APPENDICES

A. Waikoloa Water Master Plan, Tom Nance Water Resources Engineering, 1991.

B. A Survey of Botanical, Avian and Terrestrial Mammalian Species for the Waikoloa Highlands Subdivision, Rana Productions, Ltd. and AECOS Consultants, May 2006.

C. Social Impact Assessment, SMS Research, September 2006.

D. Market Study, Economic Impact Analysis and Public Cost/Benefits Assessment, The Hallstrom Group, Inc., May 2006.

E. Evaluation of Archaeological Potential at a 702.28-acre Parcel at Waikoloa, South Kohala District, Hawai‘i Island, Cultural Surveys Hawai‘i, April 2006

F. Cultural Impact Assessment, Cultural Surveys Hawai‘i, September 2006.

G. Traffic Impact Analysis Report, Julian Ng, Incorporated, July 2005.

H. Flood Plain Limits and Flood Control Plan for the Waikoloa Highlands Subdivision, R.M. Towill Corporation, September 2006.

I. Drainage Report for the Waikoloa Highlands Subdivision, Phase 1, R.M. Towill Corporation, September 2006.

J. Waikoloa Highlands Water Distribution System, Waikoloa Highlands Subdivision, R.M. Towill Corporation, September 2006.

K. Highlands Golf Estate Landscape Irrigation Water Study, Hawai‘i Design Associates, Inc., August 2005

L. Water Supply for the Highlands Estates at Waikoloa, Hawai‘i, November 2006 (Revised 2007).

M. Comments and Responses – EIS Preparation Notice

N. Comments and Responses – Draft EIS

O. Correspondence from County of Hawai‘i, Planning Department, February 8, 2007, relating to Amendment to Change of Zone Ordinance 05-157.

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APPENDIX A

Waikoloa Water Master Plan
Tom Nance Water Resources Engineering, 1991.

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Waikoloa Water Master Plans

Source Development Plan
Village Distribution System Plan
Beach Resort Distribution System Plan

Prepared by
Tom Nance Water Resources Engineering

Prepared for
Waikoloa Development Co.
HCO2 Box 5050
Waikoloa, Hawaii 96743

February 1991

Source Development Plan

I. Scope and Objectives

A. Identify required potable and brackish well development to supply the projected build-out of the Village and Resort.

B. Recommend a well development program for these wells.

C. Identify and evaluate potential regulatory constraints which may adversely affect the well development program.

D. Two other water master plans are also currently being prepared for Waikoloa:

1. The Village Distribution system master plan recommends tank and pipeline construction to accommodate planned development in the Village and Highlands.

2. The Resort master plan presents recommendations to complete the potable distribution system in the Resort and substantially expand its non-potable irrigation system.

II. Projected Potable and Brackish Supply Requirements

A. Potable Supply

1. Waikoloa's Development Model (September 1990 version), hereafter referred to as the Development Model, has been used to define average water use requirements. At present level of development, that requirement is approximately three million gallons per day (MGD). By the year 2005, it is projected to be more than 11 MGD. It should be noted that these figures do not include an amount for the Unplanned Reserve between the Village and Resort. It is estimated that its requirements could ultimately be as high as five to six MGD.

2. Average water use is translated into well pumping capacity by adding 12 percent for unaccounted losses and multiplying this sum by a 1.25 maximum day factor. (The basis for these factors is presented in the Village Distribution System master plan.) To this resulting required pumping capacity must be added standby supply. The standby well is defined as the largest one in the system. In other words, the required well pumping capacity must be met without counting the largest well pump in the system.

3. Table 1 summarizes these results. Upon completion of the outfitting of Waikoloa Well No. 2 (WW No. 2), the 1990 potable supply requirement will have been met. Using the growth assumptions in the Development Model, this supply capability must be doubled by 1995 and almost tripled to meet the 2005 requirement.

4. Storage tanks are located within the system in near proximity to supply wells and to meet distribution requirements. Table 2 is a tabulation of storage requirements by service area within the system. Upon completion of the 1.0 million gallon (MG) tank next to WW No. 2, the 1990 storage requirement will have been met. However, new storage construction should be initiated within the coming year. The most appropriate sites for this next tank are discussed in detail in the Village Distribution System Master Plan.

B. Brackish Well Supply at the Resort.

1. A combination of sewage treatment plant (STP) effluent and brackish well water will be used to irrigate the four golf courses planned for the Resort. Table 3 details their irrigation requirement, the expected STP effluent supply, and the balance which must be supplied by brackish wells. If the Elleair Country Club golf course (third course in the Resort) comes on line in 1992 and the fourth course in 1994, required brackish well supply will reach a maximum of 4.87 MGD in 1994; it will gradually diminish thereafter as more effluent becomes available.

2. The combined STP effluent and brackish well water supply may also be used to irrigate the Resort's roadway landscaping. For this possibility, the maximum well supply needed will be higher, reaching a maximum of 5.50 MGD in 1995 (also detailed in Table 3).

Table 1

Required New Potable Well Pumping Capacity, 1990 to 2005

Parameter	Year			
	1990	1995	2000	2005
Projected Average Demand (MGD)[1]	2.58	6.91	9.23	10.02
Unaccounted Losses (MGD)[2]	0.32	0.83	1.11	1.32
Required Average Supply (MGD)	2.90	7.74	10.34	11.34
Maximum Day Required Supply (MGD)[3]	3.62	9.68	12.93	14.18
Standby Capacity (MGD)[4]	2.16	2.16	2.16	2.16
Required Total Well Pumping Capacity (MGD)	5.78	11.84	15.09	16.34
(GPM)	4,010	8,220	10,480	11,350
Total Existing Well Pumping Capacity[5]	4,000			
Required New Well Pumping Capacity (GPM)	10	4,220	6,480	7,350

[1] Average demand is taken from Waikoloa's Development Model as of September 1990.

[2] Unaccounted losses are 12 percent of average demand.

[3] The maximum day required supply is 1.25 times the average required supply.

[4] Standby capacity is defined by the largest well pump, Waikoloa Well No. 1 (WW No. 1) at 1500 GPM (2.16 MGD).

[5] Upon completion of outfitting of Waikoloa Well No. 2 (WW No. 2), the existing pumping capacity will be 4000 GPM:

Well	GPM
Parker 4	750
Parker 5	750
WW No. 1	1,500
WW No. 2	1,000
Total	4,000

Table 2

Projected Storage Requirements for the Waikoloa Water System

Year	Storage Requirements by Area in Million Gallons				
		Village			
	Resort	1210-Foot Zone	1000-Foot Zone	Highlands	Total
1990	1.87	1.05	0.06		2.98
1991	2.21	1.25	0.22		3.68
1992	2.37	1.48	0.56	.07	4.48
1993	2.58	1.90	0.75	.15	5.38
1994	3.44	1.94	1.01	.17	6.56
1995	4.31	2.25	1.44	.22	8.22
1996	4.55	2.32	1.73	.43	9.03
1997	4.55	2.46	2.09	.49	9.59
1998	4.70	2.50	2.37	.62	10.19
1999	4.70	2.53	2.58	.68	10.49
2000	5.24	2.66	2.75	.74	11.39
2001	5.24	2.69	2.87	.79	11.59
2002	5.52	2.75	2.95	.85	12.07
2003	5.52	2.75	3.06	.91	12.23
2004	5.70	2.76	3.09	.94	12.49
2005	5.72	2.82	3.12	.97	12.63

Notes:

1. Required storage is defined as the maximum day's water use. It is computed as 1.25, the maximum day factor, times the sum of projected average use plus 12 percent for unaccounted losses.

2. Within the Resort, projected use for roadway irrigation, which is controlled by Waikoloa and can be curtailed if the need arises, has not been included in the computation of storage.

Table 3

Projected Brackish Water Requirements for Waikoloa Beach Resort

Year	Golf Course Irrigation (MGD)			Addition of Road Irrigation (MGD)	
	Golf Course Supply Requirement	Expected STP Effluent Supply	Balance Required From Brackish Wells	Required Resort Roads Irrigation Supply	Maximum Potential Brackish Requirement
1990	2.50	0.45	2.05	0.22	2.27
1991	2.50	0.49	2.01	0.22	2.23
1992	4.00	0.55	3.45	0.41	3.86
1993	4.00	0.57	3.43	0.48	3.91
1994	5.50	0.63	4.87	0.48	5.35
1995	5.50	0.81	4.69	0.81	5.50
1996	5.50	1.02	4.48	0.81	5.29
1997	5.50	1.05	4.45	0.87	5.32
1998	5.50	1.06	4.44	0.87	5.31
1999	5.50	1.10	4.40	0.87	5.27
2000	5.50	1.11	4.41	0.87	5.28
2001	5.50	1.18	4.32	0.87	5.19
2002	5.50	1.19	4.31	0.87	5.18
2003	5.50	1.23	4.27	0.87	5.14
2004	5.50	1.23	4.27	0.87	5.14
2005	5.50	1.25	4.25	0.87	5.12

Notes:

1. The golf course irrigation requirement is estimated as follows: (a) the two existing courses have a combined 2.5 MGD requirement; (b) in 1992, the third course will add 1.5 MGD to bring the total to 4.0 MGD; and (c) the fourth course in 1994 will complete the requirement at 5.5 MGD.

2. Expected STP effluent supply has been estimated by Waikoloa Resort Utilities with the following assumptions: (a) the Development Model establishes the expected build-out rate in the Resort; (b) sewage generated by this development is computed by applying various unit rates and on occupancy rate of 73%; and (c) a further reduction of available effluent is made assuming a 10% loss in pipelines and at the treatment plant.

3. Roadway irrigation is estimated at 37 and 25 GPD per linear foot for major and minor (cul de sac) roads, respectively. All roads, except those along which pedestrian traffic is expected, have been included in the estimate.

3. In Table 4, these rates of brackish supply for golf course only and for the addition of roadway landscaping are translated into required new well pumping capacity. For this calculation, a peak season factor of 1.15 has been applied to the required brackish supply shown in Table 3 to accommodate seasonal variations in irrigation needs and available effluent supply. The current plan is to reserve the nursery well, because it is close to and downgradient of the 51-foot well, for standby. The 51-foot well would be upgraded from its present 250 GPM capacity to 500 GPM. Assuming that new wells will produce approximately 500 to 600 GPM each, two new wells must be added to supply the Elleair Country Club golf course whether roadway landscape irrigation is included or not. When the fourth golf course is developed, two more wells would then be needed. Ultimately, including roadway irrigation, the Resort would have eight active wells and the nursery well for standby. Beyond the mid-1990s, however, increasing quantities of STP effluent will allow groundwater pumpage to be reduced.

C. Brackish Wells in the Village

1. Parker 1 Well, located at 800-foot elevation just below the Village, can deliver up to 1.0 MGD of brackish water to the Village golf course. The golf course requirement averages about 0.7 MGD year-round but reaches 0.9 MGD during peak use periods.

2. Development of two other brackish wells will be appropriate, one within or next to the Highlands golf course and the other to supply the proposed golf course in Waikoloa Heights (Lot 3 of FP 1967). To comply with State Water Commission policy, both of these wells should be located and designed to produce brackish, rather than potable quality, water. This can be easily accomplished for both courses.

3. STP effluent should be used to augment the Waikoloa Heights golf course supply. It would be the most practical disposal option available and it would also decrease golf course irrigation costs. As the effluent supply increases, total brackish pumpage in the Village should ultimately be less than 2.0 MGD.

Table 4

Estimated Future Brackish Well Pumping Capacity
for Waikoloa Beach Resort

Parameter	Units	Milestone Years			
		1990	1992	1994	1995
Required Brackish Well Supply for Golf Course Irrigation (Figures from Table 3 increased by 1.15)	MGD	2.36	3.97	5.60	5.39
	GPM	1,640	2,755	3,890	3,745
Required New Well Pumping Capacity (Assumes upgrade of 51-foot well)	GPM	None	880	2,015	1,870
Required Brackish Well Supply for Golf Course and Roadway Irrigation	MGD	2.61	4.44	6.15	6.32
	GPM	1,810	3,080	4,270	4,390
Required New Well Pumping Capacity	GPM	None	1,205	2,395	2,515

Notes:

1. The milestones in 1992 and 1994 are the additions of the Ellelair Country Club and fourth golf courses. 1994 is the year of maximum brackish water use for golf course use alone. If roadway irrigation is added, 1995 would be the year of maximum use. Beyond 1995, increases STP effluent will lower the brackish water requirement.

2. To identify required new well supply, the Nursery well is held in reserve as a back-up source. Other existing wells have a present combined capacity of 1625 GPM which could be increased to 1875 GPM by upgrading the 51-foot well:

Well	Present Capacity (GPM)	After Upgrade (GPM)
51-Foot	250	500
No. 1	350	350
No. 2	525	525
No. 3	500	500
Totals	1,625	1,875

III. Recommended Well Development Program

A. Potable Wells

1. The recommended development program is intended to strike an optimal balance among resource opportunities, facilities construction cost, and system operating requirements. It focuses on the three areas described below and depicted on Figure 1.

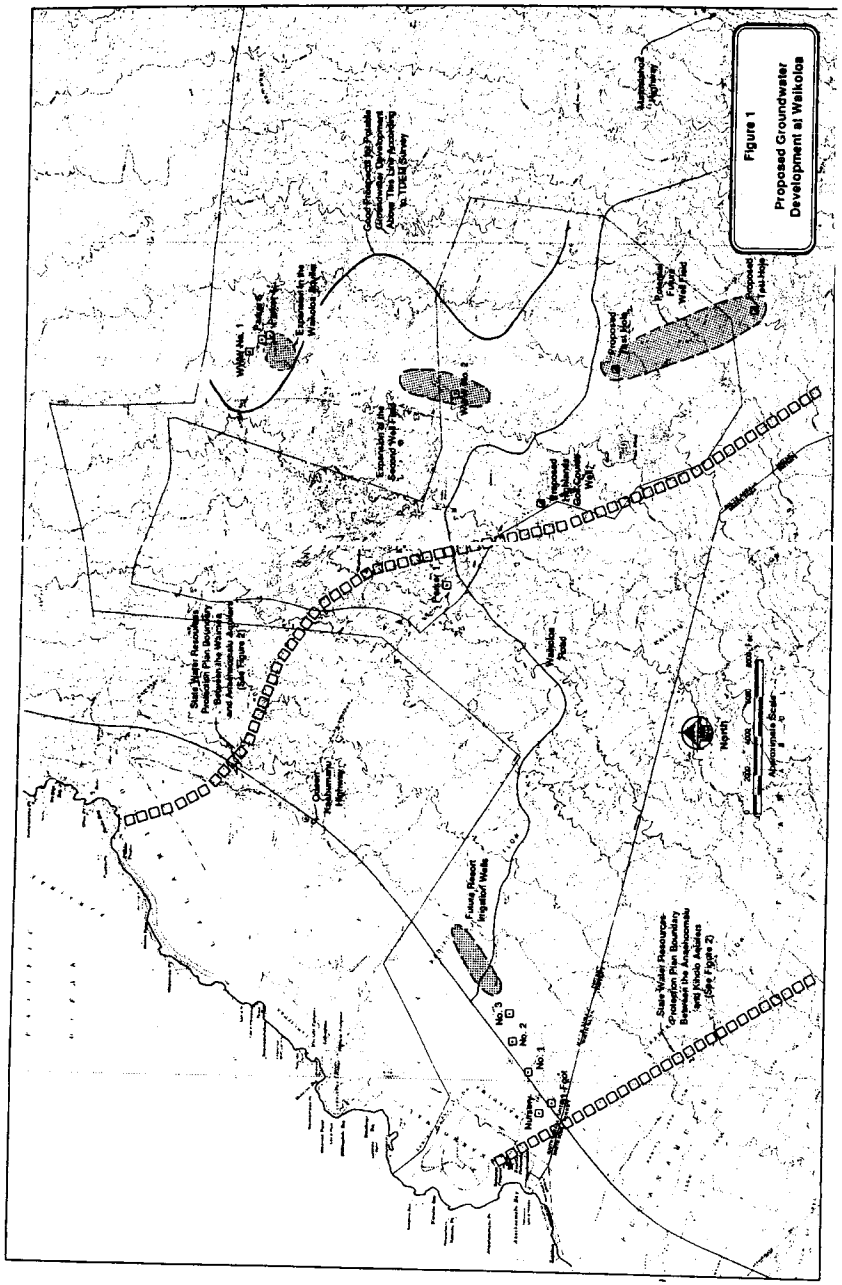
   a. The original well field now consists of three wells having a combined pumping capacity of 3000 GPM and an average draft of 2.7 MGD. It should ultimately be expanded to supply up to six MGD with an installed pumping capacity of approximately 5800 to 6000 GPM. This could be accomplished by adding two more wells of 1400 to 1500 GPM each.

   b. The aquifer in which the existing well field is located is a truly remarkable resource. Key aspects in the evaluation of its potential are as follows:

      (i) A long-term aquifer test by simultaneous pumping the first two wells (Parker 4 and 5) was performed from August 22 through October 25, 1972. Combined average pumpage for the two-month period was 1.90 MGD. Significant results and conclusions were:

      - Water quality showed absolutely no change throughout the test.

      - A gradual but continuous drawdown due to pumping occurred. After the first seven days, there was a change to a steeper drawdown rate. This suggests that the drawdown cone had encountered a boundary. If values of transmissivity and storativity determined from the drawdown curve are applied, calculations suggest this boundary is on the order of 1.0 to 2.0



miles from the pumping center. Subsequent geophysical surveys by Blackhawk suggest the boundary or boundaries may be closer.

- Using projections of continuous drawdown, both hydrologists involved in the test (Harold T. Stearns and Stephen P. Bowles) concluded that the aquifer could yield more than two MGD with no change in water quality.

- Re-interpretation of the test data, particularly with the hindsight of the aquifer's performance since 1972, indicates that the drawdown actually did stabilize about 30 to 35 days into the test. That fact, as well as the aquifer's performance, strongly suggest an aquifer yield significantly greater than originally concluded.

(ii) Data available since the 1972 test confirm the stabilized drawdown to various rates of pumping with no change in water quality:

Date	Average Draft (MGD)	Average Water Level at Parker 4 (Ft. msl)	MGD per Foot of Drawdown
1985	0.75	17.1	1.09
Aug.-Sept. 1988	1.9 to 2.0	16.0	1.50
July 1990	2.8	15.4	

The data suggest that the water level will still be above 12 feet at Parker 4 when draft from the aquifer is on the order of 6.0 MGD. Notably, drawdown level reflects turbulent loss as well as actual aquifer drawdown. In other words, the actual aquifer water level is significantly higher than measured in Parker 4. Such a result would be comfortably within the aquifer's capability. The conclusion is that given the aquifer's excellent

quality, its unique supply capability on the South Kohala plain, and the vulnerability of wells located elsewhere to salinity intrusion, Waikoloa should exploit this aquifer to its fullest potential.

(iii) As the draft rate is increased, the aquifer's response should be carefully monitored and periodically reviewed. To assist this, a data collection format to correlate pumpage, water level, and water quality systematically should be developed so that seasonal variations and long-term trends can be easily identified.

c. The new well field in the vicinity of WW No. 2 should be expanded to an average supply of up to three MGD with an installed pumping capacity of 3000 GPM.

(i) Two new wells at 1000 GPM each would complete development in this vicinity.

(ii) Wells in this area may be vulnerable to salinity increases in response to pumping. Spacing among the wells must be chosen carefully and water quality should be closely monitored.

d. New wells at higher elevation in the Highlands should be developed to supply up to three MGD with installed pumping capacity of 3000 GPM.

(i) To achieve cost and operational advantages, these wells should be located next to proposed tank sites in the Highlands.

(ii) To avoid the use of booster pump stations in the Highlands, one 1000 GPM well at the 1370-foot tank and two 1000 GPM wells near the 1830-foot tank would be appropriate. These wells will develop more supply than would be used in the Highlands alone. The balance of their supply would be delivered into the 1210-foot pressure zone into the Village and possibly down to the Resort.

(iii) Blackhawk's TDEM survey results suggest that the proposed well sites may have some hydrologic risk. However, if they are successful, significant pipeline savings and operational benefits could be achieved. And by distributing the draft from wells over a wider area, they would also help avoid an overdraft in one or both of the other well fields. To minimize the financial risk, beginning the exploratory effort with pilot boreholes which could be reamed and cased as production wells at a later date is recommended. This would provide the opportunity to recover the cost of the exploratory holes while minimizing the time and expense to determine the viability of well development at these sites. About $300,000 to $450,000, depending on elevation, would be at risk at each site.

2. System transmission limitations, particularly the 16- and 14-inch, three-mile long pipeline from the original well field to Waikoloa Road, dictate the well development sequence:

a. The next two production wells should be located in the near vicinity of WW No. 2.

b. For both resource and system distribution considerations, it will be important to develop a brackish well to irrigate the Highlands golf course rather than rely on WW No. 2 of the potable system. Work on this irrigation well should begin as soon as required to meet the golf course's needs.

(i) If WW No. 2 in the new well field is used to irrigate the Highlands golf course, the well's benefit to the potable distribution system would be dramatically reduced to an almost negligible level.

(ii) Because there will be only one well in the new field in operation for at least a year or more, there would be no back-up supply for the Highlands golf course.

(iii) If the golf course had its own well, the potable system could provide back-up supply.

c. At least one and preferably both of the proposed test holes in the Highlands shown on Figure 1 should be undertaken as soon as practical to facilitate long-term planning.

B. Brackish Wells in the Resort and Village

1. Brackish wells in the Resort can be added incrementally as needed moving north through the area identified on Figure 1.

2. The Waikoloa Heights golf course well could be located within the golf course itself or further makai next to the planned sewage treatment plant.

3. The Highlands golf course well should be located relatively near to the irrigation lake along its 10th hole.

IV. Potential Regulatory Constraints to Well Development

A. Regulatory Authority

1. State Water Code gives authority to the State to regulate the development and use of surface and groundwater.

2. The State Commission of Water Resource Management, consisting of four appointed and two ex-officio commissioners, exercises this authority.

3. The two volume "State Water Resources Protection Plan," dated June 1990, delineates aquifer boundaries and proposes maximum groundwater use rates, termed "sustainable yields", throughout the State.

B. Aquifer Delineations, Sustainable Yields, and Present Use of Groundwater in South Kohala

1. Figure 2 illustrates the State's regulatory boundaries for the Waimea Aquifer (No. 80301) and Anaehoomalu Aquifer (No. 80701) in South Kohala. Table 5 is a compilation of existing wells in these two aquifers.

2. Table 6 lists the parameters used by the State to arrive at sustainable yields of 24 and 30 MGD, respectively, for the Waimea and Anaehoomalu aquifers.

3. Table 7 lists the wells in the Waimea aquifer which presently draw a total of 7.0 MGD. This draft represents 29 percent of the regulatory sustainable yield. All of Waikoloa's potable wells are in this aquifer.

4. Table 8 lists the wells in the Anaehoomalu aquifer which presently draw 7.0 MGD, 23 percent of its regulatory limit. Use is limited to Waikoloa's Village and Resort brackish wells and Mauna Lani's brackish wells.

C. Potential Future Regulatory Constraints to Groundwater Development and Use

1. Tables 9 and 10 are compilations of expected future use of these two aquifers.

a. The forecast 33 MGD draft rate from the Waimea aquifer exceeds its 24 MGD regulatory sustainable yield. If supply for Waikoloa's Unplanned Reserve was also included, the potential overdraft could be five to six MGD higher.

b. The estimated 15 to 16 MGD ultimate draft from the Anaehoomalu aquifer is below its 30 MGD sustainable yield.

2. According to the State Water Code, when withdrawal from the Waimea aquifer reaches 90 percent of its regulatory limit (21.6 MGD), it will be designated by the State as a Groundwater Management Area (GMA). The designation would bring stricter control of well development and use. The GMA designation could also occur sooner at a lower level of pumping if water quality problems arise or if disputes among water users occur:

Table 7

Active Wells and Present Pumpage From the Waimea Aquifer

Well Name and/or Owner	State Number	Pump Capacity (GPM)	Ave. Draft Rate (MGD)
Potable Wells:			
County Dept. of Water Supply (Lalamilo) A	5946-01	700	2.0
B	5946-02	1000	
C	5946-03	1000	
D	5946-04*	1000	
Waikoloa - Parker 4	5745-01	750	2.7
- Parker 5	5745-02	800	
- Waikoloa Water Well 1	5745-03	1500	
- Waikoloa Water Well 2	5746-01*	1000	
Waikii Ranch - No. 1	5239-01	150	0.1
- No. 2	5239-02	150	
Subtotal for Potable Wells		8050	4.8
Brackish Irrigation Wells:			
Mauna Kea Properties No. 1	6048-02	350	0.7
No. 2	6049-01	350	
No. 3	6047-01	500	1.3
No. 4	6047-02	500	
Hapuna State Park	5949-02	250	0.2
Subtotal for Brackish Irrigation Wells		1950	2.2
TOTAL FOR THE WAIMEA AQUIFER		10,000	7.0

Table 8

Active Wells and Present Pumpage From the Anaehoomalu Aquifer

Well Name and/or Owner	State Number	Pump Capacity (GPM)	Ave. Draft Rate (MGD)
Brackish Irrigation Wells:			
Mauna Lani Resort - Puako Shaft	5750-01	1500	3.3
- Nursery	5750-02	200	
- No. 1 (STP)	5750-04	400	
- No. 2 (Fire Sta.)	5750-03	400	
- No. 3 (Highway)	5551-01	425	
Waikoloa Village - Parker 1	5548-01	700	0.7
Waikoloa Resort - Nursery	5452-01	750	3.0
- STP	5452-02	250	
- No. 1	5452-03	350	
- No. 2	5552-01	525	
- No. 3	5551-01	500	
TOTAL FOR THE ANAEHOOMALU AQUIFER		6000	7.0

Table 9

Potential Draft From the Waimea Aquifer to Supply Planned Development Projects

Land Owner and/or Development Project	Draft Rate (MGD)
Potable Wells	
County (Lalamilo) System	3.1
Mauna Lani (Parker Ranch Well Sites)	3.8
Mauna Kea Properties	5.5
Nansay (Formerly Signal)	3.3
Waikoloa (Does not include Unplanned Reserve)	12.4
Subtotal for Potable Supply	28.1
Brackish Irrigation Wells	
Mauna Kea Properties	2.8
Hapuna State Park	0.2
Waikoloa Village - Village Golf Course	0.7
- Highlands Golf Course	0.7
- Heights Golf Course	0.7
Subtotal for Brackish Irrigation	5.1
TOTAL FOR THE WAIMEA AQUIFER	33.2

Table 10

Potential Draft From the Anaehoomalu Aquifer

Land Owner and/or Development Project	Draft Rate (MGD)
Brackish Irrigation Wells	
Mauna Lani Resort	4.5
Nansay-Puako	6.5
Waikoloa	5.0
TOTAL FOR THE ANAEHOOMALU AQUIFER	15.5

a. Many of the numerous brackish irrigation wells along the shoreline, particularly within Mauna Lani Resort, now have relatively high salinity. As the draft by inland wells "upstream" increases, salinities of the nearshore wells are likely to be adversely affected. This problem would invite State intervention and possible GMA designation. Development of irrigation wells in Nansay's Puako property and expansion of potable supply for Waikoloa will occur upstream of Mauna Lani.

b. Competition for potable well sites near the Waimea-Kawaihae Road among Mauna Kea Properties, Nansay, the State, and the County could also invite early State intervention. Although Waikoloa is not directly involved in this problem, it could be affected by its outcome.

D. Possible Solutions to the Prospective Regulatory Limitation

1. It should be recognized that the resource limitation is a regional problem which will require a cooperative regional solution among the State, County, Waikoloa, Mauna Lani Resort, Mauna Kea Properties, and possibly Nansay.

2. The State's aquifer boundary delineations and sustainable yield limits do not actually reflect the best information and analyses that are available. Waikoloa should participate in a cooperative effort among users to relocate the designated aquifer boundaries to more accurately reflect actual hydrologic boundaries. Sustainable yields should then be recomputed for the redefined boundaries.

3. The recommended development of potable wells at upper elevation in the Highlands should be pursued. These sites are near to the presently designated Waimea-Anaehoomalu aquifer boundary and are likely to be in the Anaehoomalu aquifer if the boundaries are reconfigured on a more appropriate hydrologic basis.

4. STP effluent should be reused for irrigation wherever possible. It will reduce pumpage of groundwater, reduce pumping costs, and demonstrate an effort to conserve to the State Water Commission.

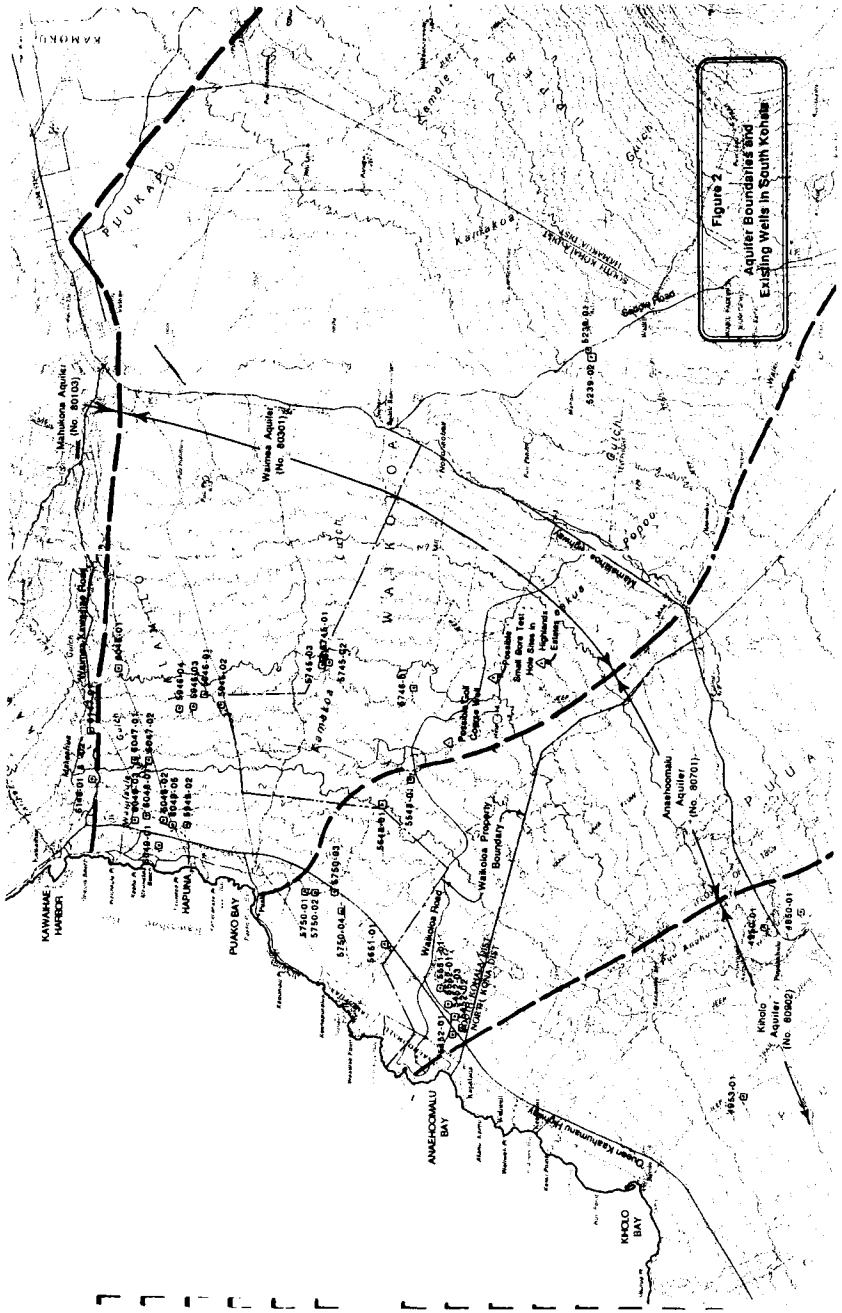


Figure 2
Aquifer Boundaries and Existing Wells in South Kohala

Table 5

Existing Wells in South Kohala

State No.	Owner	Name of Well	Use / Status
6048-02	Mauna Kea Properties	MKBH No. 1	Golf Course Irrigation
6049-01	Mauna Kea Properties	MKBH No. 2	Golf Course Irrigation
6047-01	Mauna Kea Properties	MKBH No. 3	Under Construction
6047-02	Mauna Kea Properties	MKBH No. 4	Golf Course Irrigation
5949-02	State Parks	Hapuna	Park Irrigation
6048-01	State DOWALD	Kawaihae 2	Test Well - Not in Use
6048-03	Mauna Kea Properties	Ouli North	Not in Use
6049-05	Mauna Kea Properties	Ouli South	Not in Use
6148-01	County DWS	Kawaihae 1	Brackish Blending - Not in Use
6148-02	County DWS	Kawaihae 14	Brackish Blending - Not in Use
6147-01	State DOWALD	Kawaihae 16	Test Well - Not in Use
6046-01	Nansay Corporation	Signal-Nansay	Not in Use
5946-01	County DWS	Lalamilo A	Potable
5946-02	County DWS	Lalamilo B	Potable
5946-03	County DWS	Lalamilo C	Potable
5946-04	County DWS	Lalamilo D	Potable
[illegible]	[illegible]	Parker 5	Potable
5745-02	Waikoloa Water Company	Parker 4	Potable
5745-03	Waikoloa Water Company	Waikoloa Water Well 1	Potable
5546-01	Waikoloa Water Company	Waikoloa Water Well 2	Potable
5548-01	Waikoloa Water Company	Parker 1	Golf Course Irrigation
5648-01	Waikoloa Water Company	Parker 2	Test Hole - Not in Use
5750-01	Mauna Lani Resort	Puako Shaft	Golf Course Irrigation
5750-02	Mauna Lani Resort	Nursery Well	Nursery Irrigation
5750-03	Mauna Lani Resort	No. 2 (Fire Station)	Golf Course Irrigation
5750-04	Mauna Lani Resort	No. 1 (STP)	Golf Course Irrigation
5651-01	Mauna Lani Resort	No. 3 (Highway)	Golf Course Irrigation
5452-01	Waikoloa Water Company	Nursery Well	Golf Course Irrigation
5452-02	Waikoloa Water Company	51-Foot	Golf Course Irrigation
5452-03	Waikoloa Water Company	No. 1	Golf Course Irrigation
5552-01	Waikoloa Water Company	No. 2	Golf Course Irrigation
5555-01	Waikoloa Water Company	No. 3	Golf Course Irrigation
4953-01	State DOWALD	Kiholo	Test Well - Not in Use
4850-01	Newell Bohnett	Puu Anahulu	Potable
4950-01	Premier Resort Development	Royal Vista	Under Construction
5239-01	Waikii Ranch	No. 1	Potable
5239-02	Waikii Ranch	No. 2	Potable

Table 6

State Water Resources Protection Plan
Estimated Sustainable Yields by Aquifer System

Sector	System	Code No.	Area (Sq. Miles)	Average Rainfall (Inches/Year)	Runoff (Inches/Year)	ET (Inches/Year)	Infiltration		h(o) (Feet)	Sustainable Yield (MGD)
							Inches/Year	MGD		
Kohala	Mahukona	80103	113.9	25	1	17	7	38	4	17
West Mauna Kea	Waimea	80301	282.1	18	1	13	4	54	5	24
NW Mauna Loa	Anaehoomalu	80701	291.0	23	1	17	5	69	5	30
Hualalai	Kiholo	80902	146.2	25	1	18	6	42	5	18

Village Distribution System Plan

I. Scope and Objectives

A. Establish appropriate design criteria and flowrate parameters to size storage tanks and pipelines for planned expansion in the Village, the Highlands, and an area of potential future urban expansion along Waikoloa Road above the Resort. Figure 1 depicts these three areas.

