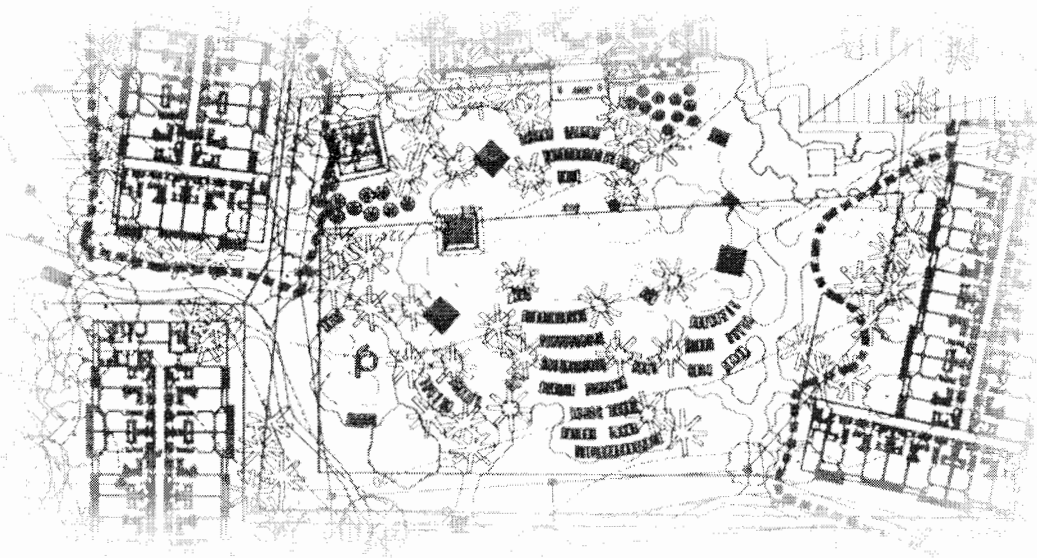


Traffic Impact Report

Princeville Lot 25



Prepared for:
SVO Pacific, Inc.

Prepared by:
Wilson Okamoto Corporation

March 2005

TRAFFIC IMPACT REPORT

for the proposed

Princeville Lot 25 Project

Prepared for:

SVO Pacific, Inc.
8801 Vistana Centre Drive, Suite 140
Orlando, Florida 32821-6350

Prepared by:

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March 2005

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I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to identify and assess the traffic impacts resulting from the proposed Princeville Lot 25 project. The project includes the development of an approximately 18.517-acre parcel located at the end of Wyllie Road in Princeville on the Island of Kauai. The development will include timeshare and hotel units, and support facilities.

B. Scope of Study

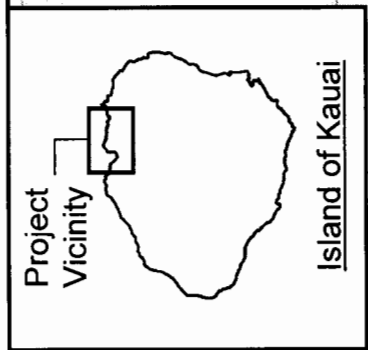
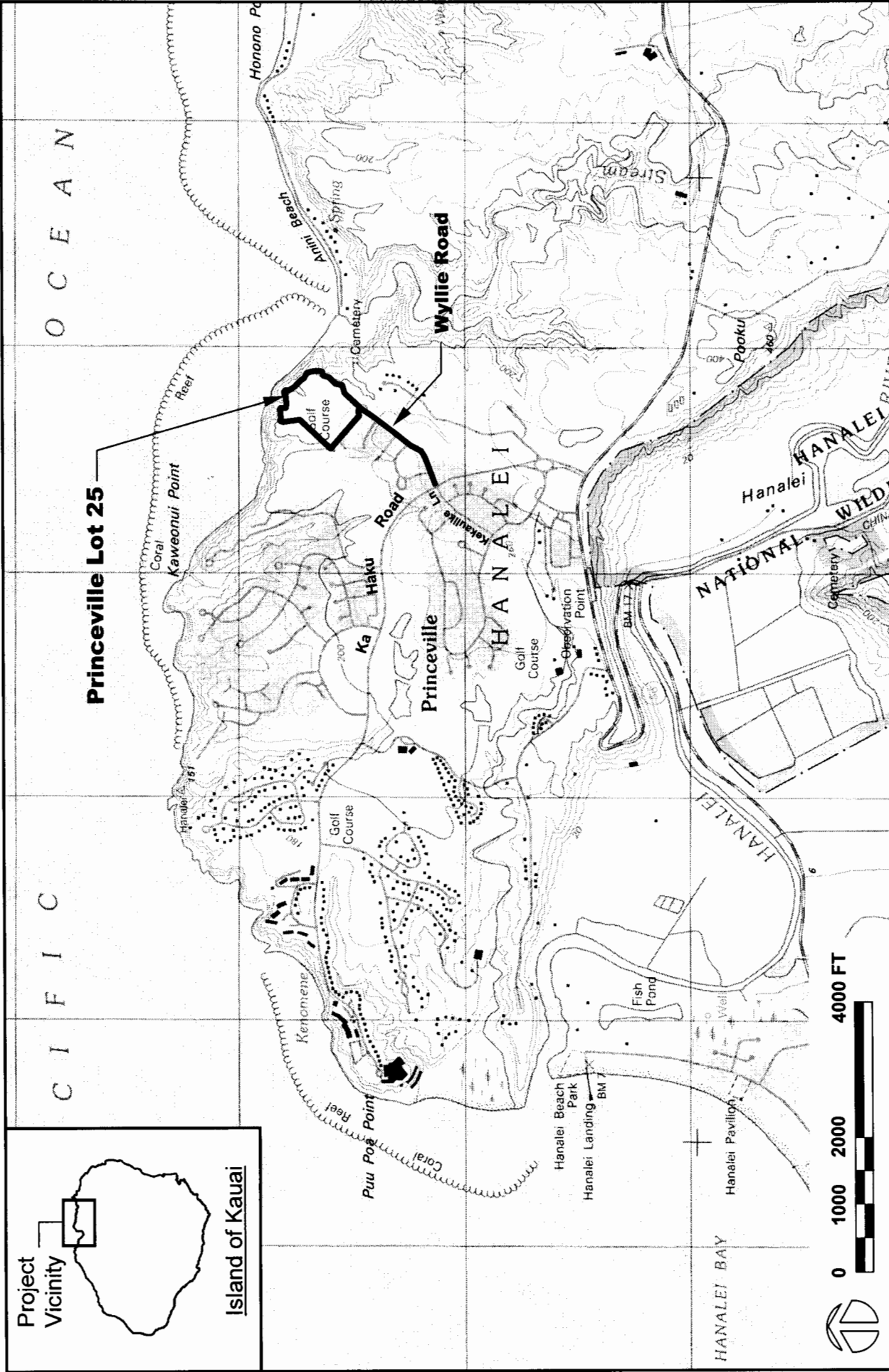
This report presents the findings and conclusions of the traffic study, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. Analysis of future roadway and traffic conditions without the proposed project.
4. Analysis and development of trip generation characteristics for the proposed project.
5. Superimposition of proposed project-generated traffic over future traffic conditions.
6. Identification and analysis of traffic impacts resulting from the proposed project.
7. Formulation of recommendations for improvements, if appropriate, to mitigate traffic impacts resulting from the proposed project.

