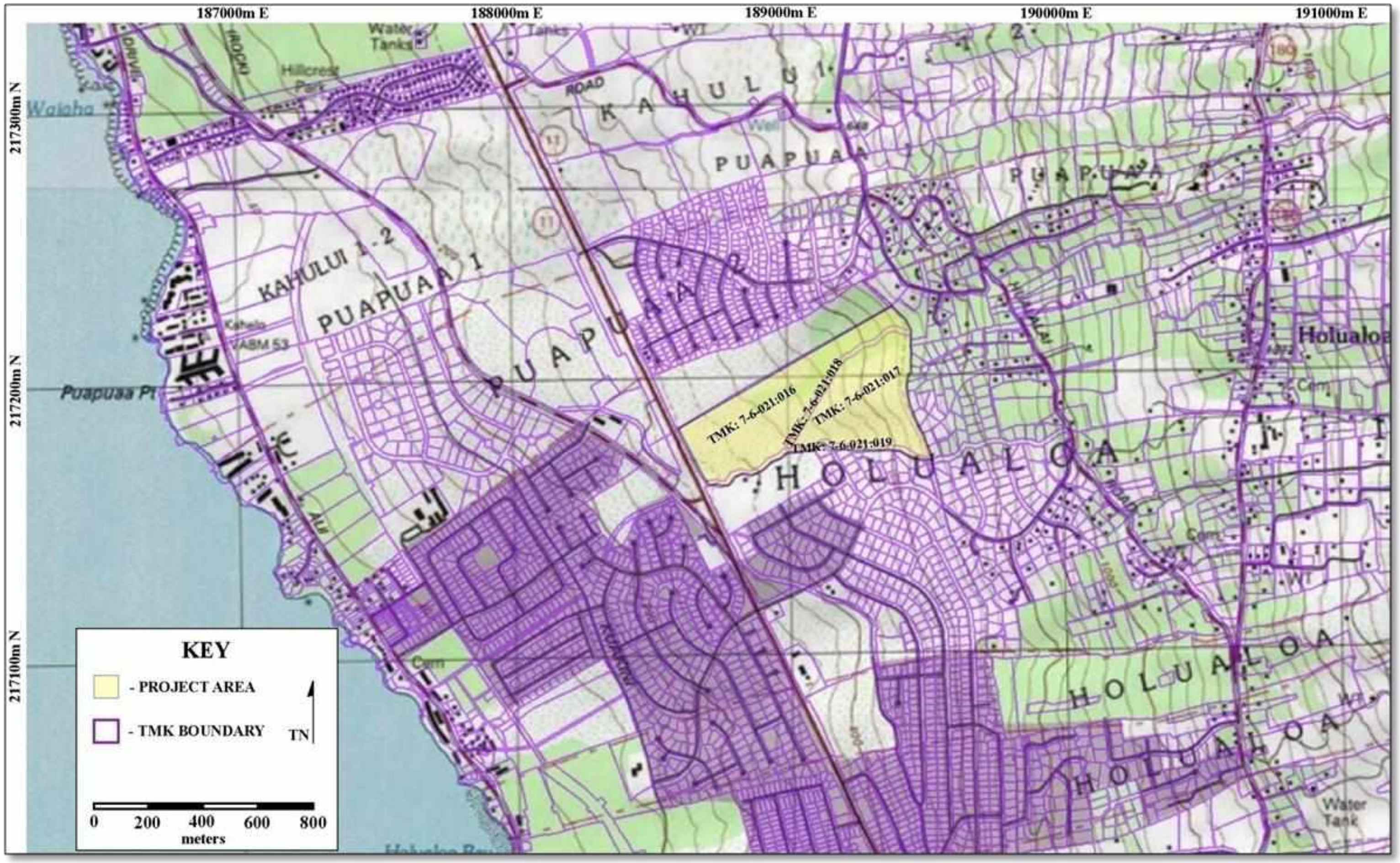

Figure 2: 7.5-Minute Series USGS Topographic Map Showing the Location of Project Areas and TMK Parcels (Kealakekua Quadrangle. ESRI, 2013. Data Sources: National Geographic and County of Hawai‘i Planning Department, 2019).

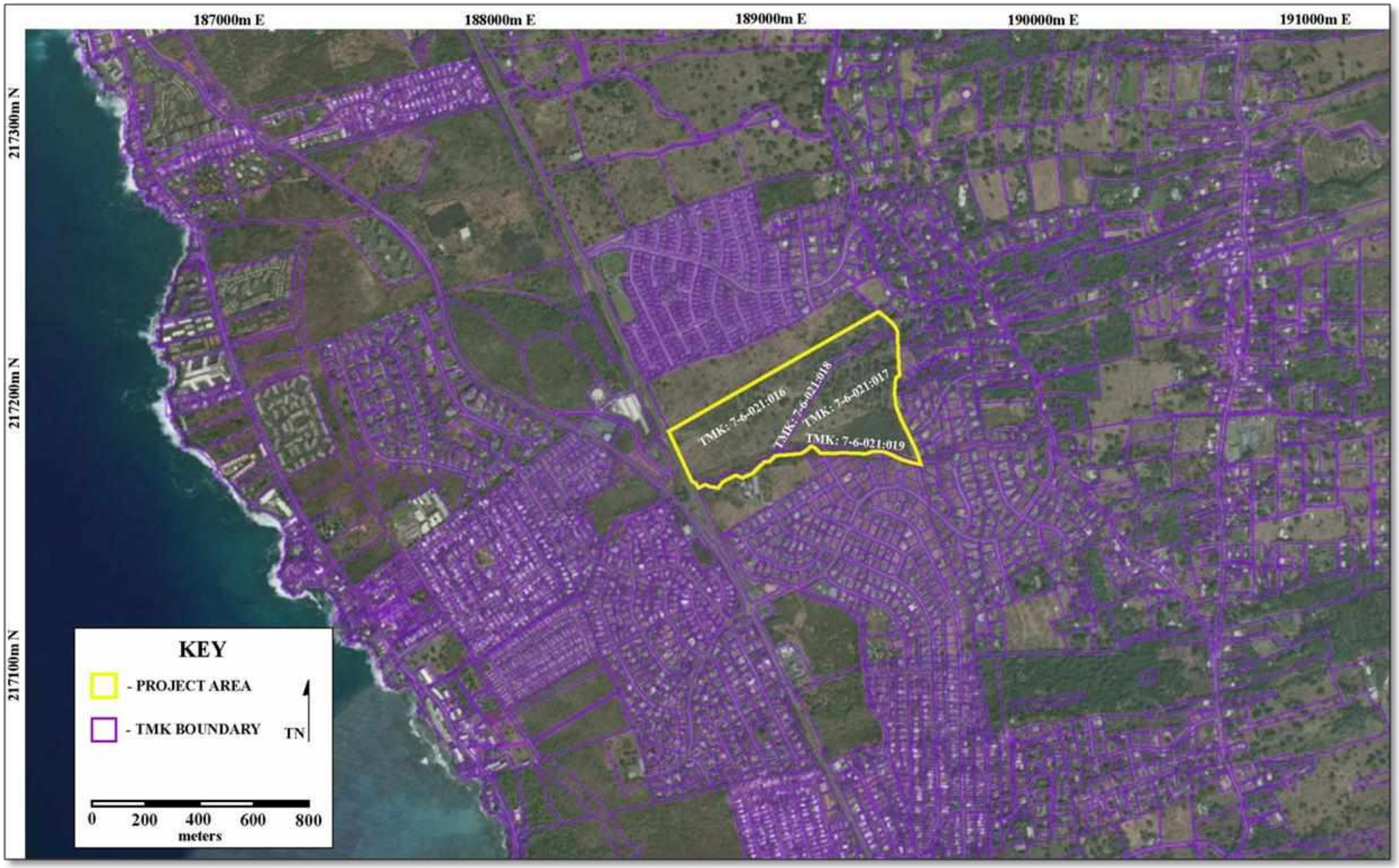

Figure 3: Aerial Photograph Showing Project Area, Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (ESRI, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

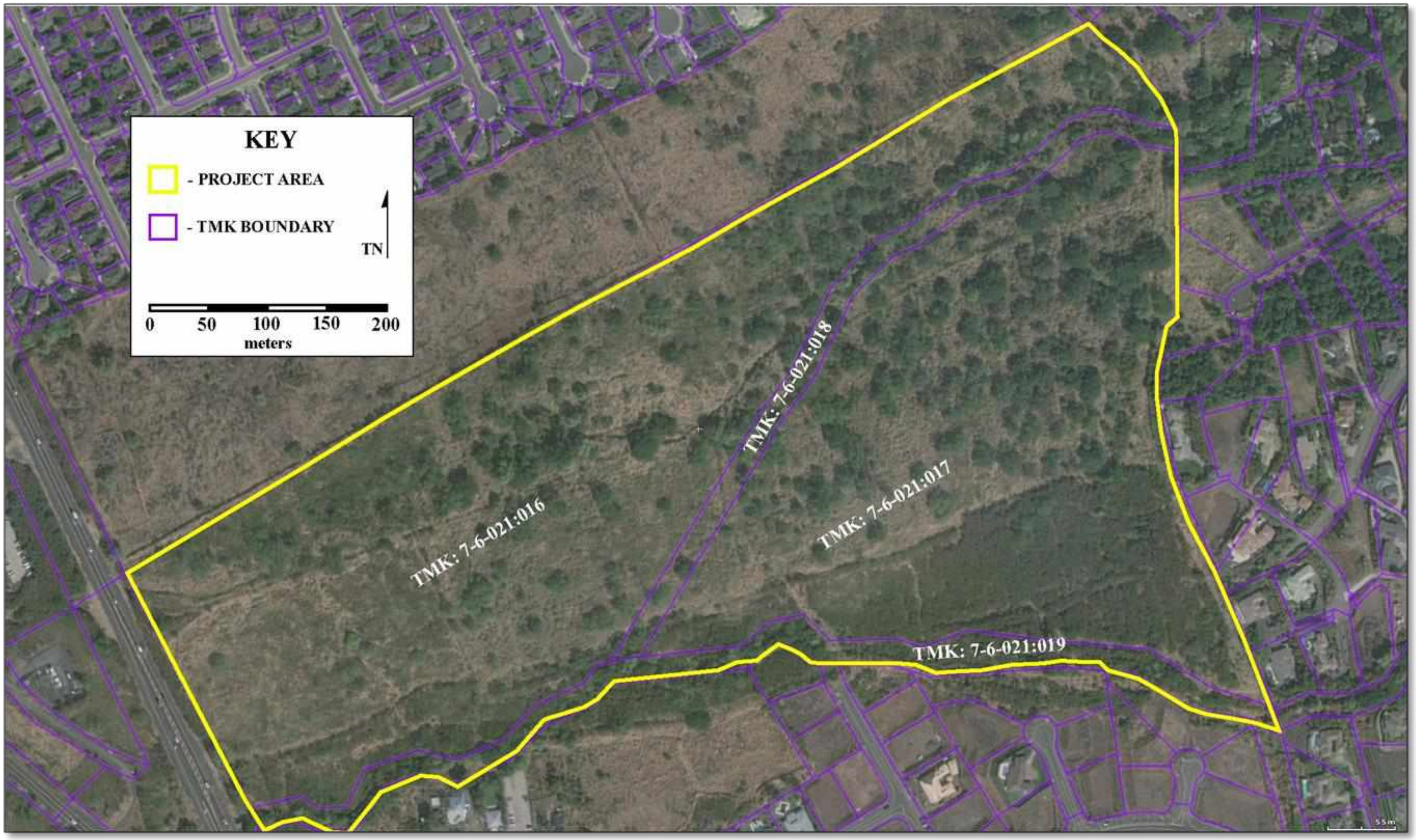

Figure 4: Aerial Photograph Close-Up Showing Project Area, Hōlualoa, HI, Zone 5 North, 189445 m E, 2171790 m N. (ESRI, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

The project area ground surface is a Hualālai lava flow dating between 5,000 and 10,000 years before present (ybp) (Wolfe and Morris 1996). Soil in the project area is Punaluʻu Series (rPYD series) extremely rocky peat with six to twenty percent slopes (Sato 1973:48). The majority of the project area has been bulldozed in the past and the present ground surface is rocky soil.

Rainfall in the project area is very low, less than thirty inches per year. There is a seasonal gulch along the southern edge of the project area. This region is extremely dry, hot, and somewhat barren except for thick California grass (*Urochloa mutica*), Guinea grass (*Megathyrsus maximus*), and some *koa haole* (*Leucaena leucocephala*), *kiawe* (*Prosopis pallida*), and *kukui* nut (*Aleurites moluccana*) trees (Starr Environmental 2016).

HISTORICAL AND CULTURAL CONTEXTS

Kona is divided into two sections: North Kona or *Kona ʻakau*, and; South Kona, or *Kona hema* (Maly 1996). *Kona ʻakau* was further subdivided into north (called *Kekaha*) and south (called *Konakaiʻōpua*) areas, with the division between the two at the *ahupuaʻa* of Keahuolu. The project area is in Hōlualoa 1st Ahupuaʻa (Figure 5) within the area of *Konakaiʻōpua* in *Kona ʻakau*. Hōlualoa means (literally) "long sled course" (Pukui *et al*. 1974:48). Hōlualoa 1st is a traditional *ahupuaʻa* stretching from the ocean to the foot of Hualālai in the uplands. The coastline of Hōlualoa 1st Ahupuaʻa is primarily low rock cliffs.

Very little is recorded of Hōlualoa Ahupuaʻa in traditional oral accounts. *The Heart Stirring Legend of Ka-Miki*, published in the Hawaiian language newspaper *Ka Hoku o Hawaii* and translated by Maly (1993) contains the only description of Hōlualoa. The legend is set in the 13th century but also reflects more recent influences (Maly and Maly 2002: 17).

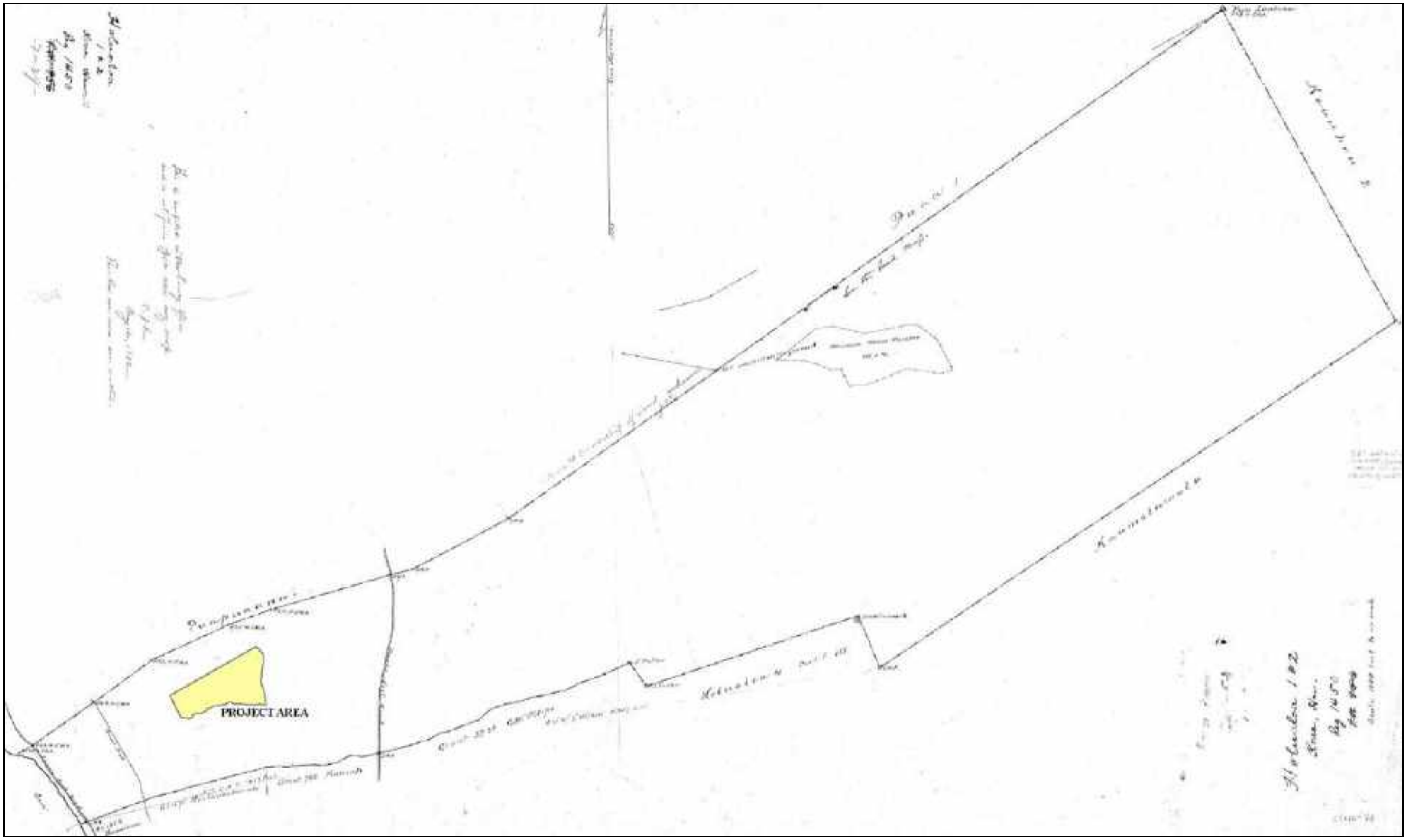

Figure 5: Map of Hōlualoa 1st and 2nd Ahupuaʻa Showing Location of Project Area (Alexander 1855).

According to the narrative,

> The lands of Hōlualoa were named for the chief of that name; both Hōlualoa and Puapuaʻa were high chiefs, who controlled the lands from mountain to sea, which bear their names… Kaluaokalani served as a priest of Hōlualoa at the temple of Pākiha. This *heiau* was near the contest field of Hōlualoa… The lands of this region are named for various *aliʻi*, all of whom were related. When the chief Hōlualoa took up the challenge against Kepakaʻiliʻula on behalf of the Kona chiefs, Hōlualoa called upon his god *Kālaipāhoa* to assist him in his battle… Hōlualoa was the first chief to call upon the god *Kālaipāhoa*, and this was the beginning of this gods' use by the chiefs of Hawaiʻi [Maly 1993:208-209].

PRE-CONTACT ERA

Hōlualoa, Kona, and much of the leeward side of Hawaiʻi Island, while well populated at the time of European Contact, were settled later than the windward side. This in part may be due to the fertile land, numerous streams, and abundant rainfall on the windward side (Maly 1996:3). Many archaeologists believe that Hawaiʻi Island was first settled around A.D. 1,000 by people sailing from the Marquesas (Athens et al. 2014; Dye 2011; Kahn et al. 2014; Kirch 2011; Kirch and McCoy 2007; McCoy 2005 and 2007; Mulrooney et al. 2011; Reith et al. 2011; Wilmhurst et al. 2011a and 2011b).

During early settlement of the leeward side permanent habitations were established in Kona concentrated along the shoreline and lowland slopes (Cordy 1981, 1995; Schilt 1984). Informal fields were cleared at higher elevations where rainfall was higher. Between AD 1200 and 1400, habitation and agriculture expanded across the slopes and coastal area of Hualālai (Burtchard 1995; Cordy 1995). The initial construction of the Kona Field System (KFS) began approximately between AD 1400 and 1600 (Schilt 1984). The development of these extensive formal walled fields coincides with a dramatic population increase and with the development of the stratified chiefdom structure which is reflected through large residential complexes and *heiau* (Burtchard 1995; Cordy 1981; Haun *et al*. 1998; Hommon 1986; Schilt 1984). Thus, there was a need to expand the previously limited agricultural base. The royal centers and larger heiau were in place by AD 1600 to 1800 reflecting the growth in power of the rulers and chiefs in the region (Barrera 1971; Hammatt and Folk 1980). Royal centers were located at Kailua, Hōlualoa, Kahaluʻu, Kealakekua, and Honaunau (Cordy 1995).

The region of Hōlualoa developed into a royal center in the late 1600s to early 1700s under the reigns of Keakamahana (reigned 1680-1700) and Keakealaniwahine (reigned 1700-1720) (Cordy 2000:244). Many *ʻaliʻi* and *konohiki* residences and numerous religious sites are known to have existed here. The majority of the heiau and royal residences were constructed along or near the coast, most notably at Kamoa Point south of the project area. The royal center at Hōlualoa was eclipsed in the second half of the 1700s by the royal center in the Kahaluʻu and Keauhou region.

The Kona Field System

The Kona Field System extends north at least to Kaʻu Ahupuaʻa and south to Honaunau, west from the coastline and east to the forested slopes of Hualālai (Cordy 1995). During his travels in 1823, William Ellis noted the extensive field system divided with "low stone walls, made of fragments of lava", producing "bananas, sweet potatoes, mountain taro, tapa trees, melons and sugar cane" and "flourishing luxuriantly in every direction" (Handy and Handy 1940:114 and 162). Many of the archaeological projects conducted within Kona deal with components of the Kona Field System (Cordy 1995; Newman 1970; Schilt 1984).

The *kula* zone of the Kona Field System is from sea level to 150 m amsl. This zone is associated with habitations along the shoreline and cultivation of sweet potatoes (*uala*), paper mulberry (*wauke*), and gourds (*ipu*). Clearing mounds, planting depressions, planting mounds, planting terraces, and modified outcrops are common agricultural features in the *kula* zone (Hammatt and Clark 1980; Hammatt and Folk 1980; Haun *et al*. 1998; Schilt 1984). Permanent habitation including royal and high chiefly centers as well as non-agricultural activities such as fishing, ceremonies and burial practices were usually concentrated along the shoreline zone portion of the *kula* zone.

The higher elevation zones are the *kaluʻulu zone, ʻapaʻa* zone and the *ʻamaʻu* zone. The current project area is in the *kaluʻulu* zone. This wetter region is above 150 m amsl where bread fruit, sweet potatoes (*Ipomoea batatas*), *ti*, (*Cordyline fruticosa*) *wauke* (*Broussonetia papyrifera*), *taro* (*Colocasia esculenta*), sugar cane (*Saccharum* sp.), and other arboreal crops were grown (Kelly 1983, Menzies 1920). The *ʻapaʻa* zone is above the *kaluʻulu* zone. Hawaiians cultivated melons, sweet potatoes, *ti*, bananas, *taro*, *wauke* and sugar cane in fields with low stone walls. The highest zone, the *ʻamaʻu* zone, was used to grow bananas and plantains in walled fields. The *ʻapaʻa* zone and the *ʻamaʻu* zone were also used to collect timber and catch birds therefore temporary habitations were constructed.

POST-CONTACT ERA

During the post-contact era, the Kona Field System was exploited and the planting of coffee, sugar, sisal, citrus, and cotton took over original Hawaiian crops until eventually the land was used for cattle pasture. The first cattle and sheep were brought to the island by Vancouver in 1793 and 1794 (Vancouver 1967). Horses, mules, oxen, goats, and donkeys were brought shortly after. Feral cattle, sheep, and goats overran agricultural fields by 1813 to 1815 (Ellis 1963: 291; Wilkes 1970: 204). By 1848, in the Kona District, a Great Wall (the Kuakini Wall) was constructed from Lanihau to ʻŌnouli to keep them away from homes and agricultural areas (Maly and Maly 2001:286). Formal cattle ranching began in the Kona region in the mid-1800s.

The Kona landscape evolved rapidly with the turn of the century. The rapid growth of the sugar industry produced the Kona Sugar Company in 1899. A railroad was built in 1901 to help sustain this influx in produce. It was later used to haul lumber and freight along with the sugarcane. The rail line was seven miles long and extended from Hōlualoa to Keōpuka (Figure 6). Cotton, tobacco, and sisal were grown in the dryer lands below the railroad (Kelly 1983).

The changing subsistence and trade regimes developed by incoming European and American settlers, as well as other historical factors, caused a depopulation of the coastal areas of Kona. Ranches were established at middle and upper elevations, and farms were established in the uplands where rainfall was higher and the temperatures were cooler. Cattle ranching and clearing for sugar cane and coffee removed many of the endemic species of plants. The suite of vegetation that existed prior to the pre-Contact era were replaced by *koa haole* (*Leucaena leucocephala*), *kiawe* (*Prosopis pallida*), and other newly introduced invasive plant species.

Figure 6: Portion of 15-Minute Series USGS Topographic Map Showing Location of Railroad and Project Area (USGS 1928).

Schools, churches, stores, and other businesses were also established in the uplands. During the late 1800s and early 1900s, coastal Kona was no longer the densely populated sociopolitical center it once was. It became a small cluster of houses along the trail from Kailua Bay to Keauhou (Tomonari-Tuggle 1993:15). Homesteads, ranches, and plantations developed in the uplands during this period as reflected in the pattern of Land Commission Awards (LCA) and Land Grants (LG) recorded during the Māhele (Escott and Escott 2018).

The project area is just *makai* (west) of most of the land commission awards and is at the same elevation as portions of the land grants in the region. Based on historic documents, the project area and surrounding lands were likely being used for subsistence and commercial agriculture, as well as for cattle pasture from the mid to late 1800s. The project area might have been used later than surrounding lands because of its steep slopes and very rocky soil, but based on aerial photographs, the project area was bulldozed sometime around the 1950s in preparation for commercial agriculture.

THE MĀHELE

The Land Commission awarded the majority of Hōlualoa 1st and 2nd Ahupuaʻa to Victoria Kamāmalu Kaʻahumanu IV, *Kuhina Nui* of Hawaiʻi Island and Crown Princess of Hawaiʻi as Land Commission Award (LCA) Number 7713, ʻApana 43 (Figure 7). Several smaller LCA and LG properties were also recorded in the upland region of Hōlualoa 1st and 2nd Ahupuaʻa (Figure 8). Twenty four Land Commission awards were recorded in Hōlualoa 1st Ahupuaʻa, the ahupuaʻa where the project area is located (Table 1).

A portion of LCA #3660 to John G. Munn makes up a thin strip of land located through the center of the current project area. With the notable exception of LCA #3660 and a few other large LCAs, the average award was 2.8 acres, most (n=16) were for less than 3.0 acres. Three Land Grants (LG #1592, 1602, and 3630) were also recorded in Hōlualoa 1st and 2nd Ahupuaʻa. LG #1592 was a 25.0-acre parcel sold to Kealalio and LG #3630 was a 38.2-acre parcel sold to W.H. Cromwell. Almost all of the awards and grants were used as subsistence and commercial farm land, and some were used to pasture cattle (Escott and Escott 2018).

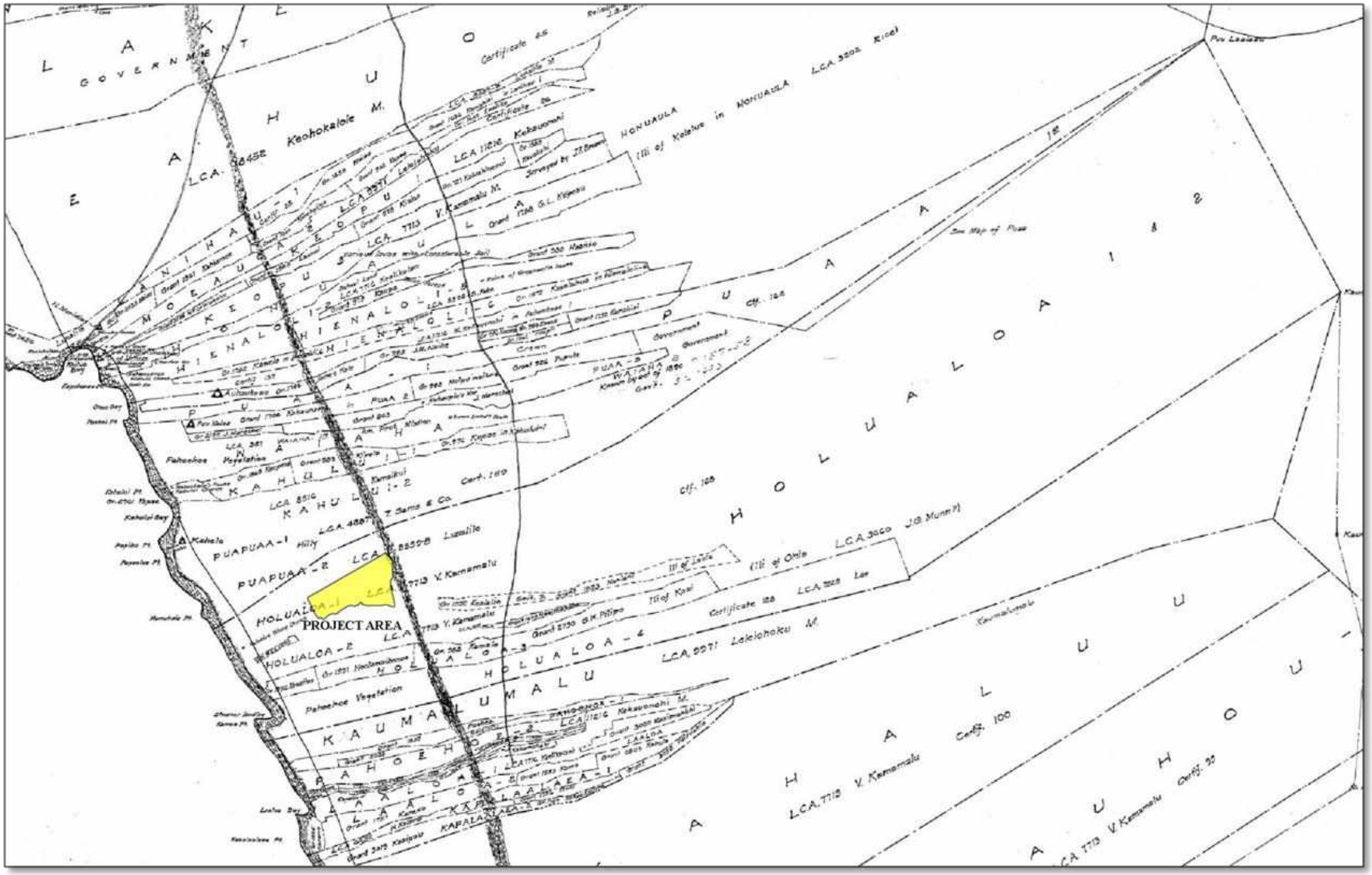

Figure 7: Portion of Kailua Section, North Kona Map Showing Location of LCA 7713 and Project Area (Aki 1952).

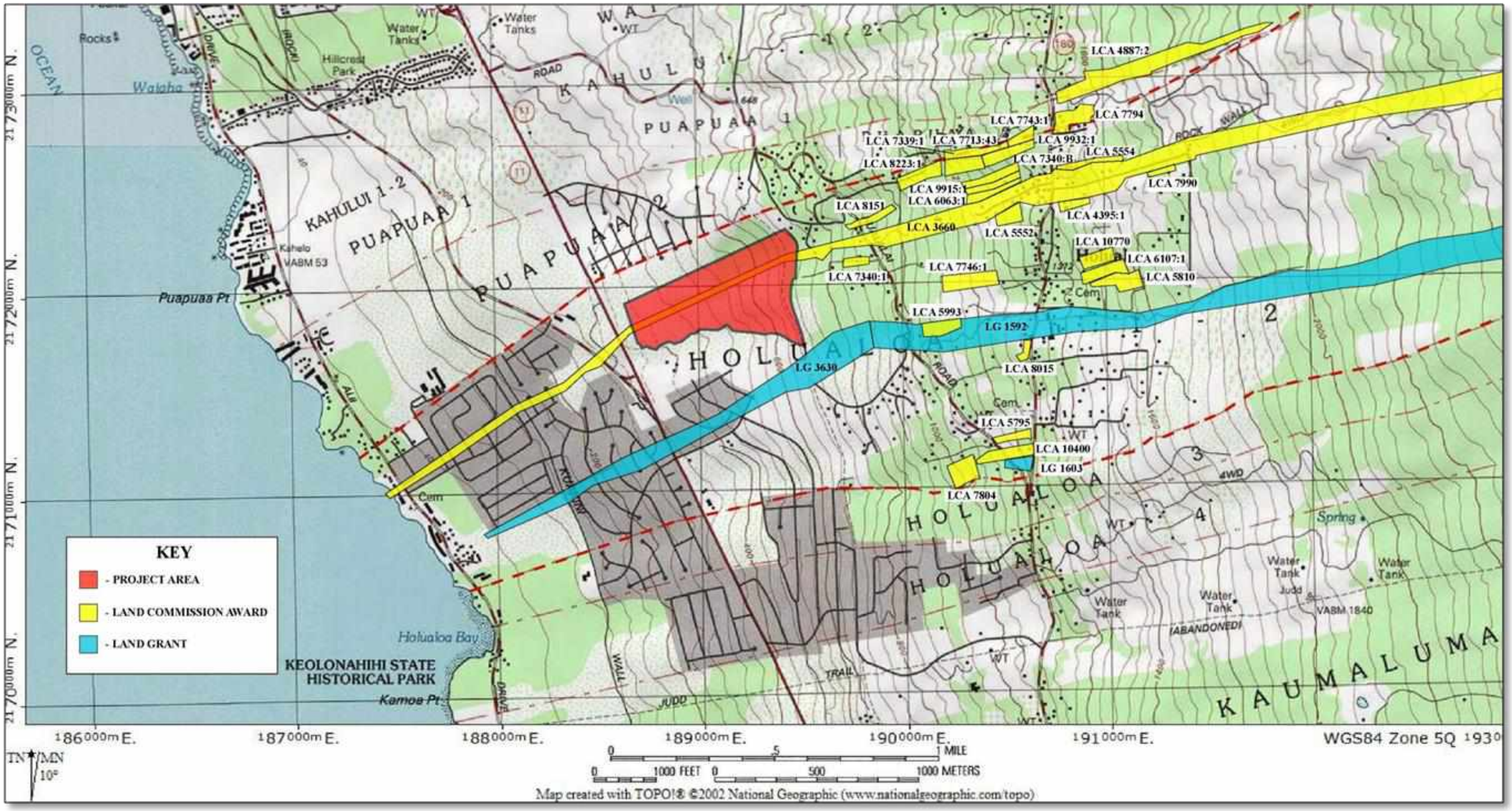

Figure 8: 7.5-Minute Series USGS Topographic Map Showing Location of Land Commission Awards, Land Grants, and the Project Area (National Geographic Topo!, 2003, Kailua Quad. Data Sources: National Geographic Society, USGS).

Table 1: Land Commission Awards Recorded in Hōlualoa 1st and 2nd Ahupua‘a.

LCA#	AWARDED TO	AHUPUA‘A	ACRES
3660	John G. Munn	Hōlualoa 1st	111.5
4395	Kekoi	Hōlualoa 1st	1.7
5552	Kauila	Hōlualoa 1st	1.9
5554	Keawekolohe	Hōlualoa 1st	11.27
5795	Keliikanakaole	Hōlualoa 2nd	2.2
5810	Kaopukauila	Hōlualoa 1st	1.74
5993	Leipalapala	Hōlualoa 2nd	2.0
6063	Hāna	Hōlualoa 1st	2.9
6107	Naai	Hōlualoa 1st	3.94
7339	Kuaana	Hōlualoa 1st	4.15
7340	Kama 2	Hōlualoa 1st	2.5
7340:B	Kama 1	Hōlualoa 1st	1.3
7443	Kalimapaa	Hōlualoa 1st	1.94
7713	Kamamalu	Hōlualoa 1st & Hōlualoa 2nd	Large
7746	Kamahalo	Hōlualoa 1st	5.0
7794	Kauakini	Hōlualoa 1st	1.8
7990	Pupuka	Hōlualoa 1st	1.1
8015	Aipo	Hōlualoa 2nd	1.4
8151	Hehena	Hōlualoa 1st	2.3
8223	Ikaiaka	Hōlualoa 1st	3.5
9915	Limahana	Hōlualoa 1st	2.42
9932	Lumaawe	Hōlualoa 1st	2.98
10770	Puuone	Hōlualoa 1st	3.06
10400	Naaimakaohi	Hōlualoa 1st & Hōlualoa 2nd	3.5

PREVIOUS ARCHAEOLOGICAL STUDIES

There are at least 26 previous archaeological reports for lands near the current project area, including studies in Puapua‘a 2nd and Hōlualoa 1st, 2nd, and 3rd Ahupua‘a (Table 2 and Figure 9). The studies were conducted from the coast to roughly 1,460 ft amsl and encompass the *kula* region (0-500 ft), the *kalu‘ulu* region (500-1,000 ft), and the lower portions of the *‘āpa‘a* region (1,000-2,500 ft). Results of the previous archaeological studies are summarized below by elevation: studies numbered 1 through 15 in Table 2 and Figure 9 are situated from the coast to Queen Ka‘ahumanu Highway (0-360 ft amsl), studies 16 through 21 are located from above the Queen Ka‘ahumanu Highway to just below Hualālai Road (306-760 ft amsl), and studies 22 through 24 are above Hualālai Road to just above Māmalahoa Highway (1,100-1,460 ft amsl).

Table 2: Inventory of Previous Archaeological Investigations.

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
1	Landrum et al. 1990	Archaeological Inventory Survey	N/A	46 Sites
1	Calis et al. 2004	Archaeological Data Recovery	N/A	10 Sites
2	Carlson & Rosendahl 1990	Archaeological Inventory Survey	65	64 Sites
3	Haun et al. 1998	Archaeological Inventory Survey	15	31 Sites
4	Hammatt & Folk 1981	Archaeological Survey	20	20 Sites
4	Hammatt et al. 1986	Archaeological Survey & Excavations	20	21 Sites
5	Haun & Henry 2001	Archaeological Data Recovery	1.59	1 Site
6	Escott 2013	Archaeological Inventory Survey	1.962	2 Sites
7	Sinoto 1979	Archaeological Reconnaissance Survey	6	Rock Walls
8	Hammatt 1979b	Archaeological Survey	22	3 Sites
9	Hammatt 1979c	Archaeological Survey	23	39 Sites
10	Conolly & Gunness 1979	Archaeological Reconnaissance Survey	46.8	80 Sites
10	Hammatt 1979a	Archaeological Inventory Survey	46.8	11 Sites
10	Hammatt 1980	Archaeological Survey & Excavation	103	88 Sites
11	Nelson et al. 205	Archaeological Inventory Survey	28	22 Sites
12	Rosendhal 1978	Archaeological Reconnaissance Survey	2.5	1 Site

Project Number (Figure 8)	Reference	Type of Study	Area in Acres	Results
12	Soehren 1980a	Archaeological Reconnaissance Survey	n/a	7 Sites
12	Wolforth et al. 2000	Archaeological Inventory Survey	8	7 Sites
13	Barrera 1995	Archaeological Reconnaissance Survey	17	3 + several ag. mounds
13	Haun & Henry 2000	Archaeological Inventory Survey	17	12 (104 Features, 82 of Which Were Agricultural)
14	Rosendahl 1989	Archaeological Field Inspection	6	Modified Outcrops
15	Schilt 1984	Archaeological Study	17	134 Sites
16	Walker & Rosendahl 1988	Archaeological Reconnaissance Survey	104	67 Sites
16	Graves & Goodfellow 1993	Archaeological Data Recovery	104	58 Sites
16	Maly & Rosendahl 2006	Archaeological Preservation Plan	104	67 Sites
17	Hammatt et al. 1992	Archaeological Survey	174	71 Sites
18	Soehren 1980b	Archaeological Reconnaissance Survey	16	1 Site
19	Rechtman 2006	Archaeological Inventory Survey	1.008	2 Sites
20	Rosendahl 1988	Archaeological Reconnaissance Survey	17	17 Sites
20	Fager & Graves 1993	Archaeological Inventory Survey	17	17 Sites
21	Dircks et al. 2013	Archaeological Inventory Survey	10.266	1 Site (149 Historic to Modern Farming Features)
22	Desilets et al. 2004	Archaeological Inventory Survey	11.7	1 Homestead Features
23	Rechtman 2013		29	24 Sites
24	Clark & Rechtman 2006	Archaeological Inventory Survey	2.7	6 Historic Era Sites
25	Escott & Escott 2018	Archaeological Inventory Survey	5.0	22 Pre-Contact and Historic Era Sites
26	Escott & Escott 2020	Archaeological Inventory Survey	73.122	18 Pre-Contact and Historic Era Sites 1 Isolated Find (Petroglyph)

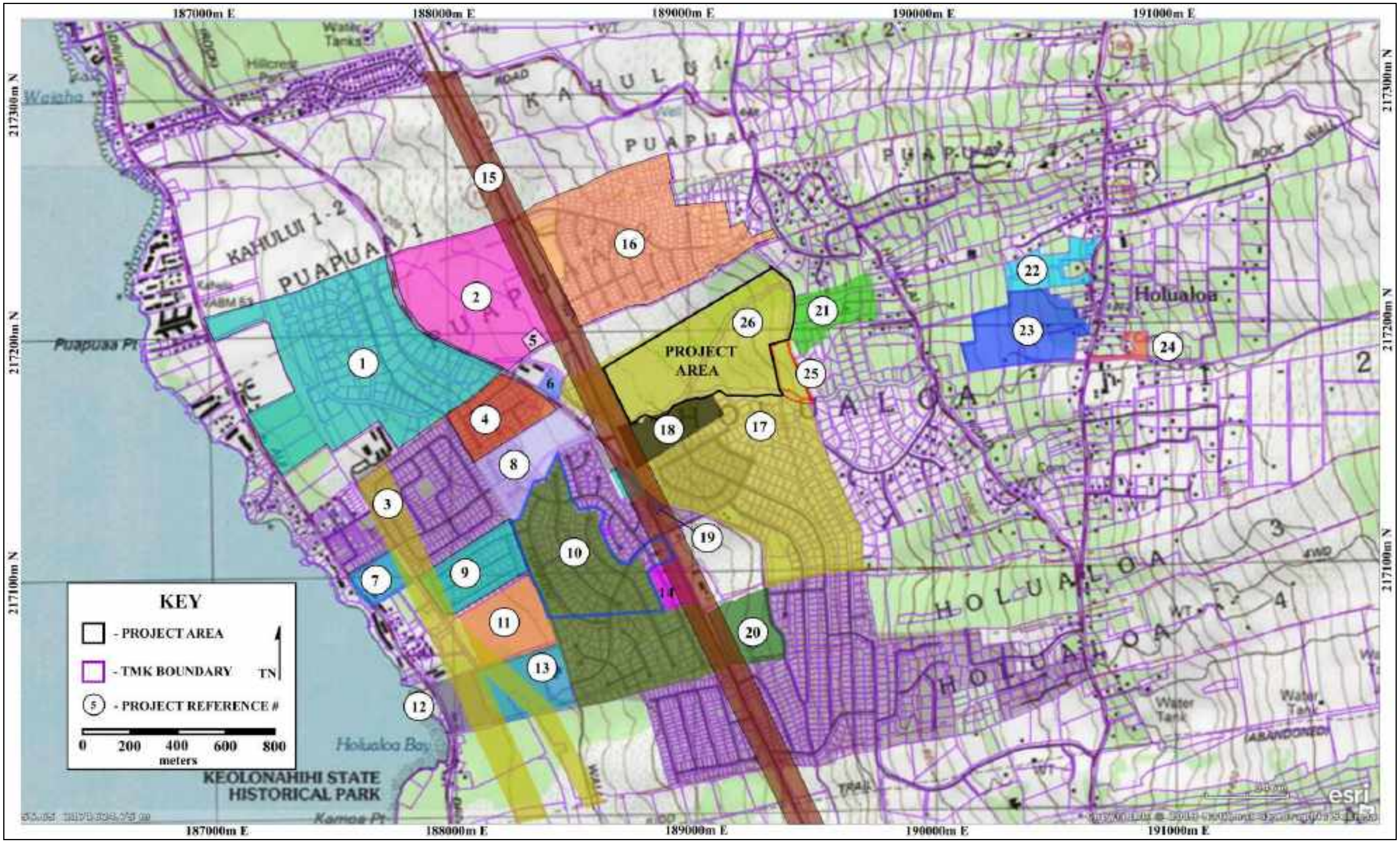

Figure 9: 7.5-Minute Series USGS Topographic Map Showing Location of Previous Archaeological Studies and Project Area (Kealakekua Quad, ESRI, 2013. Data Sources: National Geographic Society, USGS).

REGIONAL PREVIOUS ARCHAEOLOGICAL STUDIES

1. Landrum et al. 1990, and Calis et al. 2004. PHRI, Inc. conducted an archaeological inventory survey (Landrum et al. 1990) and SCS, Inc. conducted data recovery investigations (Calis et al. 2004) at the Kahakai development project. The project area is located within the lower elevations of Puapuaʻa 2nd Ahupuaʻa. Pre-Contact era to early post-Contact era cave shelters, agricultural rock clearing mounds, burials, shrines, and a possible heiau were identified during the AIS study. A heiau complex, several burials, and five permanent habitation sites were recommended for preservation. All of the preservation sites are near the coast.

2. Carleson and Rosendahl 1990. PHRI, Inc. conducted an archaeological inventory survey of 65 acres between Kuakini and Queen Kaʻahumanu highways in Puapuaʻa 2nd Ahupuaʻa. Their study recorded 64 archaeological sites including pre-Contact era habitation, agricultural, and burial sites. Seven sites were assessed as significant and recommended for preservation (Carleson and Rosendahl 1990: 34).

3. Haun et al. 1998. PHRI, Inc. conducted an archaeological inventory survey of the proposed Aliʻi Drive corridor through several ahupuaʻa. Numerous pre-Contact era site complexes were recorded in Puapuaʻa 2nd and Hōlualoa 1st through 4th Ahupuaʻa. The site complexes included a large number of agricultural features, as well as habitation, burial, and ceremonial features.

4. Hammatt and Folk 1981, and Hammatt et al. 1986. Two archaeological surveys were conducted on a 20-acre parcel of below Kuakini Highway. The first study recorded 20 sites, and the second recorded 21 sites. None of the sites were recommended for preservation (Hammatt and Folk 1981: ii, and Hammatt et al. 1986: 87). The report also recommended that the single documented burial be relocated.

5. Haun & Henry 2001. Haun and Associates conducted an archaeological data recovery study at a c-shaped enclosure located on 1.59 acres of land below Queen Kaʻahumanu Highway

6. Escott 2013. SCS conducted an archaeological study on1.962 acres of land near the intersection of Kuakini and Queen Kaʻahumanu highways. Two historic era ranch walls were recorded during the study.

7. Sinoto 1979. Aki Sinoto recorded several Historic era ranch rock walls on a six acre parcel of land just mauka of Ali‘i Drive.

8. Hammatt 1979b. The Archaeological Research Center, Inc. conducted an archaeological survey of 22 acres just south of Kuakini Highway. Three archaeological sites were recorded during the study. None of the sites were recommended for preservation (Hammatt 1979b: ii, and 10).

9. Hammatt 1979c. The Archaeological Research Center, Inc. conducted an archaeological survey of 23 acres located in the near coastal portion of Hōlualoa 1st and 2nd Ahupua‘a. Thirty nine archaeological sites were recorded during the study. The report recommended that all burials, including a known cemetery site be relocated (Hammatt 1979a: 5). None of the remaining sites (pre-Contact era habitation and agriculture sites) were recommended for preservation in place.

10. Conolly and Gunness 1979, and Hammatt 1979a and 1980. The Archaeological Research Center, Inc. conducted an archaeological survey of 103 acres within the near coastal portions of Hōlualoa 1st through 4th Ahupua‘a (Hammatt 1980). One hundred and thirty six archaeological sites were recorded on the project area. They included pre-Contact era habitation, agriculture, burial, and a ceremonial sites. The Hammatt report recommended that a heiau (Site 6661) was significant and should be preserved in place (Hammatt 1980: 4). The report also recommended that the single documented burial be relocated to the perimeter of heiau (Site 6661) and preserved. No other sites were recommended for preservation.

11. Nelson et al. 2005. An archaeological inventory survey was conducted by Rechtman Consulting on 28.0 acres located in the near coastal portion of Hōlualoa 2nd Ahupua‘a. A total of 22 sites containing 150 features were recorded. The sites were primarily pre-Contact era agricultural and habitation sites, though five burial sites, a possible heiau, and a trail were also documented within the project area.

12. Rosendahl 1978, Soehren 1980a, Wolforth et al. 2000. PHRI conducted an archaeological inventory survey of eight acres of coastal Hōlualoa 3rd Ahupua‘a and recorded seven archaeological sites including three Historic era rock walls, three residential sites, and Hikapaia Heiau.

13. Barrera 1995, Haun & Henry 2000. Barrera (1995) recorded a possible burial platform, two habitation site, agricultural rock clearing mounds and modified outcrops during a reconnaissance survey of 17 acres in near coastal Hōlualoa 2nd Ahupuaʻa. Haun and Associates conducted an archaeological inventory survey of the property and recorded 12 sites with 104 features (Haun and Henry 2000:14). The majority of features (n=82) were pre-Contact era agricultural rock clearing mounds. Eleven permanent habitation and one temporary habitation feature were also recorded during the study.

14. Rosendahl 1989. PHRI conducted an archaeological field inspection of 6.0 acres of land just below Queen Kaʻahumanu Highway in Hōlualoa 2nd Ahupuaʻa. Several modified outcrops were recorded in the letter report. There were no other archaeological features identified on the project area.

15. Schilt 1984. The Bishop Museum conducted an archaeological study of the Kuakini Highway Realignment Project located roughly along present day Queen Kaʻahumanu Highway and recorded 39 sites Puapuaʻa 2nd and Hōlualoa 1st and 2nd Ahupuaʻa. Twenty two of the sites were pre-Contact to early post-Contact era agricultural gardens and modified outcrops (rock clearing). There were also traditional habitation platforms and trails, as well as Historic era roads and walls recorded during the study.

16. Walker and Rosendahl 1988, Graves and Goodfellow 1993, and Maly and Rosendahl 2006. An archaeological reconnaissance survey (Walker and Rosendahl 1988), an archaeological data recovery study (Graves and Goodfellow 1993), and an archaeological preservation plan (Maly and Rosendahl 2006) were conducted by PHRI, Inc. for 104 acres in the upland region of Puapuaʻa 2nd Ahupuaʻa. A total of 67 sites were documented within the project area, including traditional (KFS) sites, temporary habitation sites, three burials, and a *heiau*. The archaeological preservation plan recommended that the three burials be relocated to the *heiau* site, and that the *heiau* be preserved as a formal historic preservation area (Maly and Rosendahl 2006).

17. Hammatt et al. 1992. An archaeological survey was conducted by Cultural Surveys Hawaiʻi on 174 acres of land in the upland region of Hōlualoa 1st, 2nd, and 3rd Ahupuaʻa. The project area lands had been heavily bulldozed during the modern era for ranching and agricultural purposes. Despite the bulldozing, seventy one sites were recorded during the study, including temporary habitation features, rock walls, agricultural features, and

three burial sites. Many of the sites were determined to be associated with Historic era ranching and agriculture.

18. Soehren 1980b. Soehren conducted an archaeological reconnaissance survey of 16.0 acres above Queen Kaʻahumanu Highway in the inland region of Hōlualoa 1st Ahupuaʻa (Soehren 1980b). A single enclosure was identified during the survey.

19. Rechtman 2006. An archaeological inventory survey was conducted by Rechtman Consulting, LLC on a roughly one-acre parcel located *makai* of Queen Kaʻahumanu Highway in Hōlualoa 2nd Ahupuaʻa. Two rock walls were recorded on the project area. The report recommended no further work at the wall sites.

20. M. Rosendahl 1988, Fager & Graves 1993. Fager and Graves (1993) conducted an archaeological inventory survey of 17.0 acres just mauka of Queen Kaʻahumanu Highway in Hōlualoa 3rd Ahupuaʻa. Seventeen sites containing 27 pre-Contact to early post-Contact era agricultural features, including rock mounds, modified outcrops, C-shaped enclosures, terraces, walls, and rock enclosures, were recorded.

21. Dircks et al. 2013. Rechtman Consulting conducted an archaeological inventory survey of 10.266 acres of land located between 840 and 920 ft amsl in Hōlualoa 1st and 2nd Ahupuaʻa. One Historic era to modern era homestead/agriculture site (Miyose Farm) containing 149 features was recorded during the survey.

22. Desilets et al. 2004. Desilets et al. (2004) conducted an archaeological inventory survey of 11.7 acres of land in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. A single site associated with Historic era and modern era homesteads, commercial agriculture (coffee), and ranching was recorded. Features included rock walls, roads, coffee terraces, and buildings.

23. Rechtman 2013. Rechtman Consulting conducted and archaeological inventory survey of 29 acres of land located in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. Twenty four sites were recorded. The majority of the sites were associated with Historic era and modern era homesteads, commercial agriculture. Features included rock walls, roads, and remnants of structures. A single pre-Contact era to early post-Contact era residential and agricultural site was also recorded.

24. Clark & Rechtman 2006. Rechtman Consulting conducted an archaeological inventory survey of 2.7 acres of land located in the *ʻāpaʻa* region of Hōlualoa 1st Ahupuaʻa. Six sites were recorded, including five ranch walls and an area of coffee terraces.

A number of conclusions can be made from the previous archaeological studies. A primary conclusion is that the majority of habitation features, especially permanent habitation features, are located from the coast to about 360 ft amsl, below the present day Queen Kaʻahumanu Highway. The same is true of ceremonial features, burials, and, to a lesser extent, agricultural features. The density of agricultural features and habitation features, mostly temporary habitation features, in the upland regions between 360 ft amsl and 700 ft amsl is much lower than the site density in the coastal *kula* and lower *kaluʻulu* regions of the KFS. The pre-Contact traditional Hawaiian settlement and agricultural patterns are strongly oriented to the *kula* and lower *kaluʻulu* regions.

Even though cattle ranching and commercial agriculture may have removed some archaeological sites from the ground surface in the *kaluʻulu* region, there appear to be fewer sites than at lower elevations. The majority of sites in the *kaluʻulu* region are KFS agricultural sites including rock clearing mounds, modified outcrops, garden enclosures, and low garden walls. Within the lands of the current project, it is clear that ranching and commercial agricultural practices have removed and damaged many of the pre-Contact era sites from the ground surface (see the Hammatt et al. 1992 summary below). Moreover, many of the sites identified near the current project area are associated with Historic era ranching and commercial agriculture.

A second conclusion is that the establishment of Historic era homesteads, ranches, and commercial agriculture seems to have removed, or obscured, the majority of pre-Contact era sites in the upper *kaluʻulu* and lower *ʻāpaʻa* regions. It might be that pre-Contact uses in these regions did not involve the construction of large or permanent features, as in the lower regions of Kona. It is also likely that Historic era ranching and commercial agriculture in the lower *ʻāpaʻa* region have caused large scale land alterations through the use of bulldozers for pasture and garden. It is possible that traditional features were disassembled to build rock walls and coffee terraces.

CURRENT PROJECT AREA SPECIFIC PREVIOUS ARCHAEOLOGY

26. Hammatt et al. 1992. Lands of the current AIS study were subject to an AIS study conducted by Hammatt et al. (1992). That study encompassed 66.039 acres of land within the current project area located between 320 to 690 feet (98 to 210 meters) amsl [TMK: (3) 7-6-021:016 and 017] (see Figure 9, Project #17). The current project area is located within the northern portion of the Hammatt et al. (1992) project area.

Twenty one archaeological sites and two areas of bulldozed modern planting "terraces" were recorded in the AIS report (Figure 10 and Table 3). Eight of the 21 archaeological sites (SIHP #50-10-37-10015, #50-10-37-10017, #50-10-37-10018, #50-10-37-10020, #50-10-37-10031, #50-10-37-10033, #50-10-37-10034, and #50-10-37-10049, hereafter abbreviated to the last five digits) were recorded by CSH in tabular format only. Written descriptions of the remaining 13 sites are in the CSH AIS report. Excavations were conducted at ten of the 13 sites. The AIS report included plan view figures for four of the 13 sites. At the request of SHPD, additional site documentation for Sites 10011, 10012, 10031, 10049, and 10071 was submitted to SHPD in a letter report (Hammatt and Shideler 2007).

Six of the sites were determined to be pre-Contact era, four associated with habitation, one with agriculture, and one single feature site (Site 10012) contained two burials. Fifteen of the sites were determined to be Historic era sites, the majority associated with coffee agriculture and cattle ranching. Two Historic era habitation sites were also documented in the AIS study.

The burials at Site 10012 were removed and reinterred off-project prior to 1983. The site was further excavated to ensure that all *iwi* had been removed. The site was then back-filled and leveled by bulldozer.

The AIS recommended no further work at all 21 sites documented in the current project area. The Hammatt and Shideler (2007) letter report repeated the AIS recommendation that "all surface sites in the area were documented" in the AIS report and that "significant material from the study area has been recovered and that further investigation would be of minimum productivity" (Hammatt and Shideler 2007:11). However, the authors recommended that the sites should be located to document their current conditions and to document the sites to prevailing SHPD AIS standards.

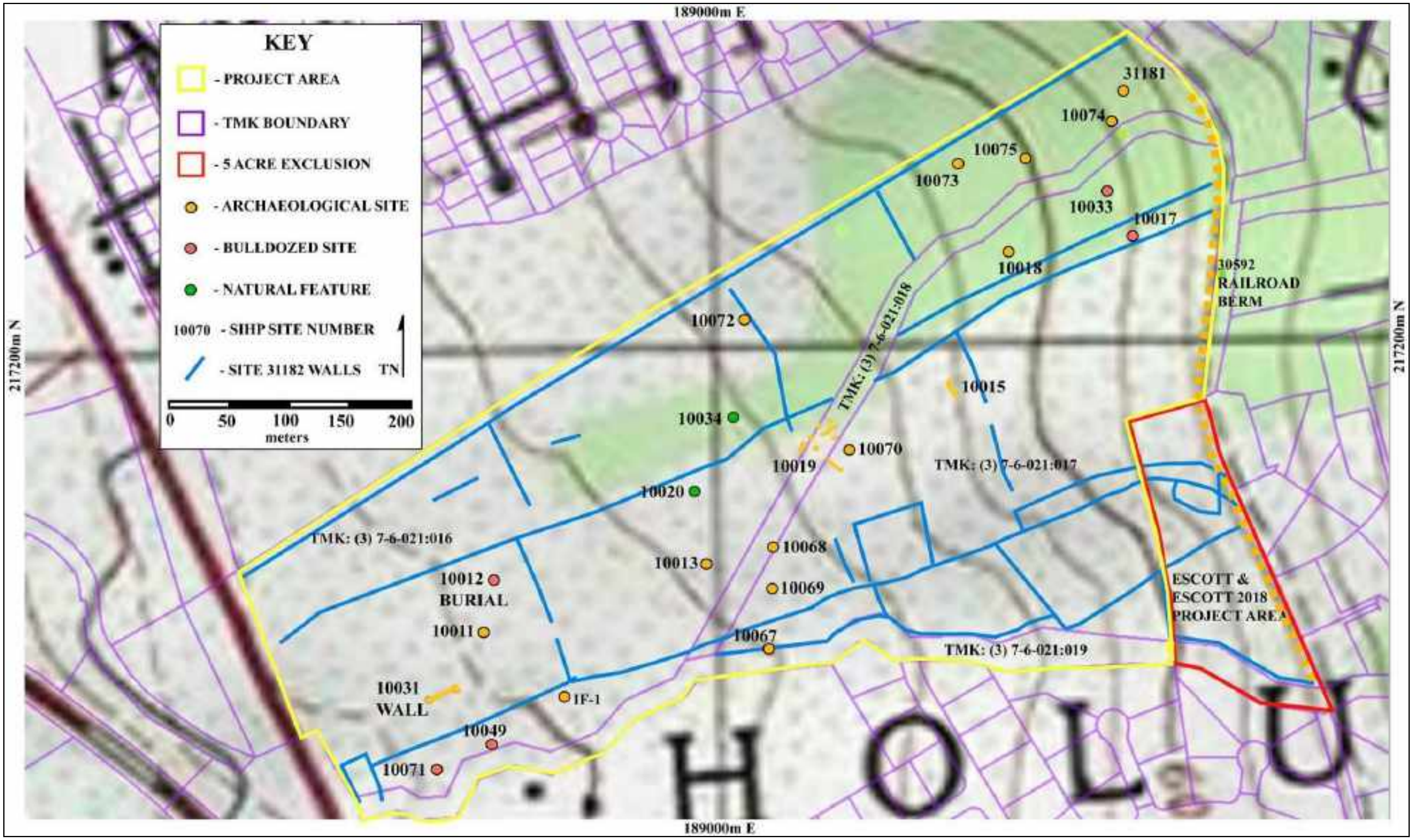

Figure 10: 7.5-Minute Series USGS Topographic Map Showing Location of Northern Portion of Hammatt et al. (1992) Sites and Current Project Area (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

Table 3: Inventory of Previously Recorded Archaeological Sites (Hammatt et al. 1992; Hammatt and Shideler 2007).

SIHP #	CSH SITE#	TYPE	FUNCTION	AGE	EXCAVATION	CULTURAL MATERIAL
10011	9	Platform	Ag. Clearing	Prehistoric	1.5 m long trench	3 cowrie shells
10012	10	Platform & Wall	Burial	Prehistoric	Entire Feature	Burial reinterred off-project
10013	11	Enclosure & Lava Tube	Habitation	Prehistoric	4.5 m square total	Fire features & Prehistoric artifacts
10015	13	Terrace	Road Bed	Historic		
10017	15	Platform	Cattle Ramp	Historic		
10018	16	Enclosure	Habitation	Historic		
10019	17	6 Rock Mounds	Ag. Clearing	Historic	3 1.0 m wide trenches	Metal File
10020	18	Platform	Ag. Clearing	Historic		
10031	110	Enclosure Wall	Agriculture	Historic		
10033	112	Planting Complex	Coffee Ag	Historic		
10034	113	Platform	Ag. Clearing	Historic		
10049	216	Terraces	Agriculture	Historic		
10067	232	Terraces	Habitation	Prehistoric	1.0 X 1.0 m	VG & a small amount of midden & fire feature
10068	233	Enclosure	Habitation	Prehistoric	0.5 X 0.25 m	small amount of midden
10069	234	Modified Bluff/Platform	Habitation	Historic	0.5 X 0.5 m	VG & a small amount of midden
10070	235	U-Shape Enclosure	Agriculture	Historic	1.0 X 0.5 m	No artifacts
10071	237	Platform	Habitation	Prehistoric		
10072	238	Modified Bluff	Ag. Clearing	Historic	7.0 m square total	No arts Small amount of MS in TU-2
10073	239	Platforms	Ranching/Ag.	Historic		
10074	240	Enclosure	Coffee Work Shed	Historic	1.25 m square total	1 VG, little MS, historic artifacts
10075	241	Enclosure	Pig Pen	Historic		

In a letter to the County of Hawaiʻi Department of Planning dated July 30, 2018, (Log. No. 2018.00878 Doc. No. 1807SN01), SHPD requested a new pedestrian survey to identify all archaeological historic properties present on the project area, and to update previous archaeological documentation to include site plans for each site with site boundaries and areas impacted by bulldozing, photographs of all sites and features, an assessment of their integrity, and site significance.

25. Escott & Escott 2018. SCS conducted an archaeological inventory survey on a 5.0-acre portion of Parcel 017 in the southeast portion of the current project area (Escott and Escott 2018) and recorded twenty-two new archaeological sites within the project area (Table 4 and Figure 11). Fifteen of the sites are single-feature sites. The remaining seven agricultural sites contained two to seven features. A majority of the sites are agricultural terraces and complexes dating to the pre-Contact era to the Historic era. The agricultural complexes are located in the lower *kaluʻulu* zone, between 600 and 700 feet (182 to 213 meters) amsl.

Three of the ranch walls (Site 30595, 30601, and 3065) are the primary dividers of the five-acre project area. These Historic era walls have typical characteristics of ranch walls including cobble core fill and bi-faced inward sloping walls toward the top. They are approximately 1.0 meter tall. Site 30602 and Site 30603 are Historic era ranching and agricultural enclosures constructed along wall Site 30595 and wall Site 30601. These two wall sites are constructed onto the west edge of the Site 30592 railroad berm and post-date the railroad berm.

The northern third of the project area only has two sites (Site 30591 and 30956). Site 30591 is an agricultural complex with six terraces. Portions of the sites were bulldozed in the early Modern era. Both sites date to pre-Contact to early Historic era. The terraces reflect Kona Field System features but are roughly constructed that more closely resemble Historic era commercial agriculture. Site 30956 is a rectangular Historic style hearth.

The middle one third of the project area between wall sites 30595 and 30605 is within the bulldozed "terraces" portion of the project area. Site 30593 is a pre-Contact era to early post-Contact era lava tube burial. The burial will be preserved in place in accordance with a Burial Site Component of a Preservation Plan. Site 30594 is an agricultural terrace complex that resembles the Kona Field System but is more roughly constructed. Artifacts recovered from subsurface testing at Site 30604 suggest it is a Historic era agricultural terrace.

The southern third of the project area, south of wall Site 30605, contained six primarily agricultural sites (Site 30598, 30600, 30606, 30607, 30610, and 30611) and four Historic era sites (Site 30599, 30608, 30609, and 30612) with functions other than agriculture. The agricultural features included rock walls (Site 30598 and30606), terraces (Site 30600 and 30610), and agricultural complexes with terraces (Site 30607 and 30610). The non-agricultural features included three enclosures (Site 30599, 30608, and 30609), and a refuse disposal area lava blister (Site 30612). The cluster of these sites indicates their use for Historic era commercial agriculture.

Twenty-nine shovel probes and two excavation units tested the sites. Marine shell fragments, a basalt flake and volcanic-glass flakes recovered during testing indicate that Hawaiians likely used the area for limited agricultural purposes. However, the agricultural terraces more closely resemble the remains of Historic era commercial agriculture.

All 22 sites identified during the current AIS study were assessed significant under criterion “d” as they are likely to yield information important to history. The railroad berm is also significant under criteria “a” and “c” as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. The railroad berm was recommended for preservation with preservation measures outlined in an archaeological preservation plan (Escott and Mello 2019b). The rest of the sites require no further work.

The burial is also significant under criterion “e” as it has important value to Hawaiian people and people of other ethnic backgrounds in the state. The burial was recommended for preservation in place with preservation treatments outlined in a Burial Site Component of a Preservation Plan (Escott and Mello 2019a).

Table 4: Inventory of Archaeological Sites Identified on the AIS Project Area (Escott and Escott 2018).

Site #	Site Type	Features	Site Function	Age	Testing
30591	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30592	Railroad Bed and Berm	1	Transportation	Historic Era	
30593	Lava Tube Burial	1	Burial	Pre-Contact to Early Post-Contact Era	
30594	Agricultural Complex	6	Agriculture	Pre-Contact to Historic Era	SP-1 & 2
30595	Rock Wall	1	Ranching	Historic Era	
30596	Hearth	1	Food Preparation	Historic Era	TU-1
30597	Rock Wall	1	Ranching	Historic Era	
30598	Rock Wall	1	Agriculture/Ranching	Pre-Contact to Historic Era	
30599	Platform & Enclosure	2	Ranching/Agriculture	Historic Era	SP-1 & 2, TU-1
30600	Terrace	1	Agriculture	Historic Era	SP-1
30601	Rock Wall	1	Ranching	Historic Era	
30602	Enclosure	1	Ranching/Agriculture	Historic Era	SP-1, 2, 3 & 4
30603	Enclosure	4	Ranching/Agriculture	Historic Era	SP-1 & 2
30604	Agricultural Complex	4	Agriculture	Pre-Contact to Historic Era	SP-1
30605	Rock Wall	1	Ranching/Agriculture	Historic Era	
30606	Rock Wall	1	Ranching/Agriculture	Pre-Contact to Historic Era	
30607	Agricultural Complex	7	Agriculture	Pre-Contact to Historic Era	SP-1 to SP-10
30608	Enclosure	1	Structure	Historic Era	
30609	Enclosure	1	Structure	Historic Era	
30610	Terrace	1	Agriculture	Pre-Contact to Historic Era	SP-1
30611	Agricultural Complex	3	Agriculture	Pre-Contact to Historic Era	SP-1, 2, 3
30612	Lava Blister	1	Refuse Dump	Historic Era	

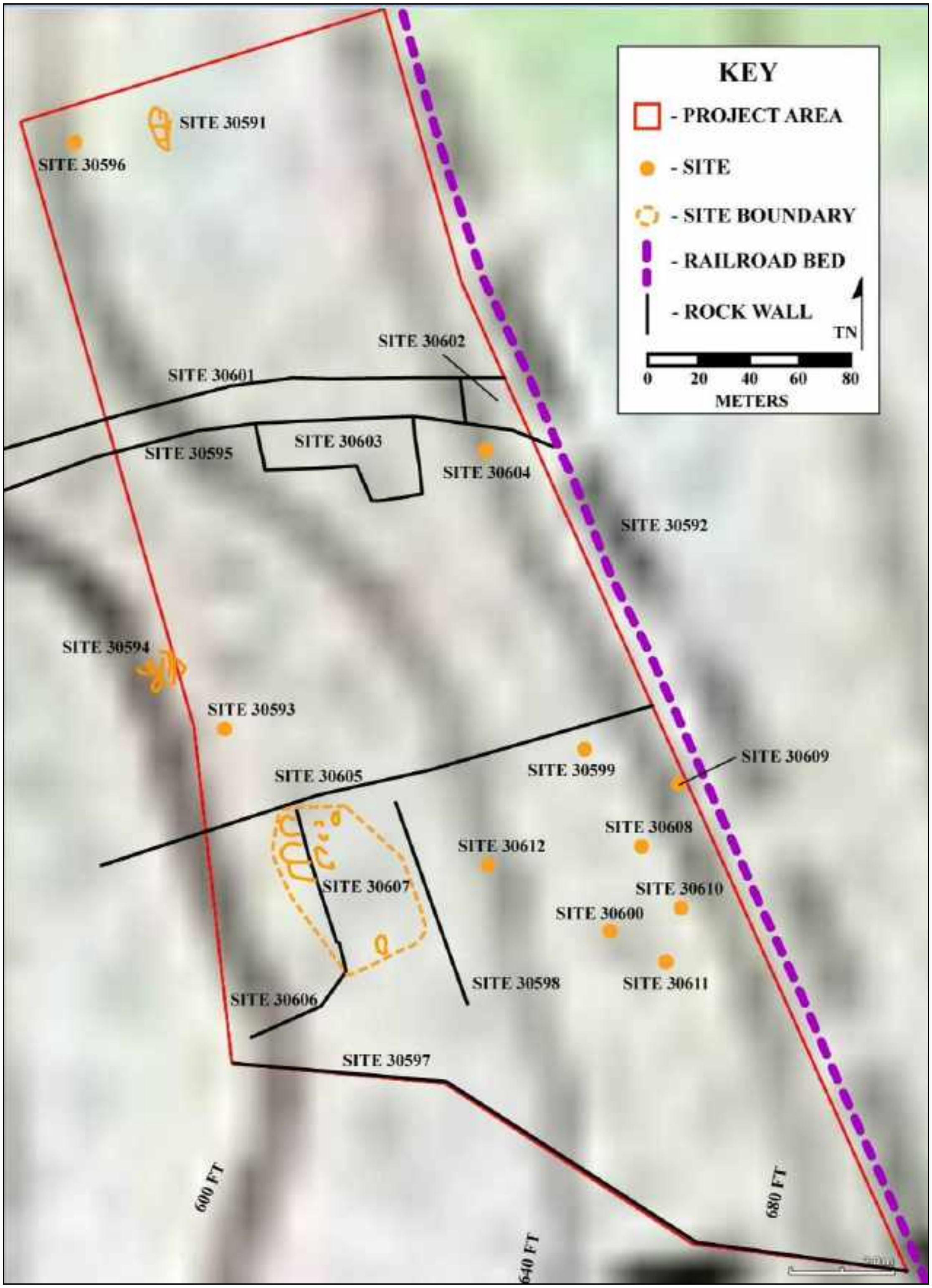

Figure 11: 7.5-Minute Series USGS Topographic Map Showing Locations of Escott and Escott (2018) AIS Project Area Archaeological Sites (ESRI, 2011. Sources: National Geographic Society, USGS. Kealakekua Quadrangle).

26. Escott & Escott 2020. SCS conducted an archaeological inventory survey on a 73.122-acre portion of the current project area in Parcel 016, 017 (por.), 018, and 019 to identify all archaeological historic properties present on the project area, and to update previous archaeological documentation (see Figure 10).

Seventeen of the twenty-one sites previously identified in Hammatt et al. (1992) were located during the course of the archaeological inventory survey study (Figure 10 and Table 5). Two of the previously documented sites (Site 10020 and Site 10034) relocated by SCS are natural bedrock outcrops and one site former burial site (Site 10012). The burials at Site 10012 were reinterred off-project in 1983.

The four remaining previously documented sites (Sites 10017, 10033, 10049, and 10071) were bulldozed prior to the SCS fieldwork and the remains of the sites are no longer present on the ground surface. Three previously undocumented sites were also recorded, including a portion of the railroad berm (Site 30592), a small coffee shed enclosure (Site 31181), and several ranch walls (Site 31182). A single petroglyph on a loose cobble was recorded as Isolated Find 1 (IF-1).

A total of 21 sites, 17 previously documented and four newly documented, were identified on the project area and are documented in this report. Two of the sites (Site 10020 and Site 10034) were determined to be natural geological features. Six of the sites were determined to be pre-Contact era, three associated with habitation, one with agriculture, a single petroglyph site, and one single feature site (Site 10012) formerly contained two burials. Twelve of the sites were determined to be Historic era sites, the majority associated with coffee agriculture and cattle ranching. Two Historic era habitation sites were also documented in the AIS study. One site (Site 10015) was determined to be a short segment of modern bulldozer road.

The burials at Site 10012 were removed and reinterred off-project prior to 1983. The site was further excavated to ensure that all *iwi* had been removed. The site was then back-filled and leveled by bulldozer.

Table 5: Inventory of Escott & Escott (2020) Archaeological Sites.

SIHP#	TYPE	FUNCTION	AGE
10011	Platform	Ag. Clearing	Pre-Contact
10012	Platform & Wall	Burial	Pre-Contact
10013	Enclosure & Lava Tube	Habitation	Pre-Contact
10015	Bulldozer Road	Transportation	Modern
10017	Platform	Cattle Ramp	Historic
10018	Enclosure	Agricultural	Historic
10019	6 Rock Mounds	Ag. Clearing	Historic
10020	Bedrock Outcrop	Geological Feature	Natural
10031	Enclosure Wall	Agriculture	Historic
10033	Planting Complex	Coffee Ag	Historic
10034	Bedrock Outcrop	Geological Feature	Natural
10049	Terraces	Agriculture	Historic
10067	Terraces	Habitation	Pre-Contact
10068	Enclosure	Habitation	Pre-Contact
10069	Modified Bluff/Platform	Habitation	Historic
10070	U-Shape Enclosure	Agriculture	Historic
10071	Platform	Habitation	Pre-Contact
10072	Complex	Ag. Clearing	Pre-Contact
10073	Platforms	Ranching/Ag.	Historic
10074	Enclosure	Coffee Work Shed	Historic
10075	Enclosure	Pig Pen	Historic
30592	Railroad Berm	Transportation	Historic
31181	Enclosure	Coffee Work Shed	Historic
31182	Rock Walls	Ranching & Agri	Historic
IF-1	Petroglyph	Marker	Pre-Contact

AIS SIGNIFICANCE ASSESSMENTS

All sites identified during the Escott and Escott (2018) and Escott and Escott (2020) AIS studies were assessed as significant under criterion "d" as they are likely to yield information important to history. The railroad berm is also significant under criteria "a" and "c" as it is associated with events that have made a significant contribution to the broad patterns of our history and it embodies distinctive characteristics of the type, period, and method of railroad bed construction. The railroad berm was recommended for preservation. The petroglyph (IF-1) is recommended for preservation in a safe location on the project area, preferably within the Site 30592 railroad berm preservation area.

Burial Site 30593 is also significant under criterion "e" as it has important value to Hawaiian people and people of other ethnic backgrounds in the state. The burial is recommended for preservation in place with preservation treatments outlined in the SHPD-approved burial site component of a burial treatment plan (Escott and Mello 2019). The remaining sites are recommended for no further work. Site 30592 is summarized below from Escott and Escott (2018:53-54).

SITE 30592	**RAILROAD BERM**
FUNCTION:	Transportation
AGE:	Historic Era
DIMENSIONS:	300.0 m long (N/S) by 4.0 m wide max. by 5.0 m max. height
CONDITION:	Good
INTEGRITY:	Unaltered: retains integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	Modern Trash Debris
EXCAVATION:	None

DESCRIPTION: Site 30592 is an Historic era railroad berm located between 680 m and 690 m amsl along the eastern boundary of the project area (see Figure 8). The railroad berm is approximately 300.0 m in length (SE/NW) and 4.0 m wide by a maximum of 5.0 m in height. The railroad bed is a level dirt and rock surface, and the berm is located along the west side of the railroad bed.

The southern portion of the berm retaining wall is constructed of small boulders and large cobbles stacked up to nine courses high (Figure 9 and Figure 10). The berm is well faced with fairly tightly fitted natural rock. The rock has not been worked prior to stacking. The berm face slopes slightly toward the east as it approaches the top to prevent collapse.

The southern portion of the railroad bed top surface has been bulldozed in the fairly recent past, likely during construction of the homes along the east edge of the project area property. Portions of the berm are partially collapsed. There is a fair amount of modern construction debris and refuse along the southern course of the railroad bed.

The northern portion of the railroad berm retaining wall is constructed of small boulders and large cobbles stacked up to nine courses high (Figure 12 and Figure 13). The berm is well faced with fairly tightly fitted natural rock. The rock has not been worked prior to stacking. The berm face slopes slightly toward the east as it approaches the top to prevent collapse.

Figure 12: Photograph of Site 30592 Railroad Berm Rail Bed, Looking South (25 cm scale).

Figure 13: Photograph of Site 30592 Railroad Berm Retaining Wall, Looking Southeast.

The retaining wall is approximately 5.0 m high and is constructed of fifteen courses of large basalt cobbles and small boulders. The north end of the berm has been bulldozed roughly 60.0 m south of the northeast corner of the project area. Site 30592 appears to be unaltered and is in good condition. Only the north end of the railroad berm has been altered by bulldozing. Site 30592 will be preserved under significance Criteria a, c, and d.

SITES #50-10-37-30592 PRESERVATION TREATMENTS

The former Kona Sugar Company railroad bed and berm (Site 30592) is a long linear feature extending across the eastern boundary of Parcel 016 and Parcel 017. Preservation at Site 30592 consists of avoidance and protection (conservation) per HAR §13-277-3(1). The majority of the feature will be preserved with the proviso that it may be breached for purposes of access.

Short-Term Preservation Measures

In the event of land disturbance or construction in the area of Site 30592 using heavy earthmoving equipment, a buffer will be established at twenty feet from the western perimeter of the railroad berm (Figure 14 and Figure 15). The twenty-foot buffer will be clearly marked with orange fencing. Any construction work using earthmoving equipment in close proximity to the twenty-foot buffer will require the presence of an archaeological monitor. No construction will take place between the railroad berm and the eastern property boundary. Any construction within 30 feet of the railroad bed and berm shall be monitored by a qualified archaeologist familiar with Site 30592 and previous archaeological studies conducted on the property.

Long-Term Preservation Measures

A permanent preservation buffer will be established twenty feet from the western perimeter of Site 30592 (see Figure 14 and Figure 15). Native ornamental plants may be used to mark the twenty-foot preservation buffer. No use of heavy earthmoving equipment will be allowed within the twenty foot buffer. Hand-tools only shall be permitted within the twenty-foot permanent preservation buffer.

Bureau of Conveyances

Subsequent to final approval by SHPD of this Preservation Plan, a metes and bounds description of the burial and archaeological preservation sites, and permanent preservation easements shall be surveyed and recorded with the State of Hawaiʻi Bureau of Conveyances in conformance with HAR §13-300-38(g). The TMK plat map will include a map of the preservation area.

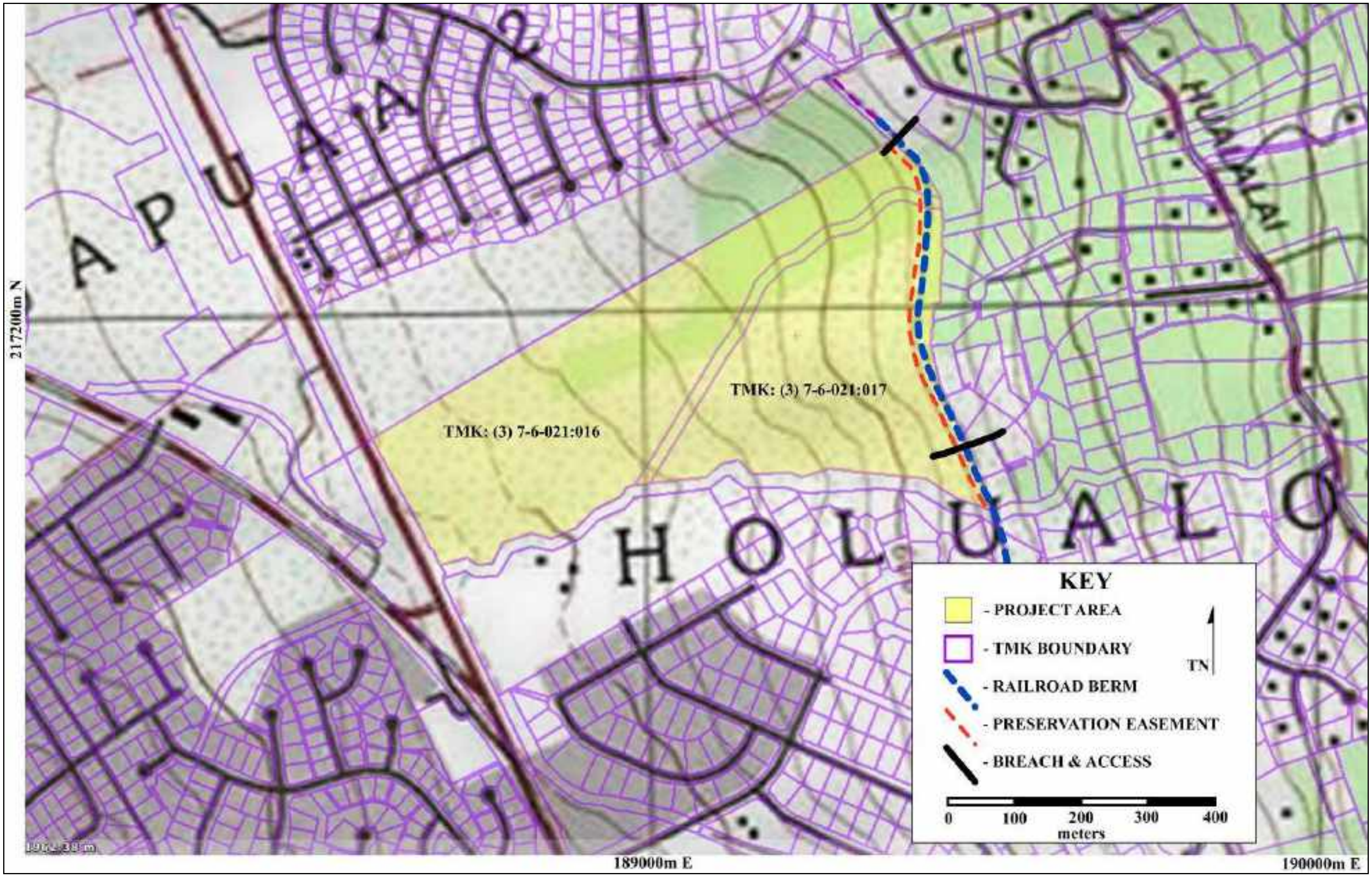

Figure 14: 7.5-Minute Series USGS Topographic Map (Kauluoa and Puu Pohakuloa Quads) Showing Location of Project Area, Archaeological Sites and Preservation Easements (ESRI 2013. Data Sources: NASA, NGS and USGS).

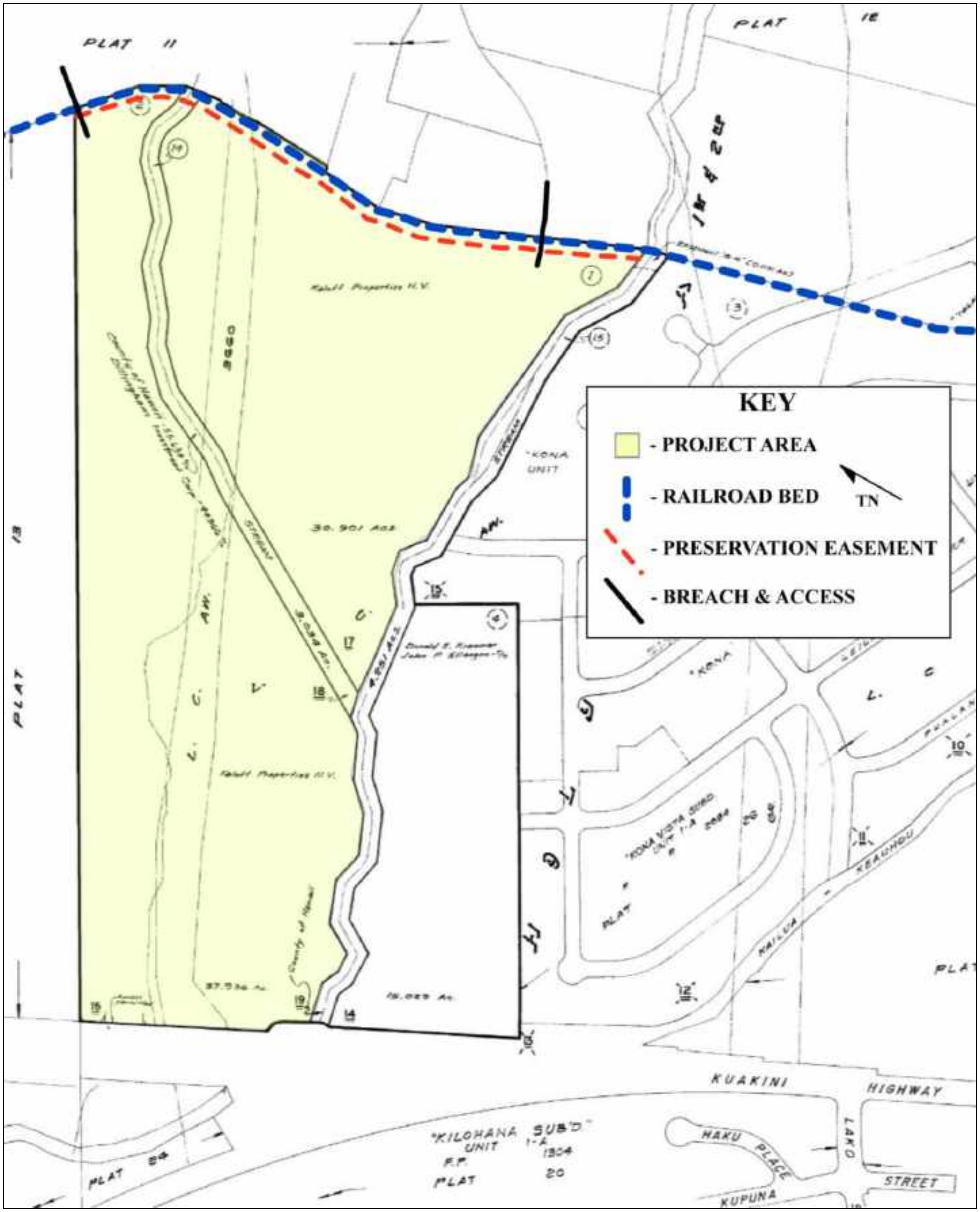

Figure 15: Portion of TMK: (3) 7-6-021 Map Showing the Locations of Site 30592, Preservation and Access Easements, and Access Breach.

Property Title

The details of this preservation plan and its preservation measures shall become a matter of record with the parcel title. The descriptions of the preservation easements will be added to the title, including the specific requirements and restrictions related to physical improvements, signage, maintenance and access.

Access

Pedestrian access to Site 30592 shall be from Io Place located east of the site (see Figure 12 to Figure 15). Parking is available on Io Place. The property owner is responsible for ensuring the access easement is usable for pedestrian travel, and is responsible for keeping the access easement clear and open. Access will be permitted seven days a week, one-half hour before sunrise to one-half hour after sunset. Access can be arranged by calling the property owner.

Signage

Weather-resistant signs, approximately 18 by 24 inches in size, shall be placed at the railroad bed at the end of Io Place. The signs shall read:

Kona Sugar Company Railroad Preserve
This site is historically significant.
Historic sites are protected under state law.
Violation could result in a $20,000 fine.
(Chapter 6E-11, Hawaiʻi Revised Statutes)
DLNR-SHPD (808) 692-8015

Maintenance

The landowner is responsible for maintenance of the preservation easement, access path, signage, vegetation clearing, and general appearance of the preservation area.

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APPENDIX A: SHPD AIS APPROVAL LETTER

DAVID Y. IGE
GOVERNOR OF
HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

May 31, 2018

IN REPLY REFER TO:
Log No. 2018.01123
Doc. No. 1805SN05
Archaeology

Rick Wheelock
181 Kalaniana‘ole Street
Hilo, Hawai‘i 96720
Email: richardeastwestrealty.org

Dear Mr. Wheelock:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Archeological Inventory Survey of 5.0 Acres in Hōlualoa
Hōlualoa 1st Ahupua‘a, North Kona District, Island of Hawai‘i
TMK: (3) 7-6-021:017 por.

This letter provides the State Historic Preservation Division’s (SHPD’s) review of the revised report titled *Archaeological Inventory Survey Report for 5.0 Acres Located in Hōlualoa 1st Ahupua‘a, North Kona, Hawai‘i Island, Hawai‘i [TMK: (3) 7-6-021:017 por.]* (Escott and Escott, revised May 2018). Revisions to the report were requested via email on May 13, 2018 (Susan Lebo [SHPD] to Glenn Escott [Scientific Consultant Services, Inc. (SCS)]) and SHPD received the revised report on May 18, 2017.

SCS conducted the archaeological inventory survey (AIS) at the request of the landowner, Kona Three, LLC. The AIS was conducted in support of a County of Hawaii permit application for proposed development of the property. The AIS covered a 5.0-acre portion of the 30.901-acre parcel. The fieldwork included a 100% pedestrian survey of the entire project area. Ground visibility was fair to poor. Subsurface testing was conducted at several features.

The AIS documented twenty-two newly identified historic properties (Table 1). The sites include a pre- and/or early post-Contact lava tube burial, pre- and/or early post-Contact agricultural terraces, and post-Contact walls and enclosures associated with agriculture and/or ranching, and a post-Contact railroad berm.

Table 1. Summary of Sites Documented in AIS

Site #50-10-37-	Type	Function	Age
30591	Agricultural Complex	Agriculture	Pre- to Post-Contact
30592	Railroad and Berm	Transportation	Historic
30593	Lava Tube	Burial	Pre- to Early Post-Contact
30594	Agricultural Complex	Agriculture	Pre- to Post-Contact
30595	Rock Wall	Ranching	Historic
30596	Possible Hearth	Food Preparation	Historic
30597	Rock Wall	Ranching	Historic
30598	Rock Wall	Agriculture/Ranching	Pre- to Post-Contact
30599	Platform & Enclosure	Ranching/Agriculture	Historic
30600	Terrace	Agriculture	Historic
30601	Rock Wall	Ranching	Historic
30602	Enclosure	Ranching/Agriculture	Historic
30603	Enclosure	Ranching/Agriculture	Historic

Site #50-10-37-	Type	Function	Age
30604	Agricultural Complex	Agriculture	Pre- to Post-Contact a
30605	Rock Wall	Ranching/Agriculture	Pre- to Post-Contact
30606	Rock Wall	Ranching/Agriculture	Pre- to Post-Contact
30607	Agricultural Complex	Agriculture	Pre- to Post-Contact
30608	Enclosure	Dwelling and Storage	Historic
30609	Enclosure	Dwelling and Storage	Historic
30610	Terrace	Agriculture	Pre- to Post-Contact
30611	Agricultural Complex	Agriculture	Pre- to Post-Contact
30612	Lava Blister	Refuse Dump	Historic

The 22 sites were assessed as significant under HAR §13-284-6 Criterion d. Site 30592 (railroad berm) was also assessed as significant under Criteria a and c and was recommended for preservation. Site 30593 (lava tube burial) was assessed as significant under Criterion e and was recommended for preservation. Preservation measures will be outlined in Burial Treatment Plan. The AIS report recommends no further archaeological work for the Site 30591 and for Sites 30594 through 30612. Sufficient information has been collected for these sites to adequately provide information on their age and function.

Based on the above information, SHPD's determination is "effect, with agreed-upon mitigation". SHPD concurs with the significance and treatment recommendations.

The report meets the requirements specified in HAR §13-276-5. **The report is accepted.** Please send two hard copies of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version to the Kapolei SHPD office, attention SHPD Library (Helen.W.Smith@hawaii.gov).

As stipulated in HAR §13-284-7, when SHPD comments that a project will result in "effect with agreed-upon mitigation commitments", then detailed mitigation plans shall be developed for SHPD review and acceptance prior to project initiation. The agreed upon mitigation commitments are preservation and archaeological monitoring.

Pursuant to HAR §13-284-8, **SHPD looks forward to receiving** a burial treatment plan for Site 30593, an archaeological preservation plan meeting the requirements of HAR 13-279-4 for Site 30592, and an archaeological monitoring plan meeting the requirements of HAR §13-279-4, prior to any County permit issuance.

SHPD shall notify the County when our office has reviewed and accepted the archaeological preservation plan and the archaeological monitoring plan, and the interim preservation and the burial treatment measures have been implemented, and the permit application has been reviewed, and permit issuance may occur.

Please contact Sean Nāleimaile at (808) 933-7651 or at Sean.P.Naleimaile@hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,

Susan A. Lebo

Susan A. Lebo, PhD
Archaeology Branch Chief

cc. Glenn Escott, SCS, ggescott@yahoo.com

This is a copy of Bureau of Conveyances
Document No. A-80600287, and / or
Land Court Document No. ________
affecting Certificate of Title No. ________
recorded on 1/26/2022 at 8:01 o'clock AM.
TITLE GUARANTY OF HAWAII, INCORPORATED

LAND COURT | REGULAR SYSTEM

Return by Mail ( ) Pickup ( ) To:

Office of Housing and Community Development
1990 Kino'ole St., Suite 102
Hilo, Hawai'i 96720

TG: Accom

TGE: Accom
DEBRA N. TOMONO

TITLE OF DOCUMENT:

AFFORDABLE HOUSING AGREEMENT

PARTIES TO DOCUMENT:

COUNTY: COUNTY OF HAWAI'I, a municipal corporation of the State of Hawai'i, whose address is 1990 Kino'ole Street Suite 102, Hilo, Hawai'i 96720

DEVELOPER: Kona Three LLC, a Hawai'i limited liability company, whose address is 101 Hualālai Street, Hilo, Hawai'i 96720

Affects TMK (3) 7-6-021:016 and (3) 7-6-021:017

Document contains 14 pages.

AFFORDABLE HOUSING AGREEMENT

AKS/NY
JK/NY

This Affordable Housing Agreement ("Agreement") is made and effective this 10th day of January, 20~~21~~ 22 (the "Effective Date"), by and between **KONA THREE LLC**, a Hawai'i limited liability company, (the "Developer"), whose place of business and mailing address in the State of Hawai'i is 101 Hualālai Street, Hilo, Hawai'i 96720, and the **COUNTY OF HAWAI'I**, a municipal corporation of the State of Hawai'i, (the "County"), whose principal place of business and mailing address is 25 Aupuni Street, Hilo, Hawai'i 96720.

RECITALS

WHEREAS, the Developer proposes to develop 450 residential units on approximately 68.836 acres of real property located at Hōlualoa, North Kona, Island, County and State of Hawai'i on Tax Map Key (TMK) Nos. (3) 7-6-021:016 and (3) 7-6-021:017, herein after called the "Kona Three Project" and more particularly described in Exhibit A attached hereto and made a part of; and

WHEREAS, the Developer proposes to satisfy the Kona Three Project affordable housing requirements, along with additional requirements for Gamlon Corp. ("Original Project Developer") through the acquisition of affordable housing credits in accordance with Hawai'i County Code ("HCC") Section 11-5(a)(7); and

WHEREAS, on December 13, 1983, the State Land Use Commission ("LUC") of the State of Hawai'i amended the Agricultural Land Use District Boundary into the Urban Land Use District Boundary of approximately 173.66 acres of property, which included the Kona Three Project, subject to Condition "A", which provided for the development of affordable housing as follows:

1. Petitioner shall provide housing opportunities for low and moderate income Hawai'i residents prior to assigning or transferring (except by way of mortgage or assignment as security) its interest in the subject property, by offering for sale, on a preferential basis, on its own cooperation with either or both the Hawaii Housing Authority or the County of Hawai'i, ten percent (10%) of the lots or houses and lots to be developed on the subject property, to residents of the State of Hawai'i of low and moderate family income as determined by the Hawaii Housing Authority or County of Hawai'i from time to time. The preferential lots or houses and lots shall be offered for sale at prices not exceeding prices that enable such purchasers to qualify for and obtain state -assisted financing (i.e., Act 105 or Hula Mae) or federally insured or assisted financing (i.e., FHA Section 245 Program) intended to encourage homeownership by low- and moderate-income families

WHEREAS, on May 15, 1984, Change of Zone Ordinance 84-23 became effective, amending the lands from Unplanned (U) to Single Family Residential (RS-15) and Multiple Family Residential (RM-5) for the then TMK Nos. (3) 7-6-021:004, (3) 7-6-021:009 through 013, and 7-6-021:015 through 017, subject to Condition "J", which provides for the development of affordable housing as follows:

J. Housing opportunities for Hawaii residents shall be provided in accordance with the condition imposed by the State Land Use Commission. The number of units and manner in which they are to be provided shall meet with the approval of the Hawaii County Housing Agency[.]

WHEREAS, the Original Developer developed and sold two hundred and fifteen (215) units within the original project area of 173.66 acres, and provided no affordable housing units in this development phase; and

WHEREAS, the Developer proposes that the Kona Three Project will consist of four-hundred and fifty (450) residential units on approximately 68.836 acres; and

WHEREAS, Chapter 11, HCC, Section 11-5(a)(7) provides that the affordable housing requirements can be satisfied by obtaining excess credits from another developer pursuant to HCC Section 11-15; and

WHEREAS, the OHCD has confirmed its willingness to consent to such an assignment of excess housing credits for the Developer's intended purpose; and

WHEREAS, the Developer has confirmed its willingness to comply with the ten percent (10%) requirement imposed by the State Land Use Boundary Amendment and Rezoning Ordinance for the entire property consisting of approximately 173.66 acres, satisfying the C requirements for a combined total of 665 residential units; and

WHEREAS, Chapter 11, Article 1 of the Hawai'i County Code, relating to Affordable Housing Policy, authorizes the Mayor, the County of Hawai'i Office of Housing and Community Development ("OHCD") or their duly authorized representative, to enter into this Agreement with the Developer to perform one or any combination of the options for satisfaction of the affordable housing requirements contained in Hawai'i County Code Section 11-5; and

NOW, THEREFORE, in consideration of the mutual covenants in this Agreement, and pursuant to Chapter 11, Article 1 (Affordable Housing) of the Hawai'i County Code ("Chapter 11"), the parties hereby agree as follows:

1. The Developer shall provide proof and OHCD shall verify excess credits are valid. Upon the closing of the Developer's purchase of the 67 excess housing credits which are verified by OHCD, the Developer will be entitled to use said housing credits to satisfy the affordable housing requirements for the entire project including, Gamlon Corp's Original Development Project of 215 units and the Kona Three Project consisting of a maximum of 450 residential units/lots, pursuant to the following: HCC, Chapter 11, Article 1 (Affordable Housing Policy).

2. Upon the closing of the Developer's purchase of the 67 excess housing credits,a full Release of this Agreement and any other appropriate documentation reasonably required by the parties related to the satisfaction of the affordable housing requirements for this 450 residential unit Kona Three Project shall be executed by the parties hereto and recorded by the Developer with the Bureau of Conveyances, or with the Land Court of the State of Hawaii, as applicable, with Developer paying all costs of recordation.

3. In the event the Developer builds more than 450 residential units, Developer shall obtain the required credits to satisfy the affordable housing requirement for the additional units.

4. This Agreement supersedes all other agreement and understandings (whether oral or written) made heretofore or contemporaneously herewith by the parties on the subjectmatter hereof. The provisions of this Agreement may not be modified, altered, or changed except by another written instrument executed by the parties hereto.

2. This Agreement shall run with the land and shall be binding upon and inure to the benefit of the parties hereto, and their respective successors and assigns. This Agreement shall be recorded against the title to the Affordable Housing Site by the Developer at the Bureau of Conveyances or with the Land Court of the State of Hawai'i as applicable, within thirty (30) days after being fully executed by the parties. The parties agree to take such actions and execute whatever other documents as are reasonably necessary to effectuate and carry out the intent of this Agreement. As provided in Paragraph 2, above, upon Developer's purchase of the 67 excess housing credits, the parties shall execute and record a full Release of this Agreement along with any other appropriate documentation.

3. Notices. All notices to be given pursuant to this Agreement shall be in writing and shall be deemed given when mailed by certified or registered mail, return receipt requested, to the parties hereto at the addresses set forth below, or to such other place as a party may from time to time designate in writing.

To the County:

Housing Administrator
Office of Housing and Community Development
1990 Kino'ole Street, Suite 102
Hilo, Hawai'i 96720

To the Developer:

Kona Three LLC
101 Hualālai Street
Hilo, Hawai'i 96720

ATTN: Roland Higashi

The OHCD and the Developer may, by notice given hereunder, designate any further or different addresses to which subsequent notices, certificates or other communications shall be sent.

4. The Developer agrees, if applicable, that it will take all actions necessary to effect amendment of this Agreement as may be necessary to comply with amendments to HCC Chapter 11, and all applicable rules, regulations, policies, procedures, rulings, or other official statements pertaining to Chapter 11.

5. This instrument may be executed in two or more counterparts, and when all counterparts have been executed, each counterpart shall be considered an original but when assembled shall constitute one and the same instrument and shall have the same force and effect as though all of the signatories had executed a single signature page. Any unexecuted duplicate pages may be omitted from the assembled original document.

6. The parties agree that no party shall be deemed to be the drafter of this Agreement, and further that in the event this Agreement is ever construed by a court of law, such court shall not construe this Agreement or any provisions of this Agreement against any party as the drafter of this Agreement.

7. This agreement shall be recorded with the State of Hawaii Bureau of Conveyances, and a true and correct copy shall be provided to the County of Hawaii Office of Housing & Community Development within 30 days.

8. This Agreement shall be governed and construed in accordance with the laws of the Third Circuit Court of the State of Hawaiʻi.

[THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK.]

SIGNATURE PAGE FOLLOWS

//

//

//

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first written above.

DEVELOPER:

Kona Three LLC,
a Hawai'i limited liability company

By: Robert G. Williams
Name: Robert G. Williams
Title: Treasurer of Kona Three LLC and Manager of OIP, LLC, a Hawai'i limited liability company and member of Kona Three LLC

Date:

COUNTY:

COUNTY OF HAWAI'I,
a municipal corporation of the State of Hawai'i

By:
Name: LEE E. LORD
Title: Managing Director

Date: 1|10|22

RECOMMEND APPROVAL:

Susan K. Kunz
Housing Administrator

Date: 12/27/21

APPROVED AS TO FORM AND LEGALITY:

Deputy Corporation Counsel

Date: 01/07/22

STATE OF HAWAIʻI)
) SS.
COUNTY OF HAWAIʻI)

On this 10th day of January, 2022, before me personally appeared LEE E. LORD, to me personally known, who, being by me duly sworn, did say that he is the Managing Director of the County of Hawaiʻi, a municipal corporation of the State of Hawaiʻi, that the foregoing instrument was signed on behalf of the County of Hawaiʻi by authority given to said Mayor of the County of Hawaiʻi by Sections 5-1.3 and 13-13 of the County Charter, County of Hawaiʻi (2018), as amended, and assigned by the Mayor to the Managing Director pursuant to Section 6-1.3(h) of the County Charter; and said LEE E. LORD acknowledged said instrument to be the free act and deed of said County of Hawaiʻi.

Amber K.S. Kepoo
Signature

AMBER K.S. KEPOO
Print or Type Name

Notary Public, State of Hawaiʻi

My Commission Expires: 04/01/22

AMBER K.S. KEPOO NOTARY 18-145 PUBLIC STATE OF HAWAII

NOTARY CERTIFICATION	
Doc. Date: 01/10/22	No. of Pages: 7
Notary Name: AMBER K.S. KEPOO	Third Circuit
Doc. Description: Affordable Housing Agreement	
Amber K.S. Kepoo 01/10/22	AMBER K.S. KEPOO NOTARY 18-145 PUBLIC STATE OF HAWAII
Notary Signature Date	

STATE OF HAWAIʻI)
) SS.
COUNTY OF HAWAIʻI)

On 12/21/2021, before me appeared Robert G Williams to me personally known, who, being by me duly sworn, did say that he is the Treasurer of KONA THREE LLC; that the instrument was signed on behalf of KONA THREE LLC by authority of its member(s); and acknowledged said instrument to be the free act and deed of said company.

DEBRA N. TOMONO ★ STATE OF HAWAII ★ NOTARY 85-542 PUBLIC

Debra N. Tomono
Print Name
Notary Public, State of Hawaiʻi
My commission expires: EXPIRATION: October 17, 2022

NOTARY CERTIFICATION

Doc. Date:	undated	No. of Pages:	14
Notary Name:	Debra N. Tomono		
Doc. Description:	**AFFORDABLE HOUSING AGREEMENT, TMKs (3) 7-6-021:016 and (3) 7-6-021:017**	Circuit:	3rd
Notary Signature	12/21/2021 (Date)		

DEBRA N. TOMONO ★ STATE OF HAWAII ★ NOTARY 85-542 PUBLIC

EXPIRATION: October 17, 2022

EXHIBIT A
[Property Description]

EXHIBIT "A"

All of that certain parcel of land (being portion(s) of the land(s) described in and covered by Royal Patent Number 4475, Land Commission Award Number 7713, Apana 43 to Victoria Kamamalu and a portion of Royal Patent 8217, Land Commission Award 3360 to John P Munn) situate, lying and being at Holualoa 1 and 2, District of North Kona, Island and County of Hawaii, State of Hawaii, being LOT 2, and thus bounded and described:

Beginning at the southwest corner of this parcel of land, being also the northwest corner of Lot 15 (Stream) and along the northeasterly side of Hawaii Belt Road, F.A.P. Route 11 Project No. 11A-03-69, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA", being 9,837.83 feet south and 9,057.80 feet east, thence running by azimuths measured clockwise from true South:

1. 152°	22'	30"	95.69	feet along Hawaii Belt Road, F.A.P. Route 11 Project No. 11A-03-69;
2. 139°	59'	30"	20.75	feet along same;
3. 99°	48'	30"	35.07	feet along same;
4. 154°	11'		597.05	feet along same;
5. 240°	28'	30"	2,903.35	feet along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to Victoria Kamamalu;
6. 255°	18'		17.97	feet along same;
7. 311°	55'		219.92	feet along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to Victoria Kamamalu (Lot 2-A);
8. 331°	14'	15"	143.36	feet along same;
				Thence along Lot 14 (Stream) for the next thirteen (13) courses, the direct azimuth and distances being:
9. 96°	54'		67.99	feet;
10. 112°	56'		86.79	feet;
11. 90°	55'		56.48	feet;
12. 69°	49'		76.70	feet;
13. 46°	39'		114.37	feet;

14.	51° 06'	83.31	feet;
15.	76° 01'	139.84	feet;
16.	51° 29'	175.76	feet;
17.	66° 32'	91.49	feet;
18.	44° 49'	170.06	feet;
19.	25° 59'	247.57	feet;
20.	37° 21'	124.60	feet;
21.	31° 20' 30"	825.56	feet;
			Thence along Lot 15 (Stream) for the next ten (10) courses, the direct azimuth and distances being:
22.	37° 01	57.76	feet;
23.	66° 24'	138.13	feet;
24.	44° 01'	114.46	feet;
25.	67° 01'	134.84	feet;
26.	102° 13'	107.13	feet;
27.	69° 30'	139.97	feet;
28.	31° 40'	114.38	feet;
29.	88° 52'	64.98	feet;
30.	114° 04'	60.22	feet;
31.	77° 28'	132.01	feet to the point of beginning and containing an area of 37.936 acres, more or less.

TOGETHER WITH Easements "C", "D", "E" and "F" for roadway and utility purposes, as described in QUITCLAIM DEED dated September 4, 1987, and recorded in the Bureau of Conveyances of the State of Hawaii in Liber 21336 Page 36; and SUBJECT TO the terms and provisions contained therein.

LOT1-A

Land situated approximately 100 feet Westerly of 'Io Place at Holualoa 1st and 2nd, North Kona, Island and County of Hawaii, State of Hawaii.

Being portions of:

Lot 1;

Royal Patent 8217, Land Commission Award 3660 to John P. Munn; and

Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu.

Beginning at an angle on the Easterly boundary of this parcel of land, being also the Northwesterly corner of Lot 18-G-1 of this subdivision and a point on the Westerly boundary of Lot 1-A-1, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KAILUA (NORTH MERIDIAN)" being 9,233.63 feet South and 11,607.67 feet East and running by azimuths measured clockwise from True South:

1. 39° 41' 16" 271.61 feet along Lot 18-G-1of this subdivision and along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu to a point;

Thence, for the next ten (10) courses following along Lot 22 (Stream) (County of Hawaii) (Holualoa Drainageway) and along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu:

2. 95° 15' 205.20 feet to a point;

3. 96° 50' 273.37 feet to a point;

WES THOMAS ASSOCIATES
– Land Surveyors –
75-5749 Kalawa Street, Kailua-Kona, Hawaii 96740-1817

4.	74°	55'		132.84	feet to a point;
5.	107°	39'		54.73	feet to a point;
6.	90°	53'		191.87	feet to a point;
7.	129°	17'		98.53	feet to a point;
8.	80°	07'		71.22	feet to a point;
9.	53°	36'		104.76	feet to a point;
10.	83°	27'		205.32	feet to a point;
11.	84°	08'		104.72	feet to a point;

Thence, for the next three(3) courses following along Lot 14 (Stream) (County of Hawaii) (Horseshoe Bend Drainageway):

12.	211°	20'	30"	763.45	feet along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu to a point;
13.	217°	21'		127.42	feet along the remainders of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu and Royal Patent 8217, Land Commission Award 3660 to John P. Munn to a point;
14.	205°	59'		243.59	feet along the remainders of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu and Royal Patent 8217, Land Commission Award 3660 to John P. Munn to a point;

Thence, for the next ten (10) courses following along Lot 14 (Stream) (County of Hawaii) (Horseshoe Bend Drainageway) and along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu :

15.	224°	49'		148.60	feet to a point;
16.	246°	32'		87.91	feet to a point;
17.	231°	29'		170.64	feet to a point;
18.	256°	01'		140.06	feet to a point;
19.	231°	06'		98.89	feet to a point;
20.	226°	39'		104.41	feet to a point;

21.	249°	49'		53.22	feet to a point;
22.	270°	55'		33.64	feet to a point;
23.	292°	56'		83.57	feet to a point;
24.	276°	54'		90.29	feet to a point;
25.	354°	02'		55.41	feet along Lot 2-A and along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu to a point;
26.	21°	41'	50"	8.60	feet along Lot 2-C and along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu to a point;
27.	359°	37'	20"	20.09	feet along Lot 2-C and along the remainder of Royal Patent 8217, Land Commission Award 3660 to John P. Munn to a point;
28.	5°	07'	20"	44.89	feet along Lot 2-C and along the remainder of Royal Patent 8217, Land Commission Award 3660 to John P. Munn to a point;
29.	355°	00'		65.72	feet along Lot 12 and along the remainder of Royal Patent 8217, Land Commission Award 3660 to John P. Munn to a point;

Thence, for the next five (5) courses following along the remainder of Royal Patent 4475, Land Commission Award 7713, Apana 43 to V. Kamamalu:

30.	3°	05'	265.06	feet along Lot 11 and Lot 10 to a point;
31.	77°	08'	20.55	feet along Lot 10 to a point;
32.	4°	39'	203.73	feet along Lot 10 and Lot 9 to a point;
33.	347°	02'	187.60	feet along Lot 1-A-3 to a point;
34.	337°	00'	317.65	feet along Lot 1-A-3, Lot 1-A-2 and Lot 1-A-1 to the point of beginning and containing an area of 29.762 Acres.

SUBJECT, HOWEVER, to Zone X (areas determined to be outside the 0.2% annual chance floodplain), Zone XS (X Shaded) (areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood), Zone AE (special flood hazard areas subject to inundation by the 1% annual chance flood, BFE determined), Zone AEF (special flood hazard areas subject to inundation by the 1% annual chance flood, floodway areas in ZONE AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE), as per Flood Insurance Rate Map (F.I.R.M.) Community-Panel Number 155166 0952 F, revised September 29, 2017.

TOGETHER WITH, Easement "AU-2" for Access and Utility Purposes over and across Lot 16-G-1 of this subdivision and being more particularly described by the attached description.

ALSO TOGETHER WITH, existing Easements "C", "C-1", "D" and "D-1" for Road and Utility Purposes as previously recorded at the Bureau of Conveyances in Honolulu, Hawaii in Liber 21336 Page 36.

ALSO TOGETHER WITH, existing Easement "F" for Road and Utility Purposes as previously recorded at the Bureau of Conveyances in Honolulu, Hawaii in Liber 21336 Page 36 and Document Number 2004-086915.