B. Develop a sequential plan of construction for these tanks and pipelines.

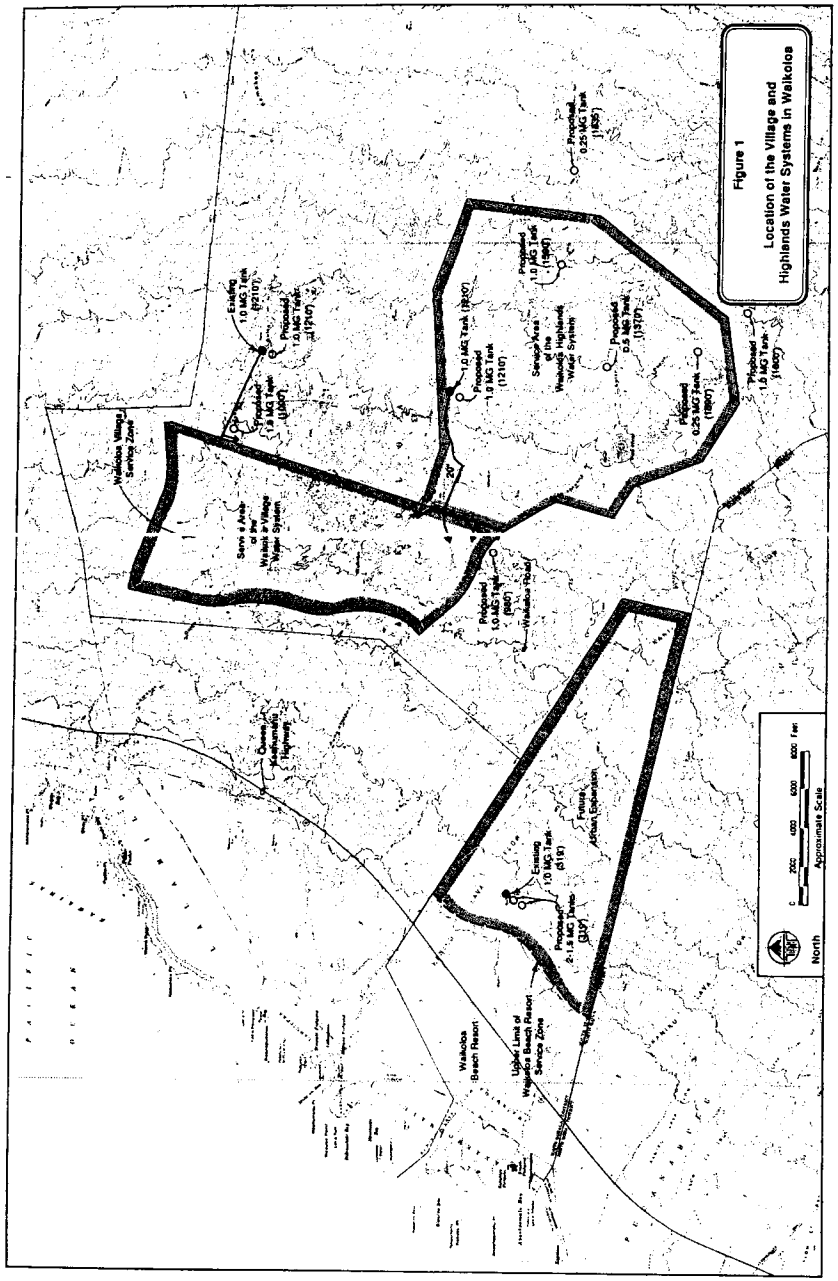
C. This plan is one of three master plans for the expansion of the water system. The other two are for the development of new well sources and the expansion of the distribution system in the Resort:

1. The source development identifies supply requirements and recommends sites for the addition potable and brackish wells.

   a. New potable wells are to be located above the Village near Waikoloa Road and within and above the Highlands initially. Subsequently, wells can also be added in the original well field.

   b. Brackish wells are to be developed as needed in near proximity to the specific uses served.

2. The distribution system plan for Waikoloa Beach Resort includes both potable and the non-potable irrigation systems. The potable system expansion merely completes the pipeline loop through the Resort. The irrigation system will involve a major expansion in capacity and level of service.



II. Basis of Design: Development Model, Design Criteria, Flowrate Parameters, and Analytical Methods

A. Waikoloa Development Model

1. The Development Model is prepared by Waikoloa and is periodically updated. It provides a compilation of project development and estimated market absorbtion by year and by respective average water use through the planning period.

2. The versions of the model used for the sizing presented in this draft of the master plan are dated May and October 1990. A later, December 1990 version will be used for the final version of this master plan.

B. System Design Criteria

1. Design criteria used to size tanks and pipelines are listed in Table 1.

2. These criteria are identical to those used in previous water master plans dated February 1988 and September 1989. These generally follow the design standards of the various County Departments of Water Supply. The several exceptions to County standards are discussed below.

   a. A maximum day demand factor of 1.25 is used rather than the County's 1.5 factor. This value is the basis for storage tank sizing and to test for adequate fire protection. The lower value was chosen for Waikoloa after examining patterns of use within the system. Waikoloa's use is relatively constant year-round, a fact attrributed to the dominance of irrigation use within the system and the area's consistently hot and dry climate. The effect of varying occupancy rates in the Resort and in condominiums in the Village is lessened as a result.

   b. Comparisons of well pumpage and metered use within the system show that the difference between the two is generally in the range of 12 percent of metered use. To determine required well pumping capacity and storage tank volume, this 12 percent of unmetered use is included. County standards do not include this amount for design. Its inclusion here offsets, to some extent, use of the lower maximum day factor.

Table 1

Water System Facilities Sizing Criteria

Demand Factors

- o Average Day Demand = Application of the water use rates of Table 1
- o Maximum Day Demand = 1.25 x Average Day Demand
- o Peak Demand = 3.0 x Average Day Demand

Fire Flow

- o Shopping Centers, High Rise Apartments, and Hotels: 2000 GPM for 2 hours
- o Townhouse, Low Rise Apartments, Duplex: 1500 GPM for 1 hour
- o Single Family Residential: 1000 GPM for 1 hour (lots $\leq$ 10,000 sq. ft.)
  500 GPM for 2 hours (lots > 10,000 sq. ft.)

Service Pressures

- o Minimum of 40 psi (except during fire flow)
- o Maximum of 125 psi
- o 20 psi at critical fire hydrant for fire flow with coincident maximum daily demand

Pipeline Sizes

- o Meet minimum pressure criterion at peak flowrate with a maximum of 7.0 feet per second (fps) velocity.
- o Meet minimum hydrant pressure criterion at fire plus maximum daily flowrate with no velocity restriction.
- o Compute pipeline pressure losses using Hazen-Williams formula with:
  C = 100 for 6" or smaller pipelines
  C = 110 for 8", 10", & 12" pipelines
  C = 120 for 14" to 20" pipelines
  C = 130 for 24" or larger pipelines

Well Pumping Capacity

- o Provide the maximum daily demand, including unmetered supply, in a 24-hour pumping day with the largest well out of service.

Reservoir Storage

- o Provide the maximum daily demand, including unmetered supply but excluding controllable common area irrigation, with no credit for well inflow.
- o Meet fire flow and coincident maximum daily demand for the duration of the fire flow with the reservoir 3/4 full at the start and credit for well inflow with the largest pump out of service.

c. One of the two storage tank sizing criteria is to provide the maximum daily system demand without credit for well inflow. This is generally intended to ensure supply for at least 24 hours during a power outage when all well pumping ceases. This criteria provides far more storage than required by operational requirements if the well pumps are operating. For this criterion, Waikoloa's situation is somewhat unique:

(i) Unmetered use has been included in the maximum daily demand; it is not normally considered by the various counties.

(ii) Irrigation use which can be curtailed in such an emergency has been excluded from the maximum daily use figure. For the calculations herein, the controllable irrigation use is roadway irrigation.

(iii) Waikoloa now has back-up power for some of its wells. Waikoloa Water Well No. 1 can be run by electric motor or direct-drive diesel. A diesel gen-set is also available to run either Parker 4 or Parker 5 during a power outage. These additions have not been considered in storage tank sizing. In effect, an extra measure of safety is provided.

C. Flowrate Parameters

1. In Tables 2 and 3, Waikoloa's projections of average water use in the Village have been converted to design flowrates for tank and pipeline sizing. Table 2 is the design flows for the areas served directly from the 1210-foot tanks. Table 3 is for the lower portion of the Village to ultimately be served by 1000- and 980-foot tanks.

2. Design flowrates for the Highlands are separated by areas north and south of Waikoloa Road (Ranch and Golf Estates, respectively) and by service pressure zones within these areas.

a. The Golf Estates are south of Waikoloa Road and will require multiple service pressure zones.

Table 2

Design Flowrate Parameters for the 1210' Service Pressure Zone in the Village

Node	Lot and/or Land Use	Type and Number of Development			Flowrates for Design (GPD)			Peak in Gallons Per Minute
		Single Family (Units)	Multi Family (Units)	Commercial (Acres)	Average Day	Max. Day	Peak	
	In the Village:							
11	Lot 115 - Commercial Center			6	18,000	22,500	54,000	37
22	Fairway Terrace		100		40,000	50,000	120,000	83
23	Fairway Terrace		100		40,000	50,000	120,000	83
206	File Plan 1209 Phase I			26	78,000	97,500	234,000	162
206	File Plan 1209 Phase II			20	60,000	75,000	180,000	125
45	Francolin Place	17			10,200	12,750	30,600	21
201	Gardens Condo		24		9,600	12,000	28,800	20
11	Hills Condo I		24		9,600	12,000	28,800	20
11	Hills Condo II		50		20,000	25,000	60,000	42
700 series	Jitchaku Increment 2A-1	134			80,400	100,500	241,200	167
700 series	Jitchaku Increment 2A-2	104			62,400	78,000	187,200	130
700 series	Jitchaku Increment 2A-3	104			62,400	78,000	187,200	130
205	Lot 111 Waikoloa Greens		197		78,800	98,500	236,400	164
200	Lot 1 FP 1378		110		44,000	55,000	132,000	92
200	Lot 2/3B FP 1378		100		40,000	50,000	120,000	83
800 series	Lot 3 FP1967 (Portion)	429		10	287,400	359,250	862,200	599
201	Lot 4 File Plan 1378		50		20,000	25,000	60,000	42
202,207	Lot 5 FP 1378		250		100,000	125,000	300,000	208
12	Paniolo I		24		9,600	12,000	28,800	20
12	Paniolo II		36		14,400	18,000	43,200	30
12	Paniolo III		16		6,400	8,000	19,200	13
205	Police and Fire Station			3	9,000	11,250	27,000	19
13 to 108	Unit I in the Village	984			590,400	738,000	1,771,200	1,230
22,23	The Villas Condominium		104		41,600	52,000	124,800	87
16	Village Condos Lot 113		128		51,200	64,000	153,600	107
17	Village Condos Lot 114		88		35,200	44,000	105,600	73
16,17	Villages Remain. Lot 114		40		16,000	20,000	48,000	33
20	WVA Existing			3	9,000	11,250	27,000	19
10	Existing Village Comm. Sp.			7	21,000	26,250	63,000	44
21	Waikoloa Fairway		51		20,400	25,500	61,200	42
	Subtotal Village 1210' Zone ->	1,772	1,492	75	1,885,000	2,356,250	5,655,000	3,927
	In the Highlands:							
1,001	Lot 9 - FP 1172			26	78,000	97,500	234,000	162
1,001	Palmer Commercial Center			10	30,000	37,500	90,000	62
1,006	Highland Golf Estates - Unit I	13			13,000	16,250	39,000	27
1,007	Highland Golf Estates - Unit I	11			11,000	13,750	33,000	23
1,009	Highland Golf Estates - Unit I	12			12,000	15,000	36,000	25
1,008	Highland Golf Estates - Condos		124		49,600	62,000	148,800	103
	Subtotal Highlands 1210' Zone	36	124	36	193,600	242,000	580,800	403
	TOTAL 1210-FT ZONE	1,808	1,616	111	2,078,600	2,598,250	6,235,800	4,330

Notes:

1. Average water use is 600 GPD for single family residences for the Village and 1000 GPD for the Highlands, 400 GPD for multi-family units, and 3000 GPD per acre of commercial development.
2. The column of nodes (at left) identifies the location within the Village that the water use occurs. Figure 2, a hydraulic schematic of the system, shows the locations of these nodes.

Table 3

Design Flowrate Parameters for the 1000' Service Pressure Zone in the Village

Node	Lot and/or Land Use	Type and Number of Development			Flowrates for Design (GPD)			Peak in Gallons Per Minute
		Single Family (Units)	Multi Family (Units)	Commercial (Acres)	Average Day	Max. Day	Peak	
600 series	Co. of Hawaii Housing I	225	200		215,000	268,750	645,000	448
600 series	Co. of Hawaii Housing II	200	90		156,000	195,000	468,000	325
600 series	Co. of Hawaii Housing III	200	50		140,000	175,000	420,000	292
600 series	Co. Of Hawaii Housing IV	200	50		140,000	175,000	420,000	292
600 series	Co. Of Hawaii Housing V	75	50		65,000	81,250	195,000	135
500 series	Lot 1 FP1967	400			240,000	300,000	720,000	500
800 series	Lot 3 FP1967 (Portion)	821		0	492,600	615,750	1,477,800	1,026
300 series	Lot 4-C Unit I	207			124,200	155,250	372,600	259
300 series	Lot 4-C Unit II	207			124,200	155,250	372,600	259
300 series	Lot 4-C Unit III	200			120,000	150,000	360,000	250
410 to 415	Pheasant Ridge I	44			26,400	33,000	79,200	55
410 to 415	Pheasant Ridge II	66			39,600	49,500	118,800	82
503	School (Elementary)			21	63,000	78,750	189,000	131
504	School (Secondary)			21	63,000	78,750	189,000	131
400 series	Sunset Ridge I	30			18,000	22,500	54,000	37
400 series	Sunset Ridge II	161			96,600	120,750	289,800	201
400 series	Sunset Ridge III	200			120,000	150,000	360,000	250
	Subtotal 1000' Zone ---->	3,236	440	42	2,243,600	2,804,500	6,730,800	4,674

Notes:

1. Average water use is 600 GPD for single family residences for the Village and 1000 GPD for the Highlands, 400 GPD for multi-family units, and 3000 GPD per acre of commercial development.
2. The column of nodes (at left) identifies the location within the Village that the water use occurs. Figure 3, a hydraulic schematic of the system, shows the locations of these nodes.

(i) The lowest portion of the Highlands, comprising 36 single family lots, 124 multi-family units, and Palmer Commercial Center, will be served directly from the Village 1210-foot service zone. These have been included at the bottom of Table 2.

(ii) Table 4 summarizes design flowrates for the 1370-foot or lowest Golf Estates service zone.

(ii) Table 5 compiles design flowrates for the upper two zones in the Golf Estates.

b. The Ranch Estates are on the North side of Waikoloa Road. Table 6 presents the design flowrates for the two service pressures zones it will require.

3. No plans have been developed for the Future Urban Expansion area along Waikoloa Road between the Village and Resort. For this master plan, no allocation of water use has been made.

D. Analytical Methods

1. The first step in the analytical process is to develop a hydraulic model of the existing pipe network. The model consists of pipeline segments, junction nodes at pipe connections or any other location where significant water use occurs, fixed grade nodes at tank sites, and PRV stations wherever they occur in the system.

2. The Kentucky Pipe Network computer program then solves for resulting flowrates in pipelines, drafts from tanks, and resulting residual pressures throughout the distribution system. The computer provides these results by an iterative solution of the Hardy–Cross technique. When applied to the level of existing water use, it is essentially a calibration of the model to ensure that it reasonably simulates system performance.

3. Projected water use can then be added to the model and the performance of alternative tank and pipeline additions to supply this use can be evaluated.

Table 4

Design Flowrates for the 1370-Foot Service Pressure Zone of Highlands Golf Estates

Node		Lot and/or Land Use	Type and Number of Development			Flowrates for Design (GPD)			Flowrates for Design (GPM)	
No.	Elevation (Feet msl)		Single Family (Units)	Multi Family (Units)	Commercial (Acres)	Average Day	Max. Day	Peak	Peak	Max. Day
		Lower Golf Estates (1370' Zone)								
1004	1162		0			0	0	0	0	0
1011	1162		0			0	0	0	0	0
1012	1140	Single Family Units	7			7,000	8,750	21,000	15	6
1013	1145	" " "	10			10,000	12,500	30,000	21	9
1014	1105	" " "	7			7,000	8,750	21,000	15	6
1015	1160	" " "	9			9,000	11,250	27,000	19	8
1016	1170	Single Family & Comm.	14		13	53,000	66,250	159,000	110	46
1017	1170	" " "	6			6,000	7,500	18,000	13	5
1018	1163	" " "	11			11,000	13,750	33,000	23	10
1019	1160	Single Family Units	11			11,000	13,750	33,000	23	10
1020	1142	Single Family & Condos	11	160		75,000	93,750	225,000	156	65
1021	1112	" " "	17			17,000	21,250	51,000	35	15
1022	1150	" " "	14			14,000	17,500	42,000	29	12
1023	1150	" " "	11			11,000	13,750	33,000	23	10
1024	1153	" " "	13			13,000	16,250	39,000	27	11
1025	1185	" " "	11			11,000	13,750	33,000	23	10
1026	1167	" " "	6			6,000	7,500	18,000	13	5
1027	1185	" " "	40			40,000	50,000	120,000	83	35
1028	1167	Single Family Units	31			31,000	38,750	93,000	65	27
1029	1270	Lot F	15			15,000	18,750	45,000	31	13
1030	1200	" " "	8			8,000	10,000	24,000	17	7
1031	1210	" " "	7			7,000	8,750	21,000	15	6
1032	1250	" " "	19			19,000	23,750	57,000	40	16
1033	1270	Lot B	20			20,000	25,000	60,000	42	17
		Tank Elev. = 1370								
		1370' Zone Totals	298	160	13	401,000	501,250	1,203,000	835	348

Notes: 1. Average water use is 600 GPD for single family residences for the Village and 1000 GPD for the Highlands, 400 GPD for multi-family units, and 3000 GPD per acre of commercial development.

2. The column of nodes (at left) identifies the location within the Village that the water use occurs. Figure 5, a hydraulic schematic of the system, shows the locations of these nodes.

Table 5

Design Flowrates for the Two Higher Service Pressure Zones of Highlands Golf Course Estates

Node		Lot and/or Land Use	Type and Number of Development			Flowrates for Design (GPD)			Flowrates for Design (GPM)	
No.	Elevation (Feet msl)		Single Family (Units)	Multi Family (Units)	Commercial (Acres)	Average Day	Max. Day	Peak	Peak	Max. Day
		Upper Golf Estates (1800' Zone)								
1047	1500	Single Family Units	18			18,000	22,500	54,000	38	16
1048	1530	" " "	15			15,000	18,750	45,000	31	13
1049	1520	" " "	0			0	0	0	0	0
1050	1485	" " "	14			14,000	17,500	42,000	29	12
1051	1480	" " "	11			11,000	13,750	33,000	23	10
1052	1520	" " "	10			10,000	12,500	30,000	21	9
1053	1595	" " "	11			11,000	13,750	33,000	23	10
1054	1600	" " "	21			21,000	26,250	63,000	44	18
1055	1635	" " "	0			0	0	0	0	0
1056	1630	" " "	11			11,000	13,750	33,000	23	10
1057	1625	" " "	14			14,000	17,500	42,000	29	12
1058	1580	" " "	14			14,000	17,500	42,000	29	12
1059	1490	" " "	8			8,000	10,000	24,000	17	7
1060	1520	" " "	15			15,000	18,750	45,000	31	13
		Upper Golf Totals	182	0	0	182,000	202,500	486,000	338	141
		Middle Golf Estates (1590' Zone)								
1034	1300	Single Family Units	20			20,000	25,000	60,000	42	17
1035	1370	" " "	20			20,000	25,000	60,000	42	17
1036	1345	" " "	13			13,000	16,250	39,000	27	11
1037	1400	" " "	11			11,000	13,750	33,000	23	10
1038	1475	" " "	11			11,000	13,750	33,000	23	10
1039	1300	" " "	14			14,000	17,500	42,000	29	12
1040	1475	" " "	45			45,000	56,250	135,000	94	38
1041	1355	" " "	45			45,000	56,250	135,000	94	38
1042	1510	" " "	0			0	0	0	0	0
1043	1475	" " "	34			34,000	42,500	102,000	71	30
1044	1410	" " "	34			34,000	42,500	102,000	71	30
1045	1345	" " "	46			46,000	57,500	138,000	96	40
1046	1475	" " "	46			46,000	57,500	138,000	96	40
		Middle Golf Totals	339	0	0	339,000	423,750	1,017,000	706	294
1800' & 1590' Zone Totals ——→			521	0	0	521,000	626,250	1,503,000	1,044	435

Notes: 1. Average water use is 600 GPD for single family residences for the Village and 1000 GPD for the Highlands, 400 GPD for multi-family units, and 3000 GPD per acre of commercial development.

2. The column of nodes (at left) identifies the location within the Village that the water use occurs. Figure 5, a hydraulic schematic of the system, shows the locations of these nodes.

Table 6

Design Flowrates for the Two Service Pressure Zones of Highlands Ranch Estates

Node		Land and/or Land Use	Type and Number of Development			Flowrates for Design (GPD)			Flowrates for Design (GPM)	
No.	Elevation (Feet msl)		Single Family (Units)	Multi Family (Units)	Commercial (Acres)	Average Day	Max. Day	Peak	Peak	Max. Day
		Upper Ranch Estates (1635' Zone)								
1120	1475	Single Family Units	32			32,000	40,000	96,000	67	28
1121	1580	" " "	21			21,000	26,250	63,000	44	18
1122	1610	" " "	37			37,000	46,250	111,000	77	32
1123	1680	" " "	37			37,000	46,250	111,000	77	32
1124	1475	" " "	15			15,000	18,750	45,000	31	13
1125	1515	" " "	0			0	0	0	0	0
1126	1485	" " "	10			10,000	12,500	30,000	21	9
1127	1550	" " "	8			8,000	10,000	24,000	17	7
1128	1610	" " "	10			10,000	12,500	30,000	21	9
1129	1550	" " "	10			10,000	12,500	30,000	21	9
		Upper Ranch Total	180	0	0	180,000	225,000	540,000	375	156
		Lower Ranch Estates (1590' Zone)								
1101	1380	Single Family Units	55			55,000	68,750	165,000	115	48
1102	1386	" " "	56			56,000	70,000	168,000	117	49
1103	1412	" " "	56			56,000	70,000	168,000	117	49
1104	1260	Equestrian Center	0		15	45,000	56,250	135,000	94	39
1105	1320	Single Family & Condos	46	126		96,400	120,500	289,200	201	84
1106	1355	Single Family Units	46			46,000	57,500	138,000	96	40
1107	1420	" " "	57			57,000	71,250	171,000	119	49
1108	1460	" " "	60			60,000	75,000	180,000	125	52
1109	1305	" " "	47			47,000	58,750	141,000	98	41
1110	1340	" " "	29			29,000	36,250	87,000	60	25
1111	1340	" " "	18			18,000	22,500	54,000	38	16
1112	1435	" " "	20			20,000	25,000	60,000	42	17
		Lower Ranch Total	490	126	15	565,400	731,750	1,756,200	1,220	508
		Ranch Estates Totals ——→	670	126	15	765,400	956,750	2,296,200	1,595	664

Notes: 1. Average water use is 600 GPD for single family residences for the Village and 1000 GPD for the Highlands, 400 GPD for multi-family units, and 3000 GPD per acre of commercial development.

2. The column of nodes (at left) identifies the location within the Village that the water use occurs. Figure 5, a hydraulic schematic of the system, shows the locations of these nodes.

III. Storage Requirements and Proposed Storage Tank Construction

A. Storage Requirements

1. Table 7 is a compilation of storage requirements by service area throughout the Waikoloa system.

2. With completion of the 1.0 MG tank next to Waikoloa Water Well No. 2, the 1990 design storage requirement will have been met. However, construction of additional storage should be initiated as soon as practical.

B. Proposed Storage Tank Locations

1. Proposed tank locations and sizes to meet ultimate service requirements are shown on Figure 1. These choices consider distribution system demands as well as existing and future water source development:

   a. The proposed total of 3.0 MG of storage in five different tanks in the Highlands is more than required by development in this area. However, operational requirements of future wells next to 1370-foot and 1800-foot tanks make these choices appropriate.

   b. A total of 6.0 MG of storage at four locations in the Village is proposed. One of the two new tanks at 1210 feet would be adjacent to the existing tank in the original well field. The other would be next to the tank now being built in the new well field. The 1000- and 980-foot tanks would serve the lower half of the Village.

   c. A total of 4.0 MG for the Resort, to be accomplished by adding two 1.5 MG tanks next to the existing 1.0 MG tank, is recommended. The balance of its storage requirement would be provided in higher elevation tanks.

2. For the next storage addition which should be initiated as soon as practical, a number of tank locations could be considered. Following is a capsule summary of the choices:

Table 7

Projected Storage Requirements for the Waikoloa Water System

Year	Storage Requirements by Area in Million Gallons			
	Resort	Village	Highlands	Total
1990	1.87	1.11		2.98
1991	2.21	1.47		3.68
1992	2.37	2.04	.07	4.48
1993	2.58	2.65	.15	5.38
1994	3.44	2.95	.17	6.56
1995	4.31	3.69	.22	8.22
1996	4.55	4.05	.43	9.03
1997	4.55	4.55	.49	9.59
1998	4.70	4.87	.62	10.19
1999	4.70	5.11	.68	10.49
2000	5.24	5.41	.74	11.39
2001	5.24	5.56	.79	11.59
2002	5.52	5.70	.85	12.07
2003	5.52	5.80	.91	12.23
2004	5.70	5.85	.94	12.49
2005	5.72	5.94	.97	12.63

Notes:

1. Required storage is defined as the maximum day's water use. It is computed as 1.25, the maximum day factor, times the sum of projected average use plus 12 percent for unaccounted losses.

2. Within the Resort, projected use for roadway irrigation, which is controlled by Waikoloa and can be curtailed if the need arises, has not been included in the computation of storage.

a. Locations which would not be appropriate for the next tank due to development phasing or minimal near-term beneficial impact to system operation are as follows:

(i) Construction next to the 1210-foot, 1.0 MG tank in the existing well field would not significantly benefit system operation.

(ii) The site at 1370 feet in the Highlands should be keyed to the development of that project.

(iii) The operational benefit of the tank site in the Village at 1000 feet above Lot 3 (Waikoloa Heights) will occur only when the makai half of the Village is substantially built out.

b. The following three possible locations should be given serious consideration for the next tank:

(i) A site at 980 feet on the south side of the Village, to replace the small head tank there, could remove the operational problems associated with the control valve and head tank. It would also be appropriately positioned to serve the Resort and the makai portion of the Village, particularly Lot 4C.

(ii) A site next to the 1210-foot tank under construction in the new well field could buffer the difference between peak draws by the system and constant inflow from wells in the new field.

(iii) A site next to the 319-foot, 1.0 MG tank above the Resort could provide a direct reserve for the Resort which, during an emergency, would not depend on the long pipeline transmission link to be effective.

c. The choice among the three best sites should weigh the following: The 1.0 MG, 980-foot tank on the south side of the Village would provide the most immediate operating benefits; a 1.0 MG, 1210-foot tank in the new well field would be the least expensive to construct; and if the 319-foot Resort site is selected, the tank should probably be 1.5 MG in size. The 980-foot tank is the recommended choice.

IV. Village Distribution System

A. Problems Posed by Projected Growth

1. Until Waikoloa Water Well No. 2 (WW No. 2) is brought on line, all water to the system will be supplied from the existing well field via the 17,000-foot long, transmission pipeline of 16- and 14-inch diameter. Its capacity has already been reached; low pressures occur in the highest elevations in the Village during peak use.

2. When WW No. 2 and the tank next to it are on line, the system will preferentially draw water from this new tank rather than from the existing well field's tank. To offset this unbalanced draft, the flow from the new tank will have to be controlled.

3. If the Highlands golf course irrigation is to be supplied from the potable system, it would diminish the beneficial effect of the new tank and well to an almost negligible level.

4. The Village encompasses several pressure zones. Until the proposed 1000- and 980-foot tanks and related pipelines are constructed, its lower zones will have to be served through a succession of pressure reducing stations.

B. Hydraulic Model of the Village Pipe Network

1. The analytical model of the system used for analysis is shown on Figures 2 and 3. Uses within the system are simulated as draft rates from the various nodes. The Kentucky Pipe Network computer program then computes resulting flowrates and residual pressures.

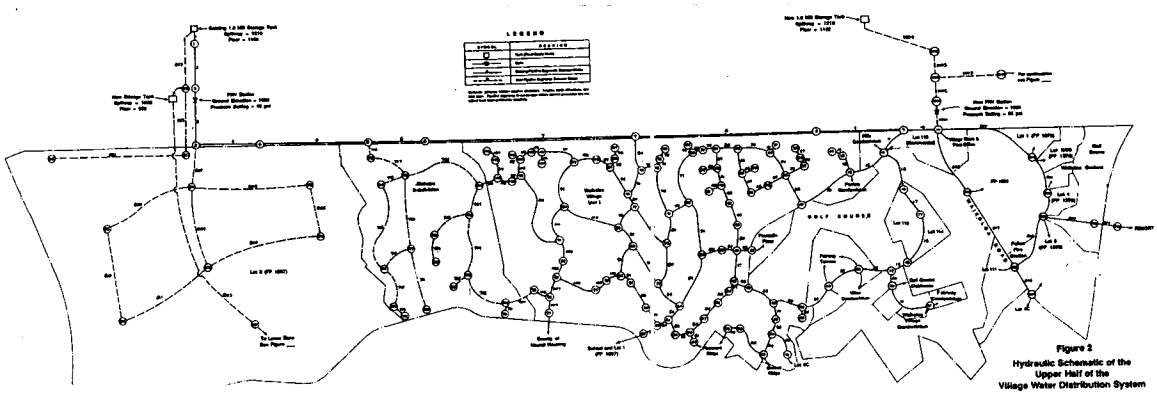


Figure 2
Hydraulic Schematic of the
Upper Half of the
Village Water Distribution System

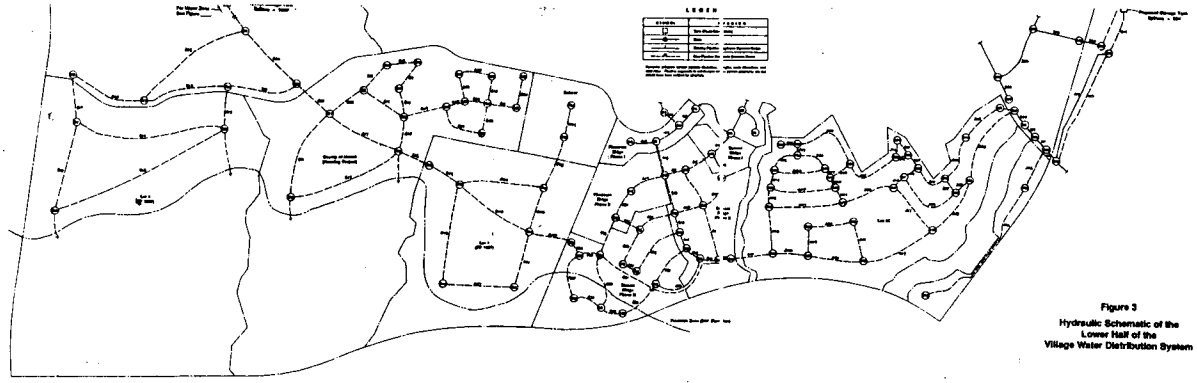
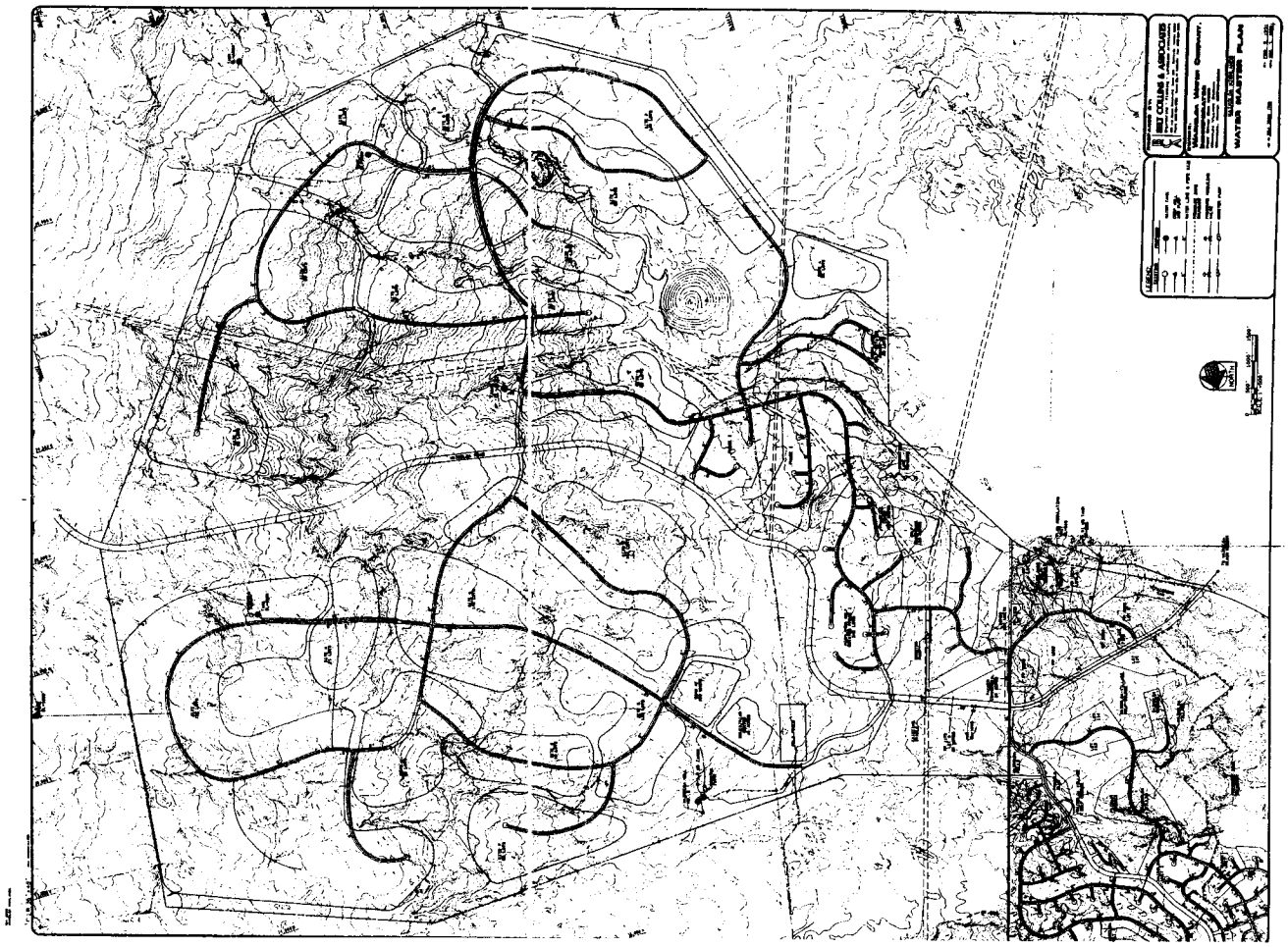
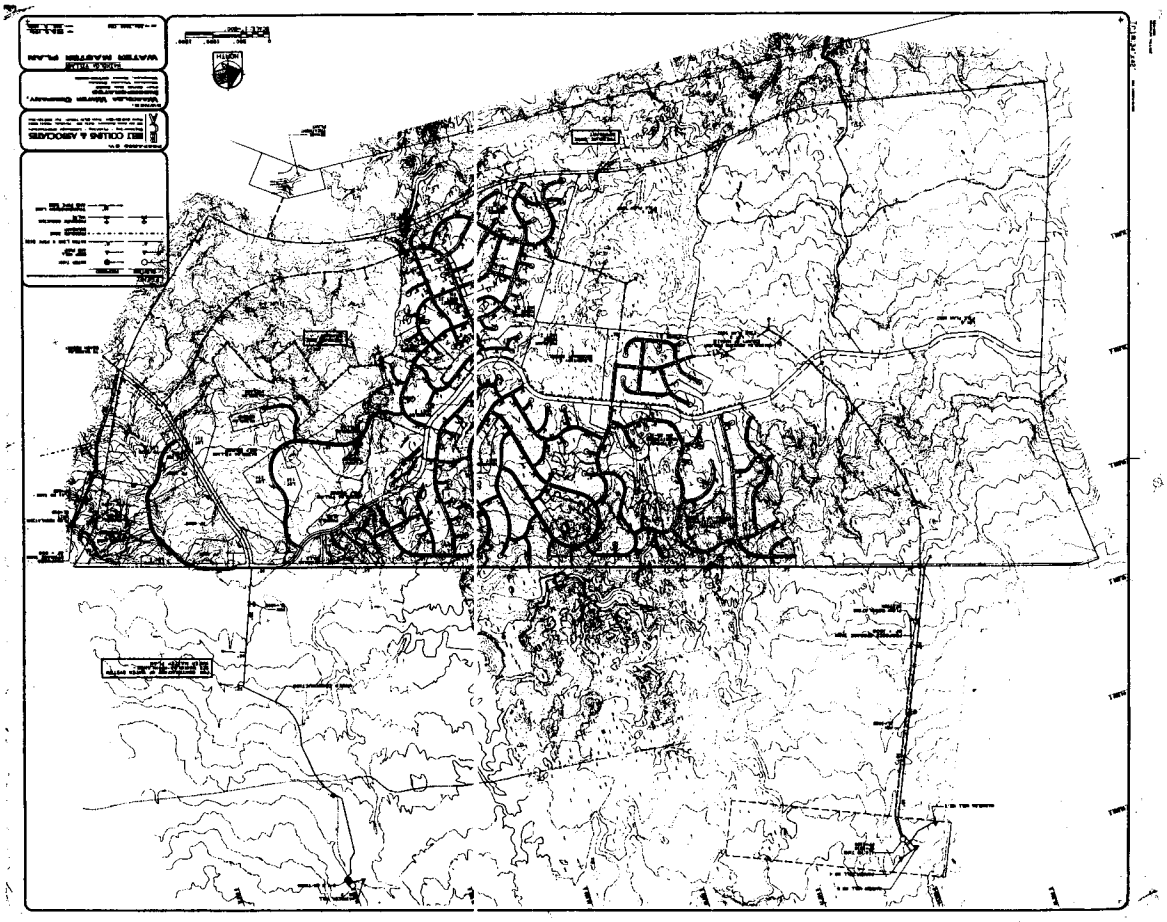


Figure 3
Hydraulic Schematic of the
Lower Half of the
Village Water Distribution System





C. Results and Recommendations

1. There are three basic options to meet projected pressure, transmission, and distribution requirements to move water from well sources to projected water use throughout the system:

   a. A parallel pipeline could be installed from the existing well field to the intersection of Waikoloa Road and Paniolo Avenue. The pipeline length would be approximately 17,000 feet. While this line would solve the immediate low pressure problems at high elevation locations in the Village, it would have more limited long-range benefit.

   b. Well supply and storage could be developed at the south end of the system. Some of this is presently underway with the outfitting of WW No. 2 and construction of the adjacent 1.0 MG tank.

   c. Pipelines through projects in the lower pressure zone of the Village could be oversized to provide transmission as well as distribution capability.