II. PROJECT DESCRIPTION

A. Location

The project site is located in Princeville on the island of Kauai (see Figure 1). The 18.517-acre site is further identified as a consolidation of Tax Map Keys (TMK) (4) 5-4-05: 19, 20, and 21. Primary access to the proposed project will be via a driveway connection on Wyllie Road (Tax Map Key: 5-4-05: 09).



PROPOSED LOT 25 IN PRINCEVILLE

LOCATION AND VICINITY MAP

FIGURE 1

WILSON OKAMOTO CORPORATION
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B. Project Characteristics

The proposed Princeville Lot 25 project entails the development of the following:

- Two-bedroom timeshare units with separate entrances for each bedroom (approximately 179 units)
- Hotel Rooms (approximately 6 rooms)
- Clubhouse (approximately 25,920 square feet)
- Restaurant (Marketessen open to the public and seats approximately 90 people)

For the purpose of this study, the traffic impacts identified in the study only reflect trips associated with the condominium and hotel units, and the restaurant. The project also includes residential amenities, the creation of open spaces, and landscaping. A split-level parking structure with up to 296 parking stalls and a surface parking lot to accommodate an additional 211 parking stalls will be provided for visitors, guests, and employees. In addition, 10 parking stalls will be provided along the Wyllie Road cul-de-sac for public parking. Access to the project would be via a new driveway off of Wyllie Road. Completion and occupancy of the proposed Princeville Lot 25 project is expected by the Year 2010. Figure 2 shows the conceptual project site plan.

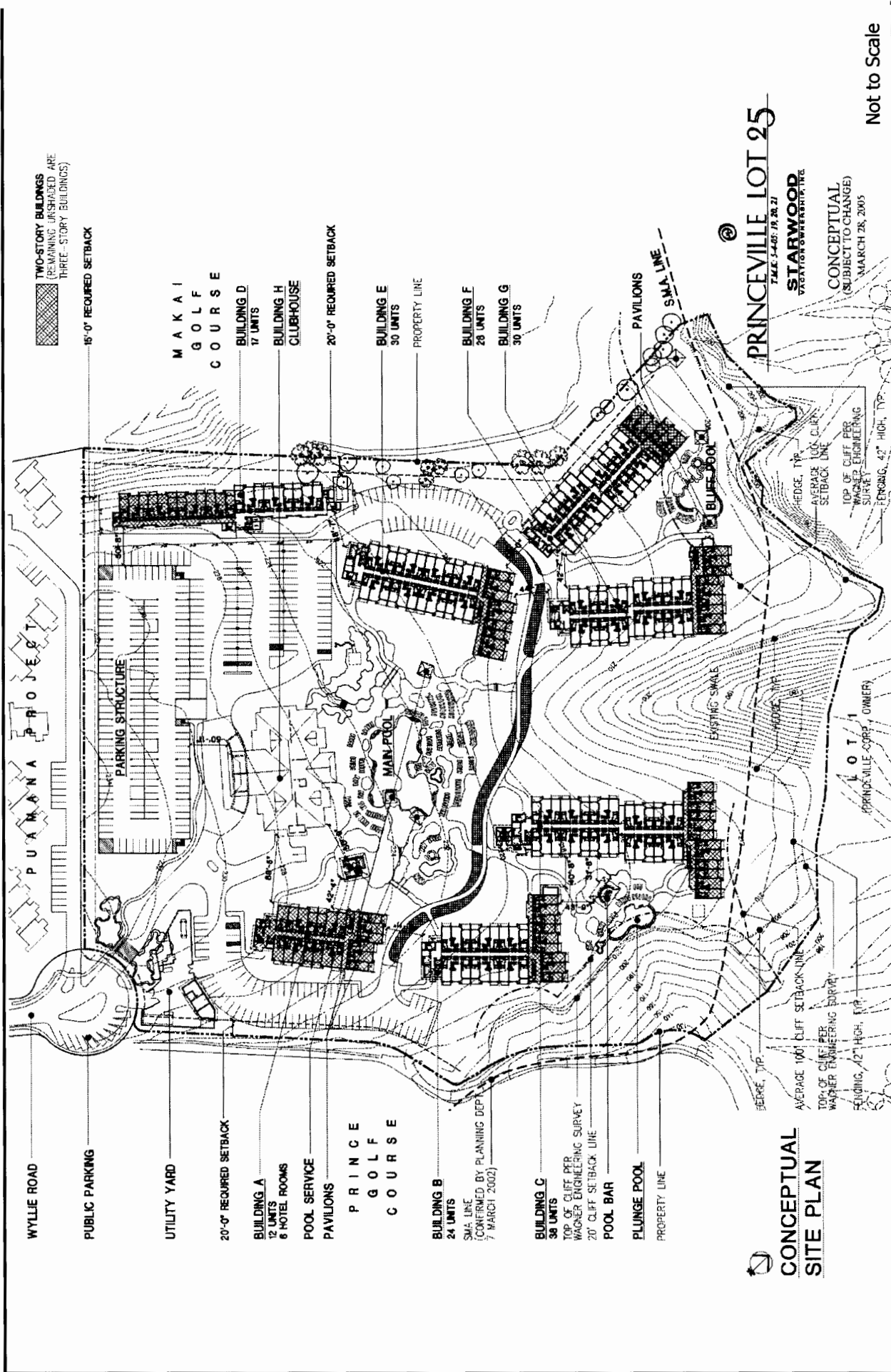
III. EXISTING TRAFFIC CONDITIONS

A. General

At the southeast corner of the project site, Wyllie Road serves as the main access for the existing timeshare and condominium properties along its length. The roadway continues southwest from the project site for approximately 2,115 feet where it intersects with Kekaulike Lane and Ka Haku Road. Kekaulike Lane is a local roadway approximately 1,305 feet in length that provides access to the adjacent residential areas. Ka Haku Road serves as the main collector roadway through the Princeville area between Kuhio Highway and the Princeville Hotel.