WES THOMAS ASSOCIATES
– Land Surveyors –
75-5749 Kalawa Street, Kailua-Kona, Hawaii 96740-1817

Harry Kim
Mayor

West Hawai'i Office
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September 1, 2017

Mr. Richard Wheelock
Kona Three LLC
101 Hualālai Street
Hilo, HI 96720

Dear Mr. Wheelock:

Application to Amend Rezone Ordinance No. 02-131 (REZ 470)
Subject: Project Consistency with Kona CDP and Status of Plan Approval (PLA-07-000325)
Applicant: Kona Three LLC (formerly Kona Vistas LLC and Gamrex, Inc.)
Tax Map Keys: (3) 7-6-021:016 & 017

This is in response to your July 24, 2017 letter requesting the Planning Director's determination of whether the multi-family residential project called "Kona Village" is consistent with the Kona Community Development Plan (CDP). The project includes approximately 508 residential units consistent with the property's RM-5 zoning.

According to the Official Kona Land Use Map (Figure 4-7) in the Kona CDP, the western portion of the subject property is situated in the Pua'a-Wai'aha Village Transit Oriented Development (TOD) Floating Zone. The location of this TOD has not yet become fixed by a master plan and project district zoning; however it is likely that the future TOD will be located makai of Queen Ka'ahumanu Highway and mauka of Kuakini Highway. Therefore, the Director has determined the subject properties are not located in the TOD.

It is our understanding that the applicant will be submitting an application to amend conditions of the zoning ordinance and then the proposed project will be developed according to Policy LU-2.8(1)(b), which indicates the project may be developed in accordance with the existing zoning, subject to the following requirements: Parks in Policy PUB-6.2, Affordable Housing in Policy HSG-5.2, Street Standards in Policies TRAN-2.1, TRAN-3.1, TRAN-3.7, Wastewater in Policy PUB-4.4, Concurrency in HCC 25-2-46 and Policy TRAN-6.1, and Sensitive Resources in Policy ENV-1.5.

SEP - 5 2017

The second purpose of this letter is to inform you that Plan Approval PLA-07-000325 is no longer valid per Section 25-2-7 of the Zoning Code because it was not utilized within two (2) years of its issuance in 2007. Thus, the applicant will need to secure a new Plan Approval before building permits can be issued for the multi-family residential development.

Should you have questions, please contact Maija Jackson of my staff at 961-8159.

Sincerely,

MICHAEL YEE
Planning Director

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cc: Kona Planning Office
Alan M. Okamoto, Nakamoto, Okamoto & Yamamoto via email
Robert G. Williams, Kona Three LLC via email

FINAL

Royal Vistas

Tax Map Key (3) 7-6-021: 016, 17

Traffic Impact Analysis Report

Kona, Island of Hawaii

November 30, 2021

Prepared for
Kona Three LLC.

Prepared by

SSFM International

Previous Submittals	Date	Application
Traffic Impact Analysis for Kona Village	October 2018	Zoning Amendment
Draft Traffic Impact Analysis Report for the Royal Vistas	May 2020	Draft Environmental Assessment
Final Traffic Impact Analysis Report for the Royal Vistas	July 2020	Final Environmental Assessment

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I. PROJECT DESCRIPTION

Kona Three LLC is planning to develop a multi-family residential subdivision named Royal Vistas in Kona, on the Island of Hawaii. The property is located on the mauka side of the Queen Kaahumanu Highway (Route 11) at TMK (3) 7-6-021:016, 17 between Kona Vista Subdivision and Pualani Estates Subdivision. Only one roadway is planned to provide access for Phase I of the property. This roadway intersects with Queen Kaahumanu Highway, approximately 600 feet north of the intersection with Kuakini Highway. For this traffic impact analysis report (TIAR), this access is referred to as “Royal Vistas Roadway”. The project location, along with the study intersections associated with this TIAR, are shown in Figure 1.

The proposed site is 70-acres and zoned “RM-5”. Even though the new development’s total buildout is estimated as 450 units, only 258 units are planned as Phase 1. Phase 1 is expected to be completed by 2024. Phase 2 will include the full buildout of the remaining 192 units. Phase 2 is expected to be completed by 2029. The Royal Vistas proposed conceptual site plan is shown in Figure 2. The intent of this TIAR is to evaluate existing conditions and assess impacts in the surrounding area as a result of the proposed development for 5-year (Phase 1 completion in 2024), 10-year (Phase 2 completion in 2029), and 20-year future conditions in 2039 will be analyzed. Future years will be evaluated with and without the Royal Vistas project.

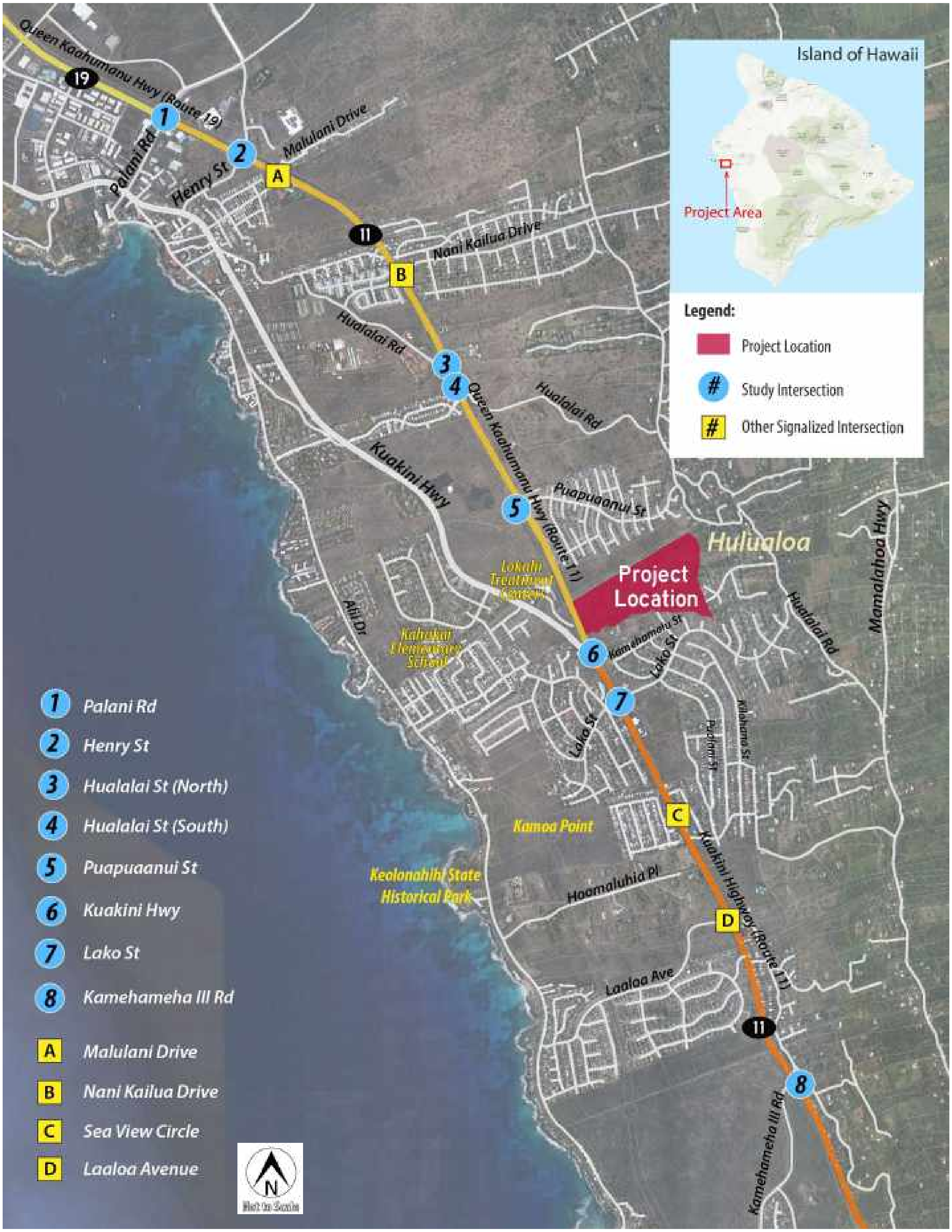


Figure 1: Project Location Map

Figure 2: Conceptual Site Plan

II. EXISTING (2019) CONDITIONS

A. Geometric Configuration

1. Roadway Configuration

a) Queen Kaahumanu Highway

Where it intersects with Royal Vistas Roadway, Queen Kaahumanu Highway (Route 11) is an undivided, two-lane, State-owned arterial, oriented in the north-south direction. Queen Kaahumanu Highway extends from Kawaihae Road (Route 19) in the north to the intersection with Palani Road (Route 190) where it turns into State Route 11. The posted speed limit along Queen Kaahumanu Highway varies from 45-55 mph. At the future Royal Vistas Roadway, the posted speed limit is 45 MPH. Queen Kaahumanu Highway opens to 4-5 lanes with dedicated left turning and right turning lanes at major intersections northwest of Henry Street. Route 11 goes by the various names of Queen Kaahumanu Highway, Kuakini Highway, Mamalahoa Highway, and Hawaii Belt Road. To avoid confusion, the name Route 11 will be used throughout this report.

2. Study Intersections

The study intersections include the following:

1. Route 11 and Palani Road (Route 190)
   a. At this location, Route 11 is predominantly oriented in an east-west direction and Palani Road is predominantly oriented in a north-south direction.
   b. Four-leg signalized intersection with dedicated left turning lanes and channelized right turn lanes for all approaches. The Route 11 approaches and the northbound Palani Road approach have double left turn lanes.
   c. All left turns are protected (have green arrow phases).
   d. The north leg of the intersection extends and connects with Mamalahoa Highway (Route 190), another state-owned facility.
2. Route 11 and Henry Street
   a. At this location, Route 11 is oriented in an east-west direction and Henry Street is oriented in a north-south direction.
   b. Four-leg signalized intersection with dedicated left turning lanes and channelized right turn lanes for all approaches. The Route 11 approaches have double left turn lanes.
   c. Left tuns from Route 11 onto Henry Street are protected. The Henry Street phases are split (sequential rather than concurrent).
   d. The north leg of the intersection extends and connects with Ane Keohokalole Highway, another state-owned facility.
3. Route 11 and Hualalai Road (North)
   a. At this location, Route 11 is oriented in a north-south direction and Hualalai Road is oriented in an east-west direction.
   b. Three-leg, STOP sign controlled intersection with dedicated left turning lanes for the northbound and eastbound approaches.
   c. Channelized right turn lanes exist for the eastbound and southbound approaches.
   d. A refuge lane is provided for the eastbound left turns onto Route 11.

4. Route 11 and Hualalai Road (South)
    a. At this location, Route 11 is oriented in a north-south direction and Hualalai Road is oriented in an east-west direction.
    b. Three-leg, STOP sign controlled intersection with dedicated left turning lanes for the southbound and westbound approaches.
    c. Channelized right turn lanes exist for the northbound and westbound approaches.
    d. A refuge lane is provided for the westbound left turns onto Route 11.
5. Route 11 and Puapuaanui Street
    a. At this location, Route 11 is oriented in a north-south direction and Puapuaanui Street is oriented in an east-west direction.
    b. Three-leg, signalized intersection with dedicated left turning lanes for the southbound and westbound approaches.
    c. The southbound left turn is protected.
    d. Channelized right turn lanes are provided for the northbound and westbound approaches.
6. At this location, Route 11 and Kuakini Highway
    a. Route 11 is oriented in a north-south direction and Kuakini Highway is oriented in an east-west direction.
    b. Three-leg, STOP sign controlled intersection with dedicated left turning lanes for northbound and eastbound.
    c. Channelized right turn lanes exist for the eastbound and southbound approaches.
    d. A refuge lane is provided for the eastbound left turns onto Route 11.
    e. Kuakini Highway is a state-owned facility.
7. Route 11 and Lako Street
    a. At this location, Route 11 is oriented in a north-south direction and Lako Street is oriented in an east-west direction.
    b. Four-leg, signalized intersection with dedicated left turning lanes for each approach.
    c. Left turns from Route 11 onto Lako Street are protected-permitted. This is the only intersection in the project area on Route 11 that uses protected-permitted phasing. The Lako Street phases are split.
    d. Channelized right turn lanes exist for each approach.
8. Route 11 and Kamehameha III Road
    a. At this location, Route 11 is oriented in a north-south direction and Kamehameha III Road is oriented in an east-west direction.
    b. Four-leg, signalized intersection with dedicated left turn lanes exist on the northbound, and southbound approaches.
    c. Left turns from Route 11 are protected. The Kamehameha III Road phases are split.
    d. Channelized right turn lane exists for southbound and eastbound approach.

Existing (2019) lane configurations and traffic controls at the study intersections are shown in Figure 3.

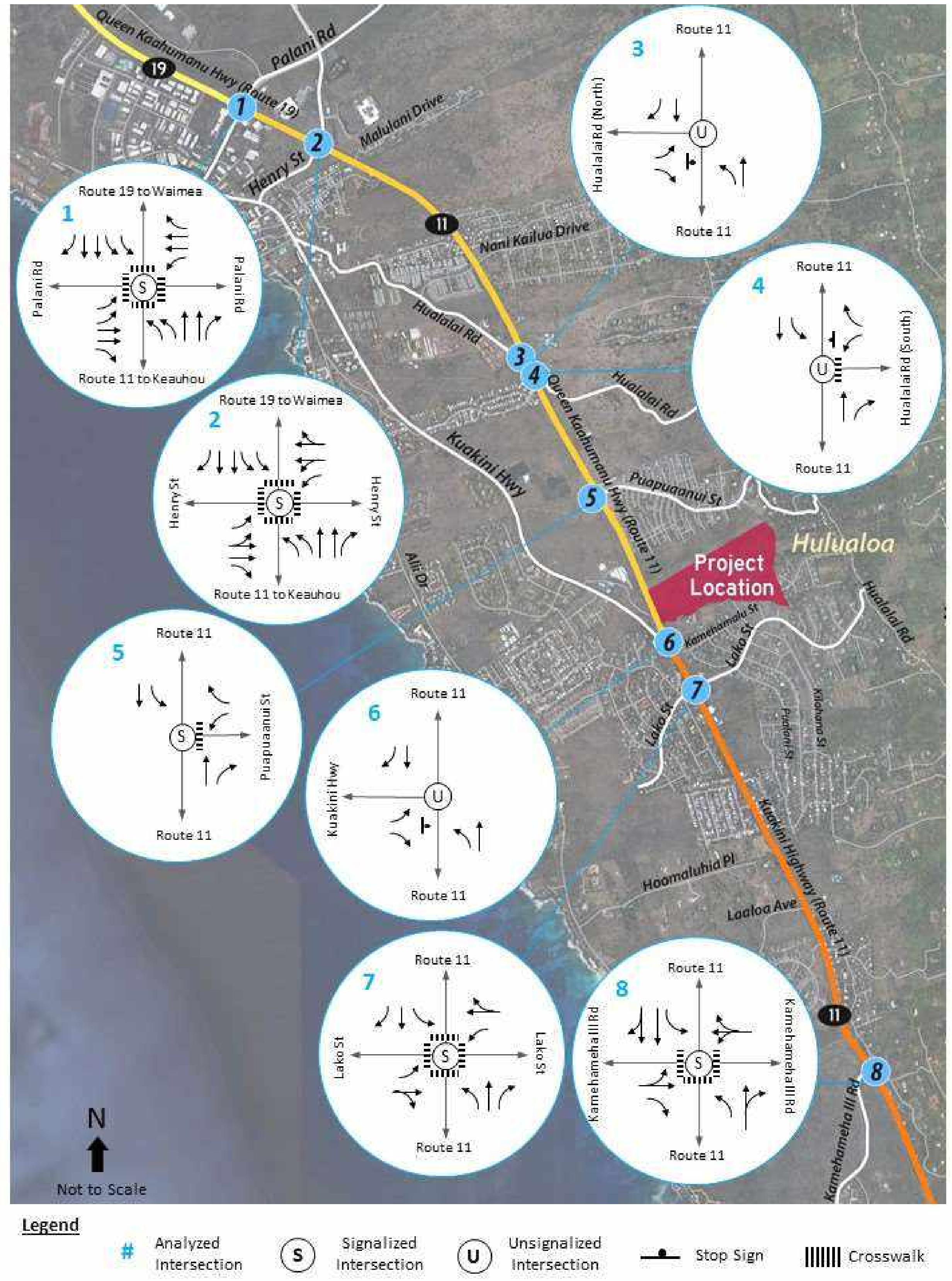


Figure 3: Existing 2019 Lane Configuration

3. Pedestrian Facilities

Sidewalks are provided on each corner of Palani Road and Henry Street. A sidewalk is provided on the south side of Route 11 between Palani Road and Henry Street. Sidewalks are provided on both sides of Puapuaanui Street and stop just before the intersection with Route 11. The crosswalks provided at each intersection are shown in Figure 3.

4. Bike Facilities

Marked bike lanes are provided on Route 11 at Henry Street and extend north. There are no marked bike lanes south of this intersection. There are bike lanes on Lako Street east of Route 11 to Hualalai Road. Based on the State Route System, marked shoulders along Route 11 in the study area range from 6 feet to 10 feet.

5. Bus Stops and Bus Routes

The County of Hawaii's transit system (Hele-on Bus) doesn't have bus routes that travel along Route 11 near the study area. The closest bus stops to the proposed facility are located at Kona Commons Shopping Center, more than 3 miles away. The Intra Kona bus route serves this stop and operates between 6:55 AM to 8:30 PM, Monday to Saturday. Appendix A includes the detailed bus route schedule and map for this route.

B. Volumes

1. Vehicular Volume

a) Roadway Traffic Volumes

Historical average daily traffic (ADT) and peak hour volumes along Route 11 in the study area are shown in Table 1. The ADT is based on Hawaii DOT traffic counts included in *Historical Traffic Station Maps*.

Table 1: Roadway Traffic Volumes

Roadway	Location	ADT	YEAR
Route 11	Between Nani Kailua Drive and Hualalai Road	25,800	2016
		25,900	2015

Source: *Historical Traffic Station Maps* (HDOT)

The 24-hour traffic volume distribution along Route 11 (see Figure 4) at the traffic count station shows a variation in travel patterns throughout the day with prominent morning and afternoon commuter peak periods. Detailed 24-hour counts are included in Appendix B.

Along Route 11, during the morning peak hour of 7:00 - 8:00 AM, there were approximately 1,083 vehicles per hour (vph) travelling northbound and 765 vph travelling southbound for a total of 1,848 vph. During the afternoon peak hour of 3:45 – 4:45 PM, there were approximately 914 vph travelling northbound and 1,017 travelling southbound for a total of 1,931 vph.

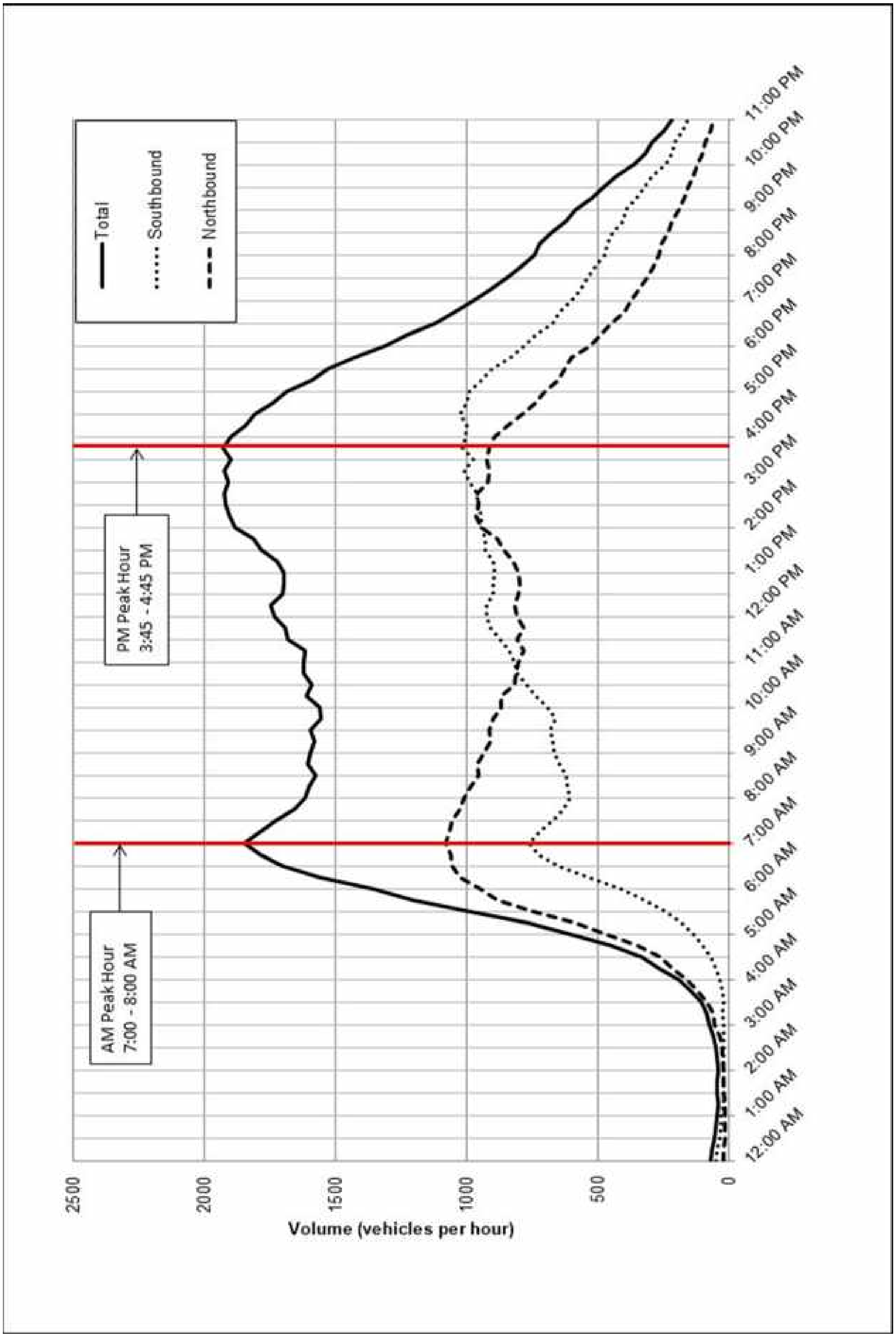


Figure 4: Route 11, Nani Kailua Dr to Hualalai Rd, 24-Hour Volume Distribution (2016)

b) Existing 2019 Intersection Peak Hour Volumes

Manual intersection turning movement traffic counts were taken at the eight study intersections: 1) Route 11 and Palani Road, 2) Route 11 and Henry Street, 3) Route 11 and Hualalai Road (north), 4) Route 11 and Hualalai Road (south), 5) Route 11 and Puapuaanui Street, 6) Route 11 and Kuakini Highway, 7) Route 11 and Lako Street, and 8) Route 11 and Kamehameha III Road. Counts were collected during the peak periods on Tuesday, April 30, 2019 and Thursday, August 29, 2019. Counts included tabulation of passenger vehicles, heavy trucks, pedestrians, and bicycles. The Existing (2019) peak hour volumes are shown in Figure 5. Detailed peak period counts are included in Appendix B.

2. Pedestrian and Bicycle Volumes

Route 11 is a frequently used training route for triathletes and other cyclists and therefore has regular bicycle activity. Table 2 shows the 2019 pedestrian and bicycle volumes. Most of the observed pedestrian activity occurred at Henry Street. Bicycle counts were higher in the AM peak hour than the PM peak hour. Detailed peak period pedestrian and bicycle counts are included in Appendix B.

Table 2: Existing 2019 Pedestrian and Bicycle Volumes

Intersection	AM		PM	
	Ped	Bike	Ped	Bike
Queen Kaahumanu Hwy & Palani Rd	1	3	4	3
Queen Kaahumanu Hwy & Henry St	9	4	12	4
Queen Kaahumanu Hwy & Hualalai Rd (N)	0	3	0	1
Queen Kaahumanu Hwy & Hualalai Rd (S)	0	4	0	0
Queen Kaahumanu Hwy & Puapuaanui St	0	2	1	0
Queen Kaahumanu Hwy & Kuakini Hwy	0	2	0	0
Queen Kaahumanu Hwy & Lako St	1	2	1	0
Queen Kaahumanu Hwy & Kamehameha III	1	10	0	2

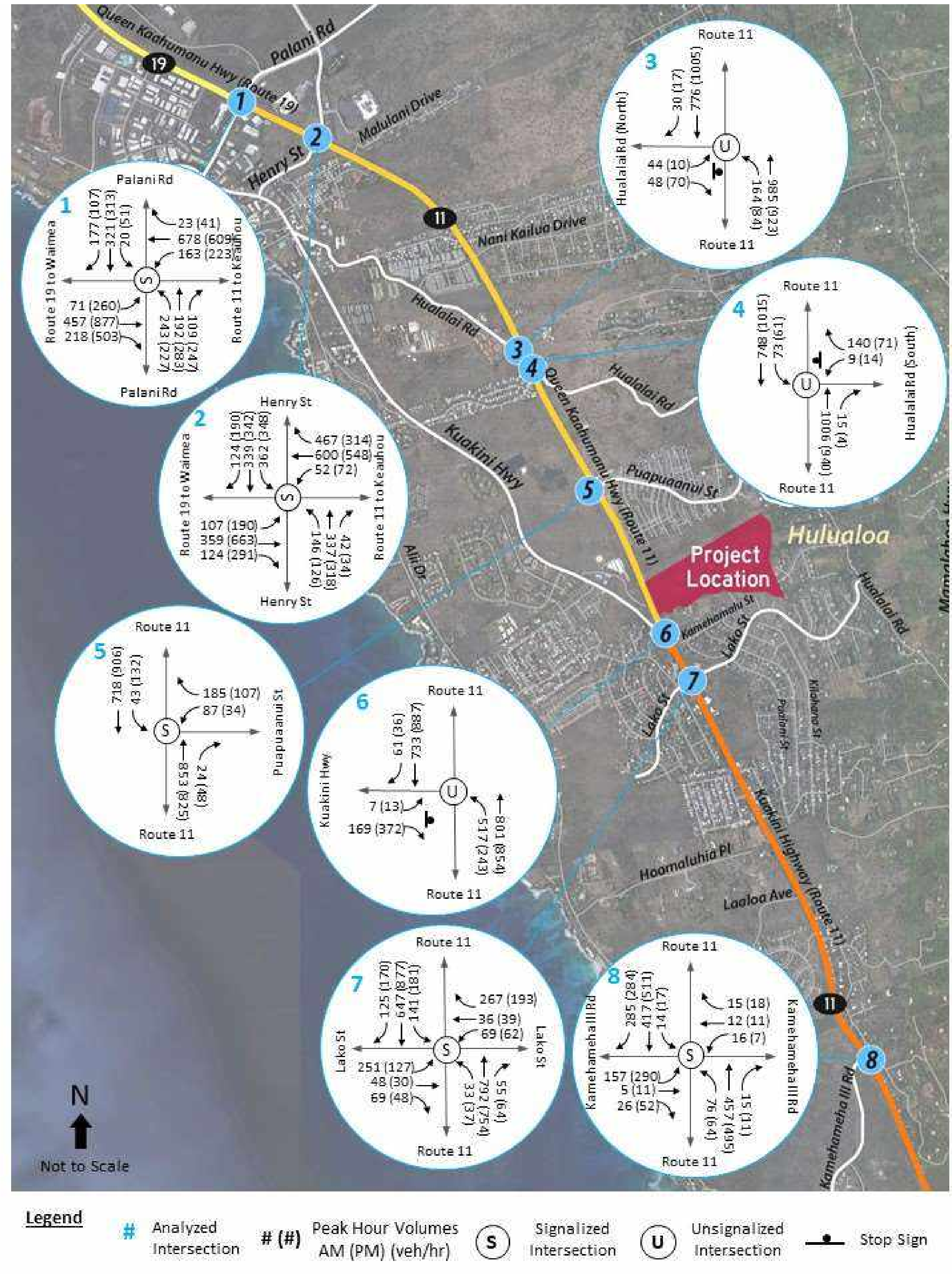


Figure 5: Existing 2019 Peak Hour Volumes

C. Traffic Operation Analysis

1. Level of Service Methodology

Level of service (LOS) is an operational analysis rating system used in traffic engineering to measure the effectiveness of roadway operating conditions. There are six LOS ranging from A to F. LOS A is defined as being the least interrupted flow conditions with little or no delays, whereas LOS F is defined as conditions where extreme delays exist. Guidelines from the *County of Hawaii* Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) state that an "Acceptable level of service" means that the level of service of a transportation facility at the AM and PM peak hour is "D" or better. Level of service, or LOS, means a qualitative measure describing operational conditions within a traffic stream and shall be determined using the procedures in the latest edition of the Highway Capacity Manual, Transportation Research Board. Intersection LOS and delay were determined for the AM and PM peak hours using *Synchro 10* traffic analysis software and analyzed using *HCM* 6th Edition (TRB, 2016) methodologies.

As stated in the *Highway Capacity Manual* (*HCM*) 6th Edition (TRB, 2016), LOS for a two-way stop controlled (TWSC) intersection is determined by the measured control delay (see Table 3) and is defined for each movement. Vehicles traveling along the major, free-flow road, of a TWSC intersection, proceed through with minimal delay or no delay at all. Those vehicles approaching the intersection along the minor movement are controlled by a stop sign and thus experience delay attributable to the volume of vehicles passing along the free-flow road and the gaps available.

Table 3: LOS Criteria for Unsignalized Intersections

Average Control Delay (s/veh)	LOS by v/c Ratio	
	<=1.0	>1.0
≤ 10.0	A	F
>10 and ≤15	B	F
>15 and ≤25	C	F
>25 and ≤35	D	F
>35 and ≤50	E	F
>50	F	F

Source: *HCM* (TRB, 2016)

The LOS analysis for signalized intersections is based on average total vehicle delay based on the methodologies of the *HCM* (TRB, 2016), as shown in Table 4. The HCM 6th Edition doesn't support the analysis with both exclusive and shared lanes. In those cases, methodologies from HCM (TRB, 2000) are used. For this traffic study, the Route 11 and Henry Street intersection will use the 2000 HCM methodology.

Another measure of intersection delay is the volume to capacity (v/c) ratio. This is the ratio of the volume of traffic utilizing the intersection compared to the maximum volume of vehicles that can be accommodated by the intersection during a specific period. A v/c ratio under 0.85 means the intersection is operating under capacity and excessive delays are not experienced. An intersection is operating near its capacity when v/c ratios range from 0.85 to 0.95. Unstable flows are expected when the v/c ratio is between 0.95 and 1.0. A traffic movement can have a poor LOS but low v/c, which suggests that the traffic volumes along that movement are low but must wait a long time to make the movement. This is common for low volume protected left-turn turn movements or side streets that must wait through a long cycle length for their split to come up.

Table 4: LOS Criteria for Signalized Intersections

Average Control Delay (s/veh)	LOS by v/c Ratio	LOS by v/c Ratio
	<=1.0	>=1.0
≤ 10.0	A	F
>10 and ≤20	B	F
>20 and ≤35	C	F
>35 and ≤55	D	F
>55 and ≤80	E	F
>80	F	F

Source: *HCM* (TRB, 2016)

Where signalized intersections are less than 2.0 miles apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities (HCM, Chapter 16). For Urban Street Facilities, through vehicle travel speed is used to analyze vehicular LOS. This speed reflects the factors that influence running time along each link, and the delay incurred by through vehicles at each boundary intersection. This performance measure indicates the degree of mobility provided by the facility.

2. Existing 2019 Intersection LOS

Existing intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours. Table 5 show the existing vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Movements that operate at LOS E or worse are highlighted in yellow. Synchro output is in Appendix C.

a) Route 11 and Palani Road. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersections of Route 11 with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.

b) Route 11 and Henry Street Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersections of Route 11 with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

c) Route 11 and Hualalai Road (North)

At the unsignalized intersection of Route 11 with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 1.31 and 0.23 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

Table 5: Existing 2019 Intersection Level of Service

Intersection	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Palani Rd (overall)	**23.7**	**-**	**C**	**26.1**	**-**	**C**
Route 11 EB Left	38.6	0.45	D	38.0	0.74	D
Route 11 EB Through	14.1	0.30	B	17.9	0.57	B
Route 11 WB Left	38.9	0.67	D	38.8	0.72	D
Route 11 WB Through	14.2	0.42	B	16.4	0.41	B
Palani NB Left	37.4	0.72	D	39.1	0.73	D
Palani NB Through	25.8	0.25	C	28.8	0.42	C
Palani SB Left	47.7	0.50	D	48.3	0.68	D
Palani SB Through	33.7	0.66	C	33.6	0.62	C
Route 11 & Henry St (overall)	**31.8**	**0.62**	**C**	**32.6**	**0.65**	**C**
Route 11 EB Left	43.6	0.50	D	46.7	0.65	D
Route 11 EB Through	24.6	0.34	C	27.8	0.57	C
Route 11 EB Right	22.0	0.08	C	23.1	0.19	C
Route 11 WB Left	45.0	0.37	D	48.4	0.52	D
Route 11 WB Through	30.5	0.60	C	31.0	0.56	C
Route 11 WB Right	26.9	0.31	C	26.7	0.21	C
Henry NB Left	34.9	0.46	C	35.9	0.41	D
Henry NB Left-Through	35.8	0.58	D	37.1	0.56	D
Henry NB Right	31.0	0.03	C	32.5	0.02	C
Henry SB Left	38.3	0.72	D	39.3	0.73	D
Henry SB Left-Through-Right	34.6	0.69	C	34.2	0.67	C
Route 11 & Hualalai (N) (overall)	**10.3**	**-**	**-**	**1.0**	**-**	**-**
Route 11 NB Left	10.8	0.22	B	11.2	0.13	B
Hualalai EB Left	429.0	1.31	F	107.3	0.23	F
Route 11 & Hualalai (S) (overall)	**3.3**	**-**	**-**	**1.7**	**-**	**-**
Route 11 SB Left	11.5	0.13	B	10.8	0.09	B
Hualalai WB Left	87.5	0.18	F	112.5	0.31	F
Hualalai WB Right	35.8	0.58	E	20.4	0.24	C
Route 11 & Puapuaanui St (overall)	**9.7**	**-**	**A**	**9.8**	**-**	**A**
Route 11 SB Left	60.4	0.71	E	53.1	0.81	D
Route 11 WB Through	3.3	0.50	A	3.0	0.57	A
Puapuaanui WB Left	55.4	0.78	E	56.0	0.62	E
Puapuaanui WB Right	7.9	0.64	A	8.5	0.63	A
Route 11 & Kuakini (overall)	**7.7**	**-**	**-**	**2.8**	**-**	**-**
Route 11 NB Left	17.6	0.67	C	12.1	0.33	B
Kuakini EB Left	1035.4	1.08	F	208.2	0.46	F
Route 11 & Lako St (overall)	**30.6**	**-**	**C**	**21.8**	**-**	**C**
Route 11 NB Left	12.8	0.10	B	12.8	0.14	B
Route 11 NB Through	30.4	0.87	C	18.8	0.75	B
Route 11 SB Left	21.9	0.58	C	13.5	0.51	B
Route 11 SB Through	19.2	0.68	B	20.1	0.82	C
Lako EB Left	60.2	0.88	E	44.3	0.76	D
Lako EB Through-Right	34.1	0.16	C	35.7	0.17	D
Lako WB Left	50.5	0.66	D	45.9	0.64	D
Lako WB Through-Right	44.5	0.33	D	41.2	0.39	D
Route 11 & Kam III Rd (overall)	**17.7**	**-**	**B**	**22.0**	**-**	**C**
Route 11 NB Left	43.5	0.79	D	47.2	0.75	D
Route 11 NB Through	12.4	0.55	B	17.4	0.60	B
Route 11 SB Left	42.2	0.46	D	45.7	0.48	D
Route 11 SB Through	10.3	0.27	B	14.0	0.34	B
Kamehameha EB Left-Through	32.0	0.73	C	34.1	0.84	C
Kamehameha WB Left-Through-Right	41.4	0.66	D	44.9	0.61	D

d) Route 11 and Hualalai Road (South)

At the unsignalized intersection of Route 11 with Hualalai Road (south), the westbound left turning movement has LOS F (v/c of 0.18 and 0.31 respectively) and the westbound right turn operates at LOS E (v/c of 0.58) during the AM peak hour. The long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

e) Route 11 and Puapuaanui Street Overall Intersection LOS = A/A (AM/PM)

The southbound left and westbound left turn movements operate at LOS E (v/c of 0.71 and 0.78, respectively) during the AM peak hour. The westbound left turn operates at LOS E (v/c of 0.62) during the PM peak hour. The left turn volumes are low and should clear every cycle. These delays are a result of signal timing and could be adjusted to reduce approach delay if desired.

f) Route 11 and Kuakini Highway

At the unsignalized intersection of Route 11 with Kuakini Highway, the eastbound left turning movement has an LOS F (v/c of 1.08 and 0.46 respectively) and long delays during both AM and PM peak hours due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

g) Route 11 and Lako Street. Overall Intersection LOS = C/C (AM/PM)

At the signalized intersection of Route 11 with Lako Street, the eastbound left turn operates at LOS E (v/c of 0.88) during the AM peak hour. This delay is attributed to the high eastbound left turn volume, and the split phasing for the Lako Street approaches. All other movements at Lako Street operates at LOS D or better during both peak hours.

h) Route 11 and Kamehameha III Road

The overall intersection resulted in LOS B and C for the AM and PM peak hours, respectively. All movements at the signalized intersection of Route 11 with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

3. Existing 2019 Mitigation

a) Traffic Signal Warrant Analysis

Four-Hour and Peak-Hour traffic signal warrants were evaluated at the unsignalized intersections where the minor street left turns onto Route 11 operate at LOS F during both peak hours. It should be noted that these movements have a refuge lane on Route 11 which is not recognized by Synchro and therefore the actual/observed delay is less than the calculated delay shown in Table 5. The Peak-Hour warrant is not a good measure of whether or not a traffic signal should be installed in this setting. However, it is being evaluated and provided only as an indicator of when an intersection should be monitored.

The minor street left turn movements at both Hualalai Road intersections and Kuakini Highway operate at LOS F during both peak hours. For these intersections, the minor street left turns were used for the minor street approach. The major street approach was represented by a sum of the through volumes and the left turns from Route 11. Right turns for all approaches were excluded from the analysis since the right turns enter the roadway with minimal conflict.

For the Four-Hour warrant, Figure 4C-2 (MUTCD) was used since the 45 MPH posted speed limit on Route 11 is over 40 MPH. The "2 or more Lanes & 1 Lane" curve was used for analysis. Table 6 shows the Four-Hour warrant analysis.

Table 6: Four-Hour Warrant based on 2019 traffic volumes

Existing - Hualalai (N)	4-Hour Warrant		
	Major	Minor	Warrant?
6:45-7:45 AM	1925	44	NO
7:45-8:45 AM	1783	2	NO
3:00-4:00 PM	2012	10	NO
4:00-5:00 PM	1842	14	NO
5:00-6:00 PM	1767	7	NO
Existing - Hualalai (S)	**4-Hour Warrant**		
	Major	Minor	Warrant?
6:45-7:45 AM	1824	9	NO
7:45-8:45 AM	1769	6	NO
3:00-4:00 PM	2014	14	NO
4:00-5:00 PM	1900	4	NO
5:00-6:00 PM	1835	3	NO
Existing - Kuakini	**4-Hour Warrant**		
	Major	Minor	Warrant?
6:45-7:45 AM	2047	8	NO
7:45-8:45 AM	1976	4	NO
3:00-4:00 PM	1979	14	NO
4:00-5:00 PM	1998	14	NO
5:00-6:00 PM	1749	5	NO

For the Peak-Hour warrant, Figure 4C-4 (MUTCD) was used since the 45 MPH posted speed limit on Route 11 is over 40 MPH. The "2 or more Lanes & 1 Lane" curve was used for analysis. Table 7 shows the Peak-Hour warrant analysis.

Table 7: Peak-Hour Warrant based on 2019 traffic volumes[1]

Minor Road	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	1925	44	NO	2012	10	NO
Hualalai (S)	1614	9	NO	1863	14	NO
Kuakini	2051	7	NO	1984	13	NO

None of the three unsignalized intersections satisfy the 4-Hour or Peak Hour Traffic Signal Warrant.

[1] A Peak Hour warrant was evaluated to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.

b) *Roundabout Analysis*

The minor street left turn movements at both Hualalai Road intersections and Kuakini Highway operate at LOS F during both peak hours. For these intersections, the traffic operations for a single-lane roundabout were analyzed (see Table 8). At both Hualalai Road intersections, the minor street approach improved to LOS B or better, however, the Route 11 approach LOS deteriorates to LOS C or LOS D. at Kuakini Highway, the overall intersection delay increased from 7.7 seconds to 75.6 seconds and from 2.8 seconds to 24.7 seconds in the AM and PM peak hours, respectively. The Route 11 approaches will operate at LOS F with v/c over 1.00 in the AM peak hour.

Table 8: Existing Roundabout Analysis at Unsignalized Intersections

	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Hualalai (N) (overall)	**27.1**	**-**	**D**	**18.3**	**-**	**C**
Route 11 NB approach	34.6	0.96	D	16.1	0.79	C
Route 11 SB approach	19.0	0.80	C	21.2	0.85	C
Hualalai North EB approach	8.9	0.18	A	10.3	0.18	B
Route 11 & Hualalai (S) (overall)	**18.4**	**-**	**C**	**17.2**	**-**	**C**
Route 11 NB approach	24.2	0.89	C	16.0	0.78	C
Route 11 SB approach	11.8	0.68	B	18.7	0.84	C
Hualalai North WB approach	14.7	0.37	B	9.9	0.18	A
Route 11 & Kuakini (overall)	**75.6**	**-**	**F**	**24.7**	**-**	**C**
Route 11 NB approach	64.6	1.08	F	19.5	0.85	C
Route 11 SB approach	108.1	1.16	F	29.4	0.90	D
Kuakini EB approach	11.0	0.33	B	28.1	0.75	D

c) *Alternative Mitigation Measures*

(1) Acceleration Lane at Hualalai Road (South)

The Hualalai Road (South) westbound right turn operates at LOS E during the AM peak hour. An acceleration lane for the westbound right turn onto northbound Route 11 would remove the conflict at the intersection, similar to other intersections on the Route 11 corridor.

(2) Lako Street

Lako Street was analyzed with various left turn phasing for the Lako Street approach. A comparison between showing the different left turn phasing on Lako Street is shown in Table 9.

Protected left turns on Lako Street will provide a slight improvement in the overall delay, but the eastbound left will still operate with LOS E. The other alternatives will provide acceptable LOS for all movements.

The City and County of Honolulu's *Traffic Assessment for Left-Turn Signal Phasing Guidelines* (ATA, 2017) recommends that for approaches that do not have adequate sight distance, a protected left-turn phase should be considered, and a permissive left-turn phase is not suitable. The eastbound approach sight distance should be checked before considering allowing permissive left-turn phasing. The widening of Route 11 from Henry Street to Kamehameha III Road is needed in 2024.

Table 9: Existing Condition – Route 11 and Lako Street Left-Turn Signal Phasing Alternatives

2-Lane Route 11, Protected Left Turn Signal Phasing on Lako Street	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Lako St (overall)	**29.8**	-	**C**	**21.7**	-	**C**
Route 11 NB Left	12.4	0.10	B	12.8	0.14	B
Route 11 NB Through	29.1	0.86	C	18.8	0.75	B
Route 11 SB Left	20.8	0.57	C	13.4	0.51	B
Route 11 SB Through	18.5	0.67	B	20.1	0.82	C
Lako EB Left	59.9	0.88	E	44.2	0.76	D
Lako EB Through-Right	34.3	0.17	C	35.9	0.17	D
Lako WB Left	49.8	0.66	D	44.6	0.61	D
Lako WB Through-Right	45.1	0.36	D	41.3	0.40	D
2-Lane Route 11, Permissive Left Turn Signal Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**22.1**	-	**C**	**15.4**	-	**B**
Route 11 NB Left	10.2	0.09	B	8.9	0.11	A
Route 11 NB Through	24.1	0.83	C	12.9	0.68	B
Route 11 SB Left	16.6	0.51	B	9.2	0.43	A
Route 11 SB Through	15.7	0.65	B	13.8	0.75	B
Lako EB Left	34.1	0.69	C	35.6	0.51	D
Lako EB Through-Right	25.5	0.11	C	30.0	0.12	C
Lako WB Left	27.8	0.19	C	32.2	0.24	C
Lako WB Through-Right	25.2	0.09	C	30.2	0.16	C
2-Lane Route 11, Prot+Perm Left Turn Signal Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**23.6**	-	**C**	**19.4**	-	**B**
Route 11 NB Left	10.4	0.09	B	11.5	0.14	B
Route 11 NB Through	24.4	0.83	C	17.6	0.75	B
Route 11 SB Left	16.9	0.51	B	12.1	0.49	B
Route 11 SB Through	15.9	0.65	B	18.9	0.82	B
Lako EB Left	38.6	0.72	D	32.4	0.49	C
Lako EB Through-Right	33.3	0.20	C	33.1	0.21	C
Lako WB Left	36.3	0.29	D	31.3	0.24	C
Lako WB Through-Right	40.7	0.34	D	35.7	0.36	D
4-Lane Route 11, Split Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**18.6**	-	**B**	**14.9**	-	**B**
Route 11 NB Left	11.6	0.09	B	9.7	0.11	A
Route 11 NB Through	19.0	0.67	B	14.8	0.58	B
Route 11 SB Left	12.7	0.42	B	9.8	0.43	A
Route 11 SB Through	14.5	0.49	B	13.0	0.59	B
Lako EB Left	27.3	0.80	C	27.5	0.70	C
Lako EB Through-Right	20.2	0.15	C	21.7	0.16	C
Lako WB Left	30.4	0.57	C	26.1	0.49	C
Lako WB Through-Right	27.1	0.28	C	24.3	0.30	C

III. Future (2024) Near-Term Conditions – Completion of Phase 1

Royal Vistas Phase 1 is expected to be completed by 2024, representing the 5-year future forecast. Phase 1 will contain 258 dwelling units and the only point of access will be the Royal Vistas Roadway intersecting with Route 11, about 600 feet north of the Kuakini Highway intersection.

A. Surrounding Area Developments

Surrounding area developments identified below were researched and analyzed to assess their potential future impact on study intersections. No other significant developments are expected in the surrounding area that would significantly affect the roadway geometrics or traffic volumes at the study intersections. This is based on research completed on October 10, 2019 at the State of Hawaii Office of Environmental Quality Control (OEQC) website.

1. Living Stones Church

The Living Stones Church is located north of Puapuaanui Street, just north of Hoomama Street. The church will have 600 seats with approximately 19,000 square feet gross floor area (SF GFA). The church will mainly be open on Sundays. The *Living Stones Church Traffic Assessment Report* (The Traffic Management Consultant, 2018) analyzed the Sunday peak hour conditions as weekday use of the church is minor. Traffic generated by this project on a typical weekday was assumed to be included in the annual growth rate.

2. Pualani Makai

The Pualanai Makai development is located makai of Route 11, across of Puapuaanui Street, over two miles north of the Laipala Makai project. This mixed-use development consists of multi-family housing and various retail/commercial space. The Puapuaanui Street intersection will become a 4-way intersection with a dedicated left turn, through, and right turn lane for all approaches. Approaches on Route 11 were recommended to have protected/permitted left-turn phasing. There was no phasing recommendation for the Puapuaanui Street approaches. The addition of the makai leg of Puapuaanui Street will divert some traffic away from Kuakini Highway. The *Pualani Makai Traffic Impact Analysis Report* (The Traffic Management Consultant, 2019) included project generated traffic assignment and diverted traffic. Traffic from this project will impact the study intersections of this project and were added to the background volumes. The Pualani Makai project calls for more north-south regional traffic capacity through the widening of Route 11 or the construction of Alii Highway, which is a consistent recommendation for projects in this area.

3. Youth Gymnastics and Sports Fitness Facility

The Youth Gymnastics and Sports Fitness Facility is located east of Route 11, with access off of Hualalai Road (south). The gym and fitness facility opened for operations in October 2020. The gymnasium and fitness center are approximately 15,000 SF GFA. Classes are offered only in the afternoons from 2:00 PM – 7:00 PM. Approximately 15 to 20 children attend the facility. To model the traffic generated by this facility, 20 vehicles were added to the background PM peak hour. Trips were distributed based on the 2019 traffic patterns.

B. Roadway Construction Projects

Roadway construction projects identified below were researched and analyzed to assess their potential future impact on study roadways and intersections. No other significant future construction projects are expected in the surrounding area that would significantly affect the roadway geometrics or traffic volumes at the study intersections. This is based on review of the Statewide Transportation Improvements Program (STIP). The projects referenced in the long-range transportation plan and Bike Plan Hawaii are not found in the STIP. The impacts of these projects were assumed to be captured in the background growth rate.

1. Widening of Route 11 from Henry Street to Kamehameha III Road

The *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (July 2014) and the *County of Hawaii General Plan* (February 2005) includes improvements to Route 11 from Henry Street to Kamehameha III Road. It is proposed that Route 11 will be widened by two travel lanes and include bicycle facilities and sidewalks. This project will improve north-south regional capacity. There is currently no anticipated start/completion date for this project and therefore it was not included in the analysis of future conditions.

2. Lako Street Extension

The most recent extension of Lako Street is proposed from the current terminus to a future roundabout at the intersection with Alii Drive. The proposed roadway connection is about 1.2 miles north of the project site. The Lako Street extension would provide another mauka-makai connector road between Laaloa Avenue and Royal Poinciana Drive. This project would provide access to Alii Drive and the future Alii Highway. There is currently no anticipated start/completion date for this project.

3. Alii Highway from Hualalai Road to Keauhou Shopping Center

The *County of Hawaii General Plan* (February 2005) includes a recommendation for the construction of Kahului-Keauhou Parkway (Alii Highway) from Queen Kaahumanu Highway to Keauhou. The official Transportation Network Maps for the Nani Kailua Area (see Figure 6) shows the future Alii Highway extension running parallel to Route 11, connecting to Route 11 between Hualalai Road and Puapuaanui Street and extending through the project area to the Keauhou Shopping Center. The completion of this project would provide an alternative to Alii Drive and Route 11 in the north-south direction, passing around the northbound Lako Street bottleneck. Proposed pedestrian and bike paths are planned along the Alii Highway extension. There is currently no anticipated start/completion date for this project and therefore it was not included in the analysis of future conditions.

C. Multimodal Plans

1. Bike Plan Hawaii

Bike Plan Hawaii (2003) references several near-term projects. Two of the projects nearby are: a signed shared road on Kuakini Highway from Lako Street to Hualalai Road, and a signed shared road on Route 11 from Henry Street to Kuakini Highway. This project is not expected to have an impact to the vehicular traffic in the study area.

2. Statewide Pedestrian Master Plan

The 2011 Statewide Pedestrian Master Plan does not include any pedestrian facility upgrades or construction in the project area.

D. Community Plan

1. Kona Community Development Plan

The official *Transportation Network Map – Nani Kailua Area from the Kona Community Development Plan* (Wilson Okomoto, 2008) shows future connections of ‘minor collectors’ running parallel to Route 11 in the location of Royal Vistas, (1) extending Hoomama Street to Leilani Street, and (2) extending Paulehia Street to Kekuanaoa Place, shown in Figure 6. The completion of Alii Highway and the Lako Street Extension are also shown in Figure 6. The timing of these improvements is undetermined, and it is not expected they will be completed prior to 2024. The most likely condition is that the developers of Royal Vistas will complete the extension to Kekuanaoa Place before Phase 2 is occupied.

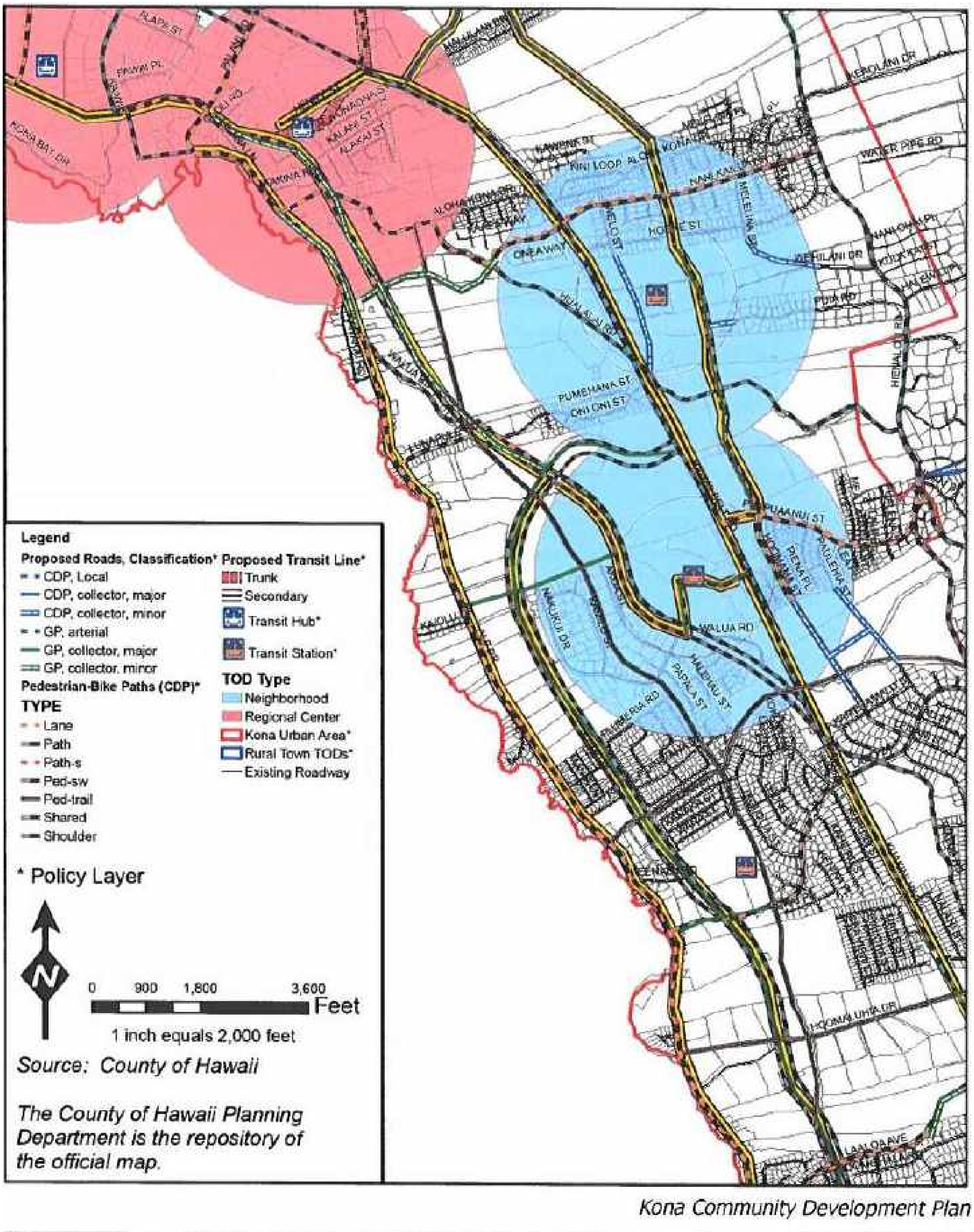


Figure 6: Kona Community Development Plan

E. Volumes

1. Future 2024 Without Project Volumes

The project study area within Kona has been experiencing modest growth. HDOT ADT counts on Route 11 between Nani Kailua Drive and Hualalai Road didn't show any increase in vehicular volumes from 2015 to 2016. The 2035 Federal Aid Highways Long Range Transportation Plan forecasts average daily traffic in Kona on Hawaii Belt Road to be 41,900 vehicles in 2020 and 48,000 vehicles in 2035. This equates to a 1.01% annual growth rate over 15 years in the Kona area. Therefore, a background growth rate of 1.0% per year was applied to all through movements on Route 11 at the study intersections. Traffic generated traffic from Pualani Makai and the Youth Gymnastics and Sports Fitness Facility were also added separately into the background volumes. The estimated future volumes without the project for the future year 2024 are shown in Figure 7.

2. Project Related Volumes

The proposed Royal Vistas include 258 multi-family residential dwelling units for Phase 1. All of these are expected to be low rise units with two or three stories. Trips generated from the proposed facility were estimated using nationally accepted land use rates from the *Trip Generation*, 10th Edition (ITE, 2016). ITE defines the Multi-family Housing (Low Rise) Land Use [220] as follows: "includes apartments, townhouses and condominiums located within the same building with at least three other dwelling units" The analysis used 258 dwelling units as the independent variable to estimate new trips expected from the proposed project. The estimates for new trips generated by the project are shown in Table 10.

Table 10: Estimated Trips Generated - Phase 1

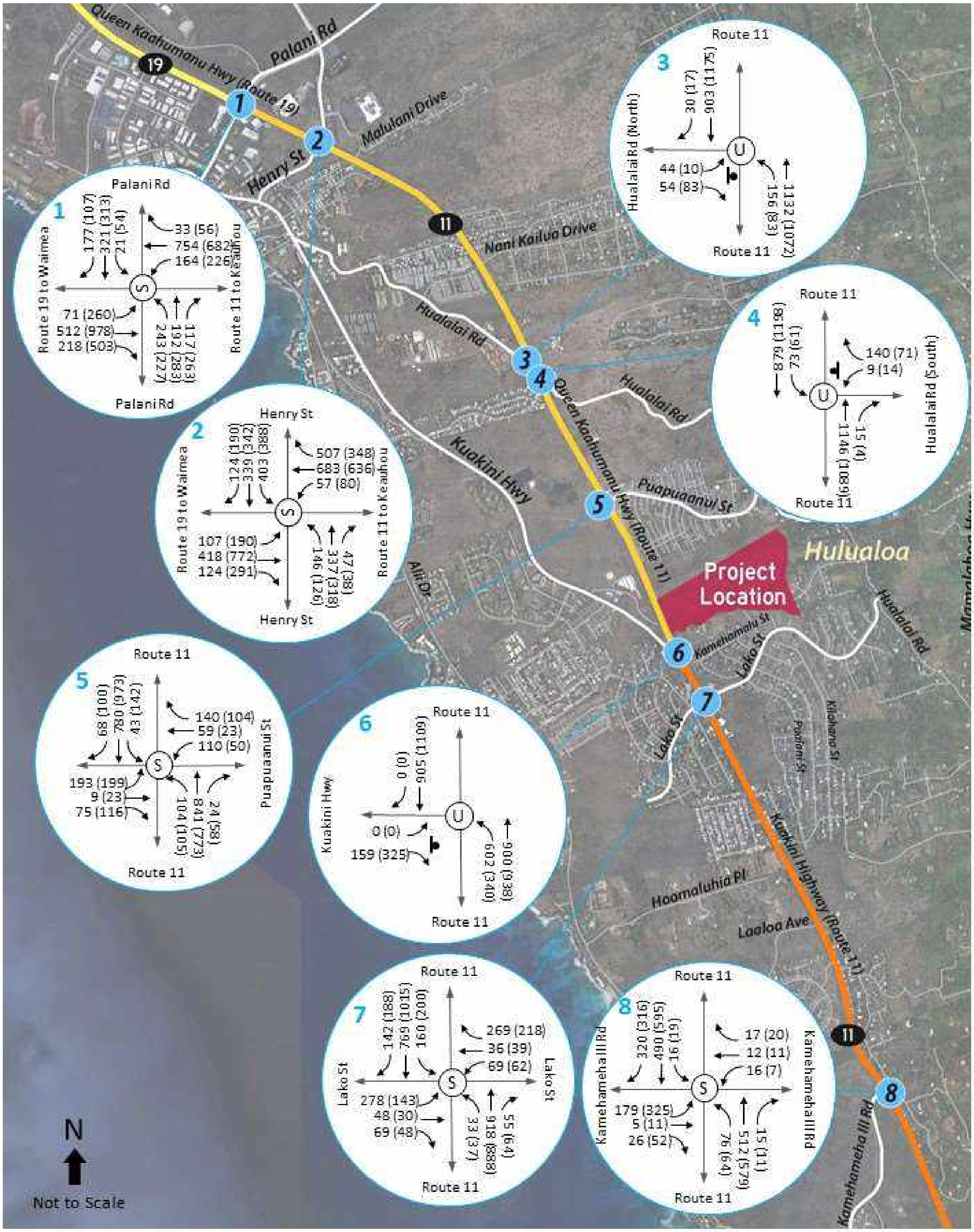
	AM		**PM**	
Land Use [ITE Code]	**Equation**		**Equation**	
Multi-family Housing (Low Rise) [220]	Ln (T) = 0.95 Ln (X) – 0.51		Ln (T) = 0.89*Ln (X) - 0.02	
Dwelling Units	258		258	
New Trips	117		137	
	In[2]	**Out**	**In**	**Out**
	23%	77%	63%	37%
	27	90	86	51

T = Total number of trips generated, X = Dwelling Units

Trips generated by the Royal Vistas Phase 1 will enter and exit at the Royal Vistas Roadway and were distributed onto Route 11 according to existing travel patterns.

The existing 2019 segment volumes between Puapuaanui Street and Kuakini Street were used to determine the inbound percent distribution.

[2] In and Out split provided by *Trip Generation*, 10th Edition (ITE 2016) for Land Use 220



Legend
Analyzed Intersection
(#) Peak Hour Volumes AM (PM) (veh/hr)
S Signalized Intersection
U Unsignalized Intersection
Stop Sign

Figure 7: Future 2024 Without Project Peak Hour Volumes

Based on the existing 2019 traffic volumes on Route 11, between Puapuaanui Street and Lako Street, the AM peak hour direction is northbound, and the PM peak hour direction is southbound. Table 11 shows the directional percentages at Route 11 and Puapuaanui Street that were used to determine the inbound trip distribution.

Table 11: Existing 2019 Volumes on Route 11 between Puapuaanui St and Kuakini Highway

	AM		PM	
	NB	SB	NB	SB
Volume	877	805	873	940
Percent	52%	48%	48%	52%

The 2019 outbound volumes at Puapuaanui Street were used to determine the outbound percent distribution. Royal Vistas will have a similar land use as Pualani Estates, which is just north of Royal Vistas and currently uses Puapuaanui Street as the main access to Route 11. Outbound traffic distribution for Pualani Estates at Puapuaanui Street is anticipated to have a similar outbound distribution at Royal Vistas Roadway. Table 12 shows the existing outbound volumes for Pualani Estates at Puapuaanui Street during the AM and PM peak hours. The percentages shown in Table 11 were used for the outbound trip distribution at the Royal Vistas Roadway intersecting Route 11.

Table 12: Existing 2019 Outbound Volumes at Puapuaanui Street

	AM		PM	
	WBR	WBL	WBR	WBL
Volume	185	87	107	34
Percent	68%	32%	76%	24%

The future ‘with project’ condition analyzed the Royal Vistas Roadway approach to have a left turn and a right turn lane. Turn lanes are provided for the southbound left turn and northbound right turn into Royal Vistas. Right turns are channelized. A peak hour traffic signal warrant and a 4-hour traffic signal warrant were conducted for the new Royal Vistas Roadway. The new roadway intersection did not warrant a signal during the AM or PM peak hour. This intersection was analyzed as a two-way stop-controlled intersection. A crosswalk would be provided on the east side of the intersection for pedestrian connectivity. A refuge lane for westbound left turns onto Route 11 is recommended as this is an unsignalized intersection and will make this turn easier for the driver. The expected future lane configuration is shown in Figure 8. Project related trips for 2024 (Phase 1) are shown in Figure 9.

3. Future 2024 With Project Volumes

Phase 1 project related trips were added to the Future 2024 Without Project volumes to estimate Future 2024 With Project peak hour volumes (see Figure 10).

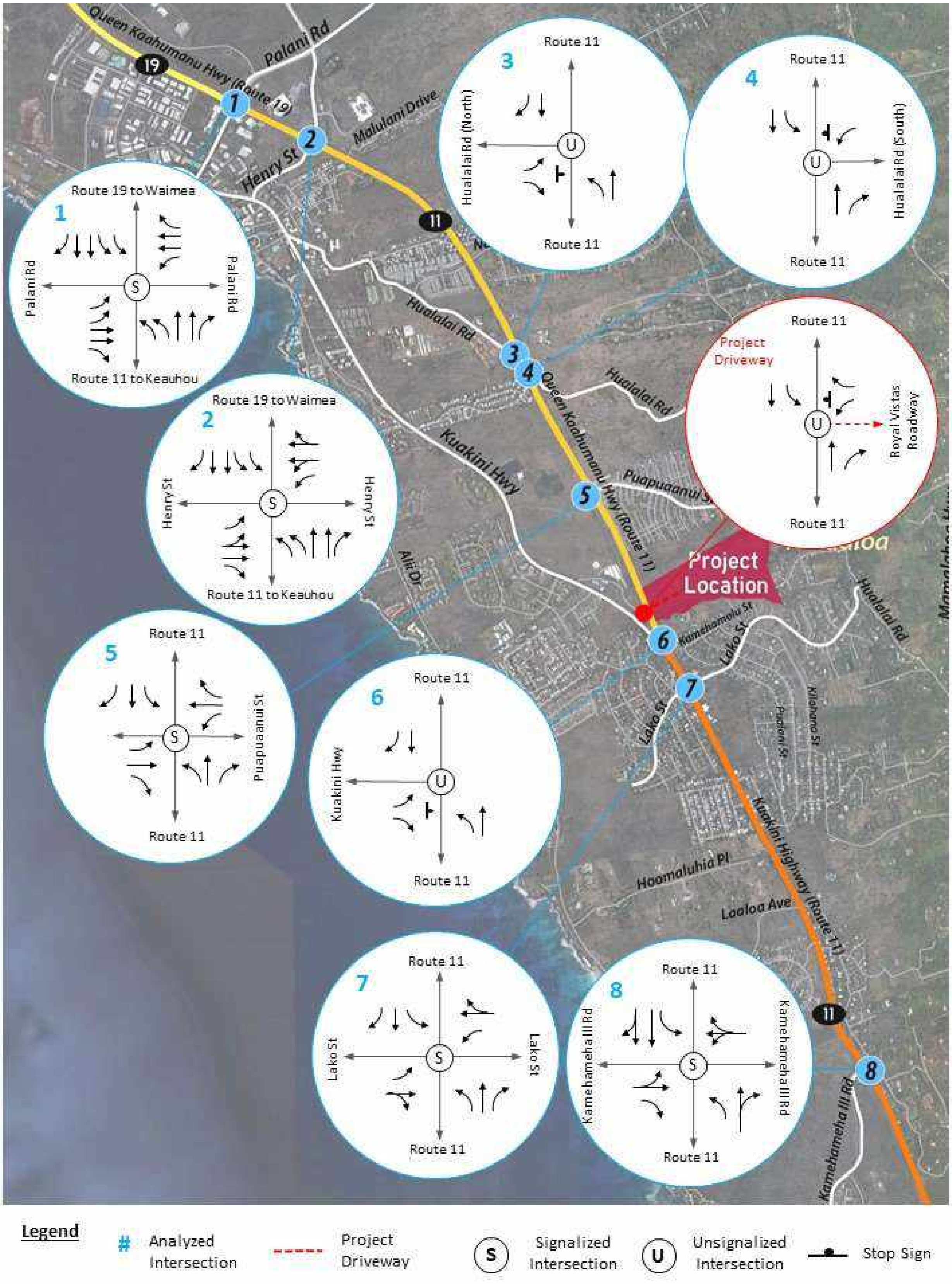


Figure 8: Expected Future Lane Configuration

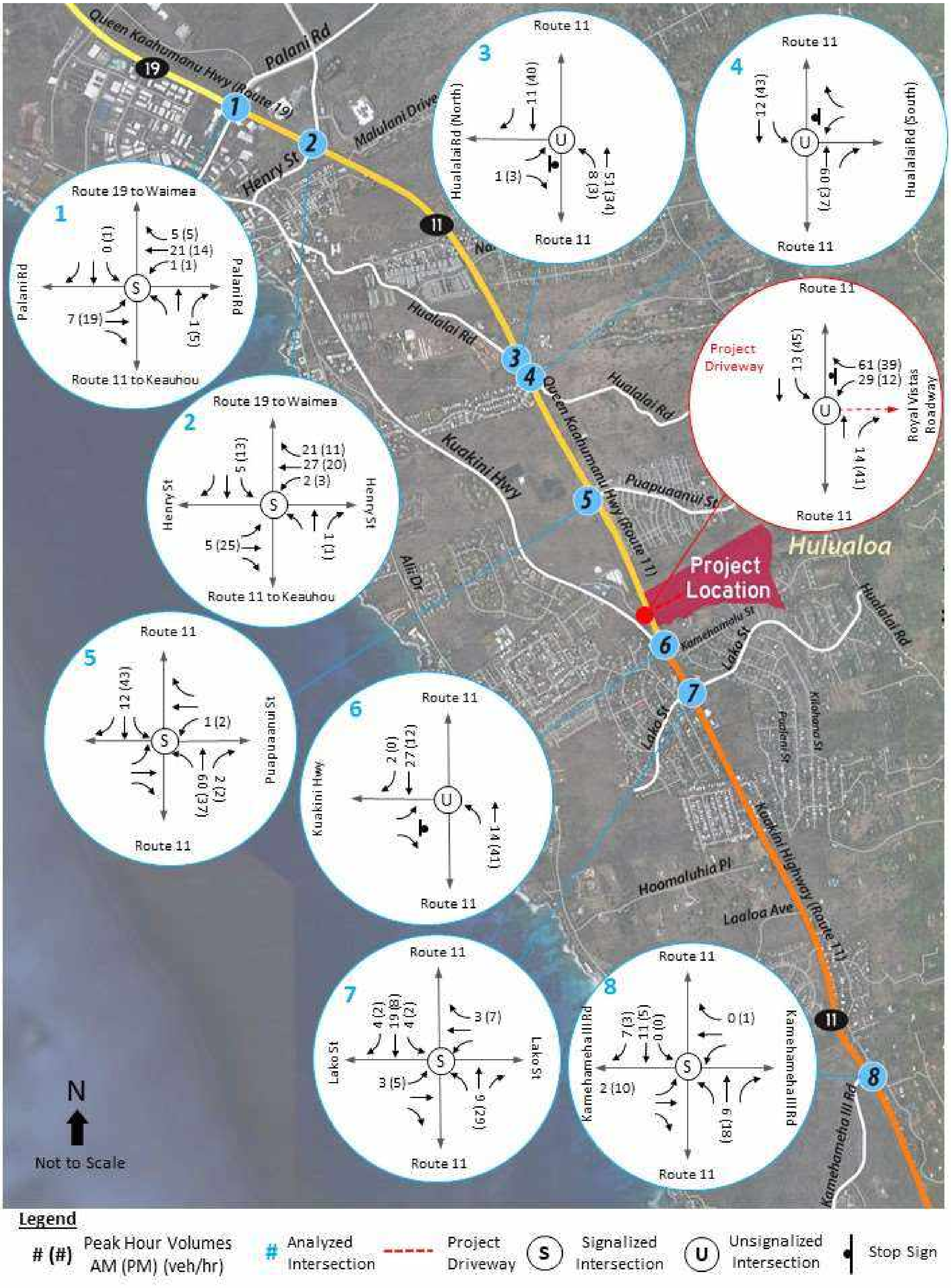


Figure 9: Phase 1 Project Related Trips

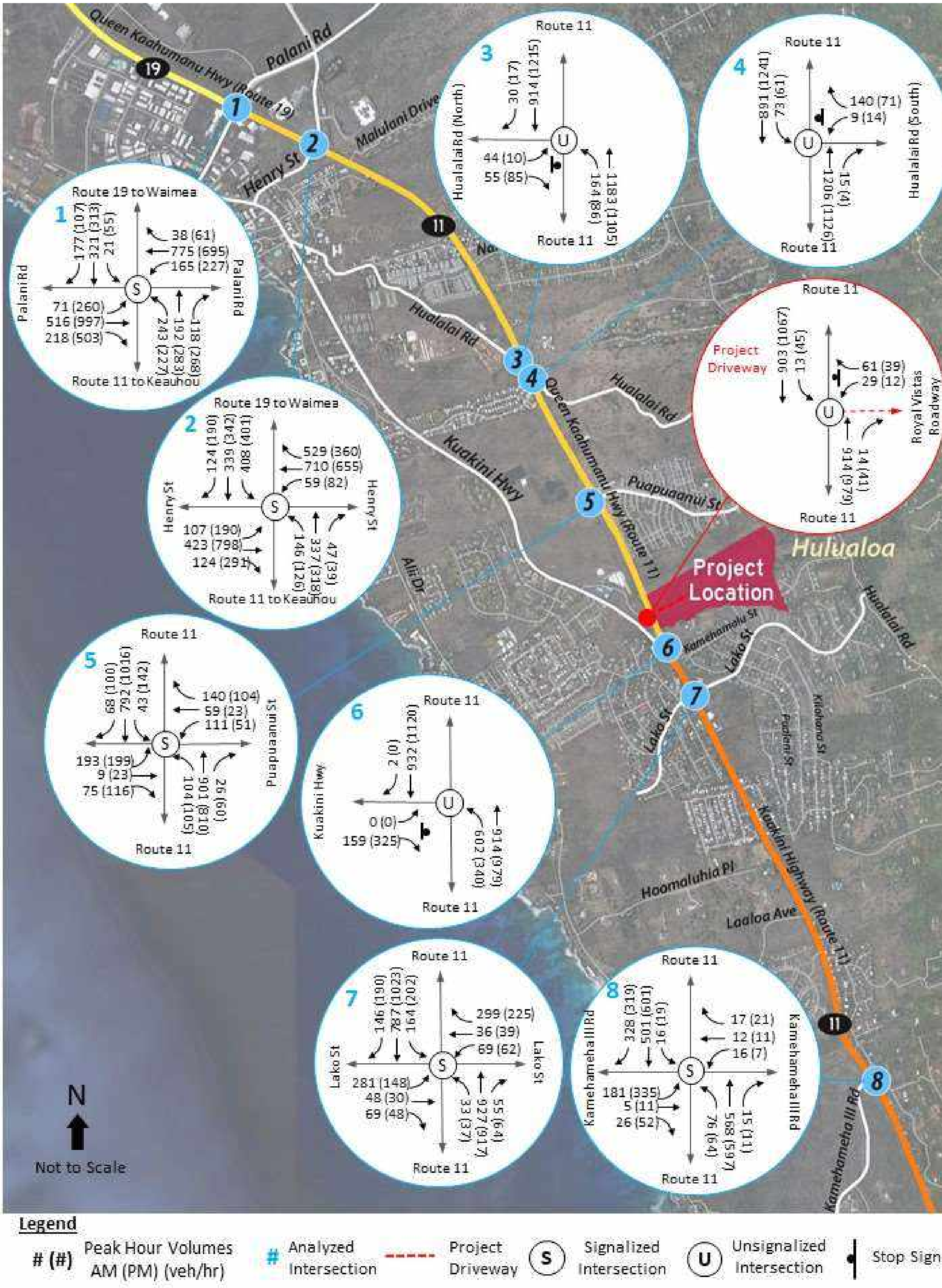


Figure 10: Future 2024 With Project Peak Hour Volumes

F. Future 2024 Intersection Traffic Operation Analysis

Puapuaanui Street was analyzed as a 4-leg signalized intersection with protected/permitted left-turn phasing on Route 11 and permissive left-turn phasing on Puapuaanui Street. The westbound right turn at Hualalai Road (South) approach was analyzed with an acceleration lane onto Route 11.

1. Future 2024 Without Project Intersection LOS

The 2024 Without Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours, shown in Table 13. The shaded row indicates the overall intersection delay. Movements that operated at LOS E or worse are highlighted in yellow. Synchro output is in Appendix D.

a) Route 11 and Palani Road. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersection of Route 11 with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.

b) Route 11 and Henry Street. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersection of Route 11 with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

c) Route 11 and Hualalai Road (North)

At the unsignalized intersection of Route 11 with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 1.97 and 0.38 respectively) and long delays during both AM and PM peak hours due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

d) Route 11 and Hualalai Road (South)

At the unsignalized intersection of Route 11 with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.29 and 0.52 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

e) Route 11 and Puapuaanui Street. Overall Intersection LOS = BC/B C (AM/PM)

All movements at the signalized intersections of Route 11 with Puapuaanui Street resulted in appropriate LOS D or better during AM and PM peak hours.

f) Route 11 and Kuakini Highway

At the unsignalized intersection of Route 11 with Kuakini Highway, northbound left turning movement has LOS E (v/c of 0.91) and long delays during the AM peak hour due to high through volumes on Route 11. The Pualani Makai development will lead to Puapuaanui Street becoming a 4-leg intersection. The Pualani Makai TIAR rerouted the eastbound left turns from Kuakini Highway to Puapuaanui Street and other internal roads.

Table 13: Future 2024 Without Project Intersection Level of Service

Intersection	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Palani Rd (overall)	**23.8**	**-**	**C**	**27.0**	**-**	**C**
Route 11 EB Left	39.5	0.45	D	40.1	0.74	D
Route 11 EB Through	14.4	0.34	B	18.8	0.61	B
Route 11 WB Left	39.6	0.67	D	40.9	0.73	D
Route 11 WB Through	14.6	0.47	B	16.9	0.44	B
Palani NB Left	38.2	0.72	D	41.0	0.73	D
Palani NB Through	26.4	0.25	C	30.8	0.43	C
Palani SB Left	48.4	0.51	D	52.4	0.72	D
Palani SB Through	34.5	0.66	C	35.8	0.64	D
Route 11 & Henry St (overall)	**34.1**	**0.65**	**C**	**34.5**	**0.68**	**C**
Route 11 EB Left	46.3	0.48	D	47.5	0.63	D
Route 11 EB Through	25.4	0.38	C	30.6	0.65	C
Route 11 EB Right	22.2	0.08	C	23.9	0.19	C
Route 11 WB Left	48.9	0.42	D	51.4	0.56	D
Route 11 WB Through	32.4	0.65	C	34.0	0.64	C
Route 11 WB Right	28.0	0.34	C	28.0	0.23	C
Henry NB Left	38.3	0.48	D	37.9	0.42	D
Henry NB Left-Through	39.6	0.60	D	39.3	0.58	D
Henry NB Right	34.0	0.03	C	34.3	0.03	C
Henry SB Left	42.9	0.76	D	41.2	0.75	D
Henry SB Left-Through-Right	38.0	0.73	D	35.8	0.70	D
Route 11 & Hualalai (N) (overall)	**16.3**	**-**	**-**	**1.3**	**-**	**-**
Route 11 NB Left	11.7	0.24	B	12.3	0.15	B
Hualalai EB Left	798.8	1.97	F	204.8	0.38	F
Route 11 & Hualalai (S) (overall)	**1.1**	**-**	**-**	**1.7**	**-**	**-**
Route 11 SB Left	12.6	0.14	B	11.7	0.11	B
Hualalai WB Left	148.6	0.29	F	228.8	0.52	F
Route 11 & Puapuaanui St (overall)	**22.1**	**-**	**C**	**22.3**	**-**	**C**
Route 11 NB Left	13.0	0.35	B	18.0	0.44	B
Route 11 NB Through	21.1	0.83	C	15.9	0.71	B
Route 11 SB Left	12.6	0.16	B	11.1	0.38	B
Route 11 SB Through	20.9	0.81	C	24.8	0.88	C
Puapuaanui EB Left	34.0	0.63	C	39.8	0.66	D
Puapuaanui EB Through	24.5	0.03	C	29.6	0.07	C
Puapuaanui WB Left	27.3	0.31	C	31.4	0.16	C
Puapuaanui WB Through	25.4	0.16	C	29.6	0.07	C
Route 11 & Kuakini Hwy (overall)	**10.0**	**-**	**-**	**2.6**	**-**	**-**
Route 11 NB Left	40.2	0.91	E	18.1	0.56	C
Kuakini EB Left	0.0	0.00	A	0.0	0.00	A
Route 11 & Lako St (overall)	**42.1**	**-**	**D**	**27.0**	**-**	**C**
Route 11 NB Left	16.3	0.12	B	18.2	0.18	B
Route 11 NB Through	42.4	0.95	D	22.3	0.81	C
Route 11 SB Left	52.7	0.86	D	21.8	0.66	C
Route 11 SB Through	23.3	0.76	C	24.7	0.87	C
Lako EB Left	83.6	0.94	F	58.0	0.82	E
Lako EB Through-Right	41.2	0.15	D	45.2	0.16	D
Lako WB Left	62.1	0.69	E	59.0	0.68	E
Lako WB Through-Right	54.8	0.34	D	53.0	0.42	D
Route 11 & Kam III Rd (overall)	**18.8**	**-**	**B**	**24.4**	**-**	**C**
Route 11 NB Left	42.6	0.80	D	46.9	0.74	D
Route 11 NB Through	16.3	0.69	B	23.4	0.76	C
Route 11 SB Left	39.7	0.47	D	44.0	0.49	D
Route 11 SB Through	11.5	0.33	B	16.0	0.42	B
Kamehameha EB Left-Through	29.6	0.74	C	33.7	0.85	C
Kamehameha WB Left-Through-Right	39.5	0.66	D	43.7	0.62	D

g) Route 11 and Lako Street. Overall Intersection LOS = D/C (AM/PM)

At the signalized intersection of Route 11 with Lako Street, the eastbound left turn operates at LOS F (v/c of 0.94) during the AM peak hour and LOS E (v/c of 0.82) during the PM peak hour. The westbound left turn also operates at LOS E (v/c of 0.69 and 0.68, respectively) during the AM and PM peak hours. This delay is attributed to the traffic volumes and the split phasing for the Lako Street approaches. All other movements at Lako Street operates at LOS D or better during both peak hours.

h) Route 11 and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)

All movements at the signalized intersections of Route 11 with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

2. Future 2024 With Project Intersection LOS

The 2024 With Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours, shown in Table 14. NOTE: All Royal Vistas vehicles are routed through the one Royal Vistas Access Roadway to Route 11 for purposes of the Phase 1 analysis. The shaded row indicates the overall intersection delay. Movements that operate at LOS E or worse are highlighted in yellow. Synchro output is in Appendix E.

a) Route 11 and Palani Road. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersections of Route 11 with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.

b) Route 11 and Henry Street. Overall Intersection LOS = C/C (AM/PM)

The westbound left turn operates at LOS E (v/c of 0.63) during the PM peak hour. The delay is a result of signal timing and the signal timing could be adjusted to reduce approach delay. All other movements at the signalized intersections of Route 11 with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

c) Route 11 and Hualalai Road (North)

At the unsignalized intersection of Route 11 with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 2.37 and 0.43 respectively) during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

d) Route 11 and Hualalai Road (South)

At the unsignalized intersection of Route 11 with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.29 and 0.58 respectively) during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

e) Route 11 and Puapuaanui Street. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersections of Route 11 with Puapuaanui Street resulted in appropriate LOS D or better during AM and PM peak hours.

Table 14: Future 2024 With Project Intersection Level of Service

Intersection	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Palani Rd (overall)	**23.8**	**-**	**C**	**27.3**	**-**	**C**
Route 11 EB Left	39.5	0.45	D	40.7	0.74	D
Route 11 EB Through	14.5	0.34	B	18.9	0.62	B
Route 11 WB Left	39.6	0.67	D	41.7	0.74	D
Route 11 WB Through	14.8	0.47	B	17.0	0.44	B
Palani NB Left	38.2	0.72	D	41.8	0.74	D
Palani NB Through	26.5	0.25	C	31.4	0.43	C
Palani SB Left	48.2	0.51	D	53.7	0.74	D
Palani SB Through	34.5	0.66	C	36.5	0.64	D
Route 11 & Henry St (overall)	**34.4**	**0.66**	**C**	**34.9**	**0.69**	**C**
Route 11 EB Left	46.8	0.49	D	47.9	0.63	D
Route 11 EB Through	25.8	0.38	C	30.6	0.66	C
Route 11 EB Right	22.5	0.08	C	23.6	0.19	C
Route 11 WB Left	49.4	0.44	D	56.9	0.63	E
Route 11 WB Through	33.4	0.68	C	34.3	0.66	C
Route 11 WB Right	28.5	0.35	C	28.1	0.24	C
Henry NB Left	38.5	0.48	D	38.0	0.42	D
Henry NB Left-Through	39.8	0.60	D	39.5	0.58	D
Henry NB Right	34.2	0.03	C	34.5	0.03	C
Henry SB Left	42.1	0.74	D	41.9	0.76	D
Henry SB Left-Through-Right	37.9	0.72	D	36.6	0.71	D
Route 11 & Hualalai (N) (overall)	**20.2**	**-**	**-**	**1.4**	**-**	**-**
Route 11 NB Left	11.9	0.25	B	12.7	0.16	B
Hualalai EB Left	1027.1	2.37	F	239.9	0.43	F
Route 11 & Hualalai (S) (overall)	**1.1**	**-**	**-**	**1.9**	**-**	**-**
Route 11 SB Left	13.1	0.14	B	11.9	0.11	B
Hualalai WB Left	167.0	0.29	F	269.4	0.58	F
Route 11 & Puapuaanui St (overall)	**22.9**	**-**	**C**	**24.6**	**-**	**C**
Route 11 NB Left	13.0	0.34	B	20.9	0.49	C
Route 11 NB Through	22.0	0.85	C	17.0	0.74	B
Route 11 SB Left	14.3	0.18	B	12.2	0.40	B
Route 11 SB Through	19.0	0.77	B	29.1	0.92	C
Puapuaanui EB Left	42.0	0.67	D	39.8	0.66	D
Puapuaanui EB Through	28.8	0.03	C	29.6	0.07	C
Puapuaanui WB Left	32.1	0.33	C	31.4	0.16	C
Puapuaanui WB Through	29.8	0.17	C	29.6	0.07	C
Route 11 & Royal Vistas (overall)	**2.3**	**-**	**-**	**2.6**	**-**	**-**
Route 11 SB Left	10.3	0.02	B	18.1	0.56	C
Royal Vistas WB Left	104.2	0.49	F	18.1	0.56	C
Royal Vistas WB Right	20.5	0.22	C	0.0	0.00	A
Route 11 & Kuakini Hwy (overall)	**11.1**	**-**	**-**	**2.5**	**-**	**-**
Route 11 NB Left	45.0	0.94	E	18.3	0.57	C
Kuakini EB Left	0.0	0.00	A	0.0	0.00	A
Route 11 & Lako St (overall)	**42.3**	**-**	**D**	**27.9**	**-**	**C**
Route 11 NB Left	17.5	0.12	B	18.6	0.17	B
Route 11 NB Through	39.5	0.92	D	22.6	0.81	C
Route 11 SB Left	51.4	0.85	D	24.3	0.68	C
Route 11 SB Through	24.0	0.75	C	23.6	0.86	C
Lako EB Left	89.4	0.94	F	69.0	0.84	E
Lako EB Through-Right	47.5	0.15	D	50.0	0.16	D
Lako WB Left	72.3	0.72	E	65.5	0.69	E
Lako WB Through-Right	63.9	0.35	E	58.9	0.43	E
Route 11 & Kam III Rd	**19.0**	**-**	**B**	**25.6**	**-**	**C**
Route 11 NB Left	42.6	0.80	D	49.8	0.75	D
Route 11 NB Through	16.7	0.70	B	25.1	0.79	C
Route 11 SB Left	39.7	0.47	D	44.5	0.49	D
Route 11 SB Through	11.6	0.34	B	16.4	0.43	B
Kamehameha EB Left-Through	29.6	0.74	C	34.8	0.85	C
Kamehameha WB Left-Through-Right	39.6	0.66	D	44.4	0.63	D

f) Route 11 and Royal Vistas Roadway

At the proposed unsignalized intersection of Route 11 and the Royal Vistas Roadway, the southbound left turn movement from Route 11 into Royal Vistas Roadway functions well, with minimal delay, an average of 10 to 18 seconds during both peak hours. The westbound left turning movement has LOS F (v/c of 0.49) during the AM (29 vehicles) peak hour due to high through volumes on Route 11. The intersection functions acceptably, with an average of 2.3 seconds of delay per vehicle in the AM peak hour and 2.6 seconds of delay per vehicle in the PM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

g) Route 11 and Kuakini Highway

At the unsignalized intersection of Route 11 with Kuakini Highway, the northbound left turn operates at LOS E (v/c of 0.94) during the AM peak hour. All other movements operated at acceptable levels of service during the AM and PM peak hours.

h) Route 11 and Lako Street. Overall Intersection LOS = D/C (AM/PM)

At the signalized intersection of Route 11 with Lako Street, the eastbound left turn operates at LOS F (v/c of 0.94) during the AM peak hour and LOS E (v/c of 0.84) during the PM peak hour. The westbound left turn also operates at LOS E (v/c of 0.72 and 0.69, respectively) during the AM and PM peak hours. The westbound shared through-right lane also operates at LOS E (v/c of 0.35 and 0.43, respectively) during the AM and PM peak hours. This delay is attributed to the traffic volumes and split phasing for the Lako Street approaches. All other movements at Lako Street operates at LOS D or better during both peak hours.

i) Route 11 and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)

All movements at the signalized intersections of Route 11 with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

3. Future 2024 With Project Mitigation

Long term improvements including the Lako Street Extension, the completion of Alii Highway, and the widening of Route 11 from Henry Street to Kamehameha III Road will improve regional traffic in the study area. The completion dates of these projects are not known. In the interim, short-term mitigations were considered.

a) Traffic Signal Warrant Analysis

Similar to the existing condition, the minor street approach left turns operate at LOS F during both peak hours at both Hualalai Road intersections and the Royal Vistas driveway. Peak-Hour volume traffic signal warrants were evaluated for the 2024 with and without project conditions. Table 15 shows the Peak-Hour warrant analysis in 2024 with and without the project.

Table 15: Future 2024 Peak-Hour Warrant[3]

2024 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	2191	44	NO	2330	10	NO
Hualalai (S)	2098	9	NO	2348	14	NO
Kuakini Hwy	2407	0	NO	2387	0	NO
2024 With Project	**Peak Hour Warrant**					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	2261	44	NO	2406	10	NO
Hualalai (S)	2170	9	NO	2401	14	NO
Royal Vistas Dwy	1830	29	NO	2091	12	NO
Kuakini Hwy	2448	0	NO	2439	0	NO

None of the unsignalized intersections satisfy the Peak Hour Warrant. Each of the unsignalized intersections operate with relatively low overall delay. The minor street left volumes at Hualalai Road and Puapuaanui Street are relatively low and the observed delays are generally much lower than the calculated delays.

The 2009 MUTCD states: "At an intersection with high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the 'minor-street' volume and the corresponding single direction of opposing traffic on the major street as the 'major-street" volume'. The Route 11 and Kuakini Highway northbound left turn operates at LOS E during the AM peak hour. For this analysis, the northbound left turn volume represents the minor approach volume, and the opposing southbound volume represents the major approach volume (see Table 16).

Table 16: Future 2024 Peak-Hour Warrant[4]

2024 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Kuakini Hwy	905	602	YES	1109	340	YES
2024 With Project	**Peak Hour Warrant**					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Kuakini Hwy	932	602	YES	1120	340	YES

The Route 11 and Kuakini Highway intersection will satisfy the Peak Hour Warrant in 2024. The satisfaction of a traffic warrant does not require the installation of a traffic control signal. Kuakini Highway was analyzed as a signalized intersection with various northbound left-turn phasing for the Future 2024 With Project condition (see Table 17).

[3] Single Peak Hour warrant was evaluated because sufficient data was available and to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.
[4] Single Peak Hour warrant was evaluated because sufficient data was available and to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.

Table 17: Future 2024 With Project – Route 11 and Kuakini Highway Left-Turn Signal Phasing Alternatives

2-Lane Route 11, Protected Left Turn Signal Phasing on Kuakini Highway	AM Delay (sec/veh)	AM v/c	AM LOS	PM Delay (sec/veh)	PM v/c	PM LOS
Route 11 & Kuakini Hwy (overall)	**37.5**	**-**	**D**	**20.3**	**-**	**C**
Route 11 NB Left	74.6	1.00	E	76.6	0.93	E
Route 11 NB Through	1.5	0.56	A	1.4	0.56	A
Route 11 SB Through	48.8	0.97	D	19.7	0.85	B
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A
2-Lane Route 11, Permissive Left Turn Signal Phasing on Kuakini Highway	**Delay (sec/veh)**	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Kuakini Hwy (overall)	**22.7**	**-**	**C**	**2.7**	**-**	**A**
Route 11 NB Left	87.9	1.13	F	9.3	0.69	A
Route 11 NB Through	1.5	0.56	A	1.4	0.56	A
Route 11 SB Through	1.5	0.57	A	1.9	0.63	A
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A
2-Lane Route 11, Prot+Perm Left Turn Signal Phasing on Kuakini Highway	**Delay (sec/veh)**	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Kuakini Hwy (overall)	**23.5**	**-**	**C**	**3.9**	**-**	**A**
Route 11 NB Left	55.4	0.95	E	10.0	0.72	A
Route 11 NB Through	1.5	0.56	A	1.4	0.56	A
Route 11 SB Through	24.6	0.84	C	4.3	0.69	A
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A

The overall delay at this intersection will increase in both peak hours, while the northbound left turn will still operate at LOS E or worse for all alternatives. It is recommended that a signal not be installed at this intersection.

b) *Roundabout Analysis*

The minor street left turn movements at both Hualalai Road intersections and Kuakini Highway operate at LOS F. For these intersections, the traffic operations for a single-lane roundabout were analyzed (see Table 18). The overall LOS at each intersection will be LOS F, with the v/c ratio above 1.00 for all Route 11 approaches. A single-lane roundabout is not recommended for the unsignalized intersections. All future conditions were not analyzed, since the traffic volume would increase, and the v/c would worsen.

Table 18: Future 2024 Without Project Roundabout Analysis at Unsignalized Intersections

	AM Delay (sec/veh)	AM v/c	AM LOS	PM Delay (sec/veh)	PM v/c	PM LOS
Route 11 & Hualalai (N) (overall)	**125.2**	**-**	**F**	**97.4**	**-**	**F**
Route 11 NB approach	161.5	1.31	F	79.4	1.11	F
Route 11 SB approach	86.7	1.12	F	121.1	1.21	F
Hualalai North EB approach	13.7	0.27	B	17.4	0.30	C
Route 11 & Hualalai (S) (overall)	**83.0**	**-**	**F**	**93.7**	**-**	**F**
Route 11 NB approach	126.7	1.23	F	78.3	1.10	F
Route 11 SB approach	38.6	0.96	E	112.3	1.19	F
Hualalai North WB approach	25.3	0.51	D	15.0	0.25	C
Route 11 & Kuakini (overall)	**267.2**	**-**	**F**	**153.6**	**-**	**F**
Route 11 NB approach	235.5	1.48	F	109.2	1.19	F
Route 11 SB approach	363.4	1.75	F	228.8	1.46	F
Kuakini EB approach	18.4	0.44	C	71.7	0.95	F

c) Alternative Mitigation Measures

(1) Alternatives at Lako Street

A comparison between the widening of Route 11 and various left-turn phasing on Lako Street was analyzed for the Future 2024 With Project, shown in Table 19. All movements will operate with an acceptable LOS with 4-Lane Route 11 and permissive left-turn phasing on Lako Street. Protected left turns on Lako Street will provide a slight improvement in the overall delay, but the eastbound left will operate with LOS F and LOS E, respectively, and the westbound left will still operate with LOS E during both peak hours.

Table 19: Future 2024 With Project – Route 11 and Lako Street Left-Turn Signal Phasing Alternatives

2-Lane Route 11, Protected Left Turn Signal Phasing on Lako Street	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Lako St (overall)	**39.5**	**-**	**D**	**26.3**	**-**	**C**
Route 11 NB Left	16.0	0.12	B	17.3	0.16	B
Route 11 NB Through	37.4	0.92	D	21.0	0.80	C
Route 11 SB Left	45.3	0.82	D	22.0	0.65	C
Route 11 SB Through	22.4	0.75	C	21.9	0.85	C
Lako EB Left	83.3	0.93	F	68.0	0.84	E
Lako EB Through-Right	44.8	0.16	D	50.8	0.18	D
Lako WB Left	67.0	0.72	E	64.3	0.69	E
Lako WB Through-Right	62.4	0.47	E	62.5	0.55	E
2-Lane Route 11, Permissive Left Turn Signal Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**33.2**	**-**	**C**	**21.9**	**-**	**C**
Route 11 NB Left	15.2	0.12	B	14.3	0.16	B
Route 11 NB Through	37.1	0.92	D	19.6	0.82	B
Route 11 SB Left	46.4	0.82	D	18.6	0.64	B
Route 11 SB Through	21.7	0.75	C	20.8	0.87	C
Lako EB Left	46.3	0.77	D	39.1	0.58	D
Lako EB Through-Right	33.3	0.11	C	32.1	0.11	C
Lako WB Left	36.4	0.19	D	34.5	0.23	C
Lako WB Through-Right	33.0	0.08	C	32.4	0.14	C
2-Lane Route 11, Prot+Perm Left Turn Signal Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**31.8**	**-**	**C**	**23.3**	**-**	**C**
Route 11 NB Left	13.8	0.11	B	15.0	0.16	B
Route 11 NB Through	28.7	0.85	C	20.0	0.82	B
Route 11 SB Left	31.1	0.69	C	19.6	0.65	B
Route 11 SB Through	18.9	0.70	B	21.2	0.87	C
Lako EB Left	66.4	0.84	E	47.7	0.66	D
Lako EB Through-Right	50.3	0.19	D	42.4	0.23	D
Lako WB Left	59.0	0.38	E	41.0	0.29	D
Lako WB Through-Right	67.5	0.50	E	47.0	0.44	D
4-Lane Route 11, Split Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**21.2**	**-**	**C**	**15.9**	**-**	**B**
Route 11 NB Left	12.2	0.10	B	9.9	0.12	A
Route 11 NB Through	20.3	0.69	C	15.5	0.61	B
Route 11 SB Left	14.3	0.51	B	10.8	0.51	B
Route 11 SB Through	15.4	0.53	B	13.2	0.61	B
Lako EB Left	39.0	0.85	D	32.4	0.74	C
Lako EB Through-Right	23.9	0.14	C	25.5	0.14	C
Lako WB Left	38.2	0.63	D	32.7	0.55	C
Lako WB Through-Right	33.4	0.31	C	30.0	0.34	C

The *Traffic Assessment for Left-Turn Signal Phasing Guidelines* (ATA, 2017) recommends that approaches that do not have adequate sight distance, a protected left-turn phase should be considered, and a permissive left-turn phase is not suitable. The eastbound approach sight distance should be checked before considering allowing permissive left-turn phasing. The widening of Route 11 is needed in 2024.

4. Future 2024 With Project Segment LOS

Arterial LOS was analyzed in Synchro on Route 11 from Hualalai (north) to Lako Street. Where signalized intersections are separated by less than 2.0 miles in an urban area, the facility should analyzed with the methodologies of Urban Street Facilities. For Urbaan Street Facilities, through-vehicle travel speed is used to analyze facility LOS. Analysis worksheets can be found in Appendix E. The arterial LOS can be found in Table 20.

Table 20: Future 2024 With Project Segment LOS

Peak Hour	Northbound (To Waimea)		Southbound (To Keauhou)	
	Speed (mph)	LOS	Speed (mph)	LOS
AM Peak	19.3	C	23.8	C
PM Peak	21.7	C	22.2	C

This segment of Route 11 operates at LOS C in the northbound and southbound direction during the AM and PM peak hours, satisfying the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding “acceptable level of service” for transportation facilities.

IV. Future (2029) Mid-Term Conditions – Completion of Phase 2

A. Surrounding Area Conditions

Phase 2 is expected to be completed by 2029, representing the full buildout 10-year future forecast. Phase 2 will contain 192 dwelling units. Inbound trips and Phase 1 outbound trips continue to use the Royal Vistas Roadway and Route 11 intersection.

Long term improvements including the Lako Street Extension, the completion of Alii Highway, and the widening of Route 11 from Henry Street to Kamehameha III Road will improve regional traffic in the study area. The completion dates of these projects are not known. Volumes were not adjusted based on these improvement projects.

B. Volumes

1. Future 2029 Without Project Volumes

The project study area within Kona has been experiencing modest growth. HDOT ADT counts on Route 11 between Nani Kailua Drive and Hualalai Road didn't show any increase in vehicular volumes from 2015 to 2016. Similarly, the 2035 Federal Aid Highways Long Range Transportation Plan forecasts average daily traffic in Kona to be 41,900 vehicles in 2020 and 48,000 vehicles in 2035. This is approximately equal to a 1% annual growth rate. The estimated future volumes without the project for the future year 2029 are shown in Figure 11.

1. Project Related Volumes

The proposed Royal Vistas include 192 multi-family residential dwelling units for Phase 2. All of these are expected to be low rise units with two or three stories. Trips generated from the proposed facility were estimated using nationally accepted land use rates from the *Trip Generation*, 10th Edition (ITE, 2016). ITE defines the Multi-family Housing (Low Rise) Land Use [220] as follows: "includes apartments, townhouses and condominiums located within the same building with at least three other dwelling units" The analysis used 192 dwelling units as the independent variable to estimate new trips expected from Phase 2 of the proposed project. The estimates for new trips generated by Phase 2 are shown in Table 21.

Table 21: Estimated Trips Generated by Project – Phase 2

	AM		PM	
Land Use [ITE Code]	**Equation**		**Equation**	
Multi-family Housing (Low Rise) [220]	Ln (T) = 0.95 Ln (X) – 0.51		Ln (T) = 0.89*Ln (X) - 0.02	
Dwelling Units	192		192	
New Trips	89		106	
	In[5]	**Out**	**In**	**Out**
	23%	77%	63%	37%
	20	69	67	39

T = Total number of trips generated, X = Dwelling Units

[5] In and Out split provided by *Trip Generation*, 10th Edition (ITE 2016) for Land Use 220

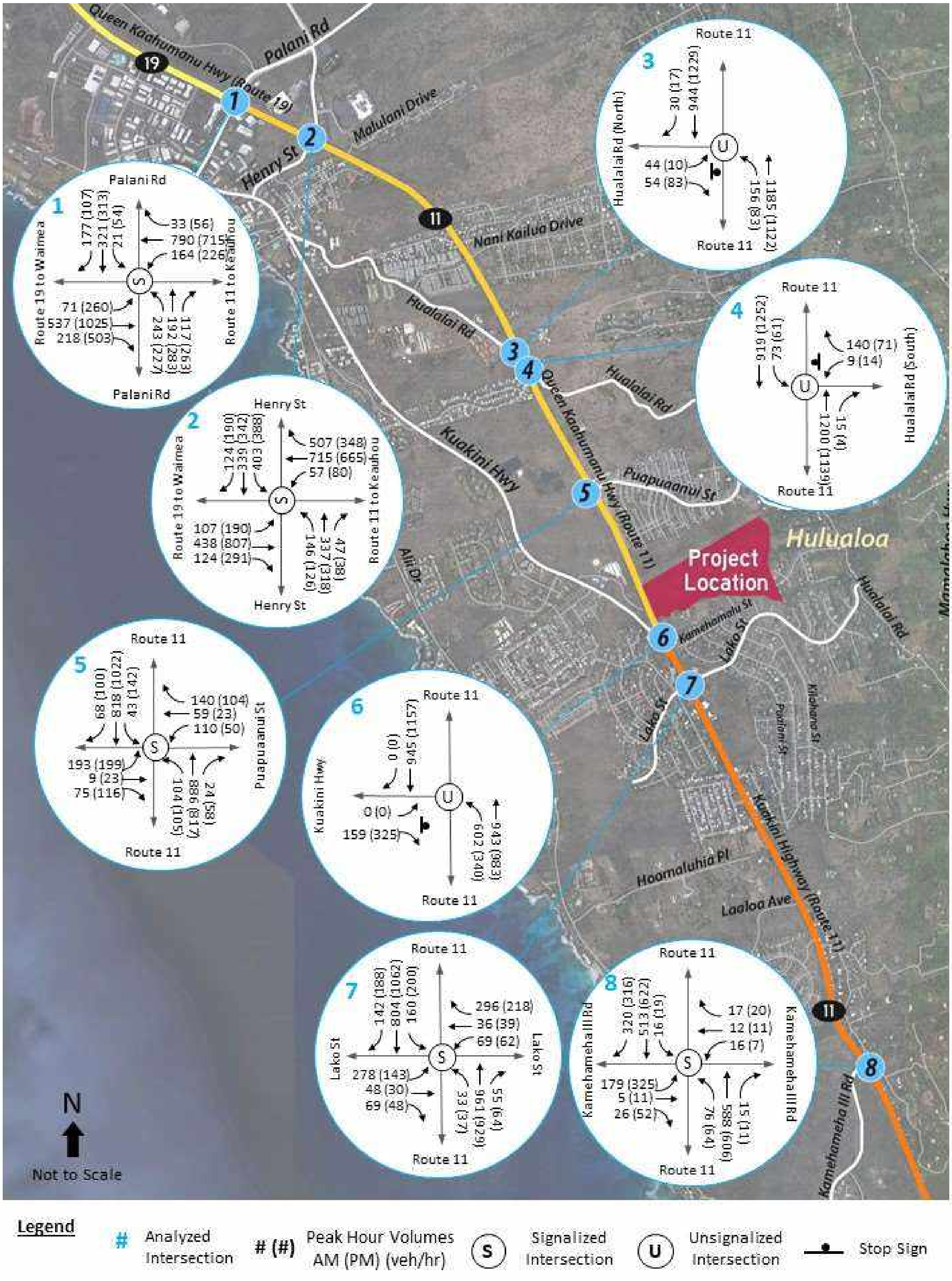


Figure 11: Future 2029 Without Project Peak Hour Volumes

The project related trips were distributed according to existing travel volumes. The segment volumes between Puapuaanui Street and Kuakini Street were used to determine the inbound percent distribution. Future inbound trips will continue entering at the Royal Vistas Roadway at Route 11. It is expected that once a connection to Lako Street is provided, Phase 2 left out (southbound traffic) will utilize the Lako Street intersection during the peak hours, since the traffic signal at Lako Street will provide guaranteed exit opportunities and drivers will not have to wait for a gap at the stop-controlled Royal Vistas driveway.

The Future 2029 lane configuration is the same as the Future 2024 lane configuration.

Figure 12 shows the Phase 2 inbound project generated and distributed trips.

Figure 13 shows the Phase 2 outbound project generated and distributed trips.

2. Future 2029 With Project Volumes

Phase 1 (Figure 9) and Phase 2 project related trips (Figure 12 and Figure 13) were added to the Future 2029 Without Project volumes (Figure 11) to estimate Future 2029 With Project peak hour volumes (see Figure 14).

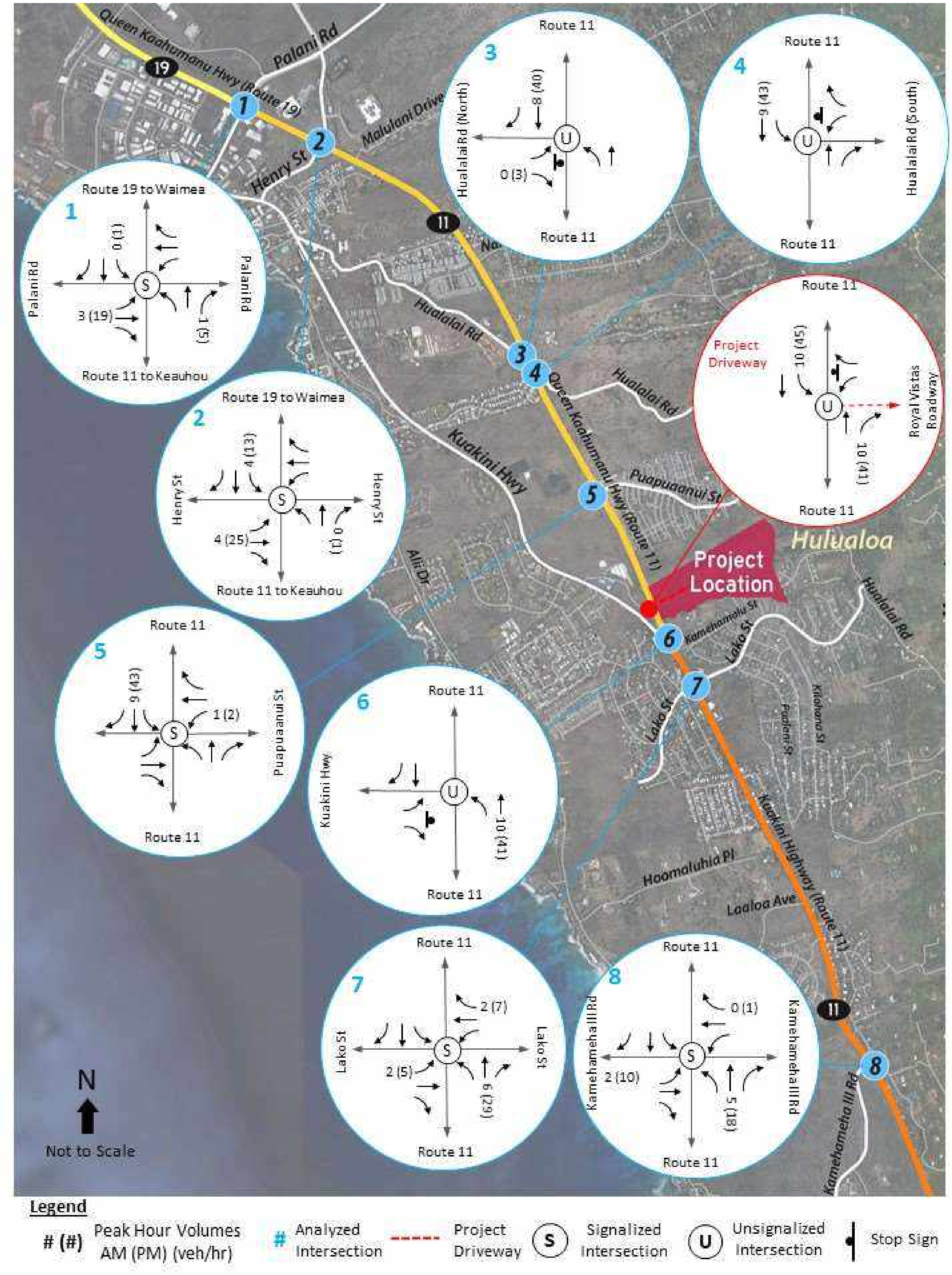


Figure 12: Phase 2 Inbound Project Related Trips

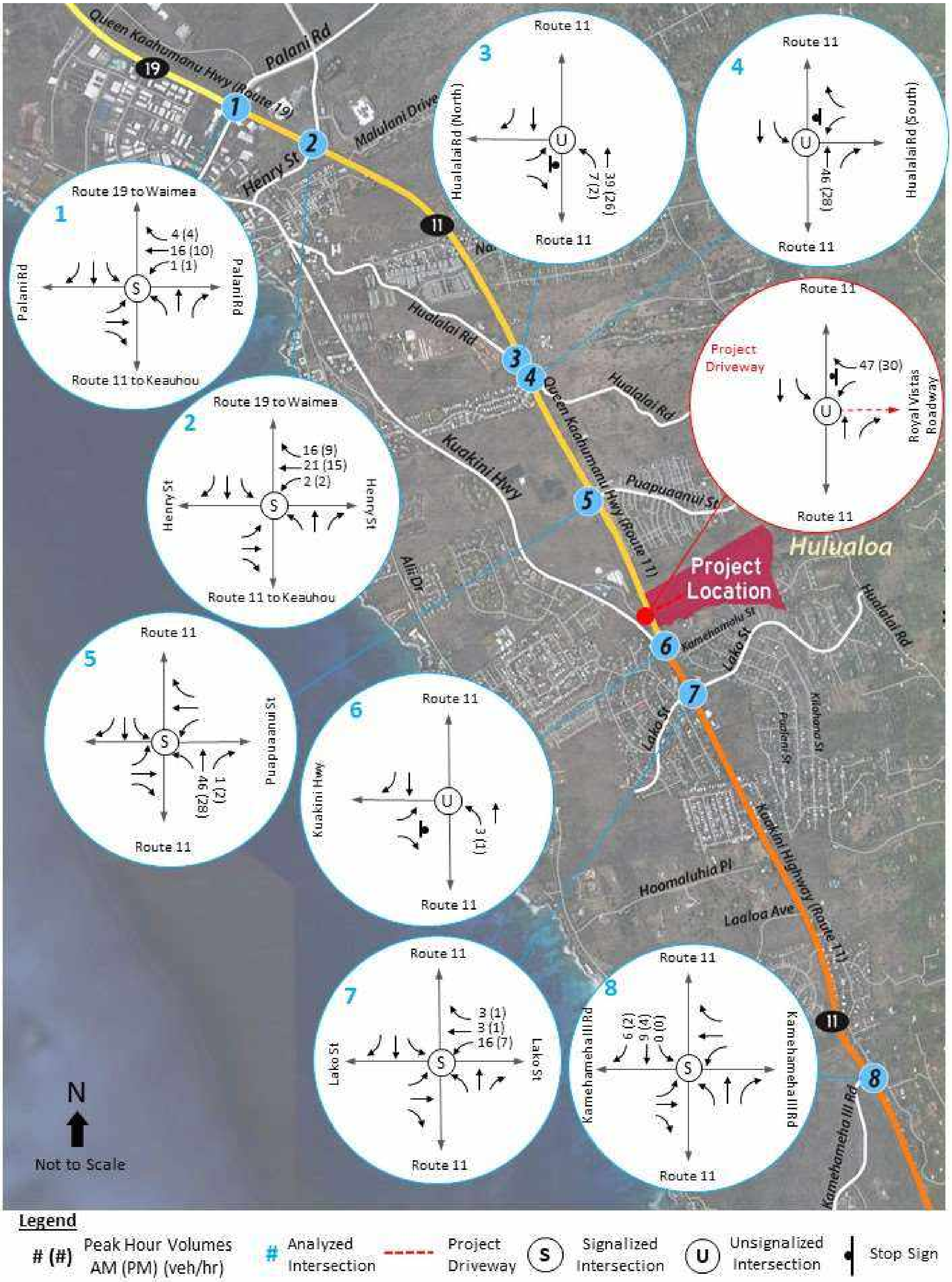


Figure 13: Phase 2 Outbound Project Related Trips

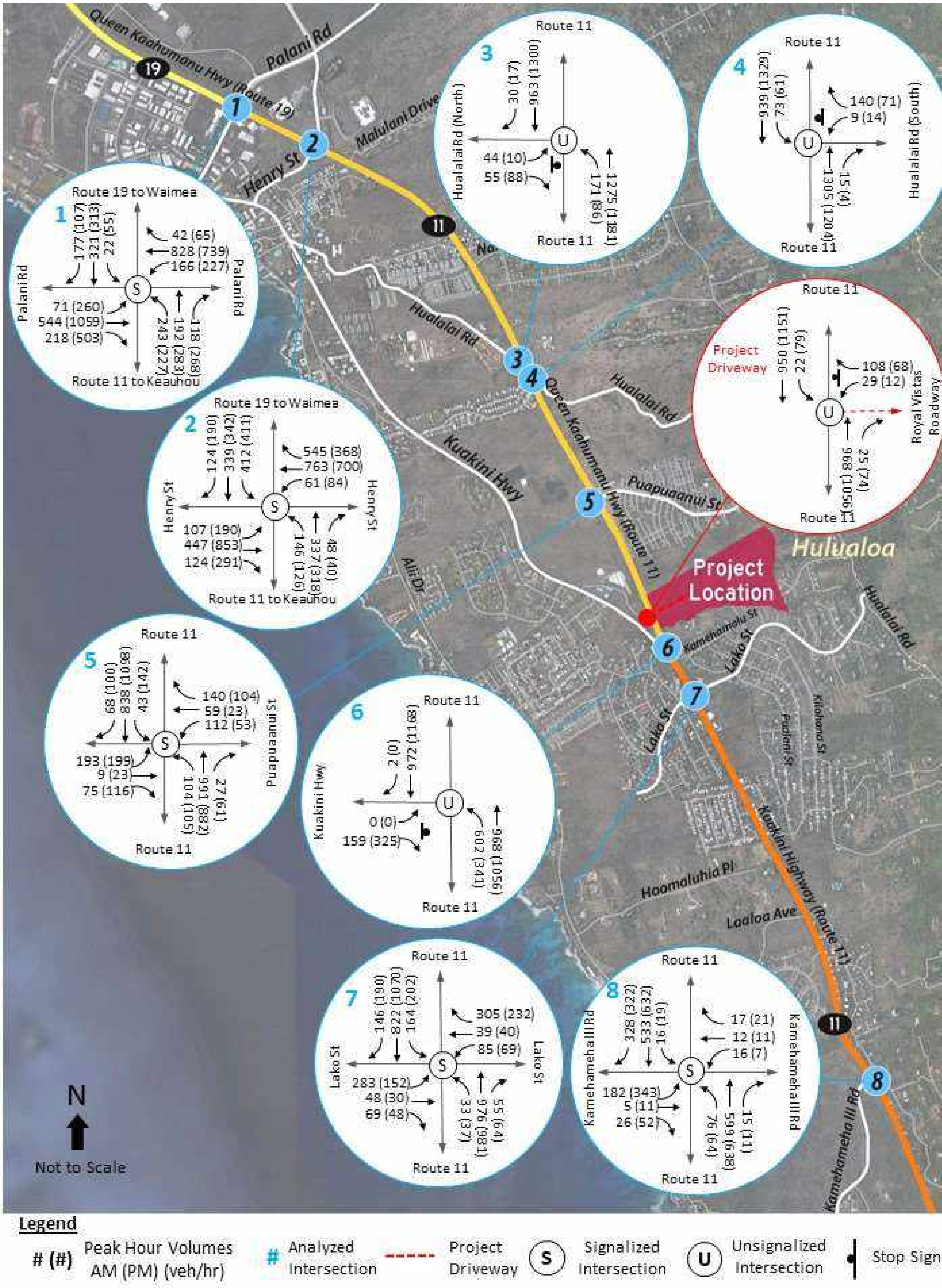


Figure 14: Future 2029 With Project Peak Hour Volumes

C. Future 2029 Intersection Traffic Operation Analysis

The Future 2024 lane configuration and signal phasing was used for the Future 2029 analysis.