2. A combination of well development at the south end of the system and oversizing through the lower half of the Village is recommended. Exhibit A (separate map) illustrates this solution. Some of its features and benefits are discussed below.

   a. Based on computer analysis to simulate the transmission potential of an oversized pipeline through the lower half of the Village, the following is recommended:

      (i) A 1.0 MG tank should be located above Waikoloa Heights (Lot 3 of FP 1967) with a 1000-foot spillway elevation.

      (ii) The pipeline from this tank through the lower half of the Village should be 20-inch through Lot 3 and the County Housing Project and 16-inch the rest of the way to Waikoloa Road.

      (iii) Another 1.0 MG tank with a 980-foot spillway should be located above the control valve and head tank at 900 feet at the south end of the system.

      (iv) When these additions are completed, all development below the 1210-foot pressure zone of the Village would be served from the 1000- and 980-foot tanks, all interim use PRV stations could be deactivated, and substantial additional transmission capacity to the Resort would have been created.

3. Until the recommended pipeline through the lower part of the Village is completed, pressure problems at the upper end of the Village may become more severe. This potential problem can be avoided by adding additional supply at the south end of the system, either in the existing well field or within the Highlands. If these improvements or the pipeline through the lower part of the Village take longer to implement than expected, an interim solution to alleviate the pressure problem is available with the pipeline additions shown on Figure 4. Most of these lines would be incorporated in the ultimate system build-out in any event. However, the 16-inch, 2800-foot line between nodes 3 and 5 on Figure 4 would not actually be needed in the system's ultimate configuration. This segment would cost approximately $0.45 million. It should be compared against the cost of accelerating the schedule of the system build-out.

V. Highlands Distribution System

A. Problems to be Dealt With During its Development

1. The Highlands encompasses a wide range of elevation which must be divided into multiple service pressure zones.

2. The development will be extensive rather than intensive. Long pipelines will be required to supply relatively modest water use.

3. Unless well sources are developed within the area, water will have to be lifted to successive service pressure zones by booster pump stations.

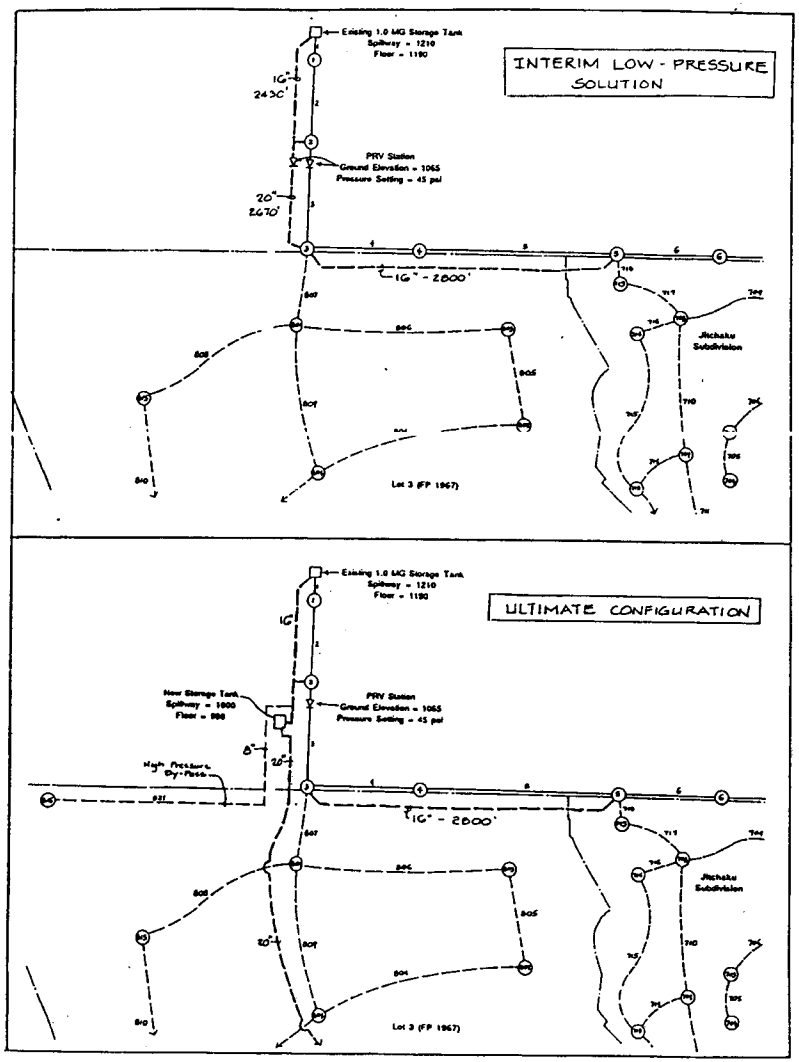


Figure 4

Recommended Interim Pipeline Addition in the Village

B. Hydraulic Model

1. Figure 5 depicts the hydraulic model used for analysis. The several significant features to note are as follows:

   a. Areas north and south of Waikoloa Road are to be served by two independent pipe networks (Golf Estates to the south and Ranch Estates to the north).

   b. Golf Estates will have four service pressure zones. Its lowest portion will be served from the 1210-foot Village tank and the three upper service zones will be supplied from tanks at 1370, 1590, and 1800 feet.

   c. There are two pressure zones in the Ranch Estates which will be served from 1590- and 1835-foot tanks. Pressures at the lower end of the 1590-foot zone will be higher than desirable and require PRVs. However, water use at this end will be too small to justify another storage tank.

C. Results and Recommendations (see Exhibit B)

1. Well development next to the Golf Estates tanks at 1370 feet initially and 1800 feet subsequently is recommended. It would provide the following advantages:

   a. It would help meet overall system well supply requirements and distribute the draft on groundwater resources over a wider area.

   b. It would avoid construction of several booster pump stations within the Golf Estates.

   c. It could deliver supply to the 1210-foot pressure zone of the Village system at an optimal location to balance drafts from the respective 1210-foot tanks and thereby alleviate present transmission capacity limitations.

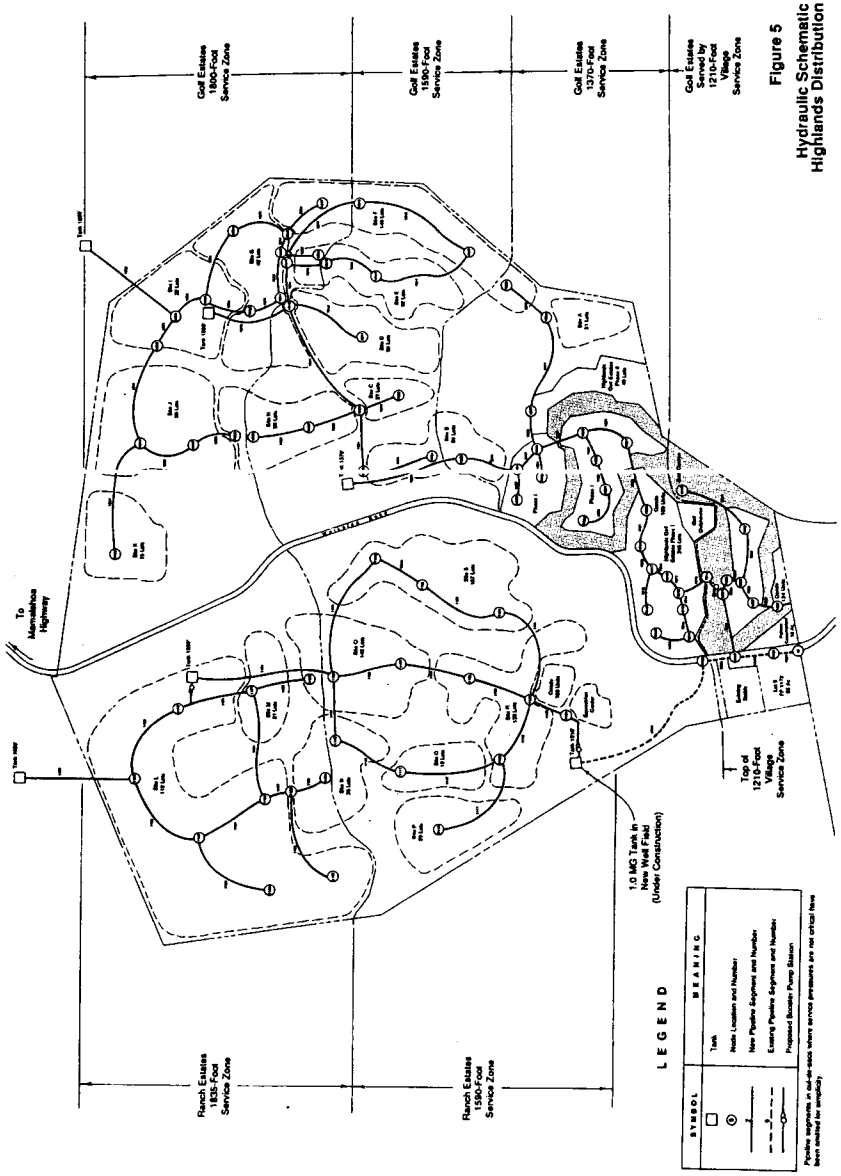


Figure 5
Hydraulic Schematic of the Highlands Distribution System

2. Golf Estates and Ranch Estates should be supplied by separate sets of tanks. This would avoid extremely long pipelines crossing Waikoloa Road and provide maximum flexibility for development phasing.

IV. Conceptual Distribution Plan for the Future Urban Expansion Area

A. Service Pressure Zones

1. Figure 6 presents a logical separation of service pressure zones between the proposed 980-foot tank in the Village and the existing 319-foot tank above the Resort.

2. Depending on the type and size of development, tanks or PRV stations could be used to create these service pressure zones.

3. Due to its elevation, the upper portion of this area could not be served from the proposed 980-foot tank and existing 16-inch transmission line. A separate pipeline, most logically to be brought down from the Highlands, would be required.

B. Pipeline Capacity

1. Relative to the Resort's ultimate transmission requirements, the 16-inch pipeline down Waikoloa Road no additional capacity to serve this area unless the 7.0 feet per second maximum pipeline velocity criterion is relaxed. Due to the elevation drop along the road, it would be physically to move more water through the line than allowed by this velocity criterion.

2. Distribution lines for development can be designed to augment the 16-inch pipeline's capacity so as to avoid a parallel transmission pipeline.

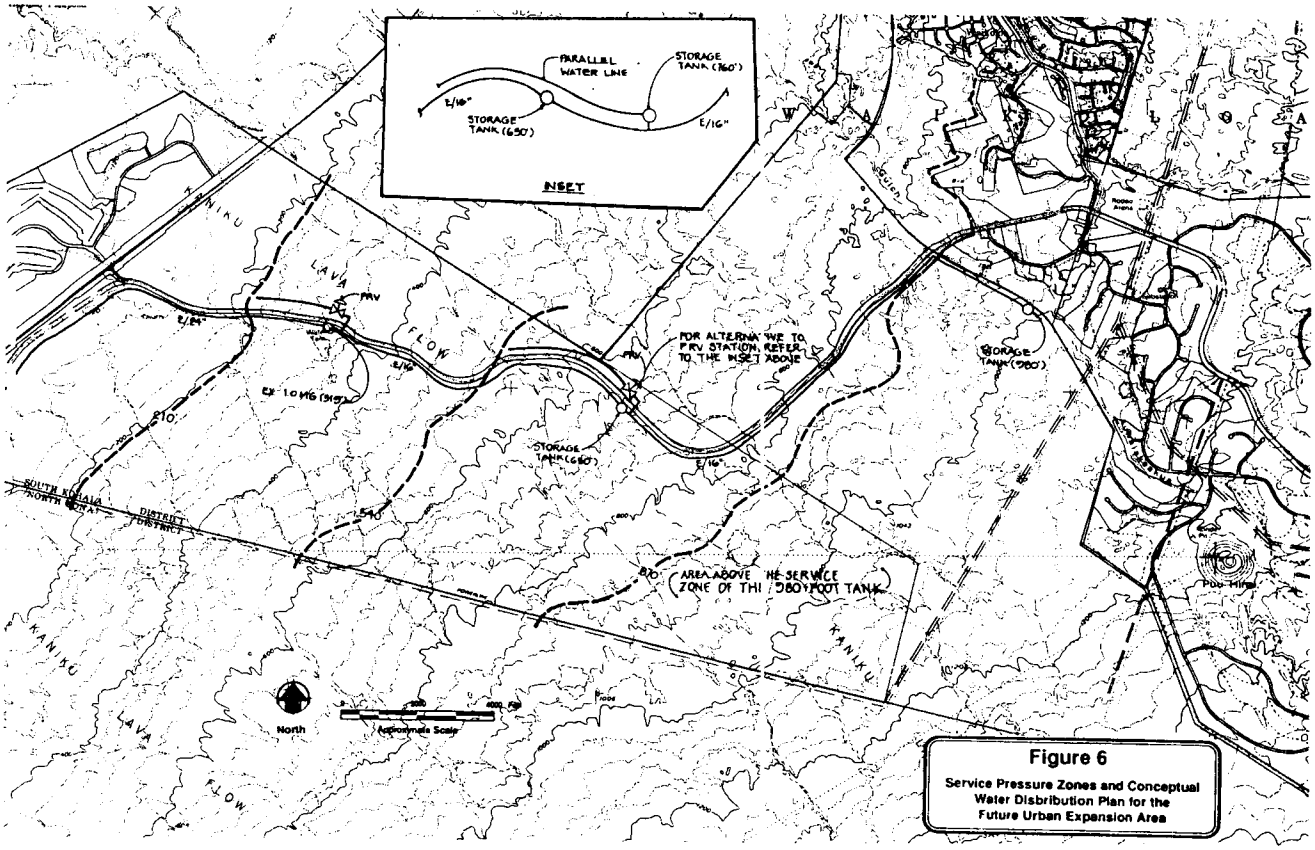


Figure 6

Service Pressure Zones and Conceptual Water Disbribution Plan for the Future Urban Expansion Area

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APPENDIX B

A Survey of Botanical, Avian and Terrestrial Mammalian Species for the Waikoloa Highlands Subdivision
Rana Productions, Ltd. and AECOS Consultants, May 2006.

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A Survey of Botanical, Avian and Terrestrial Mammalian Species for the Waikoloa Highlands Subdivision Project, South Kohala District, Island of Hawai'i.

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May 25, 2006

Table of Contents

Figures & Tables

Introduction

The Vitoil Corporation is seeking a State Land Use Boundary Amendment from Agricultural to Rural, so as to be able to develop a residential subdivision consisting of 400+ lots, in two phases, on approximately 700-acres of land identified as TMK (3) 6-8-002:0016 and 6-8-003:032 located adjacent to the existing Waikoloa Village in the South Kohala District, Island of Hawaii (Figure 1).

This report summarizes the findings of the botanical, avian and mammalian surveys that were conducted on the subject property to determine the potential effects of the proposed development on biological resources present on the site, and within the general project area.

The primary purpose of the survey was to determine if there were any botanical, avian or mammalian species currently listed as endangered, threatened, or proposed for listing under either the federal or the State of Hawai'i's endangered species programs on, or within in the immediate vicinity of the site. Federal and State of Hawai'i listed species status follows species identified in the following referenced documents (Division of Land and Natural Resources (DLNR) 1998, Federal Register 2005, U. S. Fish & Wildlife Service (USFWS) 2005, 2006). Fieldwork was conducted on May 11, through the 13, 2006.

Avian phylogenetic order and nomenclature follows *The American Ornithologists' Union Check-list of North American Birds 7th Edition* (American Ornithologists' Union 1998), and the 42nd through the 46th supplements to *Check-list of North American Birds* (American Ornithologists' Union 2000; Banks et al. 2002, 2003, 2004, 2005). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Hawai'i's ferns and fern allies* (Palmer, 2003) for ferns, *Manual of the Flowering Plants of Hawai'i* (Wagner et al. 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for ornamental plants. Place names follow *Place Names of Hawaii* (Pukui et al. 1976).

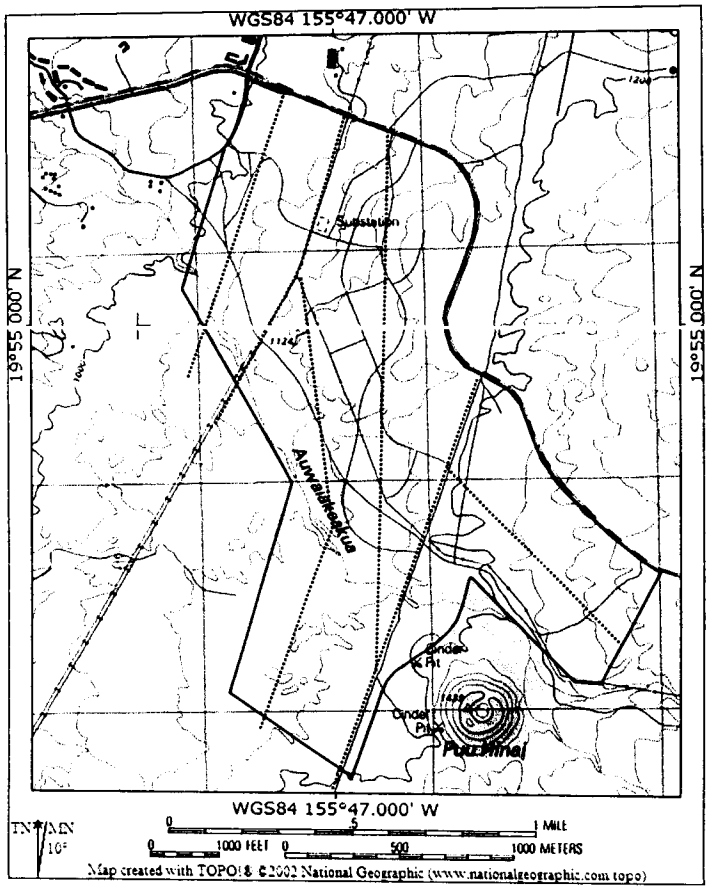
Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text on Page 19.

General Site and Project Description

The approximately 700-acre site is bound to the north by Waikoloa Road, to the west by Paniolo Avenue and to the south and east by undeveloped grassland. There is a large active quarry on Pu'u Hīna'i, a scoria cinder cone dating to the Pleistocene Age which is located immediately southeast of the proposed development (Figure 1).

The project site gently slopes from east to west, from an elevation of ~ 1,340-feet above mean sea level (MSL), at the northeastern terminus of the project, adjacent to Waikoloa

Figure 1 Waikoloa Highlands Subdivision Project Site and Wildlife Transects:
Site is Outlined in (Red) – Transects in Dotted (Blue)



Road, down to ~ 1,000-feet MSL at the western edge of the property along Auwaiakeakua Gulch, which transects the site from southeast to northwest along the southern edge of the property (United States Geological Survey 1997). The terrain is composed of a mix of *'a'ā* and *pāhoehoe* lava flows, the bulk of which were disgorged from Mauna Kea between 65,000 and 250,000 years ago during the Pleistocene Age, this in turn is overlain on the southern portion of the site below Auwaiakeakua Gulch, with newer flows deposited between 14,000 and 65,000 years ago (Wolfe and Morris 1996).

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *'ōpe'ape'a* as it is known locally, all terrestrial mammals currently found on the Island of Hawai'i are alien species. Most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all vertebrate species observed and heard within the project area. Visual and electronic scans, using a Broadband AnaBat II® ultrasonic bat detector, were made for bats during crepuscular periods on the evening of May 13, 2006.

Mammalian Survey Results

A total of eight mammalian species were detected during the course of this survey. A lone European house mouse (*Mus domesticus*) was seen crossing a four-wheel drive road adjacent to the Hawaiian Electric Light Companies substation located east of the Waikoloa Post office. Several dogs (*Canis f. familiaris*) were heard barking from within the Waikoloa Stables, located just north of the project site. One small Indian mongoose (*Herpestes a. auropunctatus*) was seen walking down the Pu'u Hīna'i Quarry access road. A litter of cats (*Felis catus*) were heard within Waiakeakua Gulch, west of the quarry. Several herds of goats (*Capra h. hircus*) were seen within the project site on all three days that we were on the property. Additionally, scat, tracks, and sign of dog, cat, horse (*Equus c. caballus*), pig (*Sus s. scrofa*), goat, and sheep (*Ovis aries*) were encountered at numerous locations within the study site. All mammals recorded are considered to be alien to the Hawaiian Islands. Hawai'i's sole endemic terrestrial mammalian species, the endangered Hawaiian hoary bat, was not detected during the course of this survey.

Avian Survey Methods

Twenty-one avian count stations were sited along linear transects within the project site (Figure 1). Count stations were placed at approximately 300-meter intervals equally spaced along these transects. Six-minute point counts were made at each of the 21-count stations. Each station was counted once. Field observations were made with the aid of Leitz 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated between 07:00 a.m. and 11:00 a.m., the peak of daily bird activity. An additional two hours were spent within the project area on the evenings of May 13, 2006, and on the

morning of February 13, 2006, in an attempt to detect nocturnally flying seabirds over-flying the project area. Time not spent counting was used to search the remainder of the project site for species and habitats that were not detected during count sessions.

Avian Survey Results

A total of 115 individual birds of nine different species, representing seven separate families, were recorded during station counts (Table 1). All nine species detected are alien to the Hawaiian Islands.

Avian diversity and densities were extremely low. Three species, Black Francolin (*Francolinus francolinus*), Sky Lark (*Alauda arvensis*), and African Silverbill (*Lonchura cantans*), accounted for more than 90% of the total number of birds recorded during station counts. The most common avian species recorded was Black Francolin, which accounted for 38% of the total number of individual birds recorded. A remarkably low number of five individual birds were recorded per station count.

Botanical Survey Methods

Botanical resources in the project area were investigated by conducting wandering "transects" over the terrain and noting species as they were encountered. Surveys were conducted on May 11-12, 2006. Photographs were taken and, in some cases, specimens collected, to verify field identifications. As the survey progressed, a total of 72-waypoints (intermittent position locations) were entered into a hand-held GPS unit (Garmin *etrex* "Vista"®). These 72-points were later downloaded into a computer-mapping program (TOPO! ®) and a map produced showing the general route of the survey (Figure 2; waypoints shown as blue diamonds with red centers). Because only waypoints of the botanists were recorded, the actual ground covered during the survey was more extensive, in addition to the fact that the actual route taken by the botanist was more convoluted than shown. This survey was conducted following a relatively wet period on Hawai'i. Consequently, most of the plants encountered (including annuals) were growing well and were in flower and/or fruiting, making positive identifications relatively easy.

A plant checklist (Table 2) was compiled from the observations, with entries arranged alphabetically under family names. Included in the list are scientific name, common name, and status (whether native or not-native) of each species. In addition to identifying the plants present within the study site, qualitative estimates of plant abundance were made. These are coded in the table as explained in the Legend to Table 2 and apply to observations made during the present survey. For some species, a two-level system of abundance is used: the letter-number codes indicating species that have a limited distribution (e.g., found in only one small area of the property), but where present occur in numbers exceeding just a few individuals. For example, an abundance rating of "R" indicates a plant encountered only one to several times during the entire survey. A "R1"

indicates a plant encountered in just one or two places, but with several individuals present in that place.

Table 1 Avian Species Detected, Waikoloa Highlands Subdivision Site

Common Name	Scientific Name	ST	RA
	GALLIFORMES		
	PHASIANIDAE – Pheasants & Partridges		
	Phasianinae – Pheasants & Allies		
Gray Francolin	*Francolinus pondicerianus*	A	0.05
Black Francolin	*Francolinus francolinus*	A	2.01
	COLUMBIFORMES		
	COLUMBIDAE – Pigeons & Doves		
Zebra Dove	*Geopelia striata*	A	0.10
Mourning Dove	*Zenaida macroura*	A	0.10
	PASSERIFORMES		
	ALAUDIDAE – Larks		
Sky Lark	*Alauda arvensis*	A	1.62
	ZOSTEROPIDAE – White-Eyes		
Japanese White-eye	*Zosterops japonicus*	A	0.05
	MIMIDAE –Mockingbirds & Thrushes		
Northern Mockingbird	*Mimus polyglottos*	A	0.10
	STURNIDAE – Starlings		
Table 1 (continued)			
Common Myna	*Acridotheres tristis*	A	0.14
	ESTRILDIDAE - Estrildid Finches		
	Estrildinae - Estrildine Finches		
African Silverbill	*Lonchura cantans*	A	1.24

KEY TO TABLE 1

ST Status
A Alien Species
RA Relative Abundance: Number of birds detected divided by the number of count stations (21)

Figure 2 Waikoloa Highlands Subdivision Project Botanical Survey Transects:
Site is Outlined in (Red) – Botanical Survey Routes in (Blue)

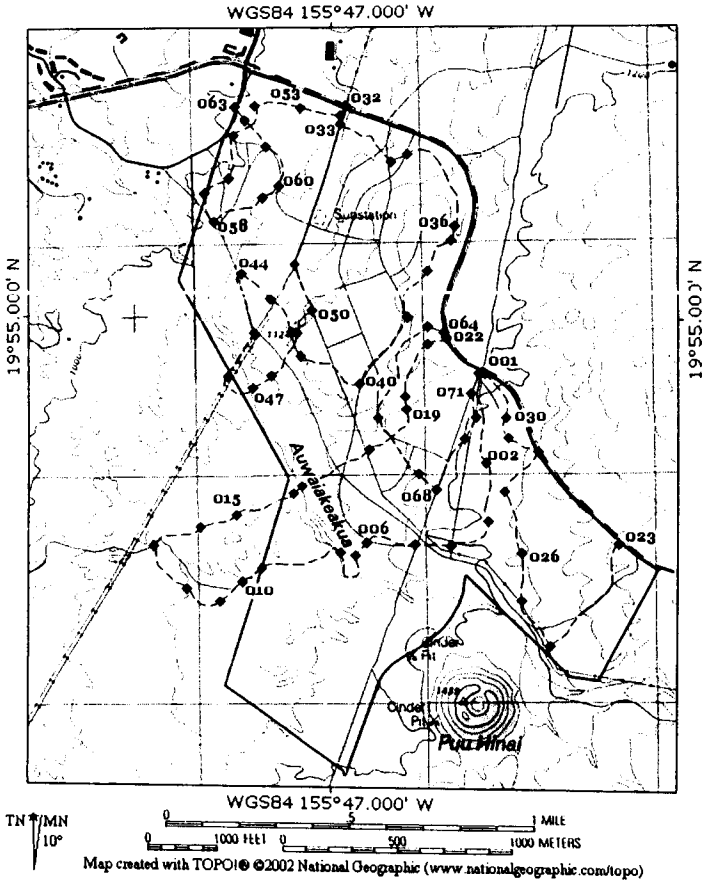


Table 2. Flora Listing, Waikoloa Highlands Subdivision Site

Species listed by family	Common name	Status	Abundance	Notes
FERNS AND FERN ALLIES				
PTERIDACEAE				
Pellaea ternifolia (Cav.) Link	*kalamoho lau li'i*	**Ind.**	R1	(1)
Pteris hillebrandii Copel.	---	**End.**	R1	(1)
FLOWERING PLANTS				
DICOTYLEDONES				
AMARANTHACEAE				
Amaranthus spinosus L.	spiny amaranth	Nat.	R	(1)
ANACARDIACEAE				
Schinus molle Raddi	California pepper tree	Orn.	R	
ASCLEPIADACEAE				
Calotropis gigantia (L.) W. T. Aiton	crown flower	Orn.	R	
ASTERACEAE (COMPOSITAE)				
Ageratum conyzoides L.	*maile honohono*	Nat.	O3	
Conyza bonariensis (L.) Cronq.	hairy horseweed	Nat.	U	
Galinsoga cf. *parviflora* Cav.	---	Nat.	U2	(1)
Emilia fosbergii Nicolson	*pualele*	Nat.	O	
Pseudognaphalium sp.	---	???	U	
Senecio madagascariensis Poir.	---	Nat.	C	
Sonchus oleraceus L.	sow thistle	Nat.	R	
Verbesina enceliodes (Cav.) Benth. & Hook.	golden crown-beard	Nat.	U2	(1)
Xanthium strumarium L.	*kikiana*, cockleburr	Nat.	R	(1)
Zinnia peruviana (L.) L.	Peruvian zinnia	Nat.	R	
Indet. sp. resembling *Hypochoeris glabra*	---	Nat.	R	(1)
BRASSICACEAE				
Lepidium sp.	---	Nat.	R	(3)
CARYOPHYLLACEAE				
Petrorhagia velutina (Guss.) P. Ball & Heyw.	childing pink	Nat.	O	
CHENOPODIACEAE				
Atriplex semibaccata R. Br.	Australian saltbush	Nat.	R	
Chenopodium carinatum R.Br.	---	Nat.	R	
Chenopodium oahuense (Meyen) Aellen.	*`aheahea*	**End.**	O2	
CONVOLVULACEAE				
Ipomoea indica (J. Burm.) Merr.	*koali'awa*	**Ind.**	U	
Jacquemontia ovalifolia (Choisy) H. Hallier	*pa'u-o-Hi'iaka*	**Ind.**	U2	
CUCURBITACEAE				
Momordica charantia L.	balsam pear	Nat.	R	

Table 2 (continued).

Species listed by family	Common name	Status	Abundance	Notes
EUPHORBIACEAE				
Chamaesyce hirta (L.) Millsp.	garden spurge	Nat.	R3	
Chamaesyce hypercifolia (L.) Millsp.	graceful spurge	Nat.	R	
Euphorbia lactea Haworth	mottled-candlestick tree	Orn.	R	
Ricinus communis L.	castor bean	Nat.	U2	
FABACEAE				
Chamaecrista nictitans (L.) Moench	partridge pea	Nat.	C	
Crotalaria incana L.	fuzzy rattlepod	Nat.	C	
Crotalaria pallida Aiton	smooth rattlepod	Nat.	U	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat.	A	
Erythrina sandwicensis Degener	*wiliwili*	**End.**	R	
Indigofera suffruticosa Mill.	indigo	Nat.	C3	
Macroptilium lathyroides (L.) Urb.	cow pea	Nat.	R	
Medicago lupulina L.	black medic	Nat.	U2	
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat.	O2	
LAMIACEAE				
Ocium basilicum L. var. *thyrsilflorum* (L.) Benth.	Thai basil	Orn.	R	(2)
MALVACEAE				
Malva parviflora L.	cheese weed	Nat.	R	(1)
Sida ciliaris L.	---	Nat.	R	
Sida fallax Walp.	*`ilima*	**Ind.**	A	
Sida rhombifolia L.	---	Nat.	R	(2)
MOLLUGINACEAE				
Mollugo cerviana (L.) Ser.	threadstem carpetweed	Nat.	C	
PORTULACACEAE				
Portulaca pilosa L.	---	Nat.	R	
SAPINDACEAE				
Dodonaea viscosa Jacq.	*'a'ali'i*	**Ind.**	O2	
SOLANACEAE				
Nicotiana glauca R.C. Graham	tree tobacco	Nat.	O3	
Solanum americanum Mill.	*popolo*	**Ind.**	R	
STERCULIACEAE				
Waltheria indica L.	*`uhaloa*	**Ind.**	A	
THYMELAEACEAE				
Wikstroemia pulcherrima Skottsb.	*'akia*	**End.**	U3	
VERBENACEAE				
Verbena litoralis Kunth	*owi*	Nat.	R	(1)

Table 2 (continued).

Species listed by family	Common name	Status	Abundance	Notes
	MONOCOTYLEDONES			
POACEAE				
Cenchrus ciliaris L.	buffelgrass	Nat.	AA	
Eleusine indica (L.) Gaertn.	beach wiregrass	Nat.	U	(2)
Eragrostis variabilis (Gaud.) Steud.	*kawelu*	**End.**	AA	
Melinus repens (Willd.) Zizka	Natal redtop	Nat.	U	
Panicum maximum Jacq.	Guinea grass	Nat.	U3	
Pennisetum setaceum (Forssk.) Choiv.	fountain grass	Nat.	AA	
Setaria gracilis Kunth	yellow foxtail	Nat.	U3	(1)
Indet. grass	small three-awn	???	R2	

Legend to Table 2

STATUS = distributional status for the Hawaiian Islands:
- end. = endemic; native to Hawaii and found naturally nowhere else.
- ind. = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.
- nat. = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
- orn. = exotic, ornamental or cultivated; plant not naturalized (not well-established outside of cultivation).
- pol. = Polynesian introduction before 1778.

ABUNDANCE = occurrence ratings for plants by area:

R – Rare	seen in only one or perhaps two locations.
U - Uncommon-	seen at most in several locations
O - Occasional	seen with some regularity
C - Common	observed numerous times during the survey
A - Abundant	found in large numbers; may be locally dominant.
AA - Very abundant	abundant and dominant; defining vegetation type.

Numbers following an occurrence rating indicate clusters within the survey area. The ratings above provide an estimate of the likelihood of encountering a species within the specified survey area; numbers modify this where abundance, where encountered, tends to be greater than the occurrence rating:
- 1 – several plants present
- 2 - many plants present
- 3 – locally abundant

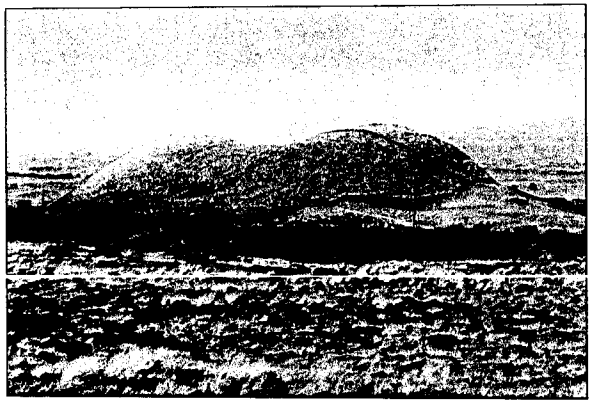
NOTES:
- (1) — Seen only along the bottom of Auwaiakeakua Gulch (riparian) or a tributary stream
- (2) — Seen only along the highway shoulder area
- (3) — Plants lacking important diagnostic characters (e.g., no flowers or fruit)

Botanical Survey Results

The flora in the project area is listed above in Table 2. The site is nearly completely covered with grassland and the terrain becomes increasingly stony to the south of Auwaiakeakua Gulch (Figure 3). An exception is the riparian zone along Auwaiakeakua Stream beside Pu'u Hīna'i, where an open *kiawe* forest with grassland understory is present on moderately thick soil and alluvial bed deposits of sand and gravel. In the deeper soils all along the gulch bottom several different grasses predominate in large patches, with buffelgrass (*Cenchrus ciliaris*) and yellow foxtail (*Setaria gracilis*) most

conspicuous (Figure 4). Note in Table 2, that a number of mostly weedy species were observed on the property only along the bottom of the gulch, reflecting germination of seeds encouraged by the recent wet season flows.

Figure 3. View towards Pu'u Hīna'i



The above figure illustrates the predominance of open grassland within the site with the exception of the bottom of Auwaiakeakua Gulch where *kiawe* trees form an open forest. Elsewhere, three species of grasses form extensive monotypic stands or are variously intermixed: *kāwelu* grass (*Eragrostis variabilis*), buffelgrass, and fountain grass (*Pennisetum setaceum*). The later two are non-natives that are extremely abundant on undeveloped lowlands of West Hawai'i. Figure 4 illustrates a portion of Auwaiakeakua Gulch which is characterized by deep soil with a dense growth of non-native grasses.

The Kāwelu Grassland forms a nearly monospecific grass stand over a wide area near the center of the property, but is mixed with other grasses towards the margins and heavily invaded by these non-native grasses wherever roadways have been cut through the *kāwelu* stand. Several shrubs are associated with the Kāwelu Grassland: *'ilima* (*Sida fallax*), *'a'ali'i* (*Dodonaea viscosa*), and *koa haole* (*Leucaena leucocephala*) (Figure 5). Buffelgrass predominates in most other areas, although fountain grass is increasingly dominant on the very stony pāhoehoe flow south of Auwaiakeakua Gulch.

Shrub species that are common to abundant on the property include fuzzy rattlepod (*Crotalaria incana*), indigo (*Indigofera suffruticosa*; especially in the area of pahoehoe lava flow), and *koa haole*. A small cluster of perhaps three dozen native *'akia* (*Wikstroemia pulcherrima*) occurs east of the quarry entrance road not far in from Waikoloa Road. *'Uhaloa* (*Waltheria indica*) is ubiquitous over the area, whereas tree

tobacco (*Nicotiana glauca*) is more common over the *pāhoehoe* flow on the south. *'Āheahea*, (*Chenopodium oahuense*), another native shrub, is limited in its distribution in the survey area to the northwest corner nearest Waikoloa Village.

Figure 4. Auwaiakeakua Gulch Characterized by Deep Soil and Alien Grasses

Figure 5. Kāwelu Grassland and Low Stature Shrubs: 'ilima and koa haole.

The *kiawe* is the most abundant tree species on the property, but is sparse outside of the riparian zone in the vicinity of Pu'u Hīna'i (Figure 3). A very few and widely scattered native *wiliwili* (*Erythrina sandwicensis*) trees are present within the site.

Discussion

Mammalian Resources

The findings of the mammalian survey are consistent with at least one other faunal survey conducted on lands immediately adjacent to the subject property (David 1999), as well as with other surveys conducted within similar habitat in the South Kohala District within the recent past (David 1996, 2000a, 2000b, 2002, 2004, 2005a, 2005b, 2006a).

Although not detected during the course of this survey, it is likely that Hawaiian hoary bats over-fly the site occasionally, as they have been recorded hawking for insects over at least one water feature within the Waikoloa Golf Course, and in as skeletal remains within a cave system found south of Pu'u Hīna'i (David 2006b).