B. Area Roadway System

Wyllie Road is a two-lane, two-way private roadway with a posted speed limit of 25 mph that begins at the southeast corner of the project site and terminates at the



TWO-STORY BUILDINGS
(REMAINING UNSHADED ARE
THREE-STORY BUILDINGS)

15'-0" REQUIRED SETBACK

M A K A I
G O L F
C O U R S E

BUILDING D
17 UNITS

BUILDING H
CLUBHOUSE

20'-0" REQUIRED SETBACK

BUILDING E
30 UNITS

PROPERTY LINE

BUILDING F
28 UNITS

BUILDING G
30 UNITS

PAVILIONS

S.M.A. LINE

PRINCEVILLE LOT 25

TABLE 1-4-05/19.20.21
STARWOOD
VACATION OWNERSHIP, LLC

CONCEPTUAL
(SUBJECT TO CHANGE)
MARCH 28, 2005

Not to Scale

WYLLIE ROAD

PUBLIC PARKING

UTILITY YARD

20'-0" REQUIRED SETBACK

BUILDING A
12 UNITS
& HOTEL ROOMS

POOL SERVICE
PAVILIONS

P R I N C E
G O L F
C O U R S E

BUILDING B
24 UNITS

S.M.A. LINE
(CONFIRMED BY PLANNING DEPT
7 MARCH 2002)

BUILDING C
36 UNITS

TOP OF CLIFF PER
WAGNER ENGINEERING SURVEY

20' CLIFF SETBACK LINE

POOL BAR

PLUNGE POOL

PROPERTY LINE

CONCEPTUAL
SITE PLAN

FEEDER TIP

AVERAGE 100' CLIFF SETBACK LINE

TOP OF CLIFF PER
WAGNER ENGINEERING SURVEY

FEEDING, 42' HIGH, TYP.

FEEDER TIP

AVERAGE 100' CLIFF
SETBACK LINE

TOP OF CLIFF PER
WAGNER ENGINEERING
SURVEY

FEEDING, 42' HIGH, TYP.



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PROPOSED LOT 25 IN PRINCEVILLE

PROPOSED CONCEPTUAL SITE PLAN

FIGURE
2

intersection with Kekaulike Lane and Ka Haku Road. At this unsignalized intersection, Wyllie Road has one lane that serves left-turn, through, and right-turn traffic movements. Kekaulike Lane and Ka Haku Road are predominantly two-lane, two-way private roadways with posted speed limits of 25 mph. At the intersection with Wyllie Road, the Kekaulike Lane approach and both approaches of Ka Haku Road have one lane that serves left-turn, through, and right-turn traffic movements.

C. Traffic Volumes and Conditions

1. General

a. Field Investigation

A field investigation was conducted on September 12 - 13, 2002 and consisted of manual turning movement count surveys between the morning peak hours of 7:00 AM and 9:00 AM, and the afternoon peak hours of 4:00 PM and 6:00 PM at the intersection of Ka Haku Road, Kekaulike Lane, and Wyllie Road. Appendix A includes the existing traffic count data.

b. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the “Highway Capacity Manual”, Transportation Research Board, 2000, and the “Highway Capacity Software”, developed by the Federal Highway Administration. The analysis is based on the concept of Level of Service (LOS).

LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS “A” through “F”; LOS “A” representing ideal or free-flow traffic operating conditions and LOS “F” unacceptable or potentially congested traffic operating conditions. The LOS definitions are included in Appendix B.

“Volume-to-Capacity” (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio less than one (1.00) indicates that the projected traffic demand is less than the road’s carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at or near capacity. A v/c ratio of greater

than 1.00 indicates that the projected traffic demand exceeds the road's carrying capacity.

2. Existing Peak Hour Traffic

a. General

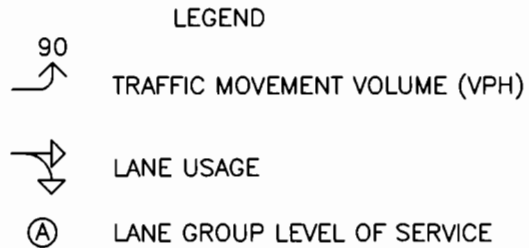
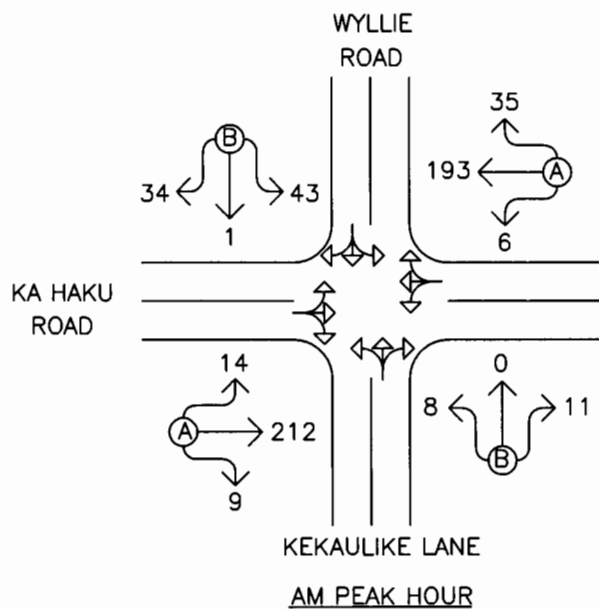
Figure 3 shows the existing AM and PM peak hour traffic volumes and operating traffic conditions at the study intersection of Ka Haku Road, Wyllie Road, and Kekaulike Lane. The AM peak hour of traffic generally occurs between 7:00 AM and 8:00 AM in the vicinity of the proposed timeshare development. In the afternoon, the PM peak hour of traffic generally occurs between the hours of 4:00 PM and 5:00 PM. The analysis is based on these peak hour time periods to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.