1. Future 2029 Without Project Intersection LOS

The 2029 Without Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours. Table 22 shows the expected vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Movements that operate at LOS E or worse are highlighted in yellow. Synchro output is in Appendix F.

a) Route 11 and Palani Road. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersections of Route 11 with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.

b) Route 11 and Henry Street. Overall Intersection LOS = C/D (AM/PM)

All movements at the signalized intersections of Route 11 with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

c) Route 11 and Hualalai Road (North)

At the unsignalized intersection of Route 11 with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 2.37 and 0.43 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

d) Route 11 and Hualalai Road (South)

At the unsignalized intersection of Route 11 with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.32 and 0.60 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The westbound right turn also operates at LOS F (v/c of .74) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

e) Route 11 and Puapuaanui Street. Overall Intersection LOS = B/B (AM/PM)

All movements at the signalized intersections of Route 11 with Puapuaanui Street resulted in appropriate LOS D or better during AM and PM peak hours.

f) Route 11 and Kuakini Highway

At the unsignalized intersection of Route 11 with Kuakini Highway, northbound left turning movement has LOS E (v/c of 0.95) and long delays during the AM peak hour due to high through volumes on Route 11. The Pualani Makai development will lead to Puapuaanui Street becoming a 4-leg intersection. The Pualani Makai TIAR rerouted the eastbound left turns from Kuakini Highway to Puapuaanui Street and other internal roads.

g) Route 11 and Lako Street. Overall Intersection LOS = D/C (AM/PM)

At the signalized intersection of Route 11 with Lako Street, the southbound left turn operates at LOS E (v/c of 0.88) during the AM peak hour. The eastbound left turn and westbound approaches operate at LOS E or worse during the AM and PM peak hours. This delay is attributed to the traffic volumes and the split phasing for the Lako Street approaches. All other movements at Lako Street operate at LOS D or better during both peak hours.

Table 22: Future 2029 Without Project Intersection Level of Service

Intersection	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Palani Rd (overall)	**23.4**	-	**C**	**26.9**	-	**C**
Route 11 EB Left	38.7	0.45	D	40.0	0.75	D
Route 11 EB Through	14.6	0.36	B	19.4	0.65	B
Route 11 WB Left	38.9	0.67	D	41.6	0.74	D
Route 11 WB Through	15.0	0.49	B	17.1	0.47	B
Palani NB Left	37.5	0.72	D	41.8	0.74	D
Palani NB Through	25.9	0.25	C	29.7	0.42	C
Palani SB Left	47.5	0.51	D	50.2	0.71	D
Palani SB Through	33.8	0.66	C	34.5	0.63	C
Route 11 & Henry St (overall)	**33.0**	**0.67**	**C**	**34.0**	**0.70**	**C**
Route 11 EB Left	49.6	0.61	D	47.7	0.66	D
Route 11 EB Through	26.2	0.42	C	31.1	0.70	C
Route 11 EB Right	22.5	0.08	C	23.5	0.19	C
Route 11 WB Left	46.2	0.40	D	51.6	0.59	D
Route 11 WB Through	32.2	0.69	C	34.2	0.68	C
Route 11 WB Right	27.0	0.34	C	27.4	0.23	C
Henry NB Left	36.0	0.47	D	36.2	0.41	D
Henry NB Left-Through	37.0	0.58	D	37.4	0.56	D
Henry NB Right	32.0	0.03	C	32.8	0.03	C
Henry SB Left	40.0	0.74	D	40.2	0.75	D
Henry SB Left-Through-Right	35.5	0.71	D	34.7	0.70	C
Route 11 & Hualalai (N) (overall)	**20.0**	-	-	**1.4**	-	-
Route 11 NB Left	12.0	0.25	B	12.8	0.16	B
Hualalai EB Left	1027.1	2.37	F	239.9	0.43	F
Route 11 & Hualalai (S) (overall)	**1.2**	-	-	**1.9**	-	-
Route 11 SB Left	13.1	0.15	B	12.0	0.11	B
Hualalai WB Left	174.2	0.32	F	285.8	0.60	F
Route 11 & Puapuaanui St (overall)	**23.2**	-	**C**	**25.1**	-	**C**
Route 11 NB Left	14.2	0.36	B	21.3	0.50	C
Route 11 NB Through	21.6	0.84	C	17.2	0.75	B
Route 11 SB Left	14.0	0.17	B	12.4	0.41	B
Route 11 SB Through	20.6	0.80	C	30.0	0.93	C
Puapuaanui EB Left	41.0	0.66	D	39.7	0.66	D
Puapuaanui EB Through	28.5	0.03	C	29.6	0.07	C
Puapuaanui WB Left	31.7	0.32	C	31.3	0.16	C
Puapuaanui WB Through	29.5	0.17	C	29.6	0.07	C
Route 11 & Kuakini Hwy (overall)	**11.5**	-	-	**2.7**	-	-
Route 11 NB Left	47.4	0.95	E	19.4	0.59	C
Kuakini EB Left	0.0	0.00	A	0.0	0.00	A
Route 11 & Lako St (overall)	**46.2**	-	**D**	**28.8**	-	**C**
Route 11 NB Left	17.7	0.13	B	20.8	0.19	C
Route 11 NB Through	45.5	0.95	D	22.8	0.82	C
Route 11 SB Left	66.7	0.88	E	24.9	0.69	C
Route 11 SB Through	24.0	0.76	C	26.0	0.89	C
Lako EB Left	95.4	0.96	F	67.7	0.84	E
Lako EB Through-Right	48.1	0.16	D	50.2	0.16	D
Lako WB Left	72.2	0.72	E	65.3	0.69	E
Lako WB Through-Right	63.8	0.35	E	58.7	0.43	E
Route 11 & Kam III Rd (overall)	**19.3**	-	**B**	**25.0**	-	**C**
Route 11 NB Left	46.8	0.79	D	48.8	0.74	D
Route 11 NB Through	15.1	0.66	B	25.0	0.79	C
Route 11 SB Left	45.4	0.48	D	44.1	0.49	D
Route 11 SB Through	11.2	0.32	B	16.2	0.44	B
Kamehameha EB Left-Through	34.9	0.76	C	33.9	0.85	C
Kamehameha WB Left-Through-Right	47.3	0.70	D	43.9	0.62	D

h) Route 11 and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)

All movements at the signalized intersections of Route 11 with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

2. Future 2029 With Project Intersection LOS

The 2029 With Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours (see Table 23). The shaded row indicates the overall intersection delay. Movements that operate at LOS E or worse are highlighted in yellow. Synchro output is in Appendix G.

a) Route 11 and Palani Road. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersections of Route 11 with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.

b) Route 11 and Henry Street. Overall Intersection LOS = C/D C (AM/PM)

The westbound left turn operates at LOS E during the PM peak hour. The overall delay and LOS have gradually gotten worse due to the increase in background volume and the trip generated by Royal Vistas. The westbound left during the PM peak hour has a volume of 85 vehicles. This volume will clear the intersection in 1 cycle. The delay increases from 53.8 seconds without the project, to 57 seconds with the project. The Royal Vistas traffic volume causes a slight increase in the overall delay. Other factors that increase the delay are the increase in background volume and the split phase. All other movements at the signalized intersections of Route 11 with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

c) Route 11 and Hualalai Road (North)

At the unsignalized intersection of Route 11 with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 3.15 and 0.57 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

d) Route 11 and Hualalai Road (South)

At the unsignalized intersection of Route 11 with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.42 and 0.76 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The westbound right turn also operates at LOS F (v/c of 0.86) during the AM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

e) Route 11 and Puapuaanui Street. Overall Intersection LOS = BC/B C (AM/PM)

The southbound left turn operates at LOS E during the AM and PM peak hour. The westbound left turn operates at LOS E during the PM peak hour. These delays are due to the cycle length. The left turn volumes are low and should clear every cycle.

f) Route 11 and Royal Vistas Roadway

At the proposed unsignalized intersection of Route 11 and the Royal Vistas Roadway, the southbound left turn movement from Route 11 into Royal Vistas Roadway functions well, with minimal delay, an average of 10 to 13 seconds during both peak hours. The westbound left turning movement has LOS F (v/c of 0.61 and 0.52 respectively) during both AM (29 vehicles) and PM (12 vehicles) peak hours due to high through volumes on Route 11. Phase 2 left turns exiting Royal Vistas are expected to use Lako Street to access Route 11. The intersection functions acceptably, with an average of 3.6 seconds of delay per vehicle in the AM peak hour and 2.4 seconds of delay per vehicle in the PM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

g) Route 11 and Kuakini Highway

At the unsignalized intersection of Route 11 with Kuakini Highway, the northbound left turning movement has LOS F (v/c of 0.98) and long delays during the AM peak hour is due to high through volumes on Route 11. All other movements operated at acceptable levels of service during the AM and PM peak hours.

h) Route 11 and Lako Street. Overall Intersection LOS = D/C (AM/PM)

At the signalized intersection of Route 11 with Lako Street, the southbound left turn operates at LOS F (v/c of 1.00) during the AM peak hour, while several Lako Street approaches operate at LOS E or worse. This delay is attributed to the high volume and the split phasing for the Lako Street approaches. All other movements at Lako Street operate at LOS D or better during both peak hours.

i) Route 11 and Kamehameha III Road. Overall Intersection LOS = B/C (AM/PM)

All movements during both peak hours operate at LOS D or better.

Table 23: Future 2029 With Project Intersection Level of Service

Intersection	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Palani Rd (overall)	**23.4**	**-**	**C**	**27.2**	**-**	**C**
Route 11 EB Left	38.7	0.45	D	40.9	0.75	D
Route 11 EB Through	14.7	0.36	B	19.7	0.67	B
Route 11 WB Left	38.9	0.67	D	42.6	0.74	D
Route 11 WB Through	15.3	0.51	B	17.3	0.48	B
Palani NB Left	37.5	0.72	D	42.8	0.74	D
Palani NB Through	25.9	0.25	C	30.3	0.43	C
Palani SB Left	47.4	0.51	D	51.7	0.73	D
Palani SB Through	33.8	0.66	C	35.1	0.63	D
Route 11 & Henry St (overall)	**33.5**	**0.69**	**C**	**34.8**	**0.72**	**C**
Route 11 EB Left	50.3	0.61	D	52.8	0.72	D
Route 11 EB Through	26.7	0.43	C	32.8	0.74	C
Route 11 EB Right	22.8	0.08	C	23.8	0.19	C
Route 11 WB Left	46.8	0.43	D	54.2	0.62	D
Route 11 WB Through	34.3	0.74	C	34.6	0.70	C
Route 11 WB Right	27.8	0.36	C	27.3	0.24	C
Henry NB Left	36.2	0.47	D	36.5	0.41	D
Henry NB Left-Through	37.2	0.58	D	37.8	0.57	D
Henry NB Right	32.2	0.03	C	33.1	0.03	C
Henry SB Left	39.4	0.73	D	40.1	0.76	D
Henry SB Left-Through-Right	35.3	0.71	D	34.9	0.71	C
Route 11 & Hualalai (N) (overall)	**27.2**	**-**	**-**	**1.8**	**-**	**-**
Route 11 NB Left	12.4	0.27	B	13.5	0.18	B
Hualalai EB Left	1488.3	3.15	F	355.4	0.57	F
Route 11 & Hualalai (S) (overall)	**1.4**	**-**	**-**	**2.4**	**-**	**-**
Route 11 SB Left	14.1	0.17	B	12.5	0.12	B
Hualalai WB Left	247.1	0.42	F	400.6	0.76	F
Route 11 & Puapuaanui St (overall)	**27.2**	**-**	**C**	**32.2**	**-**	**C**
Route 11 NB Left	14.8	0.37	B	28.6	0.64	C
Route 11 NB Through	30.3	0.93	C	19.9	0.81	B
Route 11 SB Left	18.9	0.23	B	14.9	0.46	B
Route 11 SB Through	21.2	0.82	C	43.5	1.00	D
Puapuaanui EB Left	42.0	0.67	D	39.7	0.66	D
Puapuaanui EB Through	28.8	0.03	C	29.6	0.07	C
Puapuaanui WB Left	32.1	0.33	C	31.4	0.17	C
Puapuaanui WB Through	29.8	0.17	C	29.6	0.07	C
Route 11 & Royal Vistas (overall)	**3.6**	**-**	**-**	**2.4**	**-**	**-**
Route 11 SB Left	10.6	0.04	B	12.5	0.15	B
Royal Vistas WB Left	149.1	0.61	F	254.4	0.52	F
Royal Vistas WB Right	27.5	0.43	D	26.3	0.31	D
Route 11 & Kuakini Hwy (overall)	**12.8**	**-**	**-**	**2.6**	**-**	**-**
Route 11 NB Left	54.2	0.98	F	19.7	0.59	C
Kuakini EB Left	0.0	0.00	A	0.0	0.00	A
Route 11 & Lako St (overall)	**52.5**	**-**	**D**	**32.1**	**-**	**C**
Route 11 NB Left	18.2	0.13	B	22.3	0.19	C
Route 11 NB Through	48.3	0.97	D	25.8	0.85	C
Route 11 SB Left	107.8	1.00	F	34.4	0.77	C
Route 11 SB Through	25.1	0.78	C	26.3	0.88	C
Lako EB Left	113.4	1.02	F	80.8	0.86	F
Lako EB Through-Right	47.0	0.17	D	55.1	0.16	E
Lako WB Left	68.6	0.75	E	72.2	0.73	E
Lako WB Through-Right	59.3	0.32	E	64.0	0.41	E
Route 11 & Kam III Rd (overall)	**19.5**	**-**	**B**	**27.8**	**-**	**C**
Route 11 NB Left	47.1	0.79	D	53.8	0.78	D
Route 11 NB Through	15.5	0.67	B	24.8	0.77	C
Route 11 SB Left	45.8	0.48	D	50.6	0.51	D
Route 11 SB Through	11.4	0.33	B	16.4	0.41	B
Kamehameha EB Left-Through	35.2	0.77	D	44.9	0.88	D
Kamehameha WB Left-Through-Right	47.8	0.71	D	51.8	0.66	D

3. Future 2029 With Project Mitigation

Long term improvements including the Lako Street Extension, the completion of Alii Highway, and the widening of Route 11 from Henry Street to Kamehameha III Road will improve regional traffic in the study area. The completion dates of these projects are not known. In the interim, short-term mitigations were considered.

a) Traffic Signal Warrant Analysis

Similar to the existing condition, the minor street approach left turns operate at LOS F during both peak hours at both Hualalai Road intersections and the Royal Vistas driveway. Peak-Hour volume traffic signal warrants were evaluated for the 2029 with and without project conditions. Table 24 shows the Peak-Hour warrant analysis in 2029 with and without the project.

Table 24: Future 2029 Peak-Hour Warrant[6]

2029 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	2285	44	NO	2434	10	NO
Hualalai (S)	2192	9	NO	2452	14	NO
Kuakini Hwy	2490	0	NO	2480	0	NO
2029 With Project	**Peak Hour Warrant**					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	2409	44	NO	2570	10	NO
Hualalai (S)	2317	9	NO	2594	14	NO
Royal Vistas Dwy	1940	29	NO	2283	12	NO
Kuakini Hwy	2545	0	NO	2565	0	NO

None of the unsignalized intersections will satisfy the Peak Hour Warrant. Each of the unsignalized intersections operate with relatively low overall delay. The minor street left volumes at Hualalai Road and Puapuaanui Street are relatively low and the observed delays are generally much lower than the calculated delays.

The 2009 MUTCD states: "At an intersection with high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the 'minor-street' volume and the corresponding single direction of opposing traffic on the major street as the 'major-street" volume'. The Route 11 and Kuakini Highway northbound left turn operates at LOS E during the AM peak hour. For this analysis, the northbound left turn volume represents the minor approach volume, and the opposing southbound volume represents the major approach volume (see Table 25).

[6] Single Peak Hour warrant was evaluated because sufficient data was available and to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.

Table 25: Future 2029 Peak-Hour Warrant[7]

2029 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Kuakini Hwy	945	602	YES	1157	340	YES
2029 With Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Kuakini Hwy	972	602	YES	1168	340	YES

The Route 11 and Kuakini Highway intersection will satisfy the Peak Hour Warrant in 2029. The satisfaction of a traffic warrant does not require the installation of a traffic control signal. Kuakini Highway was analyzed as a signalized intersection with various northbound left phasing for the Future 2029 With Project condition (see Table 26).

Table 26: Future 2029 With Project – Route 11 and Kuakini Highway Left-Turn Signal Phasing Alternatives

2-Lane Route 11, Protected Left Turn Signal Phasing on Kuakini Highway	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Kuakini Hwy (overall)	**41.3**	**-**	**C**	**21.5**	**-**	**C**
Route 11 NB Left	83.0	1.02	F	79.2	0.94	E
Route 11 NB Through	1.6	0.59	A	1.7	0.60	A
Route 11 SB Through	55.0	1.00	D	22.5	0.88	C
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A
2-Lane Route 11, Permissive Left Turn Signal Phasing on Kuakini Highway	**AM**			**PM**		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Kuakini Hwy (overall)	**27.4**	**-**	**C**	**3.2**	**-**	**A**
Route 11 NB Left	109.7	1.18	F	11.5	0.72	B
Route 11 NB Through	1.6	0.59	A	1.7	0.60	A
Route 11 SB Through	1.7	0.59	A	2.1	0.66	A
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A
2-Lane Route 11, Prot+Perm Left Turn Signal Phasing on Kuakini Highway	**AM**			**PM**		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Kuakini Hwy (overall)	**30.4**	**-**	**C**	**4.7**	**-**	**A**
Route 11 NB Left	64.4	0.97	E	13.7	0.77	B
Route 11 NB Through	1.6	0.59	A	1.7	0.60	A
Route 11 SB Through	37.9	0.94	D	4.8	0.72	A
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A

The overall delay at this intersection will increase in both peak hours, while the northbound left turn will still operate at LOS E or worse for all alternatives. It is recommended that a signal not be installed at this intersection.

[7] Single Peak Hour warrant was evaluated because sufficient data was available and to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.

b) Alternative Mitigation Measures

(1) Alternatives Lako Street

A comparison between the widening of Route 11 and various left-turn phasing on Lako Street was analyzed for the Future 2029 With Project, shown in Table 27. All movements will operate with an acceptable LOS with 4-Lane Route 11 and permissive left-turn phasing on Lako Street. Protected left turns on Lako Street will provide a slight improvement in the overall delay, but the eastbound left and westbound approaches will still operate with LOS E.

Table 27: Future 2029 With Project – Route 11 and Lako Street Left-Turn Signal Phasing Alternatives

2-Lane Route 11, Protected Left Turn Signal Phasing on Lako Street	AM Delay (sec/veh)	AM v/c	AM LOS	PM Delay (sec/veh)	PM v/c	PM LOS
Route 11 & Lako St (overall)	**45.0**	**-**	**D**	**29.2**	**-**	**C**
Route 11 NB Left	16.2	0.12	B	19.9	0.17	B
Route 11 NB Through	41.2	0.95	D	22.8	0.83	C
Route 11 SB Left	67.7	0.89	E	28.8	0.72	C
Route 11 SB Through	22.3	0.76	C	23.3	0.86	C
Lako EB Left	103.9	1.00	F	78.8	0.86	E
Lako EB Through-Right	48.0	0.19	D	56.3	0.19	E
Lako WB Left	67.9	0.76	E	70.8	0.73	E
Lako WB Through-Right	64.4	0.51	E	70.3	0.60	E
2-Lane Route 11, Permissive Left Turn Signal Phasing on Lako Street	**AM Delay (sec/veh)**	**AM v/c**	**AM LOS**	**PM Delay (sec/veh)**	**PM v/c**	**PM LOS**
Route 11 & Lako St (overall)	**41.5**	**-**	**D**	**23.8**	**-**	**C**
Route 11 NB Left	17.1	0.13	B	16.9	0.16	B
Route 11 NB Through	49.0	0.98	D	20.3	0.82	C
Route 11 SB Left	81.5	0.92	F	24.0	0.69	C
Route 11 SB Through	23.6	0.78	C	20.8	0.86	C
Lako EB Left	50.1	0.78	D	50.8	0.64	D
Lako EB Through-Right	35.8	0.11	D	41.3	0.11	D
Lako WB Left	39.7	0.24	D	44.7	0.28	D
Lako WB Through-Right	35.6	0.09	D	41.7	0.15	D
2-Lane Route 11, Prot+Perm Left Turn Signal Phasing on Lako Street	**AM Delay (sec/veh)**	**AM v/c**	**AM LOS**	**PM Delay (sec/veh)**	**PM v/c**	**PM LOS**
Route 11 & Lako St (overall)	**34.5**	**-**	**C**	**24.6**	**-**	**C**
Route 11 NB Left	14.0	0.12	B	16.7	0.16	B
Route 11 NB Through	34.7	0.92	C	20.0	0.82	B
Route 11 SB Left	43.6	0.82	D	23.5	0.68	C
Route 11 SB Through	19.7	0.75	B	20.5	0.86	C
Lako EB Left	64.2	0.86	E	61.0	0.72	E
Lako EB Through-Right	45.4	0.21	D	52.2	0.25	D
Lako WB Left	49.9	0.40	D	50.5	0.34	D
Lako WB Through-Right	57.5	0.47	E	59.8	0.54	E
4-Lane Route 11, Split Phasing on Lako Street	**AM Delay (sec/veh)**	**AM v/c**	**AM LOS**	**PM Delay (sec/veh)**	**PM v/c**	**PM LOS**
Route 11 & Lako St (overall)	**22.6**	**-**	**C**	**16.6**	**-**	**B**
Route 11 NB Left	12.9	0.11	B	10.2	0.13	B
Route 11 NB Through	22.3	0.74	C	16.4	0.66	B
Route 11 SB Left	16.0	0.55	B	11.7	0.54	B
Route 11 SB Through	16.5	0.56	B	13.8	0.64	B
Lako EB Left	40.4	0.85	D	32.5	0.75	C
Lako EB Through-Right	24.3	0.14	C	25.5	0.14	C
Lako WB Left	38.2	0.66	D	33.7	0.60	C
Lako WB Through-Right	32.9	0.28	C	30.2	0.34	C

The *Traffic Assessment for Left-Turn Signal Phasing Guidelines* (ATA, 2017) recommends that approaches that do not have adequate sight distance, a protected left-turn phase should be considered, and a permissive left-turn phase is not suitable. The eastbound approach sight distance should be checked before considering allowing permissive left-turn phasing. The widening of Route 11 is needed in 2029.

4. Future 2029 With Project Segment LOS

Arterial LOS was analyzed in Synchro on Route 11 from Hualalai (north) to Lako Street. Where signalized intersections are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities. For Urban Street Facilities, through-vehicle travel speed is used to analyze vehicular LOS. Analysis worksheets can be found in Appendix G. The arterial LOS can be found in Table 28.

This segment of Route 11 operates at LOS C in northbound and southbound direction during the AM and PM peak hours, satisfying the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding “acceptable level of service” for transportation facilities.

Table 28: Future 2029 With Project Segment LOS

Peak Hour	Northbound (To Waimea)		Southbound (To Keauhou)	
	Speed (mph)	LOS	Speed (mph)	LOS
AM Peak	18.9	C	23.5	C
PM Peak	20.4	C	20.8	C

V. Future (2039) Long-Term Conditions

A. Surrounding Area Conditions

Long term improvements including the Lako Street Extension, the completion of Alii Highway, and the widening of Route 11 from Henry Street to Kamehameha III Road will improve regional traffic in the study area. The completion dates of these projects are not known. Volumes were not adjusted based on these improvement projects.

No other significant developments or future construction projects are expected in the surrounding area that would significantly affect the roadway geometrics or traffic volumes at the study intersections. This is based on research completed on October 10, 2019 at the State of Hawaii Office of Environmental Quality Control (OEQC) website and the Statewide Transportation Improvements Program (STIP).

B. Volumes

1. Future 2039 Without Project Volumes

The project study area within Kona has been experiencing modest growth. HDOT ADT counts on Route 11 between Nani Kailua Drive and Hualalai Road didn't show any increase in vehicular volumes from 2015 to 2016. However, the 2035 Federal Aid Highways Long Range Transportation Plan forecasts average daily traffic in Kona on Hawaii Belt Road to be 41,900 vehicles in 2020 and 48,000 vehicles in 2035. This is approximately equal to a 1% annual growth rate over 15 years in the Kona area.

Since there is a scope for development and to acknowledge all other projects which are in planning stage, a background growth rate of 1% per year was assumed, to account for additional traffic at the study intersections. The estimated future volumes without the project for the future year 2039 are shown in Figure 15.

2. Project Related Volumes

Phase 1 and Phase 2 will be completed by 2024 and 2029, respectively. The trips generated and distributed by Phase 1 and Phase 2 will not change.

3. Future 2039 With Project Volumes

Project related trips from Phase 1 (Figure 9) and Phase 2 (Figure 12 and Figure 13) were added to the Future 2039 Without Project volumes (Figure 15) to estimate Future 2039 With Project peak hour volumes (see Figure 16).

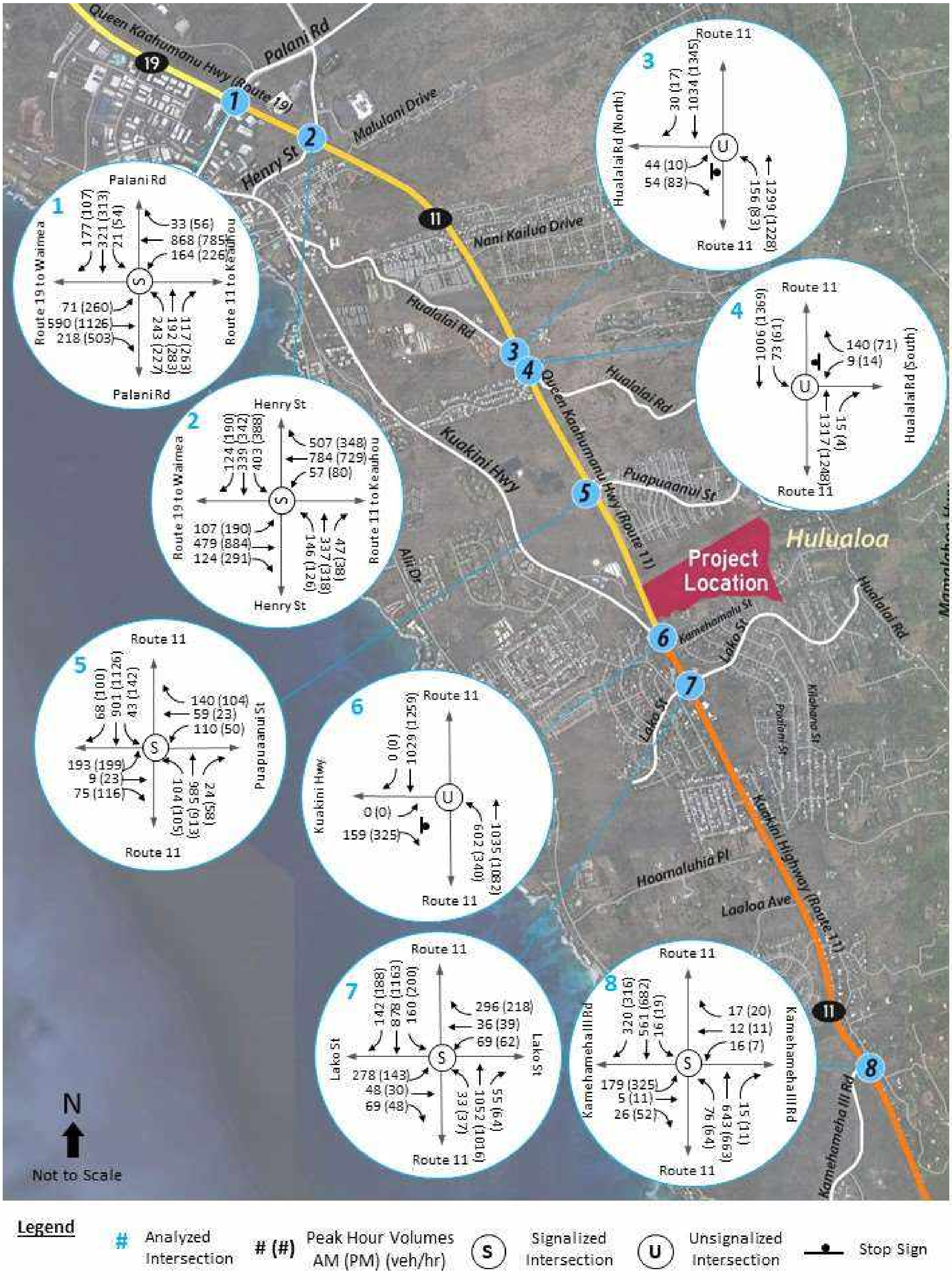


Figure 15: Future 2039 Without Project Peak Hour Volumes

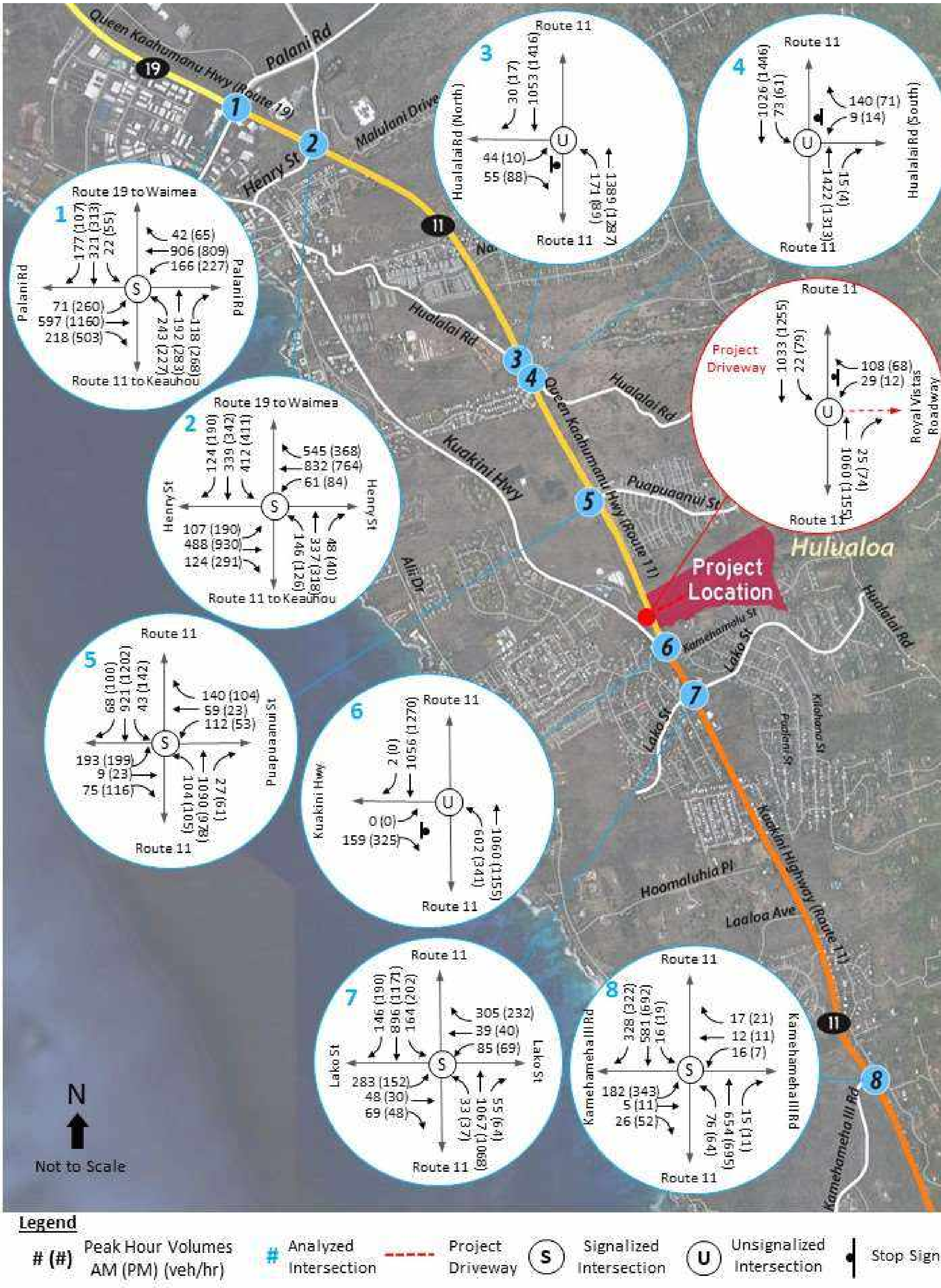


Figure 16: Future 2039 With Project Peak Hour Volumes

C. Future 2039 Intersection Traffic Operation Analysis

1. Future 2039 Without Project Intersection LOS

The 2039 Without Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours. NOTE: 2039 Future projections assume 1% annual growth rate for 20 years, which is a conservative assumption. Table 29 shows the existing vehicular delay and level of service at each intersection. The shaded row indicates the overall intersection delay. Movements that operate at LOS E or worse are highlighted in yellow. Synchro output is in Appendix H.

a) Route 11 and Palani Road. Overall Intersection LOS = C/D (AM/PM)

All movements at the signalized intersections of Route 11 with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.

b) Route 11 and Henry Street. Overall Intersection LOS = C/DC.

All movements at the signalized intersections of Route 11 with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

c) Route 11 and Hualalai Road (North)

At the unsignalized intersection of Route 11 with Hualalai Street (north), eastbound left turning movement has LOS F (v/c of 3.38 and 0.61 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

d) Route 11 and Hualalai Road (South)

At the unsignalized intersection of Route 11 with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.46 and 0.85 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

e) Route 11 and Puapuaanui Street. Overall Intersection LOS = BC/BC.

The southbound left turns operate at LOS E during both peak hours. The westbound left turn operates at LOS E during the PM peak hour. These delays are due to the cycle length. The left turn volumes are low and should clear every cycle.

f) Route 11 and Kuakini Highway

At the unsignalized intersection of Route 11 with Kuakini Highway, the northbound left turning movement has LOS F (v/c of 1.03) and long delays during the AM peak hour is due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

g) Route 11 and Lako Street. Overall Intersection LOS = E/D.

At the signalized intersection of Route 11 with Lako Street, various movements operate at LOS E or worse. This delay is attributed to the traffic volumes and the split phasing for the Lako Street approaches.

h) Route 11 and Kamehameha III Road. Overall Intersection LOS = CB/BC.

All movements at the signalized intersections of Route 11 with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

Table 29: Future 2039 Without Project Intersection Level of Service

Intersection	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Palani Rd (overall)	**23.3**	**-**	**C**	**27.7**	**-**	**D**
Route 11 EB Left	38.8	0.45	D	41.7	0.76	D
Route 11 EB Through	14.9	0.39	B	20.4	0.70	C
Route 11 WB Left	39.1	0.67	D	44.9	0.75	D
Route 11 WB Through	15.6	0.53	B	17.6	0.51	B
Palani NB Left	37.7	0.72	D	45.0	0.75	D
Palani NB Through	26.0	0.25	C	30.8	0.43	C
Palani SB Left	47.7	0.51	D	52.1	0.72	D
Palani SB Through	33.9	0.66	C	35.6	0.63	D
Route 11 & Henry St (overall)	**33.4**	**0.70**	**C**	**34.8**	**0.73**	**C**
Route 11 EB Left	49.6	0.61	D	52.0	0.72	D
Route 11 EB Through	26.8	0.46	C	33.1	0.76	C
Route 11 EB Right	22.5	0.08	C	23.6	0.20	C
Route 11 WB Left	46.2	0.40	D	51.7	0.59	D
Route 11 WB Through	34.3	0.75	C	35.0	0.73	C
Route 11 WB Right	27.0	0.34	C	26.8	0.23	C
Henry NB Left	36.0	0.47	D	36.2	0.41	D
Henry NB Left-Through	37.0	0.58	D	37.5	0.56	D
Henry NB Right	32.0	0.03	C	32.8	0.03	C
Henry SB Left	40.0	0.74	D	40.4	0.76	D
Henry SB Left-Through-Right	35.5	0.71	D	34.7	0.70	C
Route 11 & Hualalai (N) (overall)	**28.6**	**-**	**-**	**1.9**	**-**	**-**
Route 11 NB Left	12.8	0.27	B	13.8	0.17	B
Hualalai EB Left	1620.7	3.38	F	384.4	0.61	F
Route 11 & Hualalai (S) (overall)	**1.5**	**-**	**-**	**2.7**	**-**	**-**
Route 11 SB Left	14.2	0.17	B	12.9	0.12	B
Hualalai WB Left	279.3	0.46	F	469.2	0.85	F
Route 11 & Puapuaanui St (overall)	**29.3**	**-**	**C**	**30.7**	**-**	**C**
Route 11 NB Left	18.5	0.44	B	32.4	0.64	C
Route 11 NB Through	30.9	0.93	C	19.2	0.80	B
Route 11 SB Left	18.9	0.23	B	15.8	0.46	B
Route 11 SB Through	26.7	0.89	C	38.2	0.98	D
Puapuaanui EB Left	40.4	0.66	D	47.9	0.70	D
Puapuaanui EB Through	28.3	0.03	C	34.1	0.07	C
Puapuaanui WB Left	31.5	0.32	C	36.0	0.17	D
Puapuaanui WB Through	29.3	0.17	C	34.1	0.07	C
Route 11 & Kuakini Hwy (overall)	**15.4**	**-**	**-**	**2.9**	**-**	**-**
Route 11 NB Left	68.2	1.03	F	22.9	0.64	C
Kuakini EB Left	0.0	0.00	A	0.0	0.00	A
Route 11 & Lako St (overall)	**59.1**	**-**	**E**	**35.3**	**-**	**D**
Route 11 NB Left	19.4	0.14	B	29.9	0.26	C
Route 11 NB Through	58.4	1.01	F	26.4	0.87	C
Route 11 SB Left	145.1	1.08	F	38.9	0.80	D
Route 11 SB Through	25.6	0.80	C	34.0	0.95	C
Lako EB Left	119.6	1.03	F	77.6	0.85	E
Lako EB Through-Right	50.7	0.17	D	55.2	0.17	E
Lako WB Left	73.9	0.72	E	71.6	0.71	E
Lako WB Through-Right	65.3	0.35	E	64.3	0.44	E
Route 11 & Kam III Rd (overall)	**19.7**	**-**	**B**	**26.7**	**-**	**C**
Route 11 NB Left	46.8	0.79	D	53.1	0.78	D
Route 11 NB Through	16.8	0.71	B	25.1	0.79	C
Route 11 SB Left	45.4	0.48	D	49.7	0.50	D
Route 11 SB Through	11.4	0.35	B	16.2	0.44	B
Kamehameha EB Left-Through	34.9	0.76	C	42.4	0.87	D
Kamehameha WB Left-Through-Right	47.3	0.70	D	50.5	0.65	D

2. Future 2039 With Project Intersection LOS

Future 2039 With Project intersection and movement LOS and average delay (in seconds per vehicle) were determined for the AM and PM peak hours, shown in Table 30. The shaded row indicates the overall intersection delay. Movements that operate at LOS E or worse are highlighted in yellow. Synchro output is in Appendix I.

a) Route 11 and Palani Road. Overall Intersection LOS = C/C (AM/PM)

All movements at the signalized intersections of Route 11 with Palani Road resulted in appropriate LOS D or better during AM and PM peak hours.

b) Route 11 and Henry Street. Overall Intersection LOS = C/D.

All movements at the signalized intersections of Route 11 with Henry Street resulted in appropriate LOS D or better during AM and PM peak hours.

c) Route 11 and Hualalai Road (North)

In the AM peak hour, the unsignalized intersection of Route 11 with Hualalai Street (north), overall the delay at this intersection is 36.3 seconds per vehicle, a slight increase from the 2039 Without Project condition. The eastbound left turning movement has LOS F (v/c of 4.30 and 0.79, respectively) during both AM and PM peak hours due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

d) Route 11 and Hualalai Road (South)

At the unsignalized intersection of Route 11 with Hualalai Road (south), westbound left turning movement has LOS F (v/c of 0.61 and 1.11 respectively) and long delays during both AM and PM peak hours are due to high through volumes on Route 11. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

e) Route 11 and Puapuaanui Street. Overall Intersection LOS = BC/BC.

The eastbound left turn operates at LOS E (v/c of 0.78) during the PM peak hour. The delay is a result of signal timing and the signal timing could be adjusted to reduce approach delay. All other movements at the signalized intersections of Route 11 with Puapuaanui Street resulted in appropriate LOS D or better during AM and PM peak hours.

f) Route 11 and Royal Vistas Roadway

At the proposed unsignalized intersection of Route 11 and the Royal Vistas Roadway, the southbound left turn movement from Route 11 into Royal Vistas Roadway functions well, with minimal delay, an average of 11 to 13 seconds during both peak hours. The westbound left turning movement has LOS F (v/c of 0.81 and 0.73, respectively) during both AM (29 vehicles) and PM (12 vehicles) peak hours due to high through volumes on Route 11. Phase 2 left turns exiting Royal Vistas are expected to use Lako Street to access Route 11. The intersection functions acceptably, with an average of 4.8 seconds of delay per vehicle in the AM peak hour and 2.4 seconds of delay per vehicle in the PM peak hour. The major and other minor movements operated at acceptable levels of service during the AM and PM peak hours.

g) Route 11 and Kuakini Highway

At the unsignalized intersection of Route 11 with Kuakini Highway, the northbound left turning movement has LOS F (v/c of 1.06) during the AM peak hour. All other movements operated at acceptable levels of service during the AM and PM peak hours.

Table 30: Future 2039 With Project Intersection Level of Service

Intersection	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Palani Rd (overall)	**23.3**	**-**	**C**	**28.1**	**-**	**C**
Route 11 EB Left	38.7	0.45	D	42.6	0.76	D
Route 11 EB Through	15.0	0.40	B	20.8	0.71	C
Route 11 WB Left	39.1	0.67	D	45.8	0.75	D
Route 11 WB Through	15.9	0.56	B	17.7	0.52	B
Palani NB Left	37.8	0.73	D	46.0	0.75	D
Palani NB Through	26.0	0.25	C	31.4	0.43	C
Palani SB Left	47.5	0.51	D	53.6	0.74	D
Palani SB Through	33.8	0.65	C	36.3	0.64	D
Route 11 & Henry St (overall)	**34.2**	**0.72**	**C**	**35.8**	**0.75**	**D**
Route 11 EB Left	50.6	0.61	D	52.8	0.72	D
Route 11 EB Through	27.2	0.47	C	35.4	0.81	D
Route 11 EB Right	22.7	0.08	C	24.1	0.21	C
Route 11 WB Left	47.1	0.43	D	54.2	0.62	D
Route 11 WB Through	36.5	0.80	D	36.9	0.77	D
Route 11 WB Right	27.7	0.36	C	27.3	0.24	C
Henry NB Left	36.5	0.47	D	36.5	0.41	D
Henry NB Left-Through	37.5	0.59	D	37.8	0.57	D
Henry NB Right	32.4	0.03	C	33.1	0.03	C
Henry SB Left	39.8	0.74	D	40.1	0.76	D
Henry SB Left-Through-Right	35.7	0.71	D	34.9	0.71	C
Route 11 & Hualalai (N) (overall)	**36.3**	**-**	**-**	**2.4**	**-**	**-**
Route 11 NB Left	13.3	0.30	B	14.7	0.20	B
Hualalai EB Left	2163.6	4.30	F	553.1	0.79	F
Route 11 & Hualalai (S) (overall)	**1.9**	**-**	**-**	**3.6**	**-**	**-**
Route 11 SB Left	15.4	0.19	B	13.4	0.13	B
Hualalai WB Left	404.0	0.61	F	679.5	1.11	F
Route 11 & Puapuaanui St (overall)	**31.1**	**-**	**C**	**33.7**	**-**	**C**
Route 11 NB Left	17.3	0.40	B	47.2	0.75	D
Route 11 NB Through	35.3	0.96	D	19.1	0.81	B
Route 11 SB Left	24.6	0.28	C	17.7	0.49	B
Route 11 SB Through	21.8	0.84	C	41.0	0.99	D
Puapuaanui EB Left	54.5	0.76	D	60.0	0.78	E
Puapuaanui EB Through	33.7	0.03	C	39.0	0.08	D
Puapuaanui WB Left	37.7	0.37	D	41.4	0.20	D
Puapuaanui WB Through	34.9	0.19	C	39.0	0.08	D
Route 11 & Royal Vistas (overall)	**4.8**	**-**	**-**	**3.1**	**-**	**-**
Route 11 SB Left	11.2	0.04	B	13.3	0.17	B
Royal Vistas WB Left	242.4	0.81	F	405.8	0.73	F
Royal Vistas WB Right	33.3	0.49	D	31.4	0.35	D
Route 11 & Kuakini Hwy (overall)	**17.2**	**-**	**-**	**2.9**	**-**	**-**
Route 11 NB Left	77.6	1.06	F	23.4	0.65	C
Kuakini EB Left	0.0	0.00	A	0.0	0.00	A
Route 11 & Lako St (overall)	**65.4**	**-**	**E**	**47.3**	**-**	**D**
Route 11 NB Left	21.6	0.16	C	31.6	0.28	C
Route 11 NB Through	69.6	1.05	F	45.1	0.97	D
Route 11 SB Left	150.7	1.11	F	77.4	0.90	E
Route 11 SB Through	28.6	0.08	C	37.8	0.96	D
Lako EB Left	122.7	1.04	F	81.5	0.86	F
Lako EB Through-Right	50.4	0.17	D	55.5	0.16	E
Lako WB Left	73.0	0.76	E	72.6	0.73	E
Lako WB Through-Right	63.2	0.33	E	64.4	0.41	E
Route 11 & Kam III Rd (overall)	**19.9**	**-**	**B**	**29.0**	**-**	**C**
Route 11 NB Left	47.5	0.80	D	53.9	0.78	D
Route 11 NB Through	17.2	0.72	B	28.7	0.84	C
Route 11 SB Left	46.1	0.48	D	50.7	0.51	D
Route 11 SB Through	11.6	0.36	B	16.9	0.45	B
Kamehameha EB Left-Through	35.3	0.77	D	45.1	0.88	D
Kamehameha WB Left-Through-Right	48.1	0.71	D	51.9	0.66	D

h) Route 11 and Lako Street. Overall Intersection LOS = E/D.

At the signalized intersection of Route 11 with Lako Street, various movements operate at LOS E or worse. This delay is attributed to the traffic volumes and the split phasing for the Lako Street approaches.

i) Route 11 and Kamehameha III Road. Overall Intersection LOS = C/C.

All movements at the signalized intersections of Route 11 with Kamehameha III Road resulted in appropriate LOS D or better during AM and PM peak hours.

3. Future 2039 With Project Mitigation

Long term improvements including the Lako Street Extension, the completion of Alii Highway, and the widening of Route 11 from Henry Street to Kamehameha III Road will improve regional traffic in the study area. The completion dates of these projects are not known. In the interim, short-term mitigations were considered.

a) Traffic Signal Warrant Analysis

Similar to the existing condition, the minor street approach left turns operate at LOS F during both peak hours at both Hualalai Road intersections and the Royal Vistas driveway. Peak-Hour volume traffic signal warrants were evaluated for the 2039 with and without project conditions. Table 31 shows the Peak-Hour warrant analysis in 2039 with and without the project.

Table 31: Future 2039 Peak-Hour Warrant[8]

2029 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	2489	44	NO	2656	10	NO
Hualalai (S)	2396	9	NO	2678	14	NO
Kuakini Hwy	2666	0	NO	2681	0	NO
2029 With Project	**Peak Hour Warrant**					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Hualalai (N)	2613	44	NO	2792	10	NO
Hualalai (S)	2521	9	NO	2820	14	NO
Royal Vistas Dwy	2115	29	NO	2489	12	NO
Kuakini Hwy	2721	0	NO	2766	0	NO

None of the unsignalized intersections will satisfy the Peak Hour Warrant. Each of the unsignalized intersections operate with relatively low overall delay. The minor street left volumes at Hualalai Road and Puapuaanui Street are relatively low and the observed delays are generally much lower than the calculated delays.

The 2009 MUTCD states: “At an intersection with high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the ‘minor-street’ volume and the corresponding single direction of opposing traffic on the major street as the ‘major-street” volume’. The Route 11 and Kuakini Highway northbound left turn operates at LOS E during the AM peak hour. For this analysis, the northbound left turn volume represents the minor approach volume, and the opposing southbound volume represents the major approach volume (see Table 32).

[8] Single Peak Hour warrant was evaluated because sufficient data was available and to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.

Table 32: Future 2039 Peak-Hour Warrant[9]

2029 Without Project	Peak Hour Warrant					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Kuakini Hwy	1029	602	YES	1259	340	YES
2029 With Project	**Peak Hour Warrant**					
	AM			PM		
	Major	Minor	Warrant?	Major	Minor	Warrant?
Kuakini Hwy	1056	602	YES	1270	340	YES

The Route 11 and Kuakini Highway intersection will satisfy the Peak Hour Warrant in 2039. The satisfaction of a traffic warrant does not require the installation of a traffic control signal. Kuakini Highway was analyzed as a signalized intersection with various northbound left-turn phasing for the Future 2024 With Project condition (see Table 33).

Table 33: Future 2039 With Project – Route 11 and Kuakini Highway Left-Turn Signal Phasing Alternatives

2-Lane Route 11, Protected Left Turn Signal Phasing on Kuakini Highway	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Kuakini Hwy (overall)	**50.1**	**-**	**D**	**26.0**	**-**	**C**
Route 11 NB Left	108.5	1.10	F	81.4	0.94	F
Route 11 NB Through	2.1	0.65	A	2.1	0.66	A
Route 11 SB Through	64.9	1.04	F	32.8	0.96	C
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A
2-Lane Route 11, Permissive Left Turn Signal Phasing on Kuakini Highway	**AM**			**PM**		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Kuakini Hwy (overall)	**36.2**	**-**	**D**	**4.5**	**-**	**A**
Route 11 NB Left	155.6	1.29	F	19.2	0.80	B
Route 11 NB Through	2.1	0.65	A	2.1	0.66	A
Route 11 SB Through	2.0	0.64	A	2.8	0.72	A
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A
2-Lane Route 11, Prot+Perm Left Turn Signal Phasing on Kuakini Highway	**AM**			**PM**		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Kuakini Hwy (overall)	**42.7**	**-**	**D**	**7.2**	**-**	**A**
Route 11 NB Left	98.2	1.07	F	27.9	0.87	C
Route 11 NB Through	2.1	0.65	A	2.1	0.66	A
Route 11 SB Through	51.8	1.00	F	6.2	0.78	A
Kuakini Highway EB approach	0.0	0.00	A	0.0	0.00	A

The overall delay at this intersection will increase in both peak hours, while the northbound left turn will still operate at LOS F for all alternatives in the AM peak hour. It is recommended that a signal not be installed at this intersection.

[9] Single Peak Hour warrant was evaluated because sufficient data was available and to give an indication of whether or not an intersection should be considered and monitored for a traffic signal.

b) *Alternative Mitigation Measures*

(1) Alternatives Lako Street

A comparison between the widening of Route 11 and various left-turn phasing was analyzed for the Future 2039 With Project at Lako Street, shown in Table 34. All movements will operate with an acceptable LOS with 4-Lane Route 11 and permissive left-turn phasing on Lako Street. Protected left turns on Lako Street will provide a slight improvement in the overall delay, but the eastbound left and westbound approaches will still operate with LOS E.

Table 34: Future 2039 With Project – Route 11 and Lako Street Left-Turn Signal Phasing Alternatives

2-Lane Route 11, Protected Left Turn Signal Phasing on Lako Street	AM			PM		
	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c	LOS
Route 11 & Lako St (overall)	**57.9**	**-**	**E**	**37.9**	**-**	**D**
Route 11 NB Left	18.9	0.14	B	28.9	0.25	C
Route 11 NB Through	58.7	1.02	F	30.7	0.91	C
Route 11 SB Left	139.3	1.07	F	56.3	0.89	E
Route 11 SB Through	25.0	0.81	C	32.8	0.94	C
Lako EB Left	112.0	1.01	F	78.8	0.86	E
Lako EB Through-Right	51.5	0.19	D	56.3	0.19	E
Lako WB Left	72.4	0.77	E	70.8	0.73	E
Lako WB Through-Right	69.3	0.54	E	70.3	0.60	E
2-Lane Route 11, Permissive Left Turn Signal Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**54.5**	**-**	**D**	**29.3**	**-**	**C**
Route 11 NB Left	20.3	0.16	C	24.8	0.21	C
Route 11 NB Through	67.3	1.05	F	23.7	0.87	C
Route 11 SB Left	147.5	1.11	F	38.5	0.80	D
Route 11 SB Through	27.6	0.84	C	26.6	0.91	C
Lako EB Left	51.2	0.79	D	59.1	0.67	E
Lako EB Through-Right	36.6	0.11	D	48.0	0.11	D
Lako WB Left	40.5	0.24	D	52.0	0.29	D
Lako WB Through-Right	36.4	0.09	D	48.4	0.15	D
2-Lane Route 11, Prot+Perm Left Turn Signal Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**43.5**	**-**	**D**	**28.4**	**-**	**C**
Route 11 NB Left	14.6	0.12	B	22.8	0.19	C
Route 11 NB Through	42.4	0.97	D	21.2	0.85	C
Route 11 SB Left	74.7	0.89	E	32.9	0.76	C
Route 11 SB Through	19.3	0.77	B	23.5	0.89	C
Lako EB Left	101.8	0.99	F	78.9	0.80	E
Lako EB Through-Right	52.4	0.25	D	61.7	0.26	E
Lako WB Left	55.6	0.42	E	61.0	0.39	E
Lako WB Through-Right	64.4	0.51	E	72.7	0.61	E
4-Lane Route 11, Split Phasing on Lako Street	**AM**			**PM**		
	Delay (sec/veh)	**v/c**	**LOS**	**Delay (sec/veh)**	**v/c**	**LOS**
Route 11 & Lako St (overall)	**23.8**	**-**	**C**	**17.5**	**-**	**B**
Route 11 NB Left	13.1	0.12	B	10.7	0.14	B
Route 11 NB Through	24.0	0.79	C	17.4	0.71	B
Route 11 SB Left	18.3	0.59	B	13.2	0.57	B
Route 11 SB Through	17.1	0.60	B	14.8	0.69	B
Lako EB Left	42.3	0.86	D	32.8	0.75	C
Lako EB Through-Right	24.8	0.14	C	25.8	0.14	C
Lako WB Left	38.8	0.66	D	34.1	0.60	C
Lako WB Through-Right	33.4	0.29	C	30.4	0.34	C

The *Traffic Assessment for Left-Turn Signal Phasing Guidelines* (ATA, 2017) recommends that approaches that do not have adequate sight distance, a protected left-turn phase should be considered, and a permissive left-turn phase is not suitable. The eastbound approach sight distance should be checked before considering allowing permissive left-turn phasing. The widening of Route 11 is needed in 2029.

4. Future 2039 With Project Segment LOS

Arterial LOS was analyzed in Synchro on Route 11 from Hualalai (north) to Lako Street. Where signalized intersections are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities. For Urban Street Facilities, through-vehicle travel speed is used to analyze vehicular LOS. Analysis worksheets can be found in Appendix I. The arterial LOS can be found in Table 35.

Table 35: Future 2039 with Project Segment LOS

Peak Hour	Northbound (To Waimea)		Southbound (To Keauhou)	
	Speed (mph)	LOS	Speed (mph)	LOS
AM Peak	16.6	D	22.7	C
PM Peak	19.1	C	19.7	C

This segment of Route 11 operates at LOS D in the northbound direction and LOS B in the southbound direction in the AM peak hour. During the PM peak hour, both directions operate at LOS C. The arterial LOS for the AM and PM peak hours satisfies the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding “acceptable level of service” for transportation facilities.

VI. SUMMARY AND RECOMMENDATIONS

Kona Three LLC is planning to develop a multi-family residential subdivision named Royal Vistas in Kona, on the Island of Hawaii. The property is located on the mauka side of Queen Kaahumanu Highway (Route 11) at TMK (3) 7-6-021:016, 17 between Kona Vista Subdivision and Pualani Estates Subdivision. One access is planned to connect to Route 11, approximately 600 feet north of the intersection with Kuakini Highway. Another access will be built before the completion of Phase 2 connecting Royal Vistas to Kekuanaoa Place.

Various roadway projects that will increase connectivity and capacity are planned to include:

- The widening of Route 11 from Henry Street to Kamehameha III Road;
- The construction of Alii Highway from Hualalai Road to Keauhou Shopping Center;
- The Lako Street extension;
- Future ‘minor collectors’ running parallel to Route 11 through Royal Vistas including extending Hoomana Street to Leilani Street and extending Paulehia Street to Kekuanaoa Place.

Based on the existing traffic volumes and future projections of Royal Vistas on the surrounding roadways, the Route 11 and Lako Street intersection and some individual movements at other intersections are expected to deteriorate to LOS E or worse. The widening of Route 11 to 4-lanes, and the completion of Alii Highway is needed to increase the north-south regional capacity. In the interim, the following system-wide intersection improvements are recommended for consideration by Hawaii County and HDOT:

1. Route 11 and Palani Road
   Existing and future analysis indicate this intersection will operate at an acceptable LOS. Improvements to this intersection are not recommended at this time.
2. Route 11 and Henry Street
   Existing and future analysis indicate this intersection will operate at an acceptable LOS. Improvements to this intersection are not recommended at this time.
3. Route 11 and Hualalai Road (North)
   This intersection does not pass the Four-Hour warrant or peak hour warrant for any condition. The high delay is due to the high volume on Route 11. There are 44 vehicles and 10 vehicles making the westbound left turn in the AM and PM peak hours, respectively. When the delay experienced by drivers reaches this level, the eastbound drivers are likely to find alternative routes. A single-lane roundabout will improve traffic operations at this intersection for the existing condition but worsen to LOS F after 2024. A roundabout is not recommended at this intersection.
4. Route 11 and Hualalai Road (South)
   As the westbound left turn delay gets worse, drivers may decide to use Puapuaanui Street to access Route 11 in the southbound direction. This intersection did not pass the Four-Hour warrant or the Peak-Hour warrant for the existing or future conditions. Based on existing traffic operations, it is recommended an acceleration lane be installed for the westbound right turn onto Route 11. A single-lane roundabout will improve traffic operations at this intersection for the existing condition but worsen to LOS F after 2024. A roundabout is not recommended at this intersection.
5. Route 11 and Puapuaanui Street
   Signal timing should be monitored and adjusted as needed to increase the probability that queues on Route 11 can clear the intersection in 1 cycle.

6. Route 11 and Royal Vistas Roadway
   This intersection will function acceptably through the full Phase 1 buildout. Before any Phase 2 residences are occupied, it is recommended that the connection to Kekuanao'a Place is completed so that Royal Vistas Phase 2 'left out' traffic can access the Lako Street traffic signal.
7. Route 11 and Kuakini Highway
   This intersection passes the Peak-Hour warrant during all peak hours for all conditions. The satisfaction of a traffic signal does not mean a traffic signal needs to be installed. There are other factors that should be analyzed when installing a traffic signal, such as roadway geometry, added delay to a traffic network, and the impact of rear-end accidents that occur at new traffic signals. Analysis of this intersection with various phasing showed that the overall delay at the intersection would increase, while the northbound left turn will still operate at LOS E or worse. A traffic signal should not be installed at this intersection. Royal Vistas traffic has very little effect on this intersection. A single-lane roundabout will operate at LOS F for the existing AM peak hour condition, and LOS F for all future conditions. A roundabout is not recommended at this intersection.
8. Route 11 and Lako Street
   The Lako Street intersection operates at LOS E/D (AM/PM) with or without the Royal Vistas project in the 2039 condition. Lako Street currently has split phasing (sequential rather than concurrent) on the Lako Street approaches. Changing the phasing from split would help lower the delay, although several movements will still operate at LOS E or worse. This intersection would also improve significantly with more north-south regional capacity provided by the completion of the Widening of Route 11 from Henry Street to Kamehameha III Road and the construction of Alii Highway.
9. Route 11 and Kamehameha III Road
   Existing and future analysis indicate this intersection will operate at an acceptable LOS. Improvements to this intersection are not recommended at this time.

Arterial LOS was analyzed in Synchro on Route 11 from Hualalai (north) to Lako Street. Where signalized intersections are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Urban Street Facilities. For Urban Street Facilities, through-vehicle travel speed is used to analyze vehicular LOS. This segment of Route 11 operates at LOS D or better for each condition in the AM and PM peak hours. The arterial LOS satisfies the County of Hawaii Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements) regarding "acceptable level of service" for transportation facilities.

VII. REFERENCES

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Appendix A

Bus Route Schedule and Map

Appendix B

Bus Route Schedule and Map

KONA/HILO BUS SCHEDULE

Operates Monday through Saturday

Effective 3/6/2017

KONA TO HILO

Fujihara store	Honaunau	Capt. Cook Yano Hall	Kealakekua Konawaena	Kainaliu Honalo	Sheraton Keauhou Resort	Ali'i Drive	Kona Commons	Kmart	Ali'i Drive	Matsuyama Store	HCC Palamanui Campus	Waikoloa Pyramid Store	Four Seasons Resorts	Hilton Waikoloa	Marriott	Orchid @ Mauna Lani	Mauna Lani Bay	Hapuna Prince
5:45	5:55	6:00	6:05	6:10	6:20	6:30	---	6:45	---	6:55	---	7:30	---	---	---	---	---	---
---	---	---	---	---	---	**6:35**	**6:40**	**6:45**	---	---	**7:05**	---	**7:35**	**8:00**	**8:05**	**8:15**	**8:20**	---
---	---	---	---	---	---	---	4:00	4:03	4:13	4:20	---	4:55	---	---	---	---	---	---

Waimea - Pukalani Road Bus Shelter	Honokaa 76 Service Station	Paauilo	Laupahoehoe	Papaaloa	Ninole	Hakalau	Honomu Plantation Store	Pepeekeo	Papaikou	Mooheau Bus Terminal	Aupuni Center	Hilo Shopping Center	UH-Hilo	Hawaii Community College	Prince Kuhio Plaza
7:45	**8:30**	**8:35**	**8:55**	**9:00**	**9:05**	**9:15**	**9:25**	**9:30**	**9:35**	**9:45**	**9:55**	**9:57**	**10:00**	**10:02**	**10:05**
8:50	***9:15**	**9:20**	**9:35**	**9:40**	**9:45**	**9:50**	---	**9:55**	**10:00**	**10:05**	---	---	---	---	---
5:15	5:45	5:50	6:10	6:15	6:20	6:30	---	6:45	6:50	7:00	---	---	---	---	---

*Honokaa Gym Complex Upper Parking Lot

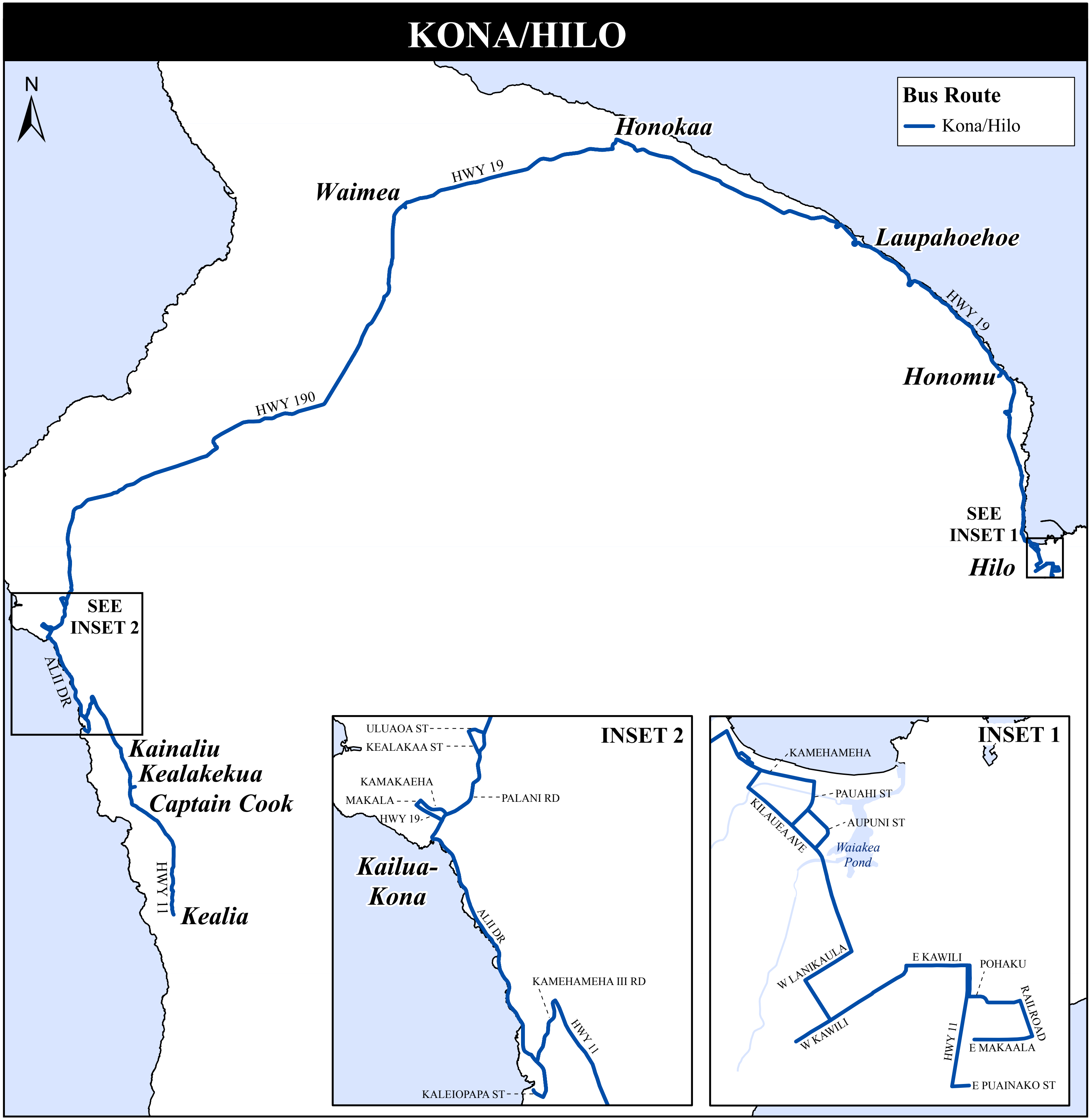
HILO TO KONA

Prince Kuhio Plaza	Hawaii Community College	UH - Hilo	Hilo Shopping Center	Aupuni Center	Mooheau Bus Terminal/*Bayfront Parking Lot	Papaikou	Honomu Plantation Store	Hakalau	Ninole	Papaaloa	Laupahoehoe	Paauilo	Honokaa Blane's Drive Inn	Waimea - Pukalani Road Bus Shelter
---	---	---	---	---	***3:40**	**3:45**	---	**4:00**	**4:05**	**4:25**	**4:30**	**4:45**	**4:50***	**5:10**
9:03	9:05	9:08	9:10	9:13	9:15	9:25	9:35	**9:40**	9:45	9:50	9:55	**10:05**	**10:20**	**10:45**
1:10	1:12	1:15	1:17	1:20	1:30	1:40	1:50	1:55	2:00	2:05	2:10	2:25	2:40	3:20

*Honokaa Gym Complex Upper Parking lot

Mauna Kea Beach Resort	Hapuna Prince	Orchid @ Mauna Lani	Mauna Lani Bay	Hilton Waikoloa	Marriott	Waikoloa Pyramid Store	Matsuyama Store	Kealakehe	Kmart Macy's	Ali'i Drive	Kona Commons	Kmart Macy's	Sheraton Keauhou	Kainaliu Honalo	Kealakekua Konawaena	Capt. Cook Manago Hotel	Honaunau	Kealia Fujihara Store
5:30	**5:35**	**5:40**	**5:45**	**5:55**	6:00	---	---	---	---	6:35	6:40	6:45	---	---	---	---	---	---
---	---	---	---	---	---	**11:05**	**11:35**	---	**11:45**	---	**11:50**	---	---	---	---	---	---	---
---	---	---	---	---	---	3:45	4:15	4:20	4:25	4:30	---	---	---*	5:05	(5:10)	5:15	5:20	5:30

BOLD = MORNINGS



COUNTY OF HAWAII MASS TRANSIT AGENCY

961-8744

KONA TO HILO BUS SCHEDULE

In consideration of others and for your safety:

1. Shirts and footwear are required.
2. No flammable, explosive or toxic material.
3. No smoking, consumption of food or beverage.
4. Discarding of litter.
5. Expectorating or spitting.
6. The playing of radios, tape players, dvd players, and cell phones are prohibited without headphones.
7. Refrain from horseplaying, yelling or talking loudly.
8. The following items are prohibited unless prior permission is granted:
   a. Bodyboards
9. **$1.00 charge for pets (except service animals) provided they are kept in an enclosed container or cage**
10. **$1.00 charge per item larger than 16" x 10" or more than one item that cannot fit underneath your seat. $1.00 charge for bicycle.**
11. Please utilize designated bus stop zones whenever possible.

How to board the bus:

1. Wait on the proper side of the roadway for the bus.
2. Flag the bus (please call for bus stop information).
3. Wait until the bus makes a complete stop.
4. Boarding will be denied if passengers appear to be intoxicated on liquor or drugs; engaged in activities that violate any other law or ordinance.

How to exit the bus:

1. Before reaching your desired "get off" spot, pull cord located by the window of the bus.
2. Remain seated until the bus comes to a complete stop.
3. Exit from front of bus.

DISCLAIMER: The County of Hawaii will not be responsible for any inconvenience, expense, or damages resulting from the failure to depart or arrive at stated times or for any items brought on the bus.

For more information visit www.heleonbus.org

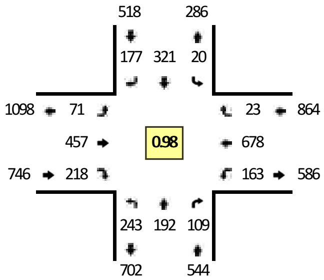
County of Hawaii is an Equal Opportunity Employer and Provider

Appendix B

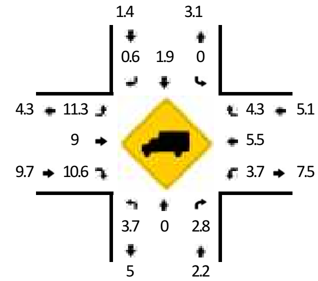
24-Hour and Peak Period Turn Movement Traffic Counts

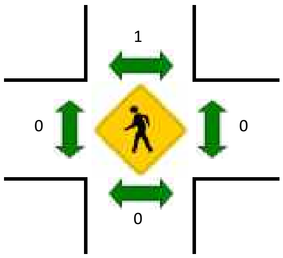
LOCATION: Palani Rd -- Hawaii Belt Rd
CITY/STATE: Hawaii, HI

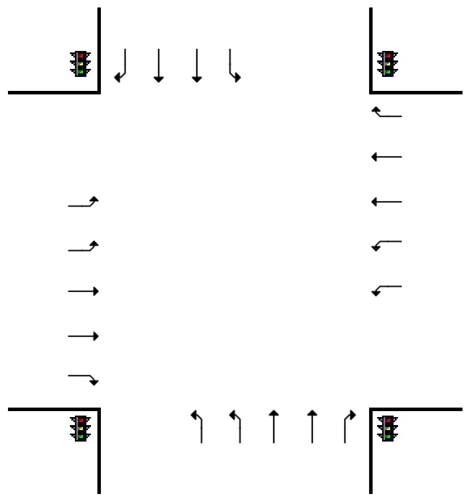
QC JOB #: 14972601
DATE: Tue, Apr 30 2019

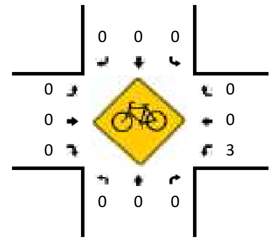


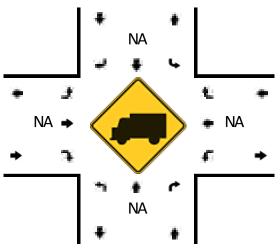
Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

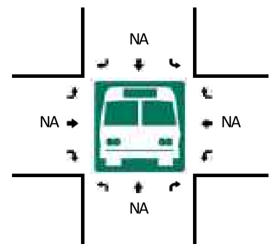












15-Min Count Period Beginning At	Palani Rd (Northbound)				Palani Rd (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:45 AM	48	18	28	0	7	57	28	0	17	76	31	0	48	175	2	0	535	
7:00 AM	51	35	26	1	5	55	17	0	11	91	38	0	36	179	3	0	548	
7:15 AM	51	39	27	0	4	78	33	1	20	122	38	0	41	157	1	0	612	
7:30 AM	54	51	26	0	8	91	38	0	13	131	58	0	40	163	11	0	684	2379
7:45 AM	63	55	28	0	1	80	49	0	23	102	59	0	45	144	7	0	656	2500
8:00 AM	68	39	29	0	7	70	51	0	12	111	53	0	44	184	3	0	671	2623
8:15 AM	58	34	27	0	5	61	29	0	22	129	51	0	38	223	5	0	682	2693
8:30 AM	55	48	35	0	8	69	28	0	25	136	75	0	61	187	4	0	731	2740

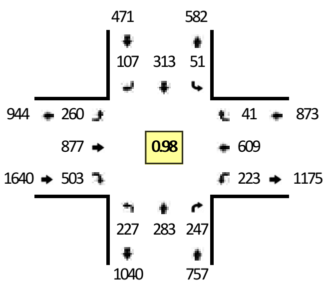
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	216	204	104	0	32	364	152	0	52	524	232	0	160	652	44	0	2736
Heavy Trucks	8	0	0		0	8	0		4	52	28		0	28	0		128
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

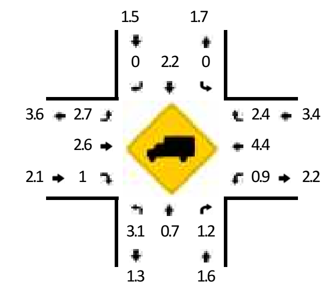
Report generated on 5/13/2019 3:10 PM

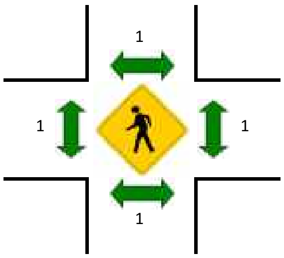
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

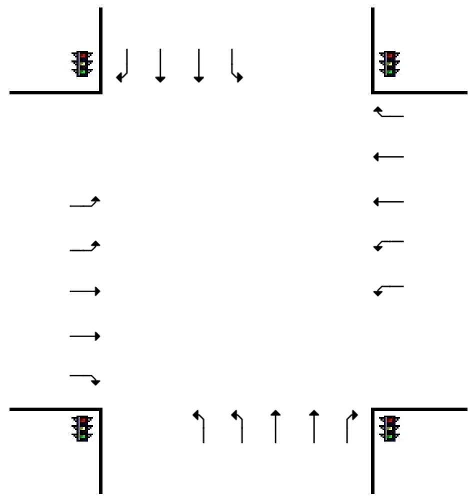
LOCATION: Palani Rd -- Hawaii Belt Rd **QC JOB #:** 14972602
CITY/STATE: Hawaii, HI **DATE:** Tue, Apr 30 2019

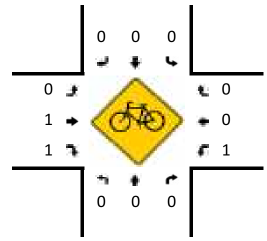


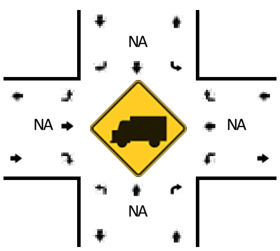
Peak-Hour: 3:45 PM -- 4:45 PM
Peak 15-Min: 3:45 PM -- 4:00 PM

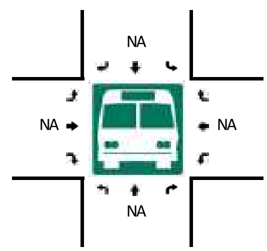












15-Min Count Period Beginning At	Palani Rd (Northbound) Left	Thru	Right	U	Palani Rd (Southbound) Left	Thru	Right	U	Hawaii Belt Rd (Eastbound) Left	Thru	Right	U	Hawaii Belt Rd (Westbound) Left	Thru	Right	U	Total	Hourly Totals
3:00 PM	66	67	66	0	10	102	35	1	52	189	93	0	54	184	18	0	937	
3:15 PM	56	76	61	0	13	84	29	0	46	175	115	1	55	156	8	0	875	
3:30 PM	77	61	59	0	15	94	27	0	53	193	114	0	52	158	4	0	907	
3:45 PM	55	82	65	0	21	93	29	0	55	198	131	1	56	154	11	0	951	3670
4:00 PM	52	57	48	1	9	74	27	0	80	227	129	0	56	172	9	0	941	3674
4:15 PM	73	69	61	0	12	79	32	0	60	213	134	0	56	138	6	0	933	3732
4:30 PM	46	75	73	0	9	67	19	0	63	239	109	1	55	145	15	0	916	3741
4:45 PM	59	71	63	0	16	94	37	0	65	176	123	0	52	114	17	0	887	3677
5:00 PM	67	79	57	1	11	69	36	0	63	225	111	2	47	155	8	1	932	3668
5:15 PM	64	68	66	0	4	91	34	0	66	176	101	0	63	142	8	0	883	3618
5:30 PM	47	75	55	0	3	66	19	0	46	166	94	0	57	120	8	0	756	3458
5:45 PM	51	88	50	0	7	59	13	0	38	164	69	1	41	101	9	0	691	3262

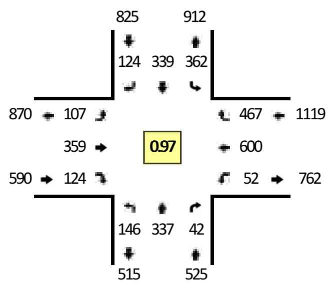
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	220	328	260	0	84	372	116	0	220	792	524	4	224	616	44	0	3804
Heavy Trucks	16	0	4		0	8	0		12	20	8		0	44	0		112
Pedestrians		0				4				4				4			12
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

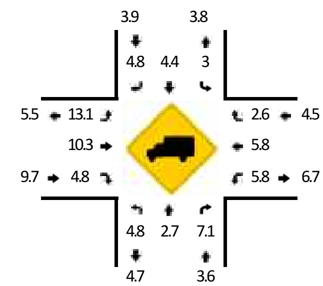
Report generated on 5/13/2019 3:06 PM SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

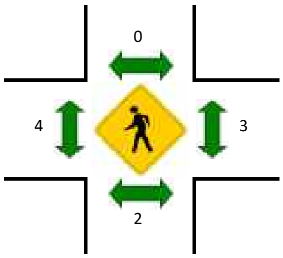
LOCATION: Henry St -- Hawaii Belt Rd
CITY/STATE: Hawaii, HI

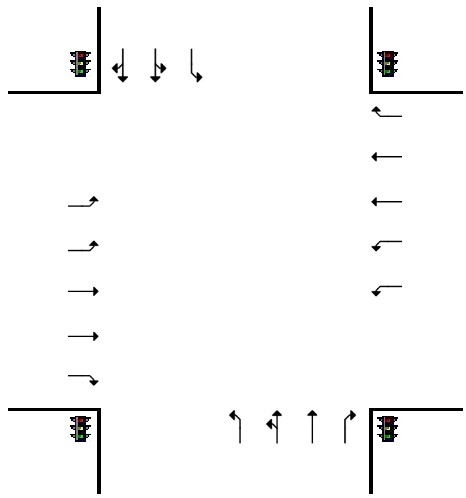
QC JOB #: 14972603
DATE: Tue, Apr 30 2019

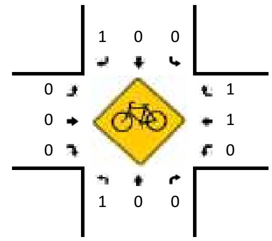


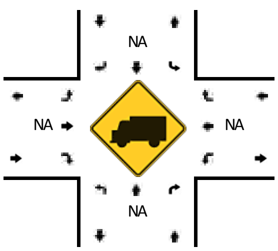
Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 8:15 AM -- 8:30 AM

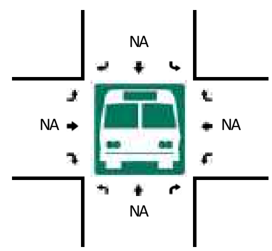












15-Min Count Period Beginning At	Henry St (Northbound) Left	Thru	Right	U	Henry St (Southbound) Left	Thru	Right	U	Hawaii Belt Rd (Eastbound) Left	Thru	Right	U	Hawaii Belt Rd (Westbound) Left	Thru	Right	U	Total	Hourly Totals
6:45 AM	31	57	5	0	77	48	26	0	16	77	23	0	13	162	103	0	638	
7:00 AM	32	40	13	0	109	69	20	0	19	86	16	0	7	170	89	0	670	
7:15 AM	44	81	8	0	112	78	25	0	27	107	18	0	8	138	132	0	778	
7:30 AM	24	81	7	0	78	68	35	0	32	105	40	0	14	160	124	0	768	2854
7:45 AM	34	82	7	0	82	93	31	1	23	79	27	0	14	142	110	0	725	2941
8:00 AM	40	83	15	0	86	85	26	0	27	93	30	0	15	165	117	0	782	3053
8:15 AM	50	81	12	0	89	77	37	0	25	97	37	0	19	184	86	0	794	3069
8:30 AM	46	68	14	0	84	63	40	0	45	90	35	0	16	163	91	0	755	3056

Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	200	324	48	0	356	308	148	0	100	388	148	0	76	736	344	0	3176
Heavy Trucks	4	16	4		12	8	0		0	36	16		4	44	20		164
Pedestrians		0				0				12				4			16
Bicycles	0	0	0		0	0	0		0	0	0		0	0	2		2
Railroad																	
Stopped Buses																	

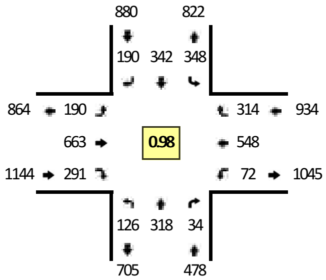
Comments:

Report generated on 5/13/2019 3:10 PM

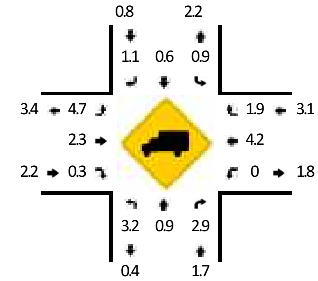
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

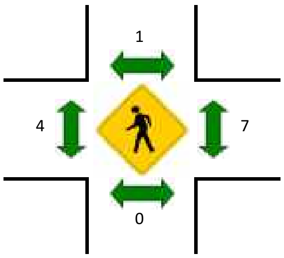
Type of peak hour being reported: User-Defined | Method for determining peak hour: Total Entering Volume

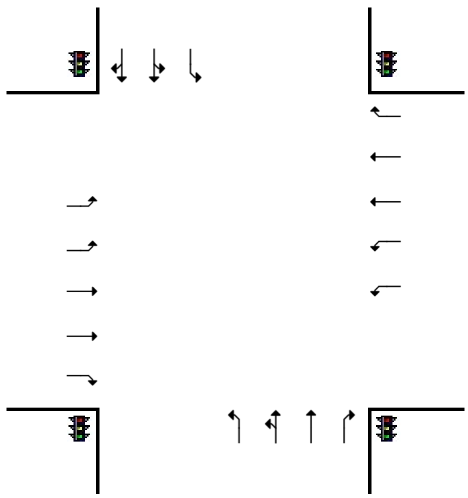
LOCATION: Henry St -- Hawaii Belt Rd | **QC JOB #:** 14972604
CITY/STATE: Hawaii, HI | **DATE:** Tue, Apr 30 2019

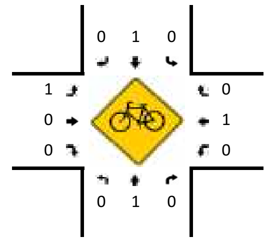


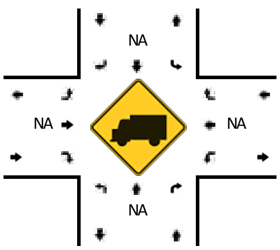
Peak-Hour: 3:45 PM -- 4:45 PM
Peak 15-Min: 3:45 PM -- 4:00 PM

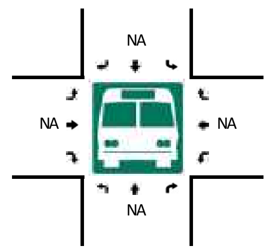












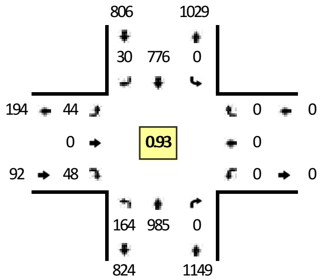
15-Min Count Period Beginning At	Henry St (Northbound)				Henry St (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	43	74	9	0	91	93	61	0	48	148	51	0	8	152	85	0	863	
3:15 PM	29	95	9	0	110	83	52	0	46	156	54	0	18	143	76	0	871	
3:30 PM	42	85	20	0	84	73	41	0	56	156	58	0	29	145	82	0	871	
3:45 PM	31	72	12	0	99	80	51	0	45	182	67	0	17	147	74	0	877	3482
4:00 PM	36	71	7	0	80	94	54	0	40	161	69	0	14	127	73	0	826	3445
4:15 PM	29	88	6	0	88	70	34	0	51	164	73	0	25	148	84	0	860	3434
4:30 PM	30	87	9	0	81	98	51	0	54	156	82	0	16	126	83	0	873	3436
4:45 PM	28	80	6	0	87	80	47	0	55	168	64	0	10	119	85	0	829	3388
5:00 PM	30	85	7	0	87	82	54	0	40	154	72	0	8	123	80	0	822	3384
5:15 PM	23	88	13	0	78	78	55	0	49	162	51	0	12	127	80	0	816	3340
5:30 PM	27	63	8	0	82	61	45	0	41	150	36	0	12	118	53	0	696	3163
5:45 PM	18	76	4	0	78	68	27	0	48	143	40	0	5	101	77	0	685	3019

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	124	288	48	0	396	320	204	0	180	728	268	0	68	588	296	0	3508
Heavy Trucks	8	0	0		4	4	0		4	12	0		0	36	0		68
Pedestrians		0				0				8				12			20
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

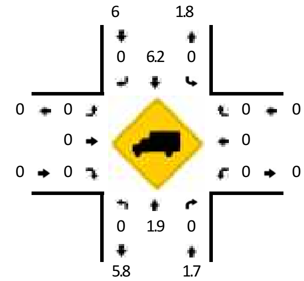
Comments:

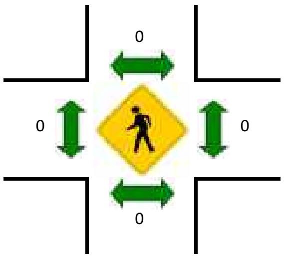
Report generated on 5/13/2019 3:06 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

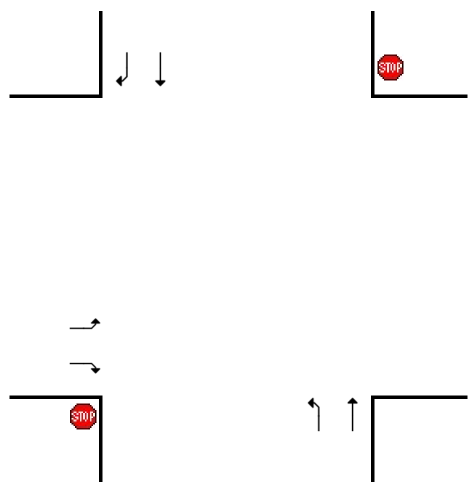
LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Northern Most)
QC JOB #: 15039901
CITY/STATE: Kailua, HI
DATE: Thu, Aug 29 2019

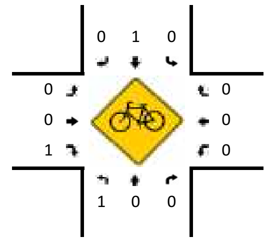


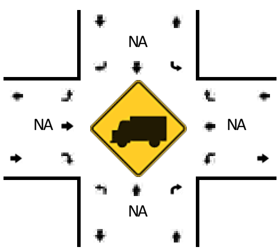
Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:15 AM -- 7:30 AM

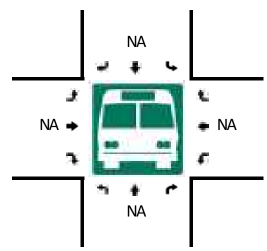












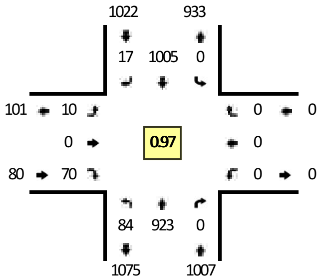
15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Northern Most) (Eastbound)				Hualalai Rd (Northern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	28	239	0	0	0	190	4	0	5	0	6	0	0	0	0	0	472	
7:15 AM	36	263	0	0	0	212	11	0	9	0	18	0	0	0	0	0	549	
7:30 AM	32	260	0	0	0	198	8	0	24	0	14	0	0	0	0	0	536	
7:45 AM	68	223	0	0	0	176	7	0	6	0	10	0	0	0	0	0	490	2047
8:00 AM	38	229	0	0	0	164	4	0	0	0	7	0	0	0	0	0	442	2017
8:15 AM	36	232	0	0	0	168	3	0	2	0	13	0	0	0	0	0	454	1922
8:30 AM	34	231	0	1	0	178	1	0	0	0	16	1	0	0	0	0	462	1848
8:45 AM	37	254	0	0	0	182	2	0	0	0	12	0	0	0	0	0	487	1845

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	144	1052	0	0	0	848	44	0	36	0	72	0	0	0	0	0	2196
Heavy Trucks	0	24	0		0	40	0		0	0	0		0	0	0		64
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

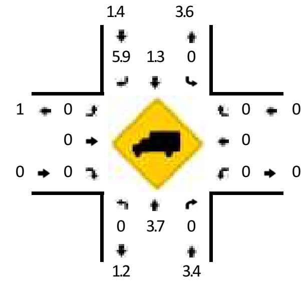
Comments:

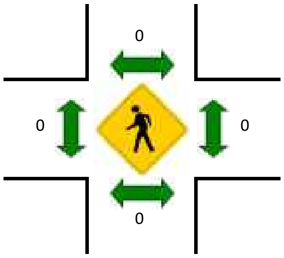
Type of peak hour being reported: System Peak   Method for determining peak hour: Total Entering Volume

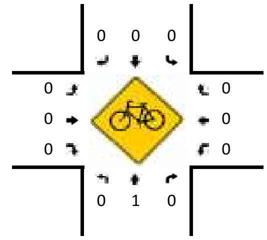
LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Northern Most)   **QC JOB #:** 15039902
CITY/STATE: Kailua, HI   **DATE:** Thu, Aug 29 2019

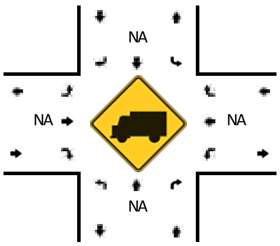


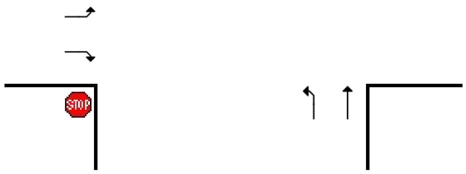
Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:30 PM -- 3:45 PM

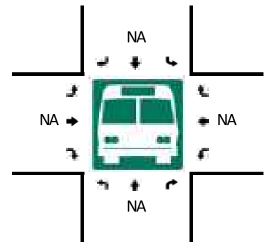












15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Northern Most) (Eastbound)				Hualalai Rd (Northern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	27	219	0	0	0	247	5	0	3	0	24	0	0	0	0	0	525	
3:15 PM	9	227	0	0	0	259	4	0	4	0	18	0	0	0	0	0	521	
3:30 PM	22	261	0	0	0	242	3	0	0	0	18	0	0	0	0	0	546	
3:45 PM	26	216	0	0	0	257	5	0	3	0	10	0	0	0	0	0	517	2109
4:00 PM	14	205	0	0	0	268	4	0	1	0	31	0	0	0	0	0	523	2107
4:15 PM	22	221	0	0	0	226	4	0	3	0	23	0	0	0	0	0	499	2085
4:30 PM	14	198	0	0	0	200	2	0	5	0	21	0	0	0	0	0	440	1979
4:45 PM	24	218	0	0	0	232	1	0	5	0	27	0	0	0	0	0	507	1969
5:00 PM	12	178	0	0	0	257	6	0	3	0	30	0	0	0	0	0	486	1932
5:15 PM	17	209	0	0	0	252	2	0	4	0	29	0	0	0	0	0	513	1946
5:30 PM	16	195	0	0	0	225	3	0	0	0	11	0	0	0	0	0	450	1956
5:45 PM	13	141	0	0	0	252	3	0	0	0	16	0	0	0	0	0	425	1874

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	88	1044	0	0	0	968	12	0	0	0	72	0	0	0	0	0	2184
Heavy Trucks	0	56	0		0	8	0		0	0	0		0	0	0		64
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/12/2019 10:43 AM   SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: System Peak

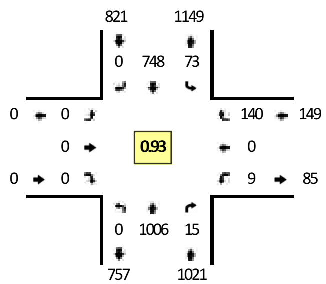
Method for determining peak hour: Total Entering Volume

LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Southern Most)

QC JOB #: 15039911

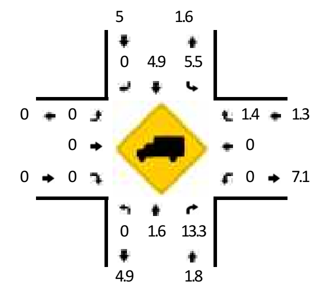
CITY/STATE: Kailua, HI

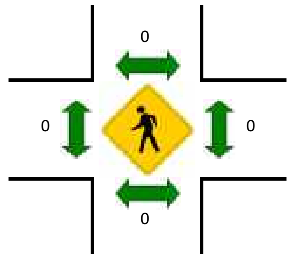
DATE: Thu, Aug 29 2019

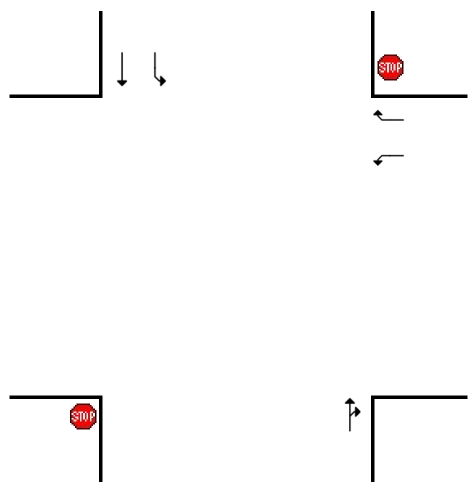


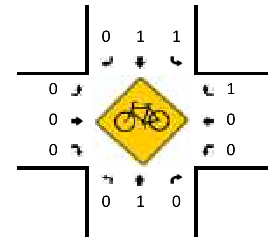
Peak-Hour: 7:00 AM -- 8:00 AM

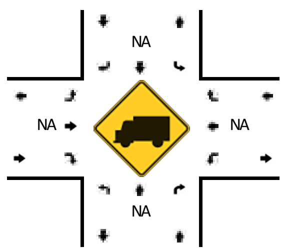
Peak 15-Min: 7:30 AM -- 7:45 AM

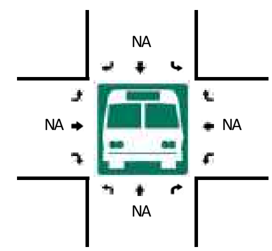












15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Southern Most) (Eastbound)				Hualalai Rd (Southern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	241	3	0	9	183	0	0	0	0	0	0	0	0	12	0	448	
7:15 AM	0	267	3	0	23	191	0	3	0	0	0	0	1	0	35	0	523	
7:30 AM	0	267	8	0	23	193	0	0	0	0	0	0	7	0	37	0	535	
7:45 AM	0	231	1	0	15	181	0	0	0	0	0	0	1	0	56	0	485	1991
8:00 AM	0	239	0	0	5	172	0	1	0	0	0	0	2	0	20	0	439	1982
8:15 AM	0	260	1	0	5	172	0	0	0	0	0	0	1	0	13	0	452	1911
8:30 AM	0	249	1	0	5	192	0	0	0	0	0	0	2	0	17	0	466	1842
8:45 AM	0	282	0	0	11	177	0	0	0	0	0	0	1	0	10	0	481	1838

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	1068	32	0	92	772	0	0	0	0	0	0	28	0	148	0	2140
Heavy Trucks	0	4	4		8	32	0		0	0	0		0	0	4		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		1	0	0		0	0	0		0	0	1		2
Railroad																	
Stopped Buses																	

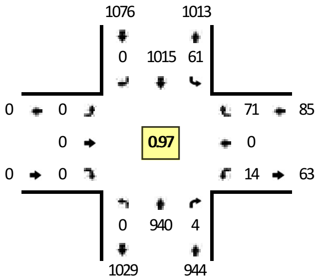
Comments:

Report generated on 9/12/2019 10:40 AM

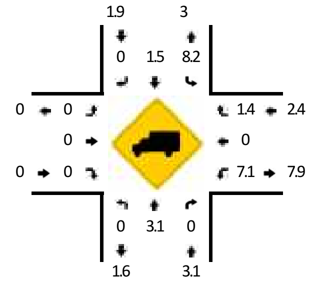
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

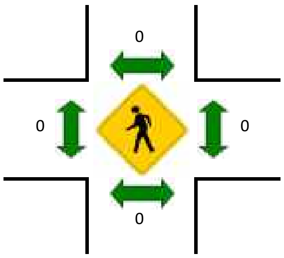
Type of peak hour being reported: System Peak | Method for determining peak hour: Total Entering Volume

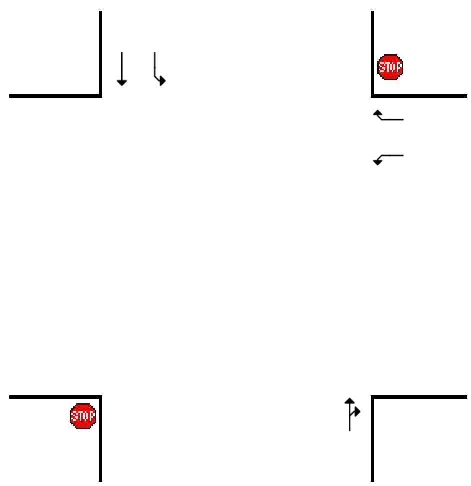
LOCATION: Queen Kaahumanu Hwy -- Hualalai Rd (Southern Most) | **QC JOB #:** 15039912
CITY/STATE: Kailua, HI | **DATE:** Thu, Aug 29 2019

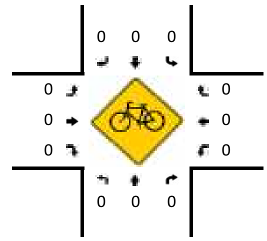


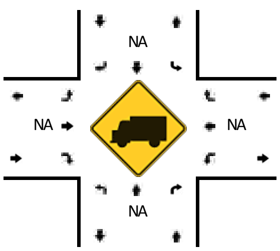
Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:00 PM -- 3:15 PM

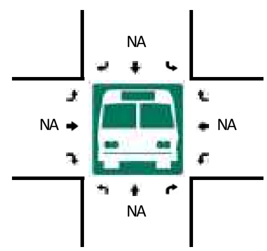












15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Hualalai Rd (Southern Most) (Eastbound)				Hualalai Rd (Southern Most) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	242	0	0	14	258	0	1	0	0	0	0	5	0	21	0	541	
3:15 PM	0	217	2	0	17	266	0	0	0	0	0	0	4	0	13	0	519	
3:30 PM	0	259	1	0	14	246	0	0	0	0	0	0	1	0	19	0	540	
3:45 PM	0	222	1	0	14	245	0	1	0	0	0	0	4	0	18	0	505	2105
4:00 PM	0	202	0	0	25	272	0	0	0	0	0	0	1	0	11	0	511	2075
4:15 PM	0	242	1	0	10	244	0	0	0	0	0	0	2	0	6	0	505	2061
4:30 PM	0	207	2	0	14	206	0	0	0	0	0	0	1	0	11	0	441	1962
4:45 PM	0	213	5	0	15	250	0	0	0	0	0	0	0	0	14	0	497	1954
5:00 PM	0	199	1	0	18	265	0	0	0	0	0	0	0	0	12	0	495	1938
5:15 PM	0	205	0	0	25	256	0	0	0	0	0	0	1	0	16	0	503	1936
5:30 PM	0	198	1	0	6	246	0	0	0	0	0	0	2	0	5	0	458	1953
5:45 PM	0	163	1	0	7	247	0	1	0	0	0	0	0	0	2	0	421	1877

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	968	0	0	56	1032	0	4	0	0	0	0	20	0	84	0	2164
Heavy Trucks	0	12	0		4	20	0		0	0	0		0	0	0		36
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

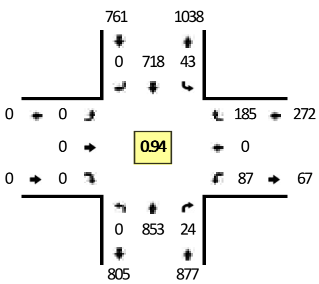
Report generated on 9/12/2019 10:43 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: System Peak | Method for determining peak hour: Total Entering Volume

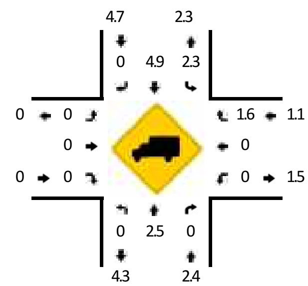
LOCATION: Queen Kaahumanu Hwy -- Puapuaanui St | **QC JOB #:** 15039905

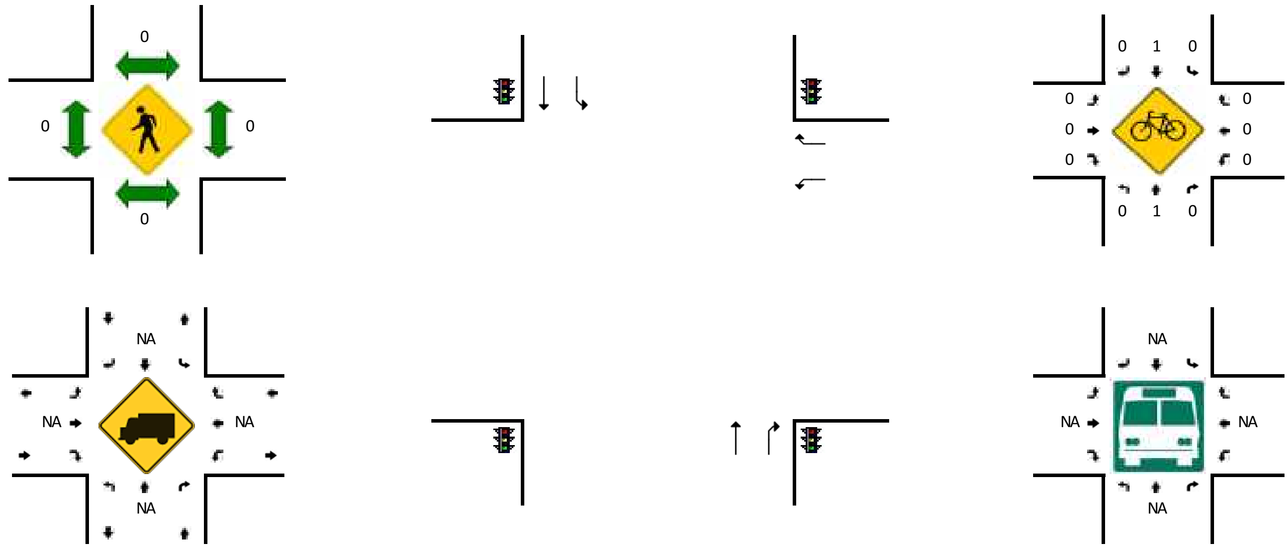
CITY/STATE: Kailua, HI | **DATE:** Thu, Aug 29 2019



Peak-Hour: 7:00 AM -- 8:00 AM

Peak 15-Min: 7:15 AM -- 7:30 AM





15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound) Left	Thru	Right	U	Queen Kaahumanu Hwy (Southbound) Left	Thru	Right	U	Puapuaanui St (Eastbound) Left	Thru	Right	U	Puapuaanui St (Westbound) Left	Thru	Right	U	Total	Hourly Totals
7:00 AM	0	224	5	0	12	171	0	0	0	0	0	0	11	0	27	0	450	
7:15 AM	0	246	3	0	8	184	0	0	0	0	0	0	20	0	48	0	509	
7:30 AM	0	209	4	0	12	188	0	0	0	0	0	0	28	0	48	0	489	
7:45 AM	0	174	12	0	11	175	0	0	0	0	0	0	28	0	62	0	462	1910
8:00 AM	0	218	10	0	9	165	0	0	0	0	0	0	18	0	39	0	459	1919
8:15 AM	0	213	15	0	19	154	0	0	0	0	0	0	9	0	30	0	440	1850
8:30 AM	0	220	11	0	16	179	0	0	0	0	0	0	11	0	31	0	468	1829
8:45 AM	0	245	11	0	14	159	0	0	0	0	0	0	17	0	23	0	469	1836

Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	0	984	12	0	32	736	0	0	0	0	0	0	80	0	192	0	2036
Heavy Trucks	0	20	0		4	20	0		0	0	0		0	0	8		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

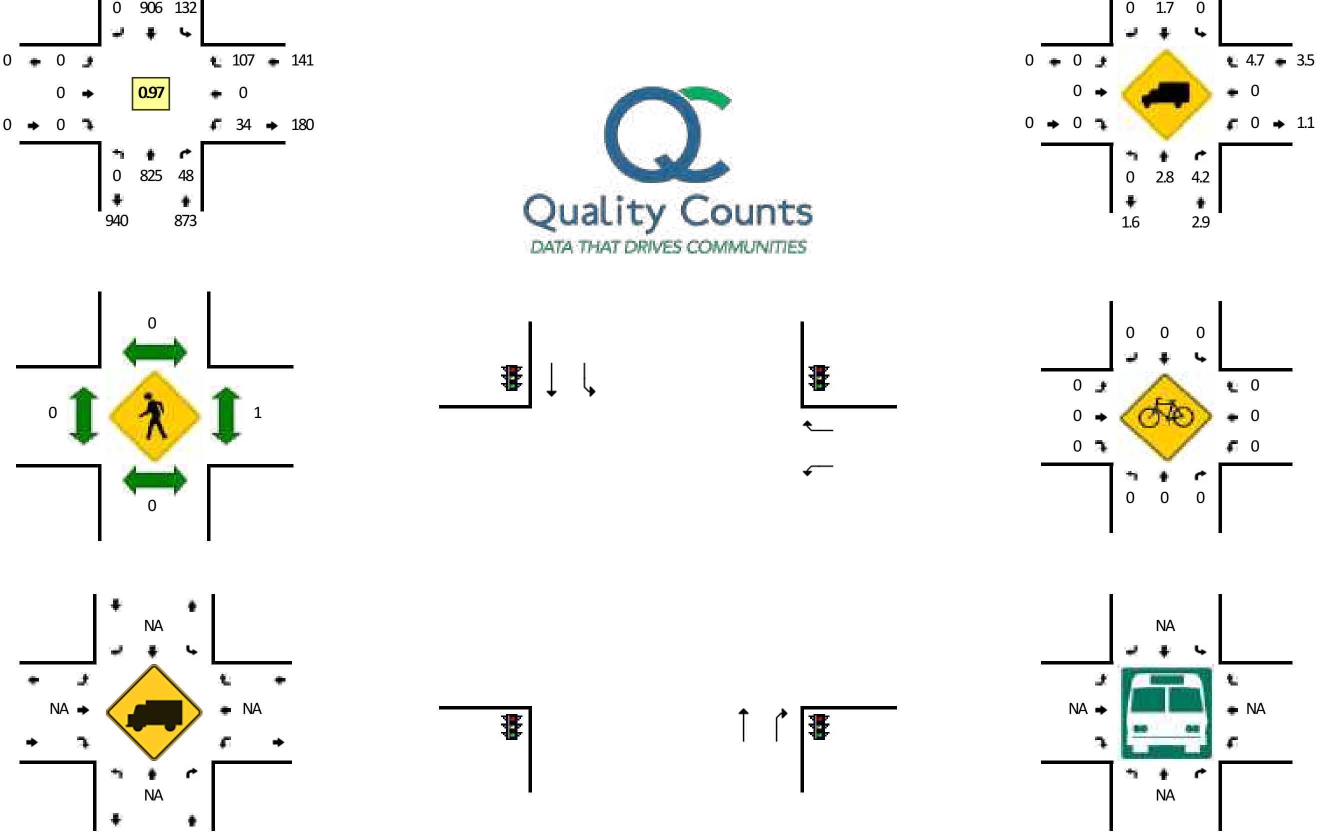
Comments:

Report generated on 9/12/2019 10:40 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: System Peak Method for determining peak hour: Total Entering Volume

LOCATION: Queen Kaahumanu Hwy -- Puapuaanui St **QC JOB #:** 15039906
CITY/STATE: Kailua, HI **DATE:** Thu, Aug 29 2019

Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:30 PM -- 3:45 PM



15-Min Count Period Beginning At	Queen Kaahumanu Hwy (Northbound)				Queen Kaahumanu Hwy (Southbound)				Puapuaanui St (Eastbound)				Puapuaanui St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	199	14	0	37	231	0	0	0	0	0	0	7	0	23	0	511	
3:15 PM	0	205	14	0	27	243	0	0	0	0	0	0	12	0	23	0	524	
3:30 PM	0	230	12	0	37	213	0	0	0	0	0	0	9	0	27	0	528	
3:45 PM	0	191	8	0	31	219	0	0	0	0	0	0	6	0	34	0	489	2052
4:00 PM	0	192	7	0	34	235	0	0	0	0	0	0	12	0	16	0	496	2037
4:15 PM	0	207	15	0	38	209	0	0	0	0	0	0	11	0	35	0	515	2028
4:30 PM	0	187	10	0	22	192	0	0	0	0	0	0	4	0	12	0	427	1927
4:45 PM	0	208	15	0	30	217	0	0	0	0	0	0	13	0	29	0	512	1950
5:00 PM	0	159	7	0	49	218	0	0	0	0	0	0	4	0	17	0	454	1908
5:15 PM	0	195	11	0	36	219	0	0	0	0	0	0	7	0	23	0	491	1884
5:30 PM	0	177	16	0	24	220	0	0	0	0	0	0	10	0	22	0	469	1926
5:45 PM	0	131	8	0	29	221	0	0	0	0	0	0	7	0	23	0	419	1833

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	920	48	0	148	852	0	0	0	0	0	0	36	0	108	0	2112
Heavy Trucks	0	28	4		0	0	0		0	0	0		0	0	12		44
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/12/2019 10:43 AM SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

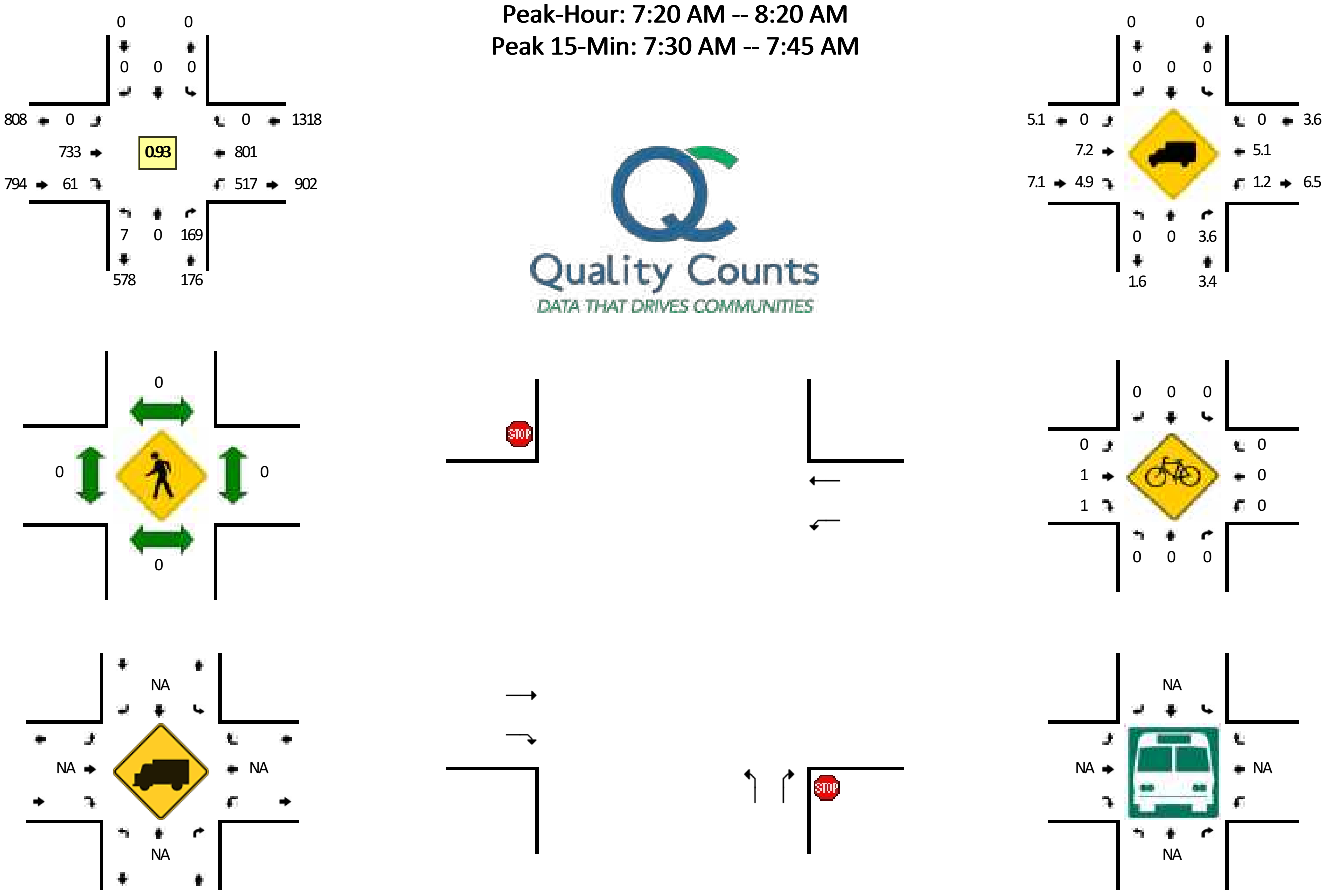
Type of peak hour being reported: User-Defined — Method for determining peak hour: Total Entering Volume

LOCATION: Kuakini Hwy -- Hawaii Belt Rd — **QC JOB #:** 14972605

CITY/STATE: Hawaii, HI — **DATE:** Tue, Apr 30 2019

Peak-Hour: 7:20 AM -- 8:20 AM

Peak 15-Min: 7:30 AM -- 7:45 AM



15-Min Count Period Beginning At	Kuakini Hwy (Northbound) Left	Thru	Right	U	Kuakini Hwy (Southbound) Left	Thru	Right	U	Hawaii Belt Rd (Eastbound) Left	Thru	Right	U	Hawaii Belt Rd (Westbound) Left	Thru	Right	U	Total	Hourly Totals
6:45 AM	2	0	37	0	0	0	0	0	0	158	0	0	71	244	0	0	512	
7:00 AM	0	0	34	0	0	0	0	0	0	206	3	0	65	240	0	0	548	
7:15 AM	3	0	45	0	0	0	0	0	0	204	12	0	85	234	0	0	583	
7:30 AM	3	0	44	0	0	0	0	0	0	208	17	0	114	218	0	0	604	2247
7:45 AM	1	0	46	0	0	0	0	0	0	150	20	0	189	156	0	0	562	2297
8:00 AM	1	0	36	0	0	0	0	0	0	163	12	0	118	207	0	0	537	2286
8:15 AM	0	0	35	0	0	0	0	0	0	178	12	0	90	233	0	0	548	2251
8:30 AM	2	0	55	0	0	0	0	0	0	192	12	0	70	230	0	0	561	2208

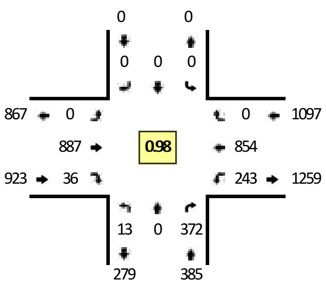
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	12	0	176	0	0	0	0	0	0	832	68	0	456	872	0	0	2416
Heavy Trucks	0	0	8		0	0	0		0	56	8		0	24	0		96
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	1	1		0	0	0		2
Railroad																	
Stopped Buses																	

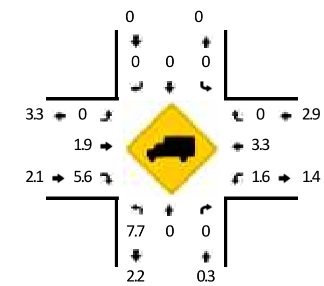
Comments:

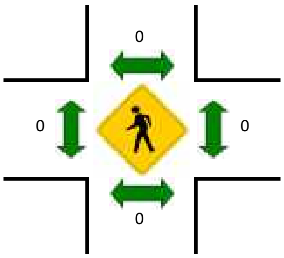
Report generated on 5/13/2019 3:10 PM — SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

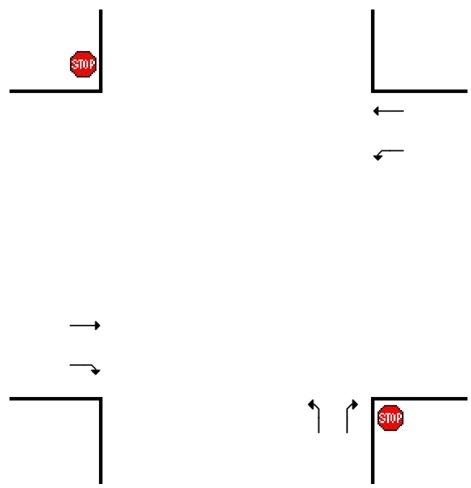
LOCATION: Kuakini Hwy -- Hawaii Belt Rd **QC JOB #:** 14972606
CITY/STATE: Hawaii, HI **DATE:** Tue, Apr 30 2019

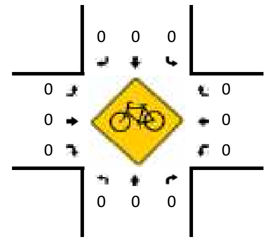
Peak-Hour: 3:45 PM -- 4:45 PM
Peak 15-Min: 4:15 PM -- 4:30 PM

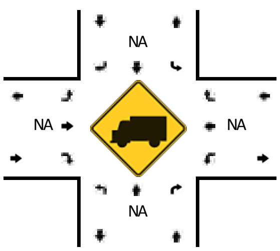


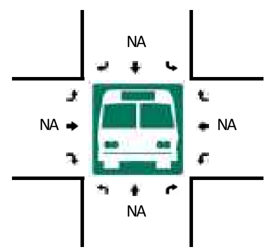












15-Min Count Period Beginning At	Kuakini Hwy (Northbound)				Kuakini Hwy (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	5	0	76	0	0	0	0	0	0	221	13	0	60	227	0	0	602	
3:15 PM	6	0	75	0	0	0	0	0	0	234	19	0	59	213	0	0	606	
3:30 PM	3	0	86	0	0	0	0	0	0	203	15	0	48	217	0	0	572	
3:45 PM	0	0	78	0	0	0	0	0	0	223	8	0	57	217	0	0	583	2363
4:00 PM	3	0	87	0	0	0	0	0	0	229	10	0	60	216	0	0	605	2366
4:15 PM	4	0	101	0	0	0	0	0	0	221	16	0	55	214	0	0	611	2371
4:30 PM	6	0	106	0	0	0	0	0	0	214	2	0	71	207	0	0	606	2405
4:45 PM	1	0	112	0	0	0	0	0	0	208	7	0	78	225	0	0	631	2453
5:00 PM	2	0	108	0	0	0	0	0	0	225	9	0	66	181	0	1	592	2440
5:15 PM	1	0	97	0	0	0	0	0	0	219	11	0	39	171	0	0	538	2367
5:30 PM	0	0	102	0	0	0	0	0	0	223	7	0	54	134	0	0	520	2281
5:45 PM	2	0	76	0	0	0	0	0	0	203	13	0	58	176	0	0	528	2178

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	0	404	0	0	0	0	0	0	884	64	0	220	856	0	0	2444
Heavy Trucks	0	0	0		0	0	0		0	16	8		4	28	0		56
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

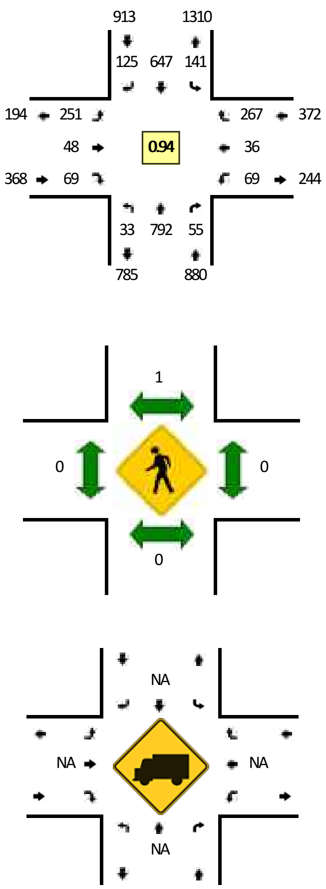
Comments:

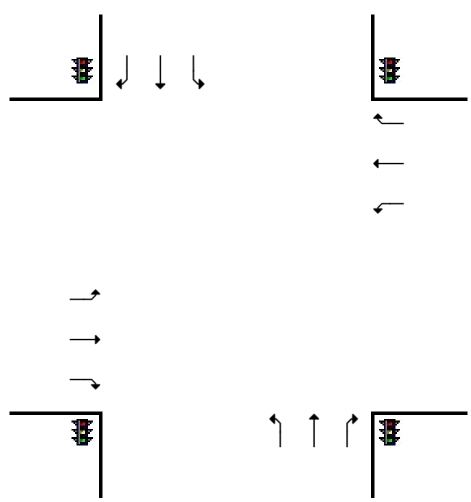
Report generated on 5/13/2019 3:06 PM SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

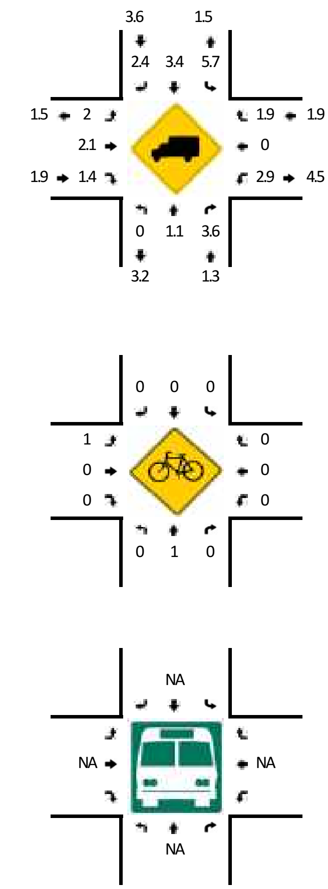
Type of peak hour being reported: System Peak | Method for determining peak hour: Total Entering Volume

LOCATION: Kuakini Hwy -- Lako St | **QC JOB #:** 15039907
CITY/STATE: Holualoa, HI | **DATE:** Thu, Aug 29 2019

Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:45 AM -- 8:00 AM







15-Min Count Period Beginning At	Kuakini Hwy (Northbound) Left	Thru	Right	U	Kuakini Hwy (Southbound) Left	Thru	Right	U	Lako St (Eastbound) Left	Thru	Right	U	Lako St (Westbound) Left	Thru	Right	U	Total	Hourly Totals
7:00 AM	13	221	15	0	34	152	28	0	41	4	13	0	9	6	53	0	589	
7:15 AM	8	188	14	0	36	154	35	0	66	9	21	0	17	7	61	0	616	
7:30 AM	6	202	15	0	34	171	36	0	67	11	19	0	16	10	67	0	654	
7:45 AM	6	181	11	0	37	170	26	0	77	24	16	0	27	13	86	0	674	2533
8:00 AM	3	206	17	0	37	145	24	0	55	18	11	0	13	7	65	0	601	2545
8:15 AM	6	219	12	0	19	165	16	0	44	6	6	0	14	12	51	0	570	2499
8:30 AM	4	220	16	0	30	180	22	0	42	9	10	0	15	6	70	0	624	2469
8:45 AM	9	216	20	0	36	150	28	0	35	10	9	0	13	8	64	0	598	2393

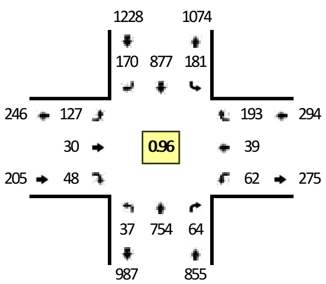
Peak 15-Min Flowrates	Northbound Left	Thru	Right	U	Southbound Left	Thru	Right	U	Eastbound Left	Thru	Right	U	Westbound Left	Thru	Right	U	Total
All Vehicles	24	724	44	0	148	680	104	0	308	96	64	0	108	52	344	0	2696
Heavy Trucks	0	8	4		16	40	4		0	0	0		0	0	8		80
Pedestrians		0				0				0				0			0
Bicycles	0	1	0		0	0	0		1	0	0		0	0	0		2
Railroad																	
Stopped Buses																	

Comments:

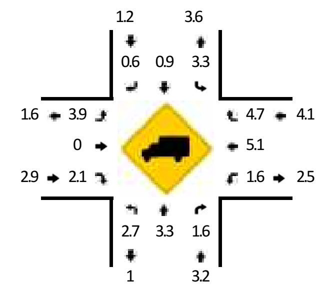
Report generated on 9/12/2019 10:40 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

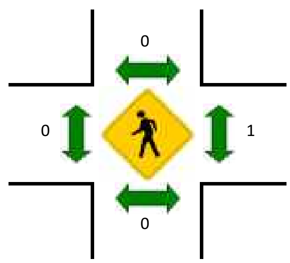
Type of peak hour being reported: System Peak Method for determining peak hour: Total Entering Volume

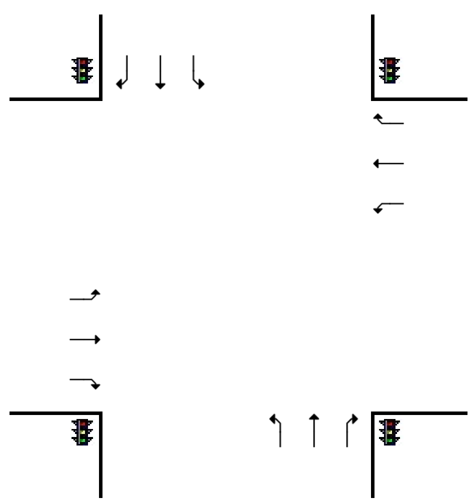
LOCATION: Kuakini Hwy -- Lako St **QC JOB #:** 15039908
CITY/STATE: Holualoa, HI **DATE:** Thu, Aug 29 2019

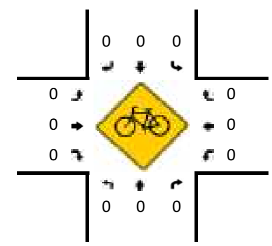


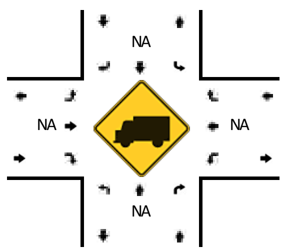
Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:15 PM -- 3:30 PM

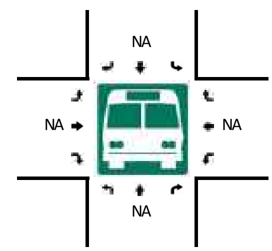












15-Min Count Period Beginning At	Kuakini Hwy (Northbound)				Kuakini Hwy (Southbound)				Lako St (Eastbound)				Lako St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	13	190	20	0	42	216	38	0	27	5	10	0	23	9	51	0	644	
3:15 PM	7	192	18	0	51	243	45	0	28	8	14	0	12	9	46	0	673	
3:30 PM	12	196	17	0	41	211	41	0	39	8	7	0	16	11	63	0	662	
3:45 PM	5	176	9	0	47	207	46	0	33	9	17	0	11	10	33	0	603	2582
4:00 PM	13	181	12	0	57	220	33	0	33	10	12	0	17	8	35	0	631	2569
4:15 PM	19	201	22	0	51	223	60	0	25	9	14	0	21	11	43	0	699	2595
4:30 PM	10	177	20	0	42	202	39	0	31	10	7	0	20	8	41	0	607	2540
4:45 PM	12	199	22	0	52	240	41	0	30	10	7	0	18	8	36	0	675	2612
5:00 PM	10	168	20	0	30	225	57	0	31	6	8	0	7	8	39	0	609	2590
5:15 PM	12	177	13	0	55	242	53	0	28	11	13	0	10	10	34	0	658	2549
5:30 PM	6	167	9	0	60	209	44	0	20	11	6	0	11	11	38	0	592	2534
5:45 PM	5	136	12	0	32	215	50	0	28	15	10	0	13	7	23	0	546	2405

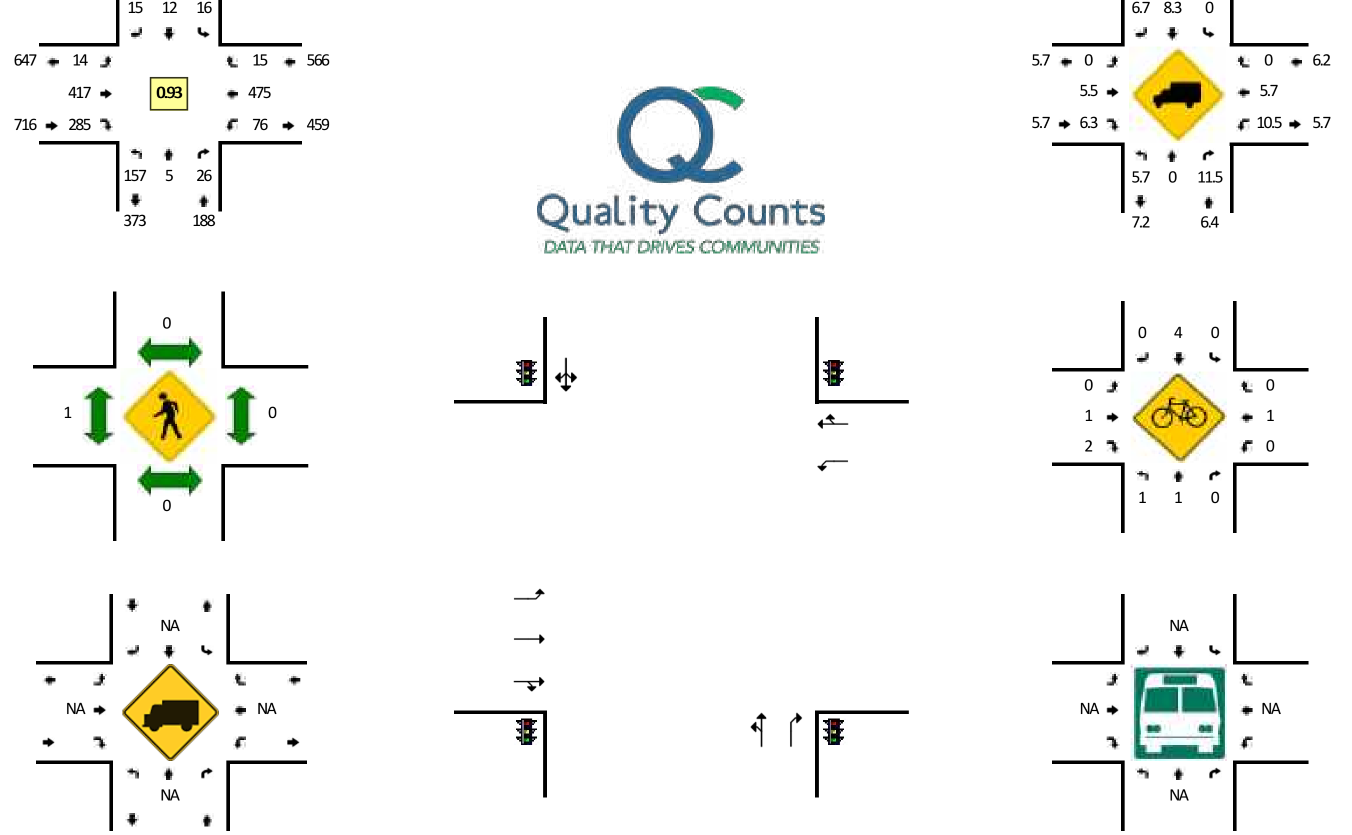
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	28	768	72	0	204	972	180	0	112	32	56	0	48	36	184	0	2692
Heavy Trucks	0	16	0		4	8	0		16	0	0		0	0	12		56
Pedestrians		0				0				0				4			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/12/2019 10:43 AM SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

LOCATION: Kamehameha III Rd -- Hawaii Belt Rd **QC JOB #:** 14972607
CITY/STATE: Hawaii, HI **DATE:** Tue, Apr 30 2019

Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 7:30 AM -- 7:45 AM



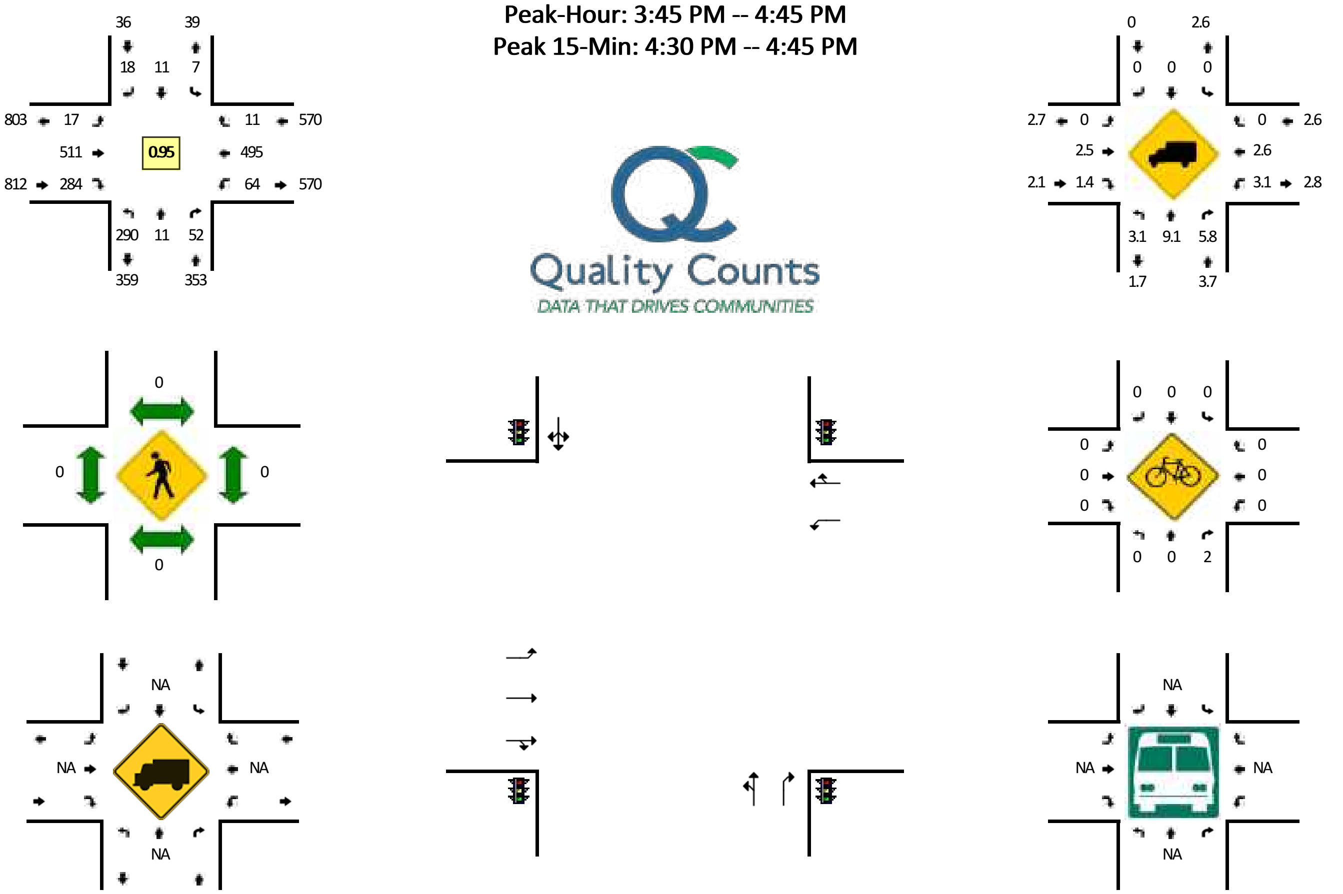
15-Min Count Period Beginning At	Kamehameha III Rd (Northbound)				Kamehameha III Rd (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:45 AM	33	0	2	0	5	1	1	0	3	88	48	0	11	170	3	0	365	
7:00 AM	41	0	0	0	1	2	2	0	3	117	41	0	5	156	3	0	371	
7:15 AM	38	2	5	0	3	2	2	0	4	133	59	0	6	125	2	0	381	
7:30 AM	36	1	10	0	8	4	6	0	4	111	88	0	22	107	3	0	400	1517
7:45 AM	37	2	6	0	4	2	3	0	5	93	78	0	25	99	6	0	360	1512
8:00 AM	41	1	6	0	1	4	4	0	3	84	58	0	17	124	4	0	347	1488
8:15 AM	51	1	7	0	3	4	3	0	1	82	61	0	20	152	3	0	388	1495
8:30 AM	34	1	10	0	2	2	4	0	2	96	55	0	7	115	1	0	329	1424

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	144	4	40	0	32	16	24	0	16	444	352	0	88	428	12	0	1600
Heavy Trucks	0	0	8		0	0	0		0	32	4		24	24	0		92
Pedestrians		0				0				4				0			4
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

LOCATION: Kamehameha III Rd -- Hawaii Belt Rd | **QC JOB #:** 14972608
CITY/STATE: Hawaii, HI | **DATE:** Tue, Apr 30 2019

Peak-Hour: 3:45 PM -- 4:45 PM
Peak 15-Min: 4:30 PM -- 4:45 PM



15-Min Count Period Beginning At	Kamehameha III Rd (Northbound)				Kamehameha III Rd (Southbound)				Hawaii Belt Rd (Eastbound)				Hawaii Belt Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	75	3	14	0	4	2	6	0	6	129	60	0	16	143	3	0	461	
3:15 PM	47	10	22	0	4	6	5	0	5	140	71	0	25	131	3	0	469	
3:30 PM	65	6	21	0	1	1	5	0	4	122	70	0	14	139	4	0	452	
3:45 PM	74	4	12	0	2	2	6	0	6	112	78	0	18	114	3	0	431	1813
4:00 PM	78	1	12	0	1	6	4	0	4	124	74	0	17	118	2	0	441	1793
4:15 PM	68	5	12	0	0	3	5	0	1	134	62	0	13	126	4	0	433	1757
4:30 PM	70	1	16	0	4	0	3	0	6	141	70	0	16	137	2	0	466	1771
4:45 PM	72	3	14	0	2	4	4	0	5	105	50	0	18	115	2	0	394	1734
5:00 PM	48	4	25	0	0	3	2	0	5	123	90	0	23	119	1	0	443	1736
5:15 PM	56	5	19	0	2	4	2	0	3	108	75	0	11	101	1	0	387	1690
5:30 PM	46	3	20	0	1	2	4	0	4	141	71	0	8	81	0	0	381	1605
5:45 PM	36	1	14	0	3	4	2	0	2	116	41	0	9	67	1	0	296	1507

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	280	4	64	0	16	0	12	0	24	564	280	0	64	548	8	0	1864
Heavy Trucks	4	0	4		0	0	0		0	12	4		0	12	0		36
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

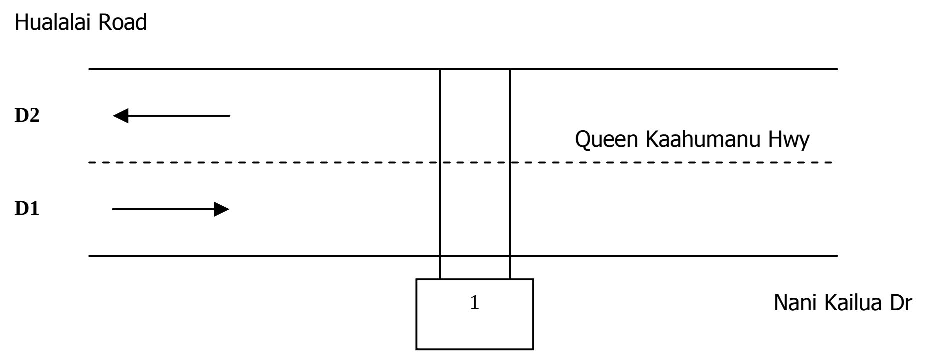
Traffic Data Service

Traffic Station Sketch

N

Island: Hawaii
Area: Kona

Section ID/Station #: B71001112038



Meter #	File Name	GPS
1. bw67	D0910037_B71001112038	19.63455, -155.9779
2.	D0910038_B71001112038	

Station Description:
Queen Kaahumanu Hwy: Hualalai Road to Nani Kailua Dr

Survey Beginning Date/Time: 9/10/15@ 0000			Survey Ending Date/Time: 9/11/15@ 2400		
Survey Method:	Road Tube	Data Type:	Class		
Survey Crew:	LM		C1B		
Sketch Updated:		By:	SR		
Remarks:	1302				

FACILITY NAME	JURI	FUNC CLASS	AREA TYPE	ROUTE NO.	ROUTE MILE
Queen Kaahumanu Hwy		14		0110	

D1= Direction to End — D1: Nani Kailua Dr/ Palani Rd (Rte 190)
D2= Direction to Begin — D2: Hualalai Road / Kamehameha Ave (Rte 19)

Run Date: 2016/05/18

Hawaii Department of Transportation

Highways Division — Highways Planning Survey Section

2015 Program Count - Summary

Site ID: B71001112038 **Town:** Hawaii **DIR 1:** +MP **DIR 2:** -MP **Final AADT:** 25900
Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** 11
Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

DATE : 09/10/2015

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
12:00-12:15	20	18	38	06:00-06:15	62	184	246	12:00-12:15	203	233	436	06:00-06:15	240	193	433
12:15-12:30	17	5	22	06:15-06:30	95	223	318	12:15-12:30	226	228	454	06:15-06:30	235	168	403
12:30-12:45	19	7	26	06:30-06:45	108	276	384	12:30-12:45	229	244	473	06:30-06:45	226	175	401
12:45-01:00	15	11	26	06:45-07:00	121	284	405	12:45-01:00	217	275	492	06:45-07:00	211	161	372
01:00-01:15	12	3	15	07:00-07:15	168	242	410	01:00-01:15	211	248	459	07:00-07:15	201	129	330
01:15-01:30	8	9	17	07:15-07:30	233	279	512	01:15-01:30	225	213	438	07:15-07:30	177	98	275
01:30-01:45	8	6	14	07:30-07:45	190	278	468	01:30-01:45	217	209	426	07:30-07:45	172	82	254
01:45-02:00	8	11	19	07:45-08:00	184	263	447	01:45-02:00	256	264	520	07:45-08:00	137	78	215
02:00-02:15	6	4	10	08:00-08:15	157	298	455	02:00-02:15	248	254	502	08:00-08:15	134	113	247
02:15-02:30	9	3	12	08:15-08:30	172	273	445	02:15-02:30	254	267	521	08:15-08:30	119	69	188
02:30-02:45	4	4	8	08:30-08:45	136	274	410	02:30-02:45	243	238	481	08:30-08:45	131	77	208
02:45-03:00	4	6	10	08:45-09:00	155	278	433	02:45-03:00	259	271	530	08:45-09:00	93	75	168
03:00-03:15	2	9	11	09:00-09:15	170	229	399	03:00-03:15	261	225	486	09:00-09:15	108	70	178
03:15-03:30	4	8	12	09:15-09:30	153	254	407	03:15-03:30	262	253	515	09:15-09:30	111	55	166
03:30-03:45	8	10	18	09:30-09:45	187	227	414	03:30-03:45	237	239	476	09:30-09:45	108	52	160
03:45-04:00	4	24	28	09:45-10:00	175	273	448	03:45-04:00	244	270	514	09:45-10:00	106	47	153
04:00-04:15	4	23	27	10:00-10:15	162	256	418	04:00-04:15	222	240	462	10:00-10:15	92	41	133
04:15-04:30	12	33	45	10:15-10:30	178	266	444	04:15-04:30	226	248	474	10:15-10:30	93	54	147
04:30-04:45	6	39	45	10:30-10:45	188	263	451	04:30-04:45	249	252	501	10:30-10:45	81	44	125
04:45-05:00	14	69	83	10:45-11:00	202	277	479	04:45-05:00	259	237	496	10:45-11:00	66	39	105
05:00-05:15	14	62	76	11:00-11:15	197	216	413	05:00-05:15	252	194	446	11:00-11:15	61	27	88
05:15-05:30	23	97	120	11:15-11:30	203	197	400	05:15-05:30	233	222	455	11:15-11:30	53	29	82
05:30-05:45	37	127	164	11:30-11:45	210	222	432	05:30-05:45	217	176	393	11:30-11:45	40	24	64
05:45-06:00	40	152	192	11:45-12:00	242	207	449	05:45-06:00	223	196	419	11:45-12:00	37	14	51

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:15 AM to 08:15 AM		
AM - PEAK HR VOLUME	764	1118	1882
AM - K FACTOR (%)			6.86
AM - D (%)	40.60	59.40	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	08:00 AM to 09:00 AM	
AM - PEAK HR VOLUME	775	1123	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	1004	987	1991
PM - K FACTOR (%)			7.26
PM - D (%)	50.43	49.57	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM	03:45 PM to 04:45 PM	
PM - PEAK HR VOLUME	1004	1010	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:15 AM to 08:15 AM		
AM - PEAK HR VOLUME	764	1118	1882
AM - K FACTOR (%)			6.86
AM - D (%)	40.60	59.40	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	02:00 PM to 03:00 PM		
PM - PEAK HR VOLUME	1004	1030	2034
PM - K FACTOR (%)			7.41
PM - D (%)	49.36	50.64	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	1004	1030	2034
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM	10:00 AM to 11:00 AM	
PEAK HR VOLUME	1004	1062	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	4,048	6,039	10,087
AM 12-HR PERIOD (00:00-12:00)	4,346	6,779	11,125
PM 6-HR PERIOD (12:00-18:00)	5,673	5,696	11,369
PM 12-HR PERIOD (12:00-24:00)	8,705	7,610	16,315
24 HOUR PERIOD	13,051	14,389	27,440
D (%)	47.56	52.44	100.00

Run Date: 2016/05/18

Hawaii Department of Transportation

Highways Division — Highways Planning Survey Section

2015 Program Count - Summary

Site ID: B71001112038
Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER
Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr
Town: Hawaii
Count Type: CLASS
DIR 1: +MP **DIR 2:** -MP
Counter Type: Tube
Final AADT: 25900
Route No: 11

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 09/11/2015															
12:00-12:15	17	6	23	06:00-06:15	69	181	250	12:00-12:15	191	203	394	06:00-06:15	220	159	379
12:15-12:30	10	9	19	06:15-06:30	88	220	308	12:15-12:30	194	214	408	06:15-06:30	204	143	347
12:30-12:45	9	7	16	06:30-06:45	102	254	356	12:30-12:45	218	190	408	06:30-06:45	162	122	284
12:45-01:00	8	5	13	06:45-07:00	136	271	407	12:45-01:00	214	209	423	06:45-07:00	176	130	306
01:00-01:15	7	2	9	07:00-07:15	174	263	437	01:00-01:15	210	202	412	07:00-07:15	173	133	306
01:15-01:30	5	4	9	07:15-07:30	214	287	501	01:15-01:30	230	209	439	07:15-07:30	155	106	261
01:30-01:45	3	2	5	07:30-07:45	195	299	494	01:30-01:45	231	208	439	07:30-07:45	151	87	238
01:45-02:00	2	5	7	07:45-08:00	174	258	432	01:45-02:00	242	192	434	07:45-08:00	139	102	241
02:00-02:15	1	7	8	08:00-08:15	154	280	434	02:00-02:15	210	203	413	08:00-08:15	131	71	202
02:15-02:30	6	5	11	08:15-08:30	188	276	464	02:15-02:30	241	227	468	08:15-08:30	132	72	204
02:30-02:45	4	6	10	08:30-08:45	161	242	403	02:30-02:45	241	229	470	08:30-08:45	145	64	209
02:45-03:00	11	2	13	08:45-09:00	168	237	405	02:45-03:00	230	260	490	08:45-09:00	131	88	219
03:00-03:15	9	10	19	09:00-09:15	196	242	438	03:00-03:15	218	260	478	09:00-09:15	110	54	164
03:15-03:30	5	10	15	09:15-09:30	151	234	385	03:15-03:30	224	265	489	09:15-09:30	97	57	154
03:30-03:45	7	21	28	09:30-09:45	185	264	449	03:30-03:45	220	254	474	09:30-09:45	82	66	148
03:45-04:00	1	18	19	09:45-10:00	170	261	431	03:45-04:00	190	223	413	09:45-10:00	89	30	119
04:00-04:15	7	19	26	10:00-10:15	156	249	405	04:00-04:15	195	218	413	10:00-10:15	74	51	125
04:15-04:30	2	27	29	10:15-10:30	176	267	443	04:15-04:30	219	256	475	10:15-10:30	62	39	101
04:30-04:45	15	45	60	10:30-10:45	168	257	425	04:30-04:45	239	228	467	10:30-10:45	66	39	105
04:45-05:00	12	66	78	10:45-11:00	206	246	452	04:45-05:00	257	249	506	10:45-11:00	51	26	77
05:00-05:15	10	68	78	11:00-11:15	164	243	407	05:00-05:15	253	229	482	11:00-11:15	46	38	84
05:15-05:30	23	102	125	11:15-11:30	204	249	453	05:15-05:30	248	190	438	11:15-11:30	28	26	54
05:30-05:45	33	130	163	11:30-11:45	230	235	465	05:30-05:45	250	199	449	11:30-11:45	30	26	56
05:45-06:00	39	161	200	11:45-12:00	191	230	421	05:45-06:00	215	175	390	11:45-12:00	30	26	56

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	757	1107	1864
AM - K FACTOR (%)			7.13
AM - D (%)	40.61	59.39	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	07:15 AM to 08:15 AM	
AM - PEAK HR VOLUME	757	1124	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:15 PM to 05:15 PM		
PM - PEAK HR VOLUME	968	962	1930
PM - K FACTOR (%)			7.38
PM - D (%)	50.16	49.84	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:45 PM to 05:45 PM	03:00 PM to 04:00 PM	
PM - PEAK HR VOLUME	1008	1002	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	757	1107	1864
AM - K FACTOR (%)			7.13
AM - D (%)	40.61	59.39	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	02:45 PM to 03:45 PM		
PM - PEAK HR VOLUME	892	1039	1931
PM - K FACTOR (%)			7.38
PM - D (%)	46.19	53.81	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	922	919	1841
DIRECTIONAL PEAK			
PEAK HR TIME	01:45 PM to 02:45 PM	09:30 AM to 10:30 AM	
PEAK HR VOLUME	934	1041	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	4,020	6,045	10,065
AM 12-HR PERIOD (00:00-12:00)	4,266	6,782	11,048
PM 6-HR PERIOD (12:00-18:00)	5,380	5,292	10,672
PM 12-HR PERIOD (12:00-24:00)	8,064	7,047	15,111
24 HOUR PERIOD	12,330	13,829	26,159
D (%)	47.13	52.87	100.00

Run Date: 2016/05/19

Hawaii Department of Transportation
Highways Division
Highways Planning Survey Section

Vehicle Classification Data Summary
2015

Site ID: B71001112038 **Route No:** 11 **Date From:** 2015/09/10 0:00

Town: Hawaii **Direction:** +MP **Date To:** 2015/09/11 23:45

Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

Functional Classification: 14 URBAN:PRINCIPAL ARTERIAL - OTHER

REPORT TOTALS - 48 HOURS RECORDED

	VOLUME	%	NUMBER OF AXLES
Cycles	263	0.49%	525
PC	45148	84.23%	90296
2A-4T	7438	13.88%	14876
LIGHT VEHICLE TOTALS	52849	98.60%	105697
HEAVY VEHICLES			
Bus	85	0.16%	213
SINGLE UNIT TRUCK			
2A-6T	96	0.18%	192
3A-SU	164	0.31%	492
4A-SU	29	0.05%	116
SINGLE-TRAILER TRUCKS			
4A-ST	266	0.50%	1064
5A-ST	50	0.09%	250
6A-ST	30	0.06%	180
MULTI-TRAILER TRUCKS			
5A-MT	12	0.02%	60
6A-MT	1	0.00%	6
7A-MT	15	0.03%	105
HEAVY VEHICLE TOTALS	748	1.40%	2678
CLASSIFIED VEHICLES TOTALS	53597 (A)	100.00%	108375 (B)
UNCLASSIFIED VEHICLES TOTALS	2	0.00%	

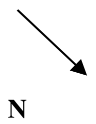
AXLE CORRECTION FACTOR (A/C) = 0.989

ROADTUBE EQUIVALENT(B/2) = 54187 (C)

PEAK HOUR VOLUME : 2034 2015/09/10 14:00	PEAK HOUR TRUCK VOLUME	% TOTAL PEAK HOUR VOLUME	24 HOUR TRUCK VOLUME	AADT	% OF AADT	HPMS K-FACTOR (PEAK/AADT) (ITEM 66)
SINGLE UNIT TRUCKS (TYPE 4-7)	10	(65A-1) 0.49%	187	25900	(65A-2) 0.72%	7.85%
COMBINATION (TYPE 8-13)	10	(65B-1) 0.49%	187		(65B-2) 0.72%	7.85%

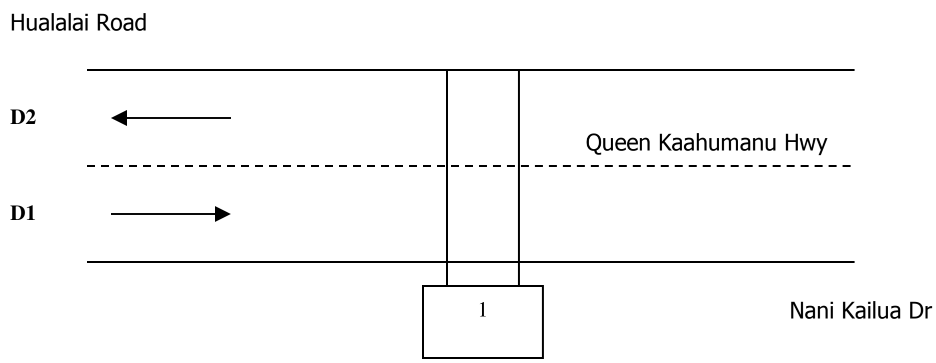
Traffic Data Service

Traffic Station Sketch



Island: Hawaii	
Area: Kona	

Section ID/Station #: B71001112038



Meter #	**File Name**	**GPS**
1. bw67	D0503007_B71001112038	19.63455, -155.9779
2.	D0503008_B71001112038	

Station Description:
Queen Kaahumanu Hwy: Hualalai Road to Nani Kailua Dr

Survey Beginning Date/Time: 5/3/16 @ 0000			Survey Ending Date/Time: 5/4/16 @ 2400
Survey Method:	Road Tube	Data Type:	Class
Survey Crew:	LM		C1B
Sketch Updated:		By:	SR
Remarks:	1302		

FACILITY NAME	JURI	FUNC CLASS	AREA TYPE	ROUTE NO.	ROUTE MILE
Queen Kaahumanu Hwy		11		0110	

D1= Direction to End — D1: Nani Kailua Dr/ Palani Rd (Rte 190)
D2= Direction to Begin — D2: Hualalai Road / Kamehameha Ave (Rte 19)

Run Date: 2017/08/08

Hawaii Department of Transportation

Highways Division **Highways Planning Survey Section**

2016 Program Count - Summary

Site ID: B71001112038 **Town:** Hawaii **DIR 1:** +MP **DIR 2:** -MP **Final AADT:** 25800
Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** 11
Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

DATE : 05/03/2016

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
12:00-12:15	19	5	24	06:00-06:15	69	205	274	12:00-12:15	212	188	400	06:00-06:15	194	131	325
12:15-12:30	16	3	19	06:15-06:30	79	226	305	12:15-12:30	220	202	422	06:15-06:30	229	127	356
12:30-12:45	14	5	19	06:30-06:45	117	292	409	12:30-12:45	215	200	415	06:30-06:45	178	138	316
12:45-01:00	7	7	14	06:45-07:00	140	242	382	12:45-01:00	214	205	419	06:45-07:00	184	127	311
01:00-01:15	6	4	10	07:00-07:15	180	270	450	01:00-01:15	234	188	422	07:00-07:15	153	109	262
01:15-01:30	4	2	6	07:15-07:30	211	252	463	01:15-01:30	210	174	384	07:15-07:30	151	106	257
01:30-01:45	9	3	12	07:30-07:45	197	261	458	01:30-01:45	233	191	424	07:30-07:45	168	102	270
01:45-02:00	7	5	12	07:45-08:00	180	262	442	01:45-02:00	225	213	438	07:45-08:00	149	69	218
02:00-02:15	4	6	10	08:00-08:15	144	267	411	02:00-02:15	246	224	470	08:00-08:15	114	69	183
02:15-02:30	7	5	12	08:15-08:30	154	262	416	02:15-02:30	239	217	456	08:15-08:30	111	76	187
02:30-02:45	3	5	8	08:30-08:45	163	258	421	02:30-02:45	245	213	458	08:30-08:45	132	64	196
02:45-03:00	4	5	9	08:45-09:00	149	267	416	02:45-03:00	233	291	524	08:45-09:00	104	55	159
03:00-03:15	5	8	13	09:00-09:15	142	253	395	03:00-03:15	223	260	483	09:00-09:15	95	53	148
03:15-03:30	5	11	16	09:15-09:30	178	230	408	03:15-03:30	258	228	486	09:15-09:30	95	43	138
03:30-03:45	5	17	22	09:30-09:45	179	266	445	03:30-03:45	235	258	493	09:30-09:45	83	52	135
03:45-04:00	6	20	26	09:45-10:00	163	210	373	03:45-04:00	262	246	508	09:45-10:00	103	41	144
04:00-04:15	7	19	26	10:00-10:15	171	198	369	04:00-04:15	249	246	495	10:00-10:15	76	35	111
04:15-04:30	6	27	33	10:15-10:30	161	213	374	04:15-04:30	239	229	468	10:15-10:30	66	35	101
04:30-04:45	6	49	55	10:30-10:45	157	216	373	04:30-04:45	278	209	487	10:30-10:45	46	39	85
04:45-05:00	13	56	69	10:45-11:00	195	198	393	04:45-05:00	236	213	449	10:45-11:00	51	20	71
05:00-05:15	23	73	96	11:00-11:15	214	206	420	05:00-05:15	245	179	424	11:00-11:15	47	23	70
05:15-05:30	26	73	99	11:15-11:30	195	201	396	05:15-05:30	251	166	417	11:15-11:30	58	14	72
05:30-05:45	41	140	181	11:30-11:45	198	243	441	05:30-05:45	260	178	438	11:30-11:45	27	15	42
05:45-06:00	54	180	234	11:45-12:00	187	182	369	05:45-06:00	228	174	402	11:45-12:00	21	9	30

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2		PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	03:15 PM to 04:15 PM		
AM - PEAK HR VOLUME	768	1045	1813	PM - PEAK HR VOLUME	1004	978	1982
AM - K FACTOR (%)			7.08	PM - K FACTOR (%)			7.74
AM - D (%)	42.36	57.64	100.00	PM - D (%)	50.66	49.34	100.00
DIRECTIONAL PEAK				DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	06:30 AM to 07:30 AM		PM - PEAK HR TIME	03:45 PM to 04:45 PM	03:00 PM to 04:00 PM	
AM - PEAK HR VOLUME	768	1056		PM - PEAK HR VOLUME	1028	992	

AM PERIOD (00:00-12:00)				PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	02:45 PM to 03:45 PM		
AM - PEAK HR VOLUME	768	1045	1813	PM - PEAK HR VOLUME	949	1037	1986
AM - K FACTOR (%)			7.08	PM - K FACTOR (%)			7.76
AM - D (%)	42.36	57.64	100.00	PM - D (%)	47.78	52.22	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	963	945	1908
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM	09:00 AM to 10:00 AM	
PEAK HR VOLUME	963	959	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,923	5,680	9,603
AM 12-HR PERIOD (00:00-12:00)	4,220	6,408	10,628
PM 6-HR PERIOD (12:00-18:00)	5,690	5,092	10,782
PM 12-HR PERIOD (12:00-24:00)	8,325	6,644	14,969
24 HOUR PERIOD	12,545	13,052	25,597
D (%)	49.01	50.99	100.00

Run Date: 2017/08/08

Hawaii Department of Transportation

Highways Division **Highways Planning Survey Section**

2016 Program Count - Summary

Site ID: B71001112038 **Town:** Hawaii **DIR 1:** +MP **DIR 2:** -MP **Final AADT:** 25800

Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** 11

Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

DATE : 05/04/2016

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
12:00-12:15	13	2	15	06:00-06:15	63	185	248	12:00-12:15	241	185	426	06:00-06:15	209	143	352
12:15-12:30	12	8	20	06:15-06:30	97	255	352	12:15-12:30	253	224	477	06:15-06:30	200	169	369
12:30-12:45	9	4	13	06:30-06:45	122	249	371	12:30-12:45	259	198	457	06:30-06:45	183	139	322
12:45-01:00	12	5	17	06:45-07:00	138	242	380	12:45-01:00	229	219	448	06:45-07:00	187	86	273
01:00-01:15	11	6	17	07:00-07:15	193	278	471	01:00-01:15	227	205	432	07:00-07:15	161	88	249
01:15-01:30	8	1	9	07:15-07:30	197	284	481	01:15-01:30	213	216	429	07:15-07:30	148	102	250
01:30-01:45	6	7	13	07:30-07:45	203	292	495	01:30-01:45	236	202	438	07:30-07:45	141	79	220
01:45-02:00	6	3	9	07:45-08:00	168	265	433	01:45-02:00	213	215	428	07:45-08:00	134	86	220
02:00-02:15	0	6	6	08:00-08:15	148	249	397	02:00-02:15	219	215	434	08:00-08:15	127	70	197
02:15-02:30	5	11	16	08:15-08:30	154	253	407	02:15-02:30	245	236	481	08:15-08:30	130	69	199
02:30-02:45	8	5	13	08:30-08:45	155	233	388	02:30-02:45	226	233	459	08:30-08:45	125	67	192
02:45-03:00	6	3	9	08:45-09:00	147	234	381	02:45-03:00	230	258	488	08:45-09:00	105	65	170
03:00-03:15	7	7	14	09:00-09:15	169	207	376	03:00-03:15	245	220	465	09:00-09:15	127	63	190
03:15-03:30	7	7	14	09:15-09:30	136	231	367	03:15-03:30	262	212	474	09:15-09:30	102	57	159
03:30-03:45	5	17	22	09:30-09:45	197	227	424	03:30-03:45	238	197	435	09:30-09:45	93	50	143
03:45-04:00	3	21	24	09:45-10:00	168	239	407	03:45-04:00	257	217	474	09:45-10:00	92	28	120
04:00-04:15	8	12	20	10:00-10:15	155	214	369	04:00-04:15	256	227	483	10:00-10:15	66	38	104
04:15-04:30	4	40	44	10:15-10:30	167	262	429	04:15-04:30	215	231	446	10:15-10:30	69	30	99
04:30-04:45	11	50	61	10:30-10:45	180	242	422	04:30-04:45	275	221	496	10:30-10:45	63	27	90
04:45-05:00	15	64	79	10:45-11:00	203	191	394	04:45-05:00	260	213	473	10:45-11:00	49	15	64
05:00-05:15	26	75	101	11:00-11:15	202	209	411	05:00-05:15	249	197	446	11:00-11:15	42	14	56
05:15-05:30	21	88	109	11:15-11:30	200	173	373	05:15-05:30	253	175	428	11:15-11:30	57	23	80
05:30-05:45	38	127	165	11:30-11:45	210	207	417	05:30-05:45	251	151	402	11:30-11:45	25	13	38
05:45-06:00	46	178	224	11:45-12:00	228	189	417	05:45-06:00	240	179	419	11:45-12:00	35	8	43

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2		PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	03:45 PM to 04:45 PM		
AM - PEAK HR VOLUME	761	1119	1880	PM - PEAK HR VOLUME	1003	896	1899
AM - K FACTOR (%)			7.32	PM - K FACTOR (%)			7.39
AM - D (%)	40.48	59.52	100.00	PM - D (%)	52.82	47.18	100.00
DIRECTIONAL PEAK				DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM	07:00 AM to 08:00 AM		PM - PEAK HR TIME	04:30 PM to 05:30 PM	03:45 PM to 04:45 PM	
AM - PEAK HR VOLUME	761	1119		PM - PEAK HR VOLUME	1037	896	

AM PERIOD (00:00-12:00)				PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK				TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM			PM - PEAK HR TIME	03:45 PM to 04:45 PM		
AM - PEAK HR VOLUME	761	1119	1880	PM - PEAK HR VOLUME	1003	896	1899
AM - K FACTOR (%)			7.32	PM - K FACTOR (%)			7.39
AM - D (%)	40.48	59.52	100.00	PM - D (%)	52.82	47.18	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	920	942	1862
DIRECTIONAL PEAK			
PEAK HR TIME	12:00 PM to 01:00 PM	09:45 AM to 10:45 AM	
PEAK HR VOLUME	982	957	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	4,000	5,610	9,610
AM 12-HR PERIOD (00:00-12:00)	4,287	6,357	10,644
PM 6-HR PERIOD (12:00-18:00)	5,792	5,046	10,838
PM 12-HR PERIOD (12:00-24:00)	8,462	6,575	15,037
24 HOUR PERIOD	12,749	12,932	25,681
D (%)	49.64	50.36	100.00

Run Date: 2017/08/08

Hawaii Department of Transportation
Highways Division
Highways Planning Survey Section

Vehicle Classification Data Summary
2016

Site ID: B71001112038 **Route No:** 11 **Date From:** 2016/05/03 0:00

Town: Hawaii **Direction:** +MP **Date To:** 2016/05/04 23:45

Location: Queen Kaahumanu Hwy - Hualalai Rd to Nani Kailua Dr

Functional Classification: 14 URBAN:PRINCIPAL ARTERIAL - OTHER

REPORT TOTALS - 48 HOURS RECORDED

	VOLUME	%	NUMBER OF AXLES
Cycles	338	0.66%	677
PC	35846	69.91%	71692
2A-4T	14198	27.69%	28396
LIGHT VEHICLE TOTALS	50382	98.25%	100765
HEAVY VEHICLES			
Bus	234	0.46%	585
SINGLE UNIT TRUCK			
2A-6T	157	0.31%	314
3A-SU	145	0.28%	435
4A-SU	31	0.06%	124
SINGLE-TRAILER TRUCKS			
4A-ST	153	0.30%	612
5A-ST	95	0.19%	475
6A-ST	31	0.06%	186
MULTI-TRAILER TRUCKS			
5A-MT	14	0.03%	70
6A-MT	1	0.00%	6
7A-MT	33	0.06%	231
HEAVY VEHICLE TOTALS	894	1.74%	3038
CLASSIFIED VEHICLES TOTALS	51277 (A)	100.00%	103803 (B)
UNCLASSIFIED VEHICLES TOTALS	1	0.00%	

AXLE CORRECTION FACTOR (A/C) = 0.988

ROADTUBE EQUIVALENT(B/2) = 51901 (C)

PEAK HOUR VOLUME : 1970 2016/05/03 15:00	PEAK HOUR TRUCK VOLUME	% TOTAL PEAK HOUR VOLUME	24 HOUR TRUCK VOLUME	AADT	% OF AADT	HPMS K-FACTOR (PEAK/AADT) (ITEM 66)
SINGLE UNIT TRUCKS (TYPE 4-7)	33	(65A-1) 1.68%	283	25800	(65A-2) 1.10%	7.64%
COMBINATION (TYPE 8-13)	27	(65B-1) 1.37%	163		(65B-2) 0.63%	7.64%

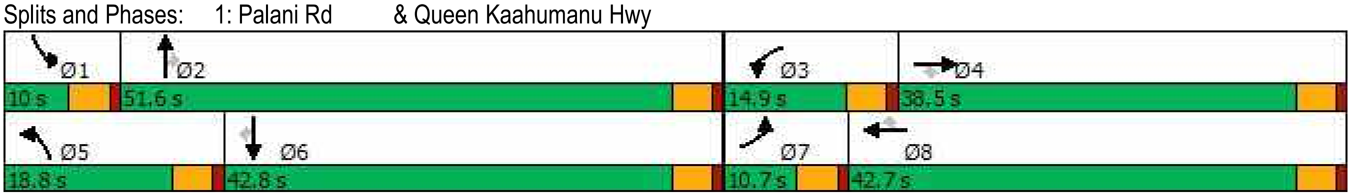
Appendix C

Analysis Reports – Existing Conditions (2019)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	457	218	163	678	23	243	192	109	20	321	177
Future Volume (vph)	71	457	218	163	678	23	243	192	109	20	321	177
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	10.7	38.5	38.5	14.9	42.7	42.7	18.8	51.6	51.6	10.0	42.8	42.8
Total Split (%)	9.3%	33.5%	33.5%	13.0%	37.1%	37.1%	16.3%	44.9%	44.9%	8.7%	37.2%	37.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	6.2	35.1	35.1	9.3	40.6	40.6	11.6	29.7	29.7	5.6	17.1	17.1
Actuated g/C Ratio	0.07	0.38	0.38	0.10	0.44	0.44	0.13	0.32	0.32	0.06	0.19	0.19
v/c Ratio	0.34	0.37	0.32	0.49	0.46	0.03	0.58	0.17	0.19	0.19	0.50	0.41
Control Delay	49.2	23.6	5.1	46.3	21.9	0.1	45.2	22.8	5.4	50.2	35.3	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.2	23.6	5.1	46.3	21.9	0.1	45.2	22.8	5.4	50.2	35.3	7.4
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		20.6			25.9			29.3			26.3	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 91.4	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.58	
Intersection Signal Delay: 25.2	Intersection LOS: C
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	457	218	163	678	23	243	192	109	20	321	177
Future Volume (veh/h)	71	457	218	163	678	23	243	192	109	20	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	466	0	166	692	0	248	196	0	20	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	161	1537		249	1656		344	780		40	500	
Arrive On Green	0.05	0.46	0.00	0.07	0.48	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	466	0	166	692	0	248	196	0	20	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.7	6.9	0.0	3.8	10.4	0.0	5.6	3.6	0.0	0.9	6.9	0.0
Cycle Q Clear(g_c), s	1.7	6.9	0.0	3.8	10.4	0.0	5.6	3.6	0.0	0.9	6.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	161	1537		249	1656		344	780		40	500	
V/C Ratio(X)	0.45	0.30		0.67	0.42		0.72	0.25		0.50	0.66	
Avail Cap(c_a), veh/h	251	1537		445	1656		613	2108		123	1714	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.6	13.5	0.0	35.8	13.4	0.0	34.6	25.6	0.0	38.4	32.3	0.0
Incr Delay (d2), s/veh	1.9	0.5	0.0	3.1	0.8	0.0	2.8	0.2	0.0	9.3	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	2.5	0.0	1.6	3.8	0.0	2.4	1.5	0.0	0.5	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.6	14.1	0.0	38.9	14.2	0.0	37.4	25.8	0.0	47.7	33.7	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		538	A		858	A		444	A		348	A
Approach Delay, s/veh		17.3			18.9			32.3			34.5	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.3	21.9	10.3	40.9	12.5	15.7	8.5	42.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	47.1	10.4	34.0	14.3	38.3	6.2	38.2
Max Q Clear Time (g_c+I1), s	2.9	5.6	5.8	8.9	7.6	8.9	3.7	12.4
Green Ext Time (p_c), s	0.0	1.3	0.2	3.1	0.5	2.2	0.0	4.9

Intersection Summary	
HCM 6th Ctrl Delay	23.7
HCM 6th LOS	C

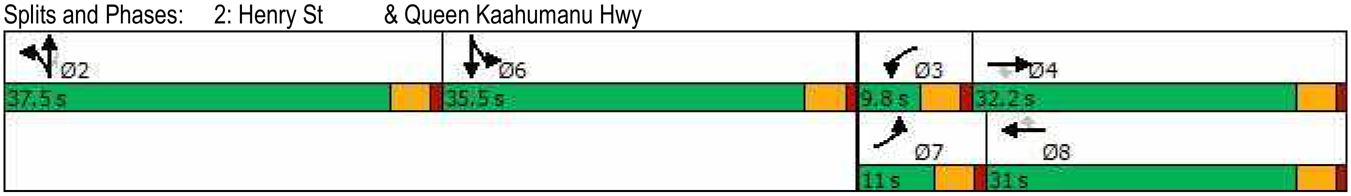
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	107	359	124	52	600	467	146	337	42	362	339
Future Volume (vph)	107	359	124	52	600	467	146	337	42	362	339
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	11.0	32.2	32.2	9.8	31.0	31.0	37.5	37.5	37.5	35.5	35.5
Total Split (%)	9.6%	28.0%	28.0%	8.5%	27.0%	27.0%	32.6%	32.6%	32.6%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	6.6	30.5	30.5	5.4	27.0	27.0	17.5	17.5	17.5	23.1	23.1
Actuated g/C Ratio	0.07	0.33	0.33	0.06	0.29	0.29	0.19	0.19	0.19	0.25	0.25
v/c Ratio	0.50	0.34	0.22	0.28	0.62	0.61	0.46	0.57	0.12	0.71	0.70
Control Delay	53.4	28.2	6.9	50.2	34.0	6.9	39.1	38.0	0.7	43.2	35.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.4	28.2	6.9	50.2	34.0	6.9	39.1	38.0	0.7	43.2	35.2
LOS	D	C	A	D	C	A	D	D	A	D	D
Approach Delay		28.3			23.5			35.3			37.8
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 92.5	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 30.3	Intersection LOS: C
Intersection Capacity Utilization 68.9%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	359	124	52	600	467	146	337	42	362	339	124
Future Volume (vph)	107	359	124	52	600	467	146	337	42	362	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3174	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	370	128	54	619	481	151	347	43	373	349	128
RTOR Reduction (vph)	0	0	86	0	0	336	0	0	35	0	23	0
Lane Group Flow (vph)	110	370	42	54	619	145	136	362	8	283	544	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	30.6	30.6	4.1	28.1	28.1	17.5	17.5	17.5	23.1	23.1	
Effective Green, g (s)	6.6	30.6	30.6	4.1	28.1	28.1	17.5	17.5	17.5	23.1	23.1	
Actuated g/C Ratio	0.07	0.33	0.33	0.04	0.30	0.30	0.19	0.19	0.19	0.25	0.25	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	219	1076	497	145	1025	466	293	627	278	394	785	
v/s Ratio Prot	c0.04	0.11		0.02	c0.18		0.09	c0.11		c0.18	0.17	
v/s Ratio Perm			0.03			0.09			0.01			
v/c Ratio	0.50	0.34	0.08	0.37	0.60	0.31	0.46	0.58	0.03	0.72	0.69	
Uniform Delay, d1	41.8	23.7	21.7	43.3	27.8	25.1	33.7	34.5	31.0	32.1	31.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.8	0.9	0.3	1.6	2.6	1.7	1.2	1.3	0.0	6.2	2.7	
Delay (s)	43.6	24.6	22.0	45.0	30.5	26.9	34.9	35.8	31.0	38.3	34.6	
Level of Service	D	C	C	D	C	C	C	D	C	D	C	
Approach Delay (s)		27.5			29.7			35.2			35.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	31.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	93.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	10.3					
Movement	**EBL**	**EBR**	**NBL**	**NBT**	**SBT**	**SBR**
Lane Configurations						
Traffic Vol, veh/h	44	48	164	985	776	30
Future Vol, veh/h	44	48	164	985	776	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	52	176	1059	834	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2246	-	835	0	-	0
Stage 1	835	-	-	-	-	-
Stage 2	1411	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 46	0	798	-	-	-
Stage 1	426	0	-	-	-	-
Stage 2	225	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 36	-	797	-	-	-
Mov Cap-2 Maneuver	~ 36	-	-	-	-	-
Stage 1	331	-	-	-	-	-
Stage 2	225	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 429	1.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	797	-	36	-	-	-
HCM Lane V/C Ratio	0.221	-	1.314	-	-	-
HCM Control Delay (s)	10.8	-	$ 429	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.8	-	5	-	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	140	1006	15	73	748
Future Vol, veh/h	9	140	1006	15	73	748
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1082	16	78	804

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2050	1090	0	0	1082	0
Stage 1	1090	-	-	-	-	-
Stage 2	960	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	61	262	-	-	630	-
Stage 1	322	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	53	262	-	-	630	-
Mov Cap-2 Maneuver	53	-	-	-	-	-
Stage 1	322	-	-	-	-	-
Stage 2	326	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	38.9	0	1
HCM LOS	E		

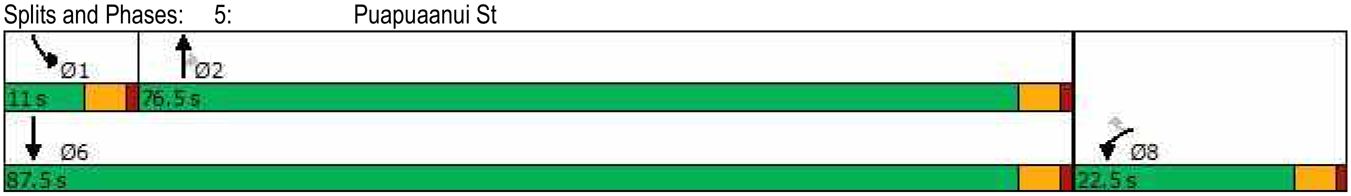
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	53	262	630	-
HCM Lane V/C Ratio	-	-	0.183	0.575	0.125	-
HCM Control Delay (s)	-	-	87.5	35.8	11.5	-
HCM Lane LOS	-	-	F	E	B	-
HCM 95th %tile Q(veh)	-	-	0.6	3.3	0.4	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	87	185	853	24	43	718
Future Volume (vph)	87	185	853	24	43	718
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	2	1	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5
Total Split (s)	22.5	22.5	76.5	76.5	11.0	87.5
Total Split (%)	20.5%	20.5%	69.5%	69.5%	10.0%	79.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	Max	Max	None	Max
Act Effct Green (s)	10.8	10.8	78.3	78.3	6.3	84.9
Actuated g/C Ratio	0.10	0.10	0.75	0.75	0.06	0.81
v/c Ratio	0.51	0.58	0.66	0.02	0.43	0.52
Control Delay	53.6	13.4	11.2	2.2	60.4	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.6	13.4	11.2	2.2	60.4	5.1
LOS	D	B	B	A	E	A
Approach Delay	26.3		10.9			8.2
Approach LOS	C		B			A

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 104.7
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 12.0 Intersection LOS: B
Intersection Capacity Utilization 63.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Puapuaanui St



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	87	185	853	24	43	718
Future Volume (veh/h)	87	185	853	24	43	718
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1826
Adj Flow Rate, veh/h	93	0	907	0	46	764
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	3	2	2	5
Cap, veh/h	120		1409		65	1536
Arrive On Green	0.07	0.00	0.76	0.00	0.04	0.84
Sat Flow, veh/h	1781	1585	1856	1585	1781	1826
Grp Volume(v), veh/h	93	0	907	0	46	764
Grp Sat Flow(s),veh/h/ln	1781	1585	1856	1585	1781	1826
Q Serve(g_s), s	5.1	0.0	22.7	0.0	2.5	11.3
Cycle Q Clear(g_c), s	5.1	0.0	22.7	0.0	2.5	11.3
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	120		1409		65	1536
V/C Ratio(X)	0.78		0.64		0.71	0.50
Avail Cap(c_a), veh/h	325		1409		117	1536
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.3	0.0	5.6	0.0	47.0	2.1
Incr Delay (d2), s/veh	10.2	0.0	2.3	0.0	13.4	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.0	7.5	0.0	1.4	2.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	55.4	0.0	7.9	0.0	60.4	3.3
LnGrp LOS	E		A		E	A
Approach Vol, veh/h	93	A	907	A		810
Approach Delay, s/veh	55.4		7.9			6.5
Approach LOS	E		A			A

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	8.1	79.4				87.5	11.1
Change Period (Y+Rc), s	4.5	4.5				4.5	4.5
Max Green Setting (Gmax), s	6.5	72.0				83.0	18.0
Max Q Clear Time (g_c+I1), s	4.5	24.7				13.3	7.1
Green Ext Time (p_c), s	0.0	9.3				7.0	0.1

Intersection Summary			
HCM 6th Ctrl Delay			9.7
HCM 6th LOS			A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	7.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	7	169	517	801	733	61
Future Vol, veh/h	7	169	517	801	733	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	8	182	556	861	788	66

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2761	-	788	0	-	0
Stage 1	788	-	-	-	-	-
Stage 2	1973	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	22	0	831	-	-	-
Stage 1	448	0	-	-	-	-
Stage 2	118	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 7	-	831	-	-	-
Mov Cap-2 Maneuver	~ 7	-	-	-	-	-
Stage 1	148	-	-	-	-	-
Stage 2	118	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1035.4	6.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	831	-	7	-	-	-
HCM Lane V/C Ratio	0.669	-	1.075	-	-	-
HCM Control Delay (s)	17.6	$ 1035.4		0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	5.3	-	1.7	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	251	48	69	36	33	792	55	141	647	125
Future Volume (vph)	251	48	69	36	33	792	55	141	647	125
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	54.1	54.1	10.9	55.5	55.5
Total Split (%)	20.5%	20.5%	20.5%	20.5%	8.6%	49.2%	49.2%	9.9%	50.5%	50.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	17.7	17.7	15.0	15.0	54.7	49.7	49.7	58.8	55.1	55.1
Actuated g/C Ratio	0.17	0.17	0.14	0.14	0.51	0.47	0.47	0.55	0.52	0.52
v/c Ratio	0.91	0.38	0.30	0.88	0.13	0.97	0.08	0.90	0.72	0.15
Control Delay	79.4	26.8	44.1	46.0	12.6	54.4	0.8	72.7	27.6	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	79.4	26.8	44.1	46.0	12.6	54.4	0.8	72.7	27.6	3.6
LOS	E	C	D	D	B	D	A	E	C	A
Approach Delay		62.7		45.7		49.4			31.3	
Approach LOS		E		D		D			C	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 106.8	
Natural Cycle: 110	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 44.3	Intersection LOS: D
Intersection Capacity Utilization 96.9%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Future Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	303	318		110	116		344	971		258	1016	
Arrive On Green	0.17	0.17	0.00	0.06	0.06	0.00	0.03	0.52	0.00	0.06	0.55	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	14.0	2.2	0.0	3.9	1.9	0.0	0.9	37.7	0.0	3.8	25.5	0.0
Cycle Q Clear(g_c), s	14.0	2.2	0.0	3.9	1.9	0.0	0.9	37.7	0.0	3.8	25.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	303	318		110	116		344	971		258	1016	
V/C Ratio(X)	0.88	0.16		0.66	0.33		0.10	0.87		0.58	0.68	
Avail Cap(c_a), veh/h	336	353		333	353		381	971		270	1016	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	38.7	33.8	0.0	43.8	42.9	0.0	12.7	20.1	0.0	19.0	15.5	0.0
Incr Delay (d2), s/veh	21.5	0.2	0.0	6.7	1.6	0.0	0.1	10.4	0.0	2.9	3.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.8	1.0	0.0	1.9	0.9	0.0	0.3	17.9	0.0	1.7	11.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	60.2	34.1	0.0	50.5	44.5	0.0	12.8	30.4	0.0	21.9	19.2	0.0
LnGrp LOS	E	C		D	D		B	C		C	B	
Approach Vol, veh/h		318	A		111	A		878	A		838	A
Approach Delay, s/veh		56.0			48.4			29.7			19.6	
Approach LOS		E			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.2	54.1		20.7	7.5	56.8		10.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	49.6		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	5.8	39.7		16.0	2.9	27.5		5.9				
Green Ext Time (p_c), s	0.0	4.4		0.2	0.0	5.1		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			30.6									
HCM 6th LOS			C									

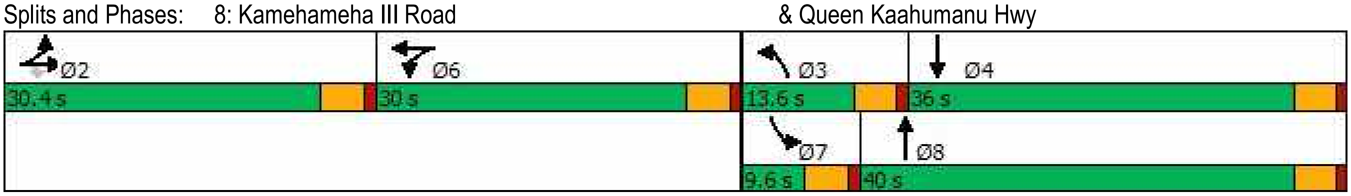
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	5	26	12	76	475	14	417
Future Volume (vph)	5	26	12	76	475	14	417
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.4	30.4	30.0	13.6	40.0	9.6	36.0
Total Split (%)	27.6%	27.6%	27.3%	12.4%	36.4%	8.7%	32.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	13.5	13.5	7.1	8.3	45.0	5.2	36.2
Actuated g/C Ratio	0.18	0.18	0.09	0.11	0.59	0.07	0.48
v/c Ratio	0.57	0.08	0.27	0.46	0.50	0.12	0.48
Control Delay	37.2	0.5	30.0	43.8	15.3	40.8	14.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.2	0.5	30.0	43.8	15.3	40.8	14.9
LOS	D	A	C	D	B	D	B
Approach Delay	32.1		30.0		19.1		15.4
Approach LOS	C		C		B		B

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 76.2	
Natural Cycle: 105	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.57	
Intersection Signal Delay: 19.3	Intersection LOS: B
Intersection Capacity Utilization 57.0%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 8: Kamehameha III Road & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	157	5	26	16	12	15	76	475	15	14	417	285
Future Volume (veh/h)	157	5	26	16	12	15	76	475	15	14	417	285
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1722	1870	1781	1796	1737	1811	1870	1870	1811	1811
Adj Flow Rate, veh/h	169	5	0	17	13	16	82	511	16	15	448	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	2	12	2	8	7	11	6	2	2	6	6
Cap, veh/h	230	7		26	20	24	103	933	29	32	1689	
Arrive On Green	0.13	0.13	0.00	0.04	0.04	0.04	0.06	0.53	0.53	0.02	0.49	0.00
Sat Flow, veh/h	1732	51	1459	598	457	563	1654	1745	55	1781	3532	0
Grp Volume(v), veh/h	174	0	0	46	0	0	82	0	527	15	448	0
Grp Sat Flow(s),veh/h/ln	1784	0	1459	1618	0	0	1654	0	1800	1781	1721	0
Q Serve(g_s), s	6.2	0.0	0.0	1.9	0.0	0.0	3.2	0.0	12.8	0.6	5.1	0.0
Cycle Q Clear(g_c), s	6.2	0.0	0.0	1.9	0.0	0.0	3.2	0.0	12.8	0.6	5.1	0.0
Prop In Lane	0.97		1.00	0.37		0.35	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	237	0		70	0	0	103	0	962	32	1689	
V/C Ratio(X)	0.73	0.00		0.66	0.00	0.00	0.80	0.00	0.55	0.46	0.27	
Avail Cap(c_a), veh/h	696	0		622	0	0	227	0	962	137	1689	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	0.0	31.3	0.0	0.0	30.7	0.0	10.2	32.3	9.9	0.0
Incr Delay (d2), s/veh	4.4	0.0	0.0	10.2	0.0	0.0	13.0	0.0	2.2	9.9	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	0.0	0.9	0.0	0.0	1.6	0.0	4.3	0.3	1.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	0.0	41.4	0.0	0.0	43.7	0.0	12.4	42.2	10.3	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		174	A		46			609			463	A
Approach Delay, s/veh		32.0			41.4			16.6			11.3	
Approach LOS		C			D			B			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		13.3	8.6	37.1		7.4	5.7	40.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	9.1	31.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		8.2	5.2	7.1		3.9	2.6	14.8				
Green Ext Time (p_c), s		0.8	0.0	2.7		0.2	0.0	3.0				

Intersection Summary		
HCM 6th Ctrl Delay		17.7
HCM 6th LOS		B

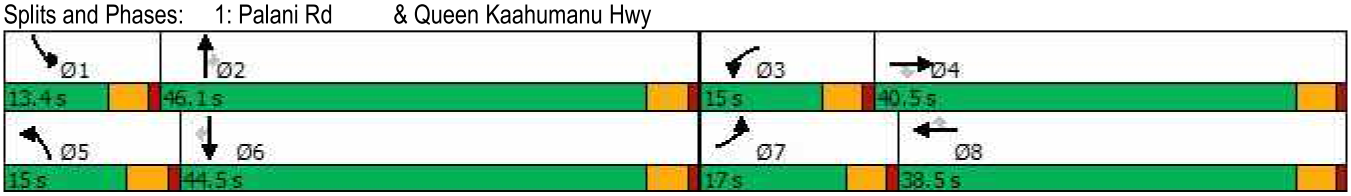
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	877	503	223	609	41	227	283	247	51	313	107
Future Volume (vph)	260	877	503	223	609	41	227	283	247	51	313	107
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	17.0	40.5	40.5	15.0	38.5	38.5	15.0	46.1	46.1	13.4	44.5	44.5
Total Split (%)	14.8%	35.2%	35.2%	13.0%	33.5%	33.5%	13.0%	40.1%	40.1%	11.7%	38.7%	38.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	11.4	36.5	36.5	10.1	35.1	35.1	10.2	24.0	24.0	7.6	16.8	16.8
Actuated g/C Ratio	0.12	0.40	0.40	0.11	0.38	0.38	0.11	0.26	0.26	0.08	0.18	0.18
v/c Ratio	0.62	0.64	0.60	0.60	0.47	0.06	0.62	0.31	0.42	0.36	0.49	0.29
Control Delay	46.8	26.8	9.6	48.2	24.7	0.2	48.6	29.1	6.0	49.7	35.5	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.8	26.8	9.6	48.2	24.7	0.2	48.6	29.1	6.0	49.7	35.5	7.8
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		24.7			29.5			27.4			30.7	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 91.7	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 27.1	Intersection LOS: C
Intersection Capacity Utilization 66.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	877	503	223	609	41	227	283	247	51	313	107
Future Volume (veh/h)	260	877	503	223	609	41	227	283	247	51	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	895	0	228	621	0	232	289	0	52	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	357	1578		316	1521		319	691		76	512	
Arrive On Green	0.10	0.45	0.00	0.09	0.43	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	895	0	228	621	0	232	289	0	52	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.0	15.1	0.0	5.2	9.8	0.0	5.3	5.7	0.0	2.3	6.8	0.0
Cycle Q Clear(g_c), s	6.0	15.1	0.0	5.2	9.8	0.0	5.3	5.7	0.0	2.3	6.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	357	1578		316	1521		319	691		76	512	
V/C Ratio(X)	0.74	0.57		0.72	0.41		0.73	0.42		0.68	0.62	
Avail Cap(c_a), veh/h	533	1578		451	1521		448	1838		197	1767	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.0	16.5	0.0	35.5	15.6	0.0	35.5	28.4	0.0	38.0	32.4	0.0
Incr Delay (d2), s/veh	3.1	1.5	0.0	3.2	0.8	0.0	3.6	0.4	0.0	10.3	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	5.9	0.0	2.2	3.8	0.0	2.3	2.4	0.0	1.2	2.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.0	17.9	0.0	38.8	16.4	0.0	39.1	28.8	0.0	48.3	33.6	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		1160	A		849	A		521	A		371	A
Approach Delay, s/veh		22.5			22.4			33.4			35.7	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.9	20.2	11.8	40.5	12.0	16.1	12.9	39.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	41.6	10.5	36.0	10.5	40.0	12.5	34.0
Max Q Clear Time (g_c+I1), s	4.3	7.7	7.2	17.1	7.3	8.8	8.0	11.8
Green Ext Time (p_c), s	0.0	2.0	0.2	6.0	0.2	2.2	0.4	4.2

Intersection Summary	
HCM 6th Ctrl Delay	26.1
HCM 6th LOS	C

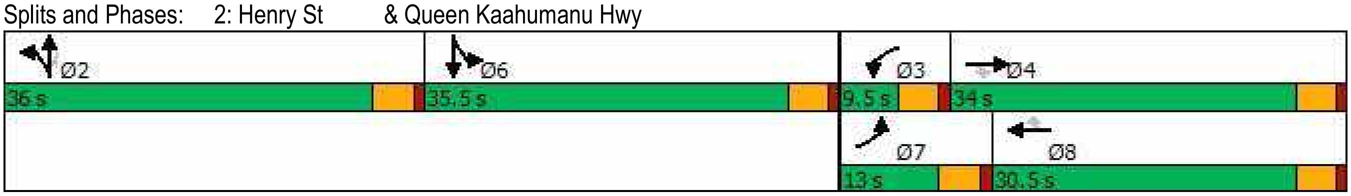
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	190	663	291	72	548	314	126	318	34	348	342
Future Volume (vph)	190	663	291	72	548	314	126	318	34	348	342
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	13.0	34.0	34.0	9.5	30.5	30.5	36.0	36.0	36.0	35.5	35.5
Total Split (%)	11.3%	29.6%	29.6%	8.3%	26.5%	26.5%	31.3%	31.3%	31.3%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	8.6	32.3	32.3	5.1	26.5	26.5	16.9	16.9	16.9	24.4	24.4
Actuated g/C Ratio	0.09	0.34	0.34	0.05	0.28	0.28	0.18	0.18	0.18	0.26	0.26
v/c Ratio	0.64	0.56	0.40	0.40	0.58	0.48	0.41	0.56	0.10	0.73	0.69
Control Delay	55.1	31.0	5.6	54.3	34.4	6.7	39.5	39.4	0.6	44.0	33.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.1	31.0	5.6	54.3	34.4	6.7	39.5	39.4	0.6	44.0	33.0
LOS	E	C	A	D	C	A	D	D	A	D	C
Approach Delay		28.6			26.6			36.6			36.7
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 94.6	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 31.2	Intersection LOS: C
Intersection Capacity Utilization 72.7%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	663	291	72	548	314	126	318	34	348	342	190
Future Volume (vph)	190	663	291	72	548	314	126	318	34	348	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3193	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	677	297	73	559	320	129	324	35	355	349	194
RTOR Reduction (vph)	0	0	197	0	0	228	0	0	29	0	47	0
Lane Group Flow (vph)	194	677	100	73	559	92	116	337	6	302	549	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	32.3	32.3	3.9	27.6	27.6	16.9	16.9	16.9	24.4	24.4	
Effective Green, g (s)	8.6	32.3	32.3	3.9	27.6	27.6	16.9	16.9	16.9	24.4	24.4	
Actuated g/C Ratio	0.09	0.34	0.34	0.04	0.29	0.29	0.18	0.18	0.18	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	300	1196	535	140	1003	451	282	598	271	411	815	
v/s Ratio Prot	c0.06	c0.19		0.02	0.16		0.07	c0.10		c0.19	0.17	
v/s Ratio Perm			0.06			0.06			0.00			
v/c Ratio	0.65	0.57	0.19	0.52	0.56	0.21	0.41	0.56	0.02	0.73	0.67	
Uniform Delay, d1	42.0	25.9	22.3	44.9	28.8	25.7	34.9	35.9	32.5	32.6	32.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.7	1.9	0.8	3.5	2.2	1.0	1.0	1.2	0.0	6.7	2.2	
Delay (s)	46.7	27.8	23.1	48.4	31.0	26.7	35.9	37.1	32.5	39.3	34.2	
Level of Service	D	C	C	D	C	C	D	D	C	D	C	
Approach Delay (s)		29.8			30.9			36.5			35.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	95.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	1					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	70	84	923	1005	17
Future Vol, veh/h	10	70	84	923	1005	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	72	87	952	1036	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2162	-	1036	0	-	0
Stage 1	1036	-	-	-	-	-
Stage 2	1126	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	52	0	671	-	-	-
Stage 1	342	0	-	-	-	-
Stage 2	310	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	45	-	671	-	-	-
Mov Cap-2 Maneuver	45	-	-	-	-	-
Stage 1	298	-	-	-	-	-
Stage 2	310	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	107.3	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	671	-	45	-	-	-
HCM Lane V/C Ratio	0.129	-	0.229	-	-	-
HCM Control Delay (s)	11.2	-	107.3	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.4	-	0.8	-	-	-

Intersection						
Int Delay, s/veh	1.7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	940	4	61	1015
Future Vol, veh/h	14	71	940	4	61	1015
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	969	4	63	1046

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2143	971	0	0	969	0
Stage 1	971	-	-	-	-	-
Stage 2	1172	-	-	-	-	-
Critical Hdwy	6.47	6.22	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.318	-	-	2.272	-
Pot Cap-1 Maneuver	52	307	-	-	688	-
Stage 1	360	-	-	-	-	-
Stage 2	288	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	47	307	-	-	688	-
Mov Cap-2 Maneuver	47	-	-	-	-	-
Stage 1	360	-	-	-	-	-
Stage 2	262	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	35.6	0	0.6
HCM LOS	E		

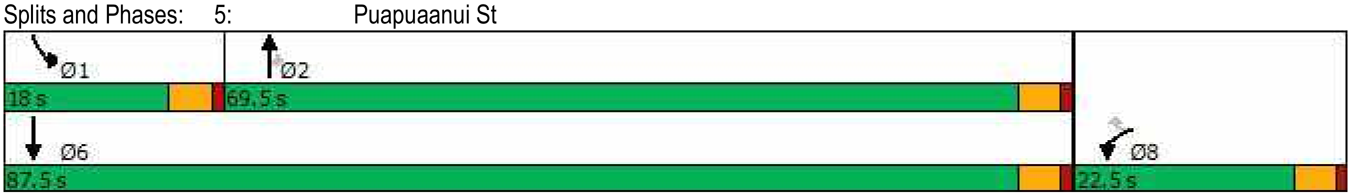
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	47	307	688	-
HCM Lane V/C Ratio	-	-	0.307	0.238	0.091	-
HCM Control Delay (s)	-	-	112.5	20.4	10.8	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	1.1	0.9	0.3	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	34	107	825	48	132	906
Future Volume (vph)	34	107	825	48	132	906
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	2	1	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5
Total Split (s)	22.5	22.5	69.5	69.5	18.0	87.5
Total Split (%)	20.5%	20.5%	63.2%	63.2%	16.4%	79.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	Max	Max	None	Max
Act Effct Green (s)	7.7	7.7	69.0	69.0	11.9	85.5
Actuated g/C Ratio	0.08	0.08	0.68	0.68	0.12	0.84
v/c Ratio	0.26	0.50	0.68	0.05	0.66	0.60
Control Delay	48.0	17.0	14.4	2.2	58.1	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.0	17.0	14.4	2.2	58.1	4.9
LOS	D	B	B	A	E	A
Approach Delay	24.5		13.8			11.7
Approach LOS	C		B			B

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 102.2
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 13.4 Intersection LOS: B
Intersection Capacity Utilization 66.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Puapuaanui St



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	34	107	825	48	132	906
Future Volume (veh/h)	34	107	825	48	132	906
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1870	1826	1856	1841	1870	1870
Adj Flow Rate, veh/h	35	0	851	0	136	934
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	5	3	4	2	2
Cap, veh/h	57		1358		168	1634
Arrive On Green	0.03	0.00	0.73	0.00	0.09	0.87
Sat Flow, veh/h	1781	1547	1856	1560	1781	1870
Grp Volume(v), veh/h	35	0	851	0	136	934
Grp Sat Flow(s),veh/h/ln	1781	1547	1856	1560	1781	1870
Q Serve(g_s), s	1.8	0.0	21.6	0.0	7.1	12.0
Cycle Q Clear(g_c), s	1.8	0.0	21.6	0.0	7.1	12.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	57		1358		168	1634
V/C Ratio(X)	0.62		0.63		0.81	0.57
Avail Cap(c_a), veh/h	337		1358		253	1634
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	45.4	0.0	6.3	0.0	42.2	1.5
Incr Delay (d2), s/veh	10.5	0.0	2.2	0.0	11.0	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	7.4	0.0	3.6	1.5
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	56.0	0.0	8.5	0.0	53.1	3.0
LnGrp LOS	E		A		D	A
Approach Vol, veh/h	35	A	851	A		1070
Approach Delay, s/veh	56.0		8.5			9.4
Approach LOS	E		A			A

Timer - Assigned Phs	1	2	6	8
Phs Duration (G+Y+Rc), s	13.5	74.0	87.5	7.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	13.5	65.0	83.0	18.0
Max Q Clear Time (g_c+I1), s	9.1	23.6	14.0	3.8
Green Ext Time (p_c), s	0.1	8.1	10.2	0.0

Intersection Summary	
HCM 6th Ctrl Delay	9.8
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	2.8					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	13	372	243	854	887	36
Future Vol, veh/h	13	372	243	854	887	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	13	380	248	871	905	37

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2272	-	905	0	-	0
Stage 1	905	-	-	-	-	-
Stage 2	1367	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	43	0	752	-	-	-
Stage 1	385	0	-	-	-	-
Stage 2	230	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	29	-	752	-	-	-
Mov Cap-2 Maneuver	29	-	-	-	-	-
Stage 1	258	-	-	-	-	-
Stage 2	230	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	208.2	2.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	752	-	29	-	-	-
HCM Lane V/C Ratio	0.33	-	0.457	-	-	-
HCM Control Delay (s)	12.1	-	208.2	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.4	-	1.5	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	127	30	62	39	37	754	64	181	877	170
Future Volume (vph)	127	30	62	39	37	754	64	181	877	170
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	52.2	52.2	12.8	55.5	55.5
Total Split (%)	20.5%	20.5%	20.5%	20.5%	8.6%	47.5%	47.5%	11.6%	50.5%	50.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	12.5	12.5	10.2	10.2	53.0	48.0	48.0	60.2	55.4	55.4
Actuated g/C Ratio	0.13	0.13	0.10	0.10	0.55	0.49	0.49	0.62	0.57	0.57
v/c Ratio	0.59	0.31	0.35	0.72	0.22	0.86	0.08	0.73	0.86	0.18
Control Delay	51.9	21.8	46.1	23.5	12.4	34.9	1.5	31.2	31.2	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.9	21.8	46.1	23.5	12.4	34.9	1.5	31.2	31.2	5.3
LOS	D	C	D	C	B	C	A	C	C	A
Approach Delay		40.4		28.3		31.4			27.6	
Approach LOS		D		C		C			C	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 97.2	
Natural Cycle: 110	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 30.0	Intersection LOS: C
Intersection Capacity Utilization 86.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street

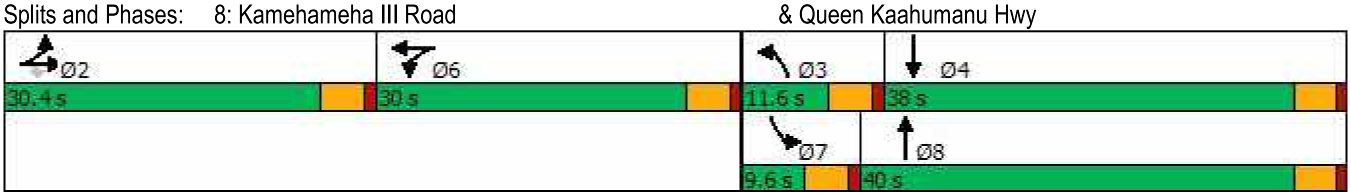
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Future Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	173	184		102	104		277	1050		373	1119	
Arrive On Green	0.10	0.10	0.00	0.06	0.06	0.00	0.04	0.57	0.00	0.07	0.60	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	6.3	1.3	0.0	3.0	1.8	0.0	0.8	27.2	0.0	3.7	32.8	0.0
Cycle Q Clear(g_c), s	6.3	1.3	0.0	3.0	1.8	0.0	0.8	27.2	0.0	3.7	32.8	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	173	184		102	104		277	1050		373	1119	
V/C Ratio(X)	0.76	0.17		0.64	0.39		0.14	0.75		0.51	0.82	
Avail Cap(c_a), veh/h	370	395		376	385		318	1050		426	1119	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.5	35.2	0.0	39.4	38.8	0.0	12.6	13.9	0.0	12.4	13.5	0.0
Incr Delay (d2), s/veh	6.9	0.4	0.0	6.6	2.4	0.0	0.2	4.9	0.0	1.1	6.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.6	0.0	1.5	0.9	0.0	0.3	11.5	0.0	1.3	13.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.3	35.7	0.0	45.9	41.2	0.0	12.8	18.8	0.0	13.5	20.1	0.0
LnGrp LOS	D	D		D	D		B	B		B	C	
Approach Vol, veh/h		163	A		106	A		824	A		1103	A
Approach Delay, s/veh		42.7			44.1			18.5			19.0	
Approach LOS		D			D			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.3	52.7		12.9	7.5	55.5		9.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.3	47.7		18.0	5.0	51.0		18.0				
Max Q Clear Time (g_c+I1), s	5.7	29.2		8.3	2.8	34.8		5.0				
Green Ext Time (p_c), s	0.1	5.6		0.3	0.0	6.6		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			21.8									
HCM 6th LOS			C									
Notes												

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	11	52	11	64	495	17	511
Future Volume (vph)	11	52	11	64	495	17	511
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.4	30.4	30.0	11.6	40.0	9.6	38.0
Total Split (%)	27.6%	27.6%	27.3%	10.5%	36.4%	8.7%	34.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	19.4	19.4	6.8	7.0	40.7	5.3	35.3
Actuated g/C Ratio	0.24	0.24	0.09	0.09	0.51	0.07	0.45
v/c Ratio	0.74	0.12	0.23	0.43	0.56	0.15	0.54
Control Delay	39.9	1.4	28.2	48.3	20.7	44.1	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.9	1.4	28.2	48.3	20.7	44.1	18.7
LOS	D	A	C	D	C	D	B
Approach Delay	34.2		28.2		23.8		19.3
Approach LOS	C		C		C		B

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 79.2	
Natural Cycle: 105	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 23.9	Intersection LOS: C
Intersection Capacity Utilization 65.4%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 8: Kamehameha III Road & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	290	11	52	7	11	18	64	495	11	17	511	284
Future Volume (veh/h)	290	11	52	7	11	18	64	495	11	17	511	284
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1767	1811	1870	1870	1870	1856	1856	1870	1870	1870	1870
Adj Flow Rate, veh/h	305	12	0	7	12	19	67	521	12	18	538	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	9	6	2	2	2	3	3	2	2	2	2
Cap, veh/h	364	14		11	20	31	89	862	20	37	1592	
Arrive On Green	0.22	0.22	0.00	0.04	0.04	0.04	0.05	0.48	0.48	0.02	0.45	0.00
Sat Flow, veh/h	1622	64	1535	313	537	851	1767	1806	42	1781	3647	0
Grp Volume(v), veh/h	317	0	0	38	0	0	67	0	533	18	538	0
Grp Sat Flow(s),veh/h/ln	1686	0	1535	1702	0	0	1767	0	1848	1781	1777	0
Q Serve(g_s), s	13.4	0.0	0.0	1.6	0.0	0.0	2.8	0.0	15.8	0.7	7.4	0.0
Cycle Q Clear(g_c), s	13.4	0.0	0.0	1.6	0.0	0.0	2.8	0.0	15.8	0.7	7.4	0.0
Prop In Lane	0.96		1.00	0.18		0.50	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	378	0		62	0	0	89	0	882	37	1592	
V/C Ratio(X)	0.84	0.00		0.61	0.00	0.00	0.75	0.00	0.60	0.48	0.34	
Avail Cap(c_a), veh/h	584	0		580	0	0	168	0	882	122	1592	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	0.0	35.5	0.0	0.0	35.1	0.0	14.3	36.2	13.4	0.0
Incr Delay (d2), s/veh	6.4	0.0	0.0	9.4	0.0	0.0	12.1	0.0	3.1	9.5	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	0.0	0.0	0.8	0.0	0.0	1.4	0.0	6.2	0.4	2.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.1	0.0	0.0	44.9	0.0	0.0	47.2	0.0	17.4	45.7	14.0	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		317	A		38			600			556	A
Approach Delay, s/veh		34.1			44.9			20.7			15.0	
Approach LOS		C			D			C			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		21.3	8.3	38.0		7.2	6.1	40.2				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	7.1	33.5		25.5	5.1	35.5				
Max Q Clear Time (g_c+I1), s		15.4	4.8	9.4		3.6	2.7	17.8				
Green Ext Time (p_c), s		1.4	0.0	3.3		0.1	0.0	2.9				
Intersection Summary												
HCM 6th Ctrl Delay			22.0									
HCM 6th LOS			C									

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Intersection Delay, s/veh	27.1
Intersection LOS	D

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	99	1235	866
Demand Flow Rate, veh/h	101	1260	917
Vehicles Circulating, veh/h	884	48	180
Vehicles Exiting, veh/h	213	937	1128
Ped Vol Crossing Leg, #/h	1	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	8.9	34.3	19.0
Approach LOS	A	D	C

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	101	1260	917
Cap Entry Lane, veh/h	560	1314	1148
Entry HV Adj Factor	0.980	0.980	0.944
Flow Entry, veh/h	99	1235	866
Cap Entry, veh/h	549	1288	1085
V/C Ratio	0.180	0.959	0.798
Control Delay, s/veh	8.9	34.3	19.0
LOS	A	D	C
95th %tile Queue, veh	1	18	9

Intersection	
Intersection Delay, s/veh	18.4
Intersection LOS	C

Approach	WB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	161	1098	882
Demand Flow Rate, veh/h	164	1122	927
Vehicles Circulating, veh/h	1104	83	10
Vehicles Exiting, veh/h	101	854	1258
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	14.7	24.2	11.8
Approach LOS	B	C	B

Lane	Left	Left	Left
Designated Moves	LR	TR	LT
Assumed Moves	LR	TR	LT
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	164	1122	927
Cap Entry Lane, veh/h	448	1268	1366
Entry HV Adj Factor	0.982	0.979	0.951
Flow Entry, veh/h	161	1098	882
Cap Entry, veh/h	439	1241	1299
V/C Ratio	0.366	0.885	0.679
Control Delay, s/veh	14.7	24.2	11.8
LOS	B	C	B
95th %tile Queue, veh	2	13	6

Intersection	
Intersection Delay, s/veh	75.6
Intersection LOS	F

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	190	1417	854
Demand Flow Rate, veh/h	197	1471	898
Vehicles Circulating, veh/h	827	8	567
Vehicles Exiting, veh/h	638	1016	912
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	11.0	64.6	108.1
Approach LOS	B	F	F

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	197	1471	898
Cap Entry Lane, veh/h	594	1369	774
Entry HV Adj Factor	0.964	0.963	0.951
Flow Entry, veh/h	190	1417	854
Cap Entry, veh/h	573	1318	736
V/C Ratio	0.332	1.075	1.160
Control Delay, s/veh	11.0	64.6	108.1
LOS	B	F	F
95th %tile Queue, veh	1	30	27

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	251	48	69	36	33	792	55	141	647	125
Future Volume (vph)	251	48	69	36	33	792	55	141	647	125
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	54.1	54.1	10.9	55.5	55.5
Total Split (%)	20.5%	20.5%	20.5%	20.5%	8.6%	49.2%	49.2%	9.9%	50.5%	50.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	17.7	25.2	9.8	15.0	54.7	49.7	49.7	58.8	55.1	55.1
Actuated g/C Ratio	0.17	0.24	0.09	0.14	0.51	0.47	0.47	0.55	0.52	0.52
v/c Ratio	0.91	0.28	0.46	0.88	0.14	0.97	0.08	0.90	0.72	0.15
Control Delay	79.4	22.3	55.4	46.0	12.6	54.4	0.8	72.7	27.6	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	79.4	22.3	55.4	46.0	12.6	54.4	0.8	72.7	27.6	3.6
LOS	E	C	E	D	B	D	A	E	C	A
Approach Delay		61.3		47.7		49.4			31.3	
Approach LOS		E		D		D			C	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 106.8	
Natural Cycle: 110	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 44.4	Intersection LOS: D
Intersection Capacity Utilization 96.9%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Future Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	302	304		111	104		351	981		264	1025	
Arrive On Green	0.17	0.16	0.00	0.06	0.06	0.00	0.03	0.52	0.00	0.06	0.55	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	13.8	2.2	0.0	3.8	1.9	0.0	0.8	36.9	0.0	3.7	24.9	0.0
Cycle Q Clear(g_c), s	13.8	2.2	0.0	3.8	1.9	0.0	0.8	36.9	0.0	3.7	24.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	302	304		111	104		351	981		264	1025	
V/C Ratio(X)	0.88	0.17		0.66	0.36		0.10	0.86		0.57	0.67	
Avail Cap(c_a), veh/h	339	356		336	356		388	981		278	1025	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	38.4	34.1	0.0	43.3	43.0	0.0	12.2	19.4	0.0	18.4	15.0	0.0
Incr Delay (d2), s/veh	21.5	0.3	0.0	6.5	2.1	0.0	0.1	9.7	0.0	2.5	3.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.8	1.0	0.0	1.9	0.9	0.0	0.3	17.4	0.0	1.6	10.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.9	34.3	0.0	49.8	45.1	0.0	12.4	29.1	0.0	20.8	18.5	0.0
LnGrp LOS	E	C		D	D		B	C		C	B	
Approach Vol, veh/h		318	A		111	A		878	A		838	A
Approach Delay, s/veh		55.8			48.2			28.5			19.0	
Approach LOS		E			D			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.1	54.1	10.4	19.9	7.5	56.7	20.5	9.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.4	49.6	18.0	18.0	5.0	51.0	18.0	18.0
Max Q Clear Time (g_c+I1), s	5.7	38.9	5.8	4.2	2.8	26.9	15.8	3.9
Green Ext Time (p_c), s	0.0	4.6	0.1	0.1	0.0	5.1	0.2	0.1

Intersection Summary	
HCM 6th Ctrl Delay	29.8
HCM 6th LOS	C

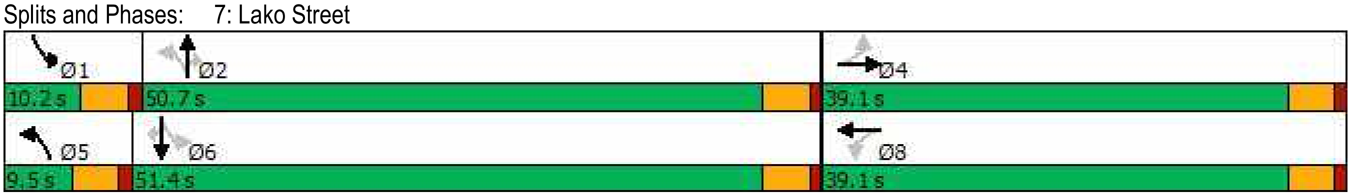
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	251	48	69	36	33	792	55	141	647	125
Future Volume (vph)	251	48	69	36	33	792	55	141	647	125
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	39.1	39.1	39.1	39.1	9.5	50.7	50.7	10.2	51.4	51.4
Total Split (%)	39.1%	39.1%	39.1%	39.1%	9.5%	50.7%	50.7%	10.2%	51.4%	51.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	34.6	34.6	34.6	34.6	51.2	46.2	46.2	54.1	50.7	50.7
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.51	0.46	0.46	0.54	0.51	0.51
v/c Ratio	1.04	0.20	0.17	0.48	0.14	0.98	0.08	0.91	0.74	0.15
Control Delay	101.1	11.4	24.2	12.5	11.1	54.0	3.8	71.0	26.5	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	101.1	11.4	24.2	12.5	11.1	54.0	3.8	71.0	26.5	3.2
LOS	F	B	C	B	B	D	A	E	C	A
Approach Delay		72.7		14.6		49.2			30.1	
Approach LOS		E		B		D			C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 40.7	Intersection LOS: D
Intersection Capacity Utilization 96.9%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Future Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	390	447		376	447		382	1015		294	1057	
Arrive On Green	0.24	0.24	0.00	0.24	0.24	0.00	0.03	0.54	0.00	0.06	0.57	0.00
Sat Flow, veh/h	1367	1870	0	1340	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Grp Sat Flow(s),veh/h/ln	1367	1870	0	1340	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	16.1	1.8	0.0	3.8	1.3	0.0	0.7	31.9	0.0	3.2	21.6	0.0
Cycle Q Clear(g_c), s	17.4	1.8	0.0	5.7	1.3	0.0	0.7	31.9	0.0	3.2	21.6	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	390	447		376	447		382	1015		294	1057	
V/C Ratio(X)	0.69	0.11		0.19	0.09		0.09	0.83		0.51	0.65	
Avail Cap(c_a), veh/h	619	760		601	760		427	1015		306	1057	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	31.9	25.3	0.0	27.6	25.2	0.0	10.1	16.2	0.0	15.2	12.5	0.0
Incr Delay (d2), s/veh	2.1	0.1	0.0	0.2	0.1	0.0	0.1	7.9	0.0	1.4	3.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	0.8	0.0	1.2	0.6	0.0	0.3	14.4	0.0	1.3	8.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.1	25.5	0.0	27.8	25.2	0.0	10.2	24.1	0.0	16.6	15.7	0.0
LnGrp LOS	C	C		C	C		B	C		B	B	
Approach Vol, veh/h		318	A		111	A		878	A		838	A
Approach Delay, s/veh		32.7			26.9			23.5			15.8	
Approach LOS		C			C			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.6	50.7		24.8	7.3	53.0		24.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.7	46.2		34.6	5.0	46.9		34.6				
Max Q Clear Time (g_c+I1), s	5.2	33.9		19.4	2.7	23.6		7.7				
Green Ext Time (p_c), s	0.0	5.0		0.9	0.0	5.1		0.4				

Intersection Summary			
HCM 6th Ctrl Delay			22.1
HCM 6th LOS			C

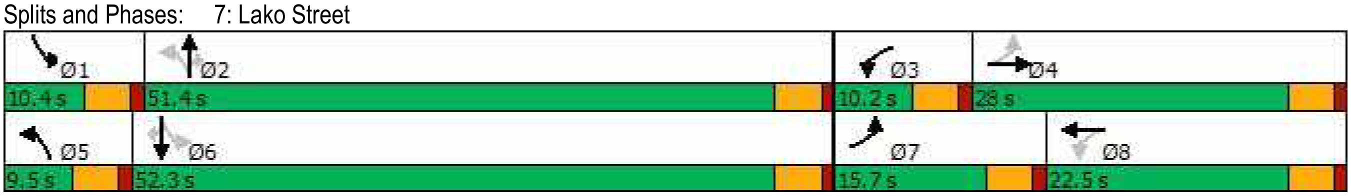
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	251	48	69	36	33	792	55	141	647	125
Future Volume (vph)	251	48	69	36	33	792	55	141	647	125
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	15.7	28.0	10.2	22.5	9.5	51.4	51.4	10.4	52.3	52.3
Total Split (%)	15.7%	28.0%	10.2%	22.5%	9.5%	51.4%	51.4%	10.4%	52.3%	52.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	29.1	21.1	19.1	13.4	52.0	47.0	47.0	55.4	52.0	52.0
Actuated g/C Ratio	0.30	0.22	0.20	0.14	0.54	0.49	0.49	0.58	0.54	0.54
v/c Ratio	0.95	0.29	0.26	0.84	0.12	0.92	0.07	0.85	0.69	0.14
Control Delay	72.4	17.8	26.6	36.5	10.0	40.6	0.2	58.6	22.7	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.4	17.8	26.6	36.5	10.0	40.6	0.2	58.6	22.7	1.7
LOS	E	B	C	D	A	D	A	E	C	A
Approach Delay		55.1		34.6		36.9			25.4	
Approach LOS		E		C		D			C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 95.6	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 35.1	Intersection LOS: D
Intersection Capacity Utilization 96.9%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Future Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	0.99		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	370	260		253	113		380	1014		292	1056	
Arrive On Green	0.13	0.14	0.00	0.05	0.06	0.00	0.03	0.54	0.00	0.06	0.57	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	11.2	2.1	0.0	3.3	1.7	0.0	0.7	32.5	0.0	3.3	22.0	0.0
Cycle Q Clear(g_c), s	11.2	2.1	0.0	3.3	1.7	0.0	0.7	32.5	0.0	3.3	22.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	370	260		253	113		380	1014		292	1056	
V/C Ratio(X)	0.72	0.20		0.29	0.34		0.09	0.83		0.51	0.65	
Avail Cap(c_a), veh/h	370	508		280	389		424	1014		306	1056	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	31.8	33.0	0.0	35.6	39.0	0.0	10.3	16.5	0.0	15.5	12.8	0.0
Incr Delay (d2), s/veh	6.8	0.4	0.0	0.6	1.7	0.0	0.1	7.9	0.0	1.4	3.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	1.0	0.0	1.4	0.8	0.0	0.3	14.7	0.0	1.3	9.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.6	33.3	0.0	36.3	40.7	0.0	10.4	24.4	0.0	16.9	15.9	0.0
LnGrp LOS	D	C		D	D		B	C		B	B	
Approach Vol, veh/h		318	A		111	A		878	A		838	A
Approach Delay, s/veh		37.8			37.8			23.8			16.1	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.7	51.4	8.9	16.5	7.3	53.7	15.7	9.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.9	46.9	5.7	23.5	5.0	47.8	11.2	18.0
Max Q Clear Time (g_c+I1), s	5.3	34.5	5.3	4.1	2.7	24.0	13.2	3.7
Green Ext Time (p_c), s	0.0	5.0	0.0	0.2	0.0	5.1	0.0	0.1