Unlike nocturnally flying seabirds, which often collide with man-made structures, bats are uniquely adapted to avoid collision with most obstacles, man-made or natural. They navigate and locate their prey primarily by using ultrasonic echolocation, which is sensitive enough to allow them to locate and capture small volant insects at night.

Very little research into the life cycle, distribution, or population estimates of this species, has been conducted; and much of what has been studied, were small, disconnected, or anecdotal studies as opposed to coherent controlled experiments. Fundamental research into this species distribution and life cycle has just begun (Bonaccorso et al. 2005).

Although we only recorded one rodent, a European house mouse, it is likely that the other three naturalized rodents present in Hawai'i, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), and possibly Polynesian rats (*Rattus exulans hawaiiensis*) utilize resources found within the project site.

Avian Resources

Avian diversity and densities were in keeping with the habitat present within the project area. The findings of the avian survey are consistent with are consistent with at least one other faunal survey conducted on lands immediately adjacent to the subject property (David 1999), as well as with other surveys conducted within similar habitat in the South Kohala District within the recent past (David 1996, 2000a, 2000b, 2002, 2004, 2005a, 2005b, 2006a).

A total of nine avian species were detected during the course of this survey (Table 1). All nine species are alien to the Hawaiian Islands. Between late July and the end of April it is likely that one indigenous migratory species, Pacific Golden-Plover (*Pluvialis fulva*) use resources within the project site. This species is a commonly encountered migratory shorebird, which nests in the high Artic during the summer months, but returns to

Hawai'i and the Tropical Pacific to spend the winters. Additionally, it is probable that the endemic Hawaiian sub-species of the nearly cosmopolitan Sort-eared Owl (*Asio flammeus sandwichensis*) uses resources within the general project area, as this species has been regularly documented within the South Kohala grasslands (David 2002, 2005a, 2005b, 2005c, 2006b).

Although not detected during this survey, it is possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened Newell's Shearwater (*Puffinus auricularis newelli*), over-fly the project area between the months of May and November (Banko 1980a, 1980b, Harrison 1990, Day et al. 2003a). Recent surveys using ornithological radar have recorded both species flying inland from Kawaihae (Day et al. 2003a)

Hawaiian Petrels were formerly common on the Island of Hawai'i (Wilson and Evans 1890–1899). This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea (Henshaw 1902), as well as at the mid-to-high elevations of Mount Hualālai. It has, within recent historic times, been reduced to relict breeding colonies located at high elevations on Mauna Loa and, possibly, Mount Hualālai (Banko 1980a, Banko et al. 2001, Cooper and David 1995, Cooper et al. 1995, Day et al. 2003a, Harrison 1990, Simons and Hodges 1998). The United States Fish & Wildlife Service listed Hawaiian Petrels as an endangered species in 1967 and by the State of Hawai'i in 1973 (Federal Register 1967, DLNR 1998)

Newell's Shearwaters were formerly common on the Island of Hawai'i (Wilson and Evans 1890–1899). This species breeds on Kaua'i, Hawai'i, and Moloka'i. Newell's Shearwater populations have dropped precipitously since the 1880s (Banko 1980b, Day et al., 2003b). This pelagic species nests high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern. Newell's Shearwater was listed as a threatened species by the USFWS in 1975 and by the State of Hawai'i in 1973 (Federal Register 1975, DLNR 1998).

The primary cause of mortality in both Hawaiian Petrels and Newell's Shearwaters is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983, Simons and Hodges 1998, Ainley et al. 2001). Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961, Telfer 1979, Sincock 1981, Reed et al. 1985, Telfer et al. 1987, Cooper and Day 1998, Podolsky et al. 1998, Ainley et al. 2001). There is no suitable nesting habitat within or close to the project area for either of these pelagic seabird species.

Botanical Resources

The flora of the project area is comprised mostly of lichens on exposed rock surfaces and flowering plants. Over much of the area, alien plant species predominate. A total of 58-species of plants including two species of ferns, were observed during the plant survey (Table 2). The dry climate and well-drained soils are not conducive to supporting most fern species found in Hawai'i, and the two species observed occurred in small numbers on exposed rock areas in a normally dry wash. However, both species (*Pelaea ternifolia* and *Pteris hillebrandii*) are natives, the latter is an endemic.

Of the 56-species of flowering plants listed in the table, ten (10 or 17.9%) are known to have been present in the Hawaiian Islands prior to the arrival of James Cook in 1778. Of these 10, four are endemic, and the remaining six are indigenous species. If we consider the abundance estimates for these native species, several are very abundant in the project area: notably *kāwelu* (*Eragrostis variabilis*) and *'ilima* (*Sida fallax*). Both were most abundant in the central part of the property.

Although the property is mostly covered by non-native grasslands, and these grasslands are best developed along the low areas of Auwaiakeakua gulch. a native Kāwelu Grassland occupies the more central part of the property roughly between the highway (Waikoloa Road) and the gulch and the quarry entrance road and the powerline road. Close to the highway and close to the gulch, non-native grasses dominate, and within the *kāwelu* stand, non-native grasses dominate all areas of previous grading, as has occurred for access roads and fire suppression. This distribution suggests that a *kāwelu* grassland is capable of excluding the prolific non-native grasses—such as bufflegrass and fountain grass that now dominate the landscape of West Hawai'i—until a disturbance and then non-natives invade and are effective at preventing reestablishment of *kāwelu*.

Potential Impacts to Protected Species

Hawaiian Hoary Bat

As previously discussed, it is likely that Hawaiian hoary bats over-fly the general project area on a seasonal basis. There is no suitable vegetation on the site for bats to roost in, so it is unlikely that the clearing of the current vegetation, and the development of a subdivision on this property will result in deleterious impacts to this species. The planting of trees and ornamental vegetation following development may increase the presence of prey items for this insectivorous bat, and thus may in fact enhance foraging resources for this species in the area.

Hawaiian Petrel and Newell's Shearwater

The principal potential impact that the development of the proposed Waikoloa Highlands Subdivision poses to Hawaiian Petrels and Newell's Shearwaters is the increased threat that birds will be downed after becoming disoriented by street lights associated with the new development.

Botanical Resources

No plant species currently listed as endangered, threatened, or proposed for listing under either the federal or the State of Hawai'i's endangered species programs were recorded within or close to the proposed project site.

Conclusions

It is not expected that the development of the proposed Waikoloa Highlands Subdivision will result in deleterious impacts to native avian or mammalian resources present within the South Kohala District. There will be adverse impacts to the native plant assemblages present within the site.

Recommendations

If streetlights are installed in conjunction with the various new roads planned for this new subdivision, it is recommended that lights be shielded to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et al. 1985, Telfer et al. 1987). This mitigation would serve the dual purpose of minimizing the threat of disorientation and downing of Hawaiian Petrels and Newell's Shearwaters, while at the same time complying with the Hawaii County Code § 14 – 50 *et seq.* which requires the shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting to the astronomical observatories located on Mauna Kea.

Use of plants indigenous to the area is encouraged for landscaping of public areas following development. The '*akia* found here (*Wikstroemia pulcherrima*) is an especially attractive plant that has potential to be a signature plant for the development. *Wiliwili* trees, increasingly rare in the Waikoloa area, are likewise deserving of consideration for wider planting in the area. Native plantings would have a distinct advantage over more typical landscape schemes of not requiring irrigation once the plants become established.

Glossary:

'A'ā – Clinker lava formed by slow moving lava flows
Alien – Introduced to Hawai'i by humans
Crepuscular – Twilight hours
Endangered – Listed and protected under the Endangered Species Act of 1973, as amended as an endangered species.
Endemic – Native and unique to the Hawaiian Islands
Indigenous – Native to the Hawaiian Islands, but also found elsewhere naturally
Nocturnal – Night-time, after dark
Pāhoehoe – Sheet lava formed by relatively fast moving lava flows
Pelagic – An animal that spends its life at sea – in this case seabirds that only return to land to nest and rear their young
Threatened – Listed and protected under the ESA as a threatened species
Volant – Flying, capable of flight, as in flying insect

DLNR – Hawaii State Department of Land & Natural resources.
MSL – Mean Sea Level
TMK – Tax Map Key
USGS – United States Geological Survey
USFWS – United States Fish & Wildlife Service

Literature Cited:

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, *In*: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22:. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. (Pg. 108-123)

American Ornithologist's Union. 1998. *Check-list of North American Birds*. 7th edition. AOU. Washington D.C. 829pp.

_____. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 117:847-858.

Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 119:897-906.

_____. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 120:923-931.

_____. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 121:985-995.

_____. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 122:1031-1031.

Banko, W. E. 1980a. Population Histories- Species Accounts Seabirds: Hawaiian Dark-rumped Petrel ('Ua'u). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Department of Botany, Technical Report #5B.

_____. 1980b. Population Histories- Species Accounts Seabirds: Newell's Shearwater ('A'o). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Department of Botany, Technical Report #5A.

Banko, P. C., R. E. David, J. D. Jacobi, and W. E. Banko. 2001. Conservation Status and Recovery Strategies for Endemic Hawaiian Birds, *In:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas (Pg. 359-376).

Bonaccorso, F. J., C. M. Todd and, A. C. Miles. 2005. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Ope'ape'a, *Lasiurus cinsereus semotus*. 1 September 2004 to 31 August 2005

Cooper, B. A. and R. E. David. 1995. Radar and Visual Surveys of Seabirds in the HELCO SSP Unit 71, Puna, Hawaii, During July 1995. Prepared for R. M. Towill Corporation & Hawaii Electric Light Co.

Cooper, B.A., R.E. David, and R.J. Blaha. 1995. Radar and Visual Surveys of Endangered Seabirds and Bats in the Pohakuloa Training Area, Hawai'i, During Summer 1995. Prepared for R.M. Towill Corporation and the U.S. Army Corps of Engineers, Pacific Division (POD).

Cooper, B. A and R. H. Day. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newells' Shearwaters at Power Lines on Kauai. Colonial Waterbirds, 21 (1): 11-19.

David, R. E. 1996. Ornithological and Mammalian Surveys of the Waikaloa Maneuver Area, Waimea, Island of Hawai'i, Hawaii. Prepared for: Wil Chee Planning and the U.S. Army Corps of Engineers, Pacific Ocean Division . 32 pp.

_____. 1999. A Survey of Terrestrial Vertebrate Species Associated with the Waikoloa Maneuver Area, Phase II: Waikoloa Village and Surrounding Areas, Island of Hawai'i, Hawai'i. Prepared for: Edward K. Noda & Associates and the U.S. Army Corps of Engineers, Pacific Ocean Division.

_____. 2000a. Waimea Trails and Greenways Avian and Mammalian Surveys. Prepared for: AECOS Consultants, and Gerald Park Consulting.

_____. 2000b. A Survey of Terrestrial Vertebrate Species Associated with the Ordnance Avoidance and Environmental Survey of the Former Nansay Hawaii Lands at Ouli, DERP-FUDS Site No. H09H1004301 and Puako, DERP-FUDS Site No. H09H1004302, South Kohala, Hawai'i. Prepared for: Donaldson Enterprises, Inc. and the U.S. Army Corps of Engineers, Pacific Ocean Division .

_____. 2002. A Survey of Avian and Terrestrial Mammalian Species for the Saddle Road Extension Project : Queen Ka'ahumanu Highway to Mamalahoa Highway South Kohala & North Kona Districts, Hawai'i. Prepared for: Okahara & Associates, and Hawai'i Department of Transportation, Highways Division.

_____. 2004. A Survey of Terrestrial Vertebrate Species Associated with the Ordnance Avoidance and Environmental Survey of Sector 15 of the former Waikoloa Maneuver Area, Phase III. South Kohala and Hamakua Districts, Island of Hawai'i. Prepared for: Donaldson Enterprises Inc. & the U.S. Army Corps of Engineers, Pacific Ocean Division.

_____. 2005a. A Survey of Avian and Terrestrial Mammalian Species for the Waimea Bypass Highway: Hawai'i: Belt Road, Mud Lane to Parker Ranch Racetrack, South Kohala District, Island of Hawai'i. Prepared for: Akinaka & Associates, Inc and State of Hawai'i Department of Transportation, Highways Division (HDOT).

_____. 2005b. A Survey of Avian and Terrestrial Mammalian Species, on the Proposed Kanu o Ka'Āina Learning 'Ohana Site, South Kohala District, Island of Hawai'i. Prepared for: Kanu o Ka'Āina Learning 'Ohana.

_____. 2006. A Survey of Avian and Terrestrial Mammalian Species for the Māmalahoa Highway to Kawaihae Road Connector Project, South Kohala District, Island of Hawai'i. Prepared for Belt Collins Hawaii, Inc. and the County of Hawai'i, Department of Transportation.

David, R. E 2006. Unpublished Field Notes – Island of Hawai'i: 1985-2006.

Day, R. H., B. Cooper, and R. J. Blaha. 2003a. Movement Patterns of Hawaiian Petrels and Newell's Shearwaters on the Island of Hawai'i. Pacific Science, 57, 2:147-159.

Day, R. H., B. Cooper, and T. C. Telfer. 2003b. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. The Auk 120: 669-679.

Department of Land and Natural Resources. (DLNR). 1998. Indigenous Wildlife, Endangered and Threatened Wildlife and Plants, and Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

Federal Register. 2005b. Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual Description of Progress on Listing Actions. Federal Register, 70 No. 90 (Wednesday, May 11, 2005): 24870-24934.

Hadley, T. H. 1961. Shearwater calamity on Kauai. Elepaio 21:60.

Harrison, C. S. 1990. *Seabirds of Hawaii: Natural History and Conservation*. Cornell University Press, Ithica, N.Y. 249 pp.

Henshaw, H.W. 1902. *Complete list of birds of the Hawaiian Possessions with notes on their habits*. Thrum, Honolulu. 146 pp.

Jacobs, D. S. 1994. Distribution and Abundance of the Endangered Hawaiian Hoary Bat, *Lasiurus cinereus semotus*, on the Island of Hawai'i. Pacific Science, Vol. 48, No. 2: 193-200.

Palmer, D. D. 2003. *Hawai'i's ferns and fern allies*. University of Hawaii Press, Honolulu. 324 pp.

Podolsky, R., D.G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. "Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kaua'i". Colonial Waterbirds 21:20-34.

Pukui , M. K., S. H. Elbert, and E. T. Mookini. 1976. *Place Names of Hawaii*. University of Hawaii Press. Honolulu, Hawai'i. 289 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. Auk 102: 377-383.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell ' s Shearwater. Pages 76-78 in Proceedings of the Hawaii Forestry and Wildllife Conference, 2-4 October 1980. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Staples, G. W. and D. R. Herbst. 2005. *A Tropical Garden Flora. Plants Cultivated in the Hawaiian Islands and other Tropical Places*. Bishop Museum, Honolulu. 908 pp.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. 'Elepaio 39:71

Telfer, T. C. , J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. Wildlife Society Bulletin 15:406-413.

Tomich, P.Q. 1986. *Mammals in Hawaii*. Bishop Museum Press. Honolulu, Hawaii. 37 pp.

U.S. Fish & Wildlife Service (USFWS) 1983. Hawaiian Dark-Rumped Petrel & Newell's Manx Shearwater Recovery Plan. USFWS, Portland, Oregon. February 1983.

_____. 1998. Recovery Plan for the Hawaiian Hoary Bat. U.S. Fish & Wildlife Service, Portland, Oregon.

_____. 2005. Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 (Tuesday, November 1, 2005).

_____. 2006. USFWS Threatened and Endangered Species System (TESS), online at http://ecos.fws.gov/tess_public/StartTESS.do

United States Geological Survey (USGS). 1997. Pu'u Hinai Quadrangle, Hawaii, Hawaii Co. 7.5 minute series (Topographic). Denver, Colorado.

Wagner, W.L., D.R Herbst, and S.H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai'i*. University of Hawaii Press, Honolulu, Hawaii 1854 pp.

Wagner, W.L. and D.R. Herbst. 1999. *Supplement to the Manual of the flowering plants of Hawai'i*, pp. 1855-1918. *In:* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the flowering plants of Hawai'i. Revised edition. 2 vols. University of Hawaii Press and Bishop Museum Press, Honolulu.

Wilson, S. B., and A. H. Evans. 1890-1899. *Aves Hawaiiensis: The birds of the Sandwich Islands*. R. H. Porter, London.

Wolfe, E. W., and J. Morris. 1996. Geological Map of the Island of Hawaii. U.S. Department of the Interior, U.S. Geological Survey.

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APPENDIX C

Social Impact Assessment
SMS Research, September 2006.

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SOCIO-ECONOMIC IMPACTS
WAIKOLOA HIGHLANDS

September 18, 2006

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CONTENTS

SOCIO-ECONOMIC IMPACTS
WAIKOLOA HIGHLANDS

1. INTRODUCTION

Waikoloa Highlands is designed to include 398 improved lots, covering a total of 700 acres, upon which buyers will build homes within the limits of the deed restrictions. A percentage of the ~~remaining~~ 1,300 acres will become areas for passive recreation and open space, complete with trails and other appropriate amenities.

The following section discusses the socio-economic context within which the project is located, specifically the South Kohala region and Hawaii Island as a whole; as well as the socio-economic impacts this project will have on South Kohala and the specific community of Waikoloa. This section will also present the concerns of community representatives and members, and public officials, as they related to the project as a whole and some of the anticipated socio-economic impacts. It concludes with a discussion of possible measures, which can be taken to address some of these concerns.

2. THE SOCIO ECONOMIC CONTEXT

When first proposed for development by Boise Cascade in the 1960's, The Village of Waikoloa showed promise as an entirely new town in the South Kohala region. In reality, except for its initial growth spurt in the 70's and 80's, the growth of Waikoloa has been modest. The area has settled nicely as a suburban community with its residents being employed primarily in Kamuela and in the visitor industry plant along the Gold Coast. Although the Waikoloa Village Golf Course does attract some external business, for the most part Waikoloa Village basically services its residents and the travelers who pass through in transit between Kamuela and the Coastal areas.

All of this is changing as Hawaii County and the South Kohala region experience strong growth pressures, and the visitor plant along the Coast continues to expand and enjoy record business. This pressure has resulted in record low unemployment, record low residential vacancy rates and record high housing costs. None of this phenomenon is good for sustainable growth in a region. In a response to these factors, Waikoloa is experiencing a resurgence in residential development proposals, and possibly an increase in development activity. Projects that have progressed far beyond the talking stages include Waikoloa Heights (1,000 units), the County's Affordable Housing Project (1,000 units) and Waikoloa Highlands (398 units). Given that there are only 1,750 units in Waikoloa today, these three projects alone will more than double the size of the village.

2.1 Economic Context

2.1.2 Hawaii Island

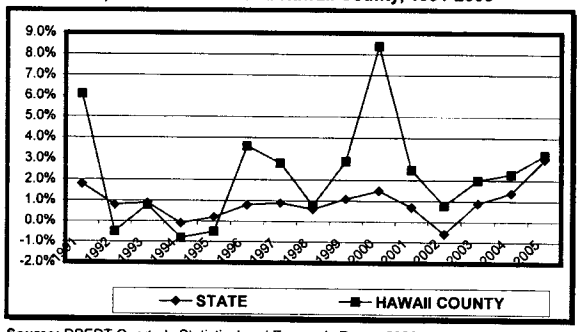
From the early 1980's to 1990 the State's economy grew quickly. In the 1990's that growth began to stagnate and it has, only in recent years, begun to return to a healthier stable growth rate. By the end of 2005, the State's unemployment rate of 2.8 was the lowest in the United States.

Somewhat contrary to Statewide trends, Hawaii County's economy has been experiencing wide scale growth for the last decade. In terms of job growth, Hawaii County has exceed the states growth since 1996 (See Exhibit 2.1). Although the civilian labor force has also increased significantly, it has not kept pace with employment opportunities, resulting in an unemployment rate that has been steadily shrinking since the mid 90's.

The visitor industry has been the backbone of that economic growth. Visitor arrivals and hotel occupancy have risen steadily over that period as each indicator rose sharply in 2005. In 2005, Hawaii County's share of the statewide visitor count was at its highest level, 15 percent, since 1998, up from 12 percent in the previous year (see Exhibit 2.4). Interestingly, Hotel Occupancy rates have risen more modestly than visitor counts, thereby supporting the contention that it is the expanding cruise ship market that is triggering much of this growth. Whether true or not, it portends further visitor count increases in the near future and greater pressure on the island's housing infrastructure to accommodate the employment demand increases.

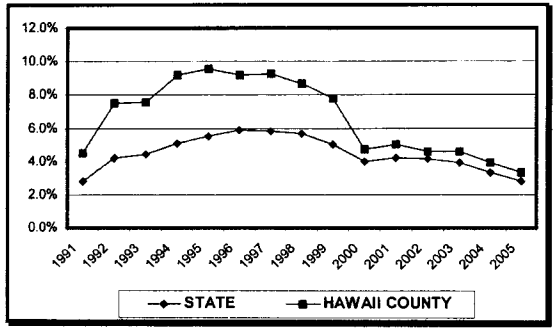
The leisure and hospitality industry accounts for the largest proportion of jobs, 22 percent, followed by government, which accounts for 18 percent of Hawaii County jobs. County officials believe that diversifying the economy is crucial to the economic health of the county and have been working at accomplishing that objective. In fact, since the early 1990's, Hawaii County has witnessed annual job growth in virtual every industry. They have not yet, however, achieved the economic diversification they would prefer.

Exhibit 2.1: Job Growth, State of Hawaii and Hawaii County, 1991-2005



Source: DBEDT Quarterly Statistical and Economic Report 2006

Exhibit 2.2: Unemployment Rate, State of Hawaii and Hawaii County, 1991-2005



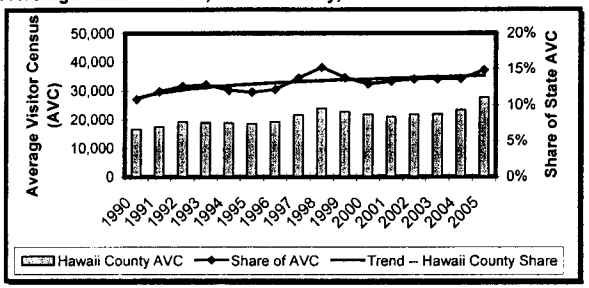
Source: DBEDT Quarterly Statistical and Economic Report 2006

Exhibit 2.3: Job Count, Hawaii County, 2006 2nd Quarter

Total wage and salary jobs	65,950		621,300	
Total non-agriculture wage and salary jobs	63,800	97%	615,050	99%
Natural Resources, Mining, Constr.	5,050	8%	35,600	6%
Manufacturing	1,550	2%	15,300	2%
Wholesale Trade	1,750	3%	18,050	3%
Retail Trade	9,050	14%	70,500	11%
Transp., Warehousing, Util.	3,050	5%	32,750	5%
Information	650	1%	11,250	2%
Financial Activities	2,650	4%	29,750	5%
Professional & Business Services	5,000	8%	76,350	12%
Educational Services	1,000	2%	13,950	2%
Health Care & Social Services	6,000	9%	57,000	9%
Leisure and Hospitality	14,250	22%	107,800	17%
Arts, Entertainment & Recreation	1,600	11%	11,800	2%
Accommodation	7,150	8%	39,200	6%
Food Services & Drinking Places	5,500	3%	56,800	9%
Other Services	2,000	18%	25,550	4%
Government	11,900	2%	121,350	20%
Federal	1,250	12%	31,500	5%
State	8,200	4%	72,550	12%
Local	2,450	3%	17,300	3%
Agricultural wage and Salary jobs	2,200	0%	6,200	1%

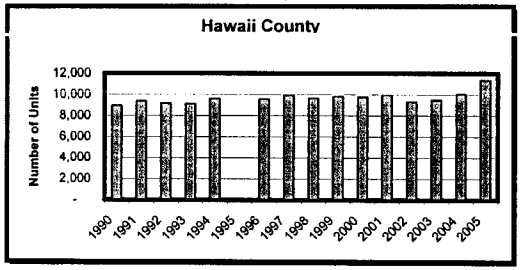
Source: DBEDT Quarterly Statistical and Economic Report, 3rd Quarter 2006

Exhibit 2.4: Average Visitor Census, Hawaii County, 1990-2005



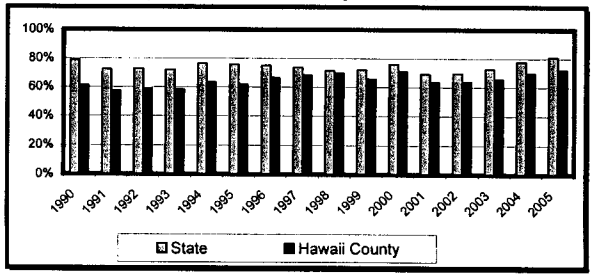
Source: DBEDT Historical Visitor Statistics, DBEDT Annual Visitor Research Report, 2005

Exhibit 2.5: Visitor Plant Inventory, Hawaii County, 1990-2005



Source: DBEDT Visitor Plant Inventory 2005

Exhibit 2.6: Hotel Occupancy Rate, State and County of Hawaii, 1990-2005



Source: DBEDT Quarterly Statistical and Economic Report, 3rd Quarter 2006

2.1.2 South Kohala

South Kohala's economy has seen dramatic changes since the completion of Queen Ka'ahumanu Highway in the late 1970's. This two-lane highway made the South Kohala area much more accessible to visitors and residents alike. Thus, the area has seen an increase in population, visitation, and the number of jobs. Since the completion of the Highway, many resorts, including the Hilton Waikoloa Village, Marriott Waikoloa Beach Resort, and others, have been added to the visitor plant along South Kohala coastline. Recent trends suggest that the South Kohala region will soon surpass other West Hawaii areas in terms of its economic contribution.

Unfortunately, except for the employment associated with the Kawaihae Harbor, employment in South Kohala is almost entirely oriented to, and dependent upon the visitor industry. With the exception of construction activity, this imbalance is not expected to change in the years ahead.

2.1.3 Waikoloa

In the early 1970's the Waikoloa Village Golf Course was opened and development of the surrounding community, Waikoloa Village, commenced. Since that time, Waikoloa Village has grown to house over 4,800 residents in 1,750 homes. It is the only village of comparable size in the region, for at least 15 miles.

The Waikoloa Village community has several commercial and residential amenities in addition to its golf course. Within the Waikoloa community there is a shopping center with a gas station, grocery store, and other retail and service businesses. The Village has a community park, tennis courts and other recreational facilities to service the growing population. Its retail/commercial areas primarily service its residential population and do not represent a major employer.

Unlike most of the recently completed homes along the Coast, Waikoloa homes are primarily built for long term, local residency.

2.2 Population Context

2.2.1 Hawaii County

Hawaii Island is by far the largest of the Hawaiian island in terms of land area with approximately 4,028 square miles of land area, and it continues to grow. However, despite its size it is only the second most populous county with a population of over 164,400[1] residents, 13.3% of the state population. Exhibits 2.7, 2.8 and 2.9 show present estimates of Hawaii County's population growth, based primarily on Census data, using interim data to modify extrapolations. The 2005 American Community Survey shows the estimated growth for the state and counties of Hawaii. During the last five years, Hawaii County population has increased markedly by 12.7 percent, the largest growth rate of all the counties during this period.

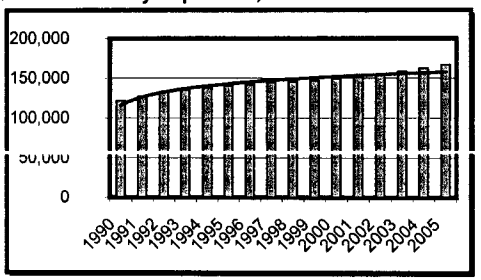
[1] Does not include those living in group quarters.

More important, these projects suggest that Hawaii County will grow at a rate well beyond that of the other counties. In fact, Hawaii County is the only county projected to have consistent appreciable growth beyond 2003. With these population increases will come increases in the demand for housing.

2.2.2 South Kohala

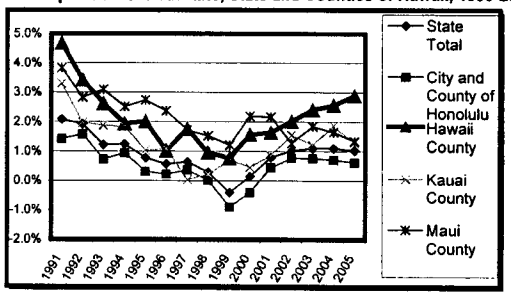
South Kohala is one of the nine districts that make up Hawaii County. The major areas in South Kohala include Waimea, Puako, and Waikoloa. Census figures show South Kohala with a total resident population in 2000 of 13,079 in 4,648 households.

Exhibit 2.7: Hawaii County Population, 1990-2005



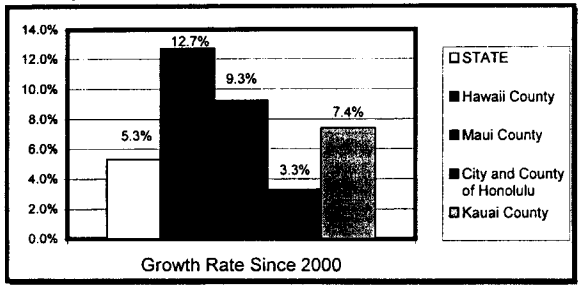
Source: DBEDT State of Hawaii Data Book, 2005

Exhibit 2.8: Projected Population Growth Rate, State and Counties of Hawaii, 1990-2005



Source: DBEDT State of Hawaii Data Book, 2005

Exhibit 2.9: Actual Population Growth Rate, State and Counties of Hawaii, 2000-2005

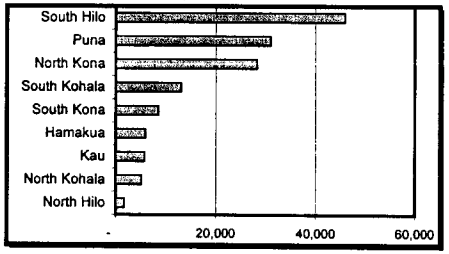


Source: US Census Bureau, 2005 American Community Survey

As seen in Exhibit 2.11, South Kohala is the fourth most populous district accounting for approximately 9 percent of the County population. South Kohala has experienced the greatest wide-scale growth since 1980, as the population has increased by more than 140 percent over that period of time.

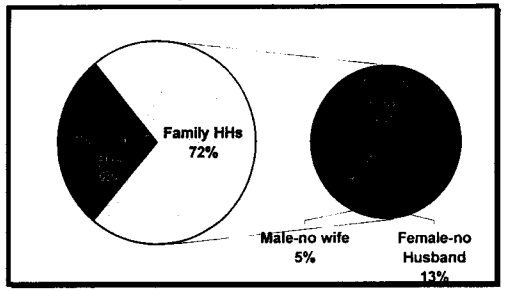
Most South Kohala households are family households and of these, most families are married couples (See Exhibit 2.12). Non-family households most often consist of a householder living alone (See Exhibit 2.13). Of those living alone, about one-quarter are over the age of 65.

Exhibit 2.11: Population of Hawaii County Districts



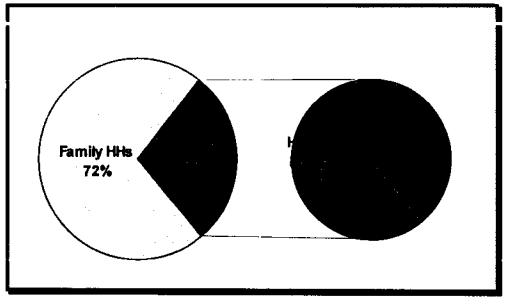
Source: U.S. Census Bureau, County of Hawaii Data Book, 2004

Exhibit 2.12: Characteristics of Family Households, South Kohala District



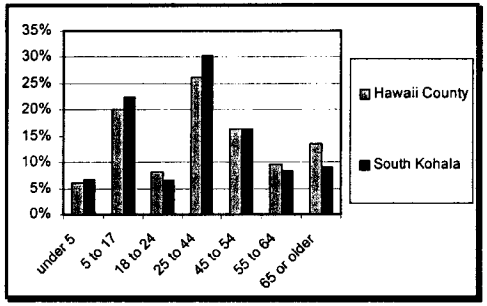
Source: U.S. Census Bureau, County of Hawaii Data Book, 2004

Exhibit 2.13: Characteristics of Non-Family Households, South Kohala District



Source: U.S. Census Bureau, County of Hawaii Data Book, 2004

Exhibit 2.14: Age Distribution, County of Hawaii and South Kohala

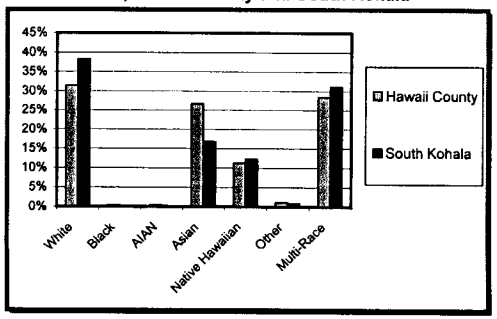


Source: U.S. Census Bureau, County of Hawaii Data Book, 2004

In terms of gender, the resident population of the South Kohala is comprised of approximately 50 percent males and 50 percent females, which is similar to the distribution in the County and State. There is a slightly higher concentration of children under the age of 18 in South Kohala, with 29 percent compared to 26 percent in Hawaii County (see Exhibit 2.14); but not nearly as many residents over the age of 55 in South Kohala with only 18 percent in this category compared to 23 percent County-wide. As a result, the median age for South Kohala residents is 36.2, lower than the County median of 38.6.

Hawaii is one of the most racially diverse states in the U.S. Exhibit 2.15 shows that Hawaii County and South Kohala contribute greatly to this diversity. Nearly one third of County residents and 28 percent of South Kohala residents classify themselves as mixed or multi-raced. South Kohala has a slightly higher concentration of Caucasians than the County with 38 percent compared to 32 percent respectively and fewer Asians (17 percent compared to 27 percent).

Exhibit 2.15 Racial Distribution, Hawaii County and South Kohala

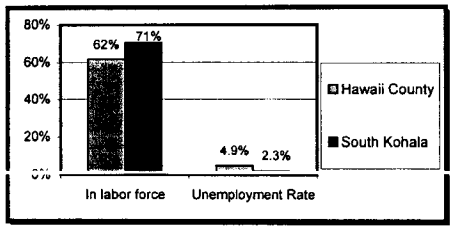


Source: U.S. Census Bureau, County of Hawaii Data Book, 2004

From an economic perspective South Kohala is one of the strongest districts in the County. Census 2000 showed that South Kohala has the highest proportion of employed adults in the County at 70.7 percent and the lowest unemployment rate of 2.3 percent. Exhibit 2.16 shows a comparison between 2000 South Kohala and Hawaii County employment figures.

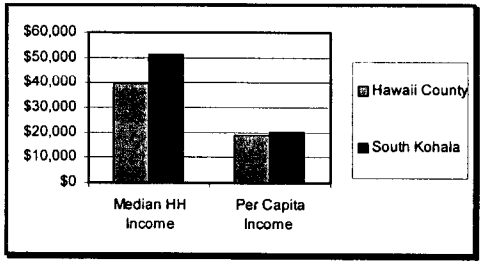
Among all the districts in Hawaii County, South Kohala residents have the highest median income at $51,379 and the per capita income of $23,194 second only to the North Kona District. (see Exhibit 2.17).

Exhibit 2.16: Employment Statistics, Hawaii County and South Kohala, 2000



Source: U.S. Census Bureau, County of Hawaii Data Book, 2004

Exhibit 2.17: Household and Per Capita Income, Hawaii County and South Kohala



Source: U.S. Census Bureau, County of Hawaii Data Book, 2004

2.2.3 Waikoloa Village

Demographically, Waikoloa Village residents are slightly younger than Hawaii County residents as a whole with a median age of 34.6 compared to 38.6 respectively. More than 75 percent of the eligible Waikoloa workforce is currently employed. This employment rate is the highest of all Big Island neighborhoods. Similarly, Waikoloa Village boasts an extremely low unemployment rate, charted at 2.5 percent in 2000.

Waikoloa Village residents have a relatively high median household income, which in 2000 was at $50,040 more than 25 percent higher than the County median. Very few Waikoloa families, 8.6 percent, were living below the poverty level in 2000.

2.3 Social Service Context

2.3.1 Hawaii County

As nearly every student of Hawaii knows, Hawaii Island is twice the size of all remaining major Hawaiian Islands combined. That makes for more than interesting trivia; it makes for an island that is very difficult to service with adequate public infrastructure. Although ever growing, the population base is also simply not large enough to financially support its public service needs.

The problem is not one of providing the basic services. The problem is driven by the size of Hawaii Island and the accessibility of services. For example, there are certainly enough schools on the island to service a population of 164,400 people, but the widely dispersed communities make it difficult to ensure that schools are adequately accessible. Some communities are short of school services simply because they are too far from other communities or they are too small to justify a new school in their community. That problem is repeated in health care, police, emergency medical facilities and in other public services.

With the notable exceptions of Hilo, Kailua-Kona and Kamuela, Hawaii Island is characterized by small towns built to service what were once rural, agrarian based communities. There always seemed to be an ever evolving balance between the economies of those communities and the population size, such that there was a sufficiently population to service the industry of the area. This is no longer the case, especially on the west side of the island where the tourism industry has grown to such an extent so as to overwhelm the capacity of the local population to service the industry. Local infrastructure, including roads and medical services are sorely taxed. And if one considers affordable housing as a basic infrastructure for housing the labor force, that service is in significant difficulty.