b. AM Peak Hour

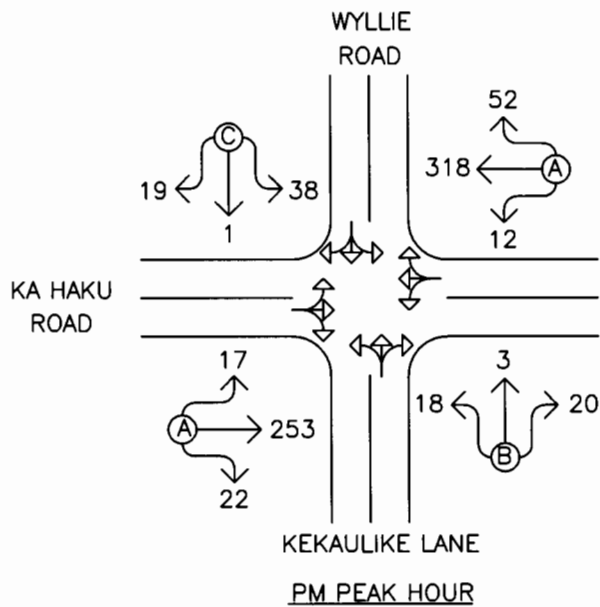
At the intersection of Ka Haku Road, Wyllie Road, and Kekaulike Lane during the AM peak hour of traffic, Ka Haku Road carries 469 vehicles, 234 vehicles westbound and 235 vehicles eastbound. Wyllie Road carries 78 vehicles southbound Kekaulike Lane carries 19 vehicles northbound. The critical movements of this intersection are the northbound and southbound left-turn, through, and right-turn traffic movements. These traffic movements operate well at LOS "B" during the AM peak hour. The ability of vehicles on the northbound and southbound approaches to traverse the intersection is dependent on the available gaps in the traffic stream on Ka Haku Road.

c. PM Peak Hour

At the intersection of Ka Haku Road, Wyllie Road, and Kekaulike Lane during the PM peak hour of traffic, Ka Haku Road carries 674 vehicles, 382 vehicles westbound and 292 vehicles eastbound. Wyllie Road carries 58 vehicles southbound and Kekaulike Lane carries 41 vehicles northbound. The northbound and



DATE OF COUNT: SEPTEMBER 12-13, 2002



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PROPOSED LOT 25 IN PRINCEVILLE

EXISTING AM AND PM PEAK HOUR
TRAFFIC CONDITIONS

FIGURE
3

southbound critical movements at this intersection operate adequately at LOS “B” and LOS “C,” respectively, during the PM peak hour.

IV. PROJECTED TRAFFIC CONDITIONS

A. Site-Generated Traffic

1. Trip Generation Methodology

The trip generation methodology used in this study is based upon generally accepted techniques and procedures developed by the Institute of Transportation Engineers (ITE) and published in “Trip Generation, 7th Edition,” 2003. The ITE trip rates are developed empirically by correlating the trip generation data with various land use characteristics, such as the number of dwelling units or square footage of development. Table 1 summarizes the project site trip generation characteristics applied to the AM and PM peak hours of traffic to measure the impact resulting from the proposed project.

Table 1: Peak Hour Trip Generation

RECREATIONAL HOMES		
Independent Variable: 179 Units w/ Dual Entry = 358 Dwelling Units		
	PROJECTED TRIP ENDS	
AM PEAK	ENTER	38
	EXIT	19
	TOTAL	57
PM PEAK	ENTER	38
	EXIT	55
	TOTAL	93
HOTEL		
Independent Variable: 6 Rooms		
	PROJECTED TRIP ENDS	
AM PEAK	ENTER	1
	EXIT	0
	TOTAL	1
PM PEAK	ENTER	2
	EXIT	2
	TOTAL	4

Table 1: Peak Hour Trip Generation (Cont'd)

RESTAURANT		
Independent Variable: Seats 90 People		
	PROJECTED TRIP ENDS	
AM PEAK	ENTER	22
	EXIT	20
	TOTAL	42
PM PEAK	ENTER	22
	EXIT	16
	TOTAL	38
COMBINED TRIPS		
	PROJECTED TRIP ENDS	
AM PEAK	ENTER	61
	EXIT	39
	TOTAL	100
PM PEAK	ENTER	62
	EXIT	73
	TOTAL	135

2. Trip Distribution

The directional distribution and traffic assignment of the site-generated trips were based upon the directional distribution of traffic headed north and south on Wyllie Road fronting the project site. For the purpose of this study, it is assumed that the directional distribution of traffic generated by the proposed project would remain the same as existing at the Ka Haku Road, Wyllie Road, and Kekaulike Lane intersection. Although traffic volumes are expected to increase, the distribution of traffic should remain similar to existing conditions.

B. Through Traffic Forecasting Methodology

Typically, travel forecasts are developed based upon historical traffic count data obtained from State Department of Transportation (SDOT), Highways Division survey stations. However, since the SDOT traffic survey data along Ka Haku Road and Kuhio Highway is limited and the available data along Ka Haku Road indicates decreasing traffic volumes, use of the SDOT data is inappropriate to derive a

reasonable level of accuracy or certainty in the traffic forecast. As such, the travel forecast developed for this study assumes the existing traffic volumes on Ka Haku Road will increase at a conservative rate of 2.0% per year to Year 2010, using 2002 as the base year. Therefore, a growth factor of 1.17 was applied to the existing traffic movements on Ka Haku Road to achieve the projected Year 2010 traffic demands.

C. Other Considerations

There are a number of projects currently being developed in the Princeville area that may influence traffic conditions along Ka Haku Road. These projects include:

- Expansion of the Bali Hai Villas along Pepelani Loop. Phase 2 of which includes 30 additional timeshare units to be completed by the Year 2005 and Phase 3 of which includes 125 additional timeshare units to be completed by the Year 2010.
- A new condominium project along Pepelani Loop adjacent to the Bali Hai Villas that includes a maximum of 150 condominium units to be completed by the Year 2010.
- The Plantations at Princeville along Pepelani Loop that includes 68 condominiums to be completed by the Year 2005.
- Villas at Kamalii along Lei O Papa Road that includes 59 condominium units to be completed by the Year 2003.

The trip generation characteristics of these projects is described in the “Traffic Assessment Report for Pepelani Loop” dated February 2003. The trips generated by these projects were assigned to the street network in the area to account for the trips generated by these projects.

In addition, there have been concerns raised by the community regarding anticipated travel patterns in the project vicinity. The Princeville at Hanalei Community Association maintains that site-generated vehicles may utilize Kekaulike Lane to “cut-through” adjacent residential neighborhoods to access the Princeville Shopping Center. In order to address their concerns, several mitigative measures along Kekaulike Lane and Emmalani Drive could be used to discourage motorists from utilizing these roadways to access the shopping center. One measure would be to install traffic signs indicating that there is no access to the shopping center along

the route. Another measure would be to install traffic calming measures such as chicanes, splitter islands, refuge islands, additional speed humps/tables, curb radius reductions, speed reduction signage, and lane narrowing along the route to provide a disincentive to speeding thereby reducing “cut-through” traffic while still providing access to residents in the immediate vicinity. Traffic calming measures also have additional benefits to the surrounding neighborhood in that slower vehicular speeds create a safer environment for pedestrian traffic and provide an opportunity to increase landscaping along the roadway, thereby aesthetically enhancing the neighborhood feel of the community.