Intersection Summary

HCM 6th Ctrl Delay	23.6
HCM 6th LOS	C

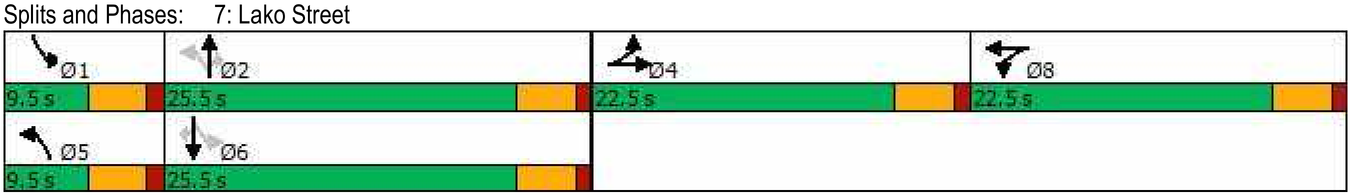
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	251	48	69	36	33	792	55	141	647	125
Future Volume (vph)	251	48	69	36	33	792	55	141	647	125
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	25.5	25.5	9.5	25.5	25.5
Total Split (%)	28.1%	28.1%	28.1%	28.1%	11.9%	31.9%	31.9%	11.9%	31.9%	31.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	14.6	14.6	10.8	10.8	26.3	21.3	21.3	29.3	27.5	27.5
Actuated g/C Ratio	0.21	0.21	0.15	0.15	0.38	0.30	0.30	0.42	0.39	0.39
v/c Ratio	0.72	0.30	0.27	0.74	0.11	0.78	0.11	0.68	0.50	0.19
Control Delay	38.7	14.0	28.8	20.5	15.2	30.7	0.4	36.1	20.9	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.7	14.0	28.8	20.5	15.2	30.7	0.4	36.1	20.9	4.8
LOS	D	B	C	C	B	C	A	D	C	A
Approach Delay		30.9		22.1		28.2			21.0	
Approach LOS		C		C		C			C	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 70	
Natural Cycle: 80	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 25.1	Intersection LOS: C
Intersection Capacity Utilization 77.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Future Volume (veh/h)	251	48	69	69	36	267	33	792	55	141	647	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	335	352		129	136		378	1261		357	1403	
Arrive On Green	0.19	0.19	0.00	0.07	0.07	0.00	0.04	0.35	0.00	0.08	0.40	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	3554	1560	1725	3526	1585
Grp Volume(v), veh/h	267	51	0	73	38	0	35	843	0	150	688	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1777	1560	1725	1763	1585
Q Serve(g_s), s	8.5	1.3	0.0	2.4	1.1	0.0	0.7	11.9	0.0	3.2	8.6	0.0
Cycle Q Clear(g_c), s	8.5	1.3	0.0	2.4	1.1	0.0	0.7	11.9	0.0	3.2	8.6	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	335	352		129	136		378	1261		357	1403	
V/C Ratio(X)	0.80	0.15		0.57	0.28		0.09	0.67		0.42	0.49	
Avail Cap(c_a), veh/h	542	569		538	569		462	1261		365	1403	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	22.9	20.1	0.0	26.5	26.0	0.0	11.5	16.1	0.0	11.9	13.3	0.0
Incr Delay (d2), s/veh	4.4	0.2	0.0	3.9	1.1	0.0	0.1	2.8	0.0	0.8	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.6	0.0	1.1	0.5	0.0	0.3	4.8	0.0	1.1	3.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.3	20.2	0.0	30.4	27.1	0.0	11.6	19.0	0.0	12.7	14.5	0.0
LnGrp LOS	C	C		C	C		B	B		B	B	
Approach Vol, veh/h		318	A		111	A		878	A		838	A
Approach Delay, s/veh		26.2			29.3			18.7			14.2	
Approach LOS		C			C			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.2	25.5		15.6	6.7	28.1		8.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	21.0		18.0	5.0	21.0		18.0				
Max Q Clear Time (g_c+I1), s	5.2	13.9		10.5	2.7	10.6		4.4				
Green Ext Time (p_c), s	0.0	3.3		0.7	0.0	3.4		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			18.6									
HCM 6th LOS			B									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Intersection Delay, s/veh	18.3
Intersection LOS	C

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	82	1039	1054
Demand Flow Rate, veh/h	83	1079	1076
Vehicles Circulating, veh/h	1057	10	89
Vehicles Exiting, veh/h	108	1130	1000
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	10.3	16.1	21.2
Approach LOS	B	C	C

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	83	1079	1076
Cap Entry Lane, veh/h	470	1366	1260
Entry HV Adj Factor	0.988	0.963	0.980
Flow Entry, veh/h	82	1039	1054
Cap Entry, veh/h	464	1315	1235
V/C Ratio	0.177	0.790	0.854
Control Delay, s/veh	10.3	16.1	21.2
LOS	B	C	C
95th %tile Queue, veh	1	9	12

Intersection	
Intersection Delay, s/veh	17.2
Intersection LOS	C

Approach	WB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	87	973	1109
Demand Flow Rate, veh/h	89	1002	1135
Vehicles Circulating, veh/h	998	68	15
Vehicles Exiting, veh/h	72	1082	1072
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	9.9	16.0	18.7
Approach LOS	A	C	C

Lane	Left	Left	Left
Designated Moves	LR	TR	LT
Assumed Moves	LR	TR	LT
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	89	1002	1135
Cap Entry Lane, veh/h	499	1287	1359
Entry HV Adj Factor	0.978	0.971	0.977
Flow Entry, veh/h	87	973	1109
Cap Entry, veh/h	487	1250	1328
V/C Ratio	0.178	0.778	0.835
Control Delay, s/veh	9.9	16.0	18.7
LOS	A	C	C
95th %tile Queue, veh	1	8	11

Intersection	
Intersection Delay, s/veh	24.7
Intersection LOS	C

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	393	1119	942
Demand Flow Rate, veh/h	402	1150	962
Vehicles Circulating, veh/h	923	14	253
Vehicles Exiting, veh/h	292	1311	911
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	28.1	19.5	29.4
Approach LOS	D	C	D

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	402	1150	962
Cap Entry Lane, veh/h	538	1360	1066
Entry HV Adj Factor	0.978	0.973	0.979
Flow Entry, veh/h	393	1119	942
Cap Entry, veh/h	526	1323	1044
V/C Ratio	0.747	0.845	0.902
Control Delay, s/veh	28.1	19.5	29.4
LOS	D	C	D
95th %tile Queue, veh	6	11	13

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	127	30	62	39	37	754	64	181	877	170
Future Volume (vph)	127	30	62	39	37	754	64	181	877	170
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	52.2	52.2	12.8	55.5	55.5
Total Split (%)	20.5%	20.5%	20.5%	20.5%	8.6%	47.5%	47.5%	11.6%	50.5%	50.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	12.5	15.5	9.0	9.7	53.0	48.0	48.0	60.2	55.5	55.5
Actuated g/C Ratio	0.13	0.16	0.09	0.10	0.55	0.50	0.50	0.62	0.57	0.57
v/c Ratio	0.59	0.26	0.40	0.73	0.22	0.86	0.08	0.73	0.86	0.18
Control Delay	51.6	19.4	50.2	24.4	12.4	34.4	1.5	31.7	30.7	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.6	19.4	50.2	24.4	12.4	34.4	1.5	31.7	30.7	5.3
LOS	D	B	D	C	B	C	A	C	C	A
Approach Delay		39.4		29.9		30.9			27.3	
Approach LOS		D		C		C			C	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 96.7	
Natural Cycle: 110	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 29.8	Intersection LOS: C
Intersection Capacity Utilization 86.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Future Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	173	178		107	103		277	1050		373	1119	
Arrive On Green	0.10	0.10	0.00	0.06	0.06	0.00	0.04	0.57	0.00	0.07	0.60	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	6.3	1.3	0.0	3.0	1.8	0.0	0.8	27.1	0.0	3.7	32.7	0.0
Cycle Q Clear(g_c), s	6.3	1.3	0.0	3.0	1.8	0.0	0.8	27.1	0.0	3.7	32.7	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	173	178		107	103		277	1050		373	1119	
V/C Ratio(X)	0.76	0.17		0.61	0.40		0.14	0.75		0.51	0.82	
Avail Cap(c_a), veh/h	370	395		376	386		318	1050		426	1119	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.4	35.5	0.0	39.1	38.8	0.0	12.6	13.9	0.0	12.4	13.5	0.0
Incr Delay (d2), s/veh	6.7	0.5	0.0	5.5	2.5	0.0	0.2	4.9	0.0	1.1	6.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.6	0.0	1.5	0.9	0.0	0.3	11.5	0.0	1.3	13.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.2	35.9	0.0	44.6	41.3	0.0	12.8	18.8	0.0	13.4	20.1	0.0
LnGrp LOS	D	D		D	D		B	B		B	C	
Approach Vol, veh/h		163	A		106	A		824	A		1103	A
Approach Delay, s/veh		42.6			43.3			18.5			19.0	
Approach LOS		D			D			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.3	52.7	9.6	12.6	7.5	55.5	12.9	9.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.3	47.7	18.0	18.0	5.0	51.0	18.0	18.0
Max Q Clear Time (g_c+I1), s	5.7	29.1	5.0	3.3	2.8	34.7	8.3	3.8
Green Ext Time (p_c), s	0.1	5.6	0.1	0.1	0.0	6.6	0.2	0.1

Intersection Summary	
HCM 6th Ctrl Delay	21.7
HCM 6th LOS	C

Notes

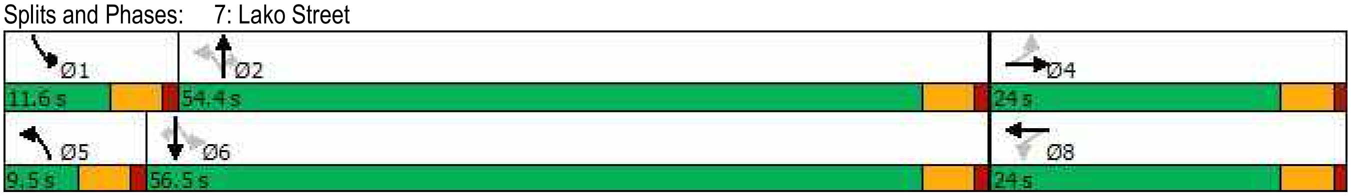
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	127	30	62	39	37	754	64	181	877	170
Future Volume (vph)	127	30	62	39	37	754	64	181	877	170
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	24.0	24.0	24.0	24.0	9.5	54.4	54.4	11.6	56.5	56.5
Total Split (%)	26.7%	26.7%	26.7%	26.7%	10.6%	60.4%	60.4%	12.9%	62.8%	62.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	18.0	18.0	18.0	18.0	55.0	50.0	50.0	60.0	55.9	55.9
Actuated g/C Ratio	0.20	0.20	0.20	0.20	0.62	0.56	0.56	0.68	0.63	0.63
v/c Ratio	0.94	0.21	0.24	0.50	0.15	0.75	0.07	0.57	0.78	0.17
Control Delay	97.9	15.5	32.0	11.3	6.2	20.9	2.4	12.2	19.8	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	97.9	15.5	32.0	11.3	6.2	20.9	2.4	12.2	19.8	1.8
LOS	F	B	C	B	A	C	A	B	B	A
Approach Delay		66.5		15.7		18.9			16.2	
Approach LOS		E		B		B			B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 88.5
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 21.0 Intersection LOS: C
Intersection Capacity Utilization 86.3% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Future Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	257	268		268	262		347	1159		440	1218	
Arrive On Green	0.14	0.14	0.00	0.14	0.14	0.00	0.04	0.62	0.00	0.06	0.65	0.00
Sat Flow, veh/h	1344	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Grp Sat Flow(s),veh/h/ln	1344	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	7.6	1.2	0.0	3.4	1.6	0.0	0.6	22.0	0.0	3.0	26.6	0.0
Cycle Q Clear(g_c), s	9.2	1.2	0.0	4.6	1.6	0.0	0.6	22.0	0.0	3.0	26.6	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	257	268		268	262		347	1159		440	1218	
V/C Ratio(X)	0.51	0.12		0.24	0.16		0.11	0.68		0.43	0.75	
Avail Cap(c_a), veh/h	392	457		407	446		393	1159		486	1218	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	34.0	29.8	0.0	31.8	30.0	0.0	8.7	9.8	0.0	8.5	9.5	0.0
Incr Delay (d2), s/veh	1.6	0.2	0.0	0.5	0.3	0.0	0.1	3.2	0.0	0.7	4.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	0.5	0.0	1.2	0.7	0.0	0.2	8.4	0.0	0.9	10.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.6	30.0	0.0	32.3	30.2	0.0	8.9	12.9	0.0	9.2	13.8	0.0
LnGrp LOS	D	C		C	C		A	B		A	B	
Approach Vol, veh/h		163	A		106	A		824	A		1103	A
Approach Delay, s/veh		34.5			31.5			12.7			13.0	
Approach LOS		C			C			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	54.4		16.0	7.4	56.5		16.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.1	49.9		19.5	5.0	52.0		19.5				
Max Q Clear Time (g_c+I1), s	5.0	24.0		11.2	2.6	28.6		6.6				
Green Ext Time (p_c), s	0.1	6.4		0.3	0.0	7.8		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			15.4									
HCM 6th LOS			B									

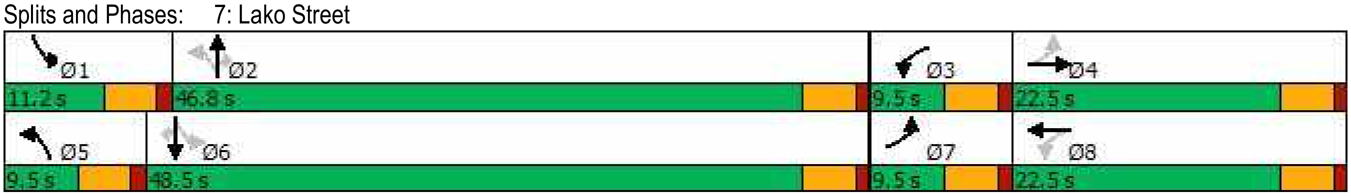
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	127	30	62	39	37	754	64	181	877	170
Future Volume (vph)	127	30	62	39	37	754	64	181	877	170
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	9.5	22.5	9.5	22.5	9.5	46.8	46.8	11.2	48.5	48.5
Total Split (%)	10.6%	25.0%	10.6%	25.0%	10.6%	52.0%	52.0%	12.4%	53.9%	53.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	14.8	10.9	13.9	8.9	47.4	42.4	42.4	52.0	48.0	48.0
Actuated g/C Ratio	0.18	0.13	0.17	0.11	0.59	0.52	0.52	0.64	0.59	0.59
v/c Ratio	0.70	0.30	0.26	0.69	0.18	0.81	0.08	0.66	0.83	0.18
Control Delay	47.9	18.8	27.3	19.0	7.9	25.7	0.4	20.4	24.4	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.9	18.8	27.3	19.0	7.9	25.7	0.4	20.4	24.4	2.7
LOS	D	B	C	B	A	C	A	C	C	A
Approach Delay		36.9		20.8		23.0			20.8	
Approach LOS		D		C		C			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 81	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 22.8	Intersection LOS: C
Intersection Capacity Utilization 86.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Future Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	267	149		270	114		287	1042		384	1113	
Arrive On Green	0.07	0.08	0.00	0.05	0.06	0.00	0.04	0.56	0.00	0.07	0.59	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	5.0	1.2	0.0	2.5	1.6	0.0	0.7	24.2	0.0	3.3	29.2	0.0
Cycle Q Clear(g_c), s	5.0	1.2	0.0	2.5	1.6	0.0	0.7	24.2	0.0	3.3	29.2	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	267	149		270	114		287	1042		384	1113	
V/C Ratio(X)	0.49	0.21		0.24	0.36		0.14	0.75		0.49	0.82	
Avail Cap(c_a), veh/h	267	447		300	436		339	1042		417	1113	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	31.0	32.4	0.0	30.8	33.8	0.0	11.2	12.5	0.0	11.1	12.1	0.0
Incr Delay (d2), s/veh	1.4	0.7	0.0	0.5	1.9	0.0	0.2	5.0	0.0	1.0	6.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	0.5	0.0	1.1	0.8	0.0	0.2	10.0	0.0	1.1	12.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.4	33.1	0.0	31.3	35.7	0.0	11.5	17.6	0.0	12.1	18.9	0.0
LnGrp LOS	C	C		C	D		B	B		B	B	
Approach Vol, veh/h		163	A		106	A		824	A		1103	A
Approach Delay, s/veh		32.6			33.0			17.3			17.8	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.8	46.8	8.2	10.5	7.3	49.3	9.5	9.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.7	42.3	5.0	18.0	5.0	44.0	5.0	18.0
Max Q Clear Time (g_c+I1), s	5.3	26.2	4.5	3.2	2.7	31.2	7.0	3.6
Green Ext Time (p_c), s	0.1	5.3	0.0	0.1	0.0	5.7	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	19.4
HCM 6th LOS	B

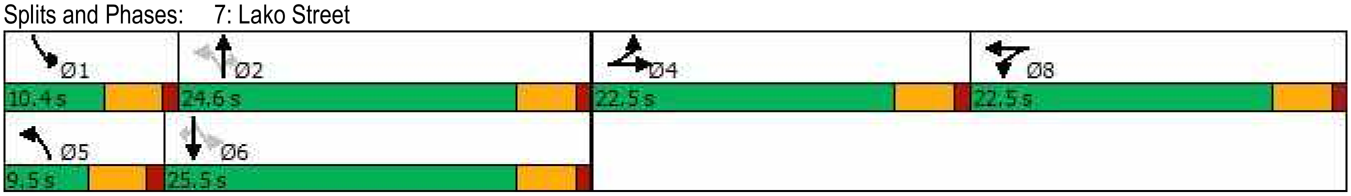
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	127	30	62	39	37	754	64	181	877	170
Future Volume (vph)	127	30	62	39	37	754	64	181	877	170
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	24.6	24.6	10.4	25.5	25.5
Total Split (%)	28.1%	28.1%	28.1%	28.1%	11.9%	30.8%	30.8%	13.0%	31.9%	31.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	10.0	10.0	8.7	8.7	25.8	20.7	20.7	30.1	28.0	28.0
Actuated g/C Ratio	0.16	0.16	0.14	0.14	0.42	0.34	0.34	0.49	0.46	0.46
v/c Ratio	0.46	0.25	0.26	0.61	0.13	0.66	0.11	0.59	0.56	0.22
Control Delay	30.5	14.4	27.3	14.0	12.2	23.3	0.4	22.9	18.8	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.5	14.4	27.3	14.0	12.2	23.3	0.4	22.9	18.8	4.5
LOS	C	B	C	B	B	C	A	C	B	A
Approach Delay		24.4		16.8		21.1			17.4	
Approach LOS		C		B		C			B	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 61.1	
Natural Cycle: 80	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 19.1	Intersection LOS: B
Intersection Capacity Utilization 66.9%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Future Volume (veh/h)	127	30	48	62	39	193	37	754	64	181	877	170
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	187	200		133	137		355	1346		444	1546	
Arrive On Green	0.11	0.11	0.00	0.07	0.07	0.00	0.04	0.38	0.00	0.09	0.43	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	3526	1585	1767	3554	1585
Grp Volume(v), veh/h	132	31	0	65	41	0	39	785	0	189	914	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1763	1585	1767	1777	1585
Q Serve(g_s), s	3.8	0.8	0.0	1.8	1.1	0.0	0.7	9.3	0.0	3.3	10.3	0.0
Cycle Q Clear(g_c), s	3.8	0.8	0.0	1.8	1.1	0.0	0.7	9.3	0.0	3.3	10.3	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	187	200		133	137		355	1346		444	1546	
V/C Ratio(X)	0.70	0.16		0.49	0.30		0.11	0.58		0.43	0.59	
Avail Cap(c_a), veh/h	600	640		609	624		450	1346		475	1546	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	22.7	21.3	0.0	23.4	23.0	0.0	9.5	12.9	0.0	9.1	11.3	0.0
Incr Delay (d2), s/veh	4.8	0.4	0.0	2.7	1.2	0.0	0.1	1.9	0.0	0.6	1.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.3	0.0	0.8	0.5	0.0	0.2	3.5	0.0	1.1	3.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.5	21.7	0.0	26.1	24.3	0.0	9.7	14.8	0.0	9.8	13.0	0.0
LnGrp LOS	C	C		C	C		A	B		A	B	
Approach Vol, veh/h		163	A		106	A		824	A		1103	A
Approach Delay, s/veh		26.4			25.4			14.5			12.4	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	24.6		10.1	6.7	27.4		8.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.9	20.1		18.0	5.0	21.0		18.0				
Max Q Clear Time (g_c+I1), s	5.3	11.3		5.8	2.7	12.3		3.8				
Green Ext Time (p_c), s	0.0	3.5		0.4	0.0	4.1		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			14.9
HCM 6th LOS			B

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Appendix D

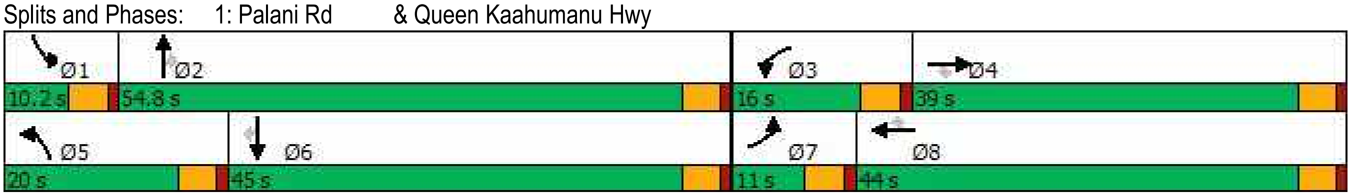
Analysis Reports – Future Without Project Conditions
(2024)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	512	218	164	754	33	243	192	117	21	321	177
Future Volume (vph)	71	512	218	164	754	33	243	192	117	21	321	177
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	11.0	39.0	39.0	16.0	44.0	44.0	20.0	54.8	54.8	10.2	45.0	45.0
Total Split (%)	9.2%	32.5%	32.5%	13.3%	36.7%	36.7%	16.7%	45.7%	45.7%	8.5%	37.5%	37.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	6.4	36.2	36.2	9.6	41.8	41.8	11.9	30.1	30.1	5.8	17.3	17.3
Actuated g/C Ratio	0.07	0.39	0.39	0.10	0.45	0.45	0.13	0.32	0.32	0.06	0.19	0.19
v/c Ratio	0.33	0.41	0.32	0.48	0.50	0.04	0.58	0.17	0.20	0.19	0.50	0.41
Control Delay	49.9	24.4	5.2	46.7	22.8	0.1	45.8	23.4	3.9	51.4	36.3	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.9	24.4	5.2	46.7	22.8	0.1	45.8	23.4	3.9	51.4	36.3	7.6
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		21.4			26.1			29.1			27.1	
Approach LOS		C			C			C			C	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 93.3
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.58
Intersection Signal Delay: 25.6 Intersection LOS: C
Intersection Capacity Utilization 63.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Palani Rd & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	512	218	164	754	33	243	192	117	21	321	177
Future Volume (veh/h)	71	512	218	164	754	33	243	192	117	21	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	522	0	167	769	0	248	196	0	21	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	159	1554		250	1676		344	775		41	498	
Arrive On Green	0.05	0.46	0.00	0.07	0.49	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	522	0	167	769	0	248	196	0	21	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.8	8.0	0.0	3.9	12.0	0.0	5.7	3.7	0.0	0.9	7.1	0.0
Cycle Q Clear(g_c), s	1.8	8.0	0.0	3.9	12.0	0.0	5.7	3.7	0.0	0.9	7.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	159	1554		250	1676		344	775		41	498	
V/C Ratio(X)	0.45	0.34		0.67	0.46		0.72	0.25		0.51	0.66	
Avail Cap(c_a), veh/h	257	1554		482	1676		650	2205		125	1775	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.5	13.8	0.0	36.6	13.7	0.0	35.3	26.2	0.0	39.1	33.0	0.0
Incr Delay (d2), s/veh	2.0	0.6	0.0	3.1	0.9	0.0	2.8	0.2	0.0	9.3	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	2.9	0.0	1.7	4.4	0.0	2.5	1.5	0.0	0.5	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.5	14.4	0.0	39.6	14.6	0.0	38.2	26.4	0.0	48.4	34.5	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		594	A		936	A		444	A		349	A
Approach Delay, s/veh		17.5			19.1			33.0			35.3	
Approach LOS		B			B			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	22.2	10.5	42.0	12.7	15.9	8.5	44.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.7	50.3	11.5	34.5	15.5	40.5	6.5	39.5
Max Q Clear Time (g_c+I1), s	2.9	5.7	5.9	10.0	7.7	9.1	3.8	14.0
Green Ext Time (p_c), s	0.0	1.4	0.2	3.5	0.5	2.3	0.0	5.6

Intersection Summary	
HCM 6th Ctrl Delay	23.8
HCM 6th LOS	C

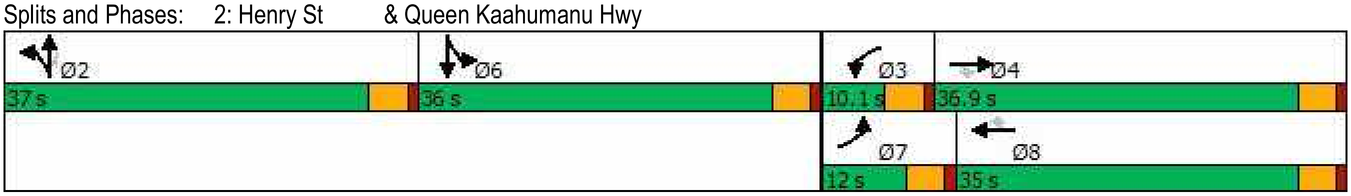
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	107	418	124	57	683	507	146	337	47	403	339
Future Volume (vph)	107	418	124	57	683	507	146	337	47	403	339
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	12.0	36.9	36.9	10.1	35.0	35.0	37.0	37.0	37.0	36.0	36.0
Total Split (%)	10.0%	30.8%	30.8%	8.4%	29.2%	29.2%	30.8%	30.8%	30.8%	30.0%	30.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	7.4	35.1	35.1	5.7	31.0	31.0	18.1	18.1	18.1	25.0	25.0
Actuated g/C Ratio	0.07	0.35	0.35	0.06	0.31	0.31	0.18	0.18	0.18	0.25	0.25
v/c Ratio	0.48	0.37	0.21	0.31	0.67	0.62	0.48	0.60	0.14	0.75	0.73
Control Delay	55.3	28.7	6.5	54.3	35.8	6.7	43.0	41.9	1.1	47.9	39.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.3	28.7	6.5	54.3	35.8	6.7	43.0	41.9	1.1	47.9	39.0
LOS	E	C	A	D	D	A	D	D	A	D	D
Approach Delay		28.8			24.8			38.6			42.0
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 99.8	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 32.3	Intersection LOS: C
Intersection Capacity Utilization 69.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	418	124	57	683	507	146	337	47	403	339	124
Future Volume (vph)	107	418	124	57	683	507	146	337	47	403	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	431	128	59	704	523	151	347	48	415	349	128
RTOR Reduction (vph)	0	0	83	0	0	356	0	0	39	0	20	0
Lane Group Flow (vph)	110	431	45	59	704	167	136	362	9	299	573	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.4	35.1	35.1	4.3	32.0	32.0	18.1	18.1	18.1	25.0	25.0	
Effective Green, g (s)	7.4	35.1	35.1	4.3	32.0	32.0	18.1	18.1	18.1	25.0	25.0	
Actuated g/C Ratio	0.07	0.35	0.35	0.04	0.32	0.32	0.18	0.18	0.18	0.25	0.25	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	228	1146	529	141	1084	492	281	602	267	396	789	
v/s Ratio Prot	c0.04	c0.13		0.02	c0.21		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.11			0.01			
v/c Ratio	0.48	0.38	0.08	0.42	0.65	0.34	0.48	0.60	0.03	0.76	0.73	
Uniform Delay, d1	44.7	24.5	21.9	46.9	29.4	26.2	37.0	37.9	34.0	34.9	34.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.6	0.9	0.3	2.0	3.0	1.9	1.3	1.7	0.0	8.0	3.4	
Delay (s)	46.3	25.4	22.2	48.9	32.4	28.0	38.3	39.6	34.0	42.9	38.0	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		28.3			31.4			38.8			39.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	100.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	16.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	54	156	1132	903	30
Future Vol, veh/h	44	54	156	1132	903	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	58	168	1217	971	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2525	-	972	0	-	0
Stage 1	972	-	-	-	-	-
Stage 2	1553	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 31	0	709	-	-	-
Stage 1	367	0	-	-	-	-
Stage 2	192	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 24	-	708	-	-	-
Mov Cap-2 Maneuver	~ 24	-	-	-	-	-
Stage 1	280	-	-	-	-	-
Stage 2	192	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 798.8	1.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	708	-	24	-	-	-
HCM Lane V/C Ratio	0.237	-	1.971	-	-	-
HCM Control Delay (s)	11.7	-	$ 798.8	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.9	-	5.9	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	1.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	140	1146	15	73	879
Future Vol, veh/h	9	140	1146	15	73	879
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1232	16	78	945

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2341	-	0	0	1232	0
Stage 1	1240	-	-	-	-	-
Stage 2	1101	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.254	-
Pot Cap-1 Maneuver	40	0	-	-	552	-
Stage 1	273	0	-	-	-	-
Stage 2	318	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	34	-	-	-	552	-
Mov Cap-2 Maneuver	34	-	-	-	-	-
Stage 1	273	-	-	-	-	-
Stage 2	273	-	-	-	-	-

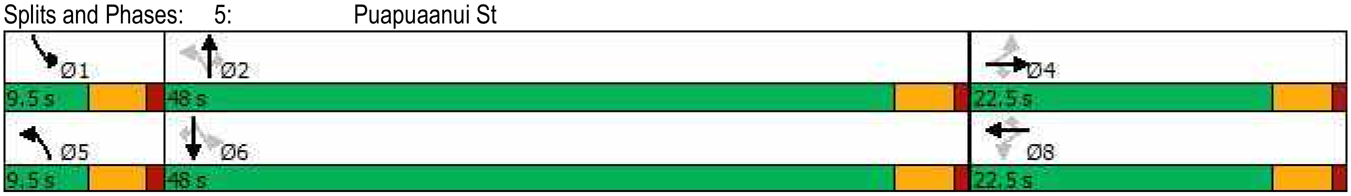
Approach	WB	NB	SB
HCM Control Delay, s	148.6	0	1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	34	-	552	-
HCM Lane V/C Ratio	-	-	0.285	-	0.142	-
HCM Control Delay (s)	-	-	148.6	0	12.6	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	0.9	-	0.5	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	193	9	75	110	59	140	104	841	24	43	780	68
Future Volume (vph)	193	9	75	110	59	140	104	841	24	43	780	68
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	48.0	48.0	9.5	48.0	48.0
Total Split (%)	28.1%	28.1%	28.1%	28.1%	28.1%	28.1%	11.9%	60.0%	60.0%	11.9%	60.0%	60.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	15.6	15.6	15.6	15.6	15.6	15.6	49.1	46.2	46.2	48.2	44.3	44.3
Actuated g/C Ratio	0.20	0.20	0.20	0.20	0.20	0.20	0.64	0.61	0.61	0.63	0.58	0.58
v/c Ratio	0.77	0.03	0.21	0.41	0.17	0.34	0.39	0.80	0.03	0.17	0.79	0.08
Control Delay	49.5	24.4	8.1	31.5	26.4	7.2	8.9	21.2	0.0	6.3	21.4	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.5	24.4	8.1	31.5	26.4	7.2	8.9	21.2	0.0	6.3	21.4	2.2
LOS	D	C	A	C	C	A	A	C	A	A	C	A
Approach Delay		37.4			19.5			19.4			19.1	
Approach LOS		D			B			B			B	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 76.3	
Natural Cycle: 80	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 21.4	Intersection LOS: C
Intersection Capacity Utilization 77.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 5: Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	193	9	75	110	59	140	104	841	24	43	780	68
Future Volume (veh/h)	193	9	75	110	59	140	104	841	24	43	780	68
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1856	1870	1870	1826	1870
Adj Flow Rate, veh/h	210	10	0	117	64	0	113	895	0	46	830	0
Peak Hour Factor	0.92	0.92	0.92	0.94	0.92	0.94	0.92	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	3	2	2	5	2
Cap, veh/h	333	389		379	389		324	1072		279	1022	
Arrive On Green	0.21	0.21	0.00	0.21	0.21	0.00	0.06	0.58	0.00	0.04	0.56	0.00
Sat Flow, veh/h	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Grp Volume(v), veh/h	210	10	0	117	64	0	113	895	0	46	830	0
Grp Sat Flow(s),veh/h/ln	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Q Serve(g_s), s	11.9	0.3	0.0	5.6	2.2	0.0	2.0	30.6	0.0	0.8	28.5	0.0
Cycle Q Clear(g_c), s	14.1	0.3	0.0	6.0	2.2	0.0	2.0	30.6	0.0	0.8	28.5	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	333	389		379	389		324	1072		279	1022	
V/C Ratio(X)	0.63	0.03		0.31	0.16		0.35	0.83		0.16	0.81	
Avail Cap(c_a), veh/h	365	433		412	433		334	1072		322	1022	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	31.0	24.5	0.0	26.9	25.2	0.0	12.4	13.4	0.0	12.3	13.8	0.0
Incr Delay (d2), s/veh	3.0	0.0	0.0	0.5	0.2	0.0	0.6	7.7	0.0	0.3	7.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.1	0.0	1.9	1.0	0.0	0.7	13.1	0.0	0.3	12.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.0	24.5	0.0	27.3	25.4	0.0	13.0	21.1	0.0	12.6	20.9	0.0
LnGrp LOS	C	C		C	C		B	C		B	C	
Approach Vol, veh/h		220	A		181	A		1008	A		876	A
Approach Delay, s/veh		33.6			26.7			20.2			20.4	
Approach LOS		C			C			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.6	49.4		20.7	9.1	48.0		20.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	43.5		18.0	5.0	43.5		18.0				
Max Q Clear Time (g_c+I1), s	2.8	32.6		16.1	4.0	30.5		8.0				
Green Ext Time (p_c), s	0.0	5.0		0.1	0.0	5.1		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			22.1									
HCM 6th LOS			C									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	10					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	159	602	900	905	0
Future Vol, veh/h	0	159	602	900	905	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	0	171	647	968	973	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3235	-	973	0	-	0
Stage 1	973	-	-	-	-	-
Stage 2	2262	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	11	0	709	-	-	-
Stage 1	366	0	-	-	-	-
Stage 2	84	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1	-	709	-	-	-
Mov Cap-2 Maneuver	1	-	-	-	-	-
Stage 1	32	-	-	-	-	-
Stage 2	84	-	-	-	-	-

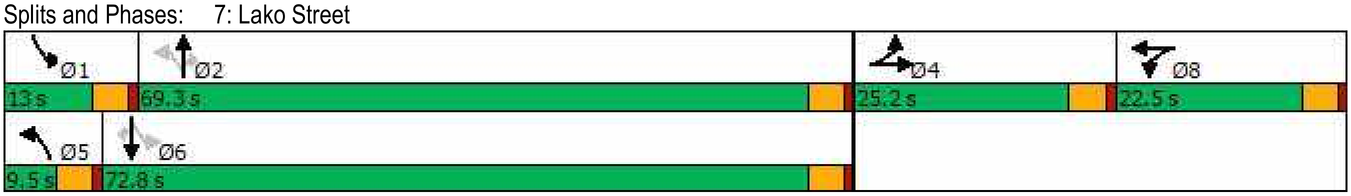
Approach	EB	NB	SB
HCM Control Delay, s	0	16.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	709	-	-	-	-	-
HCM Lane V/C Ratio	0.913	-	-	-	-	-
HCM Control Delay (s)	40.2	-	0	0	-	-
HCM Lane LOS	E	-	A	A	-	-
HCM 95th %tile Q(veh)	12.2	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	278	48	69	36	33	918	55	160	769	142
Future Volume (vph)	278	48	69	36	33	918	55	160	769	142
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	25.2	25.2	22.5	22.5	9.5	69.3	69.3	13.0	72.8	72.8
Total Split (%)	19.4%	19.4%	17.3%	17.3%	7.3%	53.3%	53.3%	10.0%	56.0%	56.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	20.7	20.7	18.0	18.0	69.8	64.8	64.8	77.2	72.1	72.1
Actuated g/C Ratio	0.16	0.16	0.14	0.14	0.54	0.50	0.50	0.59	0.55	0.55
v/c Ratio	1.05	0.40	0.30	1.04	0.17	1.05	0.07	1.04	0.80	0.16
Control Delay	120.4	34.4	54.2	93.6	13.0	76.8	1.5	113.4	31.5	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	120.4	34.4	54.2	93.6	13.0	76.8	1.5	113.4	31.5	4.8
LOS	F	C	D	F	B	E	A	F	C	A
Approach Delay		95.0		86.9		70.6			40.2	
Approach LOS		F		F		E			D	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Natural Cycle: 130	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.05	
Intersection Signal Delay: 64.9	Intersection LOS: E
Intersection Capacity Utilization 107.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	48	69	69	36	296	33	918	55	160	769	142
Future Volume (veh/h)	278	48	69	69	36	296	33	918	55	160	769	142
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	296	51	0	73	38	0	35	977	0	170	818	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	314	330		105	111		282	1032		198	1080	
Arrive On Green	0.18	0.18	0.00	0.06	0.06	0.00	0.03	0.55	0.00	0.06	0.58	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	296	51	0	73	38	0	35	977	0	170	818	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	19.3	2.7	0.0	4.8	2.3	0.0	1.0	57.5	0.0	4.9	38.7	0.0
Cycle Q Clear(g_c), s	19.3	2.7	0.0	4.8	2.3	0.0	1.0	57.5	0.0	4.9	38.7	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	314	330		105	111		282	1032		198	1080	
V/C Ratio(X)	0.94	0.15		0.69	0.34		0.12	0.95		0.86	0.76	
Avail Cap(c_a), veh/h	314	330		271	287		306	1032		221	1080	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	47.8	40.9	0.0	54.2	53.0	0.0	16.1	24.7	0.0	27.1	18.4	0.0
Incr Delay (d2), s/veh	35.8	0.2	0.0	7.9	1.8	0.0	0.2	17.8	0.0	25.6	5.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.6	1.3	0.0	2.3	1.1	0.0	0.4	29.1	0.0	4.0	17.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	83.6	41.2	0.0	62.1	54.8	0.0	16.3	42.4	0.0	52.7	23.3	0.0
LnGrp LOS	F	D		E	D		B	D		D	C	
Approach Vol, veh/h		347	A		111	A		1012	A		988	A
Approach Delay, s/veh		77.4			59.6			41.5			28.4	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.4	69.3		25.2	7.9	72.8		11.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.5	64.8		20.7	5.0	68.3		18.0				
Max Q Clear Time (g_c+I1), s	6.9	59.5		21.3	3.0	40.7		6.8				
Green Ext Time (p_c), s	0.1	3.2		0.0	0.0	6.9		0.2				

Intersection Summary			
HCM 6th Ctrl Delay			42.1
HCM 6th LOS			D

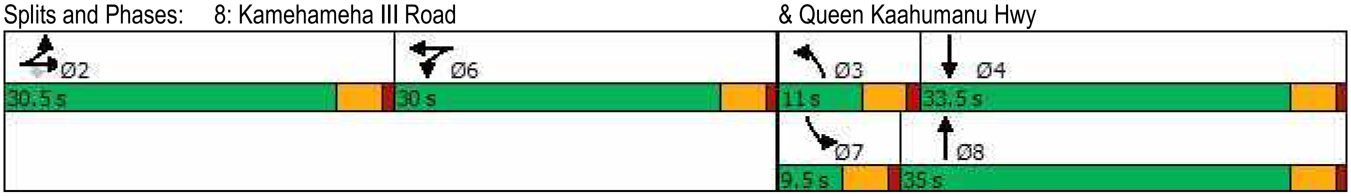
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	5	26	12	76	562	16	490
Future Volume (vph)	5	26	12	76	562	16	490
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	11.0	35.0	9.5	33.5
Total Split (%)	29.0%	29.0%	28.6%	10.5%	33.3%	9.0%	31.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	13.7	13.7	7.1	6.7	39.4	5.1	29.8
Actuated g/C Ratio	0.19	0.19	0.10	0.09	0.56	0.07	0.42
v/c Ratio	0.59	0.08	0.26	0.53	0.62	0.13	0.61
Control Delay	34.6	0.4	27.3	49.1	19.4	38.4	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.6	0.4	27.3	49.1	19.4	38.4	17.4
LOS	C	A	C	D	B	D	B
Approach Delay	30.4		27.3		22.9		17.8
Approach LOS	C		C		C		B

Intersection Summary	
Cycle Length: 105	
Actuated Cycle Length: 70.7	
Natural Cycle: 105	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.62	
Intersection Signal Delay: 21.5	Intersection LOS: C
Intersection Capacity Utilization 62.7%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 8: Kamehameha III Road & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	179	5	26	16	12	17	76	562	15	16	490	320
Future Volume (veh/h)	179	5	26	16	12	17	76	562	15	16	490	320
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1722	1870	1781	1796	1752	1811	1870	1870	1811	1811
Adj Flow Rate, veh/h	192	5	0	17	13	18	82	604	16	17	527	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	2	12	2	8	7	10	6	2	2	6	6
Cap, veh/h	260	7		26	20	27	102	877	23	36	1579	
Arrive On Green	0.15	0.15	0.00	0.05	0.05	0.05	0.06	0.50	0.50	0.02	0.46	0.00
Sat Flow, veh/h	1738	45	1459	570	436	604	1668	1755	46	1781	3532	0
Grp Volume(v), veh/h	197	0	0	48	0	0	82	0	620	17	527	0
Grp Sat Flow(s),veh/h/ln	1783	0	1459	1611	0	0	1668	0	1802	1781	1721	0
Q Serve(g_s), s	6.7	0.0	0.0	1.9	0.0	0.0	3.1	0.0	16.6	0.6	6.2	0.0
Cycle Q Clear(g_c), s	6.7	0.0	0.0	1.9	0.0	0.0	3.1	0.0	16.6	0.6	6.2	0.0
Prop In Lane	0.97		1.00	0.35		0.37	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	267	0		73	0	0	102	0	901	36	1579	
V/C Ratio(X)	0.74	0.00		0.66	0.00	0.00	0.80	0.00	0.69	0.47	0.33	
Avail Cap(c_a), veh/h	734	0		650	0	0	172	0	901	141	1579	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	25.7	0.0	0.0	29.7	0.0	0.0	29.3	0.0	12.0	30.6	10.9	0.0
Incr Delay (d2), s/veh	4.0	0.0	0.0	9.8	0.0	0.0	13.3	0.0	4.3	9.0	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	0.0	0.9	0.0	0.0	1.5	0.0	6.0	0.3	2.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.6	0.0	0.0	39.5	0.0	0.0	42.6	0.0	16.3	39.7	11.5	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		197	A		48			702			544	A
Approach Delay, s/veh		29.6			39.5			19.4			12.4	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	2	3	4	6	7	8
Phs Duration (G+Y+Rc), s	14.0	8.4	33.5	7.3	5.8	36.1
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	26.0	6.5	29.0	25.5	5.0	30.5
Max Q Clear Time (g_c+I1), s	8.7	5.1	8.2	3.9	2.6	18.6
Green Ext Time (p_c), s	1.0	0.0	3.1	0.2	0.0	3.0

Intersection Summary	
HCM 6th Ctrl Delay	18.8
HCM 6th LOS	B

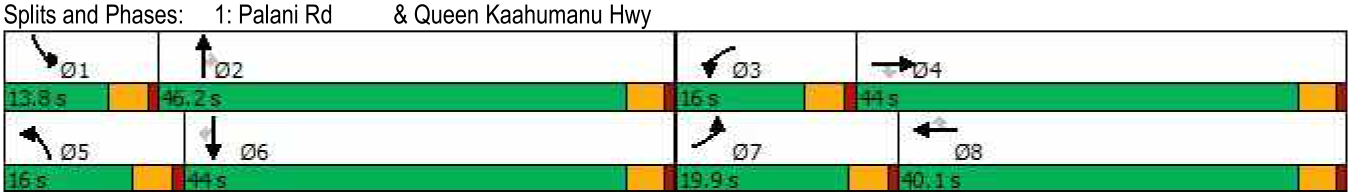
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	978	503	226	682	56	227	283	263	54	313	107
Future Volume (vph)	260	978	503	226	682	56	227	283	263	54	313	107
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	19.9	44.0	44.0	16.0	40.1	40.1	16.0	46.2	46.2	13.8	44.0	44.0
Total Split (%)	16.6%	36.7%	36.7%	13.3%	33.4%	33.4%	13.3%	38.5%	38.5%	11.5%	36.7%	36.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	12.3	40.0	40.0	10.7	38.4	38.4	10.8	22.4	22.4	7.9	17.2	17.2
Actuated g/C Ratio	0.13	0.41	0.41	0.11	0.40	0.40	0.11	0.23	0.23	0.08	0.18	0.18
v/c Ratio	0.61	0.69	0.59	0.61	0.51	0.08	0.62	0.35	0.47	0.38	0.51	0.30
Control Delay	48.0	28.4	10.0	50.3	26.0	1.8	50.5	33.0	6.6	53.2	38.2	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.0	28.4	10.0	50.3	26.0	1.8	50.5	33.0	6.6	53.2	38.2	8.2
LOS	D	C	B	D	C	A	D	C	A	D	D	A
Approach Delay		26.0			30.3			29.2			33.2	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 96.9	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 28.5	Intersection LOS: C
Intersection Capacity Utilization 66.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	978	503	226	682	56	227	283	263	54	313	107
Future Volume (veh/h)	260	978	503	226	682	56	227	283	263	54	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	998	0	231	696	0	232	289	0	55	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	357	1635		316	1577		316	678		76	502	
Arrive On Green	0.10	0.46	0.00	0.09	0.45	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	998	0	231	696	0	232	289	0	55	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.4	18.0	0.0	5.5	11.6	0.0	5.6	6.1	0.0	2.6	7.2	0.0
Cycle Q Clear(g_c), s	6.4	18.0	0.0	5.5	11.6	0.0	5.6	6.1	0.0	2.6	7.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	357	1635		316	1577		316	678		76	502	
V/C Ratio(X)	0.74	0.61		0.73	0.44		0.73	0.43		0.72	0.64	
Avail Cap(c_a), veh/h	620	1635		467	1577		463	1740		194	1648	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.0	17.1	0.0	37.7	16.0	0.0	37.6	30.4	0.0	40.3	34.5	0.0
Incr Delay (d2), s/veh	3.0	1.7	0.0	3.3	0.9	0.0	3.3	0.4	0.0	12.1	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	7.1	0.0	2.4	4.5	0.0	2.5	2.6	0.0	1.4	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.1	18.8	0.0	40.9	16.9	0.0	41.0	30.8	0.0	52.4	35.8	0.0
LnGrp LOS	D	B		D	B		D	C		D	D	
Approach Vol, veh/h		1263	A		927	A		521	A		374	A
Approach Delay, s/veh		23.3			22.9			35.3			38.3	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	20.8	12.3	44.0	12.4	16.5	13.4	42.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.3	41.7	11.5	39.5	11.5	39.5	15.4	35.6
Max Q Clear Time (g_c+I1), s	4.6	8.1	7.5	20.0	7.6	9.2	8.4	13.6
Green Ext Time (p_c), s	0.0	2.0	0.3	6.9	0.3	2.2	0.5	4.7

Intersection Summary	
HCM 6th Ctrl Delay	27.0
HCM 6th LOS	C

Notes

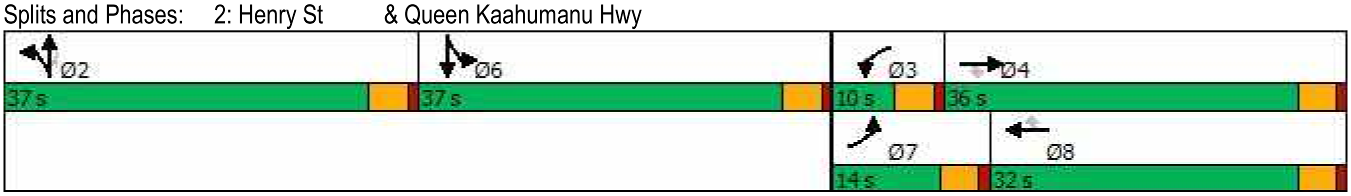
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	190	772	291	80	636	348	126	318	38	388	342
Future Volume (vph)	190	772	291	80	636	348	126	318	38	388	342
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	14.0	36.0	36.0	10.0	32.0	32.0	37.0	37.0	37.0	37.0	37.0
Total Split (%)	11.7%	30.0%	30.0%	8.3%	26.7%	26.7%	30.8%	30.8%	30.8%	30.8%	30.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	9.3	34.1	34.1	5.6	28.0	28.0	17.3	17.3	17.3	26.2	26.2
Actuated g/C Ratio	0.09	0.34	0.34	0.06	0.28	0.28	0.17	0.17	0.17	0.26	0.26
v/c Ratio	0.62	0.65	0.40	0.42	0.66	0.51	0.42	0.57	0.11	0.74	0.70
Control Delay	55.1	33.7	5.6	56.3	37.5	6.7	41.8	41.7	0.7	45.9	35.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.1	33.7	5.6	56.3	37.5	6.7	41.8	41.7	0.7	45.9	35.1
LOS	E	C	A	E	D	A	D	D	A	D	D
Approach Delay		30.4			28.9			38.5			38.8
Approach LOS		C			C			D			D

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 99.1
Natural Cycle: 115
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 33.1 Intersection LOS: C
Intersection Capacity Utilization 73.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 2: Henry St & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	772	291	80	636	348	126	318	38	388	342	190
Future Volume (vph)	190	772	291	80	636	348	126	318	38	388	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	788	297	82	649	355	129	324	39	396	349	194
RTOR Reduction (vph)	0	0	196	0	0	252	0	0	32	0	40	0
Lane Group Flow (vph)	194	788	101	82	649	103	116	337	7	317	582	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.3	34.1	34.1	4.3	29.1	29.1	17.3	17.3	17.3	26.2	26.2	
Effective Green, g (s)	9.3	34.1	34.1	4.3	29.1	29.1	17.3	17.3	17.3	26.2	26.2	
Actuated g/C Ratio	0.09	0.34	0.34	0.04	0.29	0.29	0.17	0.17	0.17	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	310	1208	540	147	1011	454	276	585	266	422	837	
v/s Ratio Prot	c0.06	c0.22		0.02	0.19		0.07	c0.10		c0.20	0.18	
v/s Ratio Perm			0.06			0.07			0.00			
v/c Ratio	0.63	0.65	0.19	0.56	0.64	0.23	0.42	0.58	0.03	0.75	0.70	
Uniform Delay, d1	43.6	27.9	23.2	46.9	30.9	26.9	36.8	37.9	34.3	33.9	33.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.9	2.7	0.8	4.5	3.1	1.2	1.0	1.4	0.0	7.4	2.5	
Delay (s)	47.5	30.6	23.9	51.4	34.0	28.0	37.9	39.3	34.3	41.2	35.8	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		31.6			33.4			38.6			37.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	99.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	83	83	1072	1175	17
Future Vol, veh/h	10	83	83	1072	1175	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	86	86	1105	1211	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2488	-	1211	0	-	0
Stage 1	1211	-	-	-	-	-
Stage 2	1277	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	32	0	576	-	-	-
Stage 1	282	0	-	-	-	-
Stage 2	262	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	27	-	576	-	-	-
Mov Cap-2 Maneuver	27	-	-	-	-	-
Stage 1	240	-	-	-	-	-
Stage 2	262	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	204.8	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	576	-	27	-	-	-
HCM Lane V/C Ratio	0.149	-	0.382	-	-	-
HCM Control Delay (s)	12.3	-	204.8	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.5	-	1.2	-	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	1089	4	61	1198
Future Vol, veh/h	14	71	1089	4	61	1198
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	1123	4	63	1235

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2486	-	0	0	1123	0
Stage 1	1125	-	-	-	-	-
Stage 2	1361	-	-	-	-	-
Critical Hdwy	6.47	-	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	-	-	-	2.272	-
Pot Cap-1 Maneuver	31	0	-	-	600	-
Stage 1	303	0	-	-	-	-
Stage 2	233	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	28	-	-	-	600	-
Mov Cap-2 Maneuver	28	-	-	-	-	-
Stage 1	303	-	-	-	-	-
Stage 2	209	-	-	-	-	-

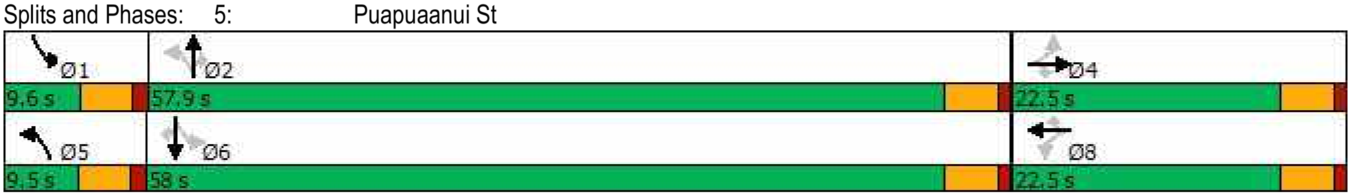
Approach	WB	NB	SB
HCM Control Delay, s	228.8	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	28	-	600	-
HCM Lane V/C Ratio	-	-	0.515	-	0.105	-
HCM Control Delay (s)	-	-	228.8	0	11.7	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	1.6	-	0.3	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	199	23	116	50	23	104	105	773	58	142	973	100
Future Volume (vph)	199	23	116	50	23	104	105	773	58	142	973	100
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	57.9	57.9	9.6	58.0	58.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	10.6%	64.3%	64.3%	10.7%	64.4%	64.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.6	16.6	16.6	16.6	16.6	16.6	58.4	53.4	53.4	58.6	53.5	53.5
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.19	0.19	0.66	0.60	0.60	0.66	0.60	0.60
v/c Ratio	0.84	0.07	0.32	0.20	0.07	0.29	0.61	0.72	0.06	0.44	0.89	0.11
Control Delay	62.6	30.0	8.3	32.4	30.0	8.6	25.2	17.3	1.7	8.8	27.7	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	30.0	8.3	32.4	30.0	8.6	25.2	17.3	1.7	8.8	27.7	1.9
LOS	E	C	A	C	C	A	C	B	A	A	C	A
Approach Delay		41.7			18.2			17.3			23.3	
Approach LOS		D			B			B			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 88.6	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 23.3	Intersection LOS: C
Intersection Capacity Utilization 86.0%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 5: Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	23	116	50	23	104	105	773	58	142	973	100
Future Volume (veh/h)	199	23	116	50	23	104	105	773	58	142	973	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1826	1870	1856	1841	1870	1870	1870
Adj Flow Rate, veh/h	216	25	0	52	25	0	114	797	0	146	1003	0
Peak Hour Factor	0.92	0.92	0.92	0.97	0.92	0.97	0.92	0.97	0.97	0.97	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	5	2	3	4	2	2	2
Cap, veh/h	326	350		326	350		262	1122		389	1135	
Arrive On Green	0.19	0.19	0.00	0.19	0.19	0.00	0.05	0.60	0.00	0.06	0.61	0.00
Sat Flow, veh/h	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Grp Volume(v), veh/h	216	25	0	52	25	0	114	797	0	146	1003	0
Grp Sat Flow(s),veh/h/ln	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Q Serve(g_s), s	13.4	1.0	0.0	2.8	1.0	0.0	2.1	26.3	0.0	2.7	40.1	0.0
Cycle Q Clear(g_c), s	14.4	1.0	0.0	3.8	1.0	0.0	2.1	26.3	0.0	2.7	40.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	326	350		326	350		262	1122		389	1135	
V/C Ratio(X)	0.66	0.07		0.16	0.07		0.44	0.71		0.38	0.88	
Avail Cap(c_a), veh/h	349	381		349	381		268	1122		394	1135	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.5	29.6	0.0	31.1	29.6	0.0	16.9	12.1	0.0	10.5	14.7	0.0
Incr Delay (d2), s/veh	4.3	0.1	0.0	0.2	0.1	0.0	1.1	3.8	0.0	0.6	10.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.4	0.0	1.0	0.4	0.0	1.3	10.7	0.0	0.9	17.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.8	29.6	0.0	31.4	29.6	0.0	18.0	15.9	0.0	11.1	24.8	0.0
LnGrp LOS	D	C		C	C		B	B		B	C	
Approach Vol, veh/h		241	A		77	A		911	A		1149	A
Approach Delay, s/veh		38.7			30.8			16.2			23.1	
Approach LOS		D			C			B			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.4	57.9		21.0	9.2	58.1		21.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.1	53.4		18.0	5.0	53.5		18.0				
Max Q Clear Time (g_c+I1), s	4.7	28.3		16.4	4.1	42.1		5.8				
Green Ext Time (p_c), s	0.0	6.5		0.1	0.0	6.0		0.1				

Intersection Summary			
HCM 6th Ctrl Delay			22.3
HCM 6th LOS			C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	325	340	938	1109	0
Future Vol, veh/h	0	325	340	938	1109	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	0	332	347	957	1132	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2783	-	1132	0	-	0
Stage 1	1132	-	-	-	-	-
Stage 2	1651	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	20	0	617	-	-	-
Stage 1	299	0	-	-	-	-
Stage 2	166	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	9	-	617	-	-	-
Mov Cap-2 Maneuver	9	-	-	-	-	-
Stage 1	131	-	-	-	-	-
Stage 2	166	-	-	-	-	-

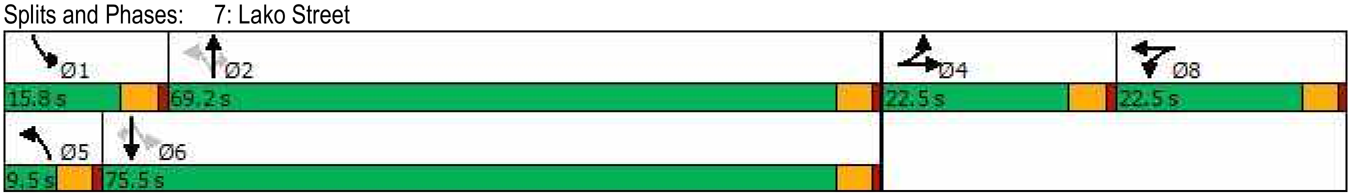
Approach	EB	NB	SB
HCM Control Delay, s	0	4.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	617	-	-	-	-	-
HCM Lane V/C Ratio	0.562	-	-	-	-	-
HCM Control Delay (s)	18.1	-	0	0	-	-
HCM Lane LOS	C	-	A	A	-	-
HCM 95th %tile Q(veh)	3.5	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	143	30	62	39	37	888	64	200	1015	188
Future Volume (vph)	143	30	62	39	37	888	64	200	1015	188
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	69.2	69.2	15.8	75.5	75.5
Total Split (%)	17.3%	17.3%	17.3%	17.3%	7.3%	53.2%	53.2%	12.2%	58.1%	58.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	14.7	14.7	12.6	12.6	70.0	65.0	65.0	80.9	75.4	75.4
Actuated g/C Ratio	0.12	0.12	0.10	0.10	0.57	0.53	0.53	0.66	0.62	0.62
v/c Ratio	0.71	0.33	0.36	0.83	0.30	0.94	0.08	0.94	0.92	0.19
Control Delay	71.1	26.5	56.4	40.3	15.8	46.0	0.2	79.5	36.8	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.1	26.5	56.4	40.3	15.8	46.0	0.2	79.5	36.8	5.7
LOS	E	C	E	D	B	D	A	E	D	A
Approach Delay		55.4		43.4		41.9			38.7	
Approach LOS		E		D		D			D	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 121.8	
Natural Cycle: 130	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 41.6	Intersection LOS: D
Intersection Capacity Utilization 96.2%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	143	30	48	62	39	218	37	888	64	200	1015	188
Future Volume (veh/h)	143	30	48	62	39	218	37	888	64	200	1015	188
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	149	31	0	65	41	0	39	925	0	208	1057	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	182	194		96	99		221	1143		316	1210	
Arrive On Green	0.10	0.10	0.00	0.05	0.05	0.00	0.03	0.62	0.00	0.06	0.65	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	149	31	0	65	41	0	39	925	0	208	1057	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	9.1	1.7	0.0	3.9	2.4	0.0	0.9	41.9	0.0	4.6	50.4	0.0
Cycle Q Clear(g_c), s	9.1	1.7	0.0	3.9	2.4	0.0	0.9	41.9	0.0	4.6	50.4	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	182	194		96	99		221	1143		316	1210	
V/C Ratio(X)	0.82	0.16		0.68	0.42		0.18	0.81		0.66	0.87	
Avail Cap(c_a), veh/h	287	307		292	299		245	1143		388	1210	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	48.2	44.8	0.0	51.0	50.3	0.0	17.8	16.1	0.0	18.9	15.8	0.0
Incr Delay (d2), s/veh	9.8	0.4	0.0	8.0	2.8	0.0	0.4	6.2	0.0	2.9	8.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	0.8	0.0	2.0	1.2	0.0	0.5	18.3	0.0	3.1	22.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.0	45.2	0.0	59.0	53.0	0.0	18.2	22.3	0.0	21.8	24.7	0.0
LnGrp LOS	E	D		E	D		B	C		C	C	
Approach Vol, veh/h		180	A		106	A		964	A		1265	A
Approach Delay, s/veh		55.8			56.7			22.2			24.2	
Approach LOS		E			E			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.3	72.2		15.9	8.0	75.5		10.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	11.3	64.7		18.0	5.0	71.0		18.0				
Max Q Clear Time (g_c+I1), s	6.6	43.9		11.1	2.9	52.4		5.9				
Green Ext Time (p_c), s	0.2	7.6		0.3	0.0	8.8		0.2				

Intersection Summary		
HCM 6th Ctrl Delay		27.0
HCM 6th LOS		C

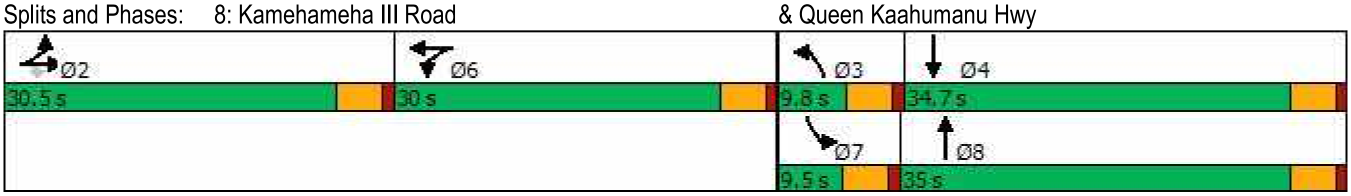
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	11	52	11	64	579	19	595
Future Volume (vph)	11	52	11	64	579	19	595
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	9.8	35.0	9.5	34.7
Total Split (%)	29.0%	29.0%	28.6%	9.3%	33.3%	9.0%	33.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	20.4	20.4	6.8	5.5	35.7	5.2	31.6
Actuated g/C Ratio	0.27	0.27	0.09	0.07	0.48	0.07	0.42
v/c Ratio	0.74	0.11	0.23	0.52	0.71	0.16	0.65
Control Delay	36.6	1.0	26.2	54.9	27.0	42.0	21.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.6	1.0	26.2	54.9	27.0	42.0	21.4
LOS	D	A	C	D	C	D	C
Approach Delay	31.8		26.2		29.7		21.8
Approach LOS	C		C		C		C

Intersection Summary	
Cycle Length: 105	
Actuated Cycle Length: 75	
Natural Cycle: 105	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 26.4	Intersection LOS: C
Intersection Capacity Utilization 71.8%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 8: Kamehameha III Road & Queen Kaahumanu Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	325	11	52	7	11	20	64	579	11	19	595	316
Future Volume (veh/h)	325	11	52	7	11	20	64	579	11	19	595	316
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1767	1811	1870	1870	1870	1856	1856	1870	1870	1870	1870
Adj Flow Rate, veh/h	342	12	0	7	12	21	67	609	12	20	626	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	9	6	2	2	2	3	3	2	2	2	2
Cap, veh/h	403	14		11	19	34	90	804	16	41	1476	
Arrive On Green	0.25	0.25	0.00	0.04	0.04	0.04	0.05	0.44	0.44	0.02	0.42	0.00
Sat Flow, veh/h	1628	57	1535	297	509	890	1767	1813	36	1781	3647	0
Grp Volume(v), veh/h	354	0	0	40	0	0	67	0	621	20	626	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1695	0	0	1767	0	1849	1781	1777	0
Q Serve(g_s), s	14.5	0.0	0.0	1.7	0.0	0.0	2.7	0.0	20.5	0.8	9.1	0.0
Cycle Q Clear(g_c), s	14.5	0.0	0.0	1.7	0.0	0.0	2.7	0.0	20.5	0.8	9.1	0.0
Prop In Lane	0.97		1.00	0.17		0.52	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	418	0		65	0	0	90	0	820	41	1476	
V/C Ratio(X)	0.85	0.00		0.62	0.00	0.00	0.74	0.00	0.76	0.49	0.42	
Avail Cap(c_a), veh/h	603	0		595	0	0	129	0	820	123	1476	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	26.0	0.0	0.0	34.4	0.0	0.0	34.0	0.0	16.9	35.1	15.1	0.0
Incr Delay (d2), s/veh	7.6	0.0	0.0	9.3	0.0	0.0	12.9	0.0	6.5	8.9	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	0.0	0.0	0.8	0.0	0.0	1.4	0.0	8.7	0.4	3.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	33.7	0.0	0.0	43.7	0.0	0.0	46.9	0.0	23.4	44.0	16.0	0.0
LnGrp LOS	C	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		354	A		40			688			646	A
Approach Delay, s/veh		33.7			43.7			25.7			16.8	
Approach LOS		C			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		22.5	8.2	34.7		7.3	6.2	36.7				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		26.0	5.3	30.2		25.5	5.0	30.5				
Max Q Clear Time (g_c+I1), s		16.5	4.7	11.1		3.7	2.8	22.5				
Green Ext Time (p_c), s		1.5	0.0	3.7		0.1	0.0	2.3				

Intersection Summary		
HCM 6th Ctrl Delay		24.4
HCM 6th LOS		C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Intersection Delay, s/veh	125.2
Intersection LOS	F

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	105	1385	1003
Demand Flow Rate, veh/h	107	1412	1062
Vehicles Circulating, veh/h	1029	48	171
Vehicles Exiting, veh/h	204	1088	1289
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	1	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	13.7	161.5	86.7
Approach LOS	B	F	F

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	107	1412	1062
Cap Entry Lane, veh/h	404	1077	952
Entry HV Adj Factor	0.981	0.981	0.944
Flow Entry, veh/h	105	1385	1003
Cap Entry, veh/h	396	1056	899
V/C Ratio	0.265	1.311	1.115
Control Delay, s/veh	13.7	161.5	86.7
LOS	B	F	F
95th %tile Queue, veh	1	51	27

Intersection	
Intersection Delay, s/veh	83.0
Intersection LOS	F

Approach	WB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	161	1248	1023
Demand Flow Rate, veh/h	164	1275	1075
Vehicles Circulating, veh/h	1257	83	10
Vehicles Exiting, veh/h	101	1002	1411
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	25.3	126.7	38.6
Approach LOS	D	F	E

Lane	Left	Left	Left
Designated Moves	LR	TR	LT
Assumed Moves	LR	TR	LT
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	164	1275	1075
Cap Entry Lane, veh/h	321	1040	1119
Entry HV Adj Factor	0.982	0.979	0.951
Flow Entry, veh/h	161	1248	1023
Cap Entry, veh/h	316	1018	1064
V/C Ratio	0.510	1.226	0.961
Control Delay, s/veh	25.3	126.7	38.6
LOS	D	F	E
95th %tile Queue, veh	3	40	17

Intersection	
Intersection Delay, s/veh	267.2
Intersection LOS	F

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	171	1615	973
Demand Flow Rate, veh/h	178	1676	1022
Vehicles Circulating, veh/h	1022	0	660
Vehicles Exiting, veh/h	660	1200	1016
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	18.4	235.5	363.4
Approach LOS	C	F	F

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	178	1676	1022
Cap Entry Lane, veh/h	407	1130	584
Entry HV Adj Factor	0.961	0.963	0.952
Flow Entry, veh/h	171	1615	973
Cap Entry, veh/h	391	1089	556
V/C Ratio	0.438	1.483	1.750
Control Delay, s/veh	18.4	235.5	363.4
LOS	C	F	F
95th %tile Queue, veh	2	74	58

Intersection	
Intersection Delay, s/veh	97.4
Intersection LOS	F

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	96	1191	1229
Demand Flow Rate, veh/h	98	1237	1254
Vehicles Circulating, veh/h	1235	10	88
Vehicles Exiting, veh/h	107	1323	1159
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	17.4	79.4	121.1
Approach LOS	C	F	F

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	98	1237	1254
Cap Entry Lane, veh/h	329	1119	1035
Entry HV Adj Factor	0.980	0.963	0.980
Flow Entry, veh/h	96	1191	1229
Cap Entry, veh/h	322	1077	1014
V/C Ratio	0.298	1.106	1.212
Control Delay, s/veh	17.4	79.4	121.1
LOS	C	F	F
95th %tile Queue, veh	1	29	39

Intersection	
Intersection Delay, s/veh	93.7
Intersection LOS	F

Approach	WB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	87	1127	1298
Demand Flow Rate, veh/h	89	1161	1328
Vehicles Circulating, veh/h	1157	68	15
Vehicles Exiting, veh/h	72	1275	1231
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	15.0	78.3	112.3
Approach LOS	C	F	F

Lane	Left	Left	Left
Designated Moves	LR	TR	LT
Assumed Moves	LR	TR	LT
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	89	1161	1328
Cap Entry Lane, veh/h	355	1056	1113
Entry HV Adj Factor	0.978	0.971	0.978
Flow Entry, veh/h	87	1127	1298
Cap Entry, veh/h	347	1025	1088
V/C Ratio	0.251	1.100	1.193
Control Delay, s/veh	15.0	78.3	112.3
LOS	C	F	F
95th %tile Queue, veh	1	28	39

Intersection	
Intersection Delay, s/veh	153.6
Intersection LOS	F

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	332	1304	1132
Demand Flow Rate, veh/h	339	1340	1155
Vehicles Circulating, veh/h	1155	0	354
Vehicles Exiting, veh/h	354	1494	986
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	71.7	109.2	228.8
Approach LOS	F	F	F

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	339	1340	1155
Cap Entry Lane, veh/h	356	1130	793
Entry HV Adj Factor	0.979	0.973	0.980
Flow Entry, veh/h	332	1304	1132
Cap Entry, veh/h	349	1100	778
V/C Ratio	0.952	1.186	1.456
Control Delay, s/veh	71.7	109.2	228.8
LOS	F	F	F
95th %tile Queue, veh	10	38	52

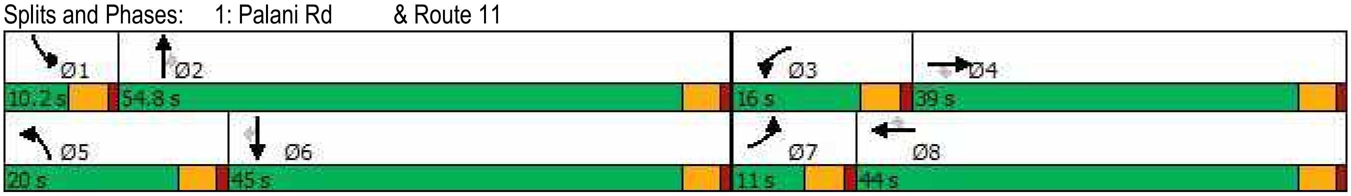
Appendix E

Analysis Reports – Future With Project Conditions (2024)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	516	218	165	775	38	243	192	118	22	321	177
Future Volume (vph)	71	516	218	165	775	38	243	192	118	22	321	177
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	11.0	39.0	39.0	16.0	44.0	44.0	20.0	54.8	54.8	10.2	45.0	45.0
Total Split (%)	9.2%	32.5%	32.5%	13.3%	36.7%	36.7%	16.7%	45.7%	45.7%	8.5%	37.5%	37.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	6.4	36.2	36.2	9.7	41.8	41.8	11.9	30.1	30.1	5.8	17.3	17.3
Actuated g/C Ratio	0.07	0.39	0.39	0.10	0.45	0.45	0.13	0.32	0.32	0.06	0.19	0.19
v/c Ratio	0.33	0.41	0.32	0.48	0.52	0.05	0.58	0.17	0.20	0.20	0.50	0.41
Control Delay	49.9	24.5	5.2	46.6	23.0	0.1	45.8	23.4	4.0	51.5	36.3	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.9	24.5	5.2	46.6	23.0	0.1	45.8	23.4	4.0	51.5	36.3	7.6
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		21.5			26.1			29.1			27.1	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 93.3	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.58	
Intersection Signal Delay: 25.6	Intersection LOS: C
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	516	218	165	775	38	243	192	118	22	321	177
Future Volume (veh/h)	71	516	218	165	775	38	243	192	118	22	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	527	0	168	791	0	248	196	0	22	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	159	1553		251	1676		344	772		43	498	
Arrive On Green	0.05	0.46	0.00	0.07	0.49	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	527	0	168	791	0	248	196	0	22	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.8	8.1	0.0	3.9	12.4	0.0	5.7	3.7	0.0	1.0	7.1	0.0
Cycle Q Clear(g_c), s	1.8	8.1	0.0	3.9	12.4	0.0	5.7	3.7	0.0	1.0	7.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	159	1553		251	1676		344	772		43	498	
V/C Ratio(X)	0.45	0.34		0.67	0.47		0.72	0.25		0.51	0.66	
Avail Cap(c_a), veh/h	257	1553		482	1676		650	2205		125	1775	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.5	13.9	0.0	36.6	13.8	0.0	35.3	26.3	0.0	39.1	33.0	0.0
Incr Delay (d2), s/veh	2.0	0.6	0.0	3.1	1.0	0.0	2.8	0.2	0.0	9.1	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	2.9	0.0	1.7	4.6	0.0	2.5	1.5	0.0	0.5	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.5	14.5	0.0	39.6	14.8	0.0	38.2	26.5	0.0	48.2	34.5	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		599	A		959	A		444	A		350	A
Approach Delay, s/veh		17.5			19.2			33.0			35.4	
Approach LOS		B			B			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.5	22.1	10.5	42.0	12.7	15.9	8.5	44.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.7	50.3	11.5	34.5	15.5	40.5	6.5	39.5
Max Q Clear Time (g_c+I1), s	3.0	5.7	5.9	10.1	7.7	9.1	3.8	14.4
Green Ext Time (p_c), s	0.0	1.4	0.2	3.6	0.5	2.3	0.0	5.8

Intersection Summary	
HCM 6th Ctrl Delay	23.8
HCM 6th LOS	C

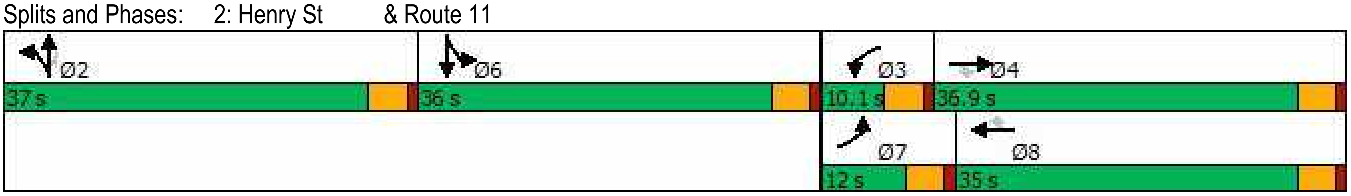
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	107	423	124	59	710	529	146	337	47	408	339
Future Volume (vph)	107	423	124	59	710	529	146	337	47	408	339
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	12.0	36.9	36.9	10.1	35.0	35.0	37.0	37.0	37.0	36.0	36.0
Total Split (%)	10.0%	30.8%	30.8%	8.4%	29.2%	29.2%	30.8%	30.8%	30.8%	30.0%	30.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	7.4	35.1	35.1	5.7	31.0	31.0	18.2	18.2	18.2	25.5	25.5
Actuated g/C Ratio	0.07	0.35	0.35	0.06	0.31	0.31	0.18	0.18	0.18	0.25	0.25
v/c Ratio	0.48	0.38	0.21	0.33	0.70	0.64	0.48	0.60	0.14	0.74	0.73
Control Delay	55.6	29.0	6.5	54.8	36.9	6.8	43.2	42.1	1.1	47.1	38.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.6	29.0	6.5	54.8	36.9	6.8	43.2	42.1	1.1	47.1	38.8
LOS	E	C	A	D	D	A	D	D	A	D	D
Approach Delay		29.1			25.5			38.8			41.6
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 100.3	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 32.5	Intersection LOS: C
Intersection Capacity Utilization 69.7%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	423	124	59	710	529	146	337	47	408	339	124
Future Volume (vph)	107	423	124	59	710	529	146	337	47	408	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	436	128	61	732	545	151	347	48	421	349	128
RTOR Reduction (vph)	0	0	84	0	0	372	0	0	39	0	19	0
Lane Group Flow (vph)	110	436	44	61	732	173	136	362	9	299	580	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.3	35.1	35.1	4.3	32.1	32.1	18.2	18.2	18.2	25.5	25.5	
Effective Green, g (s)	7.3	35.1	35.1	4.3	32.1	32.1	18.2	18.2	18.2	25.5	25.5	
Actuated g/C Ratio	0.07	0.35	0.35	0.04	0.32	0.32	0.18	0.18	0.18	0.25	0.25	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	223	1139	526	140	1081	491	281	602	267	402	800	
v/s Ratio Prot	c0.04	c0.13		0.02	c0.21		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.11			0.01			
v/c Ratio	0.49	0.38	0.08	0.44	0.68	0.35	0.48	0.60	0.03	0.74	0.72	
Uniform Delay, d1	45.1	24.8	22.2	47.2	30.0	26.5	37.2	38.1	34.2	34.8	34.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.7	1.0	0.3	2.2	3.4	2.0	1.3	1.7	0.0	7.3	3.3	
Delay (s)	46.8	25.8	22.5	49.4	33.4	28.5	38.5	39.8	34.2	42.1	37.9	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		28.6			32.1			39.0			39.3	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	101.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	20.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	55	164	1183	914	30
Future Vol, veh/h	44	55	164	1183	914	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	59	176	1272	983	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2608	-	984	0	-	0
Stage 1	984	-	-	-	-	-
Stage 2	1624	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 27	0	702	-	-	-
Stage 1	362	0	-	-	-	-
Stage 2	177	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 20	-	701	-	-	-
Mov Cap-2 Maneuver	~ 20	-	-	-	-	-
Stage 1	271	-	-	-	-	-
Stage 2	177	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, $	1027.1	1.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	701	-	20	-	-	-
HCM Lane V/C Ratio	0.252	-	2.366	-	-	-
HCM Control Delay (s)	11.9		$ 1027.1	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1	-	6.3	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	1.1					
Movement	**WBL**	**WBR**	**NBT**	**NBR**	**SBL**	**SBT**
Lane Configurations						
Traffic Vol, veh/h	9	140	1206	15	73	891
Future Vol, veh/h	9	140	1206	15	73	891
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1297	16	78	958

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2419	-	0	0	1297	0
Stage 1	1305	-	-	-	-	-
Stage 2	1114	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.254	-
Pot Cap-1 Maneuver	36	0	-	-	521	-
Stage 1	254	0	-	-	-	-
Stage 2	314	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	31	-	-	-	521	-
Mov Cap-2 Maneuver	31	-	-	-	-	-
Stage 1	254	-	-	-	-	-
Stage 2	267	-	-	-	-	-

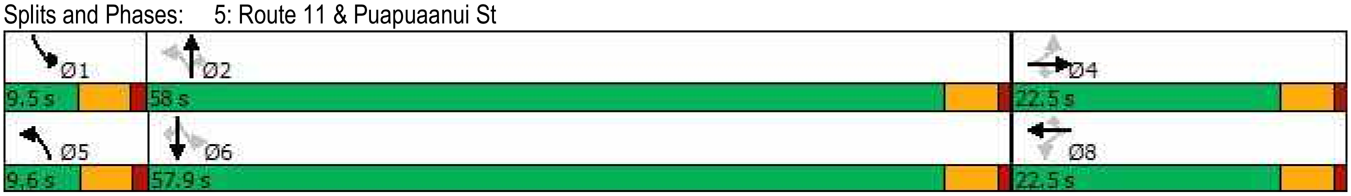
Approach	WB	NB	SB
HCM Control Delay, s	167	0	1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	31	-	521	-
HCM Lane V/C Ratio	-	-	0.312	-	0.151	-
HCM Control Delay (s)	-	-	167	0	13.1	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	1	-	0.5	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	193	9	75	111	59	140	104	901	26	43	792	68
Future Volume (vph)	193	9	75	111	59	140	104	901	26	43	792	68
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.6	58.0	58.0	9.5	57.9	57.9
Total Split (%)	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	10.7%	64.4%	64.4%	10.6%	64.3%	64.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.4	16.4	16.4	16.4	16.4	16.4	58.7	55.7	55.7	57.7	53.8	53.8
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.19	0.19	0.68	0.64	0.64	0.67	0.62	0.62
v/c Ratio	0.83	0.03	0.22	0.45	0.18	0.35	0.36	0.81	0.03	0.18	0.75	0.07
Control Delay	62.3	29.3	9.1	37.6	31.5	8.2	7.6	20.5	0.0	6.0	18.4	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.3	29.3	9.1	37.6	31.5	8.2	7.6	20.5	0.0	6.0	18.4	2.2
LOS	E	C	A	D	C	A	A	C	A	A	B	A
Approach Delay		46.8			23.2			18.7			16.6	
Approach LOS		D			C			B			B	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 86.7	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 21.6	Intersection LOS: C
Intersection Capacity Utilization 80.2%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	193	9	75	111	59	140	104	901	26	43	792	68
Future Volume (veh/h)	193	9	75	111	59	140	104	901	26	43	792	68
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1856	1870	1870	1826	1870
Adj Flow Rate, veh/h	210	10	0	118	64	0	113	959	0	46	843	0
Peak Hour Factor	0.92	0.92	0.92	0.94	0.92	0.94	0.92	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	3	2	2	5	2
Cap, veh/h	311	376		357	376		337	1133		262	1088	
Arrive On Green	0.20	0.20	0.00	0.20	0.20	0.00	0.05	0.61	0.00	0.04	0.60	0.00
Sat Flow, veh/h	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Grp Volume(v), veh/h	210	10	0	118	64	0	113	959	0	46	843	0
Grp Sat Flow(s),veh/h/ln	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Q Serve(g_s), s	13.8	0.4	0.0	6.6	2.5	0.0	2.1	37.3	0.0	0.9	31.0	0.0
Cycle Q Clear(g_c), s	16.3	0.4	0.0	7.0	2.5	0.0	2.1	37.3	0.0	0.9	31.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	311	376		357	376		337	1133		262	1088	
V/C Ratio(X)	0.67	0.03		0.33	0.17		0.34	0.85		0.18	0.77	
Avail Cap(c_a), veh/h	311	376		357	376		345	1133		293	1088	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.4	28.8	0.0	31.6	29.6	0.0	12.4	14.1	0.0	14.0	13.6	0.0
Incr Delay (d2), s/veh	5.7	0.0	0.0	0.5	0.2	0.0	0.6	7.9	0.0	0.3	5.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.2	0.0	2.3	1.1	0.0	0.8	16.0	0.0	0.4	12.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.0	28.8	0.0	32.1	29.8	0.0	13.0	22.0	0.0	14.3	19.0	0.0
LnGrp LOS	D	C		C	C		B	C		B	B	
Approach Vol, veh/h		220	A		182	A		1072	A		889	A
Approach Delay, s/veh		41.4			31.3			21.0			18.7	
Approach LOS		D			C			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.9	59.2		22.5	9.2	57.9		22.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	53.5		18.0	5.1	53.4		18.0				
Max Q Clear Time (g_c+I1), s	2.9	39.3		18.3	4.1	33.0		9.0				
Green Ext Time (p_c), s	0.0	6.5		0.0	0.0	6.5		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			22.9									
HCM 6th LOS			C									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	11.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	159	602	914	932	2
Future Vol, veh/h	0	159	602	914	932	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	0	171	647	983	1002	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3279	-	1002	0	-	0
Stage 1	1002	-	-	-	-	-
Stage 2	2277	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	10	0	691	-	-	-
Stage 1	355	0	-	-	-	-
Stage 2	83	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1	-	691	-	-	-
Mov Cap-2 Maneuver	1	-	-	-	-	-
Stage 1	23	-	-	-	-	-
Stage 2	83	-	-	-	-	-

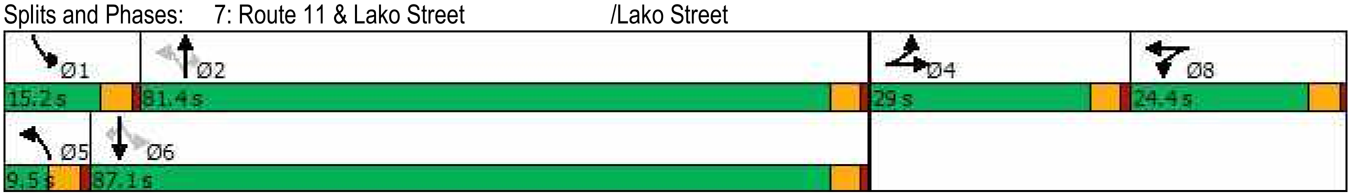
Approach	EB	NB	SB
HCM Control Delay, s	0	17.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	691	-	-	-	-	-
HCM Lane V/C Ratio	0.937	-	-	-	-	-
HCM Control Delay (s)	45	-	0	0	-	-
HCM Lane LOS	E	-	A	A	-	-
HCM 95th %tile Q(veh)	13.1	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	281	48	69	36	33	927	55	164	787	146
Future Volume (vph)	281	48	69	36	33	927	55	164	787	146
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	29.0	29.0	24.4	24.4	9.5	81.4	81.4	15.2	87.1	87.1
Total Split (%)	19.3%	19.3%	16.3%	16.3%	6.3%	54.3%	54.3%	10.1%	58.1%	58.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	24.5	24.5	19.9	19.9	81.9	76.9	76.9	92.1	84.5	84.5
Actuated g/C Ratio	0.16	0.16	0.13	0.13	0.55	0.51	0.51	0.61	0.56	0.56
v/c Ratio	1.03	0.40	0.31	1.06	0.18	1.03	0.07	1.03	0.81	0.17
Control Delay	121.8	41.4	63.1	102.0	14.0	73.7	0.2	115.4	34.4	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	121.8	41.4	63.1	102.0	14.0	73.7	0.2	115.4	34.4	5.8
LOS	F	D	E	F	B	E	A	F	C	A
Approach Delay		98.2		95.4		67.7			42.7	
Approach LOS		F		F		E			D	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 66.3	Intersection LOS: E
Intersection Capacity Utilization 108.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Future Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	319	335		102	108		284	1077		205	1122	
Arrive On Green	0.18	0.18	0.00	0.06	0.06	0.00	0.03	0.58	0.00	0.06	0.60	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	22.6	3.1	0.0	5.5	2.7	0.0	1.1	64.7	0.0	5.5	44.4	0.0
Cycle Q Clear(g_c), s	22.6	3.1	0.0	5.5	2.7	0.0	1.1	64.7	0.0	5.5	44.4	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	319	335		102	108		284	1077		205	1122	
V/C Ratio(X)	0.94	0.15		0.72	0.35		0.12	0.92		0.85	0.75	
Avail Cap(c_a), veh/h	319	335		257	272		301	1077		244	1122	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	55.3	47.3	0.0	63.3	61.9	0.0	17.3	26.0	0.0	30.9	19.5	0.0
Incr Delay (d2), s/veh	34.1	0.2	0.0	9.0	2.0	0.0	0.2	13.4	0.0	20.5	4.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.2	1.5	0.0	2.8	1.3	0.0	0.4	31.6	0.0	4.5	19.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	89.4	47.5	0.0	72.3	63.9	0.0	17.5	39.5	0.0	51.4	24.0	0.0
LnGrp LOS	F	D		E	E		B	D		D	C	
Approach Vol, veh/h		350	A		111	A		1021	A		1011	A
Approach Delay, s/veh		83.3			69.4			38.7			28.7	
Approach LOS		F			E			D			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.1	83.2		29.0	8.2	87.1		12.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	10.7	76.9		24.5	5.0	82.6		19.9				
Max Q Clear Time (g_c+I1), s	7.5	66.7		24.6	3.1	46.4		7.5				
Green Ext Time (p_c), s	0.1	5.4		0.0	0.0	7.7		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			42.3									
HCM 6th LOS			D									

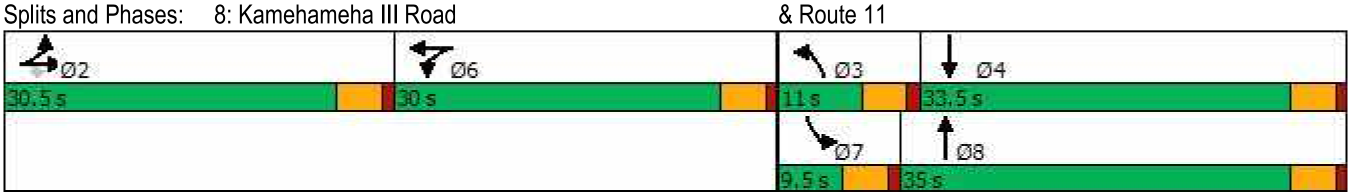
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	5	26	12	76	568	16	501
Future Volume (vph)	5	26	12	76	568	16	501
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	11.0	35.0	9.5	33.5
Total Split (%)	29.0%	29.0%	28.6%	10.5%	33.3%	9.0%	31.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	13.8	13.8	7.0	6.7	39.4	5.1	29.7
Actuated g/C Ratio	0.20	0.20	0.10	0.09	0.56	0.07	0.42
v/c Ratio	0.60	0.08	0.27	0.53	0.63	0.13	0.63
Control Delay	34.7	0.4	27.3	49.3	19.7	38.5	17.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	0.4	27.3	49.3	19.7	38.5	17.8
LOS	C	A	C	D	B	D	B
Approach Delay	30.5		27.3		23.1		18.2
Approach LOS	C		C		C		B

Intersection Summary	
Cycle Length: 105	
Actuated Cycle Length: 70.7	
Natural Cycle: 105	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.63	
Intersection Signal Delay: 21.7	Intersection LOS: C
Intersection Capacity Utilization 63.2%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 8: Kamehameha III Road & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	181	5	26	16	12	17	76	568	15	16	501	328
Future Volume (veh/h)	181	5	26	16	12	17	76	568	15	16	501	328
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1722	1870	1781	1796	1752	1811	1870	1870	1811	1811
Adj Flow Rate, veh/h	195	5	0	17	13	18	82	611	16	17	539	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	2	12	2	8	7	10	6	2	2	6	6
Cap, veh/h	264	7		26	20	27	102	876	23	36	1575	
Arrive On Green	0.15	0.15	0.00	0.05	0.05	0.05	0.06	0.50	0.50	0.02	0.46	0.00
Sat Flow, veh/h	1739	45	1459	570	436	604	1668	1756	46	1781	3532	0
Grp Volume(v), veh/h	200	0	0	48	0	0	82	0	627	17	539	0
Grp Sat Flow(s),veh/h/ln	1783	0	1459	1611	0	0	1668	0	1802	1781	1721	0
Q Serve(g_s), s	6.8	0.0	0.0	1.9	0.0	0.0	3.1	0.0	16.9	0.6	6.4	0.0
Cycle Q Clear(g_c), s	6.8	0.0	0.0	1.9	0.0	0.0	3.1	0.0	16.9	0.6	6.4	0.0
Prop In Lane	0.97		1.00	0.35		0.37	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	270	0		73	0	0	102	0	899	36	1575	
V/C Ratio(X)	0.74	0.00		0.66	0.00	0.00	0.80	0.00	0.70	0.47	0.34	
Avail Cap(c_a), veh/h	732	0		648	0	0	171	0	899	141	1575	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	25.7	0.0	0.0	29.8	0.0	0.0	29.3	0.0	12.2	30.7	11.0	0.0
Incr Delay (d2), s/veh	4.0	0.0	0.0	9.9	0.0	0.0	13.3	0.0	4.5	9.1	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	0.0	0.9	0.0	0.0	1.5	0.0	6.2	0.3	2.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.6	0.0	0.0	39.6	0.0	0.0	42.6	0.0	16.7	39.7	11.6	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		200	A		48			709			556	A
Approach Delay, s/veh		29.6			39.6			19.7			12.5	
Approach LOS		C			D			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		14.1	8.4	33.5		7.4	5.8	36.1				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		26.0	6.5	29.0		25.5	5.0	30.5				
Max Q Clear Time (g_c+I1), s		8.8	5.1	8.4		3.9	2.6	18.9				
Green Ext Time (p_c), s		1.0	0.0	3.2		0.2	0.0	3.0				
Intersection Summary												
HCM 6th Ctrl Delay			19.0									
HCM 6th LOS			B									
Notes												

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	2.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	61	914	14	13	903
Future Vol, veh/h	29	61	914	14	13	903
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	500	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	66	993	15	14	982

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2003	993	0	0	993	0
Stage 1	993	-	-	-	-	-
Stage 2	1010	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	66	298	-	-	696	-
Stage 1	359	-	-	-	-	-
Stage 2	352	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	65	298	-	-	696	-
Mov Cap-2 Maneuver	65	-	-	-	-	-
Stage 1	359	-	-	-	-	-
Stage 2	345	-	-	-	-	-

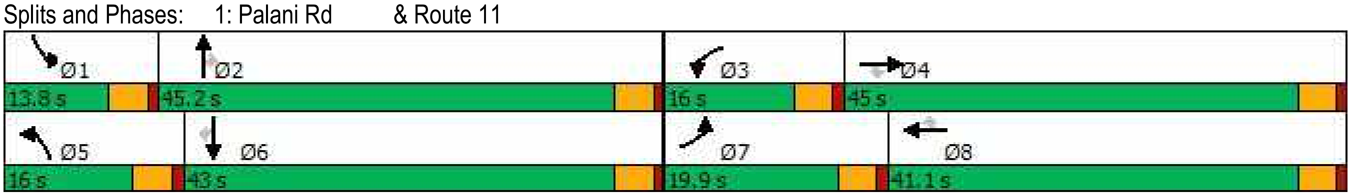
Approach	WB	NB	SB
HCM Control Delay, s	47.5	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	65	298	696	-
HCM Lane V/C Ratio	-	-	0.485	0.222	0.02	-
HCM Control Delay (s)	-	-	104.2	20.5	10.3	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	1.9	0.8	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	997	503	227	695	61	227	283	268	55	313	107
Future Volume (vph)	260	997	503	227	695	61	227	283	268	55	313	107
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	19.9	45.0	45.0	16.0	41.1	41.1	16.0	45.2	45.2	13.8	43.0	43.0
Total Split (%)	16.6%	37.5%	37.5%	13.3%	34.3%	34.3%	13.3%	37.7%	37.7%	11.5%	35.8%	35.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	12.4	41.0	41.0	10.8	39.4	39.4	10.8	22.5	22.5	7.9	17.3	17.3
Actuated g/C Ratio	0.13	0.42	0.42	0.11	0.40	0.40	0.11	0.23	0.23	0.08	0.18	0.18
v/c Ratio	0.62	0.69	0.59	0.62	0.51	0.09	0.62	0.36	0.48	0.39	0.51	0.30
Control Delay	48.6	28.4	10.2	51.1	25.9	2.4	51.3	33.5	6.7	54.3	38.8	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.6	28.4	10.2	51.1	25.9	2.4	51.3	33.5	6.7	54.3	38.8	8.3
LOS	D	C	B	D	C	A	D	C	A	D	D	A
Approach Delay		26.2			30.3			29.5			33.7	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 98.1	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 28.7	Intersection LOS: C
Intersection Capacity Utilization 66.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	997	503	227	695	61	227	283	268	55	313	107
Future Volume (veh/h)	260	997	503	227	695	61	227	283	268	55	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	1017	0	232	709	0	232	289	0	56	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	356	1651		315	1594		315	673		76	499	
Arrive On Green	0.10	0.47	0.00	0.09	0.46	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	1017	0	232	709	0	232	289	0	56	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.5	18.6	0.0	5.7	12.0	0.0	5.7	6.2	0.0	2.7	7.3	0.0
Cycle Q Clear(g_c), s	6.5	18.6	0.0	5.7	12.0	0.0	5.7	6.2	0.0	2.7	7.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	356	1651		315	1594		315	673		76	499	
V/C Ratio(X)	0.74	0.62		0.74	0.44		0.74	0.43		0.74	0.64	
Avail Cap(c_a), veh/h	611	1651		460	1594		456	1672		192	1582	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.6	17.2	0.0	38.3	16.1	0.0	38.3	30.9	0.0	40.9	35.1	0.0
Incr Delay (d2), s/veh	3.1	1.7	0.0	3.4	0.9	0.0	3.6	0.4	0.0	12.8	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	7.3	0.0	2.5	4.6	0.0	2.5	2.6	0.0	1.4	3.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.7	18.9	0.0	41.7	17.0	0.0	41.8	31.4	0.0	53.7	36.5	0.0
LnGrp LOS	D	B		D	B		D	C		D	D	
Approach Vol, veh/h		1282	A		941	A		521	A		375	A
Approach Delay, s/veh		23.4			23.1			36.0			39.0	
Approach LOS		C			C			D			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.2	20.9	12.4	45.0	12.4	16.6	13.5	43.9				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	9.3	40.7	11.5	40.5	11.5	38.5	15.4	36.6				
Max Q Clear Time (g_c+I1), s	4.7	8.2	7.7	20.6	7.7	9.3	8.5	14.0				
Green Ext Time (p_c), s	0.0	2.0	0.3	7.1	0.3	2.2	0.5	4.9				

Intersection Summary			
HCM 6th Ctrl Delay			27.3
HCM 6th LOS			C

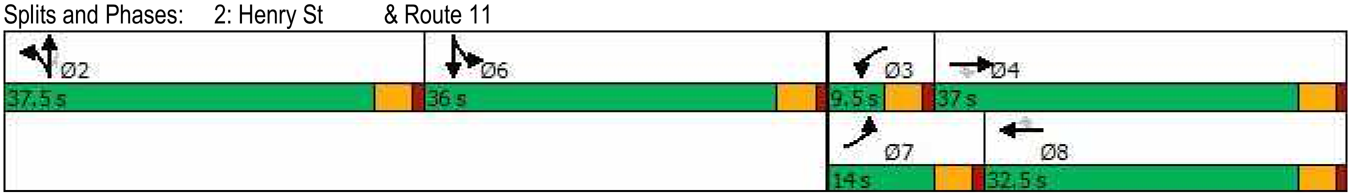
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	190	798	291	82	655	360	126	318	39	401	342
Future Volume (vph)	190	798	291	82	655	360	126	318	39	401	342
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	14.0	37.0	37.0	9.5	32.5	32.5	37.5	37.5	37.5	36.0	36.0
Total Split (%)	11.7%	30.8%	30.8%	7.9%	27.1%	27.1%	31.3%	31.3%	31.3%	30.0%	30.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	9.3	34.9	34.9	5.1	28.4	28.4	17.3	17.3	17.3	26.2	26.2
Actuated g/C Ratio	0.09	0.35	0.35	0.05	0.29	0.29	0.17	0.17	0.17	0.26	0.26
v/c Ratio	0.62	0.66	0.40	0.48	0.67	0.52	0.42	0.57	0.12	0.75	0.72
Control Delay	55.4	33.3	5.4	59.3	37.6	6.6	41.8	41.8	0.7	46.9	36.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.4	33.3	5.4	59.3	37.6	6.6	41.8	41.8	0.7	46.9	36.3
LOS	E	C	A	E	D	A	D	D	A	D	D
Approach Delay		30.3			29.1			38.5			39.9
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 99.5	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 33.3	Intersection LOS: C
Intersection Capacity Utilization 73.6%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	798	291	82	655	360	126	318	39	401	342	190
Future Volume (vph)	190	798	291	82	655	360	126	318	39	401	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	814	297	84	668	367	129	324	40	409	349	194
RTOR Reduction (vph)	0	0	194	0	0	259	0	0	33	0	38	0
Lane Group Flow (vph)	194	814	103	84	668	108	116	337	7	319	595	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.3	34.9	34.9	3.9	29.5	29.5	17.4	17.4	17.4	26.2	26.2	
Effective Green, g (s)	9.3	34.9	34.9	3.9	29.5	29.5	17.4	17.4	17.4	26.2	26.2	
Actuated g/C Ratio	0.09	0.35	0.35	0.04	0.29	0.29	0.17	0.17	0.17	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	308	1230	550	133	1019	458	276	586	266	420	833	
v/s Ratio Prot	c0.06	c0.23		0.02	0.19		0.07	c0.10		c0.20	0.19	
v/s Ratio Perm			0.07			0.07			0.00			
v/c Ratio	0.63	0.66	0.19	0.63	0.66	0.24	0.42	0.58	0.03	0.76	0.71	
Uniform Delay, d1	43.9	27.7	22.9	47.5	31.0	26.9	37.0	38.1	34.5	34.2	33.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.0	2.8	0.8	9.4	3.3	1.2	1.0	1.4	0.0	7.7	2.9	
Delay (s)	47.9	30.6	23.6	56.9	34.3	28.1	38.0	39.5	34.5	41.9	36.6	
Level of Service	D	C	C	E	C	C	D	D	C	D	D	
Approach Delay (s)		31.6			34.0			38.7			38.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	100.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection						
Int Delay, s/veh	1.4					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	85	86	1105	1215	17
Future Vol, veh/h	10	85	86	1105	1215	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	88	89	1139	1253	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2570	-	1253	0	-	0
Stage 1	1253	-	-	-	-	-
Stage 2	1317	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	29	0	555	-	-	-
Stage 1	269	0	-	-	-	-
Stage 2	250	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	24	-	555	-	-	-
Mov Cap-2 Maneuver	24	-	-	-	-	-
Stage 1	226	-	-	-	-	-
Stage 2	250	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	239.9	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	555	-	24	-	-	-
HCM Lane V/C Ratio	0.16	-	0.43	-	-	-
HCM Control Delay (s)	12.7	-	239.9	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.6	-	1.3	-	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	1126	4	61	1241
Future Vol, veh/h	14	71	1126	4	61	1241
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	1161	4	63	1279

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2568	-	0	0	1161	0
Stage 1	1163	-	-	-	-	-
Stage 2	1405	-	-	-	-	-
Critical Hdwy	6.47	-	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	-	-	-	2.272	-
Pot Cap-1 Maneuver	28	0	-	-	581	-
Stage 1	291	0	-	-	-	-
Stage 2	221	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	25	-	-	-	581	-
Mov Cap-2 Maneuver	25	-	-	-	-	-
Stage 1	291	-	-	-	-	-
Stage 2	197	-	-	-	-	-

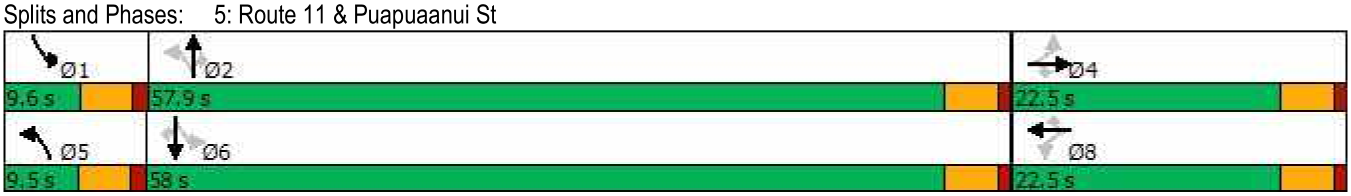
Approach	WB	NB	SB
HCM Control Delay, s	269.4	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	25	-	581	-
HCM Lane V/C Ratio	-	-	0.577	-	0.108	-
HCM Control Delay (s)	-	-	269.4	0	11.9	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	1.8	-	0.4	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	199	23	116	51	23	104	105	810	60	142	1016	100
Future Volume (vph)	199	23	116	51	23	104	105	810	60	142	1016	100
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	57.9	57.9	9.6	58.0	58.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	10.6%	64.3%	64.3%	10.7%	64.4%	64.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.6	16.6	16.6	16.6	16.6	16.6	58.4	53.4	53.4	58.6	53.5	53.5
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.19	0.19	0.66	0.60	0.60	0.66	0.60	0.60
v/c Ratio	0.84	0.07	0.32	0.21	0.07	0.29	0.62	0.75	0.07	0.48	0.93	0.11
Control Delay	62.6	30.0	8.3	32.4	30.0	8.6	26.7	18.6	1.8	10.0	32.6	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	30.0	8.3	32.4	30.0	8.6	26.7	18.6	1.8	10.0	32.6	1.9
LOS	E	C	A	C	C	A	C	B	A	A	C	A
Approach Delay		41.7			18.3			18.5			27.5	
Approach LOS		D			B			B			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 88.6	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 25.5	Intersection LOS: C
Intersection Capacity Utilization 88.2%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	23	116	51	23	104	105	810	60	142	1016	100
Future Volume (veh/h)	199	23	116	51	23	104	105	810	60	142	1016	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1826	1870	1856	1841	1870	1870	1870
Adj Flow Rate, veh/h	216	25	0	53	25	0	114	835	0	146	1047	0
Peak Hour Factor	0.92	0.92	0.92	0.97	0.92	0.97	0.92	0.97	0.97	0.97	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	5	2	3	4	2	2	2
Cap, veh/h	326	350		326	350		234	1122		365	1135	
Arrive On Green	0.19	0.19	0.00	0.19	0.19	0.00	0.05	0.60	0.00	0.06	0.61	0.00
Sat Flow, veh/h	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Grp Volume(v), veh/h	216	25	0	53	25	0	114	835	0	146	1047	0
Grp Sat Flow(s),veh/h/ln	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Q Serve(g_s), s	13.4	1.0	0.0	2.9	1.0	0.0	2.1	28.5	0.0	2.7	44.1	0.0
Cycle Q Clear(g_c), s	14.4	1.0	0.0	3.9	1.0	0.0	2.1	28.5	0.0	2.7	44.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	326	350		326	350		234	1122		365	1135	
V/C Ratio(X)	0.66	0.07		0.16	0.07		0.49	0.74		0.40	0.92	
Avail Cap(c_a), veh/h	349	381		349	381		240	1122		370	1135	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.5	29.6	0.0	31.2	29.6	0.0	19.3	12.5	0.0	11.5	15.5	0.0
Incr Delay (d2), s/veh	4.3	0.1	0.0	0.2	0.1	0.0	1.6	4.5	0.0	0.7	13.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.4	0.0	1.0	0.4	0.0	1.5	11.7	0.0	1.0	20.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.8	29.6	0.0	31.4	29.6	0.0	20.9	17.0	0.0	12.2	29.1	0.0
LnGrp LOS	D	C		C	C		C	B		B	C	
Approach Vol, veh/h		241	A		78	A		949	A		1193	A
Approach Delay, s/veh		38.7			30.8			17.5			27.0	
Approach LOS		D			C			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.4	57.9		21.0	9.2	58.1		21.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.1	53.4		18.0	5.0	53.5		18.0				
Max Q Clear Time (g_c+I1), s	4.7	30.5		16.4	4.1	46.1		5.9				
Green Ext Time (p_c), s	0.0	6.7		0.1	0.0	4.5		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			24.6									
HCM 6th LOS			C									

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	325	340	979	1120	0
Future Vol, veh/h	0	325	340	979	1120	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	0	332	347	999	1143	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2836	-	1143	0	-	0
Stage 1	1143	-	-	-	-	-
Stage 2	1693	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	18	0	611	-	-	-
Stage 1	296	0	-	-	-	-
Stage 2	158	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	8	-	611	-	-	-
Mov Cap-2 Maneuver	8	-	-	-	-	-
Stage 1	128	-	-	-	-	-
Stage 2	158	-	-	-	-	-

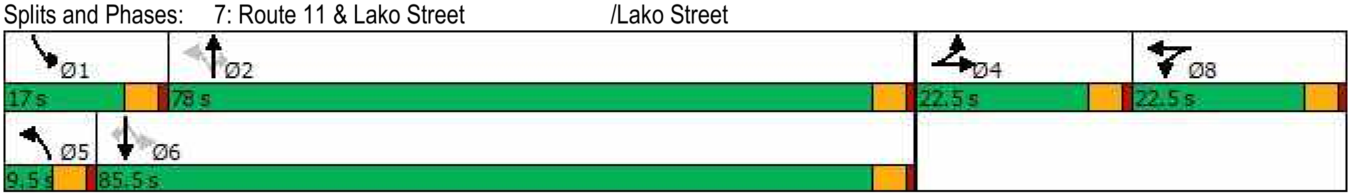
Approach	EB	NB	SB
HCM Control Delay, s	0	4.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	611	-	-	-	-	-
HCM Lane V/C Ratio	0.568	-	-	-	-	-
HCM Control Delay (s)	18.3	-	0	0	-	-
HCM Lane LOS	C	-	A	A	-	-
HCM 95th %tile Q(veh)	3.6	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Future Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	78.0	78.0	17.0	85.5	85.5
Total Split (%)	16.1%	16.1%	16.1%	16.1%	6.8%	55.7%	55.7%	12.1%	61.1%	61.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	15.7	15.7	14.0	14.0	78.8	73.7	73.7	90.8	83.4	83.4
Actuated g/C Ratio	0.12	0.12	0.10	0.10	0.59	0.55	0.55	0.68	0.62	0.62
v/c Ratio	0.76	0.34	0.35	0.87	0.33	0.94	0.07	0.97	0.92	0.19
Control Delay	81.3	30.0	61.3	50.1	17.5	47.0	0.3	91.2	38.5	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.3	30.0	61.3	50.1	17.5	47.0	0.3	91.2	38.5	5.5
LOS	F	C	E	D	B	D	A	F	D	A
Approach Delay		63.6		52.3		43.0			41.6	
Approach LOS		E		D		D			D	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 134	
Natural Cycle: 140	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 44.9	Intersection LOS: D
Intersection Capacity Utilization 98.6%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Future Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	183	196		94	96		228	1181		309	1244	
Arrive On Green	0.10	0.10	0.00	0.05	0.05	0.00	0.03	0.64	0.00	0.06	0.66	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	10.5	1.8	0.0	4.4	2.7	0.0	0.9	47.0	0.0	4.9	54.1	0.0
Cycle Q Clear(g_c), s	10.5	1.8	0.0	4.4	2.7	0.0	0.9	47.0	0.0	4.9	54.1	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	183	196		94	96		228	1181		309	1244	
V/C Ratio(X)	0.84	0.16		0.69	0.43		0.17	0.81		0.68	0.86	
Avail Cap(c_a), veh/h	259	276		263	270		248	1181		387	1244	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	53.5	49.7	0.0	56.7	55.9	0.0	18.3	16.6	0.0	20.8	15.9	0.0
Incr Delay (d2), s/veh	15.5	0.4	0.0	8.8	3.0	0.0	0.4	6.0	0.0	3.4	7.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	0.9	0.0	2.2	1.3	0.0	0.5	20.5	0.0	3.7	23.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.0	50.0	0.0	65.5	58.9	0.0	18.6	22.6	0.0	24.3	23.6	0.0
LnGrp LOS	E	D		E	E		B	C		C	C	
Approach Vol, veh/h		185	A		106	A		994	A		1276	A
Approach Delay, s/veh		65.8			63.0			22.5			23.8	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.6	82.0		17.2	8.2	85.5		10.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	12.5	73.5		18.0	5.0	81.0		18.0				
Max Q Clear Time (g_c+I1), s	6.9	49.0		12.5	2.9	56.1		6.4				
Green Ext Time (p_c), s	0.3	8.6		0.3	0.0	10.4		0.2				

Intersection Summary			
HCM 6th Ctrl Delay			27.9
HCM 6th LOS			C

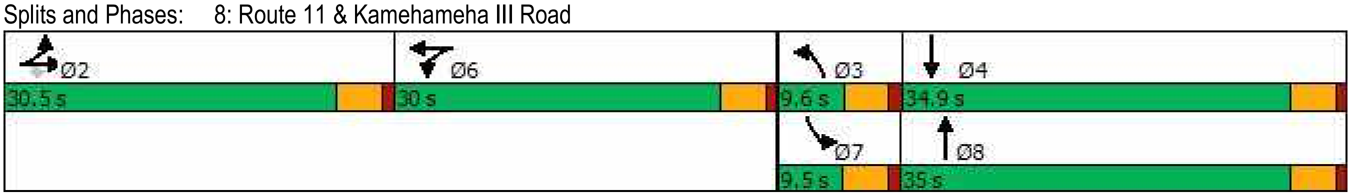
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	11	52	11	64	597	19	601
Future Volume (vph)	11	52	11	64	597	19	601
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	9.6	35.0	9.5	34.9
Total Split (%)	29.0%	29.0%	28.6%	9.1%	33.3%	9.0%	33.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	21.0	21.0	6.8	5.3	35.6	5.2	31.7
Actuated g/C Ratio	0.28	0.28	0.09	0.07	0.47	0.07	0.42
v/c Ratio	0.75	0.11	0.24	0.54	0.74	0.17	0.66
Control Delay	36.8	1.0	26.0	57.5	28.4	42.2	21.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.8	1.0	26.0	57.5	28.4	42.2	21.7
LOS	D	A	C	E	C	D	C
Approach Delay	32.1		26.0		31.2		22.1
Approach LOS	C		C		C		C