In July 2006, in response to a survey fielded by SMS Research, 42 percent of the Hawaii Island respondents felt they and their families were better off today than they were five years ago, while only 35 percent felt they were worse off. That situation switched when asked to foresee the future: 34 percent felt they would be better off five years from now, while 40 percent felt they would be worse off. When asked to describe the critical problems of their communities, Hawaii Island residents invariably mentioned the lack of affordable housing and traffic congestion as among their responses.

2.3.2 Waikoloa Village

As a relatively new community, Waikoloa Village is adequately serviced. However, like other Hawaii Island communities, its relative isolation does raise issues as to future services. Residents of Waikoloa Village are so concerned with the necessity of traveling great distances for some services that it is a goal of theirs to become a self-sufficient location with medical services, auto mechanics, and so on.

2.3.2.1 Education

Currently there are three public schools typically utilized by Waikoloa students: Waikoloa Elementary School (K-5) located in Waikoloa Village, Waimea Middle School (6-8) located in Kamuela and Kealakehe High School (9-12) located in North Kona, just north of Kailua-Kona. The Department of Education class size policy states that for grades K-3, the schools should maintain a 20:1 ratio with a maximum of 25:1; while the optimum class size for grades 4-12 is 26:1. Currently, according to statistics found in the DOE's School Status and Improvement Report for 2004-05 School Year, each of these three public schools currently have an average of 18-20 students per classroom, well in line with DOE standards. In addition to these three public schools, there are six schools in the region ranging from church daycare to private high schools.

2.3.2.2 Police

The South Kohala Police's main station is in Waimea. The staff of 32 policemen covers an area of 688 square miles, an area larger than the island of Oahu. Although 4 – 5 officers short of a full complement, the staff, with appropriate overtime, can adequately handle the service area. There are two substations in the service area, one at the Mauna Lani Resort and one at the Waikoloa Golf Club, although the Waikoloa substation is typically unmanned.

2.3.2.3 Fire

There is currently a Fire Station located on Waikoloa Road near the entrance to Waikoloa Village. According to the Regular Meeting Minutes of the Fire commission for June 14, 2006, the Waikoloa Fire Station which opened as a one man station, recently became a two man station. With the added support of the volunteer firemen in the region, the area is adequately serviced.

2.3.2.4 EMS

EMS services are located within the Waikoloa Fire Station. In addition, an emergency helicopter is located on Queen Kaahumanu Highway about one mile from the main intersection to Waikoloa Village. The accessibility to these services more than meets the requirements for Waikoloa Village.

2.3.2.5 Parks

There is one County maintained park located in Waikoloa Village; with a second park location undeveloped. The current park is 2-3 acres in size, and is used primarily for baseball and soccer, with a small jungle gym for tots. There are numerous beach park locations within five miles of the main intersection to Waikoloa Village. There is also considerable open space surrounding the Village.

Given the County of Hawaii standards of 5 acres of park area per 1,000 residents, Waikoloa is currently under serviced in park space. Unfortunately much of the land available for development received its zoning before park dedication were required. Bringing this feature of the community up to standards may require that the community raise funding, as was done for the first park, or that the County fund the improvements.

2.3.2.6 Hospitals

Although there are emergency services at the Fire Station, currently there are no emergency medical facilities located in Waikoloa Village or its immediate surrounding area. The nearest medical facility is located 18 miles away in Kamuela, the North Hawaii Community Hospital. There are four other hospitals within 40 miles that have emergency services, as well as acute and long term care: Kona Community Hospital (40 miles), Kohala Hospital (35 miles) and Hale Ho'ola Hamakua (32 miles). County acute care hospitalization has decreased 7 percent since 1995, while long-term care admissions have increased from 23 percent in 1993 to 54 percent in 2003. In 2003, there was an average of 1.5 beds per 1,000 population. Given current occupancy rates of the four facilities, the 2004 SHPDA statistics indicates that there is sufficient space for more patients.

2.3.2.3 Resident Attitude Toward Level of Service

SMS Research conducted individual interviews with residents of Waikoloa, including many of the officers of the Association. Their comments as to the levels of public service in Waikoloa today include:

- Waikoloa Road has simply too little capacity to handle the resident and through traffic today. The combined resident populations of Waikoloa and Panaolo Estates (somewhere between 6,000 and 7,500) currently burden the road. Add to that the non-resident traffic with construction trucks, through traffic, and army vehicles and the movement during peak parts of the day is very slow. If nothing else, we need another lane in each direction.

- Having just one road in and out of the Village invites troubles. There is no other access through the area. There have been proposals and discussions about an alternate route connecting the Village makai to Queen Kaahumanu Highway and mauka to Mamalahoa Highway, but nothing has happened. We at least need an alternative exit route for emergency purposes.

- The through traffic in the mornings can get so bad that it is dangerous exiting the Village onto Waikoloa Road. We need a traffic circle or a stoplight exiting the Village.

- The middle and high school students have to go so far each day for schooling. It makes for a long day being bused such long distances.

- The only library in Waikoloa is at the elementary school and, as such, its collection is primarily for children up to the 5th grade. Other readers or those requiring a library for research must travel to Kamuela to get to an adequate public library.

- There is not a lot to do in Waikoloa: no theater, no community center, no gymnasium, no place for younger people (or older people for that matter) to get together. On weekend young people go to the beach, specifically Beach 69, Hapuna, and Mauna Kea.

- There is currently one park that was financed and built by the residents and turned over to the County for maintenance. The park, however, is poorly maintained. Today its one field is used for both baseball and soccer, and it has a small jungle gym for tots. It is simply not enough. We need bike trails, hiking trails, a play structure and more playing fields.

- Both the police substation and the fire/EMS services are understaffed, but the entire island is understaffed, it's not just this area.

- Nearly every person interviewed noted that this community is in desperate need of a community center for meetings and for gatherings. They noted that the various developers should pull their resources and impact fees to develop ONE community center with ONE major park. They seem to imply that the Village today has more families than was originally envisioned, and those families need more services targeting families.

- Although the current commercial center is adequate today, respondents believe that specific other services are needed, including a theater, a library, a hardware store, more doctors and dentists, new restaurants, another gas station and maybe even their own transfer station.

2.4 Emerging Socio-Economic Trends

2.3.3 Economy

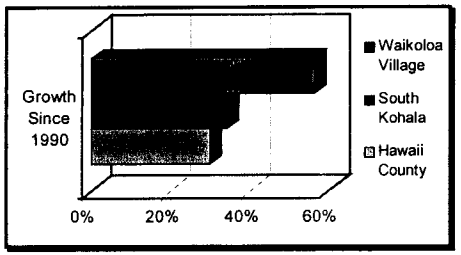
The economy of the South Kohala continues to show strong steady growth. The visitor plant has enjoyed record years and given its high end attractiveness, is less likely to experience some of the fluctuation that other more diverse visitor areas. The only foreseeable barrier to further growth is the difficulty of the hotels face in attracting median to lower end labor due to the shortage of affordable and accessible housing.

As the only deep draft harbor in west Hawaii, Kawaihae Harbor continues to be the only port of call for goods and cruise ships in the fast growing west Hawaii market. Although there have been proposals for a port closer to Kona Village, there are no real plans to deliver on that discussion. Every indication is that the cruise line industry will continue to grow; if so, South Kohala's economy will likely enjoy the fruits of that growth, while South Kohala's communities will bear the brunt of the impacts in terms of congestion and demand for housing.

2.4.2 Housing

As of 2000 there were 5,348 residential units in South Kohala, a 34 percent increase in housing units since 1990. This growth is larger than that of the County as a whole (30 percent), and given the economic health of the region, it is expected to continue.

Exhibit 2.18: Number of Housing Units by Area, 1990 to 2000



Source: US Census 2000, County of Hawaii Data Book 2004

Several new developments are planned in the district that will add to the growing community. Communications with officials at the County of Hawaii Department of Housing and Community Development and developers indicate that approximately 2,000 to 4,000 units (excluding this project) are planned in South Kohala between present and 2010. It is impossible to estimate how many of these units will actually be built, and it is quite possible that a great deal less of these planned units will actually come online by 2010. However, it is clear that the South Kohala district will continue to experience future residential growth.

2.4.1 Population

Growth in population and Big Island visitation has created uncertainty regarding the available infrastructure and housing. Most notably, there is concern regarding the availability of affordable housing and escalating housing costs. In response, the County has developed affordable housing requirements for new developments and much research and planning is underway to address insufficient infrastructure.

The State's short-term forecast anticipates annual growth in the state product and personal income reaching 5.2 and 2.4 percent by 2010. Population growth is forecasted at about 1.0 percent per year. Wage and salary jobs are also forecasted to grow at the rate of a little more than one percent per year[2]. It is unlikely that Hawaii County will experience such modest population and economic growth, as indicators suggest that the County will contribute a greater share to the state population and economy.

3. SOCIO-ECONOMIC IMPACTS

3.1 Economic Impacts

In this economic impact analysis, impacts that this project will contribute to the economic environment are reviewed. Technical terms are used here to distinguish impacts of several sorts. First, in economic analysis, a distinction is made between impacts of the actual construction and operations of a project, and the effects of project-related spending throughout the local economy. In discussions of jobs, earnings, and taxes, three broad types are distinguished:

2 (DBEDT, Quarterly Statistical & Economic Report , 3rd Quarter 2006).

- *Direct* jobs are immediately involved with construction of a project or with its operations. Direct jobs are not necessarily on-site: construction supports construction company personnel in offices and base yards, as well as on-site.

- *Indirect* jobs are created as businesses directly involved with a project purchase goods and services in the local economy.

- *Induced* jobs are created as workers spend their income for goods and services.

Indirect and induced employment in Hawaii can be estimated using multipliers from a model of input-output relations in Hawaii's economy developed and refined by State researchers.

3.1.1 Employment and Income Impacts Due to Construction

For this project estimates are made on a 10-year full build-out schedule with 3 years allocated toward infrastructure construction and 9 years allocated toward the construction of new homes.

Construction of Waikoloa Highlands is expected to take 10 years to complete. The construction period for the infrastructure is estimated at 30 months. The construction of the subsequent single-family homes will begin in second construction year and will take nine years to complete 398 homes.

Pending the receipt of final engineering figures, the construction of the infrastructure has been estimated at $150,000 per lot or a total of $59.7 million for 398 lots. Construction of Waikoloa homes is estimated at $300 per square foot applied to a 2,100 square foot home[2] plus an additional $75,000 per home for minor utility and land development. The total construction costs for single-family homes is estimated at $280.6 million.

Total construction for this project is estimated at $340.3 million. This construction spending will have a positive impact on economy by creating jobs and spending in related industries. Exhibit 3.1 shows that the direct workforce as a result of this project will include some 2,011 person-years of employment[3]. Direct jobs are not necessarily located on-site. As a rule of thumb, about 20% of direct construction jobs are off-site (in base yards, offices, and the like).

Indirect and induced jobs are also created throughout the state. These are likely to be concentrated in commercial and/or industrial centers, rather than near a job site. In addition this project will support some 3,280 indirect and induced person-years of employment. In total approximately 5,291 person-years of employment will be created through the infrastructure and single-family home construction.

Not all of these indirect and induced jobs will be created on the Big Island. Many industries that support Hawaii-based construction efforts are not located in the Islands or on the Big Island. SMS's experience with this matter suggests that approximately 4,470 person-years will be located on the Big Island[4].

2 Homes in this development will vary in size this figure represents the estimated median square footage.
3 Person years of employment is the number of full time equivalent positions required to complete the work defined by the estimated cost of construction during the specific period of time.
4 Includes all direct construction work, and 75 percent of indirect and induced work.

Exhibit 3.1: Construction Employment

Infrastructure											
Construction spending 1	19.7	25.1	14.9	-	-	-	-	-	-	-	59.7
Direct workforce 2	194	247	147								589
Indirect workforce	86	162	18								265
Induced workforce	188	239	142								568
SF Home											
Construction spending	-	24.7	28.2	35.3	35.3	35.3	35.3	35.3	28.2	23.3	280.6
Direct workforce		125	143	179	179	179	179	179	143	118	1,422
Indirect workforce		98	129	193	193	193	193	193	129	85	1,406
Induced workforce		92	105	131	131	131	131	131	105	86	1,041
Total (Infrastructure and SF)	**468**	**962**	**684**	**502**	**502**	**502**	**502**	**502**	**377**	**289**	**5,291**

Construction Earnings 1											
Direct earnings	13.7	22.5	16.2	7.3	7.3	7.3	7.3	7.3	5.8	4.8	99.2
Indirect earnings	3.3	7.5	6.3	4.7	4.7	4.7	4.7	4.7	3.8	3.1	47.5
Induced earnings	5.9	10.2	7.6	3.9	3.9	3.9	3.9	3.9	3.1	2.6	48.8
Total	**22.9**	**40.2**	**30.0**	**15.9**	**15.9**	**15.9**	**15.9**	**15.9**	**12.7**	**10.5**	**195.5**

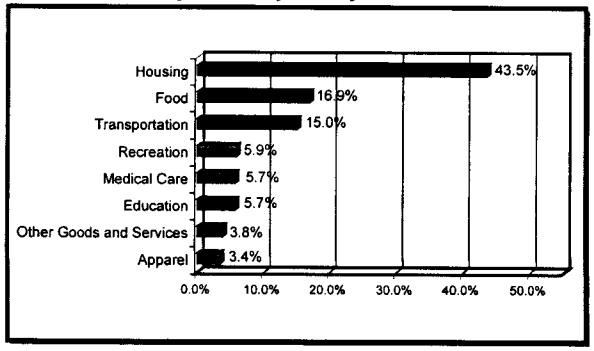
1 in millions of 2006 constant $

Source: DBEDT, State Input - Output Study, 2002

These earnings will boost the local economy, as many of these dollars will be used to purchase goods and services from other industries. Exhibit 3.3 shows Honolulu consumer spending patterns to illustrate how earnings may be used.

Housing costs such as shelter payments and utilities account for more than 43 percent of consumer expenditures. Food and transportation also account for a large amount of consumer spending (17 and 15 percent respectively). It can be expected that these patterns will continue in the future creating economic growth in several industries as a result of this project.

Exhibit 3.3: Consumer Spending Patterns by Industry



Source: US Census 2000, County of Hawaii Data Book 2004

3.1 Fiscal Impacts

Fiscal impacts consist of new tax revenues accruing in the state government and county government as a result of this project.

3.1.2 State of Hawaii

No major new commitment of County or State funds is needed to support this project. For this reason, the construction spending results in a net increase in state tax revenues. Exhibit 3.4 displays estimated state tax revenues as a result of the Waikoloa Highlands project.

Exhibit 3.4: State Tax Revenues

State Taxes 1											
Direct	0.73	1.85	1.61	1.33	1.33	1.33	1.33	1.33	1.06	0.88	12.77
Indirect	0.54	1.51	1.35	1.18	1.18	1.18	1.18	1.18	0.95	0.78	11.03
Induced	1.12	1.98	1.48	0.78	0.78	0.78	0.78	0.78	0.63	0.52	9.62
Total	**2.39**	**5.34**	**4.44**	**3.29**	**3.29**	**3.29**	**3.29**	**3.29**	**2.63**	**2.17**	**33.42**

1 in millions of 2006 constant $

Source: DBEDT, State Input – Output Study, 2002

This project involves development of 398 parcels of raw land and construction of subsequent homes. The level of construction is estimated at $340.3 million and this level of construction will result in $12.8 million in direct state tax revenues. The indirect and induced impact of this project will result in $20.7 million in state tax revenues. In total, this project will result in an estimated $33.4 million in state tax revenues. These state tax revenues will stimulate the state economy and no negative fiscal impacts are anticipated.

3.1.2 County of Hawaii

The new units developed in the Waikoloa Highlands will result in County tax revenues via property taxes. Some of these property taxes will come from new residents of Hawaii County and result in-migration while other tax revenues will come from residents relocating from other Big Island areas. For this reason, it should not be assumed that 100 percent of these property taxes represent new tax revenues.

In total, the 398 new homes could result in approximately $600,000 to $750,000 in property tax revenues. These estimates are based on the value per square foot of neighboring Waikoloa Village homes applied to 398 2,100 square-foot units[5]. This amount of property taxes would represent approximately one percent of the total property taxes collected[6].

[5] High-end Waikoloa Village homes (estimated value $800,000+) have an estimated range $366 to $504 per square-foot and the property tax assessed between $1,500 and $1,900. (Source: Zillow.com)

[6] Based on fiscal year 2005. (Source: County of Hawaii, Comprehensive Annual Financial Report 2005)

The Waikoloa Highlands project will result in property taxes that will be assessed on land and homes that overall are more valuable than the surrounding Waikoloa Village homes. The trend is that property taxes are higher for more valuable units. As a result, the amount of property taxes could be even higher than the figures estimated here.

It is clear that this development will result in relatively high property taxes, which will stimulate the local economy. Other tax revenues will also be generated via taxes on utilities and other taxable services provided to local residents by the local government. This project requires no significant government contribution to complete and will have a positive fiscal impact on both the Sate and Hawaii County.

3.2 Social Impacts

The Waikoloa Highlands project of 398 lots is small enough that it will have minimal regional impact, but of large enough scale that its impacts will certainly be felt in the village of Waikoloa.

3.2.1 South Kohala

As noted earlier, Waikoloa was originally intended to be a town of much larger size, designed as a complete community. After a relatively slow growth period in its first 30 years, current proposals may push the Village to its original intentions.

If only half of the proposed plans were to become reality, Waikoloa would more than double in size. As a community significantly off the coastline, it is unlikely that Waikoloa would develop into a community dominated by tourism investment. Rather it will, in all likelihood, develop into a diverse community whose members work throughout the region, from Kamuela to the Kailua-Kona, both in and out of the visitor industry. As a mid-point between the established community of Kamuela and the bustling coastline, Waikoloa will probably continue in its suburban character, perhaps with a more defined town center offering a wider array of commercial and public services.

The lots of Waikoloa Highlands are not a unique product to the region. Similar lots have been and are available in various parts of Kamuela and along the coast. This project will not change the regional pattern of growth or significantly affect the character of the region.

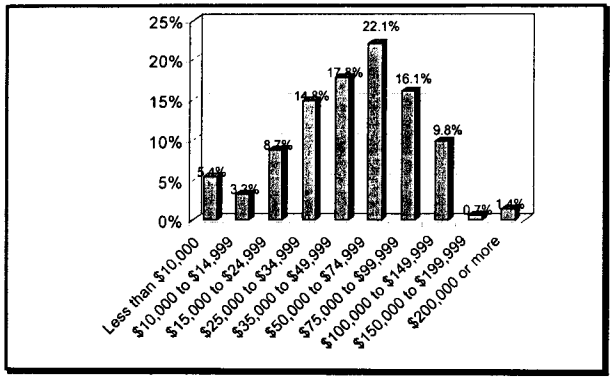
3.2.2 Waikoloa Village

Waikoloa Highlands will, however, significantly impact the existing community fabric of Waikoloa Village. If homes were built and occupied on every lot in Waikoloa Highlands, this project alone would increase the current size of the village by 23 percent. On the one hand, this will result in increased pressure on traffic and public services, but on the other hand, as some Waikoloa residents noted in interviews, its development would help support the current resident pleas for additional service.

3.2.2.1 Community Balance

While median incomes in Waikoloa Village are higher than those of the County as a whole, the median incomes in Waikoloa Village are highly concentrated around the mean. Only eight percent of the households have incomes below the poverty line, but only 2.1 percent have incomes in the higher incomes of the County, $150,000 and over.

Exhibit 3.5: Waikoloa Village 2000 Income



Source: US Census 2000, County of Hawaii Data Book 2004

The lots at Waikoloa Highlands will sell for $768,600 to $1,058,400. At that level and assuming a 2,100 square foot home constructed at $366 to $504 per square foot, families will need incomes in the range of $192,000 to $264,000[3]. This project will bring to Waikoloa Village a segment of the population that is not highly represented there today.

This creates a more balanced community with not just a wider range of incomes, but a wider range of interests, a wider range of experiences, a wider range of contributions to the community's fabric.

In addition, as one public official noted, "this creates a more balanced community. Families in these income brackets demand and often get more public services. That's not a judgment of government or of families in differing income brackets. It's just how things happen all over this country."

3.2.2.2 Public Services

The development of Waikoloa Highlands will also result in greater pressure on public services. As noted earlier, Waikoloa is adequately serviced given its current population. For the most part, Waikoloa Highlands will not change that picture. All public services reviewed have adequate capacity to absorb the anticipated increases created by the Waikoloa Highlands project.

[3] Annual incomes was calculated with a mortgage calculator and assume a $768,600 to $1,058,400 mortgage with a 30-year fixed rate of the state's current rate of 6.2%. This calculation assumes that mortgage payments should be no more than ¼ of a homeowner's monthly income.

However, as resident after resident noted in individual interviews, it is not a question of service levels, it's a question of accessibility. And on that score, for the residents of Waikoloa Highlands, although they may not add significantly to the problem, they will also experience the inconvenience of being "under serviced".

Education. The public schools that service Waikoloa are operating at class sizes lower than the maximum optimal class size. The additional 233 students that Waikoloa Highlands is estimated to add, can be adequately serviced without exceeding the maximum optimal class size. The project will have to contribute its incremental share to education services in the region, but it will not, in and of itself, trigger the development of a new school.

Education, however, is a good example of accessibility. Students in grades 6 through 8 travel 20 miles to Waimea Middle School, while high school students travel nearly 40 miles to Kealakehe. A middle/high school in the Waikoloa Village would ease the burden of travel on these students, and create an important amenity to a growing community.

Police. All indications are that the police will continue to be served from the South Kohala District utilizing its substations. Responses from the Police Department indicate that with a full staff, Waikoloa Highlands will be adequately serviced. The residents of Waikoloa are additionally hopeful that the presence of a new subdivision at Waikoloa Highlands will lead to the current substation at the Waikoloa Golf Course being manned on a more frequent basis.

Fire. With the expansion of the Waikoloa Fire Station from a one-man to two-man station, and with the addition of volunteer firemen, there is sufficient service to both service the existing community and accommodate the 398 new homes at Waikoloa Highlands.

EMS. The current EMS location in the Waikoloa Fire Station and the proximity of emergency helicopter service, are adequate to absorb the anticipated additional needs of Waikoloa Highlands.

Parks. Waikoloa Highlands is estimated to general 398 famililes with 233 school age children. The finished park area in Waikoloa Village is not adequate to service it current residents. Waikoloa Highlands will add to this shortage.

Hospitals. Given the bed occupancy rates for the four surrounding hospitals, there is sufficient capacity to adequately handle the needs of Waikoloa Highlands. Like the schools hospitals are a great distance away (between 18 and 41 miles). However, whereas students travel each weekday to school, families have much lower requirements for hospital service and the distances do not appear to be a barrier to service.

3.2.2.3 Community Comments

For the most part, all respondents were positive in their reaction to the project. Although some had reservations, as with any development, and others had a problem with the intended higher income buyers, nearly everyone expected more development in Waikoloa and were more interested in discussing the energy that new development could bring rather than the negative impacts of a project of this scale. Among their comments regarding the specifics of the project:

- Don't build a gate to the community. Don't isolate yourselves.
- It is important that the people of Waikoloa Highlands become a part of and participate in the Village community. Pay dues and enjoy the amenities.
- Build a safe, controlled intersection wherever the community merges onto Waikoloa Road. This is especially important at the intersection of Waikoloa Road and Paniolo Avenue.
- Don't change the terrain; build on it. The Village is not a flat grid like other subdivisions; it flows with and fits into the landscape.
- Build in some recreation amenities. This community needs park space for bike trails, hiking trails and active games.
- Don't just use electric power. The location is always sunny and windy, perfect for solar and wind power.
- Try to mix the incomes a little bit. The development community should be building more affordable housing.

4. MITIGATION MEASURES

From the socio-economic perspective, Waikoloa Highlands will not generate any significant negative impacts. The one notable shortfall is that the development will further tax a park shortage that already exists.

Waikoloa Highlands will contribute to the economic base of the Hawaii Island community, it will provide needed balance to an ever growing Waikoloa Village, and it may add critical mass to the need for additional services.

Interviews with residents of the community and a review of Association minutes did not register any significant opposition to the project. Growth in Waikoloa Village is expected and anticipated.

This report would be remiss, however, if it did not point out that there are necessary improvements that would enhance the creation of a sound, well-balanced community in Waikoloa; improvements to which the developers of Waikoloa Highlands might consider contribution. These include;

- A new middle and high school in Waikoloa Village.
- A substation that is staffed on a more frequent basis by the County Police Department.
- Additional active park space in Waikoloa Village.
- Affordable housing as a part of the total development package.

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APPENDIX D

Market Study, Economic Impact Analysis and Public Cost/Benefits Assessment The Hallstrom Group, Inc., May 2006.

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Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed

WAIKOLOA HIGHLANDS

to be located at Waikoloa Village, South Kohala, Hawaii

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May 31, 2006

Mr. Chester Koga, AICP
Project Manager
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420 Waiakamilo Road, Ste. 411
Honolulu, Hawaii 96817

Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed Waikoloa Highlands Subdivision Waikoloa Village, South Kohala, Hawaii

Dear Mr. Koga:

At your request, we have completed a defined-scope market study, economic impact analysis and public costs/benefits assessment of the Waikoloa Highlands master plan, a 398-lot rural subdivision proposed for a 700 acre site located southeasterly adjacent to the existing Waikoloa Village core, approximately 22 miles northeast of Kona International Airport, South Kohala, Hawaii. The project will offer homesites ranging from about 25,000 square feet to two acres, as well as parks/open space, archeological preserves, landscaped parkways and pedestrian/bike paths.

The subject property, identified on State of Hawaii Tax Maps as Third Division Tax Map Key 6-8-2, Parcel 16 and 6-8-3, Parcel 32, has a gently to moderately sloping, rolling terrain, and extends along the southerly frontage of Waikoloa Road, just east of Puu Melia Street. It is at the circa 900 to 1200 foot elevation, some seven miles upslope from Queen Kaahumanu Highway and the shoreline resort communities.

The focus of our assignment was embodied in seven tasks:

1. To quantify the demand for single family residential inventory (lots and house/lot packages) in the subject area and the competitive West Hawaii market using a variety of demographic, economic and other analytical techniques.

2. To identify the existing inventory in the effective market areas, and their construction, pricing, marketing and absorption histories.

3. To identify current and long-term proposed competitive residential inventory additions, with concern given to timing, likelihood of actualization, anticipated characteristics and other relevant traits.

4. To assess the appropriateness of the subject holding for the proposed use and ascertain whether it has sufficient attributes to obtain a competitive market share.

5. To identify the most probable purchasers for the subject inventory and estimate the speed of product absorption.

6. To estimate the direct and indirect, on and off-site benefits flowing to the local economy as a result of undertaking the subject development, including job and wage creation, business profits, discretionary expenditures, resident/de facto populations, and public school attendance.

7 To quantify the impact of the project on the public purse over time in regards to primary revenues generated (real property, income, and excise taxes) and costs of providing governmental services from actual and per capita perspectives.

The function of our assignment was to provide market data, analysis of market supply/demand factors, projections of economic outcomes, and an informed opinion of the anticipated level of market success the subject inventory can expect to achieve and contribute to the larger community, for use in the entitlement petitioning process, other land use regulatory submittals and internal decision making.

The pertinent results from our study are contained in the following summary report, focusing on tabular presentation with brief narrative conclusions.

In completing this assignment, we visited the subject property, environs, and competitive projects in the study area; interviewed developers, brokers and other parties regarding current sales and market conditions; utilized published and on-line databases; reviewed governmental land use designations, entitlements and policies in the region; and, identified proposed competitive developments and their attributes.

This study was prepared for the Vitoil Corporation and the RM Towill Corporation, with Chester Koga being the primary client contact. The purpose of this assignment is to provide market analysis and conclusions regarding the proposed subject development for use in land use entitlement petitions for the property, and for internal planning purposes. The effective date of the study is April 29, 2006.

All conclusions presented herein are subject to the identified limiting conditions, assumptions and certifications of The Hallstrom Group, Inc., in addition to any others set forth in the text or tables. All work has been completed in conformance with the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice (USPAP).

Based on our investigation and analysis we conclude:

- The residential housing market continues in a demand cycle throughout the state and in the Waikoloa Village and West Hawaii study areas, despite a recent drop from the record activity achieved in 2005. Absorption remains high, product is still relatively scarce, and prices are near all-time levels.

- An estimated 5,600 dwelling units (mid-point) will be required in Waikoloa Village during the next two decades. Fewer than 3,700 units are currently proposed apart from Waikoloa Highlands; less than two-thirds the total necessary to adequately service the sector.

- The property is well-suited for the proposed subdivision and will achieve market acceptance by providing larger lots in a less intense, high quality, well-located, rural residential subdivision; providing currently unavailable purchase opportunities for residents and second-home buyers in the village. The subject product-type, while not offered in the existing community core, has been long-envisioned for the Waikoloa area.

- Complete market absorption of the 398 rural house lots will require an estimated four to six years from the commencement of presale offerings.

- The construction of Waikoloa Highlands and its on-going use and maintenance will create some 2,296 on- and off-site, direct "worker years" of employment on the Big Island during the first decade of its construction and use, with wages of circa $113.1 million. On a stabilized basis, home and unit maintenance will support about 40 full-time equivalent on-site jobs and contribute to another 16 off-site, with total wages of $1.6 million annually.

- The average daily de facto population at build-out of the project is projected at 1,068 persons, including 907 full-time residents, with total annual discretionary expenditures by owners and guests of $39.0 million per year. Total resident household income is forecast (in 2006 dollars) at a stabilized $47.8 million annually. Public school enrollment is calculated at a maximum of 233 students. The project will infuse $340.3 million in development and construction capital and $7.2 million in annual business operations into the West Hawaii economy.

- The State of Hawaii will receive $41.5 million in primary tax receipts during the first decade of subject development and operation, and a stabilized amount of $4.4 million annually. The county of Hawaii will receive $24.4 million during the first ten years of the project, and $3.5 million per year thereafter. In no year does the state or county suffer a revenue shortfall (costs exceeding receipts) relative to the project.

We appreciate the opportunity to be of service in regards to this holding. Please contact us if further detail or discussion in the matter covered herein is required.

Respectfully submitted,

THE HALLSTROM GROUP, INC

James E. Hallstrom, Jr., MAI, CRE

/as

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REAL ESTATE CONSULTANTS & APPRAISERS

Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed

WAIKOLOA HIGHLANDS

to be located at

Waikoloa Village, South Kohala, Hawaii

Prepared for

Mr. Chester Koga
RM Towill Corporation

May 2006

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TABLE OF CONTENTS

Table of Contents (continued)

ASSIGNMENT AND SUMMARY OF CONCLUSIONS

Assignment

Waikoloa Highlands will be a rural residential subdivision containing 398 single family house lots ranging in size from about one-half to over two acres. It is southeasterly adjacent to the existing Waikoloa Village core.

The purpose of our assignment was to analyze the proposed subject project in light of competitive, regional, prevailing and base forecast economic/market conditions in order to answer four foundational study questions:

1. Is there sufficient market demand to absorb the 398 lots of the subdivision during a reasonable exposure period given village growth trends, the availability of competing developments and statewide/regional economic trends?

2. From a market perspective, will the subject project be a favorable use of the site relative to governmental land planning objectives, accepted master plan design characteristics, and the area environs?

3. What will be the general/specific and direct/indirect economic impacts on the Big Island resulting from the undertaking of the subject development through capital investments, jobs, wages, business revenues and profits, de facto population characteristics, and resident/guest discretionary expenditures?

4. What will be the impact on the state and county "public purse" from the project in regards to costs of services required versus increased tax/fee receipts?

These issues were addressed through a comprehensive research and inquiry process utilizing data from market investigation, governmental agencies, various Hawaii-based media, industry spokespersons/ sources, on-line databases, and published public and private documents.

The pertinent results of our assignment are highlighted in this narrative report. Our study findings are divided into seven chapters as follows:

- **Study Conclusions**
- **The Subject Property and Proposed Development**
- **Environs – West Hawaii, South Kohala and Waikoloa**
- **The Waikoloa Village Single Family Residential Market**
- **Subject Site Appropriateness and Absorption Conclusions**
- **Economic Impact Analysis**
- **Public Cost/Benefit Assessment**

For this analysis, we have been provided with Waikoloa Highlands conceptual master plans, project descriptions, timetables and other analytical data prepared by the owner/developer and RM Towil. Additional source information regarding the subject was taken from the files of our past studies regarding the effective market areas.

Study Conclusions

Based on our inspection of the subject site, its environs and analysis of the historic and forecast Waikoloa Village real estate market, we have reached the following conclusions about the proposed Waikoloa Highlands subdivision:

The Waikoloa Village Residential Market

Waikoloa Village has been the focal point of residential growth in the South Kohala District over the past two decades; a trend that is anticipated to continue into the long term. Over the last 20-plus years, about half the new residential units in the District were built in the village. And, given the scarcity of zoned lands and infrastructure limitations elsewhere, around 60 percent of non-resort housing development in South Kohala is projected to be located there over the next twenty years.

Based on federal census, state population forecasts, county planning projections, the availability of services, entitled lands, and market indicators, we have forecast the number of new residences that will be required in the village to meet anticipated demand through 2025 at from 4,188 to 7,038 total units; with a mid-point of 5,613. In addition to the acute need for resident housing opportunities, which the village has helped meet, the total demand figures also account for the rapidly increasing non-resident buyer segment which strongly moved into the village upper-end lot and home market during the recent up-cycle. The formula additionally provides for a nominal vacancy allowance to

facilitate household movement, units under repair and short-term fluctuations.

Single-family homes and lots, such as proposed at Waikoloa Highlands, will comprise some 89 percent of the total market. Multi-family sites are becoming increasingly scarce in the village.

An estimated 27.7 percent of the demand to 2025 will be for homes/units having a 2006 equivalent sales price of $750,000 or more; the envisioned subject target range. And, they will constitute 30 percent of the market by the end of the study period. Purchase opportunities for the lower segments will be limited, but it is probable that some/many will either "stretch" into the focal range or become renters for investor-owned homes in the subdivision.

Annualized gross sales data for Waikoloa Village homes and house lots from 2001 through 2006 (est.) depicts a dramatic upsurge in both segments, with total "sales volume" and "average sales prices" up several-fold. Although there has been a measurable downturn from the hyper-levels which peaked during 2005; activity and prices remain well-above past norms. The "sag" is primarily from appreciating prices and interest rates combining to make purchase more difficult for some local households and less attractive to the investor segment.

However, overall demand remains high, with many "new home" projects throughout West Hawaii still requiring lotteries for each inventory release (just fewer participants), with all of the higher-quality product (better view, larger lot) being immediately snapped up. The foundational trends in the full-time resident and second-home owner segments remain favorable, and are expected to expand within the village over the mid to long-term.

Apart from the subject's 398 lots (which will become single family homes over time), there are only some 3,681 units firmly proposed/moving forward at this time; fewer than the 4,000 to 7,000+ needed in the community over the coming two decades.

We conclude our analyses provide strong market support for the proposed Waikoloa Highlands subdivision.

Subject Appropriateness and Absorption Estimates

The 700 acre subject parcel, a large holding fronting Waikoloa Road southeasterly upslope of Waikoloa Village, is a highly appropriate and favorably competitive location for the proposed Waikoloa Highlands

rural subdivision. The physical, functional, scope, and amenity characteristics of the property are desirable from a market perspective, and will enhance the salability of the finished single family lot inventory.

Primary contributing factors to this conclusion include:

- Waikoloa Village has evolved into a major, comprehensive, moderate to marginally upscale, suburban community (with growing second-home owner and investor components) that is planned to be the focal point of South Kohala residential development over the coming decades. The village has achieved its long-awaited full acceptance in the market, and is primed for growth.

- The subject property is a natural village expansion site being on the only access road, nearby the main entrance to the existing community. The westerly (makai) growth of the village core is underway at Wehilani and Sunset Ridge; to the north will be Waikoloa Heights; with, the subject lands representing the primary development opportunity to the southeast.

- Though a widening spectrum of village product diversity has been envisioned for many years, the existing single family inventory of some 2,000 homes remains in its original "cookie cutter" stage; with virtually all houses and lots falling into a rather tight product range. Normal maturation of the community will require providing additional alternatives outside the in-place sector; with larger lots and less intense, more-amenitied development being of prime interest to prospective purchasers.

- The holding has access to necessary utility and roadway systems to support subdivision of the subject property.

- The parcel is of sufficient size, shape, view panoramas, and terrain to support a competitive/residential project.

We have quantified absorption rates using three techniques, all of which point to a reasonable sell-out period of four to six years for the 398 subject lots.

The gross analysis method indicates there are insufficient competitive single family "units" (lots and lots/homes) apart from the subject to meet demand regardless of other factors. The residual method demonstrates that the proposed competing developments could all achieve a reasonable absorption level and there would still be remaining timely demand for the subject product. And the market shares method indicates the Waikoloa Highlands lots would be absorbed in a relatively rapid manner based on their competitive penetration in the market.

Economic Impact of the Subject Development[1]

The project will generate some $340.3 million in direct, new capital investment and spending into the Big Island economy during a ten-year modeling period depicting the build-out of the subdivisions. This will create an estimated $47.7 million in profits for local contractors and suppliers. On a stabilized basis after completion, some 56 maintenance/renovation/repair workers and other on- and off-site positions will earn $1.6 million in wages each year, and resident/guest users of the project will spend $38.9 million annually in the local economy.

A total of 1,640 worker/years of direct on-site employment will be created during the 10-year construction and operation study timeframe, along with an additional 656 worker/years in associated and indirect off-site employment. The total wages paid during the initial decade of development and use will be $113.1 million.