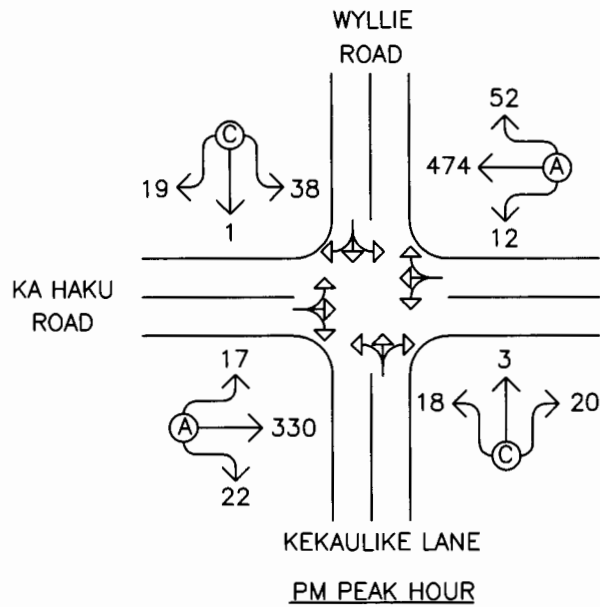
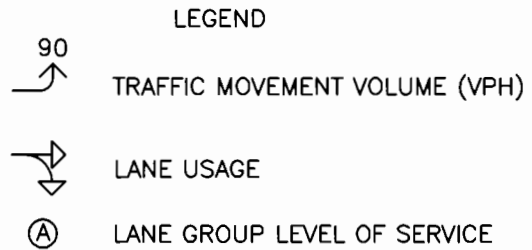
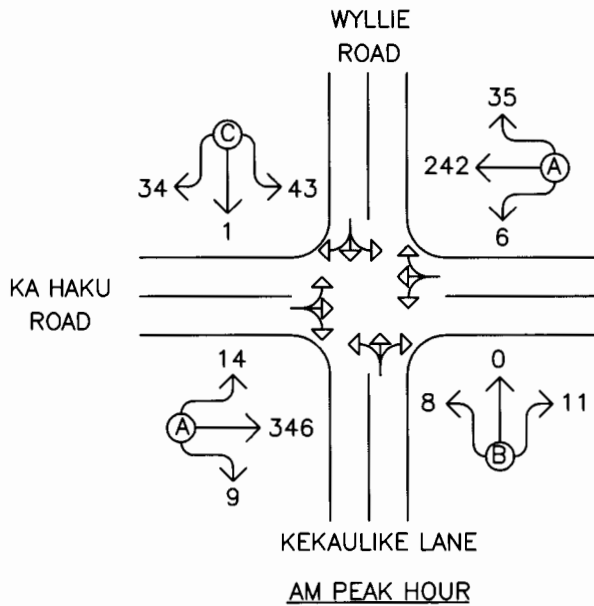
D. Total Traffic Volumes Without Project

Figure 4 shows the Year 2010 projected AM peak hour and PM peak hour traffic volumes and operating conditions within the project vicinity without the development of the proposed Princeville Lot 25 project. The existing and projected (without project) levels of service are included in Table 2 for comparison.

Table 2: Existing and Projected (Without Project) LOS Traffic Operating Conditions

Intersection	Traffic Movement	AM		PM	
		Existing	Year 2010 w/out Project	Existing	Year 2010 w/out Project
Ka Haku Road, Wyllie Road, and Kekaulike Lane	Northbound (LT, TH, RT)	B	B	B	C
	Southbound (LT, TH, RT)	B	C	C	C

Traffic operations under Year 2010 without project conditions are, in general, expected to deteriorate slightly due to the expected increases in traffic along Ka Haku Road. The southbound left-turn, through, and right-turn traffic movement is anticipated to deteriorate from LOS “B” to LOS “C” during the AM peak period. Similarly, the northbound left-turn, through, and right-turn traffic movement is anticipated to deteriorate from LOS “B” to LOS “C” during the PM peak period.



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PROPOSED LOT 25 IN PRINCEVILLE

YEAR 2010 AM AND PM PEAK HOUR
TRAFFIC CONDITIONS WITHOUT PROJECT

FIGURE
4

E. Total Traffic Volumes With Project

Figure 5 shows the cumulative Year 2010 AM and PM peak hour traffic conditions resulting from the projected external traffic and the development of the proposed Princeville Lot 25 project. The cumulative volumes consist of site-generated traffic superimposed over Year 2010 projected traffic demands. For the purpose of this study, the intersection of Ka Haku Road, Wyllie Road, and Kekaulike Lane is assumed to have been modified to provide an exclusive left-turn lane along Wyllie Road to accommodate the increase in traffic on this approach of the intersection. The traffic impacts resulting from the proposed project are addressed in the following section.

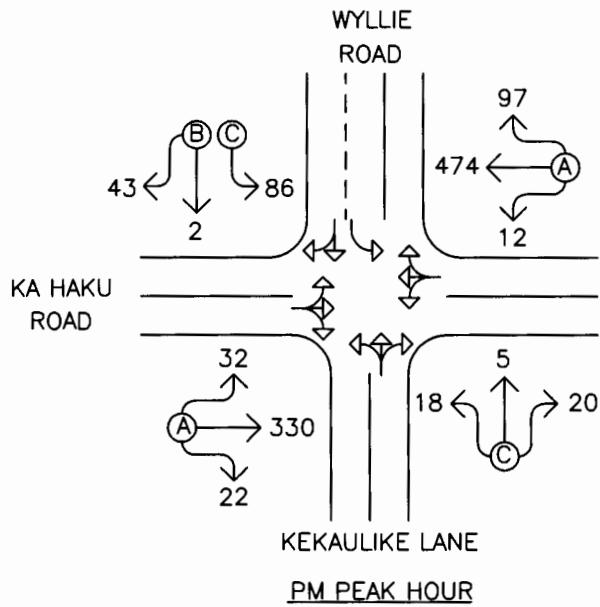
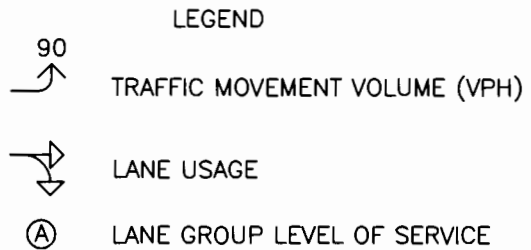
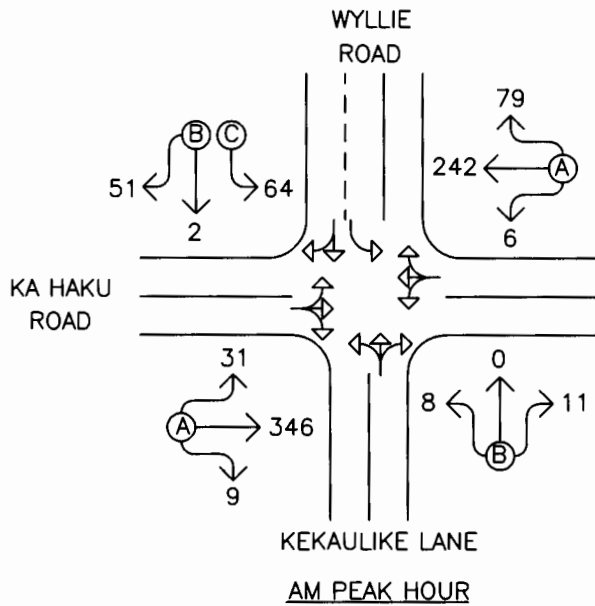
V. TRAFFIC IMPACT ANALYSIS