Intersection Summary	
Cycle Length: 105	
Actuated Cycle Length: 75.6	
Natural Cycle: 105	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 27.1	Intersection LOS: C
Intersection Capacity Utilization 73.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 8: Route 11 & Kamehameha III Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	335	11	52	7	11	21	64	597	11	19	601	319
Future Volume (veh/h)	335	11	52	7	11	21	64	597	11	19	601	319
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1767	1811	1870	1870	1870	1856	1856	1870	1870	1870	1870
Adj Flow Rate, veh/h	353	12	0	7	12	22	67	628	12	20	633	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	9	6	2	2	2	3	3	2	2	2	2
Cap, veh/h	413	14		11	19	35	90	800	15	41	1467	
Arrive On Green	0.25	0.25	0.00	0.04	0.04	0.04	0.05	0.44	0.44	0.02	0.41	0.00
Sat Flow, veh/h	1630	55	1535	289	495	908	1767	1815	35	1781	3647	0
Grp Volume(v), veh/h	365	0	0	41	0	0	67	0	640	20	633	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1692	0	0	1767	0	1849	1781	1777	0
Q Serve(g_s), s	15.2	0.0	0.0	1.8	0.0	0.0	2.8	0.0	21.8	0.8	9.4	0.0
Cycle Q Clear(g_c), s	15.2	0.0	0.0	1.8	0.0	0.0	2.8	0.0	21.8	0.8	9.4	0.0
Prop In Lane	0.97		1.00	0.17		0.54	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	427	0		65	0	0	90	0	815	41	1467	
V/C Ratio(X)	0.85	0.00		0.63	0.00	0.00	0.75	0.00	0.79	0.49	0.43	
Avail Cap(c_a), veh/h	595	0		586	0	0	122	0	815	121	1467	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	26.2	0.0	0.0	34.9	0.0	0.0	34.5	0.0	17.6	35.6	15.4	0.0
Incr Delay (d2), s/veh	8.6	0.0	0.0	9.5	0.0	0.0	15.3	0.0	7.5	8.9	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.8	0.0	0.0	0.9	0.0	0.0	1.5	0.0	9.4	0.4	3.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.8	0.0	0.0	44.4	0.0	0.0	49.8	0.0	25.1	44.5	16.4	0.0
LnGrp LOS	C	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		365	A		41			707			653	A
Approach Delay, s/veh		34.8			44.4			27.4			17.2	
Approach LOS		C			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		23.2	8.2	34.9		7.3	6.2	37.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		26.0	5.1	30.4		25.5	5.0	30.5				
Max Q Clear Time (g_c+I1), s		17.2	4.8	11.4		3.8	2.8	23.8				
Green Ext Time (p_c), s		1.5	0.0	3.7		0.1	0.0	2.1				

Intersection Summary			
HCM 6th Ctrl Delay			25.6
HCM 6th LOS			C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	39	979	41	45	1067
Future Vol, veh/h	12	39	979	41	45	1067
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	500	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	42	1064	45	49	1160

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2322	1064	0	0	1109	0
Stage 1	1064	-	-	-	-	-
Stage 2	1258	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	41	271	-	-	630	-
Stage 1	332	-	-	-	-	-
Stage 2	268	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	38	271	-	-	630	-
Mov Cap-2 Maneuver	38	-	-	-	-	-
Stage 1	332	-	-	-	-	-
Stage 2	247	-	-	-	-	-

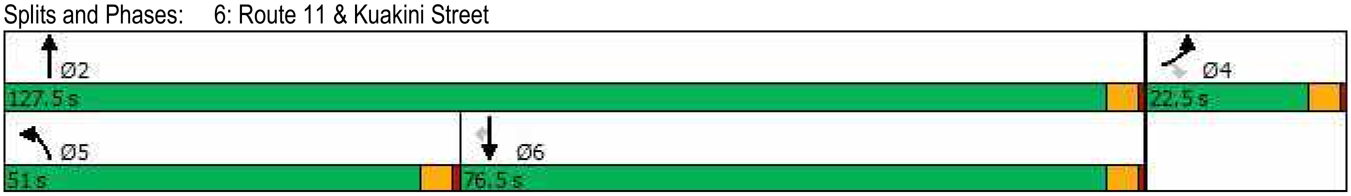
Approach	WB	NB	SB
HCM Control Delay, s	49.5	0	0.5
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	38	271	630	-
HCM Lane V/C Ratio	-	-	0.343	0.156	0.078	-
HCM Control Delay (s)	-	-	142.9	20.7	11.2	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	1.1	0.5	0.3	-

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	602	914	932	2
Future Volume (vph)	159	602	914	932	2
Turn Type	Perm	Prot	NA	NA	Perm
Protected Phases		5	2	6	
Permitted Phases	4				6
Detector Phase	4	5	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	22.5	51.0	127.5	76.5	76.5
Total Split (%)	15.0%	34.0%	85.0%	51.0%	51.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag	Lag
Lead-Lag Optimize?		Yes		Yes	Yes
Recall Mode	None	None	Max	Max	Max
Act Effct Green (s)	5.5	46.5	123.0	72.0	72.0
Actuated g/C Ratio	0.04	0.34	0.89	0.52	0.52
v/c Ratio	0.33	1.08	0.61	1.06	0.00
Control Delay	1.8	103.8	3.5	78.2	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	1.8	103.8	3.5	78.2	10.5
LOS	A	F	A	E	B
Approach Delay			43.3	78.1	
Approach LOS			D	E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 137.5	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.08	
Intersection Signal Delay: 53.2	Intersection LOS: D
Intersection Capacity Utilization 89.9%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	602	914	932	2
Future Volume (veh/h)	0	159	602	914	932	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	647	983	1002	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		650	1761	1031	
Arrive On Green	0.00	0.00	0.36	0.96	0.56	0.00
Sat Flow, veh/h	1781	1560	1781	1826	1826	1522
Grp Volume(v), veh/h	0	0	647	983	1002	0
Grp Sat Flow(s),veh/h/ln	1781	1560	1781	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	46.2	5.2	67.5	0.0
Cycle Q Clear(g_c), s	0.0	0.0	46.2	5.2	67.5	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		650	1761	1031	
V/C Ratio(X)	0.00		1.00	0.56	0.97	
Avail Cap(c_a), veh/h	251		650	1761	1031	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	40.4	0.2	26.8	0.0
Incr Delay (d2), s/veh	0.0	0.0	34.2	1.3	22.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	26.1	0.6	34.1	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	74.6	1.5	48.8	0.0
LnGrp LOS	A		E	A	D	
Approach Vol, veh/h	0	A		1630	1002	A
Approach Delay, s/veh	0.0			30.5	48.8	
Approach LOS				C	D	
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	51.0	76.5
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	46.5	72.0
Max Q Clear Time (g_c+I1), s		7.2		0.0	48.2	69.5
Green Ext Time (p_c), s		11.6		0.0	0.0	1.7
Intersection Summary						
HCM 6th Ctrl Delay			37.5			
HCM 6th LOS			D			

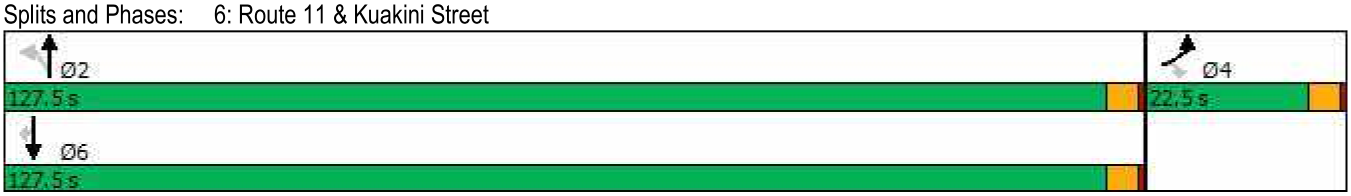
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	602	914	932	2
Future Volume (vph)	159	602	914	932	2
Turn Type	Perm	Perm	NA	NA	Perm
Protected Phases			2	6	
Permitted Phases	4	2			6
Detector Phase	4	2	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	127.5	127.5	127.5	127.5
Total Split (%)	15.0%	85.0%	85.0%	85.0%	85.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	Max	Max	Max	Max
Act Effct Green (s)	6.1	123.0	123.0	123.0	123.0
Actuated g/C Ratio	0.04	0.89	0.89	0.89	0.89
v/c Ratio	0.61	1.47	0.61	0.62	0.00
Control Delay	12.3	241.8	3.7	3.9	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	12.3	241.8	3.7	3.9	0.5
LOS	B	F	A	A	A
Approach Delay			98.2	3.9	
Approach LOS			F	A	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 138.2	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.47	
Intersection Signal Delay: 59.2	Intersection LOS: E
Intersection Capacity Utilization 89.9%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	602	914	932	2
Future Volume (veh/h)	0	159	602	914	932	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	647	983	1002	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		575	1761	1761	
Arrive On Green	0.00	0.00	0.96	0.96	0.96	0.00
Sat Flow, veh/h	1781	1560	562	1826	1826	1522
Grp Volume(v), veh/h	0	0	647	983	1002	0
Grp Sat Flow(s),veh/h/ln	1781	1560	562	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	117.5	5.2	5.5	0.0
Cycle Q Clear(g_c), s	0.0	0.0	123.0	5.2	5.5	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		575	1761	1761	
V/C Ratio(X)	0.00		1.13	0.56	0.57	
Avail Cap(c_a), veh/h	251		575	1761	1761	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	10.8	0.2	0.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	77.1	1.3	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	28.1	0.6	0.7	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	87.9	1.5	1.5	0.0
LnGrp LOS	A		F	A	A	
Approach Vol, veh/h	0	A		1630	1002	A
Approach Delay, s/veh	0.0			35.8	1.5	
Approach LOS				D	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		127.5		0.0		127.5
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		123.0		18.0		123.0
Max Q Clear Time (g_c+I1), s		125.0		0.0		7.5
Green Ext Time (p_c), s		0.0		0.0		12.1

Intersection Summary			
HCM 6th Ctrl Delay			22.7
HCM 6th LOS			C

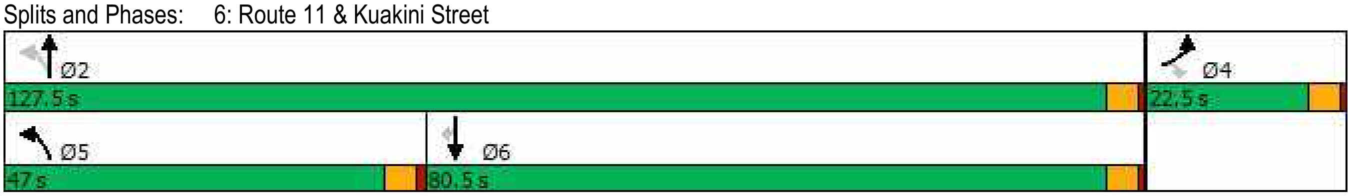
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	602	914	932	2
Future Volume (vph)	159	602	914	932	2
Turn Type	Perm	pm+pt	NA	NA	Perm
Protected Phases		5	2	6	
Permitted Phases	4	2			6
Detector Phase	4	5	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	22.5	47.0	127.5	80.5	80.5
Total Split (%)	15.0%	31.3%	85.0%	53.7%	53.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag	Lag
Lead-Lag Optimize?		Yes		Yes	Yes
Recall Mode	None	None	Max	Max	Max
Act Effct Green (s)	5.5	123.0	123.0	76.0	76.0
Actuated g/C Ratio	0.04	0.89	0.89	0.55	0.55
v/c Ratio	0.35	1.08	0.61	1.00	0.00
Control Delay	2.0	97.9	3.5	59.8	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	2.0	97.9	3.5	59.8	9.5
LOS	A	F	A	E	A
Approach Delay			40.9	59.7	
Approach LOS			D	E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 137.5	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.08	
Intersection Signal Delay: 45.3	Intersection LOS: D
Intersection Capacity Utilization 89.9%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	602	914	932	2
Future Volume (veh/h)	0	159	602	914	932	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	647	983	1002	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		680	1761	1188	
Arrive On Green	0.00	0.00	0.28	0.96	0.65	0.00
Sat Flow, veh/h	1781	1560	1781	1826	1826	1522
Grp Volume(v), veh/h	0	0	647	983	1002	0
Grp Sat Flow(s),veh/h/ln	1781	1560	1781	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	31.9	5.2	54.2	0.0
Cycle Q Clear(g_c), s	0.0	0.0	31.9	5.2	54.2	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		680	1761	1188	
V/C Ratio(X)	0.00		0.95	0.56	0.84	
Avail Cap(c_a), veh/h	251		777	1761	1188	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	35.4	0.2	17.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	20.1	1.3	7.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	23.1	0.6	23.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	55.4	1.5	24.6	0.0
LnGrp LOS	A		E	A	C	
Approach Vol, veh/h	0	A		1630	1002	A
Approach Delay, s/veh	0.0			22.9	24.6	
Approach LOS				C	C	
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	40.0	87.5
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	42.5	76.0
Max Q Clear Time (g_c+I1), s		7.2		0.0	33.9	56.2
Green Ext Time (p_c), s		11.6		0.0	1.6	8.4
Intersection Summary						
HCM 6th Ctrl Delay			23.5			
HCM 6th LOS			C			

Notes

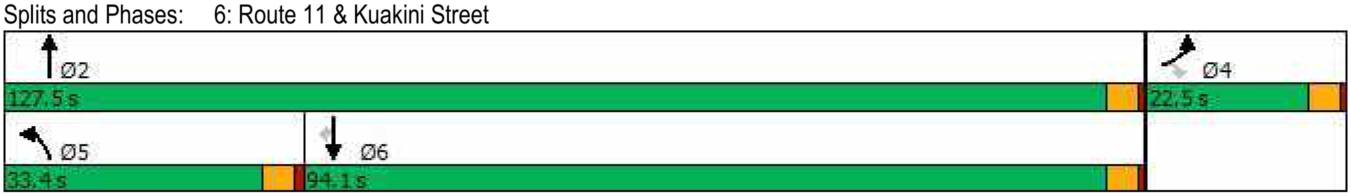
Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	340	979	1120
Future Volume (vph)	325	340	979	1120
Turn Type	Perm	Prot	NA	NA
Protected Phases		5	2	6
Permitted Phases	4			
Detector Phase	4	5	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5
Total Split (s)	22.5	33.4	127.5	94.1
Total Split (%)	15.0%	22.3%	85.0%	62.7%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag
Lead-Lag Optimize?		Yes		Yes
Recall Mode	None	None	Max	Max
Act Effct Green (s)	8.9	28.9	123.2	89.7
Actuated g/C Ratio	0.06	0.20	0.87	0.64
v/c Ratio	0.81	0.96	0.62	0.97
Control Delay	22.2	92.7	5.0	44.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	22.2	92.7	5.0	44.2
LOS	C	F	A	D
Approach Delay			27.6	44.2
Approach LOS			C	D

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 141.1
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 33.7 Intersection LOS: C
Intersection Capacity Utilization 86.6% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	340	979	1120	0
Future Volume (veh/h)	0	325	340	979	1120	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	347	999	1143	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		373	1790	1347	
Arrive On Green	0.00	0.00	0.21	0.96	0.72	0.00
Sat Flow, veh/h	1697	1585	1781	1856	1870	1535
Grp Volume(v), veh/h	0	0	347	999	1143	0
Grp Sat Flow(s),veh/h/ln	1697	1585	1781	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	24.4	5.2	56.1	0.0
Cycle Q Clear(g_c), s	0.0	0.0	24.4	5.2	56.1	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		373	1790	1347	
V/C Ratio(X)	0.00		0.93	0.56	0.85	
Avail Cap(c_a), veh/h	240		404	1790	1347	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	49.5	0.2	12.8	0.0
Incr Delay (d2), s/veh	0.0	0.0	27.1	1.3	6.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	13.6	0.6	23.2	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	76.6	1.4	19.7	0.0
LnGrp LOS	A		E	A	B	
Approach Vol, veh/h	0	A		1346	1143	A
Approach Delay, s/veh	0.0			20.8	19.7	
Approach LOS				C	B	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	31.2	96.3
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	28.9	89.6
Max Q Clear Time (g_c+I1), s		7.2		0.0	26.4	58.1
Green Ext Time (p_c), s		12.0		0.0	0.3	13.2

Intersection Summary			
HCM 6th Ctrl Delay			20.3
HCM 6th LOS			C

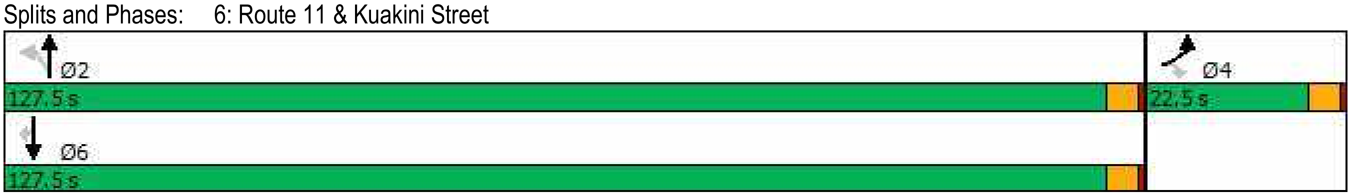
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	340	979	1120
Future Volume (vph)	325	340	979	1120
Turn Type	Perm	Perm	NA	NA
Protected Phases			2	6
Permitted Phases	4	2		
Detector Phase	4	2	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5
Total Split (s)	22.5	127.5	127.5	127.5
Total Split (%)	15.0%	85.0%	85.0%	85.0%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	Max	Max	Max
Act Effct Green (s)	17.9	123.0	123.0	123.0
Actuated g/C Ratio	0.12	0.82	0.82	0.82
v/c Ratio	0.97	1.31	0.66	0.75
Control Delay	72.1	184.3	7.8	10.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	72.1	184.3	7.8	10.1
LOS	E	F	A	B
Approach Delay			53.3	10.1
Approach LOS			D	B

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 149.9	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.31	
Intersection Signal Delay: 38.0	Intersection LOS: D
Intersection Capacity Utilization 86.6%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	340	979	1120	0
Future Volume (veh/h)	0	325	340	979	1120	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	347	999	1143	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		504	1790	1804	
Arrive On Green	0.00	0.00	0.96	0.96	0.96	0.00
Sat Flow, veh/h	1697	1585	492	1856	1870	1535
Grp Volume(v), veh/h	0	0	347	999	1143	0
Grp Sat Flow(s),veh/h/ln	1697	1585	492	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	27.7	5.2	7.1	0.0
Cycle Q Clear(g_c), s	0.0	0.0	34.7	5.2	7.1	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		504	1790	1804	
V/C Ratio(X)	0.00		0.69	0.56	0.63	
Avail Cap(c_a), veh/h	240		504	1790	1804	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	1.8	0.2	0.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	7.5	1.3	1.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	1.4	0.6	0.9	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	9.3	1.4	1.9	0.0
LnGrp LOS	A		A	A	A	
Approach Vol, veh/h	0	A		1346	1143	A
Approach Delay, s/veh	0.0			3.5	1.9	
Approach LOS				A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		127.5		0.0		127.5
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		123.0		18.0		123.0
Max Q Clear Time (g_c+I1), s		36.7		0.0		9.1
Green Ext Time (p_c), s		24.4		0.0		17.1

Intersection Summary				
HCM 6th Ctrl Delay			2.7	
HCM 6th LOS			A	

Notes

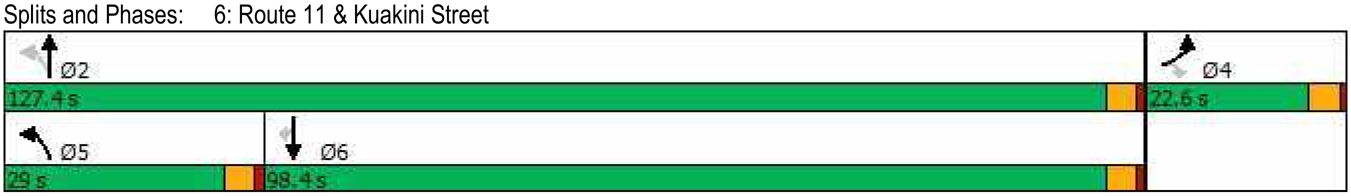
Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	340	979	1120
Future Volume (vph)	325	340	979	1120
Turn Type	Perm	pm+pt	NA	NA
Protected Phases		5	2	6
Permitted Phases	4	2		
Detector Phase	4	5	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5
Total Split (s)	22.6	29.0	127.4	98.4
Total Split (%)	15.1%	19.3%	84.9%	65.6%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag
Lead-Lag Optimize?		Yes		Yes
Recall Mode	None	None	Max	Max
Act Effct Green (s)	10.2	123.0	123.0	94.0
Actuated g/C Ratio	0.07	0.86	0.86	0.66
v/c Ratio	0.84	0.97	0.63	0.93
Control Delay	28.9	86.8	5.5	36.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	28.9	86.8	5.5	36.0
LOS	C	F	A	D
Approach Delay			26.4	36.0
Approach LOS			C	D

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 142.2
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 30.6 — Intersection LOS: C
Intersection Capacity Utilization 86.6% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	340	979	1120	0
Future Volume (veh/h)	0	325	340	979	1120	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	347	999	1143	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		479	1790	1665	
Arrive On Green	0.00	0.00	0.04	0.96	0.89	0.00
Sat Flow, veh/h	1697	1585	1781	1856	1870	1535
Grp Volume(v), veh/h	0	0	347	999	1143	0
Grp Sat Flow(s),veh/h/ln	1697	1585	1781	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	1.7	5.2	22.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	1.7	5.2	22.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		479	1790	1665	
V/C Ratio(X)	0.00		0.72	0.56	0.69	
Avail Cap(c_a), veh/h	241		752	1790	1665	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	7.9	0.2	2.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	2.1	1.3	2.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	4.8	0.6	4.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	10.0	1.4	4.3	0.0
LnGrp LOS	A		A	A	A	
Approach Vol, veh/h	0	A		1346	1143	A
Approach Delay, s/veh	0.0			3.6	4.3	
Approach LOS				A	A	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.4		0.0	9.5	117.9
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		122.9		18.1	24.5	93.9
Max Q Clear Time (g_c+I1), s		7.2		0.0	3.7	24.0
Green Ext Time (p_c), s		12.0		0.0	1.0	16.5

Intersection Summary			
HCM 6th Ctrl Delay			3.9
HCM 6th LOS			A

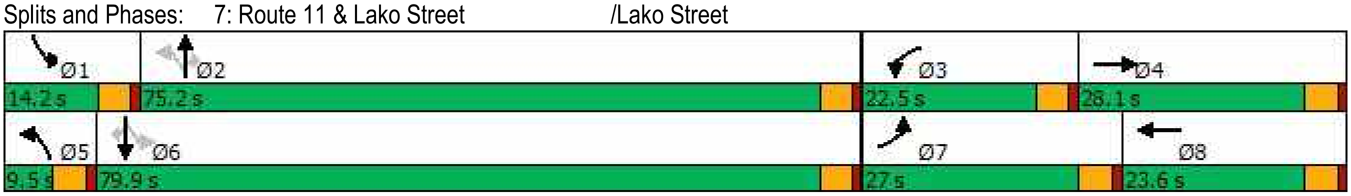
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	281	48	69	36	33	927	55	164	787	146
Future Volume (vph)	281	48	69	36	33	927	55	164	787	146
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	27.0	28.1	22.5	23.6	9.5	75.2	75.2	14.2	79.9	79.9
Total Split (%)	19.3%	20.1%	16.1%	16.9%	6.8%	53.7%	53.7%	10.1%	57.1%	57.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	22.5	32.7	11.2	19.1	75.7	70.7	70.7	84.9	77.3	77.3
Actuated g/C Ratio	0.16	0.23	0.08	0.14	0.54	0.50	0.50	0.61	0.55	0.55
v/c Ratio	1.05	0.29	0.52	1.06	0.19	1.05	0.07	1.03	0.82	0.17
Control Delay	123.3	32.3	74.3	101.0	13.9	77.1	0.2	112.1	34.7	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	123.3	32.3	74.3	101.0	13.9	77.1	0.2	112.1	34.7	5.4
LOS	F	C	E	F	B	E	A	F	C	A
Approach Delay		96.6		96.4		70.9			42.3	
Approach LOS		F		F		E			D	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 140	
Natural Cycle: 140	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 67.2	Intersection LOS: E
Intersection Capacity Utilization 108.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Future Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	321	311		101	81		291	1075		212	1121	
Arrive On Green	0.18	0.17	0.00	0.06	0.04	0.00	0.03	0.57	0.00	0.06	0.60	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	20.6	2.9	0.0	5.1	2.5	0.0	1.0	59.2	0.0	5.0	40.6	0.0
Cycle Q Clear(g_c), s	20.6	2.9	0.0	5.1	2.5	0.0	1.0	59.2	0.0	5.0	40.6	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	321	311		101	81		291	1075		212	1121	
V/C Ratio(X)	0.93	0.16		0.72	0.47		0.12	0.92		0.82	0.75	
Avail Cap(c_a), veh/h	321	354		255	286		312	1075		248	1121	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	50.4	44.6	0.0	57.9	58.3	0.0	15.8	23.8	0.0	28.2	17.8	0.0
Incr Delay (d2), s/veh	32.9	0.2	0.0	9.2	4.1	0.0	0.2	13.5	0.0	17.1	4.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.1	1.4	0.0	2.5	1.3	0.0	0.4	28.8	0.0	4.0	18.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	83.3	44.8	0.0	67.0	62.4	0.0	16.0	37.4	0.0	45.3	22.4	0.0
LnGrp LOS	F	D		E	E		B	D		D	C	
Approach Vol, veh/h		350	A		111	A		1021	A		1011	A
Approach Delay, s/veh		77.7			65.4			36.7			26.3	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.6	76.3	11.7	25.3	8.0	79.9	27.0	9.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.7	70.7	18.0	23.6	5.0	75.4	22.5	19.1
Max Q Clear Time (g_c+I1), s	7.0	61.2	7.1	4.9	3.0	42.6	22.6	4.5
Green Ext Time (p_c), s	0.1	5.1	0.1	0.2	0.0	7.5	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	39.5
HCM 6th LOS	D

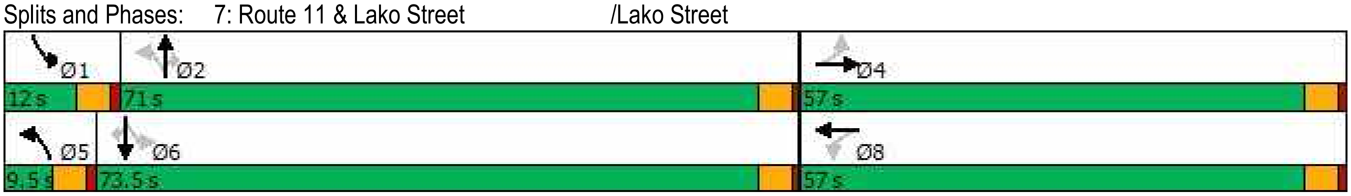
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	281	48	69	36	33	927	55	164	787	146
Future Volume (vph)	281	48	69	36	33	927	55	164	787	146
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	57.0	57.0	57.0	57.0	9.5	71.0	71.0	12.0	73.5	73.5
Total Split (%)	40.7%	40.7%	40.7%	40.7%	6.8%	50.7%	50.7%	8.6%	52.5%	52.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	52.5	52.5	52.5	52.5	71.5	66.5	66.5	76.9	70.9	70.9
Actuated g/C Ratio	0.38	0.38	0.38	0.38	0.51	0.48	0.48	0.55	0.51	0.51
v/c Ratio	1.17	0.18	0.16	0.52	0.27	1.12	0.08	1.24	0.90	0.18
Control Delay	148.7	16.2	30.4	23.0	19.2	102.1	7.4	184.4	45.5	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	148.7	16.2	30.4	23.0	19.2	102.1	7.4	184.4	45.5	7.7
LOS	F	B	C	C	B	F	A	F	D	A
Approach Delay		109.9		24.3		94.3			61.2	
Approach LOS		F		C		F			E	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 140	
Natural Cycle: 140	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.24	
Intersection Signal Delay: 74.3	Intersection LOS: E
Intersection Capacity Utilization 108.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Future Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	390	478		376	478		291	1067		213	1113	
Arrive On Green	0.26	0.26	0.00	0.26	0.26	0.00	0.03	0.57	0.00	0.06	0.60	0.00
Sat Flow, veh/h	1367	1870	0	1341	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Grp Sat Flow(s),veh/h/ln	1367	1870	0	1341	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	24.8	2.4	0.0	5.1	1.8	0.0	0.9	55.8	0.0	4.8	38.3	0.0
Cycle Q Clear(g_c), s	26.6	2.4	0.0	7.6	1.8	0.0	0.9	55.8	0.0	4.8	38.3	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	390	478		376	478		291	1067		213	1113	
V/C Ratio(X)	0.77	0.11		0.19	0.08		0.12	0.92		0.82	0.75	
Avail Cap(c_a), veh/h	657	843		638	843		316	1067		224	1113	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	43.1	33.2	0.0	36.1	33.0	0.0	15.1	22.7	0.0	26.5	17.0	0.0
Incr Delay (d2), s/veh	3.2	0.1	0.0	0.2	0.1	0.0	0.2	14.4	0.0	19.9	4.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	1.1	0.0	1.7	0.8	0.0	0.4	27.2	0.0	3.9	16.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	46.3	33.3	0.0	36.4	33.0	0.0	15.2	37.1	0.0	46.4	21.7	0.0
LnGrp LOS	D	C		D	C		B	D		D	C	
Approach Vol, veh/h		350	A		111	A		1021	A		1011	A
Approach Delay, s/veh		44.4			35.2			36.4			26.0	
Approach LOS		D			D			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.3	71.0		34.3	7.9	74.4		34.3				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.5	66.5		52.5	5.0	69.0		52.5				
Max Q Clear Time (g_c+I1), s	6.8	57.8		28.6	2.9	40.3		9.6				
Green Ext Time (p_c), s	0.0	4.8		1.2	0.0	7.3		0.4				

Intersection Summary			
HCM 6th Ctrl Delay			33.2
HCM 6th LOS			C

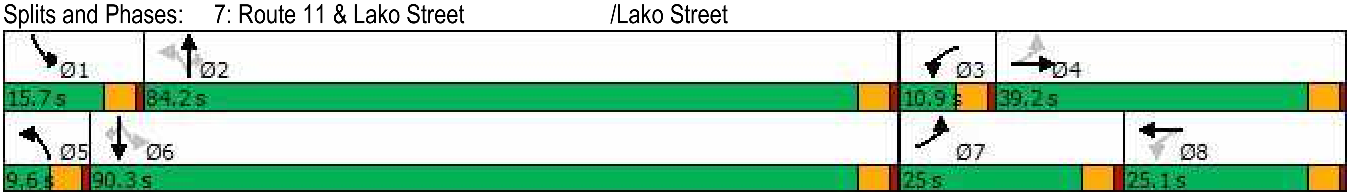
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	281	48	69	36	33	927	55	164	787	146
Future Volume (vph)	281	48	69	36	33	927	55	164	787	146
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	25.0	39.2	10.9	25.1	9.6	84.2	84.2	15.7	90.3	90.3
Total Split (%)	16.7%	26.1%	7.3%	16.7%	6.4%	56.1%	56.1%	10.5%	60.2%	60.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	45.6	34.7	27.0	20.6	84.8	79.7	79.7	95.4	87.7	87.7
Actuated g/C Ratio	0.30	0.23	0.18	0.14	0.57	0.53	0.53	0.64	0.58	0.58
v/c Ratio	1.03	0.29	0.30	1.01	0.16	1.00	0.07	1.00	0.78	0.16
Control Delay	103.7	31.9	43.7	84.6	12.2	62.7	0.1	108.3	30.6	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	103.7	31.9	43.7	84.6	12.2	62.7	0.1	108.3	30.6	4.9
LOS	F	C	D	F	B	E	A	F	C	A
Approach Delay		82.7		77.7		57.7			38.8	
Approach LOS		F		E		E			D	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 56.7	Intersection LOS: E
Intersection Capacity Utilization 108.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Future Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	0.99		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	356	274		193	77		332	1156		251	1193	
Arrive On Green	0.15	0.15	0.00	0.05	0.04	0.00	0.03	0.62	0.00	0.05	0.64	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	20.5	3.2	0.0	5.2	2.7	0.0	0.9	56.8	0.0	4.8	39.1	0.0
Cycle Q Clear(g_c), s	20.5	3.2	0.0	5.2	2.7	0.0	0.9	56.8	0.0	4.8	39.1	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	356	274		193	77		332	1156		251	1193	
V/C Ratio(X)	0.84	0.19		0.38	0.50		0.11	0.85		0.69	0.70	
Avail Cap(c_a), veh/h	356	487		193	289		352	1156		305	1193	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	50.3	49.9	0.0	57.7	62.6	0.0	13.6	20.6	0.0	25.9	15.5	0.0
Incr Delay (d2), s/veh	16.1	0.3	0.0	1.2	4.9	0.0	0.1	8.1	0.0	5.1	3.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.1	1.5	0.0	2.4	1.4	0.0	0.4	26.1	0.0	3.7	16.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	66.4	50.3	0.0	59.0	67.5	0.0	13.8	28.7	0.0	31.1	18.9	0.0
LnGrp LOS	E	D		E	E		B	C		C	B	
Approach Vol, veh/h		350	A		111	A		1021	A		1011	A
Approach Delay, s/veh		64.1			61.9			28.1			21.0	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.5	86.9	10.9	24.1	8.1	90.3	25.0	10.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	11.2	79.7	6.4	34.7	5.1	85.8	20.5	20.6
Max Q Clear Time (g_c+I1), s	6.8	58.8	7.2	5.2	2.9	41.1	22.5	4.7
Green Ext Time (p_c), s	0.2	8.4	0.0	0.2	0.0	8.0	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	31.8
HCM 6th LOS	C

Notes

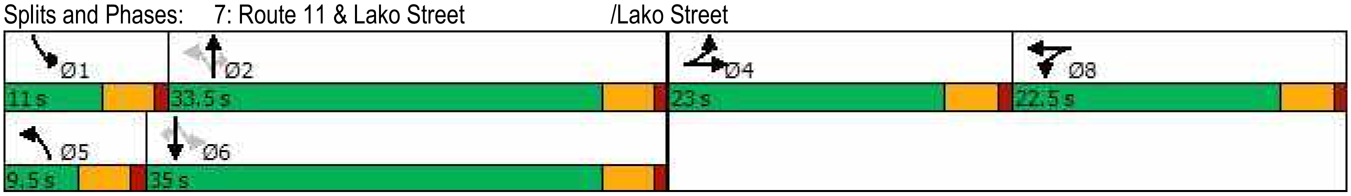
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	281	48	69	36	33	927	55	164	787	146
Future Volume (vph)	281	48	69	36	33	927	55	164	787	146
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	23.0	23.0	22.5	22.5	9.5	33.5	33.5	11.0	35.0	35.0
Total Split (%)	25.6%	25.6%	25.0%	25.0%	10.6%	37.2%	37.2%	12.2%	38.9%	38.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	17.2	17.2	14.9	14.9	34.2	29.2	29.2	38.5	34.8	34.8
Actuated g/C Ratio	0.20	0.20	0.17	0.17	0.40	0.34	0.34	0.45	0.41	0.41
v/c Ratio	0.84	0.31	0.24	0.86	0.14	0.82	0.10	0.84	0.59	0.21
Control Delay	56.1	16.8	32.7	38.8	15.5	34.0	0.3	53.9	24.3	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.1	16.8	32.7	38.8	15.5	34.0	0.3	53.9	24.3	4.5
LOS	E	B	C	D	B	C	A	D	C	A
Approach Delay		44.6		37.7		31.5			26.1	
Approach LOS		D		D		C			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 85.9
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 32.1 Intersection LOS: C
Intersection Capacity Utilization 85.7% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Future Volume (veh/h)	281	48	69	69	36	299	33	927	55	164	787	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	352	370		116	123		346	1436		338	1590	
Arrive On Green	0.20	0.20	0.00	0.07	0.07	0.00	0.03	0.40	0.00	0.08	0.45	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	3554	1560	1725	3526	1585
Grp Volume(v), veh/h	299	51	0	73	38	0	35	986	0	174	837	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1777	1560	1725	1763	1585
Q Serve(g_s), s	11.6	1.6	0.0	2.9	1.4	0.0	0.8	16.4	0.0	4.0	12.3	0.0
Cycle Q Clear(g_c), s	11.6	1.6	0.0	2.9	1.4	0.0	0.8	16.4	0.0	4.0	12.3	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	352	370		116	123		346	1436		338	1590	
V/C Ratio(X)	0.85	0.14		0.63	0.31		0.10	0.69		0.51	0.53	
Avail Cap(c_a), veh/h	459	482		443	469		408	1436		353	1590	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.8	23.8	0.0	32.7	32.0	0.0	12.1	17.6	0.0	13.1	14.2	0.0
Incr Delay (d2), s/veh	11.2	0.2	0.0	5.5	1.4	0.0	0.1	2.7	0.0	1.2	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	0.7	0.0	1.4	0.7	0.0	0.3	6.7	0.0	1.5	4.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.0	23.9	0.0	38.2	33.4	0.0	12.2	20.3	0.0	14.3	15.4	0.0
LnGrp LOS	D	C		D	C		B	C		B	B	
Approach Vol, veh/h		350	A		111	A		1021	A		1011	A
Approach Delay, s/veh		36.8			36.5			20.1			15.2	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.4	33.5		18.7	7.0	36.9		9.2
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	6.5	29.0		18.5	5.0	30.5		18.0
Max Q Clear Time (g_c+I1), s	6.0	18.4		13.6	2.8	14.3		4.9
Green Ext Time (p_c), s	0.0	5.0		0.5	0.0	5.4		0.3

Intersection Summary	
HCM 6th Ctrl Delay	21.2
HCM 6th LOS	C

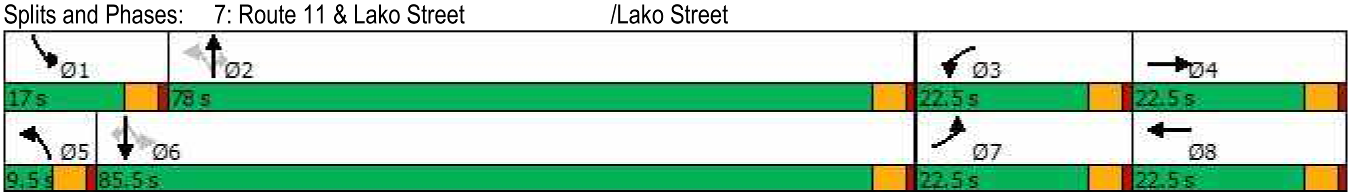
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Future Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	78.0	78.0	17.0	85.5	85.5
Total Split (%)	16.1%	16.1%	16.1%	16.1%	6.8%	55.7%	55.7%	12.1%	61.1%	61.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	15.7	21.8	10.3	14.0	78.8	73.7	73.7	90.8	83.4	83.4
Actuated g/C Ratio	0.12	0.16	0.08	0.10	0.59	0.55	0.55	0.68	0.62	0.62
v/c Ratio	0.76	0.26	0.48	0.87	0.33	0.94	0.07	0.97	0.92	0.19
Control Delay	81.3	26.3	72.1	50.1	17.5	47.0	0.3	91.2	38.5	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.3	26.3	72.1	50.1	17.5	47.0	0.3	91.2	38.5	5.5
LOS	F	C	E	D	B	D	A	F	D	A
Approach Delay		62.3		54.3		43.0			41.6	
Approach LOS		E		D		D			D	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 134	
Natural Cycle: 140	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 45.0	Intersection LOS: D
Intersection Capacity Utilization 98.6%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Future Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	183	173		95	75		241	1200		321	1261	
Arrive On Green	0.10	0.09	0.00	0.05	0.04	0.00	0.03	0.65	0.00	0.06	0.67	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	10.4	1.8	0.0	4.3	2.6	0.0	0.9	45.0	0.0	4.7	51.9	0.0
Cycle Q Clear(g_c), s	10.4	1.8	0.0	4.3	2.6	0.0	0.9	45.0	0.0	4.7	51.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	183	173		95	75		241	1200		321	1261	
V/C Ratio(X)	0.84	0.18		0.69	0.55		0.16	0.80		0.65	0.85	
Avail Cap(c_a), veh/h	263	280		267	274		261	1200		402	1261	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	52.8	50.3	0.0	55.9	56.5	0.0	17.0	15.4	0.0	19.3	14.8	0.0
Incr Delay (d2), s/veh	15.2	0.5	0.0	8.4	6.0	0.0	0.3	5.5	0.0	2.6	7.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.3	0.9	0.0	2.2	1.3	0.0	0.5	19.4	0.0	3.5	22.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	68.0	50.8	0.0	64.3	62.5	0.0	17.3	21.0	0.0	22.0	21.9	0.0
LnGrp LOS	E	D		E	E		B	C		C	C	
Approach Vol, veh/h		185	A		106	A		994	A		1276	A
Approach Delay, s/veh		65.1			63.6			20.8			21.9	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.5	82.2	10.9	15.6	8.1	85.5	17.0	9.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	12.5	73.5	18.0	18.0	5.0	81.0	18.0	18.0
Max Q Clear Time (g_c+I1), s	6.7	47.0	6.3	3.8	2.9	53.9	12.4	4.6
Green Ext Time (p_c), s	0.3	8.8	0.1	0.1	0.0	10.8	0.2	0.1

Intersection Summary	
HCM 6th Ctrl Delay	26.3
HCM 6th LOS	C

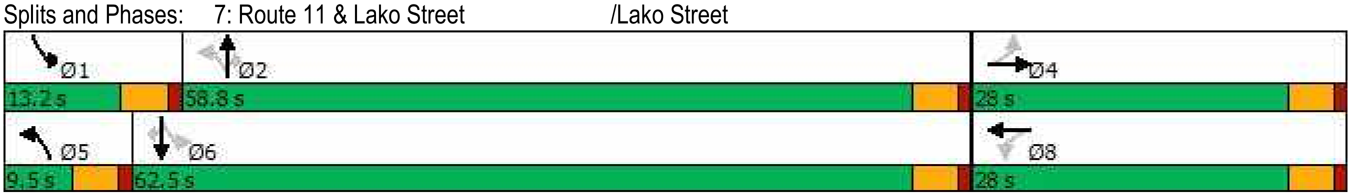
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Future Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	28.0	28.0	28.0	28.0	9.5	58.8	58.8	13.2	62.5	62.5
Total Split (%)	28.0%	28.0%	28.0%	28.0%	9.5%	58.8%	58.8%	13.2%	62.5%	62.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	23.5	23.5	23.5	23.5	59.3	54.3	54.3	67.0	61.8	61.8
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.59	0.54	0.54	0.67	0.62	0.62
v/c Ratio	1.03	0.19	0.21	0.53	0.25	0.95	0.08	0.94	0.93	0.19
Control Delay	123.1	15.6	33.0	15.3	9.9	42.3	3.2	72.0	33.6	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	123.1	15.6	33.0	15.3	9.9	42.3	3.2	72.0	33.6	2.5
LOS	F	B	C	B	A	D	A	E	C	A
Approach Delay		86.0		18.7		38.7			34.9	
Approach LOS		F		B		D			C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Natural Cycle: 100	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 38.3	Intersection LOS: D
Intersection Capacity Utilization 98.6%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Future Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	267	295		279	288		247	1158		329	1225	
Arrive On Green	0.16	0.16	0.00	0.16	0.16	0.00	0.03	0.62	0.00	0.07	0.65	0.00
Sat Flow, veh/h	1344	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Grp Sat Flow(s),veh/h/ln	1344	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	9.9	1.3	0.0	3.8	1.7	0.0	0.7	35.3	0.0	3.7	40.5	0.0
Cycle Q Clear(g_c), s	11.6	1.3	0.0	5.0	1.7	0.0	0.7	35.3	0.0	3.7	40.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	267	295		279	288		247	1158		329	1225	
V/C Ratio(X)	0.58	0.11		0.23	0.14		0.16	0.82		0.64	0.87	
Avail Cap(c_a), veh/h	412	496		428	485		285	1158		387	1225	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.1	31.9	0.0	34.1	32.1	0.0	14.0	12.9	0.0	15.9	12.3	0.0
Incr Delay (d2), s/veh	2.0	0.2	0.0	0.4	0.2	0.0	0.3	6.7	0.0	2.7	8.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	0.6	0.0	1.3	0.8	0.0	0.3	14.7	0.0	2.5	16.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.1	32.1	0.0	34.5	32.4	0.0	14.3	19.6	0.0	18.6	20.8	0.0
LnGrp LOS	D	C		C	C		B	B		B	C	
Approach Vol, veh/h		185	A		106	A		994	A		1276	A
Approach Delay, s/veh		37.9			33.7			19.4			20.5	
Approach LOS		D			C			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.3	59.8		18.5	7.6	62.5		18.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.7	54.3		23.5	5.0	58.0		23.5				
Max Q Clear Time (g_c+I1), s	5.7	37.3		13.6	2.7	42.5		7.0				
Green Ext Time (p_c), s	0.2	7.2		0.4	0.0	8.0		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			21.9
HCM 6th LOS			C

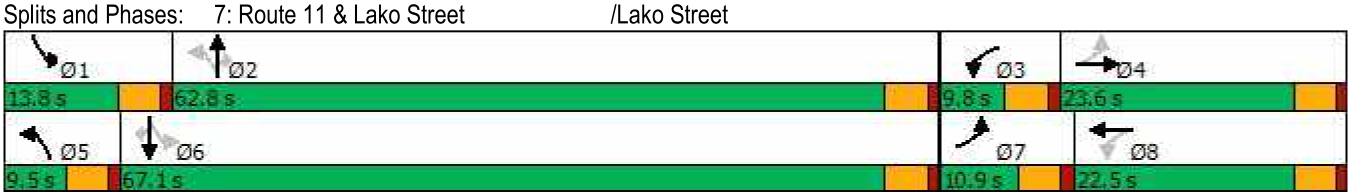
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Future Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	10.9	23.6	9.8	22.5	9.5	62.8	62.8	13.8	67.1	67.1
Total Split (%)	9.9%	21.5%	8.9%	20.5%	8.6%	57.1%	57.1%	12.5%	61.0%	61.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	20.5	15.4	17.5	12.2	63.4	58.4	58.4	72.1	66.7	66.7
Actuated g/C Ratio	0.20	0.15	0.17	0.12	0.61	0.56	0.56	0.69	0.64	0.64
v/c Ratio	0.91	0.28	0.27	0.81	0.26	0.93	0.07	0.93	0.90	0.19
Control Delay	85.9	21.2	35.4	35.3	11.0	38.2	1.0	72.9	30.3	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	85.9	21.2	35.4	35.3	11.0	38.2	1.0	72.9	30.3	3.4
LOS	F	C	D	D	B	D	A	E	C	A
Approach Delay		63.6		35.3		34.8			32.7	
Approach LOS		E		D		C			C	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 104.4	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 36.0	Intersection LOS: D
Intersection Capacity Utilization 98.6%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Future Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	233	137		227	93		243	1166		325	1231	
Arrive On Green	0.07	0.07	0.00	0.05	0.05	0.00	0.03	0.63	0.00	0.06	0.66	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	6.4	1.5	0.0	3.3	2.1	0.0	0.7	37.5	0.0	3.9	43.0	0.0
Cycle Q Clear(g_c), s	6.4	1.5	0.0	3.3	2.1	0.0	0.7	37.5	0.0	3.9	43.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	233	137		227	93		243	1166		325	1231	
V/C Ratio(X)	0.66	0.23		0.29	0.44		0.16	0.82		0.65	0.87	
Avail Cap(c_a), veh/h	233	376		246	346		277	1166		385	1231	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	41.0	41.5	0.0	40.3	43.8	0.0	14.7	13.5	0.0	16.7	12.9	0.0
Incr Delay (d2), s/veh	6.7	0.8	0.0	0.7	3.2	0.0	0.3	6.5	0.0	2.8	8.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.7	0.0	1.5	1.0	0.0	0.4	15.8	0.0	2.8	18.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.7	42.4	0.0	41.0	47.0	0.0	15.0	20.0	0.0	19.6	21.2	0.0
LnGrp LOS	D	D		D	D		B	B		B	C	
Approach Vol, veh/h		185	A		106	A		994	A		1276	A
Approach Delay, s/veh		46.8			43.3			19.8			20.9	
Approach LOS		D			D			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.6	64.3	8.8	11.5	7.7	67.1	10.9	9.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.3	58.3	5.3	19.1	5.0	62.6	6.4	18.0
Max Q Clear Time (g_c+I1), s	5.9	39.5	5.3	3.5	2.7	45.0	8.4	4.1
Green Ext Time (p_c), s	0.2	7.6	0.0	0.1	0.0	8.6	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	23.3
HCM 6th LOS	C

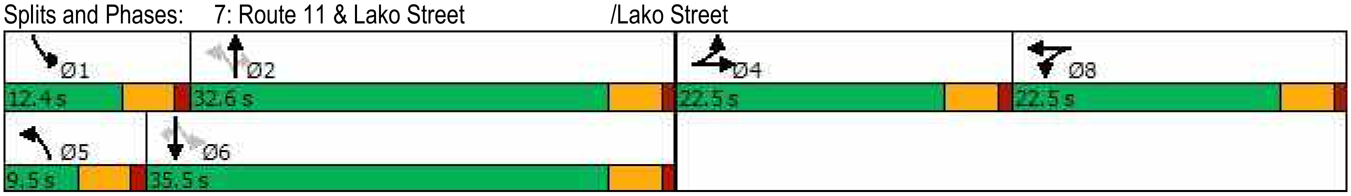
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Future Volume (vph)	148	30	62	39	37	917	64	202	1023	190
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	32.6	32.6	12.4	35.5	35.5
Total Split (%)	25.0%	25.0%	25.0%	25.0%	10.6%	36.2%	36.2%	13.8%	39.4%	39.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	12.0	12.0	9.5	9.5	33.4	28.4	28.4	40.0	35.5	35.5
Actuated g/C Ratio	0.16	0.16	0.12	0.12	0.44	0.37	0.37	0.53	0.47	0.47
v/c Ratio	0.56	0.26	0.30	0.69	0.16	0.73	0.10	0.72	0.64	0.23
Control Delay	38.6	16.6	34.2	16.8	12.8	26.3	0.8	29.1	21.0	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.6	16.6	34.2	16.8	12.8	26.3	0.8	29.1	21.0	3.9
LOS	D	B	C	B	B	C	A	C	C	A
Approach Delay		31.0		20.1		24.2			19.8	
Approach LOS		C		C		C			B	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 76	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 22.2	Intersection LOS: C
Intersection Capacity Utilization 75.7%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Future Volume (veh/h)	148	30	48	62	39	225	37	917	64	202	1023	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	207	221		118	121		328	1555		412	1755	
Arrive On Green	0.12	0.12	0.00	0.07	0.07	0.00	0.04	0.44	0.00	0.09	0.49	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	3526	1585	1767	3554	1585
Grp Volume(v), veh/h	154	31	0	65	41	0	39	955	0	210	1066	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1763	1585	1767	1777	1585
Q Serve(g_s), s	5.4	0.9	0.0	2.3	1.4	0.0	0.7	13.2	0.0	3.9	13.8	0.0
Cycle Q Clear(g_c), s	5.4	0.9	0.0	2.3	1.4	0.0	0.7	13.2	0.0	3.9	13.8	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	207	221		118	121		328	1555		412	1755	
V/C Ratio(X)	0.74	0.14		0.55	0.34		0.12	0.61		0.51	0.61	
Avail Cap(c_a), veh/h	495	528		503	516		397	1555		468	1755	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.2	25.2	0.0	28.8	28.4	0.0	9.7	13.7	0.0	9.9	11.7	0.0
Incr Delay (d2), s/veh	5.3	0.3	0.0	3.9	1.6	0.0	0.2	1.8	0.0	1.0	1.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.4	0.0	1.0	0.6	0.0	0.3	5.0	0.0	1.3	5.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.4	25.5	0.0	32.7	30.0	0.0	9.9	15.5	0.0	10.8	13.2	0.0
LnGrp LOS	C	C		C	C		A	B		B	B	
Approach Vol, veh/h		185	A		106	A		994	A		1276	A
Approach Delay, s/veh		31.3			31.7			15.3			12.8	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.4	32.6		12.0	7.0	36.0		8.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	7.9	28.1		18.0	5.0	31.0		18.0
Max Q Clear Time (g_c+I1), s	5.9	15.2		7.4	2.7	15.8		4.3
Green Ext Time (p_c), s	0.1	5.5		0.4	0.0	6.8		0.3

Intersection Summary			
HCM 6th Ctrl Delay			15.9
HCM 6th LOS			B

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Arterial Level of Service: NB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	63.2	73.7	136.9	0.53	13.9	E
Puapuaanui St	III	30	107.5	20.5	128.0	0.90	25.2	B
Total	III		170.7	94.2	264.9	1.42	19.3	C

Arterial Level of Service: SB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	18.4	112.7	0.79	25.1	B
Lako Street	III	30	107.5	34.4	141.9	0.90	22.7	C
Total	III		201.8	52.8	254.6	1.68	23.8	C

Arterial Level of Service: NB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	63.2	47.0	110.2	0.53	17.2	D
Puapuaanui St	III	30	107.5	18.6	126.1	0.90	25.6	B
Total	III		170.7	65.6	236.3	1.42	21.7	C

Arterial Level of Service: SB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.2	32.6	126.8	0.79	22.3	C
Lako Street	III	30	107.5	38.5	146.0	0.90	22.1	C
Total	III		201.7	71.1	272.8	1.68	22.2	C

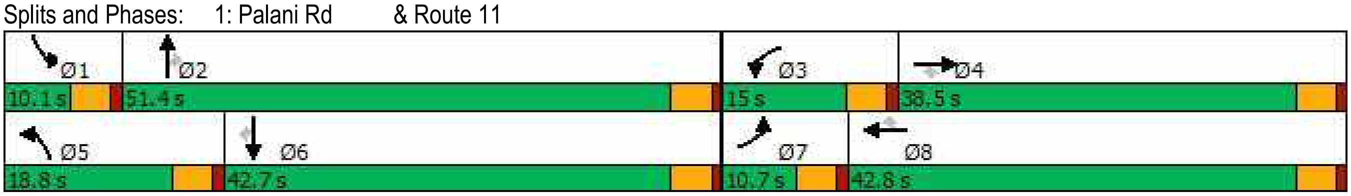
Appendix F

Analysis Reports – Future Without Project Conditions (2029)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	537	218	164	790	33	243	192	117	21	321	177
Future Volume (vph)	71	537	218	164	790	33	243	192	117	21	321	177
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	10.7	38.5	38.5	15.0	42.8	42.8	18.8	51.4	51.4	10.1	42.7	42.7
Total Split (%)	9.3%	33.5%	33.5%	13.0%	37.2%	37.2%	16.3%	44.7%	44.7%	8.8%	37.1%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	6.2	35.2	35.2	9.3	40.7	40.7	11.6	29.7	29.7	5.7	17.1	17.1
Actuated g/C Ratio	0.07	0.38	0.38	0.10	0.44	0.44	0.13	0.32	0.32	0.06	0.19	0.19
v/c Ratio	0.34	0.43	0.32	0.49	0.53	0.04	0.58	0.17	0.20	0.19	0.50	0.41
Control Delay	49.2	24.4	5.1	46.3	23.1	0.1	45.2	22.8	5.3	50.3	35.3	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.2	24.4	5.1	46.3	23.1	0.1	45.2	22.8	5.3	50.3	35.3	7.7
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		21.5			26.1			29.0			26.5	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 91.5	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.58	
Intersection Signal Delay: 25.4	Intersection LOS: C
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	537	218	164	790	33	243	192	117	21	321	177
Future Volume (veh/h)	71	537	218	164	790	33	243	192	117	21	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	548	0	167	806	0	248	196	0	21	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	161	1538		250	1657		344	777		42	500	
Arrive On Green	0.05	0.46	0.00	0.07	0.48	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	548	0	167	806	0	248	196	0	21	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.7	8.4	0.0	3.8	12.6	0.0	5.6	3.6	0.0	0.9	6.9	0.0
Cycle Q Clear(g_c), s	1.7	8.4	0.0	3.8	12.6	0.0	5.6	3.6	0.0	0.9	6.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	161	1538		250	1657		344	777		42	500	
V/C Ratio(X)	0.45	0.36		0.67	0.49		0.72	0.25		0.51	0.66	
Avail Cap(c_a), veh/h	250	1538		449	1657		612	2096		125	1707	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.7	14.0	0.0	35.9	13.9	0.0	34.6	25.7	0.0	38.4	32.3	0.0
Incr Delay (d2), s/veh	2.0	0.6	0.0	3.1	1.0	0.0	2.9	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.0	0.0	1.6	4.6	0.0	2.4	1.5	0.0	0.5	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.7	14.6	0.0	38.9	15.0	0.0	37.5	25.9	0.0	47.5	33.8	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		620	A		973	A		444	A		349	A
Approach Delay, s/veh		17.4			19.1			32.4			34.6	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	21.9	10.4	40.9	12.5	15.7	8.5	42.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.6	46.9	10.5	34.0	14.3	38.2	6.2	38.3
Max Q Clear Time (g_c+I1), s	2.9	5.6	5.8	10.4	7.6	8.9	3.7	14.6
Green Ext Time (p_c), s	0.0	1.3	0.2	3.7	0.5	2.2	0.0	5.8

Intersection Summary

HCM 6th Ctrl Delay	23.4
HCM 6th LOS	C

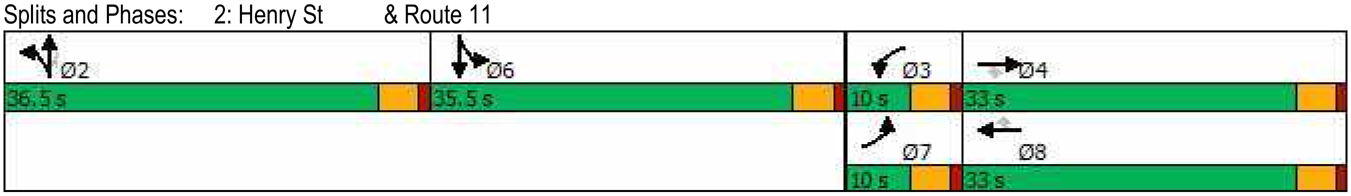
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	107	438	124	57	715	507	146	337	47	403	339
Future Volume (vph)	107	438	124	57	715	507	146	337	47	403	339
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	10.0	33.0	33.0	10.0	33.0	33.0	36.5	36.5	36.5	35.5	35.5
Total Split (%)	8.7%	28.7%	28.7%	8.7%	28.7%	28.7%	31.7%	31.7%	31.7%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	5.6	31.4	31.4	5.6	29.0	29.0	17.7	17.7	17.7	24.2	24.2
Actuated g/C Ratio	0.06	0.33	0.33	0.06	0.31	0.31	0.19	0.19	0.19	0.26	0.26
v/c Ratio	0.60	0.42	0.22	0.30	0.71	0.63	0.47	0.58	0.13	0.73	0.71
Control Delay	61.6	29.6	6.9	51.5	35.9	6.8	40.3	39.3	0.8	44.7	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.6	29.6	6.9	51.5	35.9	6.8	40.3	39.3	0.8	44.7	36.2
LOS	E	C	A	D	D	A	D	D	A	D	D
Approach Delay		30.5			25.1			36.2			39.1
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 94.8	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 31.5	Intersection LOS: C
Intersection Capacity Utilization 69.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	438	124	57	715	507	146	337	47	403	339	124
Future Volume (vph)	107	438	124	57	715	507	146	337	47	403	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	452	128	59	737	523	151	347	48	415	349	128
RTOR Reduction (vph)	0	0	86	0	0	358	0	0	39	0	21	0
Lane Group Flow (vph)	110	452	42	59	737	165	136	362	9	299	572	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	5.6	31.4	31.4	4.3	30.1	30.1	17.7	17.7	17.7	24.2	24.2	
Effective Green, g (s)	5.6	31.4	31.4	4.3	30.1	30.1	17.7	17.7	17.7	24.2	24.2	
Actuated g/C Ratio	0.06	0.33	0.33	0.04	0.31	0.31	0.19	0.19	0.19	0.25	0.25	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	181	1077	497	148	1072	487	289	619	275	403	803	
v/s Ratio Prot	c0.04	0.14		0.02	c0.22		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.11			0.01			
v/c Ratio	0.61	0.42	0.08	0.40	0.69	0.34	0.47	0.58	0.03	0.74	0.71	
Uniform Delay, d1	43.9	25.0	22.2	44.4	28.6	25.1	34.8	35.6	31.9	32.8	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.7	1.2	0.3	1.8	3.6	1.9	1.2	1.4	0.0	7.2	3.0	
Delay (s)	49.6	26.2	22.5	46.2	32.2	27.0	36.0	37.0	32.0	40.0	35.5	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		29.2			30.8			36.3			37.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	33.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	95.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	20

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	54	156	1185	944	30
Future Vol, veh/h	44	54	156	1185	944	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	58	168	1274	1015	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2626	-	1016	0	-	0
Stage 1	1016	-	-	-	-	-
Stage 2	1610	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 26	0	683	-	-	-
Stage 1	350	0	-	-	-	-
Stage 2	180	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 20	-	682	-	-	-
Mov Cap-2 Maneuver	~ 20	-	-	-	-	-
Stage 1	264	-	-	-	-	-
Stage 2	180	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay,	$ 1027.1	1.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	682	-	20	-	-	-
HCM Lane V/C Ratio	0.246	-	2.366	-	-	-
HCM Control Delay (s)	12		$ 1027.1	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1	-	6.3	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	1.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	140	1200	15	73	919
Future Vol, veh/h	9	140	1200	15	73	919
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1290	16	78	988

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2442	-	0	0	1290	0
Stage 1	1298	-	-	-	-	-
Stage 2	1144	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.254	-
Pot Cap-1 Maneuver	35	0	-	-	524	-
Stage 1	256	0	-	-	-	-
Stage 2	304	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	30	-	-	-	524	-
Mov Cap-2 Maneuver	30	-	-	-	-	-
Stage 1	256	-	-	-	-	-
Stage 2	259	-	-	-	-	-

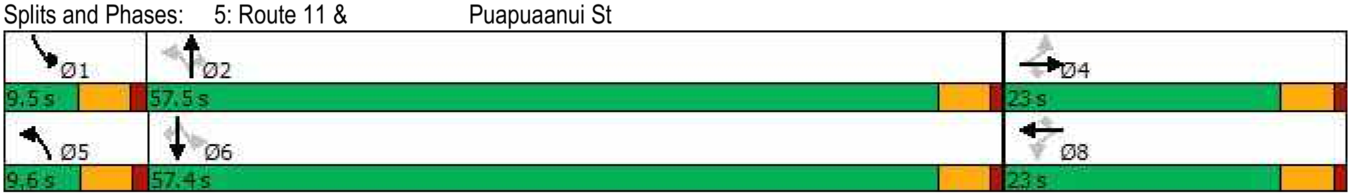
Approach	WB	NB	SB
HCM Control Delay, s	174.2	0	1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	30	-	524	-
HCM Lane V/C Ratio	-	-	0.323	-	0.15	-
HCM Control Delay (s)	-	-	174.2	0	13.1	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	1	-	0.5	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	193	9	75	110	59	140	104	886	24	43	818	68
Future Volume (vph)	193	9	75	110	59	140	104	886	24	43	818	68
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	23.0	23.0	23.0	23.0	23.0	23.0	9.6	57.5	57.5	9.5	57.4	57.4
Total Split (%)	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	10.7%	63.9%	63.9%	10.6%	63.8%	63.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.6	16.6	16.6	16.6	16.6	16.6	58.2	55.3	55.3	57.2	53.4	53.4
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.19	0.19	0.67	0.64	0.64	0.66	0.62	0.62
v/c Ratio	0.82	0.03	0.22	0.44	0.18	0.35	0.38	0.80	0.03	0.18	0.78	0.07
Control Delay	60.6	29.0	9.0	37.0	31.1	8.0	8.4	20.2	0.0	6.0	20.0	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.6	29.0	9.0	37.0	31.1	8.0	8.4	20.2	0.0	6.0	20.0	2.3
LOS	E	C	A	D	C	A	A	C	A	A	B	A
Approach Delay		45.5			22.8			18.5			18.0	
Approach LOS		D			C			B			B	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 86.4	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 21.9	Intersection LOS: C
Intersection Capacity Utilization 79.4%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	193	9	75	110	59	140	104	886	24	43	818	68
Future Volume (veh/h)	193	9	75	110	59	140	104	886	24	43	818	68
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1856	1870	1870	1826	1870
Adj Flow Rate, veh/h	210	10	0	117	64	0	113	943	0	46	870	0
Peak Hour Factor	0.92	0.92	0.92	0.94	0.92	0.94	0.92	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	3	2	2	5	2
Cap, veh/h	316	382		361	382		315	1126		267	1081	
Arrive On Green	0.20	0.20	0.00	0.20	0.20	0.00	0.05	0.61	0.00	0.04	0.59	0.00
Sat Flow, veh/h	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Grp Volume(v), veh/h	210	10	0	117	64	0	113	943	0	46	870	0
Grp Sat Flow(s),veh/h/ln	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Q Serve(g_s), s	13.7	0.4	0.0	6.5	2.5	0.0	2.2	36.3	0.0	0.9	33.2	0.0
Cycle Q Clear(g_c), s	16.2	0.4	0.0	6.9	2.5	0.0	2.2	36.3	0.0	0.9	33.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	316	382		361	382		315	1126		267	1081	
V/C Ratio(X)	0.66	0.03		0.32	0.17		0.36	0.84		0.17	0.80	
Avail Cap(c_a), veh/h	320	387		365	387		323	1126		299	1081	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.0	28.4	0.0	31.2	29.3	0.0	13.5	14.1	0.0	13.7	14.2	0.0
Incr Delay (d2), s/veh	5.0	0.0	0.0	0.5	0.2	0.0	0.7	7.5	0.0	0.3	6.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.2	0.0	2.2	1.1	0.0	0.9	15.5	0.0	0.4	14.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.0	28.5	0.0	31.7	29.5	0.0	14.2	21.6	0.0	14.0	20.6	0.0
LnGrp LOS	D	C		C	C		B	C		B	C	
Approach Vol, veh/h		220	A		181	A		1056	A		916	A
Approach Delay, s/veh		40.4			30.9			20.8			20.3	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.9	58.7		22.7	9.2	57.4		22.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	53.0		18.5	5.1	52.9		18.5
Max Q Clear Time (g_c+I1), s	2.9	38.3		18.2	4.2	35.2		8.9
Green Ext Time (p_c), s	0.0	6.5		0.0	0.0	6.4		0.4

Intersection Summary	
HCM 6th Ctrl Delay	23.2
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	11.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	159	602	943	945	0
Future Vol, veh/h	0	159	602	943	945	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	0	171	647	1014	1016	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3324	-	1016	0	-	0
Stage 1	1016	-	-	-	-	-
Stage 2	2308	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	9	0	683	-	-	-
Stage 1	350	0	-	-	-	-
Stage 2	80	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	0	-	683	-	-	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	19	-	-	-	-	-
Stage 2	80	-	-	-	-	-

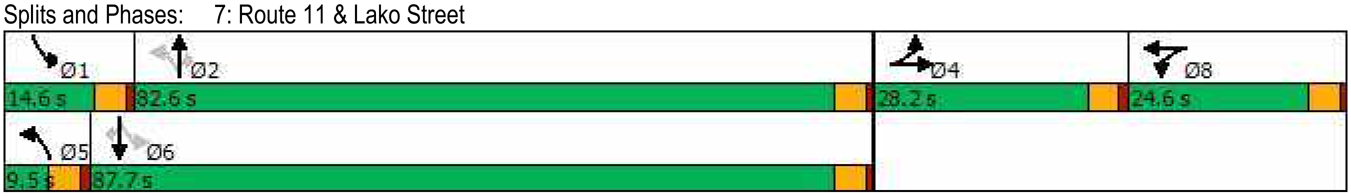
Approach	EB	NB	SB
HCM Control Delay, s	0	18.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	683	-	-	-	-	-
HCM Lane V/C Ratio	0.948	-	-	-	-	-
HCM Control Delay (s)	47.4	-	0	0	-	-
HCM Lane LOS	E	-	A	A	-	-
HCM 95th %tile Q(veh)	13.5	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	278	48	69	36	33	961	55	160	804	142
Future Volume (vph)	278	48	69	36	33	961	55	160	804	142
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	28.2	28.2	24.6	24.6	9.5	82.6	82.6	14.6	87.7	87.7
Total Split (%)	18.8%	18.8%	16.4%	16.4%	6.3%	55.1%	55.1%	9.7%	58.5%	58.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	23.7	23.7	20.1	20.1	83.1	78.1	78.1	92.7	85.1	85.1
Actuated g/C Ratio	0.16	0.16	0.13	0.13	0.55	0.52	0.52	0.62	0.57	0.57
v/c Ratio	1.06	0.41	0.31	1.08	0.19	1.05	0.07	1.05	0.82	0.16
Control Delay	129.3	42.2	62.8	107.8	13.9	79.2	0.2	121.7	34.7	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	129.3	42.2	62.8	107.8	13.9	79.2	0.2	121.7	34.7	5.8
LOS	F	D	E	F	B	E	A	F	C	A
Approach Delay		103.6		100.1		72.9			43.6	
Approach LOS		F		F		E			D	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.08	
Intersection Signal Delay: 69.7	Intersection LOS: E
Intersection Capacity Utilization 110.1%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	48	69	69	36	296	33	961	55	160	804	142
Future Volume (veh/h)	278	48	69	69	36	296	33	961	55	160	804	142
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	296	51	0	73	38	0	35	1022	0	170	855	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	309	325		102	108		279	1073		194	1131	
Arrive On Green	0.17	0.17	0.00	0.06	0.06	0.00	0.03	0.57	0.00	0.06	0.61	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	296	51	0	73	38	0	35	1022	0	170	855	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	22.5	3.2	0.0	5.5	2.7	0.0	1.1	70.1	0.0	6.5	45.5	0.0
Cycle Q Clear(g_c), s	22.5	3.2	0.0	5.5	2.7	0.0	1.1	70.1	0.0	6.5	45.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	309	325		102	108		279	1073		194	1131	
V/C Ratio(X)	0.96	0.16		0.72	0.35		0.13	0.95		0.88	0.76	
Avail Cap(c_a), veh/h	309	325		260	276		296	1073		213	1131	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	55.9	47.9	0.0	63.2	61.8	0.0	17.5	27.3	0.0	36.8	19.3	0.0
Incr Delay (d2), s/veh	39.5	0.2	0.0	9.0	1.9	0.0	0.2	18.2	0.0	29.9	4.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.5	1.5	0.0	2.8	1.3	0.0	0.5	35.3	0.0	7.4	20.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	95.4	48.1	0.0	72.2	63.8	0.0	17.7	45.5	0.0	66.7	24.0	0.0
LnGrp LOS	F	D		E	E		B	D		E	C	
Approach Vol, veh/h		347	A		111	A		1057	A		1025	A
Approach Delay, s/veh		88.4			69.3			44.6			31.1	
Approach LOS		F			E			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.1	82.8		28.2	8.2	87.7		12.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	10.1	78.1		23.7	5.0	83.2		20.1				
Max Q Clear Time (g_c+I1), s	8.5	72.1		24.5	3.1	47.5		7.5				
Green Ext Time (p_c), s	0.1	3.7		0.0	0.0	8.0		0.2				

Intersection Summary	
HCM 6th Ctrl Delay	46.2
HCM 6th LOS	D

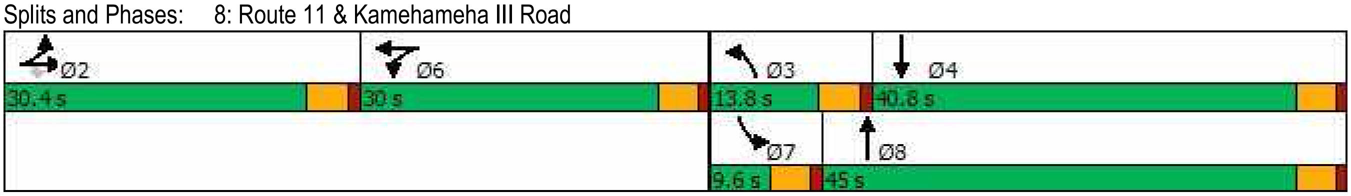
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	5	26	12	76	588	16	513
Future Volume (vph)	5	26	12	76	588	16	513
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.4	30.4	30.0	13.8	45.0	9.6	40.8
Total Split (%)	26.4%	26.4%	26.1%	12.0%	39.1%	8.3%	35.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.0	15.0	7.3	8.6	47.3	5.2	40.2
Actuated g/C Ratio	0.18	0.18	0.09	0.11	0.58	0.06	0.49
v/c Ratio	0.63	0.08	0.29	0.48	0.63	0.15	0.55
Control Delay	41.4	0.5	31.8	47.7	19.9	44.5	17.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.4	0.5	31.8	47.7	19.9	44.5	17.2
LOS	D	A	C	D	B	D	B
Approach Delay	36.3		31.8		23.0		17.7
Approach LOS	D		C		C		B

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 81.8	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.63	
Intersection Signal Delay: 22.3	Intersection LOS: C
Intersection Capacity Utilization 64.1%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 8: Route 11 & Kamehameha III Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	179	5	26	16	12	17	76	588	15	16	513	320
Future Volume (veh/h)	179	5	26	16	12	17	76	588	15	16	513	320
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1722	1870	1781	1796	1752	1811	1870	1870	1811	1811
Adj Flow Rate, veh/h	192	5	0	17	13	18	82	632	16	17	552	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	2	12	2	8	7	10	6	2	2	6	6
Cap, veh/h	252	7		24	18	26	103	964	24	36	1743	
Arrive On Green	0.15	0.15	0.00	0.04	0.04	0.04	0.06	0.55	0.55	0.02	0.51	0.00
Sat Flow, veh/h	1738	45	1459	569	435	603	1668	1757	44	1781	3532	0
Grp Volume(v), veh/h	197	0	0	48	0	0	82	0	648	17	552	0
Grp Sat Flow(s),veh/h/ln	1783	0	1459	1608	0	0	1668	0	1802	1781	1721	0
Q Serve(g_s), s	7.8	0.0	0.0	2.2	0.0	0.0	3.6	0.0	18.7	0.7	7.0	0.0
Cycle Q Clear(g_c), s	7.8	0.0	0.0	2.2	0.0	0.0	3.6	0.0	18.7	0.7	7.0	0.0
Prop In Lane	0.97		1.00	0.35		0.37	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	259	0		68	0	0	103	0	989	36	1743	
V/C Ratio(X)	0.76	0.00		0.70	0.00	0.00	0.79	0.00	0.66	0.48	0.32	
Avail Cap(c_a), veh/h	626	0		555	0	0	210	0	989	123	1743	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	0.0	0.0	34.9	0.0	0.0	34.1	0.0	11.7	35.8	10.7	0.0
Incr Delay (d2), s/veh	4.6	0.0	0.0	12.4	0.0	0.0	12.6	0.0	3.4	9.7	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	0.0	0.0	1.1	0.0	0.0	1.7	0.0	6.7	0.4	2.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.9	0.0	0.0	47.3	0.0	0.0	46.8	0.0	15.1	45.4	11.2	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		197	A		48			730			569	A
Approach Delay, s/veh		34.9			47.3			18.7			12.2	
Approach LOS		C			D			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		15.2	9.1	41.9		7.6	6.0	45.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	9.3	36.3		25.5	5.1	40.5				
Max Q Clear Time (g_c+I1), s		9.8	5.6	9.0		4.2	2.7	20.7				
Green Ext Time (p_c), s		0.9	0.0	3.5		0.2	0.0	3.9				

Intersection Summary			
HCM 6th Ctrl Delay			19.3
HCM 6th LOS			B

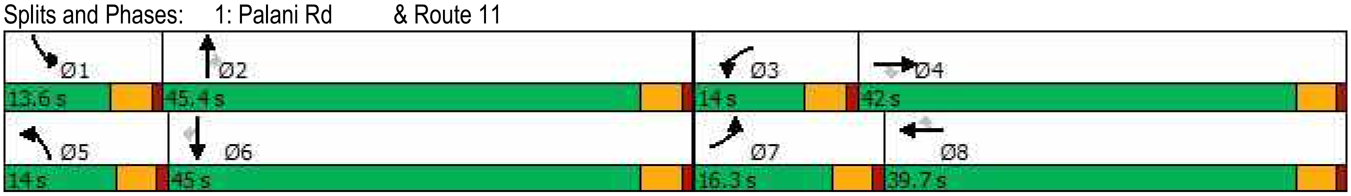
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	1025	503	226	715	56	227	283	263	54	313	107
Future Volume (vph)	260	1025	503	226	715	56	227	283	263	54	313	107
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	16.3	42.0	42.0	14.0	39.7	39.7	14.0	45.4	45.4	13.6	45.0	45.0
Total Split (%)	14.2%	36.5%	36.5%	12.2%	34.5%	34.5%	12.2%	39.5%	39.5%	11.8%	39.1%	39.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	11.2	37.9	37.9	9.5	36.2	36.2	9.5	20.7	20.7	7.8	16.8	16.8
Actuated g/C Ratio	0.12	0.41	0.41	0.10	0.39	0.39	0.10	0.23	0.23	0.08	0.18	0.18
v/c Ratio	0.64	0.72	0.58	0.65	0.53	0.08	0.66	0.36	0.48	0.37	0.49	0.29
Control Delay	47.8	27.9	8.6	51.0	24.9	1.4	51.4	31.7	6.6	49.7	35.4	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	27.9	8.6	51.0	24.9	1.4	51.4	31.7	6.6	49.7	35.4	7.7
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		25.4			29.5			29.0			30.8	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 91.9	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 27.7	Intersection LOS: C
Intersection Capacity Utilization 66.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	1025	503	226	715	56	227	283	263	54	313	107
Future Volume (veh/h)	260	1025	503	226	715	56	227	283	263	54	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	1046	0	231	730	0	232	289	0	55	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	353	1606		314	1551		314	680		77	509	
Arrive On Green	0.10	0.46	0.00	0.09	0.44	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	1046	0	231	730	0	232	289	0	55	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.2	18.9	0.0	5.4	12.1	0.0	5.4	5.9	0.0	2.5	7.0	0.0
Cycle Q Clear(g_c), s	6.2	18.9	0.0	5.4	12.1	0.0	5.4	5.9	0.0	2.5	7.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	353	1606		314	1551		314	680		77	509	
V/C Ratio(X)	0.75	0.65		0.74	0.47		0.74	0.42		0.71	0.63	
Avail Cap(c_a), veh/h	491	1606		399	1551		396	1766		197	1748	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.9	17.3	0.0	36.5	16.1	0.0	36.4	29.3	0.0	38.9	33.2	0.0
Incr Delay (d2), s/veh	4.1	2.1	0.0	5.2	1.0	0.0	5.4	0.4	0.0	11.3	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	7.4	0.0	2.4	4.7	0.0	2.5	2.5	0.0	1.3	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.0	19.4	0.0	41.6	17.1	0.0	41.8	29.7	0.0	50.2	34.5	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		1311	A		961	A		521	A		374	A
Approach Delay, s/veh		23.6			23.0			35.1			36.8	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	20.3	12.0	42.0	12.0	16.3	13.0	41.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.1	40.9	9.5	37.5	9.5	40.5	11.8	35.2
Max Q Clear Time (g_c+I1), s	4.5	7.9	7.4	20.9	7.4	9.0	8.2	14.1
Green Ext Time (p_c), s	0.0	2.0	0.2	6.8	0.2	2.2	0.3	4.9

Intersection Summary	
HCM 6th Ctrl Delay	26.9
HCM 6th LOS	C

Notes

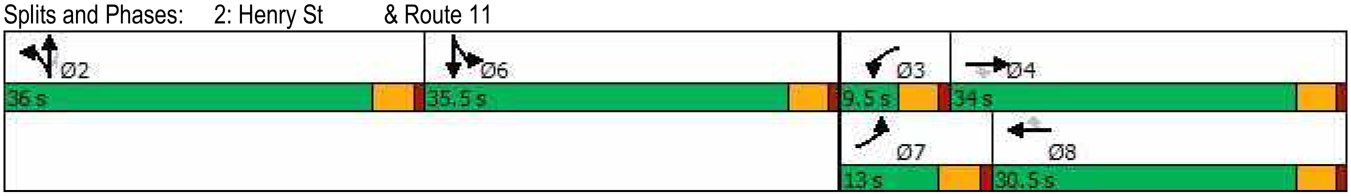
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	190	807	291	80	665	348	126	318	38	388	342
Future Volume (vph)	190	807	291	80	665	348	126	318	38	388	342
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	13.0	34.0	34.0	9.5	30.5	30.5	36.0	36.0	36.0	35.5	35.5
Total Split (%)	11.3%	29.6%	29.6%	8.3%	26.5%	26.5%	31.3%	31.3%	31.3%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	8.5	32.2	32.2	5.1	26.4	26.4	17.0	17.0	17.0	25.1	25.1
Actuated g/C Ratio	0.09	0.34	0.34	0.05	0.28	0.28	0.18	0.18	0.18	0.26	0.26
v/c Ratio	0.65	0.69	0.41	0.45	0.71	0.52	0.41	0.56	0.11	0.75	0.71
Control Delay	55.7	34.2	5.6	56.0	37.9	6.7	39.7	39.7	0.6	45.1	34.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.7	34.2	5.6	56.0	37.9	6.7	39.7	39.7	0.6	45.1	34.1
LOS	E	C	A	E	D	A	D	D	A	D	C
Approach Delay		30.9			29.3			36.6			37.8
Approach LOS		C			C			D			D

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 95.3
Natural Cycle: 115
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 32.9 Intersection LOS: C
Intersection Capacity Utilization 73.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	807	291	80	665	348	126	318	38	388	342	190
Future Volume (vph)	190	807	291	80	665	348	126	318	38	388	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	823	297	82	679	355	129	324	39	396	349	194
RTOR Reduction (vph)	0	0	198	0	0	253	0	0	32	0	41	0
Lane Group Flow (vph)	194	823	99	82	679	102	116	337	7	317	581	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.5	32.2	32.2	3.9	27.6	27.6	17.0	17.0	17.0	25.1	25.1	
Effective Green, g (s)	8.5	32.2	32.2	3.9	27.6	27.6	17.0	17.0	17.0	25.1	25.1	
Actuated g/C Ratio	0.09	0.33	0.33	0.04	0.29	0.29	0.18	0.18	0.18	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	294	1184	529	139	995	447	281	597	271	420	833	
v/s Ratio Prot	c0.06	c0.23		0.02	0.20		0.07	c0.10		c0.20	0.18	
v/s Ratio Perm			0.06			0.07			0.00			
v/c Ratio	0.66	0.70	0.19	0.59	0.68	0.23	0.41	0.56	0.03	0.75	0.70	
Uniform Delay, d1	42.5	27.7	22.7	45.4	30.4	26.2	35.2	36.2	32.7	32.7	32.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.3	3.4	0.8	6.3	3.8	1.2	1.0	1.2	0.0	7.5	2.6	
Delay (s)	47.7	31.1	23.5	51.6	34.2	27.4	36.2	37.4	32.8	40.2	34.7	
Level of Service	D	C	C	D	C	C	D	D	C	D	C	
Approach Delay (s)		31.9			33.3			36.8			36.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	96.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	83	83	1122	1229	17
Future Vol, veh/h	10	83	83	1122	1229	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	86	86	1157	1267	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2596	-	1267	0	-	0
Stage 1	1267	-	-	-	-	-
Stage 2	1329	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	28	0	548	-	-	-
Stage 1	265	0	-	-	-	-
Stage 2	247	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	24	-	548	-	-	-
Mov Cap-2 Maneuver	24	-	-	-	-	-
Stage 1	223	-	-	-	-	-
Stage 2	247	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	239.9	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	548	-	24	-	-	-
HCM Lane V/C Ratio	0.156	-	0.43	-	-	-
HCM Control Delay (s)	12.8	-	239.9	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.6	-	1.3	-	-	-

Intersection						
Int Delay, s/veh	1.9					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	1139	4	61	1252
Future Vol, veh/h	14	71	1139	4	61	1252
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	1174	4	63	1291

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2593	-	0	0	1174	0
Stage 1	1176	-	-	-	-	-
Stage 2	1417	-	-	-	-	-
Critical Hdwy	6.47	-	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	-	-	-	2.272	-
Pot Cap-1 Maneuver	27	0	-	-	574	-
Stage 1	286	0	-	-	-	-
Stage 2	218	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	24	-	-	-	574	-
Mov Cap-2 Maneuver	24	-	-	-	-	-
Stage 1	286	-	-	-	-	-
Stage 2	194	-	-	-	-	-

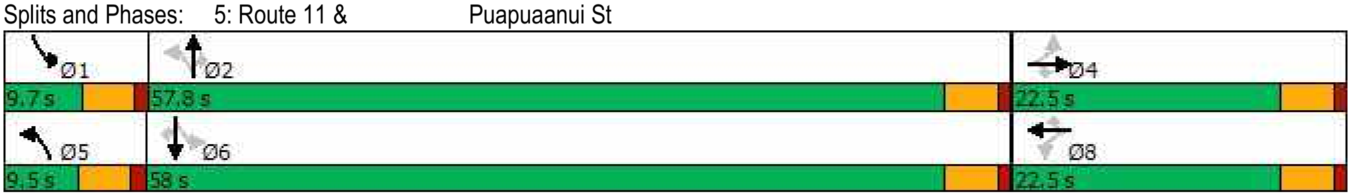
Approach	WB	NB	SB
HCM Control Delay, s	285.8	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	24	-	574	-
HCM Lane V/C Ratio	-	-	0.601	-	0.11	-
HCM Control Delay (s)	-	-	285.8	0	12	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	1.8	-	0.4	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	199	23	116	50	23	104	105	817	58	142	1022	100
Future Volume (vph)	199	23	116	50	23	104	105	817	58	142	1022	100
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	57.8	57.8	9.7	58.0	58.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	10.6%	64.2%	64.2%	10.8%	64.4%	64.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.6	16.6	16.6	16.6	16.6	16.6	58.3	53.3	53.3	58.7	53.5	53.5
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.19	0.19	0.66	0.60	0.60	0.66	0.60	0.60
v/c Ratio	0.84	0.07	0.32	0.20	0.07	0.29	0.62	0.76	0.06	0.49	0.94	0.11
Control Delay	62.6	30.0	8.3	32.4	30.0	8.6	26.8	19.0	1.7	10.2	33.5	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	30.0	8.3	32.4	30.0	8.6	26.8	19.0	1.7	10.2	33.5	1.9
LOS	E	C	A	C	C	A	C	B	A	B	C	A
Approach Delay		41.7			18.2			18.8			28.3	
Approach LOS		D			B			B			C	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 88.6
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 26.0 Intersection LOS: C
Intersection Capacity Utilization 88.5% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	23	116	50	23	104	105	817	58	142	1022	100
Future Volume (veh/h)	199	23	116	50	23	104	105	817	58	142	1022	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1826	1870	1856	1841	1870	1870	1870
Adj Flow Rate, veh/h	216	25	0	52	25	0	114	842	0	146	1054	0
Peak Hour Factor	0.92	0.92	0.92	0.97	0.92	0.97	0.92	0.97	0.97	0.97	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	5	2	3	4	2	2	2
Cap, veh/h	326	350		326	350		229	1122		360	1135	
Arrive On Green	0.19	0.19	0.00	0.19	0.19	0.00	0.05	0.60	0.00	0.06	0.61	0.00
Sat Flow, veh/h	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Grp Volume(v), veh/h	216	25	0	52	25	0	114	842	0	146	1054	0
Grp Sat Flow(s),veh/h/ln	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Q Serve(g_s), s	13.4	1.0	0.0	2.8	1.0	0.0	2.1	29.0	0.0	2.7	44.8	0.0
Cycle Q Clear(g_c), s	14.4	1.0	0.0	3.8	1.0	0.0	2.1	29.0	0.0	2.7	44.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	326	350		326	350		229	1122		360	1135	
V/C Ratio(X)	0.66	0.07		0.16	0.07		0.50	0.75		0.41	0.93	
Avail Cap(c_a), veh/h	349	382		349	382		235	1122		367	1135	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.5	29.5	0.0	31.1	29.5	0.0	19.6	12.6	0.0	11.7	15.6	0.0
Incr Delay (d2), s/veh	4.3	0.1	0.0	0.2	0.1	0.0	1.7	4.6	0.0	0.7	14.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.4	0.0	1.0	0.4	0.0	1.5	11.9	0.0	1.0	20.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.7	29.6	0.0	31.3	29.6	0.0	21.3	17.2	0.0	12.4	30.0	0.0
LnGrp LOS	D	C		C	C		C	B		B	C	
Approach Vol, veh/h		241	A		77	A		956	A		1200	A
Approach Delay, s/veh		38.7			30.8			17.7			27.8	
Approach LOS		D			C			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	57.8		21.0	9.2	58.0		21.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.2	53.3		18.0	5.0	53.5		18.0
Max Q Clear Time (g_c+I1), s	4.7	31.0		16.4	4.1	46.8		5.8
Green Ext Time (p_c), s	0.0	6.8		0.1	0.0	4.2		0.1

Intersection Summary	
HCM 6th Ctrl Delay	25.1
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	325	340	983	1157	0
Future Vol, veh/h	0	325	340	983	1157	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	0	332	347	1003	1181	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2878	-	1181	0	-	0
Stage 1	1181	-	-	-	-	-
Stage 2	1697	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	17	0	591	-	-	-
Stage 1	283	0	-	-	-	-
Stage 2	157	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	7	-	591	-	-	-
Mov Cap-2 Maneuver	7	-	-	-	-	-
Stage 1	117	-	-	-	-	-
Stage 2	157	-	-	-	-	-

Approach	EB		NB		SB	
HCM Control Delay, s	0		5		0	
HCM LOS	A					

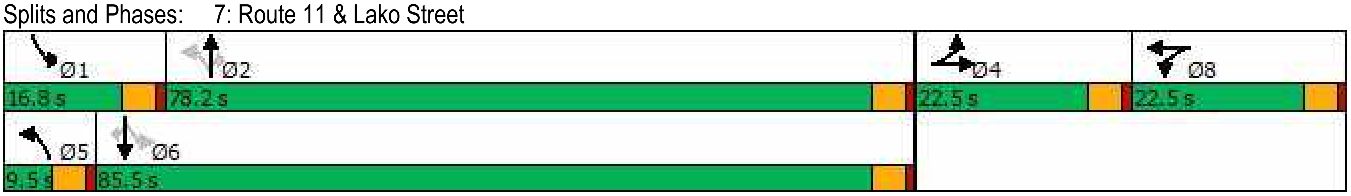
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	591	-	-	-	-	-
HCM Lane V/C Ratio	0.587	-	-	-	-	-
HCM Control Delay (s)	19.4	-	0	0	-	-
HCM Lane LOS	C	-	A	A	-	-
HCM 95th %tile Q(veh)	3.8	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	143	30	62	39	37	929	64	200	1062	188
Future Volume (vph)	143	30	62	39	37	929	64	200	1062	188
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	78.2	78.2	16.8	85.5	85.5
Total Split (%)	16.1%	16.1%	16.1%	16.1%	6.8%	55.9%	55.9%	12.0%	61.1%	61.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	15.4	15.4	13.8	13.8	79.0	73.9	73.9	90.8	83.4	83.4
Actuated g/C Ratio	0.12	0.12	0.10	0.10	0.59	0.55	0.55	0.68	0.62	0.62
v/c Ratio	0.74	0.34	0.36	0.87	0.33	0.95	0.07	0.96	0.95	0.19
Control Delay	80.4	30.2	61.4	49.8	17.3	47.7	0.3	90.6	42.9	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.4	30.2	61.4	49.8	17.3	47.7	0.3	90.6	42.9	5.7
LOS	F	C	E	D	B	D	A	F	D	A
Approach Delay		62.7		52.1		43.6			44.7	
Approach LOS		E		D		D			D	

Intersection Summary

Cycle Length: 140
Actuated Cycle Length: 133.5
Natural Cycle: 140
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 46.4 Intersection LOS: D
Intersection Capacity Utilization 98.5% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 7: Route 11 & Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	143	30	48	62	39	218	37	929	64	200	1062	188
Future Volume (veh/h)	143	30	48	62	39	218	37	929	64	200	1062	188
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	149	31	0	65	41	0	39	968	0	208	1106	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	178	190		94	96		206	1186		303	1248	
Arrive On Green	0.10	0.10	0.00	0.05	0.05	0.00	0.03	0.64	0.00	0.06	0.67	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	149	31	0	65	41	0	39	968	0	208	1106	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	10.1	1.8	0.0	4.4	2.6	0.0	0.9	47.8	0.0	4.8	58.5	0.0
Cycle Q Clear(g_c), s	10.1	1.8	0.0	4.4	2.6	0.0	0.9	47.8	0.0	4.8	58.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	178	190		94	96		206	1186		303	1248	
V/C Ratio(X)	0.84	0.16		0.69	0.43		0.19	0.82		0.69	0.89	
Avail Cap(c_a), veh/h	260	277		264	271		226	1186		380	1248	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	53.5	49.8	0.0	56.5	55.7	0.0	20.3	16.5	0.0	21.3	16.5	0.0
Incr Delay (d2), s/veh	14.2	0.4	0.0	8.8	3.0	0.0	0.4	6.3	0.0	3.7	9.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.9	0.0	2.2	1.3	0.0	0.5	20.9	0.0	3.8	25.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	67.7	50.2	0.0	65.3	58.7	0.0	20.8	22.8	0.0	24.9	26.0	0.0
LnGrp LOS	E	D		E	E		C	C		C	C	
Approach Vol, veh/h		180	A		106	A		1007	A		1314	A
Approach Delay, s/veh		64.7			62.7			22.7			25.8	
Approach LOS		E			E			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.5	82.1		16.9	8.2	85.5		10.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	12.3	73.7		18.0	5.0	81.0		18.0				
Max Q Clear Time (g_c+I1), s	6.8	49.8		12.1	2.9	60.5		6.4				
Green Ext Time (p_c), s	0.3	8.7		0.3	0.0	10.0		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			28.8									
HCM 6th LOS			C									

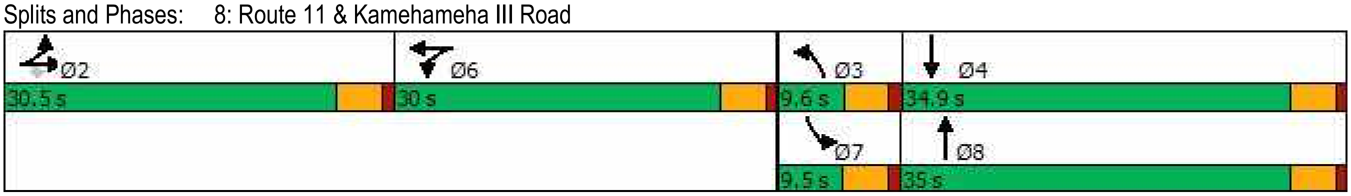
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	11	52	11	64	606	19	622
Future Volume (vph)	11	52	11	64	606	19	622
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	9.6	35.0	9.5	34.9
Total Split (%)	29.0%	29.0%	28.6%	9.1%	33.3%	9.0%	33.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	20.4	20.4	6.8	5.3	35.7	5.2	31.7
Actuated g/C Ratio	0.27	0.27	0.09	0.07	0.48	0.07	0.42
v/c Ratio	0.74	0.11	0.23	0.54	0.74	0.16	0.67
Control Delay	36.6	1.0	26.2	57.0	28.4	42.0	21.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.6	1.0	26.2	57.0	28.4	42.0	21.9
LOS	D	A	C	E	C	D	C
Approach Delay	31.8		26.2		31.1		22.3
Approach LOS	C		C		C		C

Intersection Summary	
Cycle Length: 105	
Actuated Cycle Length: 75	
Natural Cycle: 105	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 27.1	Intersection LOS: C
Intersection Capacity Utilization 73.2%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 8: Route 11 & Kamehameha III Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	325	11	52	7	11	20	64	606	11	19	622	316
Future Volume (veh/h)	325	11	52	7	11	20	64	606	11	19	622	316
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1767	1811	1870	1870	1870	1856	1856	1870	1870	1870	1870
Adj Flow Rate, veh/h	342	12	0	7	12	21	67	638	12	20	655	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	9	6	2	2	2	3	3	2	2	2	2
Cap, veh/h	403	14		11	19	34	90	807	15	41	1481	
Arrive On Green	0.25	0.25	0.00	0.04	0.04	0.04	0.05	0.44	0.44	0.02	0.42	0.00
Sat Flow, veh/h	1628	57	1535	297	509	890	1767	1815	34	1781	3647	0
Grp Volume(v), veh/h	354	0	0	40	0	0	67	0	650	20	655	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1695	0	0	1767	0	1849	1781	1777	0
Q Serve(g_s), s	14.6	0.0	0.0	1.7	0.0	0.0	2.7	0.0	22.0	0.8	9.6	0.0
Cycle Q Clear(g_c), s	14.6	0.0	0.0	1.7	0.0	0.0	2.7	0.0	22.0	0.8	9.6	0.0
Prop In Lane	0.97		1.00	0.17		0.52	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	417	0		65	0	0	90	0	823	41	1481	
V/C Ratio(X)	0.85	0.00		0.62	0.00	0.00	0.74	0.00	0.79	0.49	0.44	
Avail Cap(c_a), veh/h	601	0		593	0	0	124	0	823	122	1481	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	26.1	0.0	0.0	34.6	0.0	0.0	34.2	0.0	17.3	35.2	15.2	0.0
Incr Delay (d2), s/veh	7.7	0.0	0.0	9.3	0.0	0.0	14.6	0.0	7.6	8.9	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	0.0	0.0	0.8	0.0	0.0	1.5	0.0	9.5	0.4	3.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	33.9	0.0	0.0	43.9	0.0	0.0	48.8	0.0	25.0	44.1	16.2	0.0
LnGrp LOS	C	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		354	A		40			717			675	A
Approach Delay, s/veh		33.9			43.9			27.2			17.0	
Approach LOS		C			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		22.6	8.2	34.9		7.3	6.2	36.9				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		26.0	5.1	30.4		25.5	5.0	30.5				
Max Q Clear Time (g_c+I1), s		16.6	4.7	11.6		3.7	2.8	24.0				
Green Ext Time (p_c), s		1.5	0.0	3.9		0.1	0.0	2.1				

Intersection Summary			
HCM 6th Ctrl Delay			25.0
HCM 6th LOS			C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

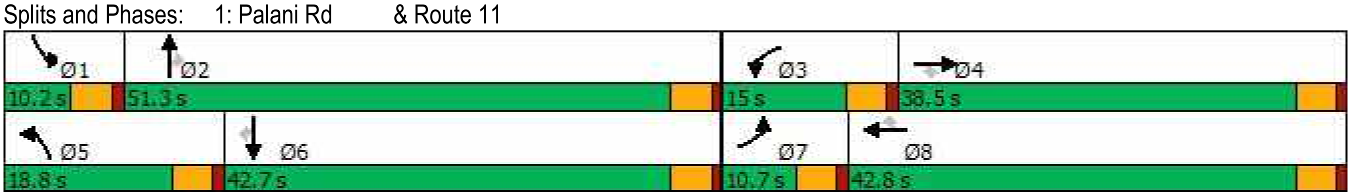
Appendix G

Analysis Reports – Future With Project Conditions (2029)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	544	218	166	828	42	243	192	118	22	321	177
Future Volume (vph)	71	544	218	166	828	42	243	192	118	22	321	177
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	10.7	38.5	38.5	15.0	42.8	42.8	18.8	51.3	51.3	10.2	42.7	42.7
Total Split (%)	9.3%	33.5%	33.5%	13.0%	37.2%	37.2%	16.3%	44.6%	44.6%	8.9%	37.1%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	6.2	35.1	35.1	9.4	40.7	40.7	11.6	29.6	29.6	5.8	17.1	17.1
Actuated g/C Ratio	0.07	0.38	0.38	0.10	0.44	0.44	0.13	0.32	0.32	0.06	0.19	0.19
v/c Ratio	0.34	0.44	0.32	0.49	0.56	0.06	0.58	0.17	0.20	0.20	0.50	0.41
Control Delay	49.2	24.5	5.1	46.3	23.5	0.1	45.3	22.9	5.3	50.3	35.4	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.2	24.5	5.1	46.3	23.5	0.1	45.3	22.9	5.3	50.3	35.4	8.3
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		21.5			26.2			29.0			26.7	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 91.5	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.58	
Intersection Signal Delay: 25.5	Intersection LOS: C
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	544	218	166	828	42	243	192	118	22	321	177
Future Volume (veh/h)	71	544	218	166	828	42	243	192	118	22	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	555	0	169	845	0	248	196	0	22	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	161	1536		253	1657		344	774		43	500	
Arrive On Green	0.05	0.46	0.00	0.07	0.48	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	555	0	169	845	0	248	196	0	22	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.7	8.5	0.0	3.8	13.4	0.0	5.6	3.6	0.0	1.0	6.9	0.0
Cycle Q Clear(g_c), s	1.7	8.5	0.0	3.8	13.4	0.0	5.6	3.6	0.0	1.0	6.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	161	1536		253	1657		344	774		43	500	
V/C Ratio(X)	0.45	0.36		0.67	0.51		0.72	0.25		0.51	0.66	
Avail Cap(c_a), veh/h	250	1536		449	1657		612	2092		128	1707	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.7	14.0	0.0	35.9	14.2	0.0	34.6	25.8	0.0	38.3	32.3	0.0
Incr Delay (d2), s/veh	2.0	0.7	0.0	3.1	1.1	0.0	2.9	0.2	0.0	9.0	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.1	0.0	1.6	4.9	0.0	2.4	1.5	0.0	0.5	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.7	14.7	0.0	38.9	15.3	0.0	37.5	25.9	0.0	47.4	33.8	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		627	A		1014	A		444	A		350	A
Approach Delay, s/veh		17.4			19.2			32.4			34.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	21.8	10.4	40.9	12.5	15.7	8.5	42.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.7	46.8	10.5	34.0	14.3	38.2	6.2	38.3
Max Q Clear Time (g_c+I1), s	3.0	5.6	5.8	10.5	7.6	8.9	3.7	15.4
Green Ext Time (p_c), s	0.0	1.3	0.2	3.7	0.5	2.2	0.0	6.1

Intersection Summary	
HCM 6th Ctrl Delay	23.4
HCM 6th LOS	C

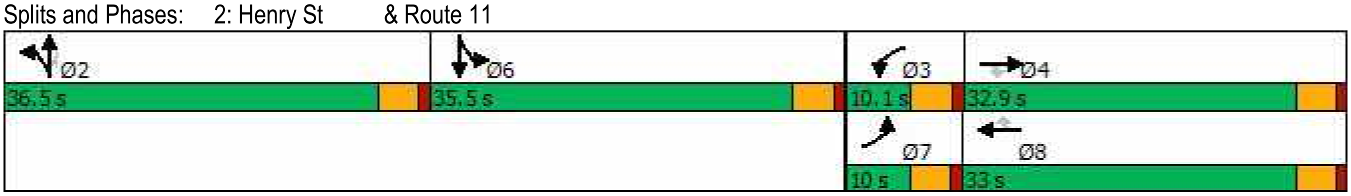
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	107	447	124	61	763	545	146	337	48	412	339
Future Volume (vph)	107	447	124	61	763	545	146	337	48	412	339
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	10.0	32.9	32.9	10.1	33.0	33.0	36.5	36.5	36.5	35.5	35.5
Total Split (%)	8.7%	28.6%	28.6%	8.8%	28.7%	28.7%	31.7%	31.7%	31.7%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	5.6	31.3	31.3	5.7	29.0	29.0	17.8	17.8	17.8	24.8	24.8
Actuated g/C Ratio	0.06	0.33	0.33	0.06	0.30	0.30	0.19	0.19	0.19	0.26	0.26
v/c Ratio	0.61	0.43	0.22	0.32	0.76	0.65	0.47	0.58	0.14	0.73	0.71
Control Delay	62.1	30.1	6.9	51.9	38.0	7.0	40.6	39.5	0.8	44.3	36.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.1	30.1	6.9	51.9	38.0	7.0	40.6	39.5	0.8	44.3	36.1
LOS	E	C	A	D	D	A	D	D	A	D	D
Approach Delay		30.9			26.3			36.3			38.9
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 95.4	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 31.9	Intersection LOS: C
Intersection Capacity Utilization 69.8%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	447	124	61	763	545	146	337	48	412	339	124
Future Volume (vph)	107	447	124	61	763	545	146	337	48	412	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	461	128	63	787	562	151	347	49	425	349	128
RTOR Reduction (vph)	0	0	86	0	0	387	0	0	40	0	20	0
Lane Group Flow (vph)	110	461	42	63	787	175	136	362	9	302	580	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	5.6	31.3	31.3	4.3	30.0	30.0	17.8	17.8	17.8	24.8	24.8	
Effective Green, g (s)	5.6	31.3	31.3	4.3	30.0	30.0	17.8	17.8	17.8	24.8	24.8	
Actuated g/C Ratio	0.06	0.33	0.33	0.04	0.31	0.31	0.19	0.19	0.19	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	180	1067	493	147	1062	482	289	619	275	411	818	
v/s Ratio Prot	c0.04	0.14		0.02	c0.23		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.11			0.01			
v/c Ratio	0.61	0.43	0.08	0.43	0.74	0.36	0.47	0.58	0.03	0.73	0.71	
Uniform Delay, d1	44.2	25.5	22.5	44.8	29.6	25.7	35.0	35.8	32.1	32.7	32.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.0	1.3	0.3	2.0	4.7	2.1	1.2	1.4	0.0	6.7	2.8	
Delay (s)	50.3	26.7	22.8	46.8	34.3	27.8	36.2	37.2	32.2	39.4	35.3	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		29.7			32.3			36.5			36.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	96.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	27.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	55	171	1275	963	30
Future Vol, veh/h	44	55	171	1275	963	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	59	184	1371	1035	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2775	-	1036	0	-	0
Stage 1	1036	-	-	-	-	-
Stage 2	1739	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 21	0	671	-	-	-
Stage 1	342	0	-	-	-	-
Stage 2	155	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 15	-	670	-	-	-
Mov Cap-2 Maneuver	~ 15	-	-	-	-	-
Stage 1	248	-	-	-	-	-
Stage 2	155	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1488.3	1.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	670	-	15	-	-	-
HCM Lane V/C Ratio	0.274	-	3.154	-	-	-
HCM Control Delay (s)	12.4		$ 1488.3	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.1	-	6.7	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	1.4					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	140	1305	15	73	939
Future Vol, veh/h	9	140	1305	15	73	939
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1403	16	78	1010

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2577	-	0	0	1403	0
Stage 1	1411	-	-	-	-	-
Stage 2	1166	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.254	-
Pot Cap-1 Maneuver	28	0	-	-	474	-
Stage 1	225	0	-	-	-	-
Stage 2	296	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	23	-	-	-	474	-
Mov Cap-2 Maneuver	23	-	-	-	-	-
Stage 1	225	-	-	-	-	-
Stage 2	247	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	247.1	0	1
HCM LOS	F		

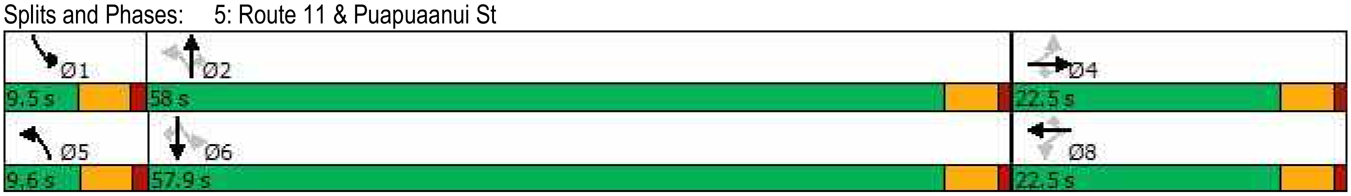
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	23	-	474	-
HCM Lane V/C Ratio	-	-	0.421	-	0.166	-
HCM Control Delay (s)	-	-	247.1	0	14.1	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	1.2	-	0.6	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	193	9	75	112	59	140	104	991	27	43	838	68
Future Volume (vph)	193	9	75	112	59	140	104	991	27	43	838	68
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.6	58.0	58.0	9.5	57.9	57.9
Total Split (%)	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	10.7%	64.4%	64.4%	10.6%	64.3%	64.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.4	16.4	16.4	16.4	16.4	16.4	58.7	55.7	55.7	57.7	53.8	53.8
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.19	0.19	0.68	0.64	0.64	0.67	0.62	0.62
v/c Ratio	0.83	0.03	0.22	0.45	0.18	0.35	0.40	0.89	0.03	0.25	0.79	0.07
Control Delay	62.3	29.3	9.1	37.7	31.5	8.2	8.7	26.6	0.0	7.7	20.5	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.3	29.3	9.1	37.7	31.5	8.2	8.7	26.6	0.0	7.7	20.5	2.2
LOS	E	C	A	D	C	A	A	C	A	A	C	A
Approach Delay		46.8			23.2			24.3			18.6	
Approach LOS		D			C			C			B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 86.7
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 24.5 Intersection LOS: C
Intersection Capacity Utilization 84.9% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	193	9	75	112	59	140	104	991	27	43	838	68
Future Volume (veh/h)	193	9	75	112	59	140	104	991	27	43	838	68
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1856	1870	1870	1826	1870
Adj Flow Rate, veh/h	210	10	0	119	64	0	113	1054	0	46	891	0
Peak Hour Factor	0.92	0.92	0.92	0.94	0.92	0.94	0.92	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	3	2	2	5	2
Cap, veh/h	311	376		357	376		305	1133		201	1088	
Arrive On Green	0.20	0.20	0.00	0.20	0.20	0.00	0.05	0.61	0.00	0.04	0.60	0.00
Sat Flow, veh/h	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Grp Volume(v), veh/h	210	10	0	119	64	0	113	1054	0	46	891	0
Grp Sat Flow(s),veh/h/ln	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Q Serve(g_s), s	13.8	0.4	0.0	6.7	2.5	0.0	2.1	45.9	0.0	0.9	34.5	0.0
Cycle Q Clear(g_c), s	16.3	0.4	0.0	7.0	2.5	0.0	2.1	45.9	0.0	0.9	34.5	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	311	376		357	376		305	1133		201	1088	
V/C Ratio(X)	0.67	0.03		0.33	0.17		0.37	0.93		0.23	0.82	
Avail Cap(c_a), veh/h	311	376		357	376		313	1133		232	1088	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.4	28.8	0.0	31.6	29.6	0.0	14.0	15.7	0.0	18.3	14.3	0.0
Incr Delay (d2), s/veh	5.7	0.0	0.0	0.5	0.2	0.0	0.7	14.5	0.0	0.6	6.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.2	0.0	2.3	1.1	0.0	1.0	21.2	0.0	0.5	14.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.0	28.8	0.0	32.1	29.8	0.0	14.8	30.3	0.0	18.9	21.2	0.0
LnGrp LOS	D	C		C	C		B	C		B	C	
Approach Vol, veh/h		220	A		183	A		1167	A		937	A
Approach Delay, s/veh		41.4			31.3			28.8			21.1	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.9	59.2		22.5	9.2	57.9		22.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	53.5		18.0	5.1	53.4		18.0				
Max Q Clear Time (g_c+I1), s	2.9	47.9		18.3	4.1	36.5		9.0				
Green Ext Time (p_c), s	0.0	3.6		0.0	0.0	6.5		0.4				

Intersection Summary			
HCM 6th Ctrl Delay			27.2
HCM 6th LOS			C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	12.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	159	605	968	972	2
Future Vol, veh/h	0	159	605	968	972	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	0	171	651	1041	1045	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3388	-	1045	0	-	0
Stage 1	1045	-	-	-	-	-
Stage 2	2343	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	8	0	666	-	-	-
Stage 1	339	0	-	-	-	-
Stage 2	77	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	0	-	666	-	-	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	8	-	-	-	-	-
Stage 2	77	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	20.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	666	-	-	-	-	-
HCM Lane V/C Ratio	0.977	-	-	-	-	-
HCM Control Delay (s)	54.2	-	0	0	-	-
HCM Lane LOS	F	-	A	A	-	-
HCM 95th %tile Q(veh)	14.7	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	976	55	164	822	146
Future Volume (vph)	283	48	85	39	33	976	55	164	822	146
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	26.0	26.0	23.0	23.0	9.5	79.0	79.0	12.0	81.5	81.5
Total Split (%)	18.6%	18.6%	16.4%	16.4%	6.8%	56.4%	56.4%	8.6%	58.2%	58.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	21.5	21.5	18.5	18.5	79.5	74.5	74.5	84.9	78.9	78.9
Actuated g/C Ratio	0.15	0.15	0.13	0.13	0.57	0.53	0.53	0.61	0.56	0.56
v/c Ratio	1.11	0.42	0.39	1.13	0.20	1.05	0.07	1.23	0.84	0.16
Control Delay	140.7	39.4	61.1	125.3	13.4	74.2	1.6	181.3	35.1	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	140.7	39.4	61.1	125.3	13.4	74.2	1.6	181.3	35.1	5.4
LOS	F	D	E	F	B	E	A	F	D	A
Approach Delay		111.1		112.6		68.6			52.4	
Approach LOS		F		F		E			D	