The full-time resident population at the subject is estimated to reach 907 persons, with a maximum of 233 children in public schools. Second-home owners and guests are expected to add a daily average of 161 persons to the community, resulting in a de facto population of 1,068 persons for the project at build-out. The total household income of full-time residents is forecast to reach a stabilized level of $47.8 million per year.

The expenditure of employee wages, business profits, and resident/guest discretionary funds into the Big Island market will enhance hundreds of additional off-site, secondary/indirect jobs on the island, and generate several million dollars in additional wages.

The total direct, local economic impact to the county of Hawaii (dollars flowing into the island market) is estimated to be $409.3

(1) All dollar amounts contained in this report are based on constant, uninflated 2006 dollars.

million during the initial decade construction and operation study period, and stabilize at $47.7 million annually thereafter. As these dollars move through the island market, they will have a multiplier effect increasing the economic impact of the Waikoloa Highlands subdivision to the Big Island during its first 10 years to some $818.6 million.

Public Cost/Benefit of the Subject Development

The county of Hawaii will receive $24.4 million in real property tax receipts from the project over the 10-year modeling period, and an estimated $3.5 million per year thereafter. The county government operating costs associated with serving the subject, using a per capita basis, will total $7.8 million for the initial decade timeframe, and be some $1.6 million on a stabilized basis. The county will enjoy a net revenue benefit (taxes less costs), totaling $16.6 million during the first 10 years of construction and use, and $1.9 million each year after build-out.

The State of Hawaii will also show a positive net revenue benefit from Waikoloa Highlands under the conservative per capita perspective. The total gross tax revenues flowing to the state during the 10-year modeling period will reach $41.5 million from income and gross excise taxes, and will stabilize at $4.4 million annually following build-out. State costs associated with the project on a per capita basis will be $16.7 million during the projection timeframe and $3.4 million per year subsequently. The state will experience a net profit of $24.9 million in the 10 years and a stabilized benefit of $1.0 million annually after build-out.

In no year does either the county or the state suffer a revenue shortfall due to the subject project.

THE SUBJECT PROPERTY AND PROPOSED DEVELOPMENT

Land

The 700 acre subject tract is an irregularly-shaped, multi-lobed expansive holding stretching along, and extending from, the southerly frontage of upper Waikoloa Road; just upslope from the existing Waikoloa Village community, approximately 22 miles northeast of Kona International Airport. The property, identified on State of Hawaii Tax Maps as Third Division Tax Map Key 6-8-2, Parcel 16

and 6-8-3, Parcel 32, runs from approximately 900 feet above sea level, along Puu Melia Road (its makai boundary), to circa the 1200 foot elevation along its mauka border.

The site has a maximum north/south width of some 8,800 feet and mauka/makai dimension of 8,000 feet, with some 11,500 lineal feet of frontage along winding Waikoloa Road. The overall slope is moderate and relatively consistent, with the terrain being slightly undulating to rolling hills.

At present, the land use designations of the subject are predominantly agricultural-oriented. The State Land Use Map designates portions of the site as being within the Urban and Agricultural Districts. The county of Hawaii General Plan identifies the property for Agriculture uses, and the county zoning overlay includes RA-1 and Open classifications. The in-place classifications would permit a limited agricultural subdivision with minimum lot sizes of one acre.

Primary access to the holding is from Waikoloa Road, a two-laned macadam-surfaced street which is the only access into the Waikoloa Village community. The thoroughfare extends some 13 miles from Queen Kaahumanu Highway near the coastline to Mamalahoa (Hawaii Belt) Highway at circa the 2000 foot elevation.

Secondary access is available from Puu Melia Road, which extends south from Waikoloa Road at the main intersection (with turn pockets) providing entrance to the village, which lies northerly of Waikoloa Road. The junction of Waikoloa and Puu Melia Roads forms the northeastern corner of the subject property.

Many points on the holding offer panoramic makai views over the shoreline resort developments to the ocean; considered the most desirable attribute for house lots in the area. Expansive mauka views are also available from most subject areas, incorporating the Kohala mountains, Hualalai, and the upper slopes of Mauna Kea.

The property has mostly rocky soil, with some loamy pockets. It is generally covered with grasses, scattered shrubs and some small trees. It is vacant and unimproved except for some wire perimeter fencing and graded access tracks.

Apart from a small realty office building on the southwest corner of its intersection with Puu Melai Road, there is no development along either side of Waikoloa Road in the area of the subject. Nor is there any immediately mauka, makai, or south of the property. Waikoloa Village extends in a northerly/makai direction from the Puu Melai/Waikoloa intersection less than a quarter mile from the subject.

Much of the land in the subject "neighborhood" is still owned by the Waikoloa Land/Development Company; the original master developers of the 30,000-acre Waikoloa plan. However, there are on-going attempts to sell much of the remaining lands in either bulk or as separate sites.

Proposed Development

Waikoloa Highlands will be a rural large-lot subdivision containing a total of 338 single family house lots ranging in size from circa 25,000 square feet to two-plus acres. The project will also contain significant open space corridors, a trail system, landscaped entry/drives and buffers spread throughout the community.

The subject project will have the lowest densities ever offered in Waikoloa Village for single family inventory at an average of only 1.76 lots per acre of the bulk holding. This will promote a needed evolution in the existing "cookie cutter" community, which currently has lots and homes only within a relatively narrow range of product types, and help the village achieve its long-envisioned status of appealing to a broad range of West Hawaii purchasers.

The subdivision is intended to attract buyers from resident, investor and second-home purchaser groups. The latter two segments have significantly expanded as a percentage of village purchasers in the recent upcycle; the result of diversification in the market, limited inventory, and the ultra-pricing structure of the resort inventory.

The main entrances to the subdivision will be from Waikoloa Road, approximately 4,000 and 9,500 feet mauka of its intersection with Puu Melia Road; from which secondary access will be provided. The main drive extends from one entrance through three of the four "nodes" comprising the project to the other entrance.

The lots are double-loaded off the interior roadway system which includes side-streets and cul de sacs. Over half of the lots will "back" to green belts, open space corridors or adjoining vacant lands. Views will range from limited/territorial to expansive/ocean; with those along the mauka frontages of the open spaces and/or steeper terrain having the best panorama potentials.

The spread of lot sizes and shapes are fairly standard throughout the subdivision, with most being (near) rectangular and between 30,000 and 45,000 square feet. Those on the perimeter or having atypical topography tend towards larger size and more varied shape.

Overall, the proposed subject development embodies modern rural subdivision planning concepts from a market perspective and contains the fundamental characteristics necessary for its product to be competitive in the regional market.

ENVIRONS

The subject holding is situated within the Waikoloa ahupua'a nearby Waikoloa Village, a primary residential community in South Kohala which is situated upland approximately seven miles inland from queen Kaahumanu Highway and eight miles from the coastline.

The purpose of this section is to provide a reasonably detailed overview of the subject environs, moving from the general to more specific. The review opens with the county of Hawaii, then moves to a discussion of West Hawaii, then the South Kohala District, and finally Waikoloa Village.

This information and analysis provides a foundation for the much more specific and macro and micro market study which follows.

We note, this less time sensitive overview utilizes data compiled through year-end 2004. Complete figures for full year 2005 had not all been released by state and county agencies as of the study date. We would not anticipate the 2005 data to have a meaningful impact on this general, long-range environs description.

Hawaii County Description

The county of Hawaii consists of the island of Hawaii (Big Island), the southernmost major island in the Hawaiian chain. Hawaii County is the second most populous of the four counties that make up the State of Hawaii, with the 2004 census update figures estimating a resident population of 161,480, representing just over 12.5 percent of the total state population. By far the largest island in the chain, land area of Hawaii is 4,038 square miles.

The island is characterized by many small towns dispersed along the coastline. The island has been divided into nine districts--Puna District, the North and South Hilo Districts, Hamakua District, North and South Kohala Districts, North and South Kona Districts, and Ka'u District.

Two volcanic mountain peaks, the 13,796-foot Mauna Kea and the 13,679-foot Mauna Loa, dominate the central portion of the island. Three other major volcanic emergences combine with Mauna Kea and Mauna Loa to form the island of Hawaii. The Kohala Volcano, which is more commonly referred to as Kohala Mountain, is the oldest volcanic land mass on the island that forms the extreme northern portion of Hawaii. Hualalai, in the west, is located northeast of Kailua-Kona. The final volcanic presence is Kilauea Crater, with its associated and yet active East Rift Zone at the far southeastern end of the island.

Hilo, located along the eastern coast, is the principal population, administrative, and civic center on the island. Other population centers include Kailua-Kona on the island's west coast and Waimea situated inland within the northern saddle between Mauna Kea and the Kohala Mountain.

West Hawaii Region

The West Hawaii Region consists of North and South Kohala as well as North and South Kona Districts. The principal towns that service this region are Kailua-Kona, North Kona; Waimea, South Kohala; Captain Cook, South Kona; and Hawi, North Kohala. The principal core area of the region is comprised of North Kona and South Kohala. The coastline of these two districts are known for their numerous high-end destination resort properties, including Mauna Kea Beach Resort, Mauna Lani Resort, Waikoloa Beach Resort, Kona Village/Hualalai Resort, Kukio, and Keauhou Resort.

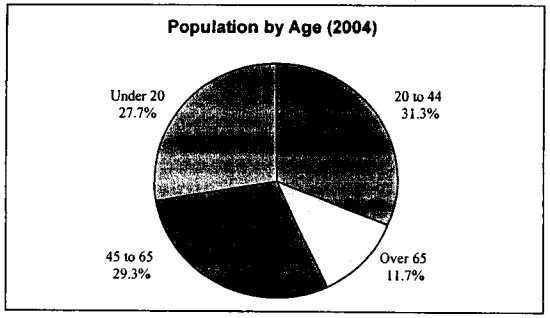
The subject property is situated within the South Kohala district, a leader in the region, trailing only North Kona in overall importance among the four districts comprising West Hawaii. The following section describes this general market area for the proposed subject inventory. The circle on the subsequent map defines the larger study region.

Key Demographic Factors

	West Hawaii	Hawaii County
Total Population (2004)	51,718	161,480
Male	50%	50.0%
Female	50%	50.0%
Median Age	38.7	38.1
2004 Households (HH)	19,288	58,557
Estimate 2009 HH (11%)	21,541	65,112
Average HH Size	2.7	2.7
1990-2000 HH Growth	35.2%	27.8%
Median Income	$50,953	$42,558
Per Capita Income	$25,222	$20,525
Average HH Income	$67,632	$55,871
Vacant Housing Units	21.6%	15.4%

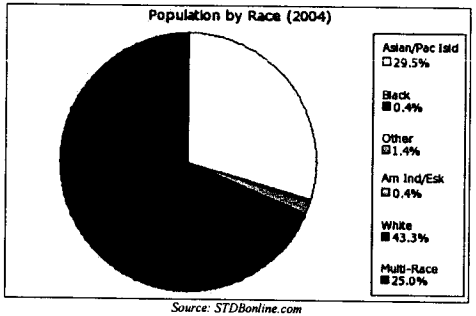
Source: STDBonline.com

The general subject market is well-established and expanding community which comprises about 30 percent of the county population. A decade of development in west Hawaii has resulted in the significant household growth reported in 2000, which outpaced the overall county and is expected to expand by 11 percent by 2009. There is a variety of mixed ages and races as seen in the graphs below.



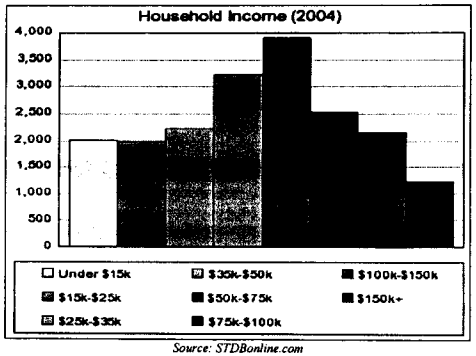
Half of all adults are married, 28 percent never married and five percent are divorced. Approximately 36 percent of households include children.

Education levels range from graduate degrees to kindergarten. The majority of the population, 57 percent, has attended some college, with 34 percent of the population achieving an Associates Degree or higher.



Source: STDBonline.com

As stated previously, the average household's mean income in 2004 is $67,632 in the West Hawaii study area, and $55,871 in Hawaii County.



Source: STDBonline.com

Spending Profile

Average Household Expenditure	West Hawaii	Hawaii County
2004	$52,659	$46,168
2009	$56,687	$49,656
Change	7.7%	7.6%
Average Retail Expenditure		
2004	$21,916	$19,186
2009	$23,584	$20,630
Change	7.6%	7.5%

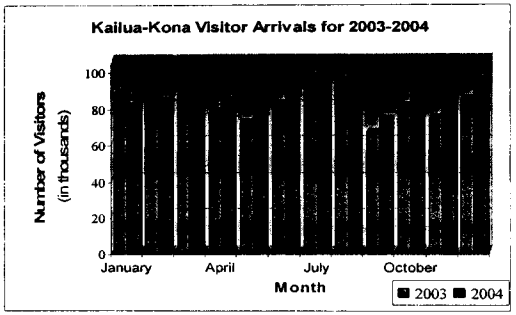
Source: STDBonline.com

In the immediate market area, the average household annually spent circa $11,000 on transportation (21.2 percent), $9,000 on shelter (17.1 percent), $8,700 on food and beverages (16.7 percent) and $5,200 on food at home (9.9 percent). Other expenditures included rental costs, health care, mortgage interest, apparel and entertainment. The local demographics depicted support a viable commercial opportunity.

Visitor Industry

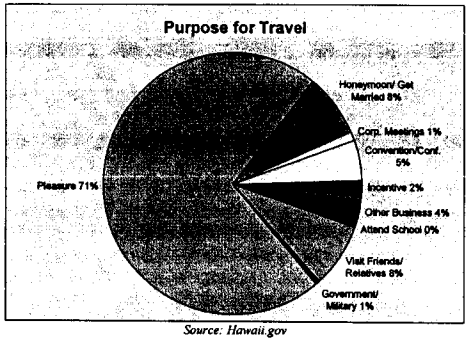
2004 Visitor Data	West Hawaii	Hawaii County
Total Visitors	1,035,114	1,278,713
Visitor Days	6,655,783	8,401,144
Average Party Size	2.13	2.10
Length of Stay	6.43	6.57

Source: DBEDT



Source: Hawaii.gov

Visitors spent an average of $141 per day in the west Hawaii area, of which approximately $48 went to restaurants and shopping centers.



Source: Hawaii.gov

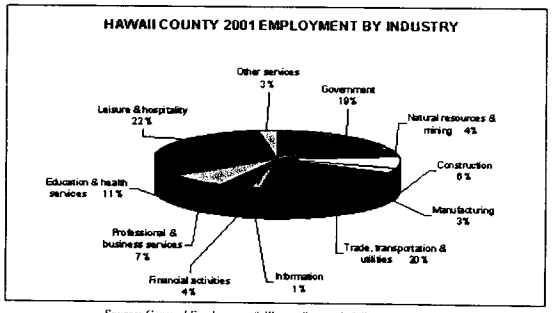
Key Economic Indicators of the State

Economic indicators point to a recovering economy led by the state's largest sector, the visitor industry. Short-term inflation is expected to be in control, while personal income will rise at moderate rates. Overall, the outlook for the state is positive in terms of total output and job creation.

Economic Indicators	2003	2004	2005	2006	2007	2008
	(Actual)		Forecast			
Total population (thousands)	1,249	1,263	1,278	1,292	1,306	1,319
Visitor arrivals (thousands)	6,442	6,988 1/	7,228	7,427	7,612	7,767
Visitor days (thousands)	59,228	63,921 1/	66,173	67,536	68,948	70,412
Visitor expenditures (million dollars)	10,055	10,726 1/	11,200	11,764	12,290	12,830
Honolulu CPI-U (1982-84=100)	184.5	190.6	196.7	202.4	207.9	213.3
Personal income (million dollars)	38,470	40,766 1/	43,212	45,632	48,004	50,405
Real personal income ($1996 million)	35,593	36,510 1/	37,500	38,484	39,414	40,345
Total wage & salary jobs (thousands)	574.4	589.2	599.8	607.6	615.5	622.9
Gross state product (million dollars)	46,638 1/	49,343 1/	52,106	54,816	57,556	60,319
Real gross state product ($1996 million)	39,831 1/	41,114 1/	42,399	43,601	44,751	45,890
Gross state product deflator (1996=100)	117.1 1/	120.0 1/	122.9	125.7	128.6	131.4
Annual Percentage Change						
Total population	1.2	1.1	1.2	1.1	1.1	1.1
Visitor arrivals	-0.2	8.5 1/	3.4	2.8	2.5	2.1
Visitor days	0.5	7.9 1/	3.5	2.1	2.1	2.1
Visitor expenditures	4.6	6.7 1/	4.4	5.0	4.5	4.4
Honolulu CPI-U	2.3	3.3	3.2	2.9	2.7	2.6
Personal income	4.7	6.0 1/	6.0	5.6	5.2	5.0
Real personal income	2.3	2.6 1/	2.7	2.6	2.4	2.4
Total wage & salary jobs	1.9	2.6	1.8	1.3	1.3	1.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Real gross state product	3.8 1/	3.2 1/	3.1	2.8	2.6	2.5
Gross state product deflator	2.1 1/	2.5 1/	2.4	2.3	2.3	2.2

1/ Preliminary
Source: Hawaii State Department of Business, Economic Development & Tourism, February 23, 2005.

Employment Outlook By Industry



Source: Covered Employment & Wages, Research & Statistics Office, HI State Dept. of Labor & Industrial Relations.

Leisure and hospitality is the leading source of employment at 22 percent in Hawaii County. This is also the leading industry in the state. Retail trade and transportation follow closely behind at approximately 20 percent. Other industries such as government (19 percent) and education (11 percent) are also top industries. The other quarter of the work force consists of construction, which is on the rise, business and other services.

Monthly Job Count (in thousands)
Hawaii County

				Change From	
	04/05	03/05	04/04	1 Mo. Ago	1 Yr. Ago
Total Nonfarm	60.8	60.7	58.7	0.16%	3.58%
Natural Res., Mining & Constr.	4.7	4.6	4.4	2.17%	6.82%
Manufacturing	1.5	1.5	1.4	0.00%	7.14%
Trade, Transportation, Util.	13	12.9	12.7	0.78%	2.36%
Information	0.6	0.6	0.6	0.00%	0.00%
Financial Activities	2.5	2.5	2.5	0.00%	0.00%
Professional & Business Svcs	4.3	4.5	4.3	-4.44%	0.00%
Educational & Health Svcs	6.9	6.7	6.4	2.99%	7.81%
Leisure & Hospitality	13.8	13.9	13.3	-0.72%	3.76%
Other Services	1.7	1.7	1.7	0.00%	0.00%
Government	11.7	11.7	11.5	0.00%	1.74%

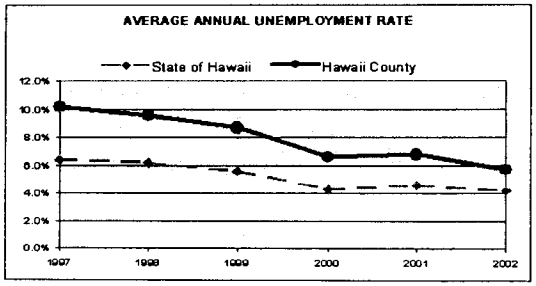
Totals may not add due to rounding.

Source .hiwi.org

Unemployment Rate

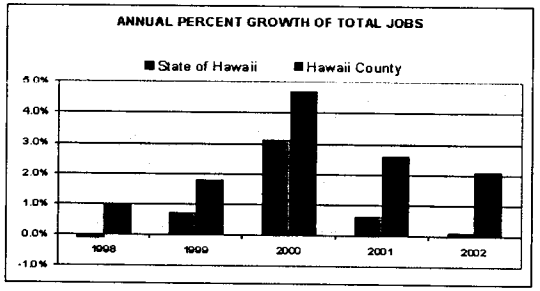
	April 05	March 05	April 04
Hawaii County	3.4	3.2	3.9
State	2.8	2.6	3.2
U. S.	4.9	5.4	5.4

Source: http://www.hiwi.org/



Source: 1) Local Area Unemployment Statistics, Research & Statistics Office, HI State Dept. of Labor & Industrial Relations; 2) Current Population Survey, Bureau of Labor Statistics, US Dept. of Labor.

Employment in the state continues to outpace the national average and reported the lowest unemployment rate in the nation in 2004. Hawaii County unemployment rates are slightly higher than the state average, but continue to be well under the national level. As seen below, the number of jobs in Hawaii County has been on the rise, and the gap between the state levels of unemployment has narrowed since 1998.



Source: Current Employment Statistics, Research & Statistics Office, HI State Dept. of Labor & Industrial Relations.

The South Kohala District

Stretching from sea level to a height of 7,000 feet, the South Kohala District encompasses a majority of the west and northwestern slopes of Mauna Kea and the Kohala Mountains in the north-central portion of the island of Hawaii. The 2000 Census estimated South Kohala's

population at 13,131, an increase of 43.7 percent over the intervening ten-year period. These figures indicate a growth of 185 percent between 1980 and 2000 or an average growth rate of 5.38 percent per annum.

The district of South Kohala has two distinct physical environments--the upper elevation areas (2,000 to 7,000 feet above sea level), centered in Waimea, and characterized by grass-matted rolling hills with cooler temperatures and emphasis on agricultural and residential land uses; and the coastal plain stretching from the shoreline up-slope to Waikoloa Village, which is typified as an arid region with kiawe trees, sparse vegetation, and scattered resort-oriented development.

The coastal areas have an average temperature range of 73 to 90 degrees, with less than ten inches of rainfall per year. Temperatures decrease and rainfall increases at higher elevation levels, with Waimea receiving 40-plus inches of rain per year, and having an average temperature range of 62 to 67 degrees.

The watershed of the area is similarly divided. The Waimea Village watershed extends to the Kohala Mountains, which have high rainfall figures. Intermittent streams from this range flow into the Waimea area where they then turn westerly and dissipate into the permeable lava flows of Mauna Kea, which run down the arid western slope to the Kawaihae-Anaehoomalu shoreline. This area has few defined channels and infrequent stream flows. The Waimea region is generally more susceptible to flooding than the lower slopes and coastal plain; however, high intensity storms periodically flood Mamalahoa Highway from Kawaihae to Puako, with the beachfront areas subject to inundation. The entire coastline of South Kohala is susceptible to tsunami (tidal wave) action.

The primary economic activities in the area are cattle ranching, diversified agriculture, and the rapidly expanding tourism industry. Cattle interests utilize a majority of the district's acreage, with pastures located along the upper slopes of Mauna Kea stretching seaward. The largest holding in the area is Parker Ranch, with approximately 230,000 acres of grazing land supporting roughly 45-50,000 head of cattle.

Additional farming is centered around Waimea, considered one of the Big Island's most productive areas. Cabbage, celery, lettuce, and other vegetables are grown in abundance, as well as melons and floral

products. Experimentation using other diversified crops is widespread. The state maintains an agricultural research facility in the Lalamilo Agricultural Subdivision near the Waimea Airport. The agricultural industry is viewed as a potential economic growth sector for the mauka or upcountry areas of the district; however, the competition for resources and land, brought about by tourism and residential development, the inconsistency of historic supply and demand levels for agricultural products in the state, and the lack of sufficient inexpensive water supply, hampers the general large-scale expansion of farming.

According to state officials, there are approximately 1,800 acres currently cultivated in the Waimea area. This represents just over one-half of the potential for arable production farming in the region.

Commercial activity in South Kohala is centered in Waimea and Waikoloa Village with lesser development in Kawaihae and within the resorts. Major projects in Waimea include the Parker Ranch Shopping Center, Parker Square, the Waimea Shopping Center (completed December 1989), and numerous strip-commercial developments along the main highways servicing the town. In Waikoloa Village, the Waikoloa Highlands Center, a 70,300-square-foot neighborhood shopping center and office complex, was completed in July 1990.

Kawaihae is the third largest community in the district (following Waimea and Waikoloa Village). The residentially oriented village has limited commercial facilities, with the interisland port of Kawaihae and an adjacent industrial park being the major industrial land use in the district and focal point in this small community.

The two major transportation facilities in the district are the deep-water port at Kawaihae and an interisland commuter airport at Waimea. A secondary, minimally used commuter helipad/airstrip serving the Waikoloa Beach and Mauna Lani Resorts was opened in 1984 along Queen Kaahumanu Highway near the vacation areas.

Public and private facilities located in South Kohala include the Lucy Henriques Medical Center in Waimea (private), fire stations near Puako on Queen Kaahumanu Highway and in Waimea, additionally several public and private schools service the area. The North Hawaii Community Hospital is currently under construction and is located adjacent to the Lucy Henriques medical center.

Recreation in the district is geared toward public and private facilities along the coast, maximizing the recreational potential of the ocean. The limited number of other quality beach facilities in the county places a premium on South Kohala's available parks, particularly Hapuna Beach State Park, considered one of the finest in the state. State and county parks are found at various elevations throughout the district with several hunting preserves in the upper elevations.

Tourism, which is rapidly becoming the primary employer and economic force in the district, is geared toward the highly desirable warm, dry climate prevalent at lower elevations along the coast.

Waikoloa Village

The residential/resort community of Waikoloa Village is located approximately eight miles inland and upslope from the oceanfront development. The 2000 US Census indicated that the village had a resident population of 4,806 up 113.8 percent over the 1990 population of 2,248. The village consists of approximately 2,795 acres with zoning in place for thousands of home sites and multi-family units, commercial center, schools, parks, and recreational amenities. About one-third of the potential residential product master planned for the village has been constructed to date.

Waikoloa Village was first conceived and developed by Boise Cascade. Residential development commenced with the 1972 opening of the Waikoloa Village Golf Course. The Waikoloa area first became readily accessible with completion of Queen Kaahumanu Highway in the early 1970s. The residential community has developed incrementally over the past 30-plus years.

Today, Waikoloa Village is centered around its 18-hole Robert Trent Jones, Jr. golf course with clubhouse and swimming pool. The village also contains tennis courts, riding stables, community park, and shopping center. The community's several residential subdivisions include some 1,600 residential lots with over 1,350 completed homes. There are 15 multi-family parcels with 11 projects totaling 1,040 completed residential units.

THE WAIKOLOA VILLAGE RESIDENTIAL MARKET

Our analysis of the Waikoloa Village residential market is divided between two perspectives:

- Macro Analysis -- Assessing the overall, long-term demand and supply trends in the competitive sector; and
- Micro Analysis -- Focusing on the current demand/supply levels in the subject segment.

The study opens with a brief overview of residential development in the primary study area followed by an analysis quantifying the demand for additional housing units in Waikoloa Village based on population, market factors, and real estate trends. Existing and proposed inventory supply is then identified in regards to number of units, development timing and product type. To the extent mid to long-term demand exceeds supply in the study area, the general (or macro) climate for the proposed subject subdivision is favorable.

The second part of the study reviews recent/current market activity in the region, including the status of the market cycle, availability of inventory, pricing and appreciation levels, and exposure time required for sale. This aids in determining whether sufficient near to mid-term demand exists relative to potential supply to support a new project and successfully absorb the subject product. If the market cycle is generally up, new and available units are being absorbed, and inventory is fairly limited, the micro conditions are favorable for the Waikoloa Highlands subdivision.

Waikoloa Village was master-planned in the late 1960s to become a "new" suburban support community providing needed housing for local residents working in the shoreline resorts. Long-term projections called for upwards of 8,000 to 10,000 housing units spread over some 3,000 acres.

After an initial spurt of interest, the population grew rather slowly for the first two decades, stymied by sluggish resort construction, the availability of desirable housing elsewhere in West Hawaii, and the lack of supporting commercial uses in the village. By 1985, there were just some 2,000 residents and about 800 total units in the community.

Major changes began emerging in the late 1980s which have resulted in a tripling of both full-time/de facto populations and in the number of housing units in Waikoloa. These factors are expected to generate similarly extensive growth in the community over the coming 20 years.

Six primary driving forces in the past 15 years that are behind the evident evolution of the residential market in the village have been:

1. The surge in economic expansion along Queen Kaahumanu Highway between Kailua-Kona and Kawaihae has been unprecedented. The resorts have achieved an exceptionally high market status and aggressively pursued development, resulting in increasing numbers of operational, construction, retail/service and maintenance jobs. Plus, the industrial parks near the airport have become a focus of commercial activity in West Hawaii.

2. Traffic congestion throughout the region has meaningfully worsened making commuting from outside the Kailua-Kona/Kawaihae (QK Hwy) Corridor to the employment and services inside increasingly difficult. Waikoloa Village, which was considered "isolated" a generation ago, has had its "proximity" enhanced by land use and traffic conditions. The village is now readily viewed as a viable alternative housing location by a ever-broadening segment of the market.

3. West Hawaii has long had a tight housing market, which became increasing so through the 1990s and into this century due to the insufficiency of zoned and serviced building sites in the face of rapidly expanding demand. The "scarcity" has resulted in rapidly appreciating prices and limited purchase opportunities during the extended upcycle (often resulting in lotteries for new offerings). Waikoloa Village is one of the major "reservoirs" of zoned, serviced lands in the region.

4. A 74,000 square foot shopping center (45 tenants and 300 parking stalls) was opened in Waikoloa Village in 1991. This filled a crucial need for community residents who were previously limited to a small "general store" for all commercial goods or had to drive upwards of 25 miles round trip to go to a true grocery. Moreso than any other single improvement, the

center transformed the village into a reasonable resident housing location.

5. Sales prices and rents in Waikoloa remain below that of comparable residential product in either Waimea or Kailua-Kona. Similar new single family homes in Waimea sell for circa $50,000 to $100,000 more than in Waikoloa, and in central Kona for up to $150,000 more. Given the high price of homes in the region, and the difficulty many local families have in qualifying for market-level mortgages, this creates a critical advantage for village inventory.

6. Second-home (vacation) purchasers have moved strongly into mauka residential projects throughout West Hawaii during the current upcycle; mimicking trends previously seen on Maui. Waikoloa Village offers a favorable climate, superior views, a championship golf course, proximity to the coastal resorts, and competitive pricing; attributes which are highly desired among the moderate to lower end of the vacation unit buying segment.

As a result of these forces within a vibrant regional market, Waikoloa Village was the location for more than half the total number of new residential homes/units constructed in South Kohala since 1990, and now has a resident population estimated at 6,300 persons with a total housing inventory of 2,400 units.

As the cited favorable factors will continue to funnel demand into the village over the mid to long-term, and it remains the largest reservoir of developable residential holdings in the District, it is expected to more than double in size again over the coming twenty-plus years. From 50 to 70 percent of the resident population growth in South Kohala is expected to occur in the subject community.

Macro Analysis

Projecting the probable mid to long-term regional demand for the subject residential product ("rural" single family home sites) is a three-step process:

1. Quantification of Waikoloa Village Housing Unit Demand -- Estimating the need for additional housing units in the study area based on population, demographic, vacancy and income characteristics.

2. Identification of Current and Proposed Projects -- Overview of recent/in-sales and proposed/potential residential development in the study area units in regards to unit types and sales activity.

3. Indicated Conclusions -- Correlation of quantified market demand and supply indicators.

We have assumed the subject lots would be appropriately priced at general market levels consistent with the scale for other new single family product in the study area and attract a spectrum of buyer types.

Quantification of Waikoloa Village Housing Unit Demand

We have projected the demand for residential units in Waikoloa Village area using standardized formulae employing population forecasts, household size trends, and other market-based factors as follows:

RP/AHS = TRUR X (1 + (VA + NRPA)) = TMUD

Where:

RP is the Resident Population
AHS is the Average Household Size
TRUR is the Total Resident Units Required
VA is a Vacancy Allowance
NRPA is a Non-Resident Purchaser Allowance
TMUD is a Total Market Unit Demand

Each of the variables in the formula is based on historic statistics compiled by the Federal Home Loan Bank, U.S. Census Bureau, State of Hawaii DBEDT, County Planning Department, other recognized governmental sources, and researched market data.

These past and current indicators were translated into estimates based on temperate trending interpretations moving forward from existing conditions. Our emphasis was on producing forecasts in sync with the historic data. We have not assumed there will emerge any meaningful market evolutions overriding prevailing demographics and tendencies; such as either anti or unbridled growth extremes, West Hawaii becoming a major retirement locale, or large-scale adjustments in resident lifestyles.

In this regard, our forecasts are representative of moderate future housing requirements for the study area, and could be understated if there is a "spike" in trends towards smaller household sizes, a greater influx of non-resident purchasers into the market, or a more pronounced pro-development governmental perspective.

The "Total Market Unit Demand" conclusions resulting from equation application are intended to quantify the total number of residential housing units which will be needed in Waikoloa Village over the 20-year projection period (2006 through 2025) in order to manifest a reasonably stable market with all purchaser/tenant demand segments adequately served.

Currently, the village housing market is in a slightly to moderately undersupplied condition. This is demonstrated both via housing demand models and the absorption of recently offered product.

While there has been, and continues to be, large inventory additions to the community, it is still experiencing low vacancy rates, high market interest, and rapidly appreciating prices over the last several years. Additionally, greater numbers of second-home owners have been purchasing in the study area "residential" sector.

The Waikoloa Village housing market is not as dysfunctional as found in other neighbor island locations, wherein major numbers of new units are immediately required, but it will be under continuing stress over the near and into the long-term as the focal point for residential construction in the South Kohala District.

Established governmental policy is to address the West Hawaii regional housing unit shortage via appropriate development of existing urban and urban-expansion areas at as rapid a pace as the infrastructure and community will bear. Waikoloa Village is one such focal development location.

The factors comprising our housing demand equation can be summarized as follows:

Resident Population (RP) -- This variable utilizes population and distribution forecasts made by the state, county and ourselves for the island and/or study area. The DBEDT 2030 series of forecasts calls for the Big Island's resident population to increase by more than 35 percent and nearly 60,000 persons

over the coming quarter of a century (1.21 percent compounded annual growth rate), with the daily tourist population to be up by more than half and 10,554 additional daily visitors (1.91 percent annually).

The County of Hawaii General Plan resident projections through 2020 are somewhat more aggressive than state figures; forecasting a range of 213,452 to 237,323 persons by the end of next decade versus 203,050 by the state. The county various modeling estimates equate to a compounded annual growth rate range of 1.53 to 2.25 percent from today's totals.

The county is similar to the state in regards to tourism growth, with their models projecting a one to three percent compounded annual growth in total visitor arrivals through 2020.

The General Plan also indicates that Waikoloa Village has been and will continue to be a focal point of the new residential construction necessary in South Kohala to serve the increasing population. Excerpts include:

> Since the previous general plan was adopted, "Slightly more than half of the newly created parcels in the district occurred at Waikoloa". And,
>
> "Waikoloa Village contains a sizable amount of undeveloped, residential-zoned lands that will eventually contribute significantly to the district's housing inventory"

The current (Spring 2006) resident population of Waikoloa Village is an estimated 6,300 persons; a gain of some 4,052 persons and a compounded annual growth rate of 7.1 percent since 1990.

At present, there are circa 16,000 residents in South Kohala, a figure the county projected in 2000 would reach between 23,947 and 26,625 by 2020. Given the strong population growth of the past five years of about 3,000 persons, it is likely the actual count in 15 years will be at or beyond the upper-end of the forecast range.

Therefore, in making our study area population forecasts we have tested District-wide growth rates commensurate with the County General Plan "Series B" (considered to be "Minimum") and at a "market based" rate that is minorly above the "Series C" models (considered "Maximum").

Our forecasts also assume that upwards of 60 percent of the increase in South Kohala full-time residents during the projection period will take place in Waikoloa Village; a marginally higher figure than in recent years due to the scarcity of developable lands elsewhere in the district.

We estimate the resident population of Waikoloa Village will expand to between 14,000 and 18,000 persons by the year 2025; more than double the current level, but at a lesser percentile growth rate than has been experienced in recent years.

Average Household Size (AHS) -- This factor was calculated using the data as provided by the above-cited sources and census figures. Extrapolating the 2000 US census indicators for the study area, we have estimated the current AHS in the study area is at about 2.80 persons. This is slightly above the island-wide level of 2.75 persons per household recorded in the last census, a function of the high proportion of single family homes (versus lower occupancy multi-family units), and the large number of middle-income families (which tend towards having more children and multi-generation households) in the village.

Most Hawaii-oriented sociologists contend the movement to smaller household sizes will continue into the future; forecasting longer life-spans, the influx of single persons attracted to the climate and employment opportunities, increasing numbers of retirees, and the tendency towards fewer children. However, given the current and expected demographics of the subject community, we do not believe the decline will be as significant in Waikoloa as elsewhere on the island.

We project the average household size in the study area will stabilize by the Year 2025 at between 2.67 and 2.72 persons; still slightly above most Big Island locales.

We note, this is a rather conservative assumption, and if the decline in household sizes more closely mirrors the state and county trends, a greater number of housing units will be necessary to meet demand.

Total Resident Units Required (TRUR) -- This figure is arrived at by dividing the subject area resident population (RP) by the average household size (AHS). It is indicative of the minimum number of residences which would be required to meet basic resident housing needs, assuming there were no vacant units, none uninhabitable due to on-going repair or deleterious conditions, and none occupied by non-resident persons.

For a market to be considered stable (and nominally operative) without spiking appreciation rates while maintaining quality lifestyle opportunities, allowances for such factors must be made.

Vacancy Allowance (VA) – Governmental agencies are on record during the past 20 years calling the state and West Hawaii among the tightest residential markets in the nation, expressing fears of a deteriorating economy and community structure unless major steps are taken over the long-term to address the shortage. While major gains in addressing this need have been made during the recent up-cycle, the undersupply condition is still acute, and a primary reason West Hawaii housing prices are so high.