The Year 2010 cumulative AM and PM peak hour traffic conditions with the proposed project are summarized in Table 3. The existing and projected Year 2010 operating conditions without the proposed project are provided for comparison.

Table 3: Existing and Projected (With and Without Project) LOS Traffic Operating Conditions

Intersection	Traffic Movement	AM			PM		
		Existing	Year 2010 w/out Project	Year 2010 w/ Project	Existing	Year 2010 w/out Project	Year 2010 w/ Project
Ka Haku Road, Wyllie Road, and Kekaulike Lane	Northbound (LT, TH, RT)	B	B	B	B	C	C
	Southbound (LT)	B	C	C	C	C	C
	Southbound (TH & RT)			B			B

Traffic operations at the intersection of Ka Haku Road, Wyllie Road, and Kekaulike Lane are expected to remain similar to Year 2010 without project conditions during the AM and PM peak hours despite the increase in traffic due to site-generated vehicles from the proposed project due to the provision of an exclusive left-turn lane along the Wyllie Road approach. The northbound left-turn, through, and right-turn traffic movement is anticipated to remain at LOS “B” and LOS “C” during the AM and PM peak periods, respectively. The



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PROPOSED LOT 25 IN PRINCEVILLE

YEAR 2010 AM AND PM PEAK HOUR
TRAFFIC CONDITIONS WITH PROJECT

FIGURE
5

southbound left-turn traffic movement is anticipated to operate at LOS “C” during both peak periods while the southbound through and right-turn traffic movements is anticipated to operate at LOS “B” during both peak periods.

VI. RECOMMENDATIONS

Based on the analysis of traffic impacts attributable by the proposed project, the following recommendations should be incorporated in the project design:

1. Maintain sufficient sight distances for motorists to safely enter and exit the project access driveways and intersections.
2. Provide adequate on-site loading and off-loading service areas and prohibit off-site loading operations.
3. Provide sufficient driveway width and storage to accommodate safe vehicle ingress and egress.
4. Provide sufficient turning radius for the traffic circle on Wyllie Road at the project driveway.
5. Provide an exclusive left-turn lane on the Wyllie Road approach (southbound approach) of the Ka Haku Road, Wyllie Road, and Kekaulike Lane intersection.
6. Consider installing traffic signs along Kekaulike Lane and Emmalani Drive indicating that there is no access to the shopping center along the route and/or implementing traffic calming measures such as chicanes, splitter islands, refuge islands, speed humps/tables, curb radius reductions, speed reduction signage, and lane narrowing along this route to reduce “cut-through” traffic in adjacent residential neighborhoods. The details regarding these improvements should be determined during the design phase of the project.

VII. CONCLUSION

By implementing the above recommendations, the proposed project should not have a significant impact on traffic operations in the vicinity of the project site. Based on field observations of current traffic operations, the intersection of Wyllie Road, Kekaulike Lane, and Ka Haku Road operates well, with maximum queues of approximately seven and five vehicles occurring on Wyllie Road during the morning and afternoon peak hours, respectively. However, there are sufficient gaps in the through traffic stream on Ka Haku Road to allow these vehicles to clear the intersection. In addition, the assumptions used in this traffic study were conservative regarding growth in external traffic unrelated to the

proposed project. Even with the conservative projected traffic forecasts and traffic generation superimposed over projected AM and PM peak periods, the project is not expected to significantly impact traffic operations within the vicinity.

APPENDIX A
EXISTING TRAFFIC COUNT DATA

Wilson Okamoto & Associates, Inc.
 1907 S. Beretania St., Suite 400
 Honolulu, HI 96826

Counter: D1-0527/D1-0769
 Counted By: PP/IQ
 Weather: CLEAR
 Other:

File Name : kahwylp
 Site Code : 00000001
 Start Date : 09/12/2002
 Page No : 1

Groups Printed- 1 - Unshifted

Start Time	Wyllie Road Southbound					Ka Haku Street Westbound					Wyllie Road Northbound					Ka Haku Street Eastbound						
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total	
	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0			
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0
04:00 PM	3	1	6	0	10	11	67	2	0	80	6	0	6	0	12	9	65	1	0	75	177	
04:15 PM	7	0	12	0	19	12	90	2	0	104	6	1	3	0	10	3	59	5	0	67	200	
04:30 PM	3	0	7	0	10	9	85	3	0	97	5	1	4	0	10	6	68	4	0	78	195	
04:45 PM	6	0	13	0	19	20	76	5	0	101	3	1	5	0	9	4	61	7	0	72	201	
Total	19	1	38	0	58	52	318	12	0	382	20	3	18	0	41	22	253	17	0	292	773	
05:00 PM	6	1	9	0	16	20	62	3	0	85	1	2	0	0	3	5	60	7	0	72	176	
05:15 PM	9	1	16	0	26	9	67	2	0	78	2	2	8	0	12	4	48	3	0	55	171	
05:30 PM	6	2	11	0	19	5	65	0	0	70	2	0	2	0	4	5	31	2	0	38	131	
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	21	4	36	0	61	34	194	5	0	233	5	4	10	0	19	14	139	12	0	165	478	
Grand Total	40	5	74	0	119	86	512	17	0	615	25	7	28	0	60	36	392	29	0	457	1251	
Approch %	33.6	4.2	62.2	0.0		14.0	83.3	2.8	0.0		41.7	11.7	46.7	0.0		7.9	85.8	6.3	0.0			
Total %	3.2	0.4	5.9	0.0	9.5	6.9	40.9	1.4	0.0	49.2	2.0	0.6	2.2	0.0	4.8	2.9	31.3	2.3	0.0	36.5		