Intersection Summary

Cycle Length: 140

Actuated Cycle Length: 140

Natural Cycle: 140

Control Type: Semi Act-Uncoord

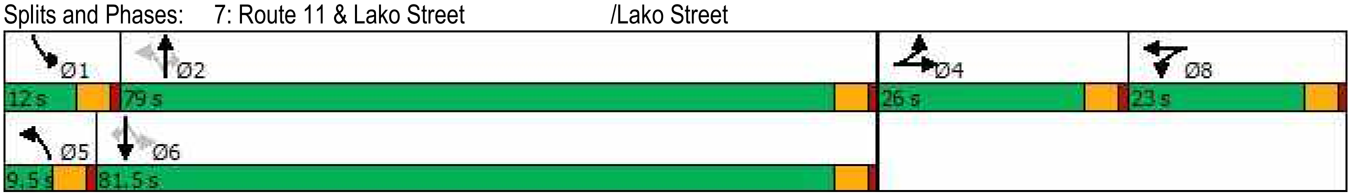
Maximum v/c Ratio: 1.23

Intersection Signal Delay: 74.4 Intersection LOS: E

Intersection Capacity Utilization 112.1% ICU Level of Service H

Analysis Period (min) 15

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Future Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	294	308		120	127		261	1069		174	1116	
Arrive On Green	0.16	0.16	0.00	0.07	0.07	0.00	0.03	0.57	0.00	0.06	0.60	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	21.5	3.1	0.0	6.5	2.7	0.0	1.0	69.7	0.0	7.5	46.3	0.0
Cycle Q Clear(g_c), s	21.5	3.1	0.0	6.5	2.7	0.0	1.0	69.7	0.0	7.5	46.3	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	294	308		120	127		261	1069		174	1116	
V/C Ratio(X)	1.02	0.17		0.75	0.32		0.13	0.97		1.00	0.78	
Avail Cap(c_a), veh/h	294	308		251	265		280	1069		174	1116	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	54.4	46.7	0.0	59.7	57.9	0.0	18.0	26.9	0.0	39.4	19.6	0.0
Incr Delay (d2), s/veh	59.0	0.2	0.0	8.9	1.4	0.0	0.2	21.4	0.0	68.4	5.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.4	1.5	0.0	3.2	1.3	0.0	0.4	35.8	0.0	9.0	20.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	113.4	47.0	0.0	68.6	59.3	0.0	18.2	48.3	0.0	107.8	25.1	0.0
LnGrp LOS	F	D		E	E		B	D		F	C	
Approach Vol, veh/h		352	A		131	A		1073	A		1048	A
Approach Delay, s/veh		103.8			65.7			47.3			38.8	
Approach LOS		F			E			D			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.0	79.0		26.0	8.1	82.9		13.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.5	74.5		21.5	5.0	77.0		18.5				
Max Q Clear Time (g_c+I1), s	9.5	71.7		23.5	3.0	48.3		8.5				
Green Ext Time (p_c), s	0.0	1.9		0.0	0.0	7.8		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			52.5
HCM 6th LOS			D

Notes

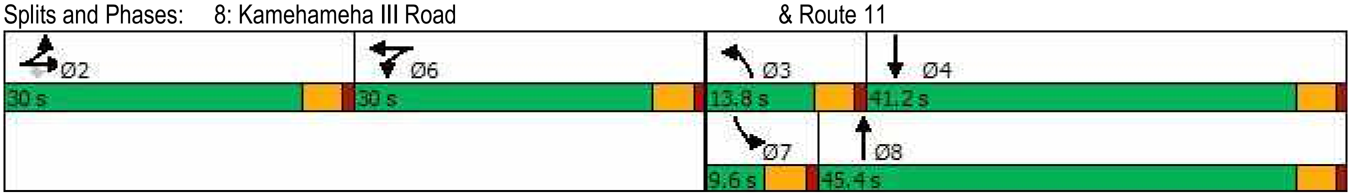
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	5	26	12	76	599	16	533
Future Volume (vph)	5	26	12	76	599	16	533
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.0	30.0	30.0	13.8	45.4	9.6	41.2
Total Split (%)	26.1%	26.1%	26.1%	12.0%	39.5%	8.3%	35.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.2	15.2	7.3	8.6	47.6	5.2	40.5
Actuated g/C Ratio	0.18	0.18	0.09	0.10	0.58	0.06	0.49
v/c Ratio	0.64	0.08	0.30	0.48	0.64	0.15	0.57
Control Delay	41.9	0.5	32.0	48.2	20.2	44.8	17.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.9	0.5	32.0	48.2	20.2	44.8	17.6
LOS	D	A	C	D	C	D	B
Approach Delay	36.9		32.0		23.3		18.1
Approach LOS	D		C		C		B

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 82.3
Natural Cycle: 115
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 22.6 — Intersection LOS: C
Intersection Capacity Utilization 64.9% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 8: Kamehameha III Road & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	182	5	26	16	12	17	76	599	15	16	533	334
Future Volume (veh/h)	182	5	26	16	12	17	76	599	15	16	533	334
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1722	1870	1781	1796	1752	1811	1870	1870	1811	1811
Adj Flow Rate, veh/h	196	5	0	17	13	18	82	644	16	17	573	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	2	12	2	8	7	10	6	2	2	6	6
Cap, veh/h	256	7		24	18	25	103	965	24	35	1744	
Arrive On Green	0.15	0.15	0.00	0.04	0.04	0.04	0.06	0.55	0.55	0.02	0.51	0.00
Sat Flow, veh/h	1739	44	1459	569	435	603	1668	1758	44	1781	3532	0
Grp Volume(v), veh/h	201	0	0	48	0	0	82	0	660	17	573	0
Grp Sat Flow(s),veh/h/ln	1783	0	1459	1608	0	0	1668	0	1802	1781	1721	0
Q Serve(g_s), s	8.1	0.0	0.0	2.2	0.0	0.0	3.6	0.0	19.4	0.7	7.3	0.0
Cycle Q Clear(g_c), s	8.1	0.0	0.0	2.2	0.0	0.0	3.6	0.0	19.4	0.7	7.3	0.0
Prop In Lane	0.98		1.00	0.35		0.37	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	262	0		68	0	0	103	0	989	35	1744	
V/C Ratio(X)	0.77	0.00		0.71	0.00	0.00	0.79	0.00	0.67	0.48	0.33	
Avail Cap(c_a), veh/h	610	0		550	0	0	208	0	989	122	1744	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.5	0.0	0.0	35.2	0.0	0.0	34.5	0.0	12.0	36.1	10.9	0.0
Incr Delay (d2), s/veh	4.6	0.0	0.0	12.6	0.0	0.0	12.6	0.0	3.6	9.7	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	0.0	1.1	0.0	0.0	1.7	0.0	7.0	0.4	2.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.2	0.0	0.0	47.8	0.0	0.0	47.1	0.0	15.5	45.8	11.4	0.0
LnGrp LOS	D	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		201	A		48			742			590	A
Approach Delay, s/veh		35.2			47.8			19.0			12.4	
Approach LOS		D			D			B			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		15.5	9.1	42.3		7.6	6.0	45.4				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.5	9.3	36.7		25.5	5.1	40.9				
Max Q Clear Time (g_c+I1), s		10.1	5.6	9.3		4.2	2.7	21.4				
Green Ext Time (p_c), s		0.9	0.0	3.7		0.2	0.0	4.0				

Intersection Summary		
HCM 6th Ctrl Delay		19.5
HCM 6th LOS		B

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	3.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	108	968	25	22	950
Future Vol, veh/h	29	108	968	25	22	950
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	500	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	117	1052	27	24	1033

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2133	1052	0	0	1052	0
Stage 1	1052	-	-	-	-	-
Stage 2	1081	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	54	275	-	-	662	-
Stage 1	336	-	-	-	-	-
Stage 2	326	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	52	275	-	-	662	-
Mov Cap-2 Maneuver	52	-	-	-	-	-
Stage 1	336	-	-	-	-	-
Stage 2	314	-	-	-	-	-

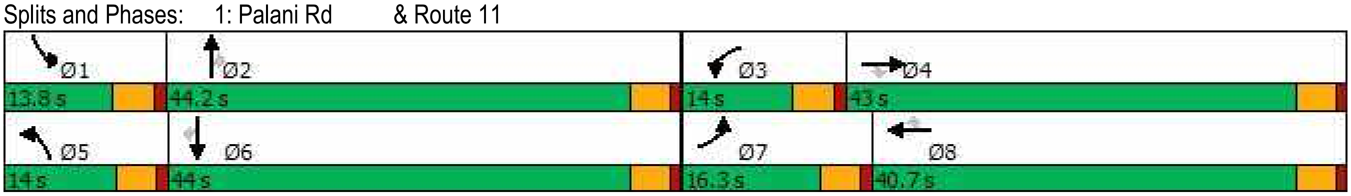
Approach	WB	NB	SB
HCM Control Delay, s	53.2	0	0.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	52	275	662	-
HCM Lane V/C Ratio	-	-	0.606	0.427	0.036	-
HCM Control Delay (s)	-	-	149.1	27.5	10.6	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	2.4	2	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	1059	503	227	739	65	227	283	272	56	313	107
Future Volume (vph)	260	1059	503	227	739	65	227	283	272	56	313	107
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	16.3	43.0	43.0	14.0	40.7	40.7	14.0	44.2	44.2	13.8	44.0	44.0
Total Split (%)	14.2%	37.4%	37.4%	12.2%	35.4%	35.4%	12.2%	38.4%	38.4%	12.0%	38.3%	38.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	11.2	38.9	38.9	9.5	37.2	37.2	9.5	20.7	20.7	7.9	16.9	16.9
Actuated g/C Ratio	0.12	0.42	0.42	0.10	0.40	0.40	0.10	0.22	0.22	0.08	0.18	0.18
v/c Ratio	0.65	0.74	0.58	0.66	0.54	0.10	0.67	0.37	0.50	0.38	0.50	0.29
Control Delay	48.5	28.2	8.6	52.0	25.0	2.4	52.3	32.4	7.4	50.4	36.0	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.5	28.2	8.6	52.0	25.0	2.4	52.3	32.4	7.4	50.4	36.0	7.8
LOS	D	C	A	D	C	A	D	C	A	D	D	A
Approach Delay		25.7			29.5			29.5			31.3	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 93	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 28.0	Intersection LOS: C
Intersection Capacity Utilization 66.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	1059	503	227	739	65	227	283	272	56	313	107
Future Volume (veh/h)	260	1059	503	227	739	65	227	283	272	56	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	1081	0	232	754	0	232	289	0	57	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	351	1623		314	1569		313	674		78	505	
Arrive On Green	0.10	0.46	0.00	0.09	0.45	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	1081	0	232	754	0	232	289	0	57	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.3	20.0	0.0	5.5	12.7	0.0	5.5	6.0	0.0	2.6	7.1	0.0
Cycle Q Clear(g_c), s	6.3	20.0	0.0	5.5	12.7	0.0	5.5	6.0	0.0	2.6	7.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	351	1623		314	1569		313	674		78	505	
V/C Ratio(X)	0.75	0.67		0.74	0.48		0.74	0.43		0.73	0.63	
Avail Cap(c_a), veh/h	484	1623		393	1569		390	1687		198	1679	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.5	17.6	0.0	37.0	16.2	0.0	37.0	29.9	0.0	39.5	33.8	0.0
Incr Delay (d2), s/veh	4.4	2.2	0.0	5.6	1.1	0.0	5.7	0.4	0.0	12.2	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	7.8	0.0	2.5	4.9	0.0	2.5	2.5	0.0	1.4	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.9	19.7	0.0	42.6	17.3	0.0	42.8	30.3	0.0	51.7	35.1	0.0
LnGrp LOS	D	B		D	B		D	C		D	D	
Approach Vol, veh/h		1346	A		986	A		521	A		376	A
Approach Delay, s/veh		23.9			23.2			35.9			37.6	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.2	20.4	12.1	43.0	12.1	16.4	13.1	42.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.3	39.7	9.5	38.5	9.5	39.5	11.8	36.2
Max Q Clear Time (g_c+I1), s	4.6	8.0	7.5	22.0	7.5	9.1	8.3	14.7
Green Ext Time (p_c), s	0.0	2.0	0.2	7.0	0.2	2.2	0.3	5.2

Intersection Summary	
HCM 6th Ctrl Delay	27.2
HCM 6th LOS	C

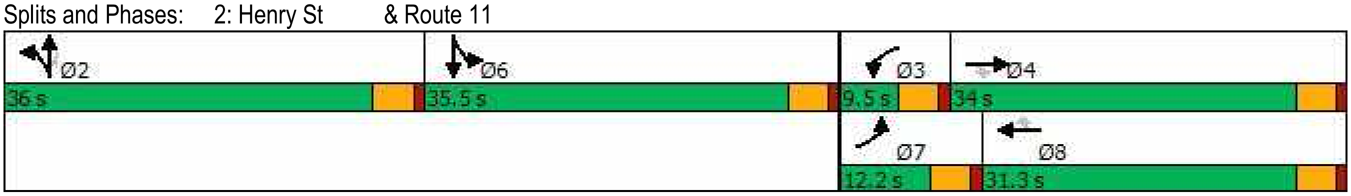
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	190	853	291	84	700	368	126	318	40	411	342
Future Volume (vph)	190	853	291	84	700	368	126	318	40	411	342
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	12.2	34.0	34.0	9.5	31.3	31.3	36.0	36.0	36.0	35.5	35.5
Total Split (%)	10.6%	29.6%	29.6%	8.3%	27.2%	27.2%	31.3%	31.3%	31.3%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	7.8	32.2	32.2	5.1	27.2	27.2	17.0	17.0	17.0	25.7	25.7
Actuated g/C Ratio	0.08	0.34	0.34	0.05	0.28	0.28	0.18	0.18	0.18	0.27	0.27
v/c Ratio	0.72	0.73	0.41	0.48	0.73	0.53	0.41	0.56	0.12	0.75	0.72
Control Delay	61.2	35.7	5.6	57.0	38.2	6.6	39.9	39.9	0.7	45.1	34.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.2	35.7	5.6	57.0	38.2	6.6	39.9	39.9	0.7	45.1	34.6
LOS	E	D	A	E	D	A	D	D	A	D	C
Approach Delay		32.7			29.5			36.6			38.2
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 96	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 33.6	Intersection LOS: C
Intersection Capacity Utilization 74.4%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	853	291	84	700	368	126	318	40	411	342	190
Future Volume (vph)	190	853	291	84	700	368	126	318	40	411	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3196	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3196	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	870	297	86	714	376	129	324	41	419	349	194
RTOR Reduction (vph)	0	0	198	0	0	266	0	0	34	0	39	0
Lane Group Flow (vph)	194	870	99	86	714	110	116	337	7	323	600	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.8	32.2	32.2	3.9	28.3	28.3	17.0	17.0	17.0	25.7	25.7	
Effective Green, g (s)	7.8	32.2	32.2	3.9	28.3	28.3	17.0	17.0	17.0	25.7	25.7	
Actuated g/C Ratio	0.08	0.33	0.33	0.04	0.29	0.29	0.18	0.18	0.18	0.27	0.27	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	268	1177	526	138	1014	456	280	593	269	427	848	
v/s Ratio Prot	c0.06	c0.25		0.03	0.21		0.07	c0.10		c0.20	0.19	
v/s Ratio Perm			0.06			0.07			0.00			
v/c Ratio	0.72	0.74	0.19	0.62	0.70	0.24	0.41	0.57	0.03	0.76	0.71	
Uniform Delay, d1	43.4	28.6	23.0	45.7	30.5	26.1	35.5	36.5	33.0	32.7	32.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	4.2	0.8	8.5	4.1	1.2	1.0	1.3	0.0	7.5	2.7	
Delay (s)	52.8	32.8	23.8	54.2	34.6	27.3	36.5	37.8	33.1	40.1	34.9	
Level of Service	D	C	C	D	C	C	D	D	C	D	C	
Approach Delay (s)		33.7			33.7			37.1			36.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	96.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	88	89	1181	1300	17
Future Vol, veh/h	10	88	89	1181	1300	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	91	92	1218	1340	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2742	-	1340	0	-	0
Stage 1	1340	-	-	-	-	-
Stage 2	1402	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	22	0	514	-	-	-
Stage 1	244	0	-	-	-	-
Stage 2	228	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	18	-	514	-	-	-
Mov Cap-2 Maneuver	18	-	-	-	-	-
Stage 1	200	-	-	-	-	-
Stage 2	228	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 355.4	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	514	-	18	-	-	-
HCM Lane V/C Ratio	0.179	-	0.573	-	-	-
HCM Control Delay (s)	13.5	-	$ 355.4	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.6	-	1.5	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	1204	4	61	1329
Future Vol, veh/h	14	71	1204	4	61	1329
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	1241	4	63	1370

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2739	-	0	0	1241	0
Stage 1	1243	-	-	-	-	-
Stage 2	1496	-	-	-	-	-
Critical Hdwy	6.47	-	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	-	-	-	2.272	-
Pot Cap-1 Maneuver	21	0	-	-	541	-
Stage 1	266	0	-	-	-	-
Stage 2	199	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	19	-	-	-	541	-
Mov Cap-2 Maneuver	19	-	-	-	-	-
Stage 1	266	-	-	-	-	-
Stage 2	176	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 400.6	0	0.5
HCM LOS	F		

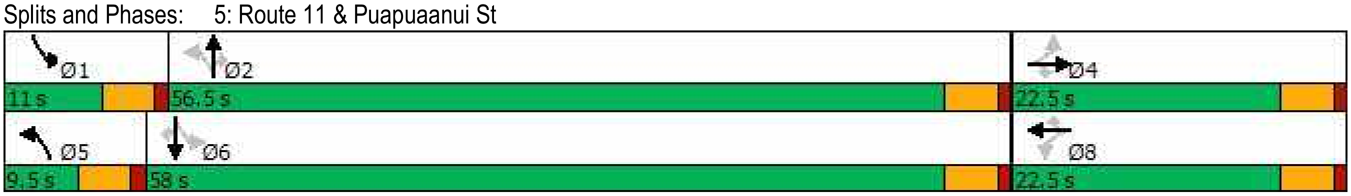
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	19	-	541	-
HCM Lane V/C Ratio	-	-	0.76	-	0.116	-
HCM Control Delay (s)	-	-	$ 400.6	0	12.5	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	2.1	-	0.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	199	23	116	53	23	104	105	882	61	142	1098	100
Future Volume (vph)	199	23	116	53	23	104	105	882	61	142	1098	100
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	56.5	56.5	11.0	58.0	58.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	10.6%	62.8%	62.8%	12.2%	64.4%	64.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.6	16.6	16.6	16.6	16.6	16.6	57.1	52.1	52.1	59.9	53.5	53.5
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.19	0.19	0.64	0.59	0.59	0.68	0.60	0.60
v/c Ratio	0.84	0.07	0.32	0.21	0.07	0.29	0.62	0.84	0.07	0.56	1.01	0.11
Control Delay	62.6	30.0	8.3	32.6	30.0	8.6	27.3	24.2	2.0	14.9	48.2	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	30.0	8.3	32.6	30.0	8.6	27.3	24.2	2.0	14.9	48.2	2.2
LOS	E	C	A	C	C	A	C	C	A	B	D	A
Approach Delay		41.7			18.5			23.2			41.1	
Approach LOS		D			B			C			D	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 88.6	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.01	
Intersection Signal Delay: 33.4	Intersection LOS: C
Intersection Capacity Utilization 92.5%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	23	116	53	23	104	105	882	61	142	1098	100
Future Volume (veh/h)	199	23	116	53	23	104	105	882	61	142	1098	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1826	1870	1856	1841	1870	1870	1870
Adj Flow Rate, veh/h	216	25	0	55	25	0	114	909	0	146	1132	0
Peak Hour Factor	0.92	0.92	0.92	0.97	0.92	0.97	0.92	0.97	0.97	0.97	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	5	2	3	4	2	2	2
Cap, veh/h	326	350		326	350		178	1122		318	1135	
Arrive On Green	0.19	0.19	0.00	0.19	0.19	0.00	0.05	0.60	0.00	0.06	0.61	0.00
Sat Flow, veh/h	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Grp Volume(v), veh/h	216	25	0	55	25	0	114	909	0	146	1132	0
Grp Sat Flow(s),veh/h/ln	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Q Serve(g_s), s	13.4	1.0	0.0	3.0	1.0	0.0	2.1	33.5	0.0	2.7	53.2	0.0
Cycle Q Clear(g_c), s	14.4	1.0	0.0	4.0	1.0	0.0	2.1	33.5	0.0	2.7	53.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	326	350		326	350		178	1122		318	1135	
V/C Ratio(X)	0.66	0.07		0.17	0.07		0.64	0.81		0.46	1.00	
Avail Cap(c_a), veh/h	349	382		349	382		184	1122		351	1135	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.5	29.5	0.0	31.2	29.5	0.0	21.6	13.5	0.0	13.9	17.3	0.0
Incr Delay (d2), s/veh	4.3	0.1	0.0	0.2	0.1	0.0	6.9	6.4	0.0	1.0	26.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.4	0.0	1.0	0.4	0.0	1.7	14.1	0.0	1.3	27.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.7	29.6	0.0	31.4	29.6	0.0	28.6	19.9	0.0	14.9	43.5	0.0
LnGrp LOS	D	C		C	C		C	B		B	D	
Approach Vol, veh/h		241	A		80	A		1023	A		1278	A
Approach Delay, s/veh		38.7			30.9			20.8			40.2	
Approach LOS		D			C			C			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.4	57.8		21.0	9.2	58.0		21.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.5	52.0		18.0	5.0	53.5		18.0				
Max Q Clear Time (g_c+I1), s	4.7	35.5		16.4	4.1	55.2		6.0				
Green Ext Time (p_c), s	0.1	6.6		0.1	0.0	0.0		0.1				

Intersection Summary	
HCM 6th Ctrl Delay	32.2
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	325	341	1056	1168	0
Future Vol, veh/h	0	325	341	1056	1168	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	0	332	348	1078	1192	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2966	-	1192	0	-	0
Stage 1	1192	-	-	-	-	-
Stage 2	1774	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	15	0	586	-	-	-
Stage 1	280	0	-	-	-	-
Stage 2	144	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	6	-	586	-	-	-
Mov Cap-2 Maneuver	6	-	-	-	-	-
Stage 1	114	-	-	-	-	-
Stage 2	144	-	-	-	-	-

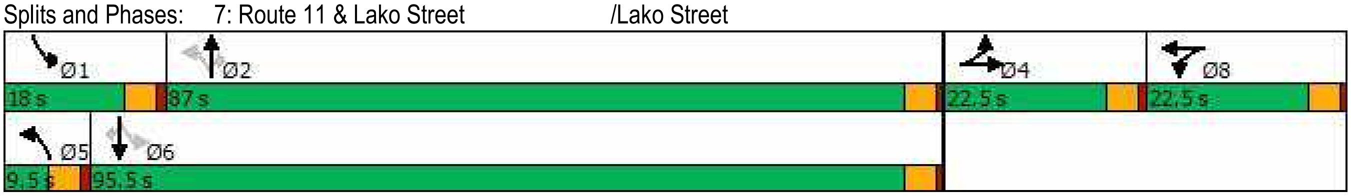
Approach	EB	NB	SB
HCM Control Delay, s	0	4.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	586	-	-	-	-	-
HCM Lane V/C Ratio	0.594	-	-	-	-	-
HCM Control Delay (s)	19.7	-	0	0	-	-
HCM Lane LOS	C	-	A	A	-	-
HCM 95th %tile Q(veh)	3.9	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Future Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	87.0	87.0	18.0	95.5	95.5
Total Split (%)	15.0%	15.0%	15.0%	15.0%	6.3%	58.0%	58.0%	12.0%	63.7%	63.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.5	16.5	15.9	15.9	87.6	82.6	82.6	100.7	93.2	93.2
Actuated g/C Ratio	0.11	0.11	0.11	0.11	0.60	0.56	0.56	0.69	0.64	0.64
v/c Ratio	0.81	0.36	0.38	0.92	0.35	0.98	0.07	1.00	0.94	0.19
Control Delay	93.5	35.1	66.8	62.0	19.8	56.0	0.6	104.5	41.8	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	93.5	35.1	66.8	62.0	19.8	56.0	0.6	104.5	41.8	5.5
LOS	F	D	E	E	B	E	A	F	D	A
Approach Delay		73.7		63.0		51.4			45.7	
Approach LOS		E		E		D			D	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 146.5	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 51.7	Intersection LOS: D
Intersection Capacity Utilization 102.7%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Future Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	184	196		99	102		204	1206		273	1266	
Arrive On Green	0.10	0.10	0.00	0.06	0.06	0.00	0.03	0.65	0.00	0.06	0.68	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	11.9	2.0	0.0	5.3	3.0	0.0	1.0	57.7	0.0	5.2	64.1	0.0
Cycle Q Clear(g_c), s	11.9	2.0	0.0	5.3	3.0	0.0	1.0	57.7	0.0	5.2	64.1	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	184	196		99	102		204	1206		273	1266	
V/C Ratio(X)	0.86	0.16		0.73	0.41		0.19	0.85		0.77	0.88	
Avail Cap(c_a), veh/h	235	250		239	245		220	1206		352	1266	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	59.2	54.7	0.0	62.5	61.4	0.0	21.8	18.3	0.0	26.9	17.4	0.0
Incr Delay (d2), s/veh	21.6	0.4	0.0	9.7	2.7	0.0	0.4	7.5	0.0	7.6	9.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	1.0	0.0	2.7	1.5	0.0	0.6	25.7	0.0	5.1	28.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	80.8	55.1	0.0	72.2	64.0	0.0	22.3	25.8	0.0	34.4	26.3	0.0
LnGrp LOS	F	E		E	E		C	C		C	C	
Approach Vol, veh/h		189	A		114	A		1061	A		1325	A
Approach Delay, s/veh		76.6			69.2			25.7			27.6	
Approach LOS		E			E			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.0	91.9		18.6	8.3	95.5		12.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	13.5	82.5		18.0	5.0	91.0		18.0				
Max Q Clear Time (g_c+I1), s	7.2	59.7		13.9	3.0	66.1		7.3				
Green Ext Time (p_c), s	0.3	9.3		0.2	0.0	11.3		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			32.1									
HCM 6th LOS			C									

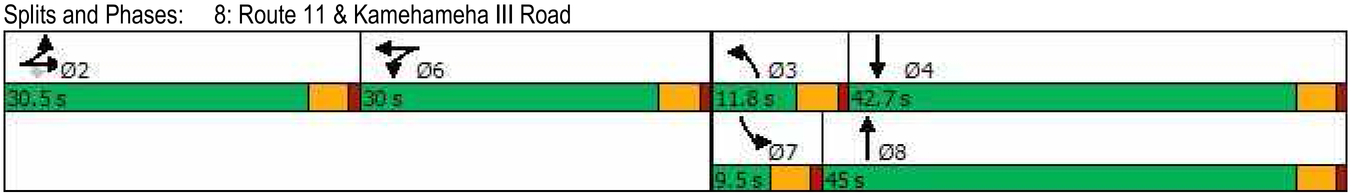
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	11	52	11	64	638	19	632
Future Volume (vph)	11	52	11	64	638	19	632
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	11.8	45.0	9.5	42.7
Total Split (%)	26.5%	26.5%	26.1%	10.3%	39.1%	8.3%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	24.0	24.0	6.8	7.1	45.1	5.1	39.6
Actuated g/C Ratio	0.27	0.27	0.08	0.08	0.51	0.06	0.45
v/c Ratio	0.78	0.11	0.27	0.48	0.73	0.20	0.65
Control Delay	44.4	1.7	29.6	54.5	26.4	48.9	22.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.4	1.7	29.6	54.5	26.4	48.9	22.1
LOS	D	A	C	D	C	D	C
Approach Delay	38.9		29.6		28.9		22.6
Approach LOS	D		C		C		C

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 88.4	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 28.0	Intersection LOS: C
Intersection Capacity Utilization 75.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 8: Route 11 & Kamehameha III Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	343	11	52	7	11	21	64	638	11	19	632	322
Future Volume (veh/h)	343	11	52	7	11	21	64	638	11	19	632	322
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1767	1811	1870	1870	1870	1856	1856	1870	1870	1870	1870
Adj Flow Rate, veh/h	361	12	0	7	12	22	67	672	12	20	665	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	9	6	2	2	2	3	3	2	2	2	2
Cap, veh/h	408	14		11	18	33	86	869	16	39	1606	
Arrive On Green	0.25	0.25	0.00	0.04	0.04	0.04	0.05	0.48	0.48	0.02	0.45	0.00
Sat Flow, veh/h	1631	54	1535	289	495	908	1767	1817	32	1781	3647	0
Grp Volume(v), veh/h	373	0	0	41	0	0	67	0	684	20	665	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1692	0	0	1767	0	1850	1781	1777	0
Q Serve(g_s), s	18.0	0.0	0.0	2.0	0.0	0.0	3.2	0.0	25.9	0.9	10.7	0.0
Cycle Q Clear(g_c), s	18.0	0.0	0.0	2.0	0.0	0.0	3.2	0.0	25.9	0.9	10.7	0.0
Prop In Lane	0.97		1.00	0.17		0.54	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	422	0		62	0	0	86	0	885	39	1606	
V/C Ratio(X)	0.88	0.00		0.66	0.00	0.00	0.78	0.00	0.77	0.51	0.41	
Avail Cap(c_a), veh/h	517	0		510	0	0	152	0	885	105	1606	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.6	0.0	0.0	40.3	0.0	0.0	39.8	0.0	18.3	40.9	15.6	0.0
Incr Delay (d2), s/veh	14.4	0.0	0.0	11.5	0.0	0.0	14.0	0.0	6.5	9.7	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	0.0	0.0	1.0	0.0	0.0	1.6	0.0	11.0	0.5	4.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.9	0.0	0.0	51.8	0.0	0.0	53.8	0.0	24.8	50.6	16.4	0.0
LnGrp LOS	D	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		373	A		41			751			685	A
Approach Delay, s/veh		44.9			51.8			27.4			17.4	
Approach LOS		D			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		25.7	8.6	42.8		7.6	6.4	45.0
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		26.0	7.3	38.2		25.5	5.0	40.5
Max Q Clear Time (g_c+I1), s		20.0	5.2	12.7		4.0	2.9	27.9
Green Ext Time (p_c), s		1.2	0.0	4.3		0.1	0.0	3.4

Intersection Summary	
HCM 6th Ctrl Delay	27.8
HCM 6th LOS	C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	68	1056	74	79	1151
Future Vol, veh/h	12	68	1056	74	79	1151
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	500	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	74	1148	80	86	1251

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2571	1148	0	0	1228	0
Stage 1	1148	-	-	-	-	-
Stage 2	1423	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	29	242	-	-	568	-
Stage 1	302	-	-	-	-	-
Stage 2	222	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	25	242	-	-	568	-
Mov Cap-2 Maneuver	25	-	-	-	-	-
Stage 1	302	-	-	-	-	-
Stage 2	188	-	-	-	-	-

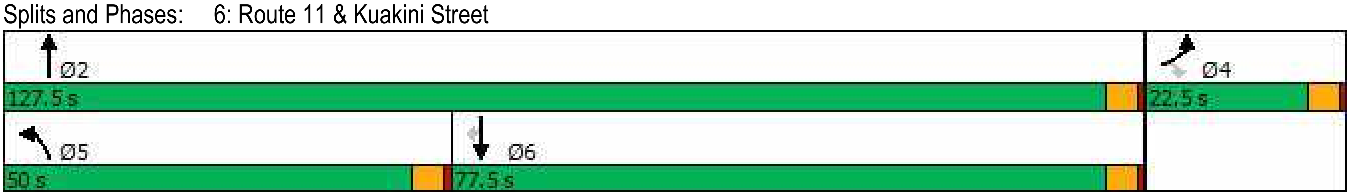
Approach	WB	NB	SB
HCM Control Delay, s	60.5	0	0.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	25	242	568	-
HCM Lane V/C Ratio	-	-	0.522	0.305	0.151	-
HCM Control Delay (s)	-	-	254.4	26.3	12.5	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	1.6	1.2	0.5	-

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	605	968	972	2
Future Volume (vph)	159	605	968	972	2
Turn Type	Perm	Prot	NA	NA	Perm
Protected Phases		5	2	6	
Permitted Phases	4				6
Detector Phase	4	5	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	22.5	50.0	127.5	77.5	77.5
Total Split (%)	15.0%	33.3%	85.0%	51.7%	51.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag	Lag
Lead-Lag Optimize?		Yes		Yes	Yes
Recall Mode	None	None	Max	Max	Max
Act Effct Green (s)	5.5	45.5	123.0	73.0	73.0
Actuated g/C Ratio	0.04	0.33	0.89	0.53	0.53
v/c Ratio	0.34	1.11	0.64	1.09	0.00
Control Delay	1.9	114.6	3.9	87.9	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	1.9	114.6	3.9	87.9	10.5
LOS	A	F	A	F	B
Approach Delay			46.5	87.7	
Approach LOS			D	F	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 137.5	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.11	
Intersection Signal Delay: 58.7	Intersection LOS: E
Intersection Capacity Utilization 92.2%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	605	968	972	2
Future Volume (veh/h)	0	159	605	968	972	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	651	1041	1045	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		636	1761	1045	
Arrive On Green	0.00	0.00	0.36	0.96	0.57	0.00
Sat Flow, veh/h	1781	1560	1781	1826	1826	1522
Grp Volume(v), veh/h	0	0	651	1041	1045	0
Grp Sat Flow(s),veh/h/ln	1781	1560	1781	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	45.5	6.0	72.9	0.0
Cycle Q Clear(g_c), s	0.0	0.0	45.5	6.0	72.9	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		636	1761	1045	
V/C Ratio(X)	0.00		1.02	0.59	1.00	
Avail Cap(c_a), veh/h	251		636	1761	1045	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	41.0	0.2	27.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	42.0	1.5	27.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	27.1	0.7	38.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	83.0	1.6	55.0	0.0
LnGrp LOS	A		F	A	D	
Approach Vol, veh/h	0	A		1692	1045	A
Approach Delay, s/veh	0.0			32.9	55.0	
Approach LOS				C	D	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	50.0	77.5
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	45.5	73.0
Max Q Clear Time (g_c+I1), s		8.0		0.0	47.5	74.9
Green Ext Time (p_c), s		13.3		0.0	0.0	0.0

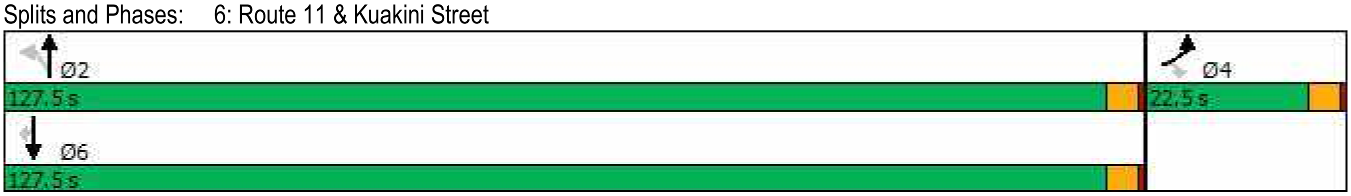
Intersection Summary			
HCM 6th Ctrl Delay			41.3
HCM 6th LOS			D

Notes
Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	605	968	972	2
Future Volume (vph)	159	605	968	972	2
Turn Type	Perm	Perm	NA	NA	Perm
Protected Phases			2	6	
Permitted Phases	4	2			6
Detector Phase	4	2	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	127.5	127.5	127.5	127.5
Total Split (%)	15.0%	85.0%	85.0%	85.0%	85.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	Max	Max	Max	Max
Act Effct Green (s)	6.5	123.0	123.0	123.0	123.0
Actuated g/C Ratio	0.05	0.89	0.89	0.89	0.89
v/c Ratio	0.64	1.58	0.65	0.65	0.00
Control Delay	14.8	289.4	4.4	4.4	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.8	289.4	4.4	4.4	1.0
LOS	B	F	A	A	A
Approach Delay			114.1	4.4	
Approach LOS			F	A	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 138.5	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.58	
Intersection Signal Delay: 68.8	Intersection LOS: E
Intersection Capacity Utilization 92.2%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	605	968	972	2
Future Volume (veh/h)	0	159	605	968	972	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	651	1041	1045	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		552	1761	1761	
Arrive On Green	0.00	0.00	0.96	0.96	0.96	0.00
Sat Flow, veh/h	1781	1560	540	1826	1826	1522
Grp Volume(v), veh/h	0	0	651	1041	1045	0
Grp Sat Flow(s),veh/h/ln	1781	1560	540	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	117.0	6.0	6.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	123.0	6.0	6.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		552	1761	1761	
V/C Ratio(X)	0.00		1.18	0.59	0.59	
Avail Cap(c_a), veh/h	251		552	1761	1761	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	11.2	0.2	0.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	98.5	1.5	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	33.0	0.7	0.7	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	109.7	1.6	1.7	0.0
LnGrp LOS	A		F	A	A	
Approach Vol, veh/h	0	A		1692	1045	A
Approach Delay, s/veh	0.0			43.2	1.7	
Approach LOS				D	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		127.5		0.0		127.5
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		123.0		18.0		123.0
Max Q Clear Time (g_c+I1), s		125.0		0.0		8.0
Green Ext Time (p_c), s		0.0		0.0		13.4

Intersection Summary		
HCM 6th Ctrl Delay		27.4
HCM 6th LOS		C

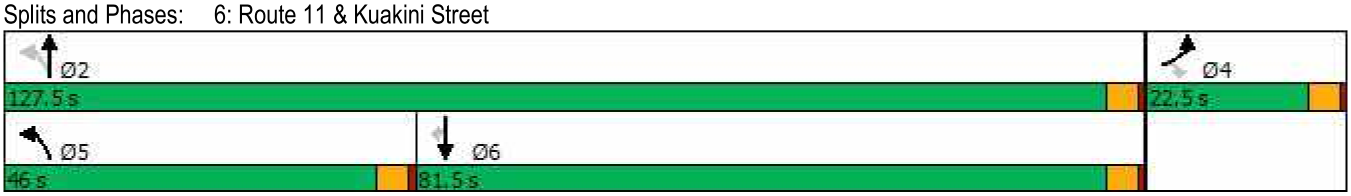
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	605	968	972	2
Future Volume (vph)	159	605	968	972	2
Turn Type	Perm	pm+pt	NA	NA	Perm
Protected Phases		5	2	6	
Permitted Phases	4	2			6
Detector Phase	4	5	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	22.5	46.0	127.5	81.5	81.5
Total Split (%)	15.0%	30.7%	85.0%	54.3%	54.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag	Lag
Lead-Lag Optimize?		Yes		Yes	Yes
Recall Mode	None	None	Max	Max	Max
Act Effct Green (s)	5.5	123.0	123.0	77.0	77.0
Actuated g/C Ratio	0.04	0.89	0.89	0.56	0.56
v/c Ratio	0.36	1.11	0.64	1.03	0.00
Control Delay	2.1	108.6	3.9	67.0	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	2.1	108.6	3.9	67.0	9.0
LOS	A	F	A	E	A
Approach Delay			44.2	66.8	
Approach LOS			D	E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 137.5	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.11	
Intersection Signal Delay: 49.9	Intersection LOS: D
Intersection Capacity Utilization 92.2%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	605	968	972	2
Future Volume (veh/h)	0	159	605	968	972	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	651	1041	1045	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		672	1761	1116	
Arrive On Green	0.00	0.00	0.32	0.96	0.61	0.00
Sat Flow, veh/h	1781	1560	1781	1826	1826	1522
Grp Volume(v), veh/h	0	0	651	1041	1045	0
Grp Sat Flow(s),veh/h/ln	1781	1560	1781	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	38.2	6.0	66.3	0.0
Cycle Q Clear(g_c), s	0.0	0.0	38.2	6.0	66.3	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		672	1761	1116	
V/C Ratio(X)	0.00		0.97	0.59	0.94	
Avail Cap(c_a), veh/h	251		685	1761	1116	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	38.0	0.2	22.5	0.0
Incr Delay (d2), s/veh	0.0	0.0	26.4	1.5	15.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	24.6	0.7	31.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	64.4	1.6	37.9	0.0
LnGrp LOS	A		E	A	D	
Approach Vol, veh/h	0	A		1692	1045	A
Approach Delay, s/veh	0.0			25.8	37.9	
Approach LOS				C	D	

Timer - Assigned Phs	2	4	5	6
Phs Duration (G+Y+Rc), s	127.5	0.0	45.1	82.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	123.0	18.0	41.5	77.0
Max Q Clear Time (g_c+I1), s	8.0	0.0	40.2	68.3
Green Ext Time (p_c), s	13.3	0.0	0.4	5.2

Intersection Summary	
HCM 6th Ctrl Delay	30.4
HCM 6th LOS	C

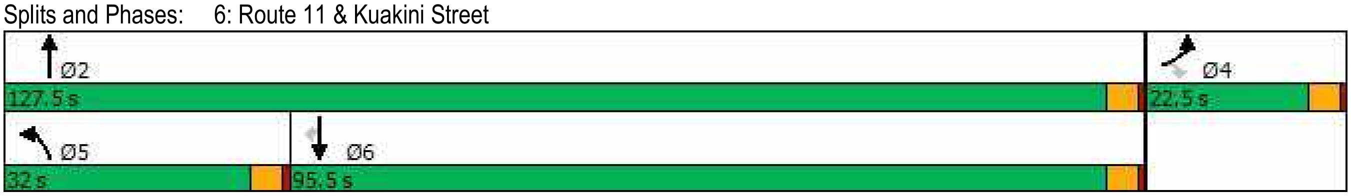
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	341	1056	1168
Future Volume (vph)	325	341	1056	1168
Turn Type	Perm	Prot	NA	NA
Protected Phases		5	2	6
Permitted Phases	4			
Detector Phase	4	5	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5
Total Split (s)	22.5	32.0	127.5	95.5
Total Split (%)	15.0%	21.3%	85.0%	63.7%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag
Lead-Lag Optimize?		Yes		Yes
Recall Mode	None	None	Max	Max
Act Effct Green (s)	9.7	27.5	123.1	91.1
Actuated g/C Ratio	0.07	0.19	0.87	0.64
v/c Ratio	0.83	1.01	0.67	1.00
Control Delay	26.2	107.9	6.1	50.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	26.2	107.9	6.1	50.9
LOS	C	F	A	D
Approach Delay			31.0	50.9
Approach LOS			C	D

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 141.8	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.01	
Intersection Signal Delay: 38.5	Intersection LOS: D
Intersection Capacity Utilization 89.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	341	1056	1168	0
Future Volume (veh/h)	0	325	341	1056	1168	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	348	1078	1192	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		372	1790	1348	
Arrive On Green	0.00	0.00	0.21	0.96	0.72	0.00
Sat Flow, veh/h	1697	1585	1781	1856	1870	1535
Grp Volume(v), veh/h	0	0	348	1078	1192	0
Grp Sat Flow(s),veh/h/ln	1697	1585	1781	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	24.5	6.2	62.6	0.0
Cycle Q Clear(g_c), s	0.0	0.0	24.5	6.2	62.6	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		372	1790	1348	
V/C Ratio(X)	0.00		0.94	0.60	0.88	
Avail Cap(c_a), veh/h	240		384	1790	1348	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	49.6	0.2	13.7	0.0
Incr Delay (d2), s/veh	0.0	0.0	29.6	1.5	8.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	13.9	0.8	26.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	79.2	1.7	22.5	0.0
LnGrp LOS	A		E	A	C	
Approach Vol, veh/h	0	A		1426	1192	A
Approach Delay, s/veh	0.0			20.6	22.5	
Approach LOS				C	C	
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	31.1	96.4
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	27.5	91.0
Max Q Clear Time (g_c+I1), s		8.2		0.0	26.5	64.6
Green Ext Time (p_c), s		14.5		0.0	0.1	13.2
Intersection Summary						
HCM 6th Ctrl Delay			21.5			
HCM 6th LOS			C			

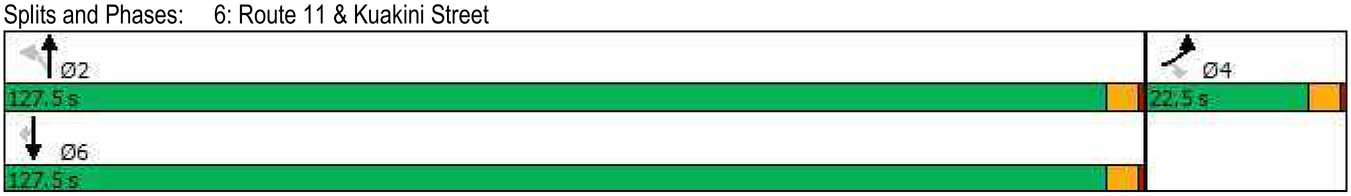
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	341	1056	1168
Future Volume (vph)	325	341	1056	1168
Turn Type	Perm	Perm	NA	NA
Protected Phases			2	6
Permitted Phases	4	2		
Detector Phase	4	2	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5
Total Split (s)	22.5	127.5	127.5	127.5
Total Split (%)	15.0%	85.0%	85.0%	85.0%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	Max	Max	Max
Act Effct Green (s)	18.0	123.0	123.0	123.0
Actuated g/C Ratio	0.12	0.82	0.82	0.82
v/c Ratio	1.00	1.50	0.71	0.78
Control Delay	83.2	265.6	9.1	11.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	83.2	265.6	9.1	11.3
LOS	F	F	A	B
Approach Delay			71.7	11.3
Approach LOS			E	B

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.50	
Intersection Signal Delay: 48.6	Intersection LOS: D
Intersection Capacity Utilization 89.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	341	1056	1168	0
Future Volume (veh/h)	0	325	341	1056	1168	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	348	1078	1192	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		480	1790	1804	
Arrive On Green	0.00	0.00	0.96	0.96	0.96	0.00
Sat Flow, veh/h	1697	1585	470	1856	1870	1535
Grp Volume(v), veh/h	0	0	348	1078	1192	0
Grp Sat Flow(s),veh/h/ln	1697	1585	470	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	35.5	6.2	7.9	0.0
Cycle Q Clear(g_c), s	0.0	0.0	43.4	6.2	7.9	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		480	1790	1804	
V/C Ratio(X)	0.00		0.72	0.60	0.66	
Avail Cap(c_a), veh/h	240		480	1790	1804	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	2.3	0.2	0.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	9.2	1.5	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	2.0	0.8	1.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	11.5	1.7	2.1	0.0
LnGrp LOS	A		B	A	A	
Approach Vol, veh/h	0	A		1426	1192	A
Approach Delay, s/veh	0.0			4.1	2.1	
Approach LOS				A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		127.5		0.0		127.5
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		123.0		18.0		123.0
Max Q Clear Time (g_c+I1), s		45.4		0.0		9.9
Green Ext Time (p_c), s		28.2		0.0		19.4

Intersection Summary				
HCM 6th Ctrl Delay			3.2	
HCM 6th LOS			A	

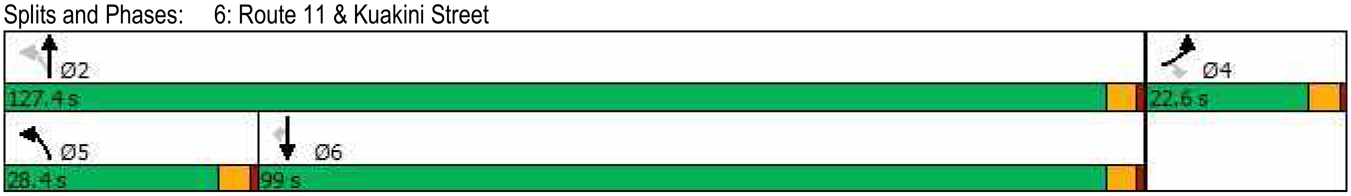
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	341	1056	1168
Future Volume (vph)	325	341	1056	1168
Turn Type	Perm	pm+pt	NA	NA
Protected Phases		5	2	6
Permitted Phases	4	2		
Detector Phase	4	5	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5
Total Split (s)	22.6	28.4	127.4	99.0
Total Split (%)	15.1%	18.9%	84.9%	66.0%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag
Lead-Lag Optimize?		Yes		Yes
Recall Mode	None	None	Max	Max
Act Effct Green (s)	10.7	123.1	123.1	94.6
Actuated g/C Ratio	0.07	0.86	0.86	0.66
v/c Ratio	0.86	1.00	0.68	0.97
Control Delay	32.2	94.9	6.6	42.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	32.2	94.9	6.6	42.3
LOS	C	F	A	D
Approach Delay			28.1	42.3
Approach LOS			C	D

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 142.8	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 34.3	Intersection LOS: C
Intersection Capacity Utilization 89.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	341	1056	1168	0
Future Volume (veh/h)	0	325	341	1056	1168	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	348	1078	1192	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		454	1790	1665	
Arrive On Green	0.00	0.00	0.04	0.96	0.89	0.00
Sat Flow, veh/h	1697	1585	1781	1856	1870	1535
Grp Volume(v), veh/h	0	0	348	1078	1192	0
Grp Sat Flow(s),veh/h/ln	1697	1585	1781	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	1.7	6.2	24.6	0.0
Cycle Q Clear(g_c), s	0.0	0.0	1.7	6.2	24.6	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		454	1790	1665	
V/C Ratio(X)	0.00		0.77	0.60	0.72	
Avail Cap(c_a), veh/h	241		718	1790	1665	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	11.0	0.2	2.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	2.7	1.5	2.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	6.4	0.8	4.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	13.7	1.7	4.8	0.0
LnGrp LOS	A		B	A	A	
Approach Vol, veh/h	0	A		1426	1192	A
Approach Delay, s/veh	0.0			4.6	4.8	
Approach LOS				A	A	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.4		0.0	9.5	117.9
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		122.9		18.1	23.9	94.5
Max Q Clear Time (g_c+I1), s		8.2		0.0	3.7	26.6
Green Ext Time (p_c), s		14.5		0.0	1.0	18.5

Intersection Summary			
HCM 6th Ctrl Delay			4.7
HCM 6th LOS			A

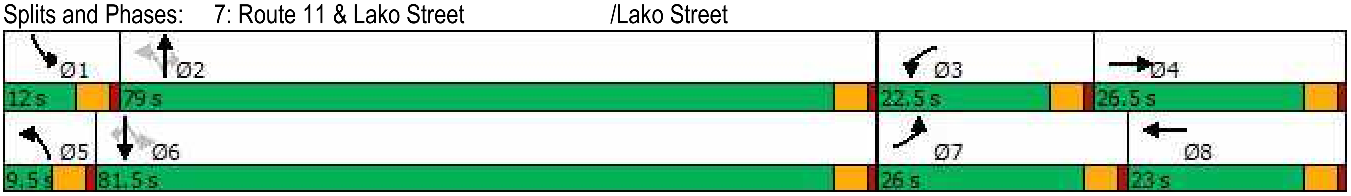
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	976	55	164	822	146
Future Volume (vph)	283	48	85	39	33	976	55	164	822	146
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	26.0	26.5	22.5	23.0	9.5	79.0	79.0	12.0	81.5	81.5
Total Split (%)	18.6%	18.9%	16.1%	16.4%	6.8%	56.4%	56.4%	8.6%	58.2%	58.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	21.5	27.5	12.5	18.5	79.5	74.5	74.5	84.9	78.9	78.9
Actuated g/C Ratio	0.15	0.20	0.09	0.13	0.57	0.53	0.53	0.61	0.56	0.56
v/c Ratio	1.11	0.34	0.58	1.13	0.20	1.05	0.07	1.23	0.84	0.16
Control Delay	140.7	34.9	75.1	122.6	13.4	74.2	1.6	181.3	35.1	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	140.7	34.9	75.1	122.6	13.4	74.2	1.6	181.3	35.1	5.4
LOS	F	C	E	F	B	E	A	F	D	A
Approach Delay		109.8		113.2		68.6			52.4	
Approach LOS		F		F		E			D	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 140	
Natural Cycle: 140	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.23	
Intersection Signal Delay: 74.3	Intersection LOS: E
Intersection Capacity Utilization 112.1%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Future Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	302	272		118	80		283	1098		196	1147	
Arrive On Green	0.17	0.15	0.00	0.07	0.04	0.00	0.03	0.59	0.00	0.06	0.62	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	21.4	3.0	0.0	6.4	2.7	0.0	1.0	65.4	0.0	5.7	43.2	0.0
Cycle Q Clear(g_c), s	21.4	3.0	0.0	6.4	2.7	0.0	1.0	65.4	0.0	5.7	43.2	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	302	272		118	80		283	1098		196	1147	
V/C Ratio(X)	1.00	0.19		0.76	0.51		0.12	0.95		0.89	0.76	
Avail Cap(c_a), veh/h	302	324		251	273		303	1098		196	1147	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	52.7	47.6	0.0	58.2	59.4	0.0	16.0	24.3	0.0	32.7	17.5	0.0
Incr Delay (d2), s/veh	51.2	0.3	0.0	9.7	4.9	0.0	0.2	16.9	0.0	34.9	4.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.9	1.5	0.0	3.2	1.4	0.0	0.4	32.4	0.0	5.1	19.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	103.9	48.0	0.0	67.9	64.4	0.0	16.2	41.2	0.0	67.7	22.3	0.0
LnGrp LOS	F	D		E	E		B	D		E	C	
Approach Vol, veh/h		352	A		131	A		1073	A		1048	A
Approach Delay, s/veh		95.8			66.8			40.4			29.9	
Approach LOS		F			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	79.0	13.0	23.0	8.0	83.0	26.0	10.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	74.5	18.0	22.0	5.0	77.0	21.5	18.5
Max Q Clear Time (g_c+I1), s	7.7	67.4	8.4	5.0	3.0	45.2	23.4	4.7
Green Ext Time (p_c), s	0.0	4.3	0.1	0.1	0.0	8.1	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	45.0
HCM 6th LOS	D

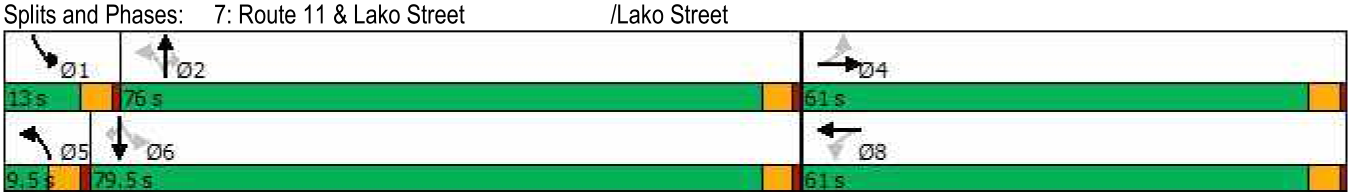
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	976	55	164	822	146
Future Volume (vph)	283	48	85	39	33	976	55	164	822	146
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	61.0	61.0	61.0	61.0	9.5	76.0	76.0	13.0	79.5	79.5
Total Split (%)	40.7%	40.7%	40.7%	40.7%	6.3%	50.7%	50.7%	8.7%	53.0%	53.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	56.5	56.5	56.5	56.5	76.5	71.5	71.5	83.7	76.9	76.9
Actuated g/C Ratio	0.38	0.38	0.38	0.38	0.51	0.48	0.48	0.56	0.51	0.51
v/c Ratio	1.21	0.18	0.20	0.54	0.33	1.17	0.08	1.22	0.92	0.18
Control Delay	165.7	17.9	33.1	26.5	23.2	124.1	8.3	177.4	50.7	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	165.7	17.9	33.1	26.5	23.2	124.1	8.3	177.4	50.7	8.8
LOS	F	B	C	C	C	F	A	F	D	A
Approach Delay		122.6		27.8		115.0			63.6	
Approach LOS		F		C		F			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 84.4	Intersection LOS: F
Intersection Capacity Utilization 112.1%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Future Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	385	481		374	481		271	1062		189	1127	
Arrive On Green	0.26	0.26	0.00	0.26	0.26	0.00	0.03	0.57	0.00	0.07	0.61	0.00
Sat Flow, veh/h	1364	1870	0	1341	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Grp Sat Flow(s),veh/h/ln	1364	1870	0	1341	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	27.1	2.6	0.0	6.9	2.1	0.0	1.0	67.8	0.0	7.3	44.0	0.0
Cycle Q Clear(g_c), s	29.2	2.6	0.0	9.5	2.1	0.0	1.0	67.8	0.0	7.3	44.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	385	481		374	481		271	1062		189	1127	
V/C Ratio(X)	0.78	0.11		0.24	0.09		0.13	0.98		0.92	0.78	
Avail Cap(c_a), veh/h	647	840		631	840		292	1062		189	1127	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	46.6	35.7	0.0	39.3	35.5	0.0	16.9	26.4	0.0	38.1	18.3	0.0
Incr Delay (d2), s/veh	3.5	0.1	0.0	0.3	0.1	0.0	0.2	22.6	0.0	43.4	5.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.5	1.2	0.0	2.3	1.0	0.0	0.4	35.2	0.0	5.3	19.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	50.1	35.8	0.0	39.7	35.6	0.0	17.1	49.0	0.0	81.5	23.6	0.0
LnGrp LOS	D	D		D	D		B	D		F	C	
Approach Vol, veh/h		352	A		131	A		1073	A		1048	A
Approach Delay, s/veh		48.0			38.4			48.0			33.2	
Approach LOS		D			D			D			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	76.0		36.9	8.0	81.0		36.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.5	71.5		56.5	5.0	75.0		56.5				
Max Q Clear Time (g_c+I1), s	9.3	69.8		31.2	3.0	46.0		11.5				
Green Ext Time (p_c), s	0.0	1.2		1.2	0.0	7.8		0.5				
Intersection Summary												
HCM 6th Ctrl Delay			41.5									
HCM 6th LOS			D									

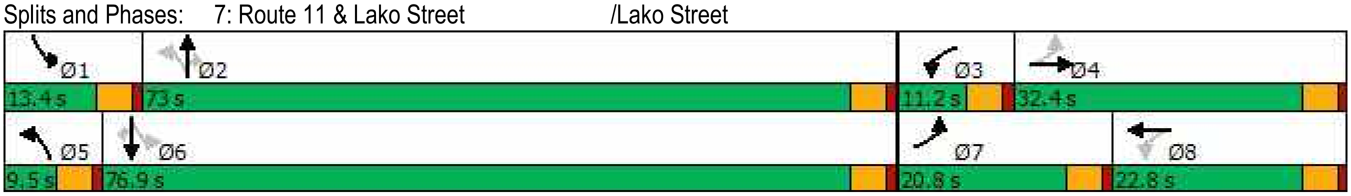
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	976	55	164	822	146
Future Volume (vph)	283	48	85	39	33	976	55	164	822	146
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	20.8	32.4	11.2	22.8	9.5	73.0	73.0	13.4	76.9	76.9
Total Split (%)	16.0%	24.9%	8.6%	17.5%	7.3%	56.2%	56.2%	10.3%	59.2%	59.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	39.1	27.9	25.0	18.3	73.5	68.5	68.5	81.5	76.2	76.2
Actuated g/C Ratio	0.30	0.21	0.19	0.14	0.57	0.53	0.53	0.63	0.59	0.59
v/c Ratio	1.08	0.31	0.34	1.07	0.17	1.06	0.07	1.03	0.81	0.16
Control Delay	114.4	27.7	39.1	101.2	11.4	76.1	0.1	109.9	29.6	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	114.4	27.7	39.1	101.2	11.4	76.1	0.1	109.9	29.6	3.9
LOS	F	C	D	F	B	E	A	F	C	A
Approach Delay		89.1		88.9		70.1			37.9	
Approach LOS		F		F		E			D	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Natural Cycle: 130	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.08	
Intersection Signal Delay: 63.2	Intersection LOS: E
Intersection Capacity Utilization 112.1%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Future Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	0.99		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	348	243		227	88		301	1122		212	1163	
Arrive On Green	0.14	0.13	0.00	0.06	0.05	0.00	0.03	0.60	0.00	0.06	0.63	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	16.3	2.8	0.0	5.5	2.5	0.0	0.9	57.6	0.0	4.4	38.4	0.0
Cycle Q Clear(g_c), s	16.3	2.8	0.0	5.5	2.5	0.0	0.9	57.6	0.0	4.4	38.4	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	348	243		227	88		301	1122		212	1163	
V/C Ratio(X)	0.86	0.21		0.40	0.47		0.12	0.92		0.82	0.75	
Avail Cap(c_a), veh/h	348	452		227	296		326	1122		249	1163	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	44.6	44.9	0.0	48.8	53.6	0.0	13.8	20.7	0.0	26.7	15.2	0.0
Incr Delay (d2), s/veh	19.6	0.4	0.0	1.1	3.9	0.0	0.2	14.0	0.0	16.8	4.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	1.3	0.0	2.5	1.3	0.0	0.3	27.5	0.0	3.9	16.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	64.2	45.4	0.0	49.9	57.5	0.0	14.0	34.7	0.0	43.6	19.7	0.0
LnGrp LOS	E	D		D	E		B	C		D	B	
Approach Vol, veh/h		352	A		131	A		1073	A		1048	A
Approach Delay, s/veh		61.4			52.3			34.0			23.6	
Approach LOS		E			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.0	73.8	11.2	19.5	7.9	76.9	20.8	9.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.9	68.5	6.7	27.9	5.0	72.4	16.3	18.3
Max Q Clear Time (g_c+I1), s	6.4	59.6	7.5	4.8	2.9	40.4	18.3	4.5
Green Ext Time (p_c), s	0.1	5.2	0.0	0.2	0.0	8.1	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	34.5
HCM 6th LOS	C

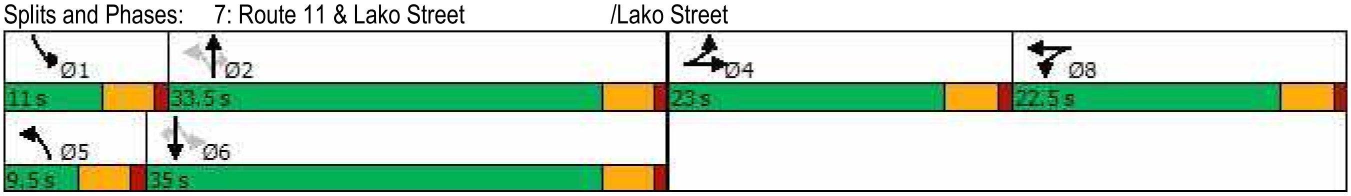
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	976	55	164	822	146
Future Volume (vph)	283	48	85	39	33	976	55	164	822	146
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	23.0	23.0	22.5	22.5	9.5	33.5	33.5	11.0	35.0	35.0
Total Split (%)	25.6%	25.6%	25.0%	25.0%	10.6%	37.2%	37.2%	12.2%	38.9%	38.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	17.3	17.3	15.3	15.3	34.1	29.1	29.1	38.4	34.7	34.7
Actuated g/C Ratio	0.20	0.20	0.18	0.18	0.40	0.34	0.34	0.44	0.40	0.40
v/c Ratio	0.85	0.31	0.29	0.88	0.15	0.87	0.10	0.85	0.62	0.21
Control Delay	56.8	16.8	33.5	41.4	15.8	37.3	0.3	55.0	25.0	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.8	16.8	33.5	41.4	15.8	37.3	0.3	55.0	25.0	4.5
LOS	E	B	C	D	B	D	A	E	C	A
Approach Delay		45.1		39.8		34.7			26.7	
Approach LOS		D		D		C			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 86.3	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.88	
Intersection Signal Delay: 33.8	Intersection LOS: C
Intersection Capacity Utilization 87.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Future Volume (veh/h)	283	48	69	85	39	305	33	976	55	164	822	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	353	370		136	144		326	1410		318	1565	
Arrive On Green	0.20	0.20	0.00	0.08	0.08	0.00	0.03	0.40	0.00	0.08	0.44	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	3554	1560	1725	3526	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1038	0	174	874	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1777	1560	1725	1763	1585
Q Serve(g_s), s	11.9	1.6	0.0	3.6	1.5	0.0	0.8	18.2	0.0	4.2	13.4	0.0
Cycle Q Clear(g_c), s	11.9	1.6	0.0	3.6	1.5	0.0	0.8	18.2	0.0	4.2	13.4	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	353	370		136	144		326	1410		318	1565	
V/C Ratio(X)	0.85	0.14		0.66	0.28		0.11	0.74		0.55	0.56	
Avail Cap(c_a), veh/h	451	473		435	460		386	1410		330	1565	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	28.3	24.2	0.0	32.8	31.8	0.0	12.8	18.8	0.0	14.2	15.0	0.0
Incr Delay (d2), s/veh	12.1	0.2	0.0	5.4	1.1	0.0	0.1	3.5	0.0	1.8	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	0.7	0.0	1.7	0.7	0.0	0.3	7.6	0.0	1.6	5.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.4	24.3	0.0	38.2	32.9	0.0	12.9	22.3	0.0	16.0	16.5	0.0
LnGrp LOS	D	C		D	C		B	C		B	B	
Approach Vol, veh/h		352	A		131	A		1073	A		1048	A
Approach Delay, s/veh		38.0			36.5			22.0			16.4	
Approach LOS		D			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.5	33.5		19.0	7.0	37.0		10.1				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.5	29.0		18.5	5.0	30.5		18.0				
Max Q Clear Time (g_c+I1), s	6.2	20.2		13.9	2.8	15.4		5.6				
Green Ext Time (p_c), s	0.0	4.6		0.5	0.0	5.5		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			22.6									
HCM 6th LOS			C									

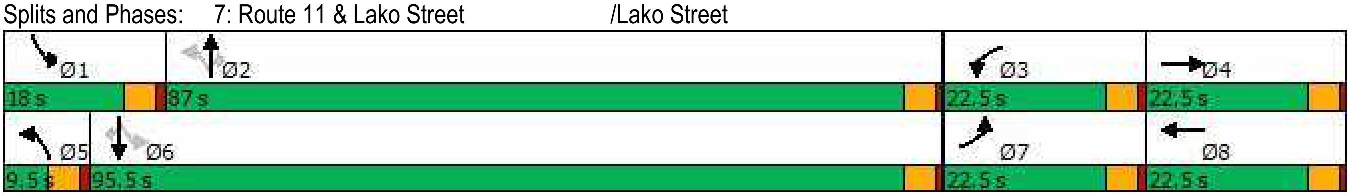
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Future Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	87.0	87.0	18.0	95.5	95.5
Total Split (%)	15.0%	15.0%	15.0%	15.0%	6.3%	58.0%	58.0%	12.0%	63.7%	63.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.5	23.5	11.3	15.9	87.6	82.6	82.6	100.7	93.2	93.2
Actuated g/C Ratio	0.11	0.16	0.08	0.11	0.60	0.56	0.56	0.69	0.64	0.64
v/c Ratio	0.81	0.26	0.53	0.92	0.35	0.98	0.07	1.00	0.94	0.19
Control Delay	93.5	31.1	79.3	62.0	19.8	56.0	0.6	104.5	41.8	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	93.5	31.1	79.3	62.0	19.8	56.0	0.6	104.5	41.8	5.5
LOS	F	C	E	E	B	E	A	F	D	A
Approach Delay		72.3		65.5		51.4			45.7	
Approach LOS		E		E		D			D	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 146.5	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 51.8	Intersection LOS: D
Intersection Capacity Utilization 102.7%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Future Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	184	164		99	70		224	1235		291	1293	
Arrive On Green	0.10	0.09	0.00	0.06	0.04	0.00	0.03	0.67	0.00	0.05	0.69	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	11.7	2.0	0.0	5.2	3.0	0.0	0.9	54.0	0.0	4.9	60.0	0.0
Cycle Q Clear(g_c), s	11.7	2.0	0.0	5.2	3.0	0.0	0.9	54.0	0.0	4.9	60.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	184	164		99	70		224	1235		291	1293	
V/C Ratio(X)	0.86	0.19		0.73	0.60		0.17	0.83		0.72	0.86	
Avail Cap(c_a), veh/h	240	256		244	250		240	1235		376	1293	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	58.0	55.7	0.0	61.2	62.3	0.0	19.5	16.4	0.0	24.1	15.6	0.0
Incr Delay (d2), s/veh	20.8	0.6	0.0	9.6	8.0	0.0	0.4	6.5	0.0	4.8	7.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	1.0	0.0	2.6	1.5	0.0	0.6	23.5	0.0	4.6	26.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	78.8	56.3	0.0	70.8	70.3	0.0	19.9	22.8	0.0	28.9	23.3	0.0
LnGrp LOS	E	E		E	E		B	C		C	C	
Approach Vol, veh/h		189	A		114	A		1061	A		1325	A
Approach Delay, s/veh		75.1			70.6			22.7			24.2	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.7	92.1	11.8	16.0	8.3	95.5	18.3	9.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	13.5	82.5	18.0	18.0	5.0	91.0	18.0	18.0
Max Q Clear Time (g_c+I1), s	6.9	56.0	7.2	4.0	2.9	62.0	13.7	5.0
Green Ext Time (p_c), s	0.3	10.0	0.1	0.1	0.0	12.1	0.2	0.1

Intersection Summary	
HCM 6th Ctrl Delay	29.2
HCM 6th LOS	C

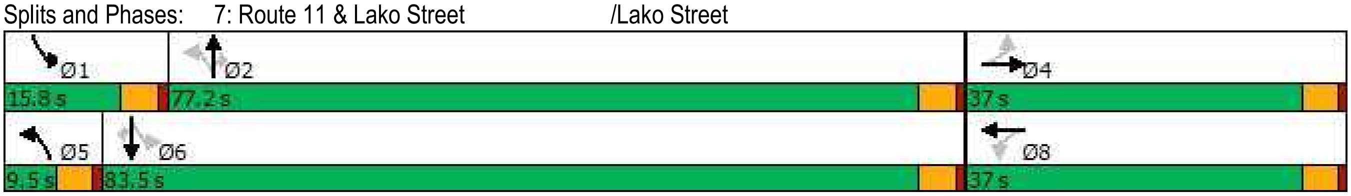
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Future Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	37.0	37.0	37.0	37.0	9.5	77.2	77.2	15.8	83.5	83.5
Total Split (%)	28.5%	28.5%	28.5%	28.5%	7.3%	59.4%	59.4%	12.2%	64.2%	64.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	32.5	32.5	32.5	32.5	77.7	72.7	72.7	88.5	80.9	80.9
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.60	0.56	0.56	0.68	0.62	0.62
v/c Ratio	1.03	0.18	0.22	0.54	0.32	0.99	0.07	1.01	0.96	0.19
Control Delay	129.6	18.2	40.9	19.2	15.0	54.8	1.5	100.9	43.2	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	129.6	18.2	40.9	19.2	15.0	54.8	1.5	100.9	43.2	4.1
LOS	F	B	D	B	B	D	A	F	D	A
Approach Delay		91.9		23.6		50.2			46.1	
Approach LOS		F		C		D			D	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Natural Cycle: 130	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 48.4	Intersection LOS: D
Intersection Capacity Utilization 102.7%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Future Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	247	293		260	287		239	1240		306	1297	
Arrive On Green	0.16	0.16	0.00	0.16	0.16	0.00	0.03	0.67	0.00	0.06	0.69	0.00
Sat Flow, veh/h	1343	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Grp Sat Flow(s),veh/h/ln	1343	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	13.1	1.6	0.0	5.4	2.3	0.0	0.8	46.4	0.0	4.2	51.5	0.0
Cycle Q Clear(g_c), s	15.4	1.6	0.0	7.0	2.3	0.0	0.8	46.4	0.0	4.2	51.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	247	293		260	287		239	1240		306	1297	
V/C Ratio(X)	0.64	0.11		0.28	0.15		0.16	0.82		0.69	0.86	
Avail Cap(c_a), veh/h	420	534		437	521		262	1240		382	1297	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	48.1	41.2	0.0	44.2	41.4	0.0	16.5	14.0	0.0	20.3	13.3	0.0
Incr Delay (d2), s/veh	2.7	0.2	0.0	0.6	0.2	0.0	0.3	6.3	0.0	3.7	7.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.8	0.0	1.9	1.0	0.0	0.5	19.5	0.0	3.8	21.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	50.8	41.3	0.0	44.7	41.7	0.0	16.9	20.3	0.0	24.0	20.8	0.0
LnGrp LOS	D	D		D	D		B	C		C	C	
Approach Vol, veh/h		189	A		114	A		1061	A		1325	A
Approach Delay, s/veh		49.3			43.6			20.1			21.3	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	10.9	80.6	22.4	8.0	83.5	22.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	11.3	72.7	32.5	5.0	79.0	32.5
Max Q Clear Time (g_c+I1), s	6.2	48.4	17.4	2.8	53.5	9.0
Green Ext Time (p_c), s	0.3	9.6	0.5	0.0	11.4	0.4

Intersection Summary	
HCM 6th Ctrl Delay	23.8
HCM 6th LOS	C

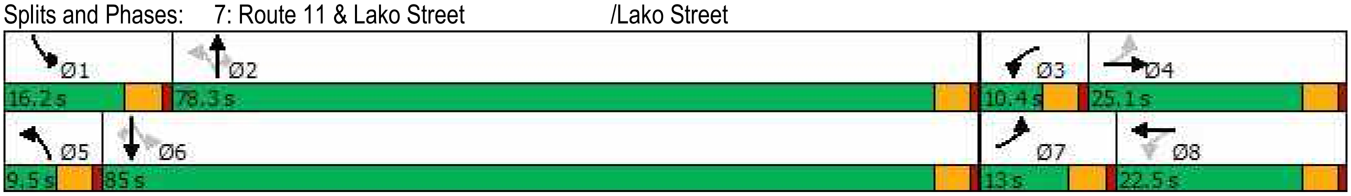
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Future Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	13.0	25.1	10.4	22.5	9.5	78.3	78.3	16.2	85.0	85.0
Total Split (%)	10.0%	19.3%	8.0%	17.3%	7.3%	60.2%	60.2%	12.5%	65.4%	65.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	24.8	18.1	19.2	13.3	78.9	73.9	73.9	90.1	82.6	82.6
Actuated g/C Ratio	0.20	0.14	0.15	0.11	0.63	0.59	0.59	0.72	0.66	0.66
v/c Ratio	0.93	0.28	0.32	0.86	0.31	0.94	0.07	0.95	0.91	0.18
Control Delay	98.4	24.6	45.1	43.3	13.8	41.7	0.1	84.3	32.4	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	98.4	24.6	45.1	43.3	13.8	41.7	0.1	84.3	32.4	3.6
LOS	F	C	D	D	B	D	A	F	C	A
Approach Delay		73.4		43.7		38.2			35.8	
Approach LOS		E		D		D			D	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 125.4	
Natural Cycle: 130	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 40.3	Intersection LOS: D
Intersection Capacity Utilization 102.7%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Future Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	219	124		211	78		242	1247		309	1303	
Arrive On Green	0.07	0.07	0.00	0.05	0.04	0.00	0.03	0.67	0.00	0.06	0.70	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	8.5	1.8	0.0	4.4	2.6	0.0	0.8	46.5	0.0	4.2	51.7	0.0
Cycle Q Clear(g_c), s	8.5	1.8	0.0	4.4	2.6	0.0	0.8	46.5	0.0	4.2	51.7	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	219	124		211	78		242	1247		309	1303	
V/C Ratio(X)	0.72	0.25		0.34	0.54		0.16	0.82		0.68	0.86	
Avail Cap(c_a), veh/h	219	334		212	285		264	1247		389	1303	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	49.9	51.2	0.0	49.5	54.2	0.0	16.4	13.8	0.0	20.2	13.1	0.0
Incr Delay (d2), s/veh	11.1	1.0	0.0	1.0	5.6	0.0	0.3	6.1	0.0	3.4	7.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.9	0.0	2.0	1.3	0.0	0.5	19.5	0.0	3.7	21.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	61.0	52.2	0.0	50.5	59.8	0.0	16.7	20.0	0.0	23.5	20.5	0.0
LnGrp LOS	E	D		D	E		B	B		C	C	
Approach Vol, veh/h		189	A		114	A		1061	A		1325	A
Approach Delay, s/veh		59.6			53.9			19.8			21.0	
Approach LOS		E			D			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.0	82.1	10.3	12.2	8.1	85.0	13.0	9.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	11.7	73.8	5.9	20.6	5.0	80.5	8.5	18.0
Max Q Clear Time (g_c+I1), s	6.2	48.5	6.4	3.8	2.8	53.7	10.5	4.6
Green Ext Time (p_c), s	0.3	9.8	0.0	0.1	0.0	11.7	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	24.6
HCM 6th LOS	C

Notes

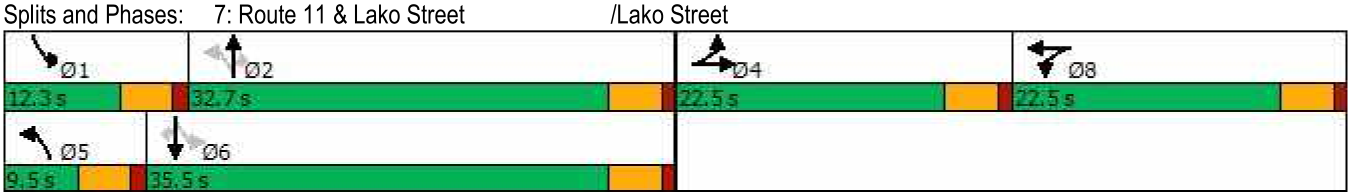
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Future Volume (vph)	152	30	69	40	37	981	64	202	1070	190
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	32.7	32.7	12.3	35.5	35.5
Total Split (%)	25.0%	25.0%	25.0%	25.0%	10.6%	36.3%	36.3%	13.7%	39.4%	39.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	12.1	12.1	9.7	9.7	33.5	28.5	28.5	39.9	35.5	35.5
Actuated g/C Ratio	0.16	0.16	0.13	0.13	0.44	0.37	0.37	0.52	0.46	0.46
v/c Ratio	0.57	0.26	0.32	0.69	0.17	0.78	0.10	0.77	0.68	0.24
Control Delay	39.1	16.7	34.6	16.6	13.2	28.3	0.7	37.1	22.0	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.1	16.7	34.6	16.6	13.2	28.3	0.7	37.1	22.0	3.9
LOS	D	B	C	B	B	C	A	D	C	A
Approach Delay		31.5		20.2		26.1			21.7	
Approach LOS		C		C		C			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 76.4
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 23.8 Intersection LOS: C
Intersection Capacity Utilization 78.1% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Future Volume (veh/h)	152	30	48	69	40	232	37	981	64	202	1070	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	211	225		121	124		312	1549		390	1750	
Arrive On Green	0.12	0.12	0.00	0.07	0.07	0.00	0.04	0.44	0.00	0.09	0.49	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	3526	1585	1767	3554	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1022	0	210	1115	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1763	1585	1767	1777	1585
Q Serve(g_s), s	5.6	1.0	0.0	2.5	1.4	0.0	0.8	14.7	0.0	3.9	14.9	0.0
Cycle Q Clear(g_c), s	5.6	1.0	0.0	2.5	1.4	0.0	0.8	14.7	0.0	3.9	14.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	211	225		121	124		312	1549		390	1750	
V/C Ratio(X)	0.75	0.14		0.60	0.34		0.13	0.66		0.54	0.64	
Avail Cap(c_a), veh/h	492	525		500	512		380	1549		442	1750	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.3	25.2	0.0	29.1	28.5	0.0	10.0	14.2	0.0	10.6	12.0	0.0
Incr Delay (d2), s/veh	5.3	0.3	0.0	4.7	1.6	0.0	0.2	2.2	0.0	1.2	1.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	0.4	0.0	1.2	0.6	0.0	0.3	5.6	0.0	1.4	5.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.5	25.5	0.0	33.7	30.2	0.0	10.2	16.4	0.0	11.7	13.8	0.0
LnGrp LOS	C	C		C	C		B	B		B	B	
Approach Vol, veh/h		189	A		114	A		1061	A		1325	A
Approach Delay, s/veh		31.4			32.4			16.2			13.5	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.4	32.7		12.2	7.0	36.1		8.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.8	28.2		18.0	5.0	31.0		18.0				
Max Q Clear Time (g_c+I1), s	5.9	16.7		7.6	2.8	16.9		4.5				
Green Ext Time (p_c), s	0.1	5.5		0.4	0.0	6.8		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			16.6
HCM 6th LOS			B

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Arterial Level of Service: NB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	63.2	74.2	137.4	0.53	13.8	E
Puapuaanui St	III	30	107.5	26.6	134.1	0.90	24.1	B
Total	III		170.7	100.8	271.5	1.42	18.9	C

Arterial Level of Service: SB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	20.5	114.8	0.79	24.6	B
Lako Street	III	30	107.5	35.1	142.6	0.90	22.6	C
Total	III		201.8	55.6	257.4	1.68	23.5	C

Arterial Level of Service: NB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	63.2	56.0	119.2	0.53	15.9	D
Puapuaanui St	III	30	107.5	24.2	131.7	0.90	24.5	B
Total	III		170.7	80.2	250.9	1.42	20.4	C

Arterial Level of Service: SB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.2	48.2	142.4	0.79	19.9	C
Lako Street	III	30	107.5	41.8	149.3	0.90	21.6	C
Total	III		201.7	90.0	291.7	1.68	20.8	C

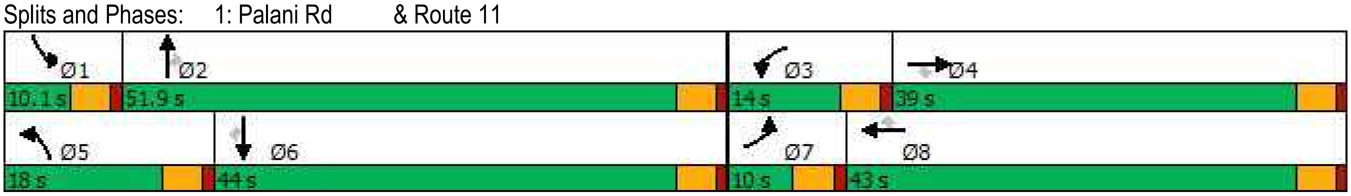
Appendix H

Analysis Reports – Future Without Project Conditions (2039)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	590	218	164	868	33	243	192	117	21	321	177
Future Volume (vph)	71	590	218	164	868	33	243	192	117	21	321	177
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	10.0	39.0	39.0	14.0	43.0	43.0	18.0	51.9	51.9	10.1	44.0	44.0
Total Split (%)	8.7%	33.9%	33.9%	12.2%	37.4%	37.4%	15.7%	45.1%	45.1%	8.8%	38.3%	38.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	5.6	35.2	35.2	8.9	40.9	40.9	11.4	29.4	29.4	5.7	17.1	17.1
Actuated g/C Ratio	0.06	0.39	0.39	0.10	0.45	0.45	0.13	0.32	0.32	0.06	0.19	0.19
v/c Ratio	0.37	0.47	0.32	0.51	0.58	0.04	0.59	0.17	0.20	0.19	0.49	0.43
Control Delay	50.6	24.5	5.0	47.1	23.4	0.1	45.3	22.7	5.3	49.8	34.9	10.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.6	24.5	5.0	47.1	23.4	0.1	45.3	22.7	5.3	49.8	34.9	10.4
LOS	D	C	A	D	C	A	D	C	A	D	C	B
Approach Delay		21.8			26.3			29.0			27.1	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 90.9	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 25.6	Intersection LOS: C
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	590	218	164	868	33	243	192	117	21	321	177
Future Volume (veh/h)	71	590	218	164	868	33	243	192	117	21	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	602	0	167	886	0	248	196	0	21	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	160	1543		249	1661		342	775		42	500	
Arrive On Green	0.05	0.46	0.00	0.07	0.48	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	602	0	167	886	0	248	196	0	21	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.7	9.4	0.0	3.8	14.3	0.0	5.6	3.6	0.0	0.9	7.0	0.0
Cycle Q Clear(g_c), s	1.7	9.4	0.0	3.8	14.3	0.0	5.6	3.6	0.0	0.9	7.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	160	1543		249	1661		342	775		42	500	
V/C Ratio(X)	0.45	0.39		0.67	0.53		0.72	0.25		0.51	0.66	
Avail Cap(c_a), veh/h	221	1543		405	1661		576	2112		125	1760	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.8	14.2	0.0	36.0	14.4	0.0	34.8	25.8	0.0	38.5	32.4	0.0
Incr Delay (d2), s/veh	2.0	0.7	0.0	3.1	1.2	0.0	2.9	0.2	0.0	9.2	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.4	0.0	1.6	5.3	0.0	2.4	1.5	0.0	0.5	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.8	14.9	0.0	39.1	15.6	0.0	37.7	26.0	0.0	47.7	33.9	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		674	A		1053	A		444	A		349	A
Approach Delay, s/veh		17.5			19.3			32.5			34.7	
Approach LOS		B			B			C			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.4	21.9	10.3	41.2	12.5	15.7	8.5	43.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	5.6	47.4	9.5	34.5	13.5	39.5	5.5	38.5				
Max Q Clear Time (g_c+I1), s	2.9	5.6	5.8	11.4	7.6	9.0	3.7	16.3				
Green Ext Time (p_c), s	0.0	1.3	0.2	4.1	0.4	2.3	0.0	6.4				
Intersection Summary												
HCM 6th Ctrl Delay			23.3									
HCM 6th LOS			C									

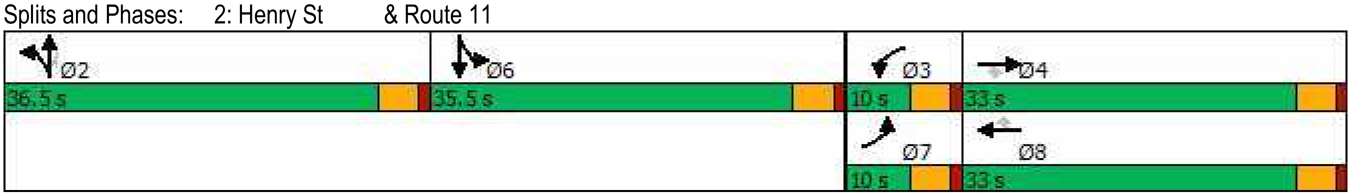
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	107	479	124	57	784	507	146	337	47	403	339
Future Volume (vph)	107	479	124	57	784	507	146	337	47	403	339
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	10.0	33.0	33.0	10.0	33.0	33.0	36.5	36.5	36.5	35.5	35.5
Total Split (%)	8.7%	28.7%	28.7%	8.7%	28.7%	28.7%	31.7%	31.7%	31.7%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	5.6	31.4	31.4	5.6	29.0	29.0	17.7	17.7	17.7	24.2	24.2
Actuated g/C Ratio	0.06	0.33	0.33	0.06	0.31	0.31	0.19	0.19	0.19	0.26	0.26
v/c Ratio	0.60	0.45	0.22	0.30	0.78	0.63	0.47	0.58	0.13	0.73	0.71
Control Delay	61.6	30.1	6.9	51.5	38.3	6.8	40.3	39.3	0.8	44.7	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.6	30.1	6.9	51.5	38.3	6.8	40.3	39.3	0.8	44.7	36.2
LOS	E	C	A	D	D	A	D	D	A	D	D
Approach Delay		30.8			27.0			36.2			39.1
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 94.8	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 32.2	Intersection LOS: C
Intersection Capacity Utilization 69.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	479	124	57	784	507	146	337	47	403	339	124
Future Volume (vph)	107	479	124	57	784	507	146	337	47	403	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	494	128	59	808	523	151	347	48	415	349	128
RTOR Reduction (vph)	0	0	86	0	0	358	0	0	39	0	21	0
Lane Group Flow (vph)	110	494	42	59	808	165	136	362	9	299	572	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	5.6	31.4	31.4	4.3	30.1	30.1	17.7	17.7	17.7	24.2	24.2	
Effective Green, g (s)	5.6	31.4	31.4	4.3	30.1	30.1	17.7	17.7	17.7	24.2	24.2	
Actuated g/C Ratio	0.06	0.33	0.33	0.04	0.31	0.31	0.19	0.19	0.19	0.25	0.25	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	181	1077	497	148	1072	487	289	619	275	403	803	
v/s Ratio Prot	c0.04	0.15		0.02	c0.24		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.11			0.01			
v/c Ratio	0.61	0.46	0.08	0.40	0.75	0.34	0.47	0.58	0.03	0.74	0.71	
Uniform Delay, d1	43.9	25.4	22.2	44.4	29.4	25.1	34.8	35.6	31.9	32.8	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.7	1.4	0.3	1.8	4.9	1.9	1.2	1.4	0.0	7.2	3.0	
Delay (s)	49.6	26.8	22.5	46.2	34.3	27.0	36.0	37.0	32.0	40.0	35.5	
Level of Service	D	C	C	D	C	C	D	D	C	D	D	
Approach Delay (s)		29.5			32.1			36.3			37.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	95.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	28.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	54	156	1299	1034	30
Future Vol, veh/h	44	54	156	1299	1034	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	58	168	1397	1112	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2846	-	1113	0	-	0
Stage 1	1113	-	-	-	-	-
Stage 2	1733	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 19	0	627	-	-	-
Stage 1	314	0	-	-	-	-
Stage 2	156	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 14	-	626	-	-	-
Mov Cap-2 Maneuver	~ 14	-	-	-	-	-
Stage 1	230	-	-	-	-	-
Stage 2	156	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 1620.7	1.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	626	-	14	-	-	-
HCM Lane V/C Ratio	0.268	-	3.379	-	-	-
HCM Control Delay (s)	12.8	$	1620.7	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.1	-	6.8	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	140	1317	15	73	1006
Future Vol, veh/h	9	140	1317	15	73	1006
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1416	16	78	1082

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2662	-	0	0	1416	0
Stage 1	1424	-	-	-	-	-
Stage 2	1238	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.254	-
Pot Cap-1 Maneuver	25	0	-	-	469	-
Stage 1	222	0	-	-	-	-
Stage 2	274	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	21	-	-	-	469	-
Mov Cap-2 Maneuver	21	-	-	-	-	-
Stage 1	222	-	-	-	-	-
Stage 2	229	-	-	-	-	-

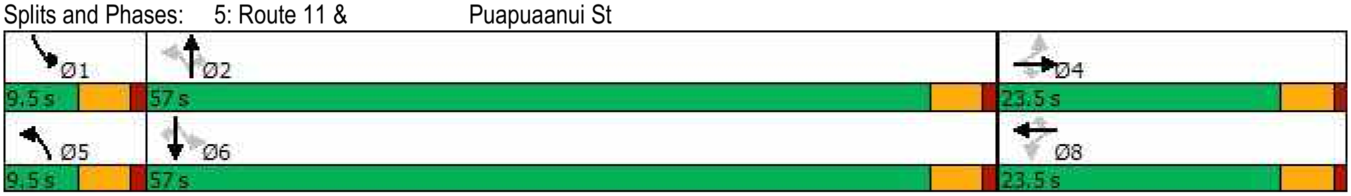
Approach	WB	NB	SB
HCM Control Delay, s	279.3	0	1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	21	-	469	-
HCM Lane V/C Ratio	-	-	0.461	-	0.167	-
HCM Control Delay (s)	-	-	279.3	0	14.2	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	1.3	-	0.6	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	193	9	75	110	59	140	104	985	24	43	901	68
Future Volume (vph)	193	9	75	110	59	140	104	985	24	43	901	68
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	23.5	23.5	23.5	23.5	23.5	23.5	9.5	57.0	57.0	9.5	57.0	57.0
Total Split (%)	26.1%	26.1%	26.1%	26.1%	26.1%	26.1%	10.6%	63.3%	63.3%	10.6%	63.3%	63.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.9	16.9	16.9	16.9	16.9	16.9	57.7	54.8	54.8	56.8	53.0	53.0
Actuated g/C Ratio	0.20	0.20	0.20	0.20	0.20	0.20	0.67	0.63	0.63	0.66	0.61	0.61
v/c Ratio	0.80	0.03	0.22	0.43	0.18	0.35	0.50	0.89	0.03	0.25	0.86	0.07
Control Delay	57.4	28.6	8.8	36.2	30.6	7.9	13.5	27.7	0.0	8.0	25.7	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.4	28.6	8.8	36.2	30.6	7.9	13.5	27.7	0.0	8.0	25.7	2.3
LOS	E	C	A	D	C	A	B	C	A	A	C	A
Approach Delay		43.2			22.3			25.7			23.3	
Approach LOS		D			C			C			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 86.3	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 26.3	Intersection LOS: C
Intersection Capacity Utilization 84.6%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	193	9	75	110	59	140	104	985	24	43	901	68
Future Volume (veh/h)	193	9	75	110	59	140	104	985	24	43	901	68
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1856	1870	1870	1826	1870
Adj Flow Rate, veh/h	210	10	0	117	64	0	113	1048	0	46	959	0
Peak Hour Factor	0.92	0.92	0.92	0.94	0.92	0.94	0.92	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	3	2	2	5	2
Cap, veh/h	317	383		363	383		256	1123		199	1078	
Arrive On Green	0.20	0.20	0.00	0.20	0.20	0.00	0.05	0.61	0.00	0.04	0.59	0.00
Sat Flow, veh/h	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Grp Volume(v), veh/h	210	10	0	117	64	0	113	1048	0	46	959	0
Grp Sat Flow(s),veh/h/ln	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Q Serve(g_s), s	13.6	0.4	0.0	6.5	2.5	0.0	2.1	45.5	0.0	0.9	40.3	0.0
Cycle Q Clear(g_c), s	16.1	0.4	0.0	6.8	2.5	0.0	2.1	45.5	0.0	0.9	40.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	317	383		363	383		256	1123		199	1078	
V/C Ratio(X)	0.66	0.03		0.32	0.17		0.44	0.93		0.23	0.89	
Avail Cap(c_a), veh/h	329	400		375	400		262	1123		231	1078	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	35.8	28.3	0.0	31.0	29.1	0.0	17.3	15.9	0.0	18.3	15.7	0.0
Incr Delay (d2), s/veh	4.7	0.0	0.0	0.5	0.2	0.0	1.2	14.9	0.0	0.6	11.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.2	0.0	2.2	1.1	0.0	1.2	21.2	0.0	0.5	17.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.4	28.3	0.0	31.5	29.3	0.0	18.5	30.9	0.0	18.9	26.7	0.0
LnGrp LOS	D	C		C	C		B	C		B	C	
Approach Vol, veh/h		220	A		181	A		1161	A		1005	A
Approach Delay, s/veh		39.9			30.7			29.7			26.3	
Approach LOS		D			C			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.9	58.3		22.7	9.2	57.0		22.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	52.5		19.0	5.0	52.5		19.0				
Max Q Clear Time (g_c+I1), s	2.9	47.5		18.1	4.1	42.3		8.8				
Green Ext Time (p_c), s	0.0	3.3		0.1	0.0	5.3		0.4				

Intersection Summary	
HCM 6th Ctrl Delay	29.3
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	15.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	159	602	1035	1029	0
Future Vol, veh/h	0	159	602	1035	1029	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	0	171	647	1113	1106	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3513	-	1106	0	-	0
Stage 1	1106	-	-	-	-	-
Stage 2	2407	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	7	0	~ 631	-	-	-
Stage 1	317	0	-	-	-	-
Stage 2	71	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	0	-	~ 631	-	-	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	0	-	-	-	-	-
Stage 2	71	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	25.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	~ 631	-	-	-	-	-
HCM Lane V/C Ratio	1.026	-	-	-	-	-
HCM Control Delay (s)	68.2	-	0	0	-	-
HCM Lane LOS	F	-	A	A	-	-
HCM 95th %tile Q(veh)	16.6	-	-	-	-	-

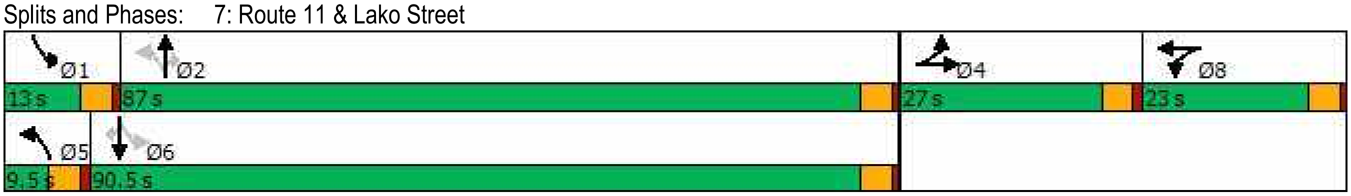
Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	278	48	69	36	33	1052	55	160	878	142
Future Volume (vph)	278	48	69	36	33	1052	55	160	878	142
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	27.0	27.0	23.0	23.0	9.5	87.0	87.0	13.0	90.5	90.5
Total Split (%)	18.0%	18.0%	15.3%	15.3%	6.3%	58.0%	58.0%	8.7%	60.3%	60.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	22.5	22.5	18.5	18.5	87.5	82.5	82.5	94.7	87.9	87.9
Actuated g/C Ratio	0.15	0.15	0.12	0.12	0.58	0.55	0.55	0.63	0.59	0.59
v/c Ratio	1.12	0.43	0.34	1.18	0.23	1.09	0.07	1.19	0.86	0.16
Control Delay	146.5	44.0	65.0	145.9	13.8	89.7	1.9	167.8	36.7	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	146.5	44.0	65.0	145.9	13.8	89.7	1.9	167.8	36.7	5.8
LOS	F	D	E	F	B	F	A	F	D	A
Approach Delay		116.2		132.1		83.3			50.8	
Approach LOS		F		F		F			D	

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.19
Intersection Signal Delay: 81.4 — Intersection LOS: F
Intersection Capacity Utilization 114.9% — ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 7: Route 11 & Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	278	48	69	69	36	296	33	1052	55	160	878	142
Future Volume (veh/h)	278	48	69	69	36	296	33	1052	55	160	878	142
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	296	51	0	73	38	0	35	1119	0	170	934	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	287	302		101	107		247	1106		157	1161	
Arrive On Green	0.16	0.16	0.00	0.06	0.06	0.00	0.03	0.59	0.00	0.06	0.63	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	296	51	0	73	38	0	35	1119	0	170	934	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	22.5	3.3	0.0	5.7	2.7	0.0	1.1	82.5	0.0	8.5	52.9	0.0
Cycle Q Clear(g_c), s	22.5	3.3	0.0	5.7	2.7	0.0	1.1	82.5	0.0	8.5	52.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	287	302		101	107		247	1106		157	1161	
V/C Ratio(X)	1.03	0.17		0.72	0.35		0.14	1.01		1.08	0.80	
Avail Cap(c_a), veh/h	287	302		234	248		263	1106		157	1161	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	58.5	50.4	0.0	64.7	63.3	0.0	19.2	28.5	0.0	48.8	19.7	0.0
Incr Delay (d2), s/veh	61.1	0.3	0.0	9.3	2.0	0.0	0.3	29.9	0.0	96.3	6.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.0	1.6	0.0	2.8	1.4	0.0	0.4	44.2	0.0	7.4	23.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	119.6	50.7	0.0	73.9	65.3	0.0	19.4	58.4	0.0	145.1	25.6	0.0
LnGrp LOS	F	D		E	E		B	F		F	C	
Approach Vol, veh/h		347	A		111	A		1154	A		1104	A
Approach Delay, s/veh		109.5			71.0			57.2			44.0	
Approach LOS		F			E			E			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	87.0		27.0	8.2	91.8		12.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.5	82.5		22.5	5.0	86.0		18.5				
Max Q Clear Time (g_c+I1), s	10.5	84.5		24.5	3.1	54.9		7.7				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	9.0		0.2				

Intersection Summary			
HCM 6th Ctrl Delay			59.1
HCM 6th LOS			E

Notes

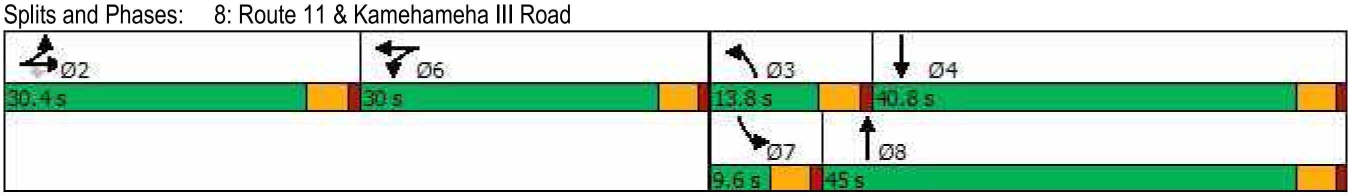
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	5	26	12	76	643	16	561
Future Volume (vph)	5	26	12	76	643	16	561
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.4	30.4	30.0	13.8	45.0	9.6	40.8
Total Split (%)	26.4%	26.4%	26.1%	12.0%	39.1%	8.3%	35.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.0	15.0	7.3	8.6	47.3	5.2	40.2
Actuated g/C Ratio	0.18	0.18	0.09	0.11	0.58	0.06	0.49
v/c Ratio	0.63	0.08	0.29	0.48	0.68	0.15	0.58
Control Delay	41.4	0.5	31.8	47.7	21.6	44.5	18.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.4	0.5	31.8	47.7	21.6	44.5	18.3
LOS	D	A	C	D	C	D	B
Approach Delay	36.3		31.8		24.4		18.8
Approach LOS	D		C		C		B

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 81.8
Natural Cycle: 115
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 23.2 — Intersection LOS: C
Intersection Capacity Utilization 67.0% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 8: Route 11 & Kamehameha III Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	179	5	26	16	12	17	76	643	15	16	561	320
Future Volume (veh/h)	179	5	26	16	12	17	76	643	15	16	561	320
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1722	1870	1781	1796	1752	1811	1870	1870	1811	1811
Adj Flow Rate, veh/h	192	5	0	17	13	18	82	691	16	17	603	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	2	12	2	8	7	10	6	2	2	6	6
Cap, veh/h	252	7		24	18	26	103	967	22	36	1743	
Arrive On Green	0.15	0.15	0.00	0.04	0.04	0.04	0.06	0.55	0.55	0.02	0.51	0.00
Sat Flow, veh/h	1738	45	1459	569	435	603	1668	1762	41	1781	3532	0
Grp Volume(v), veh/h	197	0	0	48	0	0	82	0	707	17	603	0
Grp Sat Flow(s),veh/h/ln	1783	0	1459	1608	0	0	1668	0	1803	1781	1721	0
Q Serve(g_s), s	7.8	0.0	0.0	2.2	0.0	0.0	3.6	0.0	21.5	0.7	7.7	0.0
Cycle Q Clear(g_c), s	7.8	0.0	0.0	2.2	0.0	0.0	3.6	0.0	21.5	0.7	7.7	0.0
Prop In Lane	0.97		1.00	0.35		0.37	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	259	0		68	0	0	103	0	989	36	1743	
V/C Ratio(X)	0.76	0.00		0.70	0.00	0.00	0.79	0.00	0.71	0.48	0.35	
Avail Cap(c_a), veh/h	626	0		555	0	0	210	0	989	123	1743	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	0.0	0.0	34.9	0.0	0.0	34.1	0.0	12.4	35.8	10.9	0.0
Incr Delay (d2), s/veh	4.6	0.0	0.0	12.4	0.0	0.0	12.6	0.0	4.4	9.7	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	0.0	0.0	1.1	0.0	0.0	1.7	0.0	7.8	0.4	2.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.9	0.0	0.0	47.3	0.0	0.0	46.8	0.0	16.8	45.4	11.4	0.0
LnGrp LOS	C	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		197	A		48			789			620	A
Approach Delay, s/veh		34.9			47.3			19.9			12.4	
Approach LOS		C			D			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		15.2	9.1	41.9		7.6	6.0	45.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		25.9	9.3	36.3		25.5	5.1	40.5				
Max Q Clear Time (g_c+I1), s		9.8	5.6	9.7		4.2	2.7	23.5				
Green Ext Time (p_c), s		0.9	0.0	3.9		0.2	0.0	4.2				
Intersection Summary												
HCM 6th Ctrl Delay			19.7									
HCM 6th LOS			B									

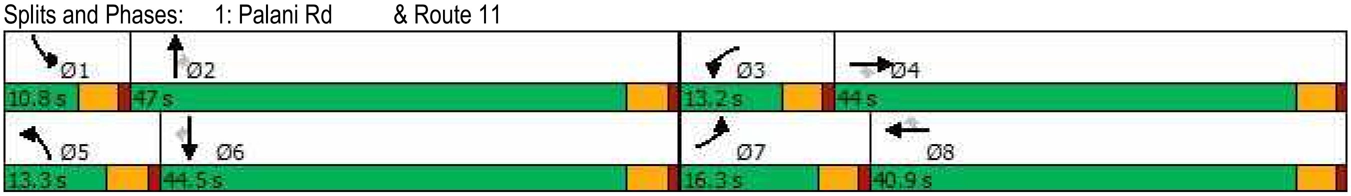
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	1126	503	226	785	56	227	283	263	54	313	107
Future Volume (vph)	260	1126	503	226	785	56	227	283	263	54	313	107
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	16.3	44.0	44.0	13.2	40.9	40.9	13.3	47.0	47.0	10.8	44.5	44.5
Total Split (%)	14.2%	38.3%	38.3%	11.5%	35.6%	35.6%	11.6%	40.9%	40.9%	9.4%	38.7%	38.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	11.2	39.9	39.9	8.8	37.6	37.6	8.9	21.7	21.7	6.2	16.8	16.8
Actuated g/C Ratio	0.12	0.43	0.43	0.09	0.41	0.41	0.10	0.23	0.23	0.07	0.18	0.18
v/c Ratio	0.65	0.76	0.58	0.71	0.57	0.08	0.71	0.35	0.50	0.46	0.50	0.29
Control Delay	48.3	28.1	9.5	55.3	25.1	1.3	55.4	30.8	9.5	57.9	35.8	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.3	28.1	9.5	55.3	25.1	1.3	55.4	30.8	9.5	57.9	35.8	7.8
LOS	D	C	A	E	C	A	E	C	A	E	D	A
Approach Delay		25.9			30.2			30.8			32.0	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 92.7	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 28.6	Intersection LOS: C
Intersection Capacity Utilization 68.5%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	1126	503	226	785	56	227	283	263	54	313	107
Future Volume (veh/h)	260	1126	503	226	785	56	227	283	263	54	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	1149	0	231	801	0	232	289	0	55	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	350	1643		309	1586		310	672		76	503	
Arrive On Green	0.10	0.47	0.00	0.09	0.45	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	1149	0	231	801	0	232	289	0	55	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.4	21.9	0.0	5.5	13.8	0.0	5.6	6.1	0.0	2.6	7.2	0.0
Cycle Q Clear(g_c), s	6.4	21.9	0.0	5.5	13.8	0.0	5.6	6.1	0.0	2.6	7.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	350	1643		309	1586		310	672		76	503	
V/C Ratio(X)	0.76	0.70		0.75	0.51		0.75	0.43		0.72	0.63	
Avail Cap(c_a), veh/h	477	1643		355	1586		356	1782		132	1677	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.0	17.9	0.0	37.6	16.4	0.0	37.6	30.3	0.0	40.1	34.3	0.0
Incr Delay (d2), s/veh	4.7	2.5	0.0	7.3	1.2	0.0	7.4	0.4	0.0	12.0	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	8.6	0.0	2.6	5.3	0.0	2.6	2.6	0.0	1.4	3.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.7	20.4	0.0	44.9	17.6	0.0	45.0	30.8	0.0	52.1	35.6	0.0
LnGrp LOS	D	C		D	B		D	C		D	D	
Approach Vol, veh/h		1414	A		1032	A		521	A		374	A
Approach Delay, s/veh		24.4			23.7			37.1			38.0	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	20.5	12.1	44.0	12.2	16.5	13.2	42.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.3	42.5	8.7	39.5	8.8	40.0	11.8	36.4
Max Q Clear Time (g_c+I1), s	4.6	8.1	7.5	23.9	7.6	9.2	8.4	15.8
Green Ext Time (p_c), s	0.0	2.0	0.1	7.3	0.1	2.2	0.3	5.5

Intersection Summary	
HCM 6th Ctrl Delay	27.7
HCM 6th LOS	C

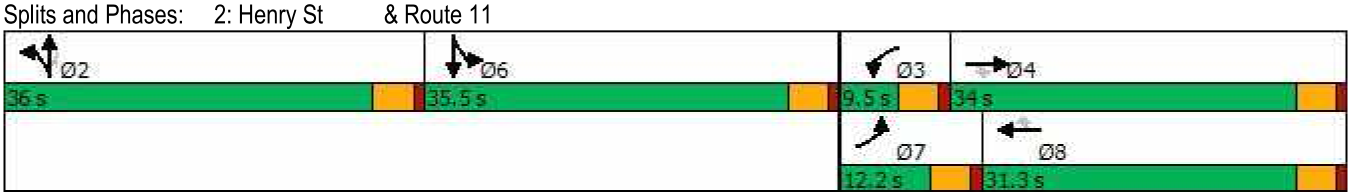
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	190	884	291	80	729	348	126	318	38	388	342
Future Volume (vph)	190	884	291	80	729	348	126	318	38	388	342
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	12.2	34.0	34.0	9.5	31.3	31.3	36.0	36.0	36.0	35.5	35.5
Total Split (%)	10.6%	29.6%	29.6%	8.3%	27.2%	27.2%	31.3%	31.3%	31.3%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	7.8	32.3	32.3	5.1	27.2	27.2	17.0	17.0	17.0	25.1	25.1
Actuated g/C Ratio	0.08	0.34	0.34	0.05	0.29	0.29	0.18	0.18	0.18	0.26	0.26
v/c Ratio	0.71	0.75	0.41	0.45	0.75	0.51	0.41	0.56	0.11	0.75	0.71
Control Delay	60.5	36.2	6.1	56.0	38.8	6.5	39.8	39.7	0.6	45.2	34.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.5	36.2	6.1	56.0	38.8	6.5	39.8	39.7	0.6	45.2	34.1
LOS	E	D	A	E	D	A	D	D	A	D	C
Approach Delay		33.1			30.3			36.6			37.9
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 95.4	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 33.8	Intersection LOS: C
Intersection Capacity Utilization 74.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	884	291	80	729	348	126	318	38	388	342	190
Future Volume (vph)	190	884	291	80	729	348	126	318	38	388	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3195	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	902	297	82	744	355	129	324	39	396	349	194
RTOR Reduction (vph)	0	0	193	0	0	250	0	0	32	0	41	0
Lane Group Flow (vph)	194	902	104	82	744	105	116	337	7	317	581	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.8	32.3	32.3	3.9	28.4	28.4	17.0	17.0	17.0	25.1	25.1	
Effective Green, g (s)	7.8	32.3	32.3	3.9	28.4	28.4	17.0	17.0	17.0	25.1	25.1	
Actuated g/C Ratio	0.08	0.34	0.34	0.04	0.29	0.29	0.18	0.18	0.18	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	270	1187	530	139	1023	460	281	597	271	419	832	
v/s Ratio Prot	c0.06	c0.25		0.02	0.21		0.07	c0.10		c0.20	0.18	
v/s Ratio Perm			0.07			0.07			0.00			
v/c Ratio	0.72	0.76	0.20	0.59	0.73	0.23	0.41	0.56	0.03	0.76	0.70	
Uniform Delay, d1	43.2	28.5	22.8	45.4	30.5	25.7	35.2	36.3	32.8	32.8	32.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.8	4.6	0.8	6.3	4.5	1.1	1.0	1.2	0.0	7.6	2.6	
Delay (s)	52.0	33.1	23.6	51.7	35.0	26.8	36.2	37.5	32.8	40.4	34.7	
Level of Service	D	C	C	D	C	C	D	D	C	D	C	
Approach Delay (s)		33.7			33.7			36.8			36.7	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	96.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	83	83	1228	1345	17
Future Vol, veh/h	10	83	83	1228	1345	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	86	86	1266	1387	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2825	-	1387	0	-	0
Stage 1	1387	-	-	-	-	-
Stage 2	1438	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	20	0	494	-	-	-
Stage 1	232	0	-	-	-	-
Stage 2	219	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	17	-	494	-	-	-
Mov Cap-2 Maneuver	17	-	-	-	-	-
Stage 1	192	-	-	-	-	-
Stage 2	219	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 384.4	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	494	-	17	-	-	-
HCM Lane V/C Ratio	0.173	-	0.606	-	-	-
HCM Control Delay (s)	13.8	-	$ 384.4	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.6	-	1.6	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	2.7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	1248	4	61	1369
Future Vol, veh/h	14	71	1248	4	61	1369
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	1287	4	63	1411

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2826	-	0	0	1287	0
Stage 1	1289	-	-	-	-	-
Stage 2	1537	-	-	-	-	-
Critical Hdwy	6.47	-	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	-	-	-	2.272	-
Pot Cap-1 Maneuver	19	0	-	-	519	-
Stage 1	252	0	-	-	-	-
Stage 2	190	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	17	-	-	-	519	-
Mov Cap-2 Maneuver	17	-	-	-	-	-
Stage 1	252	-	-	-	-	-
Stage 2	167	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 469.2	0	0.5
HCM LOS	F		