According to HUD, the Urban Institute, and other sources, a "healthy" market has a minimum vacancy level of five to six-plus percent of the total number of units in the inventory. This allows for uninhabitable units, units under repair, seasonal fluctuations, a transitional housing margin, a degree of mobility potential, and the ability to service periodic unanticipated population increases. A "slack" in unit occupancy also serves as a margin to cushion against hyper-appreciation during strong demand periods.

Given the history of the West Hawaii housing market and its inability to keep an acceptable vacancy pool available, we believe it will be exceptionally difficult for the desirable vacancy allowance of more than five percent to be achieved in the study area during the foreseeable future.

In our demand formula, we have therefore tested vacancy rate allowances of three and five percent of the Total Resident Units Required figure; at and below the minimum allowance considered healthy for a mainland market, but likely the best which could ever be achieved in West Hawaii.

Non-Resident Purchaser Allowance (NRPA) -- While many non-resident purchasers of non-resort housing units in the islands seek to rent them to residents in an effort to minimize debt service obligations, an increasing number are buying West Hawaii residential units for personal (family and friends) second-home use, business reasons, or for transient rentals

These units are not available to meet resident housing demands and are effectively withdrawn from the inventory pool. An allowance must be made for these units in the general community, which are not to be confused with those specifically intended for tourist-oriented second home ownership and transient rentals (i.e., within a resort-classified area).

On the neighbor islands and in Waikiki, there are many units in complexes or subdivisions designed for general residential use, which are owned by non-residents that often sit vacant the vast majority of the time and provide no help in servicing local household needs.

Virtually no open market subdivision or project built on the neighbor islands in the past decade has not had a second-home ownership component. In newer West Hawaii developments. It ranges from about five percent in Waimea to slightly more than half in some Kailua-Kona projects.

While some developments have attempted to minimize the impact of second home and investor owners via owner/occupancy requirements or through lottery offerings, they still represent an increasingly major segment of the primary and general market residential sectors which must be allowed for in coming years. Otherwise, their demand, which is much less price sensitive than a local family, will gradually push more and more resident households out of the market.

The impact of these buyers on the market must be taken into consideration when projecting a region's housing unit needs, given the widespread interest in Hawaii real estate and typically greater financial resources of non-resident buyers. Failure to adequately account for their demand places extreme stress on island towns.

Apart from limited interest in the original development period during the early 70s, Waikoloa Village did not have a substantial second-home buyer component until the late 1990s; and it has mushroomed since. In the newer subdivisions, second-home/vacation purchasers have represented from circa 15 to 40-plus percent of total buyers.

This trend is expected to continue expanding over the coming decades as the Waikoloa community becomes an even more established buying alternative for the second-home segment, and the high prices of the luxury-class oceanfront resorts forces more of these purchasers into residential neighborhoods.

At present, between 10 and 20 percent of the housing units in Waikoloa Village are owned by non-resident buyers, we forecast this number will steadily increase over the projection period. We have therefore utilized a NRPA which grows to a stabilized level of 25 percent to 35 percent of quantified resident user demand in the "minimum" and "maximum" projection models, respectively.

Total Market Unit Demand (TMUD) -- The solution to our demand formula is quantified by adding the Vacancy Allowance (VA) and Non-Resident Purchaser Allowance (NRPA) to the Total Resident Units Required (TRUR) figure. The result is the total number of units which will be needed in Waikoloa Village in order to meet all reasonable market demand segments.

The application of the housing demand formula to the subject community using our conservative/minimum and optimistic/maximum forecasts are shown on Table 1. Extrapolation of 2000 census figures indicates there are some 2,400 existing housing units in the village as of the 2006 study date.

TABLE I

QUANTIFICATION OF HOUSING UNIT DEMAND FOR THE
WAIKOLOA VILLAGE STUDY AREA, 2006 to 2025
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
Includes Waikoloa Village Only

	2006	2010	2015	2020	2025	Additional Units Required by 2025 (1)
Scenario One: Minimum Projections Using County "Series B" (Moderate) Population Projections and Conservative Allowance Factors						
Resident Population	6,300	8,300	10,100	12,000	14,000	
Average Household Size	2.80	2.78	2.76	2.74	2.72	
Total Resident Units Required	2,250	2,986	3,659	4,380	5,147	
Vacancy Allowance	68	90	110	131	154	
(3% of resident unit demand)						
Non-Resident Purchaser Allowance	225	448	732	1,095	1,287	
(From 10% rising to 25% of resident unit demand						
TOTAL MARKET UNIT DEMAND	2,543	3,523	4,501	5,606	6,588	4,188
Scenario Two: Maximum Projections Using Market-Based (High) Population Projections and Optimistic Allowance Factors						
Resident Population	6,300	8,900	12,000	15,000	18,000	
Average Household Size	2.80	2.77	2.74	2.70	2.67	
Total Resident Units Required	2,250	3,215	4,380	5,556	6,742	
Vacancy Allowance	113	161	219	278	337	
(5% of resident unit demand)						
Non-Resident Purchaser Allowance	450	803	1,314	1,944	2,360	
(From 20% rising to 35% of resident unit demand						
TOTAL MARKET UNIT DEMAND	2,813	4,177	5,912	7,778	9,438	7,038

	Existing	2006-2010	2011-2015	2016-2020	2021-2025	Totals
CONCLUDED HOUSING UNIT DEMAND RANGE						
MINIMUM DEMAND						
Periodic	143	981	978	1,105	982	4,188
Cumulative	143	1,123	2,101	3,206	4,188	
Average Annual Demand (2)		225	196	221	196	
MAXIMUM DEMAND						
Periodic	413	1,364	1,736	1,865	1,660	7,038
Cumulative	413	1,777	3,512	5,378	7,038	
Average Annual Demand (2)		355	347	373	332	
MID-POINT DEMAND						
Periodic	278	1,172	1,357	1,485	1,321	5,613
Cumulative	278	1,450	2,807	4,292	5,613	
Average Annual Demand (2)		290	271	297	264	

(1) There are an estimated 2,400 housing units in Waikoloa Village as of year-end 2005
(2) Existing (or latent) demand is assumed absorbed by 2010.

Source: Various and The Hallstrom Group, Inc.

Based on our analysis, the actualization of a healthy and stable housing market in Waikoloa Village will require the construction of about 4,188 to 7,038 additional housing units in the community by the Year 2025. The mid-point demand would be for 5,613 units, or more than twice the in-place inventory.

Conversion of this estimate of gross demand into pricing equivalents was completed using available data from the U.S. Census, Big Island Board of Realtors, statistical analysis and the U.S. Dept. of HUD.

Table 2 illustrates the striation of Waikoloa Village regional housing requirements through 2025 into probable percentile demand by sales prices at current dollar levels. The figures correlate both historic/actual buying trends and theoretical "affordability" quotients derived using government pricing criteria.

Given anticipated subject lot prices and current home building costs, the eventual "finished homes" comprising the subject inventory will meet the "affordability" levels for approximately 27.7 percent of the prospective buyers in the village over the next two decades. This segment, priced at $750,000 and up, equates to a demand for between 1,160 and 1,952 total new units by 2025, and will be 30 percent of the total market by the end of the projection period.

To date, there is very little of such priced inventory (above $750,000). The subject and proposed Waikoloa Heights development plan on offerings in this range.

Table 3 displays the calculations of housing price affordability for Big island residents based on HUD/state/county and conventional financing guidelines.

Using the governmental criteria, households in the "Low Income" grouping, earning 80 percent or less of the island median income, can afford a sales price, or rental equivalent, of $196,800 (rounded) or less. "Low to Moderate Income" households, earning 80 to 120 percent of median income, can afford home prices up to $246,000. And, "Moderate-Gap Group (or "low market") Income" households can afford prices up to $358,400. Above this level, prices are considered "market".

Using conventional financing criteria, the affordable housing prices for the respective groups increase by about 15 to 18 percent.

TABLE 2

STRIATED PROJECTIONS OF HOUSING UNIT DEMAND
BY SELLING PRICE IN WAIKOLOA VILLAGE 2006 TO 2025
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
Includes Waikoloa Village Only

Period	Periodic Demand (1) 2006 to 2010	2011 to 2015	2016 to 2020	2021 to 2025	Total Demand 2006-2025
1. Minimum Demand					
Less Than $250,000	**281**	**205**	**188**	**137**	**811**
Percent of Total Demand	25.00%	21.00%	17.00%	14.00%	19.38%
$250,000 to $500,000	**314**	**274**	**309**	**275**	**1,173**
Percent of Total Demand	28.00%	28.00%	28.00%	28.00%	28.00%
$500,000 to $750,000	**247**	**235**	**287**	**275**	**1,044**
Percent of Total Demand	22.00%	24.00%	26.00%	28.00%	24.93%
$750,000 to $1,000,000	**213**	**196**	**232**	**216**	**857**
Percent of Total Demand	19.00%	20.00%	21.00%	22.00%	20.46%
Over $1,000,000	**67**	**68**	**88**	**79**	**303**
Percent of Total Demand	6.00%	7.00%	8.00%	8.00%	7.23%
Total Market Demand	**1,123**	**978**	**1,105**	**982**	**4,188**
	100.00%	100.00%	100.00%	100.00%	100.00%
2. Maximum Demand					
Less Than $250,000	**444**	**365**	**317**	**232**	**1,358**
Percent of Total Demand	25.00%	21.00%	17.00%	14.00%	19.30%
$250,000 to $500,000	**498**	**486**	**522**	**465**	**1,971**
Percent of Total Demand	28.00%	28.00%	28.00%	28.00%	28.00%
$500,000 to $750,000	**391**	**417**	**485**	**465**	**1,757**
Percent of Total Demand	22.00%	24.00%	26.00%	28.00%	24.97%
$750,000 to $1,000,000	**338**	**347**	**392**	**365**	**1,442**
Percent of Total Demand	19.00%	20.00%	21.00%	22.00%	20.48%
Over $1,000,000	**107**	**122**	**149**	**133**	**510**
Percent of Total Demand	6.00%	7.00%	8.00%	8.00%	7.25%
Total Market Demand	**1,777**	**1,736**	**1,865**	**1,660**	**7,038**
	100.00%	100.00%	100.00%	100.00%	100.00%

Note: Estimates based on combination of resident household income analysis, median prices being paid for inventory, and evident trends in the Waikoloa Village residential market.

(1) Assumes existing latent demand is absorbed by 2010.

Source: Various and The Hallstrom Group, Inc.

TABLE 3

ESTIMATE OF HOUSING PRICE AFFORDABILITY FOR WEST HAWAII RESIDENTS
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawai

1. Based on General HUD/State/Hawaii County Criteria

Grouping Household Income as a Percent of County Median	Low Income 80% or less	Low-Moderate Income 80 % to 100%	Moderate-Gap Group Income 100% to 140%
Gross Household Monthly Income	$4,220	$5,275	$7,385
Maximum Allowable Housing Expense (1)	$1,393	$1,741	$2,437
Less Tax and Insurance Reserve	($150)	($175)	($200)
Less Mortgage Insurance Payment	($50)	($75)	($100)
Net Amount Available for Debt Service	$1,193	$1,491	$2,137
Maximum Mortgage Amount (2)	$186,948	$233,646	$340,518
Down payment at 5% of Sales Price	$9,839	$12,297	$17,922
Total Affordable Purchase Price	**$196,787**	**$245,943**	**$358,440**

2. Based on Conventional Financing Criteria

Grouping	Low Income	Low-Moderate Income	Moderate-Gap Group Income
Gross Household Monthly Income	$4,220	$5,275	$7,385
Maximum Allowable Housing Expense (3)	$1,182	$1,477	$2,068
Maximum Mortgage Amount (4)	$185,224	$231,452	$324,064
Down payment at 20% of Sales Price (5)	$46,306	$57,863	$81,016
Total Affordable Purchase Price	**$231,530**	**$289,315**	**$405,080**

Note: Median household income for West Hawaii estimated at $63,300 in 2006 based upon comparable figures for urban areas of Maui and Kauai. This is approaching 20% above county-wide averages.

(1) Based on standard governmental affordability criteria at 33%.
(2) Assuming 6.5% annual interest and 30 year mortgage..
(3) Conventional financing with maximum monthly mortgage payment at 28% of gross income. No reserves of mortgage insurance required.
(4) Assuming 6.5% annual interest and 30 year mortgage.
(5) Conventional financing standard.

Source: HUD, State of Hawaii, Hawaii County and The Hallstrom Group, Inc.

Inherently, a large portion of the demand is generated by lower- to middle-income groups who can have difficulty competing in the high-priced West Hawaii marketplace. Upper-middle and above income households have more meaningful purchase alternatives.

About 19.3 percent of the Waikoloa Village units required through 2025 should be priced below a current level of $250,000, which would be generally affordable to the "low" and "low-moderate" income groups; 28.0 percent of demand will have price limits between $250,000 and $500,000 (affordable to "moderate-gap group" and lower market categories); 25.0 percent of demand will be oriented towards homes having prices of $500,000 to $750,000 (moderate market pricing); and, 27.7 percent will seek properties having a price above $750,000.

The atypically high percentage of demand oriented towards the top of the market is a function of the large number of upper-income non-resident buyers in the region, and that virtually all new development must have higher prices to economically support its construction.

Given long-term plans for the community, existing zoning/general plan classifications, and the strong preference among local families for single family purchase opportunities; the large majority of village inventory will continue to be single family lots and lot/home packages. Further, unlike in many neighbor island locales, a significant portion of the non-resident and investor buyer segment in the community has expressed a preference for homes, and not condominium units.

Of the 2,400 total currently existing residential units in Waikoloa, approximately 1,360 (or 57 percent) are single family or detached homes and 1,040 (43 percent) are condominiums (some of which are detached). In light of the large numbers of condominiums already in-place, the availability of only a few remaining multi-family zoned development sites, and that several major proposed and on-going additions to the community will not include condominium components, there will be a major change in the unit mix from current levels, significantly leaning further and further towards single-family in coming years.

As shown on Table 4, we forecast that single family homes and lots will increase meaningfully in overall proportion to multi-family units within the new projects over the next 20 years. Over the last decade

TABLE 4

DIVISION OF PROJECTED DEMAND BY UNIT TYPE
FOR HOUSING UNITS IN WAIKOLOA VILLAGE 2006 TO 2025
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii

	Periodic Demand (1)				Total	
	2006 to 2010	2011 to 2015	2016 to 2020	2021 to 2025	Demand 2006-2025	Comments
1. Using Minimum Demand Projections						
Single Family Homes	674	616	740	668	2,698	As elsewhere in West Hawaii, this segment is increasing in market share, with the majority of recent developments and current/proposed projects featuring this type. As the Village evolves into a standard, well-established bedroom community (not just a lower cost or convenient alternative), this types will continue to expand.
Percent of Total	60%	63%	67%	68%	64%	
Single Family Lots	314	245	254	216	1,029	The initial phases of Village were overwhelmingly vacant lots. The large majority of which have been built-out over the past three decades. While there will always be some meaningful demand in this category, it is not expected to have as major role except for upper-end and larger "ag" lots.
Percent of Total	28%	25%	23%	22%	25%	
Effective Subject Market Segment						
Sub-Total	**988**	**861**	**995**	**884**	**3,727**	
Percent of Total	**88%**	**88%**	**90%**	**90%**	**89%**	
Multifamily Units	135	117	111	98	461	Cyclically developed in Village. Numerous projects built at commencement of development, again in late 1980s, and there is renewed interest in today's market. Available sites are somewhat scarce, although some will be included in several under-way and long-term projects.
Percent of Total	12%	12%	10%	10%	11%	
Total	1,123	978	1,105	982	4,188	
	100%	100%	100%	100%	100%	
2. Using Maximum Demand Projections						
Single Family Homes	1,066	1,094	1,250	1,129	4,538	
Percent of Total	60%	63%	67%	68%	329%	
Single Family Lots	498	434	429	365	1,726	
Percent of Total	28%	25%	23%	22%	25%	
Effective Subject Market Segment						
Sub-Total	**1,564**	**1,528**	**1,679**	**1,494**	**6,264**	
Percent of Total	**88%**	**88%**	**90%**	**90%**	**89%**	
Multifamily Units	213	208	187	166	774	
Percent of Total	12%	12%	10%	10%	11%	
Total	1,777	1,736	1,865	1,660	7,038	
	100%	100%	100%	100%	365%	
Mid-Point						
Single Family Homes	870	855	995	898	3,618	
Single Family Lots	406	339	342	291	1,377	
Effective Subject Market Segment						
Sub-Total	**1,276**	**1,194**	**1,337**	**1,189**	**4,996**	
Percent of Total	**88%**	**88%**	**90%**	**90%**	**89%**	
Multifamily Units	174	163	149	132	617	
Total	1,450	1,357	1,485	1,321	5,613	

Source: The Hallstrom Group, Inc.

well more than 80 percent of all inventory additions have been single-family oriented (lots or lot/homes), a level which we forecast to increase to 89 percent of market additions through 2025.

The total mid-point demand for multi-family development in Waikoloa Village over the next two decades is estimated at 617 units. For single-family types the demand will be for 4,996 total homes; which we have allocated between 3,618 houses and 1,377 building lots for discussion purposes, although from a market perspective they are both serving the same general segment.

Identification of Waikoloa Village Residential Projects

Existing Supply

Based on extrapolation of 2000 census data and county planning figures, we estimate the total number of habitable housing units in the Waikoloa Village study area as of Spring 2006 was approximately 2,400 units. The majority of these have been constructed on long-subdivided lots or in more recent major developments constructed since the late 1980s.

An overview of the most recent single family (and detached multi-family) projects is shown on Table 5, focusing on product type, pricing, model types and purchaser orientation.

Proposed Supply

Apart from Waikoloa highlands, there are five major projects in-development, approved or proposed in Waikoloa Village area at this time. A sixth holding of circa 600 acres considered as having long-term residential use potential is still held by the master developer (Waikoloa Development), but there have been no announced plans to pursue construction in the near to mid-term.

All of the developments are in relatively close proximity to the subject property and are summarized on Table 6. We are aware of no other major developments preliminarily proposed, announced or otherwise making headway in the entitlement process at this time.

The top of the table contains those projects which are "fully approved/moving forward". The first three developments shown were all in construction as of the study date. Waikoloa Heights anticipates commencement of its first phase in 2007. These projects will provide a maximum of 3,456 additional total residential units to the village

TABLE 5

RECENT SINGLE FAMILY RESIDENTIAL DEVELOPMENTS IN WAIKOLOA VILLAGE
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii

Location	WEHILANI @ WAIKOLOA WAIKOLOA VILLAGE	17th FAIRWAY VILLAS WAIKOLOA VILLAGE	SUNSET RIDGE WAIKOLOA VILLAGE	KILOHANA KAI WAIKOLOA VILLAGE
Year Constructed Began/Planned	2005	2003-04	1989	2003-2004
Number of homes (in-place/potential)	0/473	27/27	81 / 201+	150/230
Project Style	Mixed SF and MF	Detached Town homes	Single Family Homes	Vacant Lots / Single Family
Bed/Bath (current models)	3/2 - 4/3	3/2	3/2	3/2 to 4/3
Finished Home Price Range	$515,000 to $619,000	$409,800 to $449,800	$525,000 to $760,000	$515,000 to $719,000
Lot Size	10,000 - 14,000 Square Feet	3,300 - 5,200 Square Feet	10,000 to 30,000 Square Feet	10,000 to 50,000 Square Feet
Living Area in Square Feet	1,560 to 1,987	1,258	1,572 to 1,798	1,565 to 2,375
Indicated Price per Square Foot	$312 - $355	$326 - $358	$334- $423	$320 to $447
Marketing Insights	Most demand oriented to MF.	Strong demand during high period.	Market has softened last 6 mos.	Market slightly off in recent mos.
	Lower-price homes selling best.	Units on golf course highest demand	Investor segment most affected.	But interest high for coming phase.
	Mixed views limits demand.	Limited views, but larger lots hotter.	May drop low prices to $505,000.	No softening in prices...yet.
	All Own/Occ per restrictions.	40% Own/Occ, 25% Investor and	Huge demand for good view lots.	Huge demand for good view lots.
	Buyers asking about larger lots.	35% second home	Large lots also in demand.	"Best views" in Waikoloa.
	All 2-car garages.	Sold out in a month.	Own/Occ and 2nd home still good.	Some investors demand remains.
	10 of 16 in first phase "sold".	Re-sale prices up 20+%	3-car garage desired feature.	Large lots , 3-car garage in demand.
Realtor	Castle & Cooke	Golden Triangle Realty	Golden Triangle Realty	Several (lead Hawaiian Homes)
Developer	Castle & Cooke / Kona Coast	Towne Development Group	Towne Development Group	Various
Builder/Contractor	Castle & Cooke	Towne Development Group	Towne Development Group	JV of realtors/builders
Community Amenities	Comm. Ctr & landscaped entry	None	None	None

TABLE 6

SUMMARY OF MAJOR IN-DEVELOPMENT & PROPOSED WAIKOLOA VILLAGE RESIDENTIAL DEVELOPMENTS
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
INCLUDES THE SUBJECT PROPERTY

Development/Project	Proposed/Remaining Units (1) Single Family	Multi-Family	Total	Type	Timing	Comments
1. Fully Approved, Moving Forward						
Wehilani at Waikoloa	473	283	756	SF w/ 10,000 SF min. lot MF at 8 to 10 units/acre	Phase I infrastructure underway, with initial product (afford -MF and mkt-SF) being offered. Build-out in circa 6 years.	Deed-restricted community, owner-occupants only for one year minimum. Currently offering three products: Aff-MF at $167,000 to $249,000; Mkt-MF at $309,000 to $389,000; SF at $515,000+
Sunset Ridge	120 (2)	0	120	SF w/ 10,000 SF min. lot Selected lots to 30,000 So	Phase I commenced in 1989. Had difficulties in mid-1990s. 81 homes completed in prior phases.	Phase I fast sell-out, II prolonged, III quickly in 2004. Standard subdivision, no amenities. From $485,000.
Kilohana Kai	80	0	80	19 lots and 61 finished homes from 10,000 SF to 1.25 acres	Secon d (and final) phase of 230 lot/home project began in 2004. Full-sell out by end-2006.	Rapid sell-out first phase, most homes being built now. Phase II infrastructure underway. Lots up to $325,000, homes at $598,000 and up. Several builders.
Waikoloa Heights (Subject)	2,500	0	2,500	SF w/ 10,000 SF min. lot Planned Unit Development	First phase in 2007. Build-out to require circa decade-plus.	Long-zoned (1969) northerly expansion area of village. Includes commercial, park, and community components. Prices expected at $600,000 to $800,000+.
Sub-Total (estimated unit mix)	**3,173**	**283**	**3,456**			
2. Proposed, Seeking Entitlements						
Waikoloa Highlands	398	0	398	1/2 acre and up "estate lots" Low density much open space. Began entitlements in 3/06.	Seeking "Ag" to "Rural" SLU change. Phase I planned in 2007.	Initial 700 acres of 2,000 acre holding located mauka/southerly of village. Additional units over long-term. Lot price expected at $350,000-plus.
State of Hawaii/Hawaii County	225	0	225	Small, "affordable", deed-restricted homes. Project planning re-commenced 3/06.	Has been "on hold" for 15 yrs due to Village CC&R /other issues	Public agency development. First 56 acre phase of 300 acre project. Prices expected at $250,000 to $350,000.
REGIONAL TOTALS	**3,796**	**283**	**4,079**			
3. Other, Inactive Holdings						
Waikoloa Development Company	N/A	N/A	N/A	Partially-entitled land near existing Village. Likely use is for medium to low density SF homes.	Portion of 20,000+ acres of lands remaining under original master developer control. Recently offered for sale as part of bulk holding.	There have been no announced plans to seek near to mid-term development of this property. At best, it is likely 10+ years away from any actualization.

(1) Unit counts and absorptions are estimates based on discussions with developers, brokers and County agencies and website data.
(2) Final unit count depends upon densities of unplanned final phase. 200 total homes in initial and current phases.

Source: County of Hawaii General Plan, Development brochures & websites, project brokers, and The Hallstrom Group, Inc.

inventory; 3,173 single family homes (91.8 percent of the total) and 283 multi-family units (8.2 percent).

The middle part of the table displays two projects which are proposed and currently seeking entitlements; the subject subdivision and a public "affordable" housing development. Together, they will add an additional 623 single family homes/lots to the community. However, the public agency project will not be a "market" offering; having selling prices established based on household income formulae and with purchase being limited to local resident families.

It is improbable that all of this inventory will be built, as master plans evolve over time and actual densities invariably fall short of utmost approvals. Further it is unlikely that all of the product will be built within the study time-frame; as Waikoloa Heights, the public project, and the Waikoloa Development holding could easily extend to circa 2025 or beyond.

Based on our investigation, we estimate the potential supply of new housing in the Waikoloa Village over the next 20 years, apart from the subject holding and assuming the other projects move reasonably forward into subsequent phases, will be about 3,681 total units; with an outside chance of an additional units on the Waikoloa Development Co. site toward the end of the time frame.

Comparison of Demand and Supply Indicators

The demand for new housing opportunities in the Waikoloa Village study area over the coming 20 years, 2006 through 2025, is estimated at from 4,188 to 7,038 total new units, with a mid-point of 5,613 units.

The probable level of new inventory additions during the same time frame will be a maximum of 3,681 units, if all approved developments are built to absolute top densities. However, it is likely a smaller number will be actualized.

Therefore, approved supply will fall short of projected demand by at least 507 (minimum) to 3,357 (maximum) housing units during the next two decades without Waikoloa Highlands. The mid-point shortfall of supply relative to demand in the study area is forecast at 1,932 total new residential units.

Micro Analysis

The Waikoloa Village residential real estate market, like most sectors throughout the state, is currently in the midst of a major up-cycle. The increasing activity began in the late 1990s, was set back briefly by 9/11, and has reached record levels in 2005 before experiencing a slight drop-off in the first quarter of 2006.

Despite the recent minor slow-down since late 2005, sales volumes remain well above historic levels, average prices are at/near all-time highs, market times are below long-term trends, appreciation in recent years has been substantial, and realtors report continuing purchaser interest from most sectors (although the "investor" segment has weakened of late).

Single family residential market activity data in the study area from 2000 through 2006 (based on extrapolation of data through March) are summarized on Table 7. We note, the statistics are extracted from the Big Island Multiple Listing Service database and do not include all original sales of new inventory; thus, there is a meaningful understatement in the number of sales and total sales volume, and likely in average sales prices.

During this period sales volumes of village homes more than tripled to $80 million annually in 2005 and average sales prices have increased by 134 percent to $566,877, an effective appreciation rate of 15.2 percent compounded annually over the past six years.

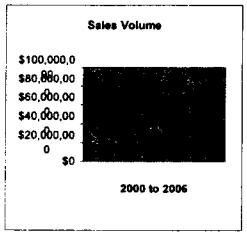
House lot activity for the same period is displayed on Table 8. The rate of expansion in this sector has also been exceptional, although it has been limited by a lack of inventory as finished home construction has become the primary goal of most developers. Sales volumes have grown nearly four-fold from 2000 to 2006 reaching $12 million per year, and average sales prices are up more than five-fold reaching $272,409 per lot, equating to an appreciation rate of 34.5 percent annually.

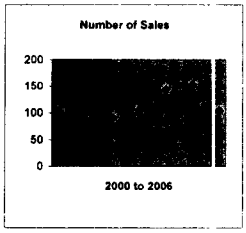
Despite the minor drop-off, 2006 will be among the strongest years in village residential real estate; below the record-setting heights of 2005, but still far above historic market trends. We uncovered no indicators in our research and interviews which demonstrated anything other than the subject area being in the midst of a continuing long-term up-cycle.

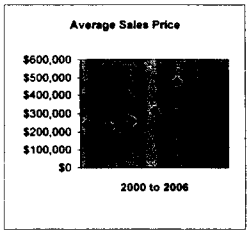
TABLE 7

SUMMARY OF SUBJECT AREA SINGLE FAMILY RESIDENTIAL MARKET ACTIVITY
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
Includes Waikoloa Village Only

Year	2000	2001	2002	2003	2004	2005	2006 (1)
Sales Volume	$24,932,460	$19,453,550	$23,436,532	$32,971,930	$68,347,849	$79,989,150	$58,955,200
Percent Annual Change		-22.0%	20.5%	40.7%	107.3%	17.0%	-26.3%
Number of Sales	103	86	91	105	143	153	104
Percent Annual Change		-16.5%	5.8%	15.4%	36.2%	7.0%	-32.0%
Average Sales Price	$242,063	$226,204	$257,544	$314,009	$477,957	$522,805	$566,877
Percent Annual Change		-6.6%	13.9%	21.9%	52.2%	9.4%	8.4%







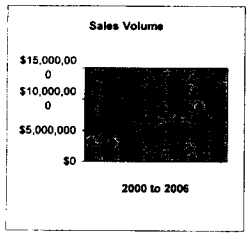
(1) Year-end estimate based on extrapolation of data through March.

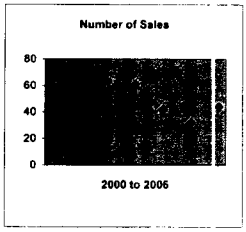
Source: Hawaii Information Service, Big Island MLS and The Hallstrom Group, Inc.

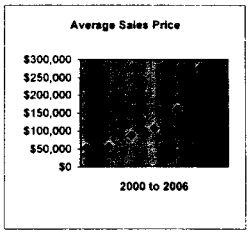
TABLE 8

SUMMARY OF SUBJECT AREA VACANT LOT MARKET ACTIVITY
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
Includes Waikoloa Village Only

Year	2000	2001	2002	2003	2004	2005	2006 (1)
Sales Volume	$3,154,650	$2,955,800	$5,525,779	$6,471,500	$6,658,500	$8,803,513	$11,986,000
Percent Annual Change		-6.3%	86.9%	17.3%	2.8%	32.2%	36.2%
Number of Sales	60	52	63	61	42	32	44
Percent Annual Change		-13.3%	21.2%	-3.2%	-31.1%	-23.8%	37.5%
Average Sales Price	$52,578	$56,842	$87,711	$106,221	$158,536	$275,110	$272,409
Percent Annual Change		8.1%	54.3%	21.1%	49.3%	73.5%	-1.0%







(1) Year-end estimate based on extrapolation of data through March.

Source: Hawaii Information Service, Big Island MLS and The Hallstrom Group, Inc.

The primary concerns expressed were lack of product diversity, high prices and rising mortgage rates.

We conclude the micro analysis perspective also provides strong market support for the proposed Waikoloa Highlands project.

SUBJECT SITE APPROPRIATENESS AND ABSORPTION CONCLUSIONS

Appropriateness of the Subject Site for the Proposed Use

The 700-acre subject property presents a superior opportunity to meet the existing and projected shortfall in residential real estate in the Waikoloa Village, specifically addressing an expressed need for larger lots and ownership opportunities outside the "cookie cutter" single family inventory which presently dominates the community.

The availability of a more diverse product type is essential if the village is to reach its potential within the regional marketplace. A vibrant community requires a broad range of housing types, from affordable condominiums to upper-end single family homes, in order to reach its full "operating" potential.

Such diversity will bring a broader range of economic resources, creative energies, and public opinions to Waikoloa, and attract households which currently cannot find their desired level of product.

Further, the availability of some upper-end lots (and eventually homes) will attract the interest of non-resident buyers, who typically have more capital resources than local households, away from the village core; leaving the more moderately priced inventory for the housing of resident families. This is essential in lowering the ever increasing competition from outside purchasers for the scarcer, "more affordable" units.

Additionally, the Waikoloa Highlands site has the fundamental attributes to become a successful subdivision from a market perspective. It has/is:

- The necessary physical traits (size, shape topography) to support large-scale competitive residential development.

- Direct access onto the main arterial in the region (Waikoloa Road).
- Proximity to the Waikoloa Village community core.
- Access to existing utility systems.
- An expanding regional resident population nearby.
- Long been planned for large-lot residential use, as indicated by the land use classifications for portions of the holding and past announcements regarding the development of the site.
- It is nearby the primary retail/restaurant/service development in the community (Waikoloa Village Center) and major regional recreational amenity (Waikoloa Village Golf Course and Club).
- It will have extensive greenbelts, open spaces and view corridors within the subdivision; traits lacking in the existing village developments.

The proposed Waikoloa Highlands master plan embodies characteristics that will prove desirable to a an expanding segment of rural/residential purchasers seeking larger lots in the subject study area.

A comparative matrix of the characteristics for the major in-development and proposed residential projects in Waikoloa Village (including the subject) is shown on Table 9.

Subject Absorption Estimates

Given the evident level of support for the proposed subject inventory from both macro and micro perspectives, as demonstrated by our market study, and that the underlying site is highly appropriate for the envisioned development, it can be readily opined the 398 lots of the Waikoloa Highlands subdivision will achieve reasonable market success upon offering.

This conclusion is supported through summary application of several techniques, as discussed following.

TABLE 9

MAJOR COMPETITIVE PROJECTS COMPARATIVE MATRIX
Market Study of Proposed Waikoloa Highlands Subdiv. on
Waikoloa Village, South Kohala, Hawaii

Project Name	Waikoloa at Waikoloa	Sunset Ridge	Kilohana Kai	Waikoloa Heights	SUBJECT PROPERTY Waikoloa Highlands
Location	Waikoloa Village	Waikoloa Village	Waikoloa Village	Waikoloa Village	Adjacent to Waikoloa Village
Status	First Phase in Development	Began in 1989, Half Through	Final Phase in Development	Groundbreaking to be in 2007	Proposed Needs Entitlement
Current Price Range					
Multifamily	$167,000 to $389,000		Low $289,000 to $325,00		
Single Family	$515,000 to $619,000	$525,000 to $760,000	Homes $515,000 to $715,000	Homes $550,000 to $1,000,000+	Lots to be $350,000 and up
Price per Square Foot	$312 to $355	$334 to $423	$320 to $447	$340 to $450	Finished homes $700,000 to $2.5 M
Characteristics					
Density Level	Moderate	Maximum	Maximum	Moderate	Low
Open Space Allowance	Limited	None	None	Moderate	High
Product Diversity	High Affordable MF to Market SF	Limited SF homes in tight range	Limited SF in tight range. Some size	Moderate SF in broad market range	Limited Estate Lots Only
Product/Models Quality	Good All aspects limit quality	Average to Good Models & units Disappointing	Good-Plus Well-designed, built for as	N/A (no product yet available)	N/A (Lots Only)
Product Appeal	High Master plan, nice look, high demand affordable component	Moderate Standard subdivision, no frills, avg. look, some good views	Moderate to High Standard subdivision, no frills, good look, most good views	High Will have open space, commercial, standard theme, some good views	Moderate to High Will have open, equestrian look, some good views
Deed Restrictions	Yes. Owner/Occ 1st year	No	No	No	No
SF Lot Size/User	10,000 SF to Mod. Larger Not an issue yet in marketing	Most 10,000 to 12,000 SF 30,000. High demand larger lots	Most 10,000 to 12,000 SF, some 50,000. High demand larger lots	Most 8,000 to 20,000 SF (avg. of 12,000) some larger high demand	25,000 SF and up. Project based on anticipated demand for large lots
Community Amenities	Limited to Community Center and Landscaped Entry	None	None	Trails, Parks, Open Space and Recreation & Community facilities	Trails, Greenbelts, Open Space and Common Elements
Community Exclusivity	Moderate. Has separate entry with signal	Low Just another Village subdivision	Low Just another Village subdivision	Moderate to High. Separated by entry from Village development.	Moderate to High. Away from existing Village development
Pricing Demographic	Wide appeal from affordable to mid-level.	Limited to mid-level	Limited to mid-level	Moderate with Mid to upper-level	Limited to upper-level
Buyer Demographic	100% Owner/Occupant-buy is as required.	50% Owner/Occ. 35% Investor and 15% second home	60% Owner/Occ. 30% Investor and 10% second home	50% Owner/Occ. 40% second-home and 10% investors	50% Owner/Occ. 40% second-home and 10% investors.
Market Acceptance	High	Moderate, and declining with emerging competition	Moderate	N/A	N/A
Pricing Appropriateness	Competitive to Under-Priced	Competitive to Over-Priced (Dropping Prices in Next Release)	Competitive	Likely Competitive, widening of standard market sector	Likely Competitive, testing new market sector

Source: Project developers, brokers, brochures, websites, and The Hallstrom Group, Inc.

- The Gross Analysis Method. This is both the simplest and most fundamentally insightful method. It is a mere comparison between demand (for additional units) and supply (proposed units) indicators. If there is more potential demand than potential units, it can be asserted there will be sufficient demand to absorb portions or all of the proposed subject units.

  As our market analysis demonstrated, the supply of proposed residential units (homes, lots and condominiums) in Waikoloa Village will be insufficient to meet forecast regional requirements. The estimated mid-point demand for study area dwelling units over the next 20 years (through 2025) is some 5,613 units. If all of the proposed non-subject units are built, the total would be a maximum of 3,681 units; nearly 2,000 less than demand.

  Even with the 398 Waikoloa Highlands lots, the sector will still be underserviced by more than 1,500 units during the projection period.

  A 2,000-unit undersupply divided by 20 years, equals an average undersupply of 100 units per year. The 398 subject "units" (lots) represents about four years worth of needed supply to match forecast mid-point demand.

  This gross analysis indicates the subject units could reasonably be absorbed, regardless of any additional competitive advantage the inventory may have.

- The Residual Method. In this technique, all of the identified competitive approved resort/residential projects in the study area are placed on a time-line depicting the sales absorption anticipated by the developers, as evidenced by our market survey, or as can be reasonably assumed through historic activity. To the extent these projects fall short of the forecast periodic demand for units in the study region, or exceed the total demand, an undersupply or oversupply situation respectively exists.