Start Time	Wyllie Road Southbound					Ka Haku Street Westbound					Wyllie Road Northbound					Ka Haku Street Eastbound						
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total	
	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0			
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																						
Intersection	19	1	38	0	58	52	318	12	0	382	20	3	18	0	41	22	253	17	0	292	773	
Volume	32.8	1.7	65.5	0.0		13.6	83.2	3.1	0.0		48.8	7.3	43.9	0.0		7.5	86.6	5.8	0.0			
Percent	6	0	13	0	19	20	76	5	0	101	3	1	5	0	9	4	61	7	0	72	201	
04:45 Volume	6	0	13	0	19	20	76	5	0	101	3	1	5	0	9	4	61	7	0	72	201	
Peak Factor					0.763					0.918					0.854					0.936	0.961	
High Int.	04:15 PM					04:15 PM					04:00 PM					04:30 PM						
Volume	7	0	12	0	19	12	90	2	0	104	6	0	6	0	12	6	68	4	0	78	78	
Peak Factor					0.763					0.918					0.854					0.936		
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																						
By Approach	27	4	49	0	80	61	313	13	0	387	20	3	18	0	41	22	253	17	0	292	773	
Volume	33.8	5.0	61.2	0.0		15.8	80.9	3.4	0.0		48.8	7.3	43.9	0.0		7.5	86.6	5.8	0.0			
Percent	9	1	16	0	26	12	90	2	0	104	6	0	6	0	12	6	68	4	0	78	78	
High Int.	05:15 PM					04:15 PM					04:00 PM					04:30 PM						
Volume	9	1	16	0	26	12	90	2	0	104	6	0	6	0	12	6	68	4	0	78	78	
Peak Factor					0.769					0.930					0.854					0.936		

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS) criteria are given in Table 1. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in the queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. If the degree of saturation is greater than about 0.9, average control delay is significantly affected by the length of the analysis period.

Table 1: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

APPENDIX C

**CAPACITY ANALYSIS CALCULATIONS
EXISTING PEAK HOUR TRAFFIC ANALYSIS**

TWO-WAY STOP CONTROL SUMMARY

Analyst: CL
 Agency/Co.: Wilson Okamoto Corporation
 Date Performed: 09/22/04
 Analysis Time Period: AM Peak
 Intersection: Wyllie Road/Ka Haku Street
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year: Existing
 Project ID: Princeville
 East/West Street: Ka Haku Street
 North/South Street: Wyllie Road
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound				Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R	
Volume		14	212	9	6	193	35	
Peak-Hour Factor, PHF		0.86	0.86	0.86	0.83	0.83	0.83	
Hourly Flow Rate, HFR		16	246	10	7	232	42	
Percent Heavy Vehicles		2	--	--	2	--	--	
Median Type/Storage		Undivided				/		
RT Channelized?								
Lanes		0	1	0		0	1	0
Configuration		LTR				LTR		
Upstream Signal?		No				No		

Minor Street:	Approach Movement	Northbound				Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R	
Volume		8	0	11	43	1	34	
Peak Hour Factor, PHF		0.65	0.65	0.65	0.85	0.85	0.85	
Hourly Flow Rate, HFR		12	0	16	50	1	39	
Percent Heavy Vehicles		2	2	2	2	2	2	
Percent Grade (%)		0				0		
Flared Approach: Exists?/Storage		No			/	No /		
Lanes		0	1	0		0	1	0
Configuration		LTR				LTR		

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound			Southbound		
			4	7	8	9	10	11
Lane Config	LTR	LTR		LTR		LTR		
v (vph)	16	7		28		90		
C(m) (vph)	1289	1309		559		530		
v/c	0.01	0.01		0.05		0.17		
95% queue length	0.04	0.02		0.16		0.61		
Control Delay	7.8	7.8		11.8		13.2		
LOS	A	A		B		B		
Approach Delay				11.8		13.2		
Approach LOS				B		B		

TWO-WAY STOP CONTROL SUMMARY

Analyst: CL
 Agency/Co.: Wilson Okamoto Corporation
 Date Performed: 09/22/04
 Analysis Time Period: PM Peak
 Intersection: Wyllie Road/Ka Haku Street
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year: Existing
 Project ID: Princeville
 East/West Street: Ka Haku Street
 North/South Street: Wyllie Road
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R		4 L	5 T	6 R
Volume	17	253	22		12	318	52
Peak-Hour Factor, PHF	0.94	0.94	0.94		0.92	0.92	0.92
Hourly Flow Rate, HFR	18	269	23		13	345	56
Percent Heavy Vehicles	2	--	--		2	--	--
Median Type/Storage	Undivided				/		
RT Channelized?							
Lanes	0	1	0		0	1	0
Configuration	LTR				LTR		
Upstream Signal?	No				No		

Minor Street: Approach Movement	Northbound				Southbound		
	7 L	8 T	9 R		10 L	11 T	12 R
Volume	18	3	20		38	1	19
Peak Hour Factor, PHF	0.85	0.85	0.85		0.76	0.76	0.76
Hourly Flow Rate, HFR	21	3	23		50	1	25
Percent Heavy Vehicles	2	2	2		2	2	2
Percent Grade (%)	0				0		
Flared Approach: Exists?/Storage	No				No		
Lanes	0	1	0		0	1	0
Configuration	LTR				LTR		

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound		
	1 LTR	4 LTR	7 	8 LTR	9 	10 	11 LTR	12
v (vph)	18	13		47			76	
C(m) (vph)	1158	1270		446			385	
v/c	0.02	0.01		0.11			0.20	
95% queue length	0.05	0.03		0.35			0.73	
Control Delay	8.2	7.9		14.0			16.6	
LOS	A	A		B			C	
Approach Delay				14.0				16.6
Approach LOS				B				C

APPENDIX D

**CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2010 PEAK HOUR TRAFFIC
ANALYSIS WITHOUT PROJECT**

TWO-WAY STOP CONTROL SUMMARY

Analyst: CL
 Agency/Co.: Wilson Okamoto Corporation
 Date Performed: 09/22/04
 Analysis Time Period: AM Peak
 Intersection: Wyllie Road/Ka Haku Street
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year: Year 2010 w/out project
 Project ID: Princeville
 East/West Street: Ka Haku Street
 North/South Street: Wyllie Road
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R	4 	5 L	6 T	7 R
Volume	14	346	9	6	242	35	
Peak-Hour Factor, PHF	0.86	0.86	0.86	0.83	0.83	0.83	
Hourly Flow Rate, HFR	16	402	10	7	291	42	
Percent Heavy Vehicles	2	--	--	2	--	--	
Median Type/Storage	Undivided				/		
RT Channelized?							
Lanes	0	1	0		0	1	0
Configuration	LTR				LTR		
Upstream Signal?	No				No		