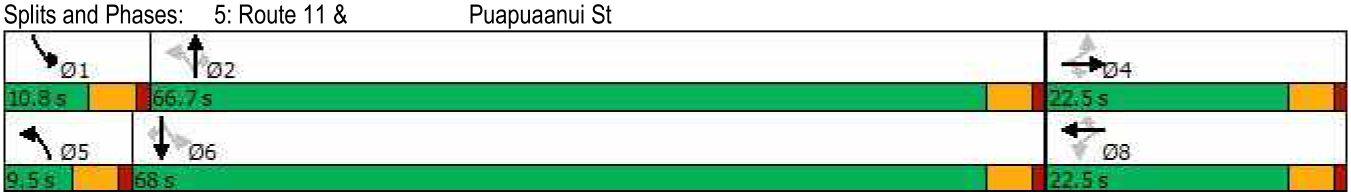
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	17	-	519	-
HCM Lane V/C Ratio	-	-	0.849	-	0.121	-
HCM Control Delay (s)	-	-	$ 469.2	0	12.9	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	2.2	-	0.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	199	23	116	50	23	104	105	913	58	142	1126	100
Future Volume (vph)	199	23	116	50	23	104	105	913	58	142	1126	100
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	66.7	66.7	10.8	68.0	68.0
Total Split (%)	22.5%	22.5%	22.5%	22.5%	22.5%	22.5%	9.5%	66.7%	66.7%	10.8%	68.0%	68.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	17.3	17.3	17.3	17.3	17.3	17.3	67.2	62.2	62.2	69.8	63.5	63.5
Actuated g/C Ratio	0.17	0.17	0.17	0.17	0.17	0.17	0.68	0.63	0.63	0.70	0.64	0.64
v/c Ratio	0.90	0.08	0.33	0.22	0.08	0.30	0.70	0.81	0.06	0.55	0.97	0.10
Control Delay	78.6	34.9	9.1	37.7	34.9	9.6	38.0	21.7	1.9	12.6	39.5	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.6	34.9	9.1	37.7	34.9	9.6	38.0	21.7	1.9	12.6	39.5	1.9
LOS	E	C	A	D	C	A	D	C	A	B	D	A
Approach Delay		51.8			21.0			22.3			33.8	
Approach LOS		D			C			C			C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 99.3	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 31.0	Intersection LOS: C
Intersection Capacity Utilization 94.0%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	23	116	50	23	104	105	913	58	142	1126	100
Future Volume (veh/h)	199	23	116	50	23	104	105	913	58	142	1126	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1826	1870	1856	1841	1870	1870	1870
Adj Flow Rate, veh/h	216	25	0	52	25	0	114	941	0	146	1161	0
Peak Hour Factor	0.92	0.92	0.92	0.97	0.92	0.97	0.92	0.97	0.97	0.97	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	5	2	3	4	2	2	2
Cap, veh/h	307	337		307	337		178	1178		314	1190	
Arrive On Green	0.18	0.18	0.00	0.18	0.18	0.00	0.05	0.64	0.00	0.05	0.64	0.00
Sat Flow, veh/h	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Grp Volume(v), veh/h	216	25	0	52	25	0	114	941	0	146	1161	0
Grp Sat Flow(s),veh/h/ln	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Q Serve(g_s), s	15.3	1.1	0.0	3.2	1.1	0.0	2.2	37.5	0.0	2.8	59.4	0.0
Cycle Q Clear(g_c), s	16.4	1.1	0.0	4.3	1.1	0.0	2.2	37.5	0.0	2.8	59.4	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	307	337		307	337		178	1178		314	1190	
V/C Ratio(X)	0.70	0.07		0.17	0.07		0.64	0.80		0.46	0.98	
Avail Cap(c_a), veh/h	307	337		307	337		181	1178		339	1190	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	40.8	34.0	0.0	35.8	34.0	0.0	25.1	13.5	0.0	14.7	17.4	0.0
Incr Delay (d2), s/veh	7.1	0.1	0.0	0.3	0.1	0.0	7.3	5.7	0.0	1.1	20.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	0.5	0.0	1.1	0.5	0.0	2.0	15.7	0.0	1.5	28.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.9	34.1	0.0	36.0	34.1	0.0	32.4	19.2	0.0	15.8	38.2	0.0
LnGrp LOS	D	C		D	C		C	B		B	D	
Approach Vol, veh/h		241	A		77	A		1055	A		1307	A
Approach Delay, s/veh		46.5			35.4			20.6			35.7	
Approach LOS		D			D			C			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	67.9		22.5	9.3	68.0		22.5
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	6.3	62.2		18.0	5.0	63.5		18.0
Max Q Clear Time (g_c+I1), s	4.8	39.5		18.4	4.2	61.4		6.3
Green Ext Time (p_c), s	0.1	8.1		0.0	0.0	1.6		0.1

Intersection Summary	
HCM 6th Ctrl Delay	30.7
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	325	340	1082	1259	0
Future Vol, veh/h	0	325	340	1082	1259	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	0	332	347	1104	1285	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3083	-	1285	0	-	0
Stage 1	1285	-	-	-	-	-
Stage 2	1798	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	13	0	540	-	-	-
Stage 1	252	0	-	-	-	-
Stage 2	140	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	5	-	540	-	-	-
Mov Cap-2 Maneuver	5	-	-	-	-	-
Stage 1	90	-	-	-	-	-
Stage 2	140	-	-	-	-	-

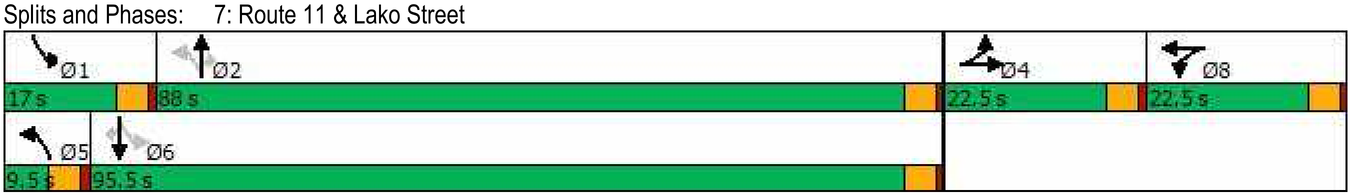
Approach	EB	NB	SB
HCM Control Delay, s	0	5.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	540	-	-	-	-	-
HCM Lane V/C Ratio	0.642	-	-	-	-	-
HCM Control Delay (s)	22.9	-	0	0	-	-
HCM Lane LOS	C	-	A	A	-	-
HCM 95th %tile Q(veh)	4.5	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	143	30	62	39	37	1016	64	200	1163	188
Future Volume (vph)	143	30	62	39	37	1016	64	200	1163	188
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	88.0	88.0	17.0	95.5	95.5
Total Split (%)	15.0%	15.0%	15.0%	15.0%	6.3%	58.7%	58.7%	11.3%	63.7%	63.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.0	16.0	15.1	15.1	88.7	83.7	83.7	100.7	93.2	93.2
Actuated g/C Ratio	0.11	0.11	0.10	0.10	0.61	0.58	0.58	0.69	0.64	0.64
v/c Ratio	0.78	0.36	0.36	0.90	0.35	1.00	0.07	1.03	1.01	0.19
Control Delay	90.0	35.2	66.4	59.2	19.7	58.1	0.5	114.2	56.8	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.0	35.2	66.4	59.2	19.7	58.1	0.5	114.2	56.8	6.0
LOS	F	D	E	E	B	E	A	F	E	A
Approach Delay		70.7		60.6		53.5			58.0	
Approach LOS		E		E		D			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 145.3	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 57.6	Intersection LOS: E
Intersection Capacity Utilization 103.8%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	143	30	48	62	39	218	37	1016	64	200	1163	188
Future Volume (veh/h)	143	30	48	62	39	218	37	1016	64	200	1163	188
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	149	31	0	65	41	0	39	1058	0	208	1211	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	176	187		92	94		153	1222		259	1280	
Arrive On Green	0.10	0.10	0.00	0.05	0.05	0.00	0.03	0.66	0.00	0.05	0.68	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	149	31	0	65	41	0	39	1058	0	208	1211	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	11.1	2.0	0.0	4.8	2.9	0.0	0.9	60.3	0.0	5.0	77.1	0.0
Cycle Q Clear(g_c), s	11.1	2.0	0.0	4.8	2.9	0.0	0.9	60.3	0.0	5.0	77.1	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	176	187		92	94		153	1222		259	1280	
V/C Ratio(X)	0.85	0.17		0.71	0.44		0.26	0.87		0.80	0.95	
Avail Cap(c_a), veh/h	237	253		241	247		168	1222		329	1280	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	58.8	54.8	0.0	62.1	61.2	0.0	29.0	18.0	0.0	28.2	18.8	0.0
Incr Delay (d2), s/veh	18.8	0.4	0.0	9.5	3.1	0.0	0.9	8.4	0.0	10.7	15.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	1.0	0.0	2.4	1.4	0.0	0.8	26.8	0.0	5.3	35.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	77.6	55.2	0.0	71.6	64.3	0.0	29.9	26.4	0.0	38.9	34.0	0.0
LnGrp LOS	E	E		E	E		C	C		D	C	
Approach Vol, veh/h		180	A		106	A		1097	A		1419	A
Approach Delay, s/veh		73.7			68.8			26.5			34.7	
Approach LOS		E			E			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.7	92.1		17.8	8.3	95.5		11.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	12.5	83.5		18.0	5.0	91.0		18.0				
Max Q Clear Time (g_c+I1), s	7.0	62.3		13.1	2.9	79.1		6.8				
Green Ext Time (p_c), s	0.3	9.5		0.2	0.0	7.9		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			35.3									
HCM 6th LOS			D									

Notes

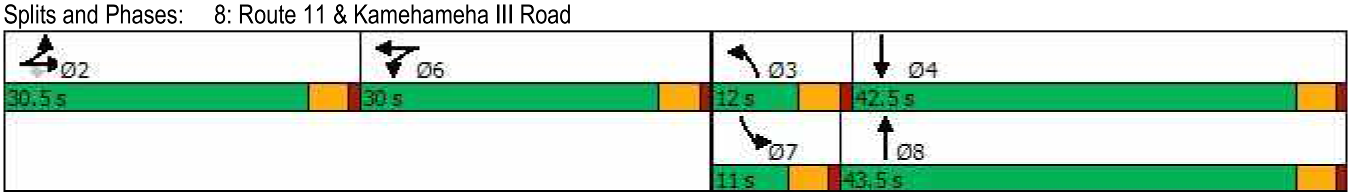
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	11	52	11	64	663	19	682
Future Volume (vph)	11	52	11	64	663	19	682
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	12.0	43.5	11.0	42.5
Total Split (%)	26.5%	26.5%	26.1%	10.4%	37.8%	9.6%	37.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	22.7	22.7	6.9	7.3	44.5	6.3	39.4
Actuated g/C Ratio	0.26	0.26	0.08	0.08	0.51	0.07	0.45
v/c Ratio	0.77	0.12	0.26	0.46	0.75	0.16	0.67
Control Delay	44.1	1.7	29.8	52.9	28.0	45.8	22.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	1.7	29.8	52.9	28.0	45.8	22.9
LOS	D	A	C	D	C	D	C
Approach Delay	38.4		29.8		30.2		23.3
Approach LOS	D		C		C		C

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 86.9
Natural Cycle: 115
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 28.4 Intersection LOS: C
Intersection Capacity Utilization 76.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 8: Route 11 & Kamehameha III Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	325	11	52	7	11	20	64	663	11	19	682	316
Future Volume (veh/h)	325	11	52	7	11	20	64	663	11	19	682	316
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1767	1811	1870	1870	1870	1856	1856	1870	1870	1870	1870
Adj Flow Rate, veh/h	342	12	0	7	12	21	67	698	12	20	718	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	9	6	2	2	2	3	3	2	2	2	2
Cap, veh/h	392	14		11	18	32	86	880	15	40	1626	
Arrive On Green	0.24	0.24	0.00	0.04	0.04	0.04	0.05	0.48	0.48	0.02	0.46	0.00
Sat Flow, veh/h	1628	57	1535	297	509	890	1767	1819	31	1781	3647	0
Grp Volume(v), veh/h	354	0	0	40	0	0	67	0	710	20	718	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1695	0	0	1767	0	1850	1781	1777	0
Q Serve(g_s), s	16.8	0.0	0.0	1.9	0.0	0.0	3.1	0.0	26.7	0.9	11.4	0.0
Cycle Q Clear(g_c), s	16.8	0.0	0.0	1.9	0.0	0.0	3.1	0.0	26.7	0.9	11.4	0.0
Prop In Lane	0.97		1.00	0.17		0.52	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	406	0		62	0	0	86	0	895	40	1626	
V/C Ratio(X)	0.87	0.00		0.65	0.00	0.00	0.78	0.00	0.79	0.50	0.44	
Avail Cap(c_a), veh/h	528	0		520	0	0	160	0	895	139	1626	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	0.0	0.0	39.5	0.0	0.0	39.1	0.0	18.0	40.2	15.3	0.0
Incr Delay (d2), s/veh	12.1	0.0	0.0	11.0	0.0	0.0	14.0	0.0	7.2	9.6	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.9	0.0	0.0	1.0	0.0	0.0	1.6	0.0	11.4	0.5	4.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.4	0.0	0.0	50.5	0.0	0.0	53.1	0.0	25.1	49.7	16.2	0.0
LnGrp LOS	D	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		354	A		40			777			738	A
Approach Delay, s/veh		42.4			50.5			27.5			17.1	
Approach LOS		D			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		24.5	8.5	42.5		7.5	6.3	44.7				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		26.0	7.5	38.0		25.5	6.5	39.0				
Max Q Clear Time (g_c+I1), s		18.8	5.1	13.4		3.9	2.9	28.7				
Green Ext Time (p_c), s		1.2	0.0	4.7		0.1	0.0	3.2				

Intersection Summary			
HCM 6th Ctrl Delay			26.7
HCM 6th LOS			C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Appendix I

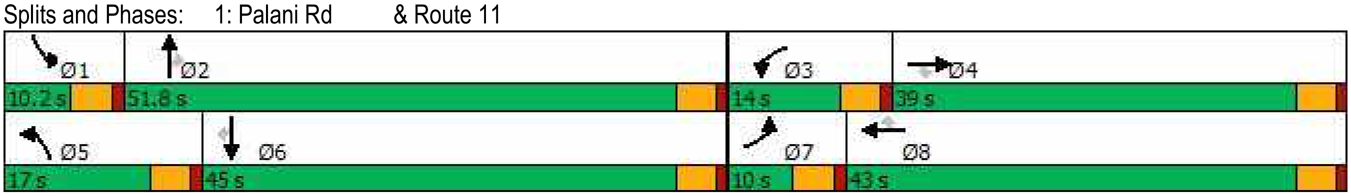
Analysis Reports – Future With Project Conditions (2039)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	597	218	166	906	42	243	192	118	22	321	177
Future Volume (vph)	71	597	218	166	906	42	243	192	118	22	321	177
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	10.0	39.0	39.0	14.0	43.0	43.0	17.0	51.8	51.8	10.2	45.0	45.0
Total Split (%)	8.7%	33.9%	33.9%	12.2%	37.4%	37.4%	14.8%	45.0%	45.0%	8.9%	39.1%	39.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	5.6	35.2	35.2	8.9	40.9	40.9	11.1	29.1	29.1	5.7	17.1	17.1
Actuated g/C Ratio	0.06	0.39	0.39	0.10	0.45	0.45	0.12	0.32	0.32	0.06	0.19	0.19
v/c Ratio	0.37	0.47	0.32	0.51	0.60	0.06	0.60	0.17	0.21	0.20	0.49	0.43
Control Delay	50.3	24.3	4.9	46.8	23.6	0.1	45.9	22.9	5.3	49.4	34.7	10.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.3	24.3	4.9	46.8	23.6	0.1	45.9	22.9	5.3	49.4	34.7	10.8
LOS	D	C	A	D	C	A	D	C	A	D	C	B
Approach Delay		21.6			26.2			29.3			27.2	
Approach LOS		C			C			C			C	

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 90.6
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.60
Intersection Signal Delay: 25.6 Intersection LOS: C
Intersection Capacity Utilization 63.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	597	218	166	906	42	243	192	118	22	321	177
Future Volume (veh/h)	71	597	218	166	906	42	243	192	118	22	321	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1767	1737	1841	1811	1841	1841	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	72	609	0	169	924	0	248	196	0	22	328	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	11	9	11	4	6	4	4	2	3	2	2	2
Cap, veh/h	160	1542		251	1662		340	771		43	501	
Arrive On Green	0.05	0.46	0.00	0.07	0.48	0.00	0.10	0.22	0.00	0.02	0.14	0.00
Sat Flow, veh/h	3209	3357	1472	3401	3441	1560	3401	3554	1572	1781	3554	1585
Grp Volume(v), veh/h	72	609	0	169	924	0	248	196	0	22	328	0
Grp Sat Flow(s),veh/h/ln	1605	1678	1472	1700	1721	1560	1700	1777	1572	1781	1777	1585
Q Serve(g_s), s	1.7	9.6	0.0	3.9	15.1	0.0	5.6	3.6	0.0	1.0	7.0	0.0
Cycle Q Clear(g_c), s	1.7	9.6	0.0	3.9	15.1	0.0	5.6	3.6	0.0	1.0	7.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	160	1542		251	1662		340	771		43	501	
V/C Ratio(X)	0.45	0.40		0.67	0.56		0.73	0.25		0.51	0.65	
Avail Cap(c_a), veh/h	221	1542		405	1662		533	2109		127	1806	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.8	14.2	0.0	36.0	14.6	0.0	34.8	25.9	0.0	38.4	32.4	0.0
Incr Delay (d2), s/veh	2.0	0.8	0.0	3.1	1.3	0.0	3.0	0.2	0.0	9.0	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.5	0.0	1.7	5.6	0.0	2.4	1.5	0.0	0.5	3.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.7	15.0	0.0	39.1	15.9	0.0	37.8	26.0	0.0	47.5	33.8	0.0
LnGrp LOS	D	B		D	B		D	C		D	C	
Approach Vol, veh/h		681	A		1093	A		444	A		350	A
Approach Delay, s/veh		17.5			19.5			32.6			34.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	21.8	10.4	41.1	12.5	15.7	8.5	43.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.7	47.3	9.5	34.5	12.5	40.5	5.5	38.5
Max Q Clear Time (g_c+I1), s	3.0	5.6	5.9	11.6	7.6	9.0	3.7	17.1
Green Ext Time (p_c), s	0.0	1.3	0.2	4.1	0.4	2.3	0.0	6.6

Intersection Summary	
HCM 6th Ctrl Delay	23.3
HCM 6th LOS	C

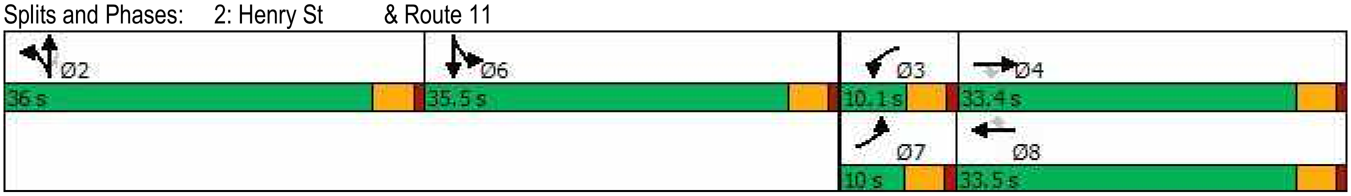
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	107	488	124	61	832	545	146	337	48	412	339
Future Volume (vph)	107	488	124	61	832	545	146	337	48	412	339
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	10.0	33.4	33.4	10.1	33.5	33.5	36.0	36.0	36.0	35.5	35.5
Total Split (%)	8.7%	29.0%	29.0%	8.8%	29.1%	29.1%	31.3%	31.3%	31.3%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	5.6	31.8	31.8	5.7	29.5	29.5	17.8	17.8	17.8	24.8	24.8
Actuated g/C Ratio	0.06	0.33	0.33	0.06	0.31	0.31	0.19	0.19	0.19	0.26	0.26
v/c Ratio	0.61	0.46	0.22	0.32	0.82	0.65	0.47	0.58	0.14	0.73	0.71
Control Delay	62.8	30.5	6.8	52.3	40.6	6.9	40.9	39.8	0.8	44.7	36.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.8	30.5	6.8	52.3	40.6	6.9	40.9	39.8	0.8	44.7	36.5
LOS	E	C	A	D	D	A	D	D	A	D	D
Approach Delay		31.2			28.4			36.6			39.3
Approach LOS		C			C			D			D

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 96	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 32.8	Intersection LOS: C
Intersection Capacity Utilization 71.1%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	488	124	61	832	545	146	337	48	412	339	124
Future Volume (vph)	107	488	124	61	832	545	146	337	48	412	339	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3099	3282	1516	3303	3406	1548	1564	3348	1487	1595	3175	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	110	503	128	63	858	562	151	347	49	425	349	128
RTOR Reduction (vph)	0	0	86	0	0	385	0	0	40	0	20	0
Lane Group Flow (vph)	110	503	42	63	858	177	136	362	9	302	580	0
Confl. Peds. (#/hr)			2	2			4		3	3		4
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	13%	10%	5%	6%	6%	3%	5%	3%	7%	3%	4%	5%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	5.6	31.8	31.8	4.3	30.5	30.5	17.8	17.8	17.8	24.8	24.8	
Effective Green, g (s)	5.6	31.8	31.8	4.3	30.5	30.5	17.8	17.8	17.8	24.8	24.8	
Actuated g/C Ratio	0.06	0.33	0.33	0.04	0.32	0.32	0.18	0.18	0.18	0.26	0.26	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	179	1079	498	146	1074	488	287	616	273	409	814	
v/s Ratio Prot	c0.04	0.15		0.02	c0.25		0.09	c0.11		c0.19	0.18	
v/s Ratio Perm			0.03			0.11			0.01			
v/c Ratio	0.61	0.47	0.08	0.43	0.80	0.36	0.47	0.59	0.03	0.74	0.71	
Uniform Delay, d1	44.5	25.7	22.4	45.0	30.3	25.6	35.3	36.1	32.4	33.0	32.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.1	1.4	0.3	2.0	6.2	2.1	1.2	1.4	0.0	6.8	3.0	
Delay (s)	50.6	27.2	22.7	47.1	36.5	27.7	36.5	37.5	32.4	39.8	35.7	
Level of Service	D	C	C	D	D	C	D	D	C	D	D	
Approach Delay (s)		29.9			33.6			36.8			37.1	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	96.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	36.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	44	55	171	1389	1053	30
Future Vol, veh/h	44	55	171	1389	1053	30
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	6	2
Mvmt Flow	47	59	184	1494	1132	32

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2995	-	1133	0	-	0
Stage 1	1133	-	-	-	-	-
Stage 2	1862	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	~ 15	0	617	-	-	-
Stage 1	307	0	-	-	-	-
Stage 2	135	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 11	-	616	-	-	-
Mov Cap-2 Maneuver	~ 11	-	-	-	-	-
Stage 1	215	-	-	-	-	-
Stage 2	135	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 2163.6	1.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	616	-	11	-	-	-
HCM Lane V/C Ratio	0.298	-	4.301	-	-	-
HCM Control Delay (s)	13.3		$ 2163.6	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	1.2	-	7.1	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	140	1422	15	73	1026
Future Vol, veh/h	9	140	1422	15	73	1026
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	13	6	5
Mvmt Flow	10	151	1529	16	78	1103

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2796	-	0	0	1529	0
Stage 1	1537	-	-	-	-	-
Stage 2	1259	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.254	-
Pot Cap-1 Maneuver	20	0	-	-	424	-
Stage 1	195	0	-	-	-	-
Stage 2	267	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	16	-	-	-	424	-
Mov Cap-2 Maneuver	16	-	-	-	-	-
Stage 1	195	-	-	-	-	-
Stage 2	218	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 404	0	1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	16	-	424	-
HCM Lane V/C Ratio	-	-	0.605	-	0.185	-
HCM Control Delay (s)	-	-	$ 404	0	15.4	-
HCM Lane LOS	-	-	F	A	C	-
HCM 95th %tile Q(veh)	-	-	1.6	-	0.7	-

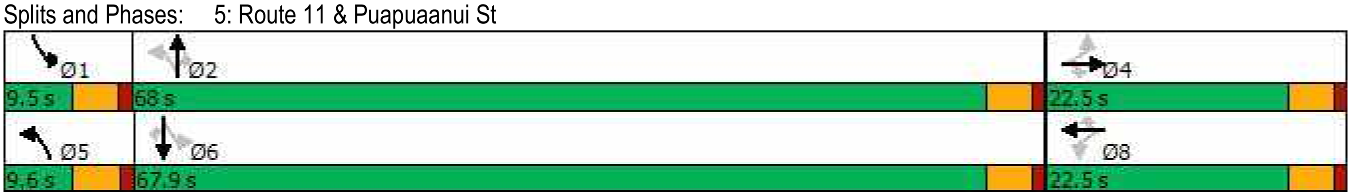
Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	193	9	75	112	59	140	104	1090	27	43	921	68
Future Volume (vph)	193	9	75	112	59	140	104	1090	27	43	921	68
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.6	68.0	68.0	9.5	67.9	67.9
Total Split (%)	22.5%	22.5%	22.5%	22.5%	22.5%	22.5%	9.6%	68.0%	68.0%	9.5%	67.9%	67.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	17.4	17.4	17.4	17.4	17.4	17.4	70.4	67.3	67.3	68.4	63.4	63.4
Actuated g/C Ratio	0.18	0.18	0.18	0.18	0.18	0.18	0.71	0.68	0.68	0.69	0.64	0.64
v/c Ratio	0.90	0.03	0.24	0.49	0.20	0.37	0.47	0.93	0.03	0.29	0.85	0.07
Control Delay	80.1	34.2	10.1	44.5	36.7	8.9	10.8	30.2	0.3	8.6	23.5	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.1	34.2	10.1	44.5	36.7	8.9	10.8	30.2	0.3	8.6	23.5	1.9
LOS	F	C	B	D	D	A	B	C	A	A	C	A
Approach Delay		59.6			27.0			27.9			21.4	
Approach LOS		E			C			C			C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 99.4	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 28.6	Intersection LOS: C
Intersection Capacity Utilization 90.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	193	9	75	112	59	140	104	1090	27	43	921	68
Future Volume (veh/h)	193	9	75	112	59	140	104	1090	27	43	921	68
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1856	1870	1870	1826	1870
Adj Flow Rate, veh/h	210	10	0	119	64	0	113	1160	0	46	980	0
Peak Hour Factor	0.92	0.92	0.92	0.94	0.92	0.94	0.92	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	3	2	2	5	2
Cap, veh/h	275	338		320	338		281	1202		166	1161	
Arrive On Green	0.18	0.18	0.00	0.18	0.18	0.00	0.05	0.65	0.00	0.04	0.64	0.00
Sat Flow, veh/h	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Grp Volume(v), veh/h	210	10	0	119	64	0	113	1160	0	46	980	0
Grp Sat Flow(s),veh/h/ln	1338	1870	1585	1405	1870	1585	1781	1856	1585	1781	1826	1585
Q Serve(g_s), s	15.1	0.4	0.0	7.6	2.9	0.0	2.1	58.5	0.0	0.9	42.0	0.0
Cycle Q Clear(g_c), s	18.0	0.4	0.0	8.0	2.9	0.0	2.1	58.5	0.0	0.9	42.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	275	338		320	338		281	1202		166	1161	
V/C Ratio(X)	0.76	0.03		0.37	0.19		0.40	0.96		0.28	0.84	
Avail Cap(c_a), veh/h	275	338		320	338		286	1202		191	1161	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	42.5	33.6	0.0	37.0	34.7	0.0	16.3	16.5	0.0	23.7	14.3	0.0
Incr Delay (d2), s/veh	12.0	0.0	0.0	0.7	0.3	0.0	0.9	18.8	0.0	0.9	7.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	0.2	0.0	2.7	1.3	0.0	1.3	27.6	0.0	0.7	17.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	54.5	33.7	0.0	37.7	34.9	0.0	17.3	35.3	0.0	24.6	21.8	0.0
LnGrp LOS	D	C		D	C		B	D		C	C	
Approach Vol, veh/h		220	A		183	A		1273	A		1026	A
Approach Delay, s/veh		53.6			36.7			33.7			21.9	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	69.1		22.5	9.3	67.9		22.5
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	63.5		18.0	5.1	63.4		18.0
Max Q Clear Time (g_c+I1), s	2.9	60.5		20.0	4.1	44.0		10.0
Green Ext Time (p_c), s	0.0	2.2		0.0	0.0	8.0		0.4

Intersection Summary	
HCM 6th Ctrl Delay	31.1
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	17.2					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	159	605	1060	1056	2
Future Vol, veh/h	0	159	605	1060	1056	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	4	2	5	5	7
Mvmt Flow	0	171	651	1140	1135	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3577	-	1135	0	-	0
Stage 1	1135	-	-	-	-	-
Stage 2	2442	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	6	0	~ 616	-	-	-
Stage 1	307	0	-	-	-	-
Stage 2	68	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	0	-	~ 616	-	-	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	0	-	-	-	-	-
Stage 2	68	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	28.2	0
HCM LOS	A		

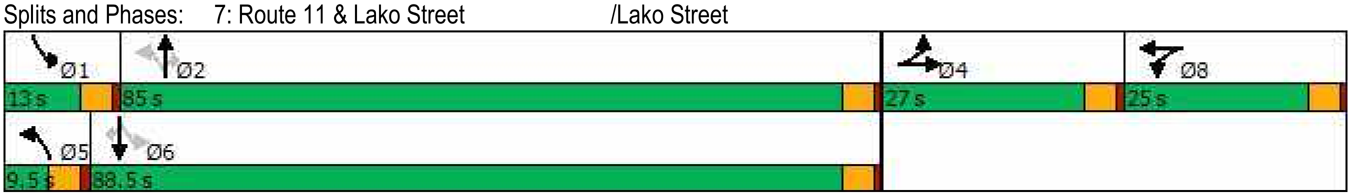
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	~ 616	-	-	-	-	-
HCM Lane V/C Ratio	1.056	-	-	-	-	-
HCM Control Delay (s)	77.6	-	0	0	-	-
HCM Lane LOS	F	-	A	A	-	-
HCM 95th %tile Q(veh)	17.9	-	-	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Future Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	27.0	27.0	25.0	25.0	9.5	85.0	85.0	13.0	88.5	88.5
Total Split (%)	18.0%	18.0%	16.7%	16.7%	6.3%	56.7%	56.7%	8.7%	59.0%	59.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	22.5	22.5	20.5	20.5	85.5	80.5	80.5	92.7	85.9	85.9
Actuated g/C Ratio	0.15	0.15	0.14	0.14	0.57	0.54	0.54	0.62	0.57	0.57
v/c Ratio	1.14	0.43	0.38	1.16	0.28	1.14	0.07	1.22	0.90	0.16
Control Delay	152.1	44.0	64.1	139.7	16.8	106.9	2.1	177.4	41.9	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	152.1	44.0	64.1	139.7	16.8	106.9	2.1	177.4	41.9	6.5
LOS	F	D	E	F	B	F	A	F	D	A
Approach Delay		120.5		124.8		99.3			56.0	
Approach LOS		F		F		F			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 89.0	Intersection LOS: F
Intersection Capacity Utilization 116.9%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Future Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	289	303		119	126		221	1084		157	1140	
Arrive On Green	0.16	0.16	0.00	0.07	0.07	0.00	0.03	0.58	0.00	0.06	0.61	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	22.5	3.3	0.0	6.9	2.9	0.0	1.1	80.5	0.0	8.5	56.5	0.0
Cycle Q Clear(g_c), s	22.5	3.3	0.0	6.9	2.9	0.0	1.1	80.5	0.0	8.5	56.5	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	289	303		119	126		221	1084		157	1140	
V/C Ratio(X)	1.04	0.17		0.76	0.33		0.16	1.05		1.11	0.84	
Avail Cap(c_a), veh/h	289	303		261	276		238	1084		157	1140	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	58.2	50.1	0.0	63.6	61.7	0.0	21.2	29.2	0.0	48.0	21.2	0.0
Incr Delay (d2), s/veh	64.6	0.3	0.0	9.3	1.5	0.0	0.3	40.4	0.0	102.7	7.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.3	1.6	0.0	3.4	1.4	0.0	0.5	46.6	0.0	7.6	25.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	122.7	50.4	0.0	73.0	63.2	0.0	21.6	69.6	0.0	150.7	28.6	0.0
LnGrp LOS	F	D		E	E		C	F		F	C	
Approach Vol, veh/h		352	A		131	A		1170	A		1127	A
Approach Delay, s/veh		112.3			69.9			68.1			47.4	
Approach LOS		F			E			E			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	85.0		27.0	8.2	89.8		13.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.5	80.5		22.5	5.0	84.0		20.5				
Max Q Clear Time (g_c+I1), s	10.5	82.5		24.5	3.1	58.5		8.9				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	8.7		0.3				

Intersection Summary	
HCM 6th Ctrl Delay	65.4
HCM 6th LOS	E

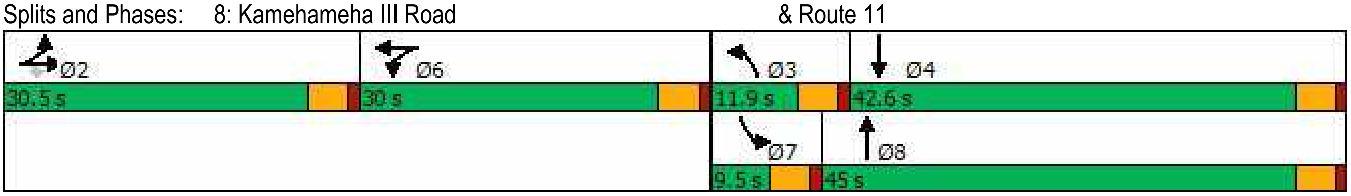
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	5	26	12	76	654	16	581
Future Volume (vph)	5	26	12	76	654	16	581
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	30.0	11.9	45.0	9.5	42.6
Total Split (%)	26.5%	26.5%	26.1%	10.3%	39.1%	8.3%	37.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.1	15.1	7.3	7.5	47.4	5.1	38.8
Actuated g/C Ratio	0.18	0.18	0.09	0.09	0.58	0.06	0.47
v/c Ratio	0.64	0.08	0.29	0.55	0.70	0.16	0.63
Control Delay	41.8	0.5	31.9	54.8	22.0	44.8	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.8	0.5	31.9	54.8	22.0	44.8	18.5
LOS	D	A	C	D	C	D	B
Approach Delay	36.8		31.9		25.4		19.0
Approach LOS	D		C		C		B

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 82.1	
Natural Cycle: 115	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 23.7	Intersection LOS: C
Intersection Capacity Utilization 67.8%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 8: Kamehameha III Road & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	182	5	26	16	12	17	76	654	15	16	581	334
Future Volume (veh/h)	182	5	26	16	12	17	76	654	15	16	581	334
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1811	1870	1722	1870	1781	1796	1752	1811	1870	1870	1811	1811
Adj Flow Rate, veh/h	196	5	0	17	13	18	82	703	16	17	625	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	2	12	2	8	7	10	6	2	2	6	6
Cap, veh/h	256	7		24	18	25	103	970	22	35	1750	
Arrive On Green	0.15	0.15	0.00	0.04	0.04	0.04	0.06	0.55	0.55	0.02	0.51	0.00
Sat Flow, veh/h	1739	44	1459	569	435	603	1668	1763	40	1781	3532	0
Grp Volume(v), veh/h	201	0	0	48	0	0	82	0	719	17	625	0
Grp Sat Flow(s),veh/h/ln	1783	0	1459	1608	0	0	1668	0	1803	1781	1721	0
Q Serve(g_s), s	8.1	0.0	0.0	2.2	0.0	0.0	3.6	0.0	22.3	0.7	8.2	0.0
Cycle Q Clear(g_c), s	8.1	0.0	0.0	2.2	0.0	0.0	3.6	0.0	22.3	0.7	8.2	0.0
Prop In Lane	0.98		1.00	0.35		0.37	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	262	0		68	0	0	103	0	992	35	1750	
V/C Ratio(X)	0.77	0.00		0.71	0.00	0.00	0.80	0.00	0.72	0.48	0.36	
Avail Cap(c_a), veh/h	619	0		547	0	0	165	0	992	119	1750	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.7	0.0	0.0	35.4	0.0	0.0	34.7	0.0	12.6	36.3	11.1	0.0
Incr Delay (d2), s/veh	4.6	0.0	0.0	12.7	0.0	0.0	12.9	0.0	4.6	9.7	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	0.0	1.1	0.0	0.0	1.7	0.0	8.2	0.4	2.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.3	0.0	0.0	48.1	0.0	0.0	47.5	0.0	17.2	46.1	11.6	0.0
LnGrp LOS	D	A		D	A	A	D	A	B	D	B	
Approach Vol, veh/h		201	A		48			801			642	A
Approach Delay, s/veh		35.3			48.1			20.3			12.5	
Approach LOS		D			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		15.5	9.1	42.6		7.7	6.0	45.7				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		26.0	7.4	38.1		25.5	5.0	40.5				
Max Q Clear Time (g_c+I1), s		10.1	5.6	10.2		4.2	2.7	24.3				
Green Ext Time (p_c), s		1.0	0.0	4.1		0.2	0.0	4.2				

Intersection Summary	
HCM 6th Ctrl Delay	19.9
HCM 6th LOS	B

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	4.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	108	1060	25	22	1033
Future Vol, veh/h	29	108	1060	25	22	1033
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	Yield	-	None
Storage Length	0	0	-	500	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	117	1152	27	24	1123

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2323	1152	0	0	1152	0
Stage 1	1152	-	-	-	-	-
Stage 2	1171	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	41	241	-	-	606	-
Stage 1	301	-	-	-	-	-
Stage 2	295	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	39	241	-	-	606	-
Mov Cap-2 Maneuver	39	-	-	-	-	-
Stage 1	301	-	-	-	-	-
Stage 2	283	-	-	-	-	-

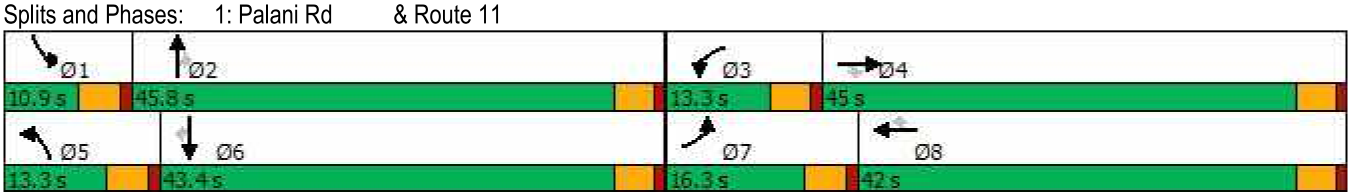
Approach	WB	NB	SB
HCM Control Delay, s	77.6	0	0.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	39	241	606	-
HCM Lane V/C Ratio	-	-	0.808	0.487	0.039	-
HCM Control Delay (s)	-	-	242.4	33.3	11.2	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	3	2.5	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	1160	503	227	809	65	227	283	272	56	313	107
Future Volume (vph)	260	1160	503	227	809	65	227	283	272	56	313	107
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	38.5	38.5	9.5	38.5	38.5	9.5	42.5	42.5	9.5	42.5	42.5
Total Split (s)	16.3	45.0	45.0	13.3	42.0	42.0	13.3	45.8	45.8	10.9	43.4	43.4
Total Split (%)	14.2%	39.1%	39.1%	11.6%	36.5%	36.5%	11.6%	39.8%	39.8%	9.5%	37.7%	37.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None	None
Act Effct Green (s)	11.2	40.9	40.9	8.9	38.6	38.6	8.9	21.7	21.7	6.3	16.9	16.9
Actuated g/C Ratio	0.12	0.44	0.44	0.09	0.41	0.41	0.09	0.23	0.23	0.07	0.18	0.18
v/c Ratio	0.65	0.77	0.58	0.71	0.58	0.09	0.72	0.35	0.52	0.48	0.50	0.29
Control Delay	49.1	28.5	9.7	56.1	25.1	2.3	56.6	31.4	10.8	59.1	36.4	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.1	28.5	9.7	56.1	25.1	2.3	56.6	31.4	10.8	59.1	36.4	7.8
LOS	D	C	A	E	C	A	E	C	B	E	D	A
Approach Delay		26.3			30.2			31.6			32.7	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 93.8	
Natural Cycle: 110	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.77	
Intersection Signal Delay: 29.0	Intersection LOS: C
Intersection Capacity Utilization 69.4%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Palani Rd & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	1160	503	227	809	65	227	283	272	56	313	107
Future Volume (veh/h)	260	1160	503	227	809	65	227	283	272	56	313	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1870	1870	1841	1870	1856	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	265	1184	0	232	826	0	232	289	0	57	319	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	3	3	2	2	4	2	3	2	2	2	2	2
Cap, veh/h	348	1659		309	1603		309	666		77	500	
Arrive On Green	0.10	0.47	0.00	0.09	0.46	0.00	0.09	0.19	0.00	0.04	0.14	0.00
Sat Flow, veh/h	3428	3526	1585	3456	3497	1585	3428	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	265	1184	0	232	826	0	232	289	0	57	319	0
Grp Sat Flow(s),veh/h/ln	1714	1763	1585	1728	1749	1585	1714	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.5	23.0	0.0	5.6	14.4	0.0	5.7	6.2	0.0	2.7	7.3	0.0
Cycle Q Clear(g_c), s	6.5	23.0	0.0	5.6	14.4	0.0	5.7	6.2	0.0	2.7	7.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	348	1659		309	1603		309	666		77	500	
V/C Ratio(X)	0.76	0.71		0.75	0.52		0.75	0.43		0.74	0.64	
Avail Cap(c_a), veh/h	470	1659		353	1603		351	1705		132	1606	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	37.6	18.2	0.0	38.2	16.5	0.0	38.2	30.9	0.0	40.7	34.9	0.0
Incr Delay (d2), s/veh	5.0	2.6	0.0	7.6	1.2	0.0	7.8	0.4	0.0	13.0	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	9.1	0.0	2.6	5.6	0.0	2.7	2.6	0.0	1.5	3.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.6	20.8	0.0	45.8	17.7	0.0	46.0	31.4	0.0	53.6	36.3	0.0
LnGrp LOS	D	C		D	B		D	C		D	D	
Approach Vol, veh/h		1449	A		1058	A		521	A		376	A
Approach Delay, s/veh		24.8			23.9			37.9			38.9	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.2	20.6	12.2	45.0	12.2	16.6	13.2	44.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.4	41.3	8.8	40.5	8.8	38.9	11.8	37.5
Max Q Clear Time (g_c+I1), s	4.7	8.2	7.6	25.0	7.7	9.3	8.5	16.4
Green Ext Time (p_c), s	0.0	2.0	0.1	7.5	0.1	2.2	0.3	5.7

Intersection Summary	
HCM 6th Ctrl Delay	28.1
HCM 6th LOS	C

Notes

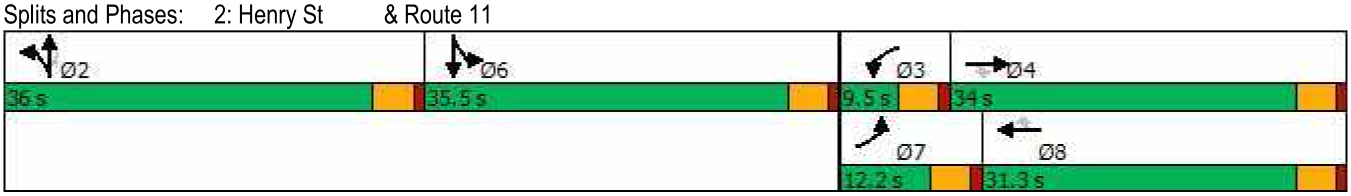
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Traffic Volume (vph)	190	930	291	84	764	368	126	318	40	411	342
Future Volume (vph)	190	930	291	84	764	368	126	318	40	411	342
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA
Protected Phases	7	4		3	8		2	2		6	6
Permitted Phases			4			8			2		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	30.5	30.5	9.5	30.5	30.5	35.5	35.5	35.5	35.5	35.5
Total Split (s)	12.2	34.0	34.0	9.5	31.3	31.3	36.0	36.0	36.0	35.5	35.5
Total Split (%)	10.6%	29.6%	29.6%	8.3%	27.2%	27.2%	31.3%	31.3%	31.3%	30.9%	30.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	7.8	32.2	32.2	5.1	27.2	27.2	17.0	17.0	17.0	25.7	25.7
Actuated g/C Ratio	0.08	0.34	0.34	0.05	0.28	0.28	0.18	0.18	0.18	0.27	0.27
v/c Ratio	0.72	0.80	0.42	0.48	0.79	0.53	0.41	0.56	0.12	0.75	0.72
Control Delay	61.2	38.2	7.0	57.0	40.8	6.6	39.9	39.9	0.7	45.1	34.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.2	38.2	7.0	57.0	40.8	6.6	39.9	39.9	0.7	45.1	34.6
LOS	E	D	A	E	D	A	D	D	A	D	C
Approach Delay		34.8			31.6			36.6			38.2
Approach LOS		C			C			D			D

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 96
Natural Cycle: 115
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 34.8 Intersection LOS: C
Intersection Capacity Utilization 76.5% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 2: Henry St & Route 11



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	930	291	84	764	368	126	318	40	411	342	190
Future Volume (vph)	190	930	291	84	764	368	126	318	40	411	342	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (prot)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3196	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	
Satd. Flow (perm)	3335	3539	1583	3433	3471	1561	1595	3382	1537	1610	3196	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	949	297	86	780	376	129	324	41	419	349	194
RTOR Reduction (vph)	0	0	184	0	0	266	0	0	34	0	39	0
Lane Group Flow (vph)	194	949	113	86	780	110	116	337	7	323	600	0
Confl. Peds. (#/hr)	1					1	4		7	7		4
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	5%	2%	2%	2%	4%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.8	32.2	32.2	3.9	28.3	28.3	17.0	17.0	17.0	25.7	25.7	
Effective Green, g (s)	7.8	32.2	32.2	3.9	28.3	28.3	17.0	17.0	17.0	25.7	25.7	
Actuated g/C Ratio	0.08	0.33	0.33	0.04	0.29	0.29	0.18	0.18	0.18	0.27	0.27	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	268	1177	526	138	1014	456	280	593	269	427	848	
v/s Ratio Prot	c0.06	c0.27		0.03	0.22		0.07	c0.10		c0.20	0.19	
v/s Ratio Perm			0.07			0.07			0.00			
v/c Ratio	0.72	0.81	0.21	0.62	0.77	0.24	0.41	0.57	0.03	0.76	0.71	
Uniform Delay, d1	43.4	29.5	23.2	45.7	31.3	26.1	35.5	36.5	33.0	32.7	32.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	6.0	0.9	8.5	5.6	1.2	1.0	1.3	0.0	7.5	2.7	
Delay (s)	52.8	35.4	24.1	54.2	36.9	27.3	36.5	37.8	33.1	40.1	34.9	
Level of Service	D	D	C	D	D	C	D	D	C	D	C	
Approach Delay (s)		35.4			35.2			37.1			36.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	35.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	96.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	88	89	1287	1416	17
Future Vol, veh/h	10	88	89	1287	1416	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	650	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	4	2	6
Mvmt Flow	10	91	92	1327	1460	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2971	-	1460	0	-	0
Stage 1	1460	-	-	-	-	-
Stage 2	1511	-	-	-	-	-
Critical Hdwy	6.42	-	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	2.218	-	-	-
Pot Cap-1 Maneuver	16	0	463	-	-	-
Stage 1	213	0	-	-	-	-
Stage 2	201	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	13	-	463	-	-	-
Mov Cap-2 Maneuver	13	-	-	-	-	-
Stage 1	171	-	-	-	-	-
Stage 2	201	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	$ 553.1	0.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	463	-	13	-	-	-
HCM Lane V/C Ratio	0.198	-	0.793	-	-	-
HCM Control Delay (s)	14.7	-	$ 553.1	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.7	-	1.8	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	3.6					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	71	1313	4	61	1446
Future Vol, veh/h	14	71	1313	4	61	1446
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	Yield	-	None
Storage Length	0	0	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	7	2	3	2	8	2
Mvmt Flow	14	73	1354	4	63	1491

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2973	-	0	0	1354	0
Stage 1	1356	-	-	-	-	-
Stage 2	1617	-	-	-	-	-
Critical Hdwy	6.47	-	-	-	4.18	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	-	-	-	2.272	-
Pot Cap-1 Maneuver	15	0	-	-	489	-
Stage 1	234	0	-	-	-	-
Stage 2	174	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 13	-	-	-	489	-
Mov Cap-2 Maneuver	~ 13	-	-	-	-	-
Stage 1	234	-	-	-	-	-
Stage 2	152	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 679.5	0	0.5
HCM LOS	F		

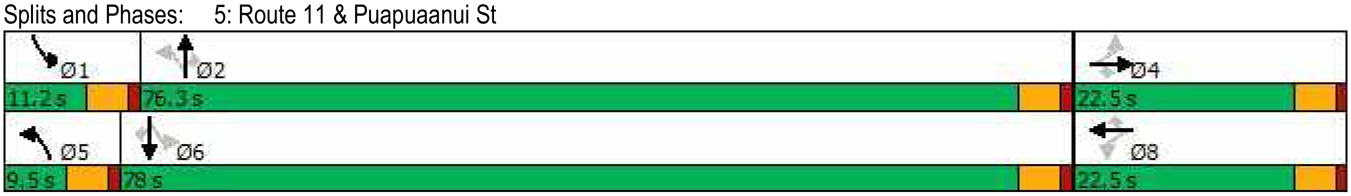
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	13	-	489	-
HCM Lane V/C Ratio	-	-	1.11	-	0.129	-
HCM Control Delay (s)	-	-	$ 679.5	0	13.4	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	2.4	-	0.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	199	23	116	53	23	104	105	978	61	142	1202	100
Future Volume (vph)	199	23	116	53	23	104	105	978	61	142	1202	100
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	76.3	76.3	11.2	78.0	78.0
Total Split (%)	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	8.6%	69.4%	69.4%	10.2%	70.9%	70.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	76.9	71.9	71.9	80.1	73.5	73.5
Actuated g/C Ratio	0.16	0.16	0.16	0.16	0.16	0.16	0.70	0.65	0.65	0.73	0.67	0.67
v/c Ratio	0.96	0.08	0.35	0.24	0.08	0.31	0.77	0.84	0.06	0.59	1.00	0.10
Control Delay	97.4	39.9	10.0	43.4	39.9	10.4	50.9	22.6	1.9	16.0	43.8	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	97.4	39.9	10.0	43.4	39.9	10.4	50.9	22.6	1.9	16.0	43.8	1.9
LOS	F	D	B	D	D	B	D	C	A	B	D	A
Approach Delay		63.5			24.1			24.2			38.0	
Approach LOS		E			C			C			D	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 110	
Natural Cycle: 110	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 35.0	Intersection LOS: D
Intersection Capacity Utilization 98.0%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 5: Route 11 & Puapuaanui St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	23	116	53	23	104	105	978	61	142	1202	100
Future Volume (veh/h)	199	23	116	53	23	104	105	978	61	142	1202	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1826	1870	1856	1841	1870	1870	1870
Adj Flow Rate, veh/h	216	25	0	55	25	0	114	1008	0	146	1239	0
Peak Hour Factor	0.92	0.92	0.92	0.97	0.92	0.97	0.92	0.97	0.97	0.97	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	5	2	3	4	2	2	2
Cap, veh/h	277	306		277	306		153	1240		299	1251	
Arrive On Green	0.16	0.16	0.00	0.16	0.16	0.00	0.04	0.67	0.00	0.04	0.67	0.00
Sat Flow, veh/h	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Grp Volume(v), veh/h	216	25	0	55	25	0	114	1008	0	146	1239	0
Grp Sat Flow(s),veh/h/ln	1386	1870	1585	1386	1870	1547	1781	1856	1560	1781	1870	1585
Q Serve(g_s), s	16.8	1.2	0.0	3.8	1.2	0.0	2.3	43.3	0.0	2.8	71.3	0.0
Cycle Q Clear(g_c), s	18.0	1.2	0.0	5.1	1.2	0.0	2.3	43.3	0.0	2.8	71.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	277	306		277	306		153	1240		299	1251	
V/C Ratio(X)	0.78	0.08		0.20	0.08		0.75	0.81		0.49	0.99	
Avail Cap(c_a), veh/h	277	306		277	306		156	1240		327	1251	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	46.7	38.9	0.0	41.1	38.9	0.0	29.8	13.2	0.0	16.5	17.8	0.0
Incr Delay (d2), s/veh	13.3	0.1	0.0	0.3	0.1	0.0	17.4	5.9	0.0	1.2	23.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.9	0.6	0.0	1.3	0.6	0.0	2.7	18.0	0.0	1.9	34.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	60.0	39.0	0.0	41.4	39.0	0.0	47.2	19.1	0.0	17.7	41.0	0.0
LnGrp LOS	E	D		D	D		D	B		B	D	
Approach Vol, veh/h		241	A		80	A		1122	A		1385	A
Approach Delay, s/veh		57.8			40.7			22.0			38.5	
Approach LOS		E			D			C			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	77.9		22.5	9.3	78.0		22.5
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	6.7	71.8		18.0	5.0	73.5		18.0
Max Q Clear Time (g_c+I1), s	4.8	45.3		20.0	4.3	73.3		7.1
Green Ext Time (p_c), s	0.1	9.7		0.0	0.0	0.1		0.1

Intersection Summary	
HCM 6th Ctrl Delay	33.7
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	325	341	1155	1270	0
Future Vol, veh/h	0	325	341	1155	1270	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	160	0	630	-	-	700
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	8	2	2	3	2	6
Mvmt Flow	0	332	348	1179	1296	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	3171	-	1296	0	-	0
Stage 1	1296	-	-	-	-	-
Stage 2	1875	-	-	-	-	-
Critical Hdwy	6.48	-	4.12	-	-	-
Critical Hdwy Stg 1	5.48	-	-	-	-	-
Critical Hdwy Stg 2	5.48	-	-	-	-	-
Follow-up Hdwy	3.572	-	2.218	-	-	-
Pot Cap-1 Maneuver	11	0	535	-	-	-
Stage 1	249	0	-	-	-	-
Stage 2	128	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	4	-	535	-	-	-
Mov Cap-2 Maneuver	4	-	-	-	-	-
Stage 1	87	-	-	-	-	-
Stage 2	128	-	-	-	-	-

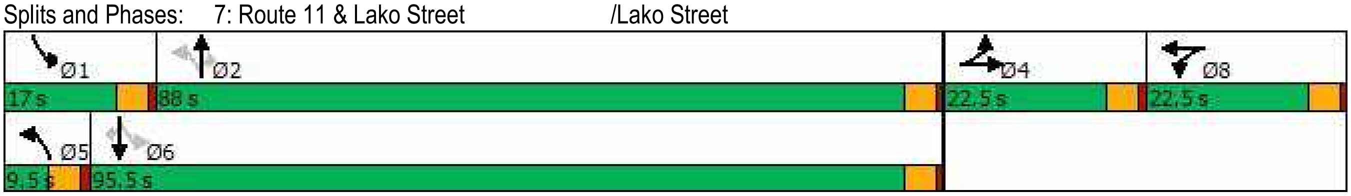
Approach	EB	NB	SB
HCM Control Delay, s	0	5.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	535	-	-	-	-	-
HCM Lane V/C Ratio	0.65	-	-	-	-	-
HCM Control Delay (s)	23.4	-	0	0	-	-
HCM Lane LOS	C	-	A	A	-	-
HCM 95th %tile Q(veh)	4.7	-	-	-	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Future Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	88.0	88.0	17.0	95.5	95.5
Total Split (%)	15.0%	15.0%	15.0%	15.0%	6.3%	58.7%	58.7%	11.3%	63.7%	63.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.5	16.5	15.9	15.9	88.6	83.6	83.6	100.7	93.2	93.2
Actuated g/C Ratio	0.11	0.11	0.11	0.11	0.60	0.57	0.57	0.69	0.64	0.64
v/c Ratio	0.81	0.36	0.38	0.92	0.36	1.06	0.07	1.06	1.03	0.19
Control Delay	93.5	35.1	66.8	62.0	20.0	75.4	0.5	119.5	61.9	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	93.5	35.1	66.8	62.0	20.0	75.4	0.5	119.5	61.9	6.1
LOS	F	D	E	E	B	E	A	F	E	A
Approach Delay		73.7		63.0		69.5			62.5	
Approach LOS		E		E		E			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 146.5	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 65.8	Intersection LOS: E
Intersection Capacity Utilization 107.2%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Future Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	184	196		99	101		137	1146		233	1268	
Arrive On Green	0.10	0.10	0.00	0.06	0.06	0.00	0.03	0.62	0.00	0.09	0.68	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	12.0	2.0	0.0	5.4	3.0	0.0	1.1	77.4	0.0	10.0	81.7	0.0
Cycle Q Clear(g_c), s	12.0	2.0	0.0	5.4	3.0	0.0	1.1	77.4	0.0	10.0	81.7	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	184	196		99	101		137	1146		233	1268	
V/C Ratio(X)	0.86	0.16		0.73	0.41		0.28	0.97		0.90	0.96	
Avail Cap(c_a), veh/h	233	249		237	243		152	1146		239	1268	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	59.5	55.1	0.0	62.9	61.7	0.0	30.5	24.7	0.0	44.9	20.2	0.0
Incr Delay (d2), s/veh	21.9	0.4	0.0	9.7	2.7	0.0	1.1	20.4	0.0	32.5	17.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.5	1.0	0.0	2.7	1.5	0.0	0.8	38.4	0.0	6.5	38.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	81.5	55.5	0.0	72.6	64.4	0.0	31.6	45.1	0.0	77.4	37.8	0.0
LnGrp LOS	F	E		E	E		C	D		E	D	
Approach Vol, veh/h		189	A		114	A		1151	A		1430	A
Approach Delay, s/veh		77.2			69.6			44.7			43.6	
Approach LOS		E			E			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	16.5	88.0		18.7	8.3	96.2		12.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	12.5	83.5		18.0	5.0	91.0		18.0				
Max Q Clear Time (g_c+I1), s	12.0	79.4		14.0	3.1	83.7		7.4				
Green Ext Time (p_c), s	0.0	2.9		0.2	0.0	5.3		0.2				

Intersection Summary		
HCM 6th Ctrl Delay		47.3
HCM 6th LOS		D

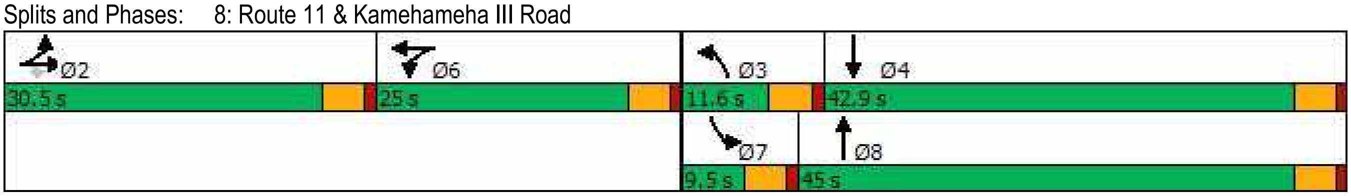
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Configurations							
Traffic Volume (vph)	11	52	11	64	695	19	692
Future Volume (vph)	11	52	11	64	695	19	692
Turn Type	NA	Perm	NA	Prot	NA	Prot	NA
Protected Phases	2		6	3	8	7	4
Permitted Phases		2					
Detector Phase	2	2	6	3	8	7	4
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	25.0	9.5	23.5	9.5	23.5
Total Split (s)	30.5	30.5	25.0	11.6	45.0	9.5	42.9
Total Split (%)	27.7%	27.7%	22.7%	10.5%	40.9%	8.6%	39.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag				Lead	Lag	Lead	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	None	Max
Act Effct Green (s)	23.1	23.1	6.9	7.0	45.3	5.1	39.9
Actuated g/C Ratio	0.26	0.26	0.08	0.08	0.52	0.06	0.46
v/c Ratio	0.81	0.12	0.27	0.48	0.78	0.19	0.68
Control Delay	46.6	1.3	29.5	55.1	28.8	48.9	22.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.6	1.3	29.5	55.1	28.8	48.9	22.8
LOS	D	A	C	E	C	D	C
Approach Delay	40.7		29.5		30.9		23.3
Approach LOS	D		C		C		C

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 87.6	
Natural Cycle: 110	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 29.2	Intersection LOS: C
Intersection Capacity Utilization 78.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 8: Route 11 & Kamehameha III Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	343	11	52	7	11	21	64	695	11	19	692	322
Future Volume (veh/h)	343	11	52	7	11	21	64	695	11	19	692	322
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1767	1811	1870	1870	1870	1856	1856	1870	1870	1870	1870
Adj Flow Rate, veh/h	361	12	0	7	12	22	67	732	12	20	728	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	9	6	2	2	2	3	3	2	2	2	2
Cap, veh/h	408	14		11	18	33	86	872	14	39	1608	
Arrive On Green	0.25	0.25	0.00	0.04	0.04	0.04	0.05	0.48	0.48	0.02	0.45	0.00
Sat Flow, veh/h	1631	54	1535	289	495	908	1767	1820	30	1781	3647	0
Grp Volume(v), veh/h	373	0	0	41	0	0	67	0	744	20	728	0
Grp Sat Flow(s),veh/h/ln	1685	0	1535	1692	0	0	1767	0	1850	1781	1777	0
Q Serve(g_s), s	18.1	0.0	0.0	2.0	0.0	0.0	3.2	0.0	29.7	0.9	12.0	0.0
Cycle Q Clear(g_c), s	18.1	0.0	0.0	2.0	0.0	0.0	3.2	0.0	29.7	0.9	12.0	0.0
Prop In Lane	0.97		1.00	0.17		0.54	1.00		0.02	1.00		0.00
Lane Grp Cap(c), veh/h	422	0		62	0	0	86	0	886	39	1608	
V/C Ratio(X)	0.88	0.00		0.66	0.00	0.00	0.78	0.00	0.84	0.51	0.45	
Avail Cap(c_a), veh/h	516	0		409	0	0	148	0	886	105	1608	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.6	0.0	0.0	40.4	0.0	0.0	39.9	0.0	19.3	41.0	16.0	0.0
Incr Delay (d2), s/veh	14.5	0.0	0.0	11.5	0.0	0.0	14.0	0.0	9.4	9.7	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.8	0.0	0.0	1.0	0.0	0.0	1.6	0.0	13.2	0.5	4.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.1	0.0	0.0	51.9	0.0	0.0	53.9	0.0	28.7	50.7	16.9	0.0
LnGrp LOS	D	A		D	A	A	D	A	C	D	B	
Approach Vol, veh/h		373	A		41			811			748	A
Approach Delay, s/veh		45.1			51.9			30.7			17.8	
Approach LOS		D			D			C			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		25.7	8.6	42.9		7.6	6.4	45.1				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		26.0	7.1	38.4		20.5	5.0	40.5				
Max Q Clear Time (g_c+I1), s		20.1	5.2	14.0		4.0	2.9	31.7				
Green Ext Time (p_c), s		1.1	0.0	4.7		0.1	0.0	3.1				

Intersection Summary			
HCM 6th Ctrl Delay			29.0
HCM 6th LOS			C

Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	3.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	68	1155	74	79	1255
Future Vol, veh/h	12	68	1155	74	79	1255
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	500	500	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	74	1255	80	86	1364

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2791	1255	0	0	1335	0
Stage 1	1255	-	-	-	-	-
Stage 2	1536	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	21	209	-	-	517	-
Stage 1	268	-	-	-	-	-
Stage 2	196	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	18	209	-	-	517	-
Mov Cap-2 Maneuver	18	-	-	-	-	-
Stage 1	268	-	-	-	-	-
Stage 2	163	-	-	-	-	-

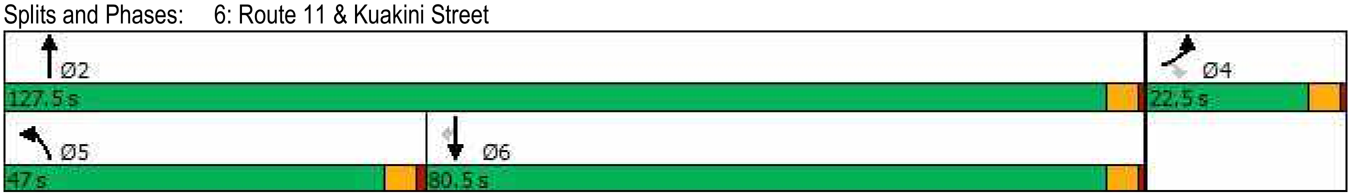
Approach	WB	NB	SB
HCM Control Delay, s	87.6	0	0.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	18	209	517	-
HCM Lane V/C Ratio	-	-	0.725	0.354	0.166	-
HCM Control Delay (s)	-	-	$ 405.8	31.4	13.3	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	1.9	1.5	0.6	-

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	605	1060	1056	2
Future Volume (vph)	159	605	1060	1056	2
Turn Type	Perm	Prot	NA	NA	Perm
Protected Phases		5	2	6	
Permitted Phases	4				6
Detector Phase	4	5	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	22.5	47.0	127.5	80.5	80.5
Total Split (%)	15.0%	31.3%	85.0%	53.7%	53.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag	Lag
Lead-Lag Optimize?		Yes		Yes	Yes
Recall Mode	None	None	Max	Max	Max
Act Effct Green (s)	5.5	42.5	123.0	76.0	76.0
Actuated g/C Ratio	0.04	0.31	0.89	0.55	0.55
v/c Ratio	0.36	1.19	0.70	1.14	0.00
Control Delay	2.2	144.2	4.8	103.4	9.5
Queue Delay	0.0	0.0	0.1	0.0	0.0
Total Delay	2.2	144.2	5.0	103.4	9.5
LOS	A	F	A	F	A
Approach Delay			55.6	103.2	
Approach LOS			E	F	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 137.5	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.19	
Intersection Signal Delay: 70.1	Intersection LOS: E
Intersection Capacity Utilization 96.6%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	605	1060	1056	2
Future Volume (veh/h)	0	159	605	1060	1056	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	651	1140	1135	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		594	1761	1088	
Arrive On Green	0.00	0.00	0.33	0.96	0.60	0.00
Sat Flow, veh/h	1781	1560	1781	1826	1826	1522
Grp Volume(v), veh/h	0	0	651	1140	1135	0
Grp Sat Flow(s),veh/h/ln	1781	1560	1781	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	42.5	7.5	76.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	42.5	7.5	76.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		594	1761	1088	
V/C Ratio(X)	0.00		1.10	0.65	1.04	
Avail Cap(c_a), veh/h	251		594	1761	1088	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	42.5	0.2	25.7	0.0
Incr Delay (d2), s/veh	0.0	0.0	66.0	1.9	39.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	29.3	0.9	42.6	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	108.5	2.1	64.9	0.0
LnGrp LOS	A		F	A	F	
Approach Vol, veh/h	0	A		1791	1135	A
Approach Delay, s/veh	0.0			40.8	64.9	
Approach LOS				D	E	
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	47.0	80.5
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	42.5	76.0
Max Q Clear Time (g_c+I1), s		9.5		0.0	44.5	78.0
Green Ext Time (p_c), s		17.1		0.0	0.0	0.0
Intersection Summary						
HCM 6th Ctrl Delay			50.1			
HCM 6th LOS			D			

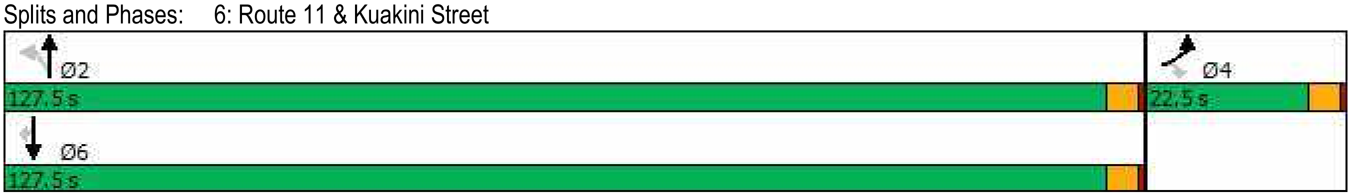
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	605	1060	1056	2
Future Volume (vph)	159	605	1060	1056	2
Turn Type	Perm	Perm	NA	NA	Perm
Protected Phases			2	6	
Permitted Phases	4	2			6
Detector Phase	4	2	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	127.5	127.5	127.5	127.5
Total Split (%)	15.0%	85.0%	85.0%	85.0%	85.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	Max	Max	Max	Max
Act Effct Green (s)	7.5	123.1	123.1	123.1	123.1
Actuated g/C Ratio	0.05	0.88	0.88	0.88	0.88
v/c Ratio	0.68	1.85	0.71	0.71	0.00
Control Delay	21.8	412.7	6.1	6.0	1.0
Queue Delay	0.0	0.0	0.2	0.0	0.0
Total Delay	21.8	412.7	6.3	6.0	1.0
LOS	C	F	A	A	A
Approach Delay			154.0	6.0	
Approach LOS			F	A	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 139.6	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.85	
Intersection Signal Delay: 92.4	Intersection LOS: F
Intersection Capacity Utilization 96.6%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	605	1060	1056	2
Future Volume (veh/h)	0	159	605	1060	1056	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	651	1140	1135	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		506	1761	1761	
Arrive On Green	0.00	0.00	0.96	0.96	0.96	0.00
Sat Flow, veh/h	1781	1560	496	1826	1826	1522
Grp Volume(v), veh/h	0	0	651	1140	1135	0
Grp Sat Flow(s),veh/h/ln	1781	1560	496	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	115.6	7.5	7.4	0.0
Cycle Q Clear(g_c), s	0.0	0.0	123.0	7.5	7.4	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		506	1761	1761	
V/C Ratio(X)	0.00		1.29	0.65	0.64	
Avail Cap(c_a), veh/h	251		506	1761	1761	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	12.4	0.2	0.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	143.2	1.9	1.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	36.6	0.9	0.9	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	155.6	2.1	2.0	0.0
LnGrp LOS	A		F	A	A	
Approach Vol, veh/h	0	A		1791	1135	A
Approach Delay, s/veh	0.0			57.9	2.0	
Approach LOS				E	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		127.5		0.0		127.5
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		123.0		18.0		123.0
Max Q Clear Time (g_c+I1), s		125.0		0.0		9.4
Green Ext Time (p_c), s		0.0		0.0		16.8

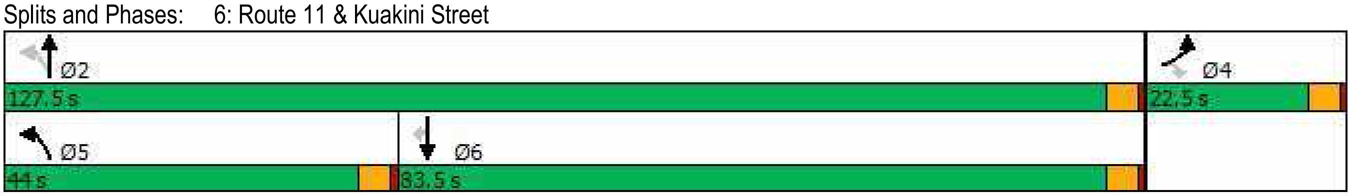
Intersection Summary						
HCM 6th Ctrl Delay			36.2			
HCM 6th LOS			D			

Notes
Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT	SBR
Lane Configurations					
Traffic Volume (vph)	159	605	1060	1056	2
Future Volume (vph)	159	605	1060	1056	2
Turn Type	Perm	pm+pt	NA	NA	Perm
Protected Phases		5	2	6	
Permitted Phases	4	2			6
Detector Phase	4	5	2	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	22.5	44.0	127.5	83.5	83.5
Total Split (%)	15.0%	29.3%	85.0%	55.7%	55.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag	Lag
Lead-Lag Optimize?		Yes		Yes	Yes
Recall Mode	None	None	Max	Max	Max
Act Effct Green (s)	5.5	123.0	123.0	79.0	79.0
Actuated g/C Ratio	0.04	0.89	0.89	0.57	0.57
v/c Ratio	0.38	1.16	0.70	1.09	0.00
Control Delay	2.4	127.9	4.8	85.8	8.5
Queue Delay	0.0	0.0	0.1	0.0	0.0
Total Delay	2.4	127.9	5.0	85.8	8.5
LOS	A	F	A	F	A
Approach Delay			49.7	85.6	
Approach LOS			D	F	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 137.5	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.16	
Intersection Signal Delay: 60.2	Intersection LOS: E
Intersection Capacity Utilization 96.6%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	159	605	1060	1056	2
Future Volume (veh/h)	0	159	605	1060	1056	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1841	1870	1826	1826	1796
Adj Flow Rate, veh/h	0	0	651	1140	1135	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	4	2	5	5	7
Cap, veh/h	1		608	1761	1131	
Arrive On Green	0.00	0.00	0.31	0.96	0.62	0.00
Sat Flow, veh/h	1781	1560	1781	1826	1826	1522
Grp Volume(v), veh/h	0	0	651	1140	1135	0
Grp Sat Flow(s),veh/h/ln	1781	1560	1781	1826	1826	1522
Q Serve(g_s), s	0.0	0.0	39.5	7.5	79.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	39.5	7.5	79.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		608	1761	1131	
V/C Ratio(X)	0.00		1.07	0.65	1.00	
Avail Cap(c_a), veh/h	251		608	1761	1131	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	41.5	0.2	24.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	56.7	1.9	27.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	27.4	0.9	40.1	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	98.2	2.1	51.8	0.0
LnGrp LOS	A		F	A	F	
Approach Vol, veh/h	0	A		1791	1135	A
Approach Delay, s/veh	0.0			37.0	51.8	
Approach LOS				D	D	

Timer - Assigned Phs	2	4	5	6
Phs Duration (G+Y+Rc), s	127.5	0.0	44.0	83.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	123.0	18.0	39.5	79.0
Max Q Clear Time (g_c+I1), s	9.5	0.0	41.5	81.0
Green Ext Time (p_c), s	17.1	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	42.7
HCM 6th LOS	D

Notes

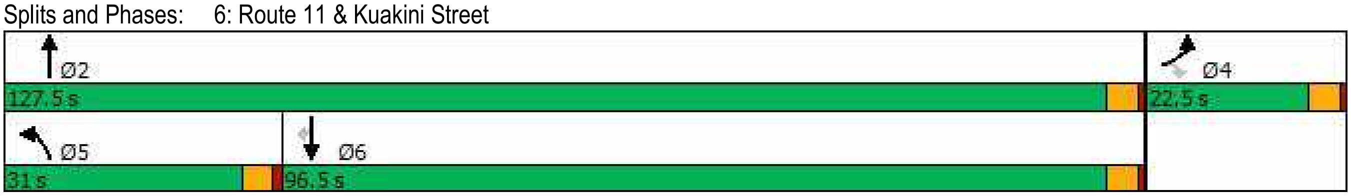
Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	341	1155	1270
Future Volume (vph)	325	341	1155	1270
Turn Type	Perm	Prot	NA	NA
Protected Phases		5	2	6
Permitted Phases	4			
Detector Phase	4	5	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5
Total Split (s)	22.5	31.0	127.5	96.5
Total Split (%)	15.0%	20.7%	85.0%	64.3%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag
Lead-Lag Optimize?		Yes		Yes
Recall Mode	None	None	Max	Max
Act Effct Green (s)	10.5	26.5	123.2	92.1
Actuated g/C Ratio	0.07	0.19	0.86	0.65
v/c Ratio	0.86	1.06	0.74	1.08
Control Delay	31.5	120.3	8.1	75.6
Queue Delay	0.0	0.0	0.2	0.0
Total Delay	31.5	120.3	8.3	75.6
LOS	C	F	A	E
Approach Delay			33.9	75.6
Approach LOS			C	E

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 142.7
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.08
Intersection Signal Delay: 50.7 Intersection LOS: D
Intersection Capacity Utilization 94.5% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	341	1155	1270	0
Future Volume (veh/h)	0	325	341	1155	1270	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	348	1179	1296	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		370	1790	1350	
Arrive On Green	0.00	0.00	0.21	0.96	0.72	0.00
Sat Flow, veh/h	1697	1585	1781	1856	1870	1535
Grp Volume(v), veh/h	0	0	348	1179	1296	0
Grp Sat Flow(s),veh/h/ln	1697	1585	1781	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	24.5	7.8	80.1	0.0
Cycle Q Clear(g_c), s	0.0	0.0	24.5	7.8	80.1	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		370	1790	1350	
V/C Ratio(X)	0.00		0.94	0.66	0.96	
Avail Cap(c_a), veh/h	240		370	1790	1350	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	49.7	0.2	16.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	31.7	1.9	16.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	14.1	1.0	35.7	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	81.4	2.1	32.8	0.0
LnGrp LOS	A		F	A	C	
Approach Vol, veh/h	0	A		1527	1296	A
Approach Delay, s/veh	0.0			20.2	32.8	
Approach LOS				C	C	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	31.0	96.5
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	26.5	92.0
Max Q Clear Time (g_c+I1), s		9.8		0.0	26.5	82.1
Green Ext Time (p_c), s		18.8		0.0	0.0	7.4

Intersection Summary			
HCM 6th Ctrl Delay			26.0
HCM 6th LOS			C

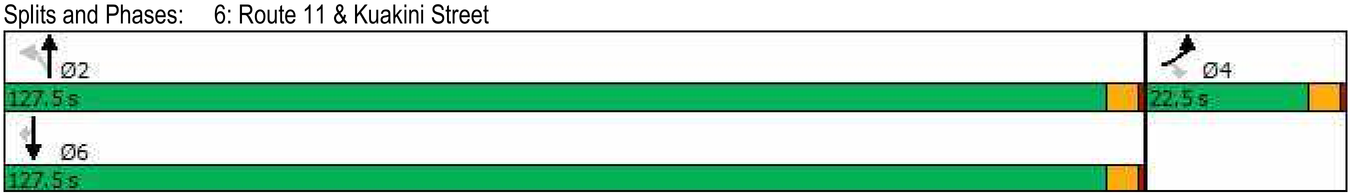
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	341	1155	1270
Future Volume (vph)	325	341	1155	1270
Turn Type	Perm	Perm	NA	NA
Protected Phases			2	6
Permitted Phases	4	2		
Detector Phase	4	2	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5
Total Split (s)	22.5	127.5	127.5	127.5
Total Split (%)	15.0%	85.0%	85.0%	85.0%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	Max	Max	Max
Act Effct Green (s)	18.0	123.0	123.0	123.0
Actuated g/C Ratio	0.12	0.82	0.82	0.82
v/c Ratio	1.07	2.13	0.78	0.85
Control Delay	107.6	548.6	11.3	15.0
Queue Delay	0.0	0.0	0.3	0.0
Total Delay	107.6	548.6	11.7	15.0
LOS	F	F	B	B
Approach Delay			134.1	15.0
Approach LOS			F	B

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 2.13	
Intersection Signal Delay: 82.4	Intersection LOS: F
Intersection Capacity Utilization 94.5%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	341	1155	1270	0
Future Volume (veh/h)	0	325	341	1155	1270	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	348	1179	1296	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		433	1790	1804	
Arrive On Green	0.00	0.00	0.96	0.96	0.96	0.00
Sat Flow, veh/h	1697	1585	425	1856	1870	1535
Grp Volume(v), veh/h	0	0	348	1179	1296	0
Grp Sat Flow(s),veh/h/ln	1697	1585	425	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	65.8	7.8	10.2	0.0
Cycle Q Clear(g_c), s	0.0	0.0	76.0	7.8	10.2	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		433	1790	1804	
V/C Ratio(X)	0.00		0.80	0.66	0.72	
Avail Cap(c_a), veh/h	240		433	1790	1804	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	4.6	0.2	0.3	0.0
Incr Delay (d2), s/veh	0.0	0.0	14.6	1.9	2.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	4.0	1.0	1.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	19.2	2.1	2.8	0.0
LnGrp LOS	A		B	A	A	
Approach Vol, veh/h	0	A		1527	1296	A
Approach Delay, s/veh	0.0			6.0	2.8	
Approach LOS				A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		127.5		0.0		127.5
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		123.0		18.0		123.0
Max Q Clear Time (g_c+I1), s		78.0		0.0		12.2
Green Ext Time (p_c), s		26.9		0.0		25.9

Intersection Summary			
HCM 6th Ctrl Delay			4.5
HCM 6th LOS			A

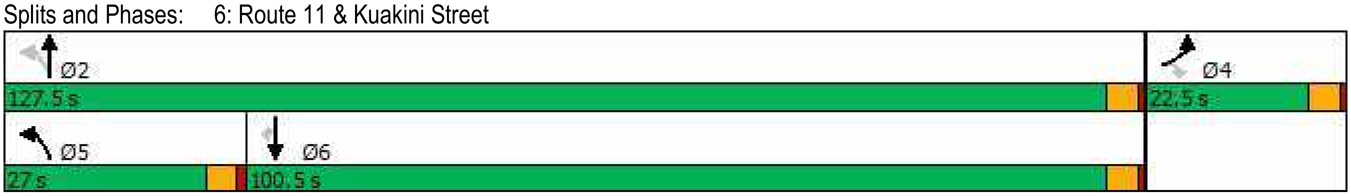
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBR	NBL	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	325	341	1155	1270
Future Volume (vph)	325	341	1155	1270
Turn Type	Perm	pm+pt	NA	NA
Protected Phases		5	2	6
Permitted Phases	4	2		
Detector Phase	4	5	2	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5
Total Split (s)	22.5	27.0	127.5	100.5
Total Split (%)	15.0%	18.0%	85.0%	67.0%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5
Lead/Lag		Lead		Lag
Lead-Lag Optimize?		Yes		Yes
Recall Mode	None	None	Max	Max
Act Effct Green (s)	12.5	123.1	123.1	96.1
Actuated g/C Ratio	0.09	0.85	0.85	0.66
v/c Ratio	0.87	1.06	0.75	1.05
Control Delay	37.7	112.7	9.1	63.8
Queue Delay	0.0	0.0	0.2	0.0
Total Delay	37.7	112.7	9.3	63.8
LOS	D	F	A	E
Approach Delay			32.9	63.8
Approach LOS			C	E

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 144.6	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 46.1	Intersection LOS: D
Intersection Capacity Utilization 94.5%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 6: Route 11 & Kuakini Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	341	1155	1270	0
Future Volume (veh/h)	0	325	341	1155	1270	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1870	1870	1856	1870	1811
Adj Flow Rate, veh/h	0	0	348	1179	1296	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	8	2	2	3	2	6
Cap, veh/h	1		400	1790	1665	
Arrive On Green	0.00	0.00	0.04	0.96	0.89	0.00
Sat Flow, veh/h	1697	1585	1781	1856	1870	1535
Grp Volume(v), veh/h	0	0	348	1179	1296	0
Grp Sat Flow(s),veh/h/ln	1697	1585	1781	1856	1870	1535
Q Serve(g_s), s	0.0	0.0	1.7	7.8	31.6	0.0
Cycle Q Clear(g_c), s	0.0	0.0	1.7	7.8	31.6	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	1		400	1790	1665	
V/C Ratio(X)	0.00		0.87	0.66	0.78	
Avail Cap(c_a), veh/h	240		644	1790	1665	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	20.4	0.2	2.5	0.0
Incr Delay (d2), s/veh	0.0	0.0	7.5	1.9	3.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	11.0	1.0	6.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.0	27.9	2.1	6.2	0.0
LnGrp LOS	A		C	A	A	
Approach Vol, veh/h	0	A		1527	1296	A
Approach Delay, s/veh	0.0			8.0	6.2	
Approach LOS				A	A	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		127.5		0.0	9.5	118.0
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		123.0		18.0	22.5	96.0
Max Q Clear Time (g_c+I1), s		9.8		0.0	3.7	33.6
Green Ext Time (p_c), s		18.8		0.0	1.0	23.2

Intersection Summary		
HCM 6th Ctrl Delay		7.2
HCM 6th LOS		A

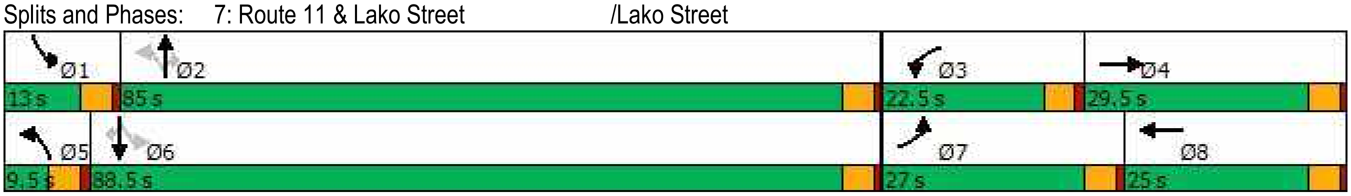
Notes

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Future Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	27.0	29.5	22.5	25.0	9.5	85.0	85.0	13.0	88.5	88.5
Total Split (%)	18.0%	19.7%	15.0%	16.7%	6.3%	56.7%	56.7%	8.7%	59.0%	59.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	22.5	30.0	13.0	20.5	85.5	80.5	80.5	92.7	85.9	85.9
Actuated g/C Ratio	0.15	0.20	0.09	0.14	0.57	0.54	0.54	0.62	0.57	0.57
v/c Ratio	1.14	0.33	0.60	1.16	0.28	1.14	0.07	1.22	0.90	0.16
Control Delay	152.1	38.0	81.2	136.8	16.8	106.9	2.1	177.4	41.9	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	152.1	38.0	81.2	136.8	16.8	106.9	2.1	177.4	41.9	6.5
LOS	F	D	F	F	B	F	A	F	D	A
Approach Delay		118.8		125.8		99.3			56.0	
Approach LOS		F		F		F			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 88.9	Intersection LOS: F
Intersection Capacity Utilization 116.9%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Future Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	297	265		116	76		245	1115		162	1173	
Arrive On Green	0.17	0.14	0.00	0.07	0.04	0.00	0.03	0.60	0.00	0.06	0.63	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	22.5	3.2	0.0	6.8	2.9	0.0	1.0	80.5	0.0	8.5	52.4	0.0
Cycle Q Clear(g_c), s	22.5	3.2	0.0	6.8	2.9	0.0	1.0	80.5	0.0	8.5	52.4	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	297	265		116	76		245	1115		162	1173	
V/C Ratio(X)	1.01	0.19		0.77	0.54		0.14	1.02		1.07	0.81	
Avail Cap(c_a), veh/h	297	346		236	284		263	1115		162	1173	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	56.2	51.1	0.0	62.1	63.5	0.0	18.7	27.2	0.0	47.4	18.8	0.0
Incr Delay (d2), s/veh	55.8	0.4	0.0	10.4	5.8	0.0	0.3	31.4	0.0	91.9	6.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.7	1.6	0.0	3.4	1.5	0.0	0.4	43.6	0.0	7.4	23.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	112.0	51.5	0.0	72.4	69.3	0.0	18.9	58.7	0.0	139.3	25.0	0.0
LnGrp LOS	F	D		E	E		B	F		F	C	
Approach Vol, veh/h		352	A		131	A		1170	A		1127	A
Approach Delay, s/veh		103.3			71.5			57.5			42.6	
Approach LOS		F			E			E			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.0	85.0	13.4	23.6	8.2	89.8	27.0	10.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.5	80.5	18.0	25.0	5.0	84.0	22.5	20.5
Max Q Clear Time (g_c+I1), s	10.5	82.5	8.8	5.2	3.0	54.4	24.5	4.9
Green Ext Time (p_c), s	0.0	0.0	0.1	0.2	0.0	9.2	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	57.9
HCM 6th LOS	E

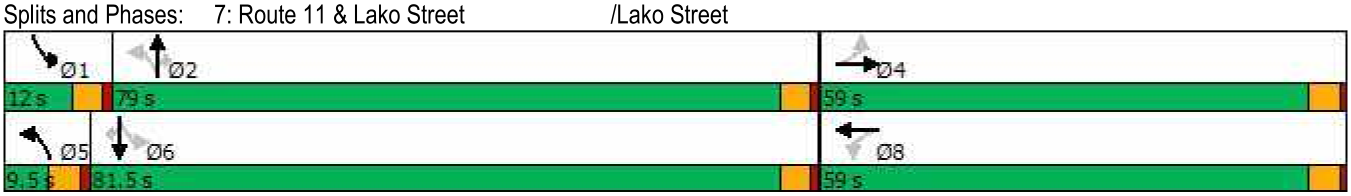
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Future Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	59.0	59.0	59.0	59.0	9.5	79.0	79.0	12.0	81.5	81.5
Total Split (%)	39.3%	39.3%	39.3%	39.3%	6.3%	52.7%	52.7%	8.0%	54.3%	54.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	54.5	54.5	54.5	54.5	79.5	74.5	74.5	84.9	78.9	78.9
Actuated g/C Ratio	0.36	0.36	0.36	0.36	0.53	0.50	0.50	0.57	0.53	0.53
v/c Ratio	1.30	0.19	0.21	0.56	0.32	1.23	0.08	1.33	0.98	0.18
Control Delay	200.6	19.0	34.6	29.2	22.0	145.9	7.7	218.7	60.2	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	200.6	19.0	34.6	29.2	22.0	145.9	7.7	218.7	60.2	9.0
LOS	F	B	C	C	C	F	A	F	E	A
Approach Delay		147.6		30.3		135.7			75.5	
Approach LOS		F		C		F			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.33	
Intersection Signal Delay: 100.3	Intersection LOS: F
Intersection Capacity Utilization 116.9%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



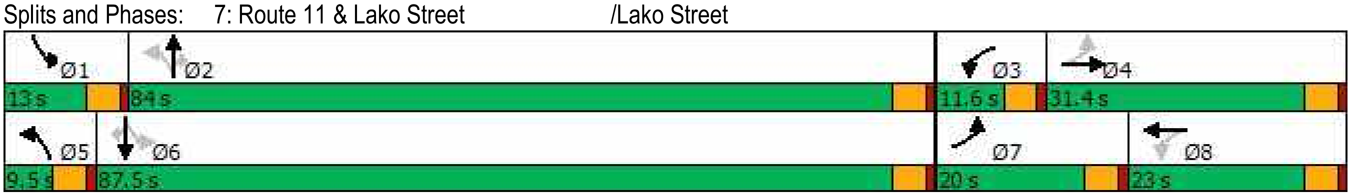
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Future Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	383	480		372	480		223	1085		157	1133	
Arrive On Green	0.26	0.26	0.00	0.26	0.26	0.00	0.03	0.58	0.00	0.06	0.61	0.00
Sat Flow, veh/h	1364	1870	0	1341	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Grp Sat Flow(s),veh/h/ln	1364	1870	0	1341	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	27.7	2.7	0.0	7.1	2.1	0.0	1.0	74.5	0.0	7.5	52.8	0.0
Cycle Q Clear(g_c), s	29.8	2.7	0.0	9.7	2.1	0.0	1.0	74.5	0.0	7.5	52.8	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	383	480		372	480		223	1085		157	1133	
V/C Ratio(X)	0.79	0.11		0.24	0.09		0.16	1.05		1.11	0.84	
Avail Cap(c_a), veh/h	612	793		597	793		243	1085		157	1133	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	47.6	36.5	0.0	40.2	36.3	0.0	20.0	27.0	0.0	43.0	20.0	0.0
Incr Delay (d2), s/veh	3.6	0.1	0.0	0.3	0.1	0.0	0.3	40.3	0.0	104.5	7.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.7	1.3	0.0	2.4	1.0	0.0	0.4	43.4	0.0	9.6	24.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	51.2	36.6	0.0	40.5	36.4	0.0	20.3	67.3	0.0	147.5	27.6	0.0
LnGrp LOS	D	D		D	D		C	F		F	C	
Approach Vol, veh/h		352	A		131	A		1170	A		1127	A
Approach Delay, s/veh		49.1			39.2			65.9			46.2	
Approach LOS		D			D			E			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.0	79.0		37.5	8.1	82.9		37.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.5	74.5		54.5	5.0	77.0		54.5				
Max Q Clear Time (g_c+I1), s	9.5	76.5		31.8	3.0	54.8		11.7				
Green Ext Time (p_c), s	0.0	0.0		1.2	0.0	8.2		0.5				
Intersection Summary												
HCM 6th Ctrl Delay			54.5									
HCM 6th LOS			D									
Notes												

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Future Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	20.0	31.4	11.6	23.0	9.5	84.0	84.0	13.0	87.5	87.5
Total Split (%)	14.3%	22.4%	8.3%	16.4%	6.8%	60.0%	60.0%	9.3%	62.5%	62.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	38.5	26.9	25.6	18.5	84.5	79.5	79.5	91.7	84.9	84.9
Actuated g/C Ratio	0.28	0.19	0.18	0.13	0.60	0.57	0.57	0.66	0.61	0.61
v/c Ratio	1.21	0.34	0.36	1.14	0.20	1.07	0.06	1.14	0.85	0.15
Control Delay	163.9	33.3	44.8	128.2	11.3	79.8	0.1	147.4	32.3	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	163.9	33.3	44.8	128.2	11.3	79.8	0.1	147.4	32.3	4.0
LOS	F	C	D	F	B	E	A	F	C	A
Approach Delay		125.8		111.7		74.0			44.5	
Approach LOS		F		F		E			D	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 140	
Natural Cycle: 140	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.21	
Intersection Signal Delay: 74.4	Intersection LOS: E
Intersection Capacity Utilization 116.9%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Future Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	0.99		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	303	204		213	80		290	1171		196	1234	
Arrive On Green	0.12	0.11	0.00	0.06	0.04	0.00	0.03	0.63	0.00	0.07	0.67	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1870	1560	1725	1856	1585
Q Serve(g_s), s	15.5	3.2	0.0	6.1	2.7	0.0	0.9	73.2	0.0	6.7	44.9	0.0
Cycle Q Clear(g_c), s	15.5	3.2	0.0	6.1	2.7	0.0	0.9	73.2	0.0	6.7	44.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	303	204		213	80		290	1171		196	1234	
V/C Ratio(X)	0.99	0.25		0.42	0.51		0.12	0.97		0.89	0.77	
Avail Cap(c_a), veh/h	303	396		213	273		310	1171		196	1234	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	52.4	51.8	0.0	54.3	59.4	0.0	14.4	22.6	0.0	39.3	14.6	0.0
Incr Delay (d2), s/veh	49.4	0.6	0.0	1.3	4.9	0.0	0.2	19.8	0.0	35.4	4.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	1.5	0.0	2.8	1.4	0.0	0.3	36.2	0.0	5.4	19.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	101.8	52.4	0.0	55.6	64.4	0.0	14.6	42.4	0.0	74.7	19.3	0.0
LnGrp LOS	F	D		E	E		B	D		E	B	
Approach Vol, veh/h		352	A		131	A		1170	A		1127	A
Approach Delay, s/veh		94.6			58.4			41.6			27.9	
Approach LOS		F			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.0	84.0	11.6	18.4	8.0	89.0	20.0	10.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.5	79.5	7.1	26.9	5.0	83.0	15.5	18.5
Max Q Clear Time (g_c+I1), s	8.7	75.2	8.1	5.2	2.9	46.9	17.5	4.7
Green Ext Time (p_c), s	0.0	3.1	0.0	0.2	0.0	9.7	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	43.5
HCM 6th LOS	D

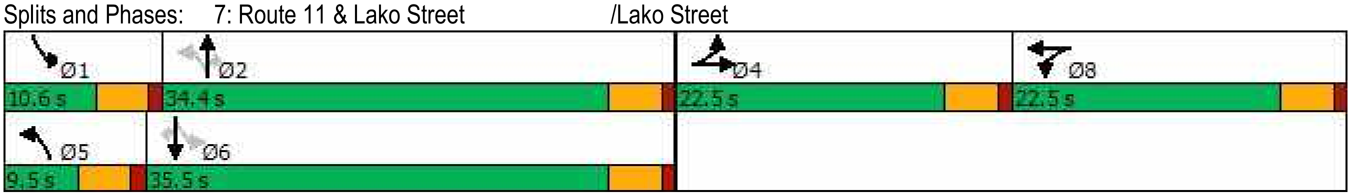
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Future Volume (vph)	283	48	85	39	33	1067	55	164	896	146
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	34.4	34.4	10.6	35.5	35.5
Total Split (%)	25.0%	25.0%	25.0%	25.0%	10.6%	38.2%	38.2%	11.8%	39.4%	39.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	17.1	17.1	15.5	15.5	35.0	30.0	30.0	38.7	35.1	35.1
Actuated g/C Ratio	0.20	0.20	0.18	0.18	0.40	0.35	0.35	0.45	0.40	0.40
v/c Ratio	0.86	0.32	0.29	0.88	0.16	0.93	0.10	0.89	0.67	0.21
Control Delay	59.5	17.0	33.4	43.1	15.8	42.7	0.3	62.2	26.0	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.5	17.0	33.4	43.1	15.8	42.7	0.3	62.2	26.0	4.5
LOS	E	B	C	D	B	D	A	E	C	A
Approach Delay		47.1		41.1		39.9			28.3	
Approach LOS		D		D		D			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 86.8	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 36.6	Intersection LOS: D
Intersection Capacity Utilization 90.2%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Future Volume (veh/h)	283	48	69	85	39	305	33	1067	55	164	896	146
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1870	1870	1870	1870	1841	1811	1856	1870
Adj Flow Rate, veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	4	6	3	2
Cap, veh/h	351	368		136	144		303	1431		296	1584	
Arrive On Green	0.20	0.20	0.00	0.08	0.08	0.00	0.03	0.40	0.00	0.08	0.45	0.00
Sat Flow, veh/h	1781	1870	0	1767	1870	0	1781	3554	1560	1725	3526	1585
Grp Volume(v), veh/h	301	51	0	90	41	0	35	1135	0	174	953	0
Grp Sat Flow(s),veh/h/ln	1781	1870	0	1767	1870	0	1781	1777	1560	1725	1763	1585
Q Serve(g_s), s	12.1	1.7	0.0	3.7	1.5	0.0	0.8	20.8	0.0	4.2	15.1	0.0
Cycle Q Clear(g_c), s	12.1	1.7	0.0	3.7	1.5	0.0	0.8	20.8	0.0	4.2	15.1	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	351	368		136	144		303	1431		296	1584	
V/C Ratio(X)	0.86	0.14		0.66	0.29		0.12	0.79		0.59	0.60	
Avail Cap(c_a), veh/h	432	453		428	453		361	1431		298	1584	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	28.8	24.6	0.0	33.3	32.3	0.0	13.0	19.5	0.0	15.3	15.4	0.0
Incr Delay (d2), s/veh	13.5	0.2	0.0	5.4	1.1	0.0	0.2	4.6	0.0	3.0	1.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.3	0.7	0.0	1.7	0.7	0.0	0.3	8.8	0.0	1.7	5.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.3	24.8	0.0	38.8	33.4	0.0	13.1	24.0	0.0	18.3	17.1	0.0
LnGrp LOS	D	C		D	C		B	C		B	B	
Approach Vol, veh/h		352	A		131	A		1170	A		1127	A
Approach Delay, s/veh		39.8			37.1			23.7			17.3	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.5	34.4		19.1	7.1	37.9		10.2				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.1	29.9		18.0	5.0	31.0		18.0				
Max Q Clear Time (g_c+I1), s	6.2	22.8		14.1	2.8	17.1		5.7				
Green Ext Time (p_c), s	0.0	4.3		0.5	0.0	5.7		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			23.8
HCM 6th LOS			C

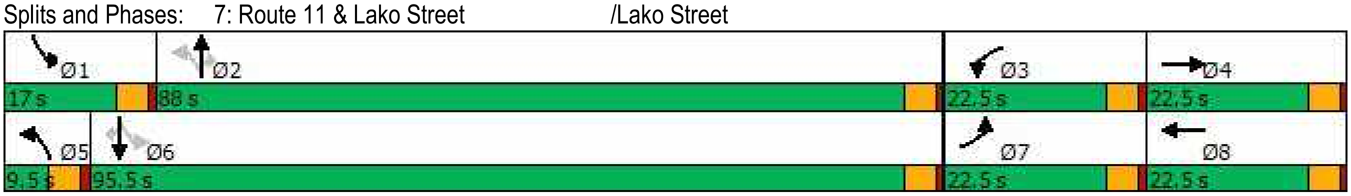
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Future Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	88.0	88.0	17.0	95.5	95.5
Total Split (%)	15.0%	15.0%	15.0%	15.0%	6.3%	58.7%	58.7%	11.3%	63.7%	63.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	16.5	23.5	11.3	15.9	88.6	83.6	83.6	100.7	93.2	93.2
Actuated g/C Ratio	0.11	0.16	0.08	0.11	0.60	0.57	0.57	0.69	0.64	0.64
v/c Ratio	0.81	0.26	0.53	0.92	0.36	1.06	0.07	1.06	1.03	0.19
Control Delay	93.5	31.1	79.3	62.0	20.0	75.4	0.5	119.5	61.9	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	93.5	31.1	79.3	62.0	20.0	75.4	0.5	119.5	61.9	6.1
LOS	F	C	E	E	B	E	A	F	E	A
Approach Delay		72.3		65.5		69.5			62.5	
Approach LOS		E		E		E			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 146.5	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 66.0	Intersection LOS: E
Intersection Capacity Utilization 107.2%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Future Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	184	164		99	70		156	1222		237	1293	
Arrive On Green	0.10	0.09	0.00	0.06	0.04	0.00	0.03	0.66	0.00	0.06	0.69	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	11.7	2.0	0.0	5.2	3.0	0.0	0.9	67.2	0.0	5.8	76.3	0.0
Cycle Q Clear(g_c), s	11.7	2.0	0.0	5.2	3.0	0.0	0.9	67.2	0.0	5.8	76.3	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	184	164		99	70		156	1222		237	1293	
V/C Ratio(X)	0.86	0.19		0.73	0.60		0.25	0.91		0.89	0.94	
Avail Cap(c_a), veh/h	240	256		244	250		172	1222		297	1293	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	58.0	55.7	0.0	61.2	62.3	0.0	28.1	19.1	0.0	34.0	18.1	0.0
Incr Delay (d2), s/veh	20.8	0.6	0.0	9.6	8.0	0.0	0.8	11.6	0.0	22.3	14.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	1.0	0.0	2.6	1.5	0.0	0.8	30.6	0.0	6.0	34.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	78.8	56.3	0.0	70.8	70.3	0.0	28.9	30.7	0.0	56.3	32.8	0.0
LnGrp LOS	E	E		E	E		C	C		E	C	
Approach Vol, veh/h		189	A		114	A		1151	A		1430	A
Approach Delay, s/veh		75.1			70.6			30.6			36.3	
Approach LOS		E			E			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.5	91.3	11.8	16.0	8.3	95.5	18.3	9.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	12.5	83.5	18.0	18.0	5.0	91.0	18.0	18.0
Max Q Clear Time (g_c+I1), s	7.8	69.2	7.2	4.0	2.9	78.3	13.7	5.0
Green Ext Time (p_c), s	0.2	8.0	0.1	0.1	0.0	8.4	0.2	0.1

Intersection Summary		
HCM 6th Ctrl Delay		37.9
HCM 6th LOS		D

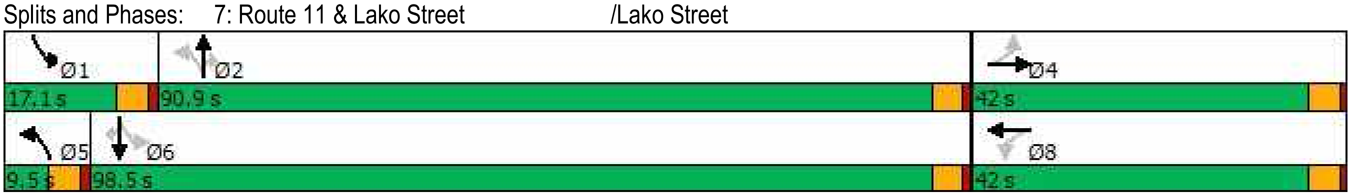
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Future Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	42.0	42.0	42.0	42.0	9.5	90.9	90.9	17.1	98.5	98.5
Total Split (%)	28.0%	28.0%	28.0%	28.0%	6.3%	60.6%	60.6%	11.4%	65.7%	65.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	37.5	37.5	37.5	37.5	91.4	86.4	86.4	103.5	95.9	95.9
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.61	0.58	0.58	0.69	0.64	0.64
v/c Ratio	1.07	0.18	0.23	0.55	0.36	1.05	0.07	1.07	1.02	0.19
Control Delay	145.3	20.4	47.0	23.4	20.1	72.5	2.4	125.6	60.0	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	145.3	20.4	47.0	23.4	20.1	72.5	2.4	125.6	60.0	5.2
LOS	F	C	D	C	C	E	A	F	E	A
Approach Delay		103.0		28.2		66.9			61.8	
Approach LOS		F		C		E			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.07	
Intersection Signal Delay: 63.0	Intersection LOS: E
Intersection Capacity Utilization 107.2%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Future Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	236	289		248	282		186	1283		261	1335	
Arrive On Green	0.15	0.15	0.00	0.15	0.15	0.00	0.03	0.69	0.00	0.05	0.71	0.00
Sat Flow, veh/h	1343	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Grp Sat Flow(s),veh/h/ln	1343	1870	0	1378	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	15.2	1.9	0.0	6.2	2.6	0.0	0.8	60.8	0.0	4.5	70.6	0.0
Cycle Q Clear(g_c), s	17.8	1.9	0.0	8.1	2.6	0.0	0.8	60.8	0.0	4.5	70.6	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	236	289		248	282		186	1283		261	1335	
V/C Ratio(X)	0.67	0.11		0.29	0.15		0.21	0.87		0.80	0.91	
Avail Cap(c_a), veh/h	411	533		428	520		202	1283		339	1335	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	55.9	47.8	0.0	51.3	48.2	0.0	24.3	15.7	0.0	28.3	15.5	0.0
Incr Delay (d2), s/veh	3.3	0.2	0.0	0.6	0.2	0.0	0.6	8.1	0.0	10.2	11.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	0.9	0.0	2.2	1.2	0.0	0.7	26.2	0.0	5.5	30.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.1	48.0	0.0	52.0	48.4	0.0	24.8	23.7	0.0	38.5	26.6	0.0
LnGrp LOS	E	D		D	D		C	C		D	C	
Approach Vol, veh/h		189	A		114	A		1151	A		1430	A
Approach Delay, s/veh		57.3			50.7			23.8			28.3	
Approach LOS		E			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.3	95.5		24.9	8.3	98.5		24.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	12.6	86.4		37.5	5.0	94.0		37.5				
Max Q Clear Time (g_c+I1), s	6.5	62.8		19.8	2.8	72.6		10.1				
Green Ext Time (p_c), s	0.3	10.9		0.5	0.0	12.1		0.4				

Intersection Summary			
HCM 6th Ctrl Delay			29.3
HCM 6th LOS			C

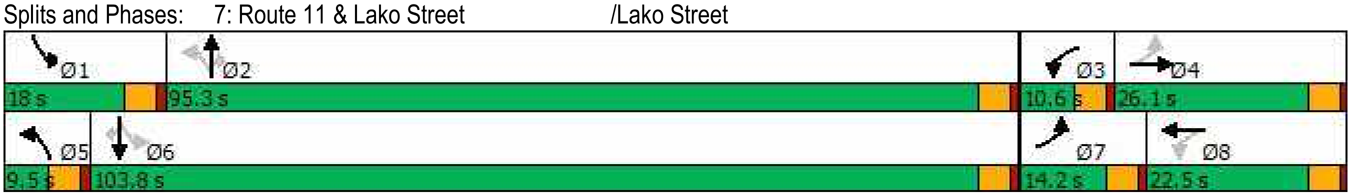
Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Future Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	14.2	26.1	10.6	22.5	9.5	95.3	95.3	18.0	103.8	103.8
Total Split (%)	9.5%	17.4%	7.1%	15.0%	6.3%	63.5%	63.5%	12.0%	69.2%	69.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	29.2	19.5	22.0	15.9	95.8	90.8	90.8	108.9	101.3	101.3
Actuated g/C Ratio	0.20	0.13	0.15	0.11	0.65	0.61	0.61	0.74	0.68	0.68
v/c Ratio	0.97	0.31	0.34	0.92	0.36	0.98	0.07	1.00	0.96	0.18
Control Delay	115.9	31.6	54.4	62.5	19.7	51.5	0.5	107.5	39.9	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	115.9	31.6	54.4	62.5	19.7	51.5	0.5	107.5	39.9	3.8
LOS	F	C	D	E	B	D	A	F	D	A
Approach Delay		87.3		60.8		47.6			44.2	
Approach LOS		F		E		D			D	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 148	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 50.2	Intersection LOS: D
Intersection Capacity Utilization 107.2%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Future Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	198	120		185	69		205	1316		278	1366	
Arrive On Green	0.07	0.06	0.00	0.04	0.04	0.00	0.03	0.71	0.00	0.05	0.73	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1856	1585	1767	1870	1585
Q Serve(g_s), s	9.7	2.1	0.0	5.3	3.1	0.0	0.8	59.2	0.0	4.4	68.9	0.0
Cycle Q Clear(g_c), s	9.7	2.1	0.0	5.3	3.1	0.0	0.8	59.2	0.0	4.4	68.9	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	198	120		185	69		205	1316		278	1366	
V/C Ratio(X)	0.80	0.26		0.39	0.61		0.19	0.85		0.76	0.89	
Avail Cap(c_a), veh/h	198	297		185	242		219	1316		366	1366	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	59.1	60.5	0.0	59.6	64.4	0.0	22.3	14.4	0.0	26.6	14.2	0.0
Incr Delay (d2), s/veh	19.8	1.1	0.0	1.3	8.3	0.0	0.4	6.8	0.0	6.3	9.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	1.1	0.0	2.5	1.6	0.0	0.7	25.0	0.0	5.4	29.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	78.9	61.7	0.0	61.0	72.7	0.0	22.8	21.2	0.0	32.9	23.5	0.0
LnGrp LOS	E	E		E	E		C	C		C	C	
Approach Vol, veh/h		189	A		114	A		1151	A		1430	A
Approach Delay, s/veh		76.1			65.3			21.2			24.9	
Approach LOS		E			E			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.2	100.9	10.6	13.3	8.4	103.8	14.2	9.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	13.5	90.8	6.1	21.6	5.0	99.3	9.7	18.0
Max Q Clear Time (g_c+I1), s	6.4	61.2	7.3	4.1	2.8	70.9	11.7	5.1
Green Ext Time (p_c), s	0.3	12.2	0.0	0.1	0.0	14.3	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	28.4
HCM 6th LOS	C

Notes

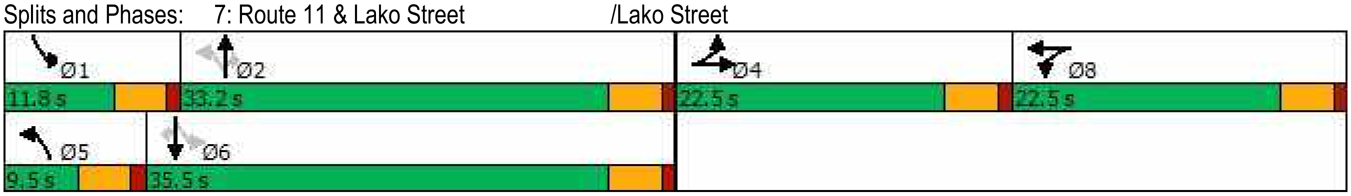
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Future Volume (vph)	152	30	69	40	37	1068	64	202	1171	190
Turn Type	Split	NA	Split	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	4	8	8	5	2		1	6	
Permitted Phases					2		2	6		6
Detector Phase	4	4	8	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	9.5	33.2	33.2	11.8	35.5	35.5
Total Split (%)	25.0%	25.0%	25.0%	25.0%	10.6%	36.9%	36.9%	13.1%	39.4%	39.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effct Green (s)	12.1	12.1	9.7	9.7	34.0	29.0	29.0	39.7	35.5	35.5
Actuated g/C Ratio	0.16	0.16	0.13	0.13	0.45	0.38	0.38	0.52	0.46	0.46
v/c Ratio	0.57	0.26	0.32	0.69	0.19	0.84	0.10	0.82	0.74	0.24
Control Delay	39.1	16.7	34.6	16.6	13.6	30.4	0.7	43.6	23.8	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.1	16.7	34.6	16.6	13.6	30.4	0.7	43.6	23.8	3.9
LOS	D	B	C	B	B	C	A	D	C	A
Approach Delay		31.5		20.2		28.3			23.9	
Approach LOS		C		C		C			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 76.4
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 25.6 Intersection LOS: C
Intersection Capacity Utilization 80.6% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 7: Route 11 & Lako Street /Lako Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Future Volume (veh/h)	152	30	48	69	40	232	37	1068	64	202	1171	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1870	1870	1870	1826	1826	1856	1856	1870	1856	1870	1870
Adj Flow Rate, veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	2	2	2	5	5	3	3	2	3	2	2
Cap, veh/h	211	225		120	123		285	1563		366	1761	
Arrive On Green	0.12	0.12	0.00	0.07	0.07	0.00	0.04	0.44	0.00	0.09	0.50	0.00
Sat Flow, veh/h	1753	1870	0	1781	1826	0	1767	3526	1585	1767	3554	1585
Grp Volume(v), veh/h	158	31	0	72	42	0	39	1112	0	210	1220	0
Grp Sat Flow(s),veh/h/ln	1753	1870	0	1781	1826	0	1767	1763	1585	1767	1777	1585
Q Serve(g_s), s	5.6	1.0	0.0	2.5	1.4	0.0	0.8	16.6	0.0	3.9	17.1	0.0
Cycle Q Clear(g_c), s	5.6	1.0	0.0	2.5	1.4	0.0	0.8	16.6	0.0	3.9	17.1	0.0
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	211	225		120	123		285	1563		366	1761	
V/C Ratio(X)	0.75	0.14		0.60	0.34		0.14	0.71		0.57	0.69	
Avail Cap(c_a), veh/h	488	520		495	508		353	1563		405	1761	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.5	25.5	0.0	29.3	28.8	0.0	10.5	14.6	0.0	11.6	12.5	0.0
Incr Delay (d2), s/veh	5.3	0.3	0.0	4.8	1.6	0.0	0.2	2.8	0.0	1.6	2.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.4	0.0	1.2	0.7	0.0	0.3	6.4	0.0	1.4	6.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.8	25.8	0.0	34.1	30.4	0.0	10.7	17.4	0.0	13.2	14.8	0.0
LnGrp LOS	C	C		C	C		B	B		B	B	
Approach Vol, veh/h		189	A		114	A		1151	A		1430	A
Approach Delay, s/veh		31.7			32.7			17.2			14.6	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.4	33.2		12.3	7.0	36.6		8.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	7.3	28.7		18.0	5.0	31.0		18.0				
Max Q Clear Time (g_c+I1), s	5.9	18.6		7.6	2.8	19.1		4.5				
Green Ext Time (p_c), s	0.1	5.5		0.4	0.0	6.7		0.3				

Intersection Summary			
HCM 6th Ctrl Delay			17.5
HCM 6th LOS			B

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Arterial Level of Service: NB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	63.2	106.9	170.1	0.53	11.1	E
Puapuaanui St	III	30	107.5	30.2	137.7	0.90	23.4	C
Total	III		170.7	137.1	307.8	1.42	16.6	D

Arterial Level of Service: SB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.3	23.5	117.8	0.79	24.0	B
Lako Street	III	30	107.5	41.9	149.4	0.90	21.6	C
Total	III		201.8	65.4	267.2	1.68	22.7	C

Arterial Level of Service: NB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lako Street	III	30	63.2	75.4	138.6	0.53	13.7	E
Puapuaanui St	III	30	107.5	22.6	130.1	0.90	24.8	B
Total	III		170.7	98.0	268.7	1.42	19.1	C

Arterial Level of Service: SB Route 11

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Puapuaanui St	III	30	94.2	43.8	138.0	0.79	20.5	C
Lako Street	III	30	107.5	61.9	169.4	0.90	19.0	C
Total	III		201.7	105.7	307.4	1.68	19.7	C