Minor Street: Approach Movement	Northbound				Southbound		
	7 L	8 T	9 R	10 	11 L	12 T	13 R
Volume	8	0	11	43	1	34	
Peak Hour Factor, PHF	0.65	0.65	0.65	0.85	0.85	0.85	
Hourly Flow Rate, HFR	12	0	16	50	1	39	
Percent Heavy Vehicles	2	2	2	2	2	2	
Percent Grade (%)	0				0		
Flared Approach: Exists?/Storage				No	/	No /	
Lanes	0	1	0		0	1	0
Configuration	LTR				LTR		

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound			Southbound		
	1	4 7	8	9	10	11	12	
Lane Config	LTR	LTR	LTR		LTR	LTR		
v (vph)	16	7	28			90		
C(m) (vph)	1226	1147	420			405		
v/c	0.01	0.01	0.07			0.22		
95% queue length	0.04	0.02	0.21			0.85		
Control Delay	8.0	8.2	14.2			16.4		
LOS	A	A	B			C		
Approach Delay			14.2			16.4		
Approach LOS			B			C		

TWO-WAY STOP CONTROL SUMMARY

Analyst: CL
 Agency/Co.: Wilson Okamoto Corporation
 Date Performed: 09/22/04
 Analysis Time Period: PM Peak
 Intersection: Wyllie Road/Ka Haku Street
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year: Year 2010 w/out project
 Project ID: Princeville
 East/West Street: Ka Haku Street
 North/South Street: Wyllie Road
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments							
Major Street:	Approach	Eastbound			Westbound		
	Movement	1	2	3	4	5	6
		L	T	R	L	T	R
Volume		17	330	22	12	474	52
Peak-Hour Factor, PHF		0.94	0.94	0.94	0.92	0.92	0.92
Hourly Flow Rate, HFR		18	351	23	13	515	56
Percent Heavy Vehicles		2	--	--	2	--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	1	0	0	1	0
Configuration		LTR			LTR		
Upstream Signal?		No			No		

Minor Street:	Approach	Northbound			Southbound		
	Movement	7	8	9	10	11	12
		L	T	R	L	T	R
Volume		18	3	20	38	1	19
Peak Hour Factor, PHF		0.85	0.85	0.85	0.76	0.76	0.76
Hourly Flow Rate, HFR		21	3	23	50	1	25
Percent Heavy Vehicles		2	2	2	2	2	2
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage		No			/	No /	
Lanes		0	1	0	0	1	0
Configuration		LTR			LTR		

Delay, Queue Length, and Level of Service								
Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR			LTR	
v (vph)	18	13		47			76	
C(m) (vph)	1002	1184		322			266	
v/c	0.02	0.01		0.15			0.29	
95% queue length	0.05	0.03		0.51			1.19	
Control Delay	8.7	8.1		18.1			23.9	
LOS	A	A		C			C	
Approach Delay				18.1			23.9	
Approach LOS				C			C	

APPENDIX E

**CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2010 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT**

TWO-WAY STOP CONTROL SUMMARY

Analyst: CL
 Agency/Co.: Wilson Okamoto Corporation
 Date Performed: 09/22/04
 Analysis Time Period: AM Peak
 Intersection: Wyllie Road/Ka Haku Street
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year: Year 2010 w/ project
 Project ID: Princeville
 East/West Street: Ka Haku Street
 North/South Street: Wyllie Road
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound				Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R	
Volume		31	346	9	6	242	79	
Peak-Hour Factor, PHF		0.86	0.86	0.86	0.83	0.83	0.83	
Hourly Flow Rate, HFR		36	402	10	7	291	95	
Percent Heavy Vehicles		2	--	--	2	--	--	
Median Type/Storage		Undivided				/		
RT Channelized?								
Lanes		0	1	0		0	1	0
Configuration		LTR			LTR			
Upstream Signal?		No			No			

Minor Street:	Approach Movement	Northbound				Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R	
Volume		8	0	11	64	2	53	
Peak Hour Factor, PHF		0.65	0.65	0.65	0.85	0.85	0.85	
Hourly Flow Rate, HFR		12	0	16	75	2	62	
Percent Heavy Vehicles		2	2	2	2	2	2	
Percent Grade (%)		0				0		
Flared Approach: Exists?/Storage				No	/		No	/
Lanes		0	1	0		1	1	0
Configuration		LTR			L TR			

Delay, Queue Length, and Level of Service

Approach Movement	EB 1	WB 4	Northbound			Southbound		
			7	8	9	10	11	12
Lane Config	LTR	LTR		LTR		L	TR	
v (vph)	36	7		28		75	64	
C(m) (vph)	1172	1147		405		426	674	
v/c	0.03	0.01		0.07		0.18	0.09	
95% queue length	0.10	0.02		0.22		0.64	0.31	
Control Delay	8.2	8.2		14.5		15.3	10.9	
LOS	A	A		B		C	B	
Approach Delay				14.5			13.3	
Approach LOS				B			B	

TWO-WAY STOP CONTROL SUMMARY

Analyst: CL
 Agency/Co.: Wilson Okamoto Corporation
 Date Performed: 09/22/04
 Analysis Time Period: PM Peak
 Intersection: Wyllie Road/Ka Haku Street
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year: Year 2010 w/ project
 Project ID: Princeville
 East/West Street: Ka Haku Street
 North/South Street: Wyllie Road
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound			Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		32	330	22	12	474	97
Peak-Hour Factor, PHF		0.94	0.94	0.94	0.92	0.92	0.92
Hourly Flow Rate, HFR		34	351	23	13	515	105
Percent Heavy Vehicles		2	--	--	2	--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	1	0	0	1	0
Configuration		LTR			LTR		
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		18	5	20	86	2	43
Peak Hour Factor, PHF		0.85	0.85	0.85	0.95	0.95	0.95
Hourly Flow Rate, HFR		21	5	23	90	2	45
Percent Heavy Vehicles		2	2	2	2	2	2
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage		No			/		
Lanes		0	1	0	1	1	0
Configuration		LTR			L	TR	

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound			Southbound		
	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR		L		TR
v (vph)	34	13		49		90		47
C(m) (vph)	960	1184		306		311		493
v/c	0.04	0.01		0.16		0.29		0.10
95% queue length	0.11	0.03		0.57		1.21		0.32
Control Delay	8.9	8.1		19.0		21.3		13.1
LOS	A	A		C		C		B
Approach Delay				19.0			18.5	
Approach LOS				C			C	