  By accounting for the total of the units likely to be built in the competitive market during the projection period, it can be reasonably asserted the subject development will "capture" a significant portion of any residual demand. This approach is

generally conservative, as it assumes the subject will capture only what is leftover after the other projects garner their anticipated share.

The tabular presentation of this method for the subject units is shown on Table 10.

Each of the identified sources of competitive additional supply are shown at the top of the table along with the reasonably anticipated number of units we consider likely to be constructed, and their periodic absorption over the projection period timeframe. The total demand forecast is shown at the bottom of the respective table, with the resulting over/under supply totals for each period and the residual demand level for the subject product under several capture rate assumptions.

In no single period is there an oversupply situation. In every period during the two-decade projection timeframe demand will exceed supply without the subject inventory.

This method indicates the 398 subject lots will require about four to five years to be absorbed.

- The Market Shares Method accounts for the probable competitiveness of the subject residential product regardless of the total level of other inventory being offered. In essence, it is an estimate of how much of the total residential demand in Waikoloa Village the subject could expect to achieve on an annual basis in light of its locational, pricing, and amenity characteristics.

This "pure competitiveness" technique is generally moderate to optimistic in application and requires some subjective variables, but is perhaps the most appropriate and "classic" approach.

Given the type, location and amenities of the proposed subject product and competitive market, we believe the Waikoloa Highlands lots could readily achieve an average share of about 22 percent of the total competitive demand during its sales period. The annual capture rate would range from 15 to 27.5 percent of the entire Waikoloa Village residential market.

TABLE 10

PROJECTION OF SUBJECT UNIT ABSORPTION USING THE RESIDUAL METHOD BASED ON TOTAL DEMAND FOR RESIDENTIAL HOUSING IN THE WAIKOLOA VILLAGE STUDY AREA
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
Approved/Announced Units Only, Assuming Mid-Point Demand Trends

Project	TOTAL UNITS		2006-2010	2011-2015	2016-2020	2021-2025
Wehilani @ Waikoloa	756		500	256		
Market Share Percentage			49%	16%		
Sunset Ridge	120		120			
Market Share Percentage			12%			
Kiohanai Kai	80		80			
Market Share Percentage			8%			
Waikoloa Heights	2,500		300	1,200	1,000	
Market Share Percentage			29%	74%	91%	
Govt. Affordable Project	225			150	75	
Market Share Percentage				9%	7%	
Other Minor Projects/In-Fill	100		25	25	25	25
Market Share Percentage			2%	2%	2%	100%
Totals	**3,781**		**1,025**	**1,631**	**1,100**	**25**
Village Housing Unit Demand	**5,613**		**1,450**	**1,357**	**1,485**	**1,321**
Shortage or (Excess) Supply	**1,832**		**425**	**(274)**	**385**	**1,296**
Potential Waikoloa Heights Residual Subject Demand						
at 100% Capture Rate	1,832		425	-274	385	1,296
at 97.5% Capture Rate	1,786		414	-267	375	1,264
at 95.0% Capture Rate	1,740		404	-260	366	1,231

SUBJECT INDICATION: If the first subject finished home sales began closing in 2008, as anticipated, i would require approximately 12 to 14 year
However, this assumes the subject is basically "non-competitive" and receiv :s only the residual (or left over) deman
Given its competitive capacity and market demographics, a shorter absorptic n period is probabl

Source: County of Hawaii, Developers/Agents, & The Hallstrom Group, Inc.

This capture rate, which is reasonable given historic sales standards and the competitiveness of the limited alternatives, would equate to a 21.8 percent share during a mid-point 6.5-year sell-out period. This equates to an average absorption of 61 lots annually.

We consider the stabilized market share rate to be moderate based on the availability of competitive inventory and their anticipated sales rates. As shown in the residual method, during the subject sales period, there will be only a handful of projects competing for market shares, and just achieving a "fair split" of the demand (regardless of the favorable competitiveness of the subject inventory) will generate capture rates at the projected levels.

Table 11 displays the subject unit market capture absorption forecasts.

Based on our analysis, we forecast the 398 "rural" subject lots will be absorbed in a four to six-year timeframe from initial offering.

These conclusions based on mid to long-term forecasting models are understated relative to existing vibrancy of the West Hawaii real estate market. Certainly, the current up-cycle could rapidly absorb the subject inventory if the pre-sale program is timed correctly.

ECONOMIC IMPACT OF THE PROPOSED DEVELOPMENT

The development of the Waikoloa Highlands subdivision will generate significant efforts and expenditures that will favorably impact the Big Island economy on both a direct and indirect basis, increasing the level of capital investment, capital growth and capital flow in the region. The project will pump millions of dollars into West Hawaii, expanding the economy, widening the tax base and creating stable long-term employment opportunities.

From a direct perspective, the proposed 398 rural residential lots and homes eventually built there-on will create numerous construction, equipment operator and specialty trade jobs on- and off-site during the planning and emplacement of the infrastructure, and building of the improvements. After completion of the homes over an estimated ten-

TABLE 11

SUMMARY OF SUBJECT PROJECTED DEMAND LEVELS
USING THE MARKET SHARES METHOD
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
Assuming 398 Total Single Homes
With Sales to Begin in 2007; First Closings in 2008

Scenario One: Using Conservative Assumptions

Sales Year		Total Waikoloa Village Residential Demand	Effective Subject Share	Indicated Total Subject Absorption
1	(2007)	225	15.00%	34
2		225	20.00%	45
3		225	25.00%	56
4		225	25.00%	56
5		196	25.00%	49
6		196	25.00%	49
7		196	25.00%	49
8		196	25.00%	49
9		196	5.50%	11
Totals		**1,880**	**21.17%**	**398**

8.2 year absorption period

Scenario Two: Using Optimistic Assumptions

Sales Year		Total Waikoloa Village Residential Demand	Effective Subject Share	Indicated Total Subject Absorption
1	(2007)	355	17.50%	62
2		355	22.50%	80
3		355	27.50%	98
4		355	27.50%	98
5		347	17.50%	61
Totals		**1,767**	**22.52%**	**398**

4.7 year absorption period

ANALYSIS MID-POINT

6.5 year absorption period	**1,824**	**21.83%**	**398**

Source: The Hallstrom Group, Inc

year development period, there will be significant additional employment positions created via the buildings themselves; such as landscape, service, maintenance, and renovation needs in the course of their use.

Numerous local businesses will enjoy significant profit opportunities arising for contracting companies constructing the improvements, and for local businesses which would supply a substantial portion of the materials needed in the building efforts.

The general island economy also will benefit from the subject development and resulting wage earners, which will spend large amounts of their income in regional shops, restaurants, and service establishments throughout the Big Island, and in purchasing day-to-day goods and services.

Indirectly, as these construction wages, profits, and resident expenditures move through the West Hawaii economy, they will have a ripple, or "multiplier," effect--increasing the amount of capital flowing to the entire island community as a result of the subject undertaking.

Construction, maintenance and other secondary/support workers earning wages from the Waikoloa Highlands and associated off-site efforts will spend the majority of their income on living and entertainment expenses while supporting and patronizing other island businesses, as will the moderate to upper income guests and residents of the community. Much of this spending would then be re-directed by these businesses to other island industries, with significant portions of these secondary profits in turn being put back through the region's economic and tax structure.

These substantial direct and indirect economic impacts associated with the proposed subject project, as quantified in the following sections, are all the result of the capital investment and entrepreneurship necessary to convert a vacant unused holding to a rural residential community. The Big Island economy will be meaningfully stimulated by the capital investments and maintenance requirements of the owners and guests.

Capital Investment and Construction Costs

The subject development will bring an estimated $340.3 million in direct construction capital into West Hawaii over the ten-year build-out period forecast for the project. A breakdown of the basic expense items, their respective costs and expenditure over time is summarized on Table 12. As with all our models, a ten-year total projection timeframe is used depicting the development, absorption and stabilized use of the community over the initial decade.

Also shown are anticipated contractor and supplier profits flowing to local businesses as a result of the project. Cost estimates and allowances were founded on our recent experiences with similar scale neighbor island residential subdivisions and tract and custom home developments, formulated and applied as described in the table footnotes.

Infrastructure sitework expenses were allocated at $150,000 per lot, pending completion of final figures by the engineering team. The total outlay of $59.7 million will occur over two sequential phases anticipated to require some 30 total months from initial groundbreaking (year 1 of the model).

Home construction costs were estimated at a total of $280.6 million in current dollars.

The single-family homes were estimated to have a current average construction cost of $705,000 each, based on a 2,100-square-foot house at $300 per square foot with an additional $75,000 per lot in utility extensions, septic system, sitework and landscaping. The total single-family home construction cost is projected to be $280.6 million.

It is expected the home types at Waikoloa Highlands will vary widely, from "smaller" houses (say 1,500 square feet costing $350,000) to "estates" with construction costs running into several million dollars. The "average" size and costs utilized are expected to be the most common (model) and median area of the overall spectrum.

Not included in the totals are indirect costs such as marketing and sales expenses, developer fees, loan interest and other non-real property items. The inclusion of these "soft cost" could result in a total capital investment undertaking approaching $360 million.

The direct costs of subject development will infuse an anticipated $34.3 million annually into the Big Island building industry on average over the build-out period. This is the equivalent of a nearly four percent boost over recent yearly construction levels on the island (estimated at $900 million in 2005). Indirect expenditures could reach up to an additional $3 to $5 million per year.

Employment Opportunities Created

Based on indicators provided by the construction of comparable sized projects and Hawaii industry averages, we have estimated the demand for on- and off-site, full-time equivalent employment positions associated with laying of initial infrastructure systems, building of the finished residential structures, and in providing continuing services to the occupied buildings.

The employment opportunities created by the construction of the subject and long-term maintenance, landscaping and renovations will not all be "new" jobs but will be enhanced opportunities for existing construction trade workers, youths reaching employment age and entering the "trades", and in-place local businesses.

The current construction upsurge has created a larger worker sector in the various trades, who will require continuing development activity across a broad spectrum of building tasks in coming years in order to maintain employment levels.

The subject will provide such mid to extended-term needed employment opportunities in the construction sector, and supply and building support industries during an estimated ten-year site development and home construction period.

Our employment estimates on are based on full-time equivalent "worker/years," although one worker/year (or circa 2,000 working hours) may be comprised of many employees involved in specialized tasks of a much shorter duration.

Estimates are based on a 10-year modeling period of project construction beginning with a first year of infrastructure emplacement (which continues for 30 months) followed by nine years of house building (model years 2 through 10). The associated number of employment opportunities created each year, in total over the decade

TABLE 12

CONSTRUCTION COSTS AND CONTRACTOR AND SUPPLIER PROFIT ESTIMATE
Economic Impact Analysis and Public Cost/Benefit Assessment
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
In Constant Year 2006 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Totals
	Infrastructure Begins	First Homes Finished (End Year 2)	Phased Infrastructure Emplacement (Approx. 30 Months)					Remaining Lots Sold and Finished Homes Built			
Construction Costs											
Infrastructure/Site work (1)	$19,701,000	$25,074,000	$14,925,000								$59,700,000
SF Construction – 356 homes (2)		$24,675,000	$28,200,000	$35,250,000	$35,250,000	$35,250 0	$35,250,000	$35,250,000	$28,200,000	$23,265,000	$280,590,000
TOTAL CONSTRUCTION COSTS	$19,701,000	$49,749,000	$43,125,000	$35,250,000	$35,250,000	$35,250 0	$35,250,000	$35,250,000	$28,200,000	$23,265,000	$340,290,000
CONTRACTOR'S PROFIT	$1,970,100	$4,974,900	$4,312,500	$3,525,000	$3,525,000	$3,525 0	$3,525,000	$3,525,000	$2,820,000	$2,326,500	$34,029,000
SUPPLIER'S PROFIT	$788,040	$1,989,960	$1,725,000	$1,410,000	$1,410,000	$1,410 0	$1,410,000	$1,410,000	$1,128,000	$930,600	$13,611,600

(1) Allocation of $150,000 "all in" infrastructure cost per lot; pending completion of final cost estimate. Based on similar scale neighbor island subdivision
Phased subdivision construction period estimated at 30 months; commencing at beginning of model and completing by middle of Year 3.
(2) Assuming average home construction budget of $705,000 based on 2,100 square foot house at $300/SF cost plus $75,000 for septic, site work and landscaping.
First homes begin construction early in Year 2 and are finished by year-end

Source: Waikoloa Highlands master plan and The Hallstrom Group, Inc.

development period and as stabilized annually are displayed on the top of Table 13.

Included in our projections on the table are the full-time equivalent (FTE) off-site and support employment opportunities which will be provided to Big Island businesses as a result of the project. Also shown are the total number of maintenance/landscaping workers which will be required to service homes in the subdivision over time.

The projections are founded on examples provided by various residential developments undertaken on the neighbor islands over the past decade, and via formulae expressing relationships between total worker wages/benefits and construction/operating tasks and costs.

Infrastructure and building construction employment forecasts are taken from job counts in similar scale developments, review of project budgets and ratios of direct costs to job creation (assuming an average wage of $60,000/year plus benefits equal to 25 percent of wages). Our analysis assumes one worker/year per $300,000 in construction contract spending for infrastructure positions and one worker/year per $225,000 in home construction contract spending.

Home "operations"/landscaping/maintenance workers in the finished homes, consisting of maintenance, landscaping, repair, installation and renovations efforts, were estimated at one full-time equivalent position per 10 houses. The average overall pay for these workers is estimated at $28,000 per year.

Off-site employees were estimated at 40 percent of on-site workers, and are comprised of three groups:

- Numerous off-site building industry positions will also be enhanced by the Waikoloa Highlands development, including such jobs as administration, office help, material providers, equipment maintenance and specialty tasks. Analysis of county of Hawaii and neighbor island labor trends from 1980 through 2005 demonstrate a linkage equal to about 20 to 30 percent between the creation of on-site construction positions and direct off-site employment.

- Off-site support businesses, including contractor/retail/counter sales, fuel providers, shipping, storage and professional services will also benefit. A conservative job creation

TABLE 13

EMPLOYEE JOB COUNT AND WAGE ESTIMATES
Economic Impact Analysis and Public Cost/Benefit Assessment
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
In Constant Year 2006 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Total 1 Through 10	Stabilized
Worker Requirements (1)												
Infrastructure/Site work (2)	66	84	50								199	
SF Home Construction (3)		110	125	157	157	157	157	157	125	103	1,246	
Operations/Maintenance (4)			8	13	18	23	28	33	36	40	195	40
Off-Site Employees (5)	26	77	73	68	70	72	74	76	64	57	656	16
TOTAL EMPLOYMENT CREATED	92	270	255	237	244	251	258	265	225	200	2,296	56
Worker Wages												
Infrastructure/Site work (6)	$3,940,200	$5,014,800	$2,985,000								$11,940,000	
Home & Unit Construction (6)		$6,573,000	$7,512,000	$9,390,000	$9,390,000	$9,390,000	$9,390,000	$9,390,000	$7,512,000	$6,197,400	$74,744,400	
House Operations/Maintenance (7)			$210,000	$350,000	$490,000	$630,000	$770,000	$910,000	$994,000	$1,114,400	$5,468,400	$1,114,400
Off-Site Employees (9)	$840,576	$2,472,064	$2,335,360	$2,163,200	$2,227,200	$2,291,200	$2,355,200	$2,419,200	$2,056,960	$1,831,552	$20,992,512	$509,440
TOTAL ANNUAL WAGES PAID	$4,780,776	$14,059,864	$13,042,360	$11,903,200	$12,107,200	$12,311,200	$12,515,200	$12,719,200	$10,562,960	$9,143,352	$113,145,312	$1,623,840

(1) All job counts expressed as "full-time" equivalent positions.
(2) Estimated at one worker/year per $300,000 in contract spending.
(3) Estimated at one worker/year per $225,000 in contract spending, or 3.13 worker/years for each single family home.
(4) Estimated at one worker/year for each 10 houses. Includes workers doing landscaping, repair, renovation, and other maintenance.
(5) Includes all off-site jobs created by work efforts at the project; direct and indirect. Estimated at 0.4 off-site positions per on-site position.
(6) Average annual wage of $60,000/worker year.
(7) Average annual wage of $28,000/worker year.
(8) Average annual wage of $32,000/worker year.

Source: Various, and The Hallstrom Group, Inc.

relationship of five to ten percent relative to on-site positions was used (or, one off-site support worker/year for each ten to 20 on-site worker/years).

- Extrapolation of state Department of Business Economic Development and Tourism (DBEDT) data, along with indicators provided by other state agencies and First Hawaiian Bank studies, demonstrate that each Hawaii worker creates demand for services (and related employment) during and directly attributable to the work day at up to a ten percent ratio. These positions include food businesses, providers of tools and trade goods, payroll/financial and insurance businesses, medical requirements and other secondary indirect/off-site employment.

During the 10-year construction modeling period of the project, the number of worker/years created on- and off-site by the development varies from 92 to 265 positions annually, totaling 2,296 worker/years over the entire projection timeframe. Of this total, 1,445 worker/years (an annual average of 145 positions during the ten-year construction period) are direct construction-oriented, 195 are on-going maintenance/operating positions; and 656 are off-site worker requirements.

On a stabilized basis after the modeling timeframe, the subdivision will generate some 56 permanent full-time equivalent and/or enhanced employment opportunities--40 directly related to on-site activities, and 16 indirect positions throughout the island.

The average annual on-site job count during the 10-year subject study period of 164 positions represents about a 0.26 percent increase from the total jobs presently available on the Big Island (164 additional jobs per year to the average in December 2006 job count of 63,500). Despite low unemployment rates of late, this number can be readily absorbed by the currently available worker pool.

Wage Income Generated

In accordance with data compiled by the state Department of Labor and Industry Relations, we have estimated the personal income (in the form of wages) which will flow to West Hawaii workers as a result of the Waikoloa Highlands subdivision.

The average wage of a full-time infrastructure construction worker is estimated at $60,000 per year (rounded) based on DLIR data for April 2006. For finished building construction workers, the average annual pay will also be about $60,000. Operating and maintenance personnel are forecast to be paid an average of $28,000 per year on average ($14 per hour). Off-site building and support industry jobs were estimated to receive an average pay of $32,000 annually.

Overall project average wages are equal to $49,279 per worker/year created during the model period, and $28,997 on a stabilized basis.

Application of these wage estimates to the employment forecasts generates personal income (wage) projections directly resulting from subject development, which were shown at the bottom of Table 13. The wage figures are all presented in constant 2006 dollars, and will undoubtedly escalate over time in accordance with inflationary pressures.

In the first year of development, the "Total Annual Wages Generated" by the subject development effort would be $4.8 million, increasing to a high of $12.7 million, as the number of construction workers peak and many maintenance positions are created in year 8. After completion of all construction, the on-going maintenance, off-site/indirect and other employment would result in average annual wages of $1.6 million thereafter.

Over the first 10 years of the development and operation period, on- and off-site, direct and indirect worker wages would total $113.1 million.

Development Costs as Profit Income

While the significant majority of the materials needed to build the subject homes must be imported to the Big Island, a portion of the construction costs spent in the development will flow to local businesses in the form of contractor profits and supplier profits.

Typically, within the industry net contractor profit margins are expected to be at 8 to 20 percent of total construction costs. We have used a conservative ten percent figure. Supplier profits were extrapolated at four percent of total costs; generally supplies/materials equate to 50 to 60 percent of total cost, with a profit margin for the supplier of six to eight percent.

Application of these estimates to the forecast development parameters of the subject project was shown on Table 12.

The total Contractor's Profit ranges from $1,970,000 to $4.97 million per year, with a cumulative profit of $34.0 million over the ten-year construction period. The total annual Supplier's Profit ranges from a low of $788,040 to a high of $2.0 million, and equates to $13.6 million over the development time-frame.

Population, Income and Expenditures

The 398 subject lots (and eventual homes thereon) will be owned by a variety of local residents, second homeowners and in-migrants. Together these groups and guests will contribute to the Big Island economy during the use of the subject units in the form of discretionary expenditures and (for full-time residents) household income levels.

Table 14 displays our population, discretionary expenditures, and household income estimates for the subject project.

For the single-family homes, it was estimated that 60 percent would be used by full-time residences and 40 percent by part-time/second home users. For the full-time component, an average household size of 3.8 persons was assumed. For the part-time users, it was estimated the homes would be occupied 20 percent of the time with an average party size of 3.8 persons.

Beyond these standard allowances would be extra guests in the households. It was estimated the average guest population in the subdivision would equate to one person per 10 finished homes on average.

At built-out, the stabilized de facto population of the project would be some 1,068 persons, comprised of 907 full-time residents and 161 second-home owners and guests, divided as follows:

Single-Family Full-Time Residents	907
Single-Family Part-Time Residents	121
Guests (Estimated at One Per 10 Units)	40
Total Average De Facto Population	**1,068**

TABLE 14

DE FACTO POPULATION, DISCRETIONARY EXPENDITURES AND RESIDENT HOUSEHOLD INCOMES
Economic Impact Analysis and Public Cost/Benefit Assessment
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
In Constant Year 2006 Dollars

Development Year	3 (1)	4	5	6	7	8	9	Stabilized 10
Cumulative Residential Development								
SF Home Construction	75	50	50	50	50	50	40	33
Total Finished Homes	75	125	175	225	275	325	365	398
Average Daily Resident/Guest Population								
SF Full-Time Residents (2)	171	285	399	513	627	741	832	907
SF Part-Time Residents (3)	23	38	53	68	84	99	111	121
Guests (4)	8	13	18	23	28	33	37	40
Total De Facto Population	201	336	470	604	738	872	980	1,068
Estimated School Age Children (5)	50	84	117	151	185	218	245	267
Estimated Public School Children (6)	44	73	102	132	161	190	214	233
COMMUNITY DISCRETIONARY (TAXABLE) EXPENDITURES (7)	$7,335,413	$12,225,688	$17,115,963	$22,006,238	$26,896,513	$31,786,788	$35,699,008	$38,926,589
Total Years 1 -10	$153,065,608							
FULL-TIME RESIDENT INCOME (8)	$9,000,000	$15,000,000	$21,000,000	$27,000,000	$33,000,000	$39,000,000	$43,800,000	$47,760,000
Total Years 1 -10	$235,560,000							

(1) Includes 35 homes finished at end of Year 2 and 40 homes finished in Year 3 of modeling period.
(2) 60 percent of homes estimated to be used as full-time residences, with average household size of 3.8 person
(3) 40 percent of homes estimated to be used as part-time (second home) residences, occupied 20% of time with average party size of 3.8 persons
(4) Estimated average guest population (not included in full-time or part-time categories) of 1 guest per 10 finished homes.
(5) Persons between the ages of three and 19 enrolled in public and private schools, estimated at 25% of total full-time resident population.
(6) Persons enrolled in public schools, using Hawaii Department of Education "per home" demand factors. The department estimates that for every new single family home built, an additional 109 public elementary students are added to the system, 040 middle school, and 069 high school students. Given the type and demographics of the community, these demand factors may be oversized for Waikoloa Highlands.
(7) Estimated at 60% of full-time resident household income, and at $175 per capita daily for part-time residents and guest populations.
(8) Estimated at $200,000 annually per full-time resident household. This is approaching four times the Big Island average as would be necessary to support reasonable mortgage.

Source: Various, and The Hallstrom Group, Inc.

It is estimated that upon subdivision build-out and population stabilization about 267 of the full-time resident population (or 25 percent of the total) will be juveniles of school age.

In order to quantify the number of children attending public schools, we have used the State of Hawaii Department of Education "per home" pupil attendance factors for new construction. The DOE estimates each new single-family home results in .109 public elementary students, .040 middle school, and .069 high schoolers. The total attendance projection per home built is thus 0.218 public school students. Given the type, ownership and demographics forecast for Waikoloa Highlands, the effective public school load may be moderately overstated.

The population of the project will place significant discretionary expenditure dollars into the Hawaii County economy. In light of the cost of the finished homes, the residents and other users will be in the top household income brackets with substantial available income for such spending. The second home users and guests will further contribute to the high amount of discretionary funds.

We estimate that full-time resident households will spend about 60 percent of their total income on local discretionary items based on the most recent data. The daily per capita spending by second-home users, and their guests in the West Hawaii economy will be on average $175, which is moderately above what the typical Big Island visitor spends daily on non-lodging purchases (commensurate with the relative upscale subject project quality). This pays for all food, entertainment, household goods, locally purchased fixtures and furnishings, utilities, clothing and other daily items.

By build-out, the total resident owner/guest discretionary expenditures made by subject project users in the local market will be at $38.9 million annually on a stabilized basis, in 2006 dollars. During the 10-year development and operation model period, the total sum of these expenditures will be $153.1 million.

The total full-time resident income amount was quantified for use in estimating discretionary expenditures and state income taxes to be paid. In order to conventionally qualify for a lot/home with prices likely to be sought for the subject houses, a household income approaching four times the islandwide average, or about $200,000 per

year, is necessary. We recognize this amount could range widely upwards, and consider this projection moderate.

On a stabilized basis after build-out, the total annual full-time taxable resident income at the subject would be some $47.8 million. The total subject household income during the decade long modeling timeframe will be some $235.6 million. Some of the resident and virtually all of the second home and guest expenditures will be "new" dollars on the Big Island, providing a true economic expansion.

Summary of Direct, Local Economic Impacts

The various direct, local economic impacts which will flow to the West Hawaii study region as a result of the subject development are summarized on Table 15.

The wages, profits and discretionary expenditures figures are taken from previously presented tables. The home maintenance, repairs and upgrades revenues were calculated based on an estimated average of $1,500 per home monthly beginning in year 3, or $7.2 million total annually on a stabilized basis.

The annual Total Base Economic Impact increases from $7.5 million in year 1 of the development effort to a high of $58.5 million in year 10 (in 2006 dollars). Over the decade long development and operation modeling period, the total is $409.3 million. Fueled by unit maintenance and resident/guest expenditures, the estimated stabilized annual base impact thereafter is $47.7 million.

These dollars will be spent, then re-spent, on goods and services on the island, diminishing in impact on the local economy with each turnover as a portion of each spending cycle flows off the Big Island for goods, services and financing commitments. First Hawaiian Bank studies have concluded the appropriate economic multiplier rates in Hawaii are from 1.2 to 3.5 times (or 20 to 250 percent) of the base impact amount. Mainland studies (by the Urban Institute and others) tend toward the upper end of this range, and reach multipliers as high as 4.0.

Due to the need to import more than 85-plus percent of supplies/goods used on the Big Island, the multiplier impact for the island is not as great as for mainland locales, particularly for construction-based

expenditures. We have therefore tested multiplier rates at the mid-point of the market spectrum, ranging from 1.5 to 3.5 times.

On a conservative basis, using a relatively low-end multiplier effect ratio of 2.0, the total overall direct impact on the island of Hawaii economy resulting from the Waikoloa Highlands subdivision would be $818.6 million over the 10-year projection period (in constant 2006 dollars). On a stabilized annual basis thereafter, the overall impact would be at $95.4 million.

PUBLIC COSTS/BENEFITS ASSESSMENT

The purpose of this analysis is to delineate the direct areas in which the proposed subject rural residential subdivision will potentially impact the sphere of public agency resources, and quantify (where possible) the costs of providing expanded services to the project, versus the economic benefits that accrue to the community through an increase in local and state tax payments.

For most developments, potential direct costs to governmental services and programs include:

- -- Police Protection
- -- Fire Protection
- -- Public Oversight Agencies
- -- Infrastructure Services
- -- Recreational Demands
- -- Educational Needs
- -- Infrastructure Costs
- -- Various Other Services and Financial Commitments

However, as a privately built master planned rural residential community many of these costs will not be increased on the state or county levels as a direct result of the proposed Waikoloa Highlands. There will be minorly increased educational or recreational needs directly attributable to the subject development; the major off-site public infrastructure items are already in place; and the development will require no specific public subsidies, welfare services, bonding or capital improvements.

TABLE 15

SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH DEVELOPMENT
Economic Impact Analysis and Public Cost/Benefit Assessment
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
In Constant Year 2006 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Total Years 1 Through 10	Stabilized
ANNUAL WAGES GENERATED	$4,780,776	$14,059,464	$13,042,360	$12,103,200	$12,107,200	$12,311,200	$12,515,200	$12,719,200	$10,562,960	$9,143,352	$113,145,312	$1,423,840
CONTRACTOR'S PROFIT	$1,970,100	$4,974,900	$4,312,500	$3,925,000	$3,925,000	$3,525,000	$3,525,000	$3,525,000	$2,820,000	$2,336,500	$34,029,000	
SUPPLIER'S PROFIT	$784,040	$1,989,960	$1,725,000	$1,410,000	$1,410,000	$1,410,000	$1,410,000	$1,410,000	$1,128,000	$930,600	$13,411,600	
HOME MAINTENANCE, REPAIRS AND UPGRADES (1)			$1,350,000	$2,250,000	$3,150,000	$4,050,000	$4,950,000	$5,850,000	$6,390,000	$7,164,000	$35,154,000	$7,164,000
DISCRETIONARY EXPENDITURES			$7,335,413	$12,225,688	$17,115,963	$22,006,238	$26,896,513	$31,786,788	$35,699,008	$38,926,589	$212,352,523	$38,926,589
TOTAL BASE ECONOMIC IMPACT	$7,534,916	$21,024,324	$27,766,273	$31,913,888	$37,708,163	$43,302,438	$ 9,296,713	$55,290,988	$56,599,968	$58,493,041	$409,293,435	$47,714,429
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$15,077,832	$42,049,448	$55,532,545	$63,827,775	$74,416,325	$86,604,875	$ 8,593,425	$110,581,975	$113,199,935	$116,986,082	$818,586,869	$95,428,858

(1) Estimated at $1,500 per home per month, beginning in Year 3.

Source: Various, and The Hallstrom Group, Inc.

Direct tax benefits to the state and county coffers will primarily flow from the project and its operation over time from three major sources:

-- Real Property Taxes
-- Gross Excise Tax Receipts
-- State Income Taxes

Some cost/benefit issues are considered as off-setting, or "a wash," as the cost of the services to the government is theoretically directly reimbursed in the form of user fees. Building permits and utility hook-up fees are two prime examples. Other such items include workers compensation premiums and benefits, utility operations and associated use billing rates, and business oversight/registration verses licensing fees. These items are excluded from this study.

A concern of this analysis is the integration of the subject project into the overall state and county of Hawaii governmental services plan on both an actual and pro rata perspective.

From an actual public service cost perspective to the Big Island and state agencies, the subject will represent only a fraction of the county and state residential inventory and overall urban lands in use. Given the vast number of housing units, resorts, businesses, and agricultural lands on the island, it is difficult to assert that of themselves the subject homeowners and users will create the need for meaningful expansion of existing public services.

No new schools, parks, highways, recreational facilities, service agencies, hospitals, or other public enterprises will be required specifically because of the Waikoloa Highlands subdivision. The impact on the total regional land base will be minimal. Public safety facilities in Waikoloa, Waimea and Kawaihae are reasonably proximate, generally have the personnel and equipment to service the businesses and buildings in the development, and will be expanded in the village with overall community growth over the next decade as the various other identified projects with their many thousands of units are built.

However, the need for additional services is a cumulative effect, each project, each resident, tourist and, to a lesser degree, business adds a little bit to the community base until increased "need thresholds" are reached.

In regard to some services, the effective actual impact of a minor/moderate subdivision such as the subject may not be apparent from a cost perspective, merely creating nominally greater demands which can be readily met through existing agencies and facilities without the need for additional workers or funds.

Our analysis of county of Hawaii and state budgets indicate the actual effect of governmental services relating to the subject would not create the need to expand county and state services in and of itself.

As an alternative to actual cost estimates, which are often disparate as they inherently cannot provide for unexpected and/or atypical items, it is most common to project public costs for a proposed development on a per capita allocation.

This approach is generally appropriate for residential subdivisions, as the substantial portion, but not entirety of public costs and services generally accrue to where a person lives (or in the case of a tourist, where they are lodging).

Government services are holistic in nature, providing a foundation throughout a community, regardless of actual, specific impact on any given land holding. A resort development or business may not have a need for parks or schools, but they are essential to the patrons and workers and create the climate in which the resort or business operates. Similarly, government administration, capital projects and public welfare items may have no direct relation to a particular project, but provide the economic underpinnings that enhances overall economic success and quality of life for its residents.

In order to meaningfully quantify public costs that may be associated with the subject development, we have therefore looked at the issue from both perspectives, on an actual cost basis and on a per capita allocation basis.

Public Costs

Actual Costs

The county of Hawaii will directly incur several areas of cost increases as a result of the Waikoloa Highlands subdivision, primarily in regards to emergency services. Based on analysis of response frequencies, time/cost data, and past discussions with affected agencies, we have made general allowances for these items as summarized below.

Police/Enforcement -- Using a base cost of $175 per hour for a responding officer (wages and benefits for responding/support/ administrative personnel, overhead, capital costs, and amortized equipment), we estimate the annual additional police/enforcement cost to the county of Hawaii on a stabilized basis after project build-out will be about $198,800.

This is comprised of:

- Four miscellaneous calls per week at an average of two total officer hours each. (2 hrs. x $175/hr. x 4 x 52 = $72,800)
- Four "minor" incidents/traffic accidents each month requiring on average five hours of officer time. (5 hrs. x $175 x 4 x 12 = $42,000)
- Two major incidents/traffic accidents each month requiring on average of 20 hours of officer time. (20 hrs. x $175 x 2 x 12 = $84,000)

This demand of 1,136 hours is the equivalent to 56.8 percent of one new full-time equivalent officer (2,000 total hours).

Fire Protection -- Our forecasts are based on a crew cost of $1,000/hour (four to five firemen, wages, benefits, overhead and amortized equipment). Using this method, we estimate that at build-out, the yearly additional costs to the county of Hawaii resulting from the Waikoloa Highlands is $168,000 per year.

This is comprised of:

- Two "minor" fire/rescue events per month requiring one crew for a total of three hours (response and/or clean-up). (3 hrs. x $1,000/hr. x 2 x 12 = $72,000)
- One "major" fire/rescue event every two months requiring two crews for a total of eight hours each. (2 crews x 8 hrs. x $1,000/hr. x 6 = $96,000)

Emergency Medical Response -- This is based on average cost per response of $700, with an average of four calls per month. The total cost to the county would be $33,600 per year on a stabilized basis after build-out. ($700/response x 4 per month x 12 = $33,600)

Road and System Maintenance -- The roadways and infrastructure system at Waikoloa Village are privately owned and funded by area residents. The county should have no substantial operating costs. However, we have made an allowance of $50,000 per year for inspections and various oversight duties.

The total annual "actual" cost to the county on a stabilized basis at build out of the subject development is estimated at $449,600. This cost would be reached on an escalating basis over time, beginning in year 3 and increasing as the community is finished and populated.

State of Hawaii costs would include nearby highway frontage work (Queen Kaahumanu and Mamalahoa), inspections and other minor oversight duties. An allowance of $100,000 per year was made for these items, increasing to the stabilized level as the project is built out.

Additionally, it is possible that up to 233 resident children (the count projected by the DOE formula) could enter the public school system. The cost per student in public schools statewide is presently at above $10,000 per year. We have used a stabilized allowance of $10,500 per potential student, or $2,446,500 in maximum student costs to the state each year.

However, as previously noted, we believe the DOE "per home" public pupil formula overstates the probable number of public education students which will come out of Waikoloa Highlands.

The total state costs on an "actual" stabilized basis would be about $2,546,500 annually.

Per Capita Costs

An alternative method for determining public costs is through per capita expenditures incurred by the State of Hawaii and county of Hawaii in accordance with the de facto population area of the jurisdiction. This is founded on the principal that each individual on the island equitably benefits from all governmental costs, regardless of type or focus throughout the day, with each new member of the community (whether resident or visitor) creating a proportionate new cost burden in their daily home and working life.

As previously noted, this is the standard method for residential application as the majority of costs are viewed as accruing to the housing or lodging aspects of a persons lifestyle and land use. We have included it as a means of demonstrating the overall public fiscal

impact potential of the proposed subject project even when viewed from this maximum potential cost perspective. We consider this approach as setting the absolute upper limit on all public costs (actual, indirect and inferred) for the proposed Waikoloa Highlands subdivision.

However, not all public costs accrue solely to a persons place of residence. Government services and oversight are also a vital component of the commercial community, and industrial, resort and retail/service land uses must also bear a proportionate share of their operational and consumer-related public expenses.

Generally, it is highly appropriate to allocate the costs of governmental services between residential and other uses, typically with two-thirds of each persons per capita governmental services impact (whether resident or tourist) being attributable to their dwelling place; the other third to the non-residential uses they patronize.

But for the subject project analysis, we have made the traditional (and exceptionally conservative) allocation of 100 percent of the per capita governmental costs to the place of residence. This results in an absolute maximum amount of public costs which could be accorded to Waikoloa Highland owners and guests.

According to the state Department of Budget and Finance database, the state will spend a total of $4.65 billion on services, salaries, infrastructure, and financing in fiscal 2005-2006. The total de facto population in the state on an average daily basis at year-end 2005 was about 1,471,000 persons, including residents, tourists, and military personnel.

The per capita expenditure by the state will thus be about $3,164 for 2005-2006, a minor increase from 2004-2005. From 1979 through 2006, state government expenditures increased at a rate of about five percent annually compounded.

The stabilized average de facto population on-site at the subject at build-out will be 1,068 persons, a figure reached in year 10 of the development model. Using the allocated state cost per de facto "resident" of $3,164 per year, the total annual "costs" to the state purse at stabilization by the project using the per capita method would be $3,380,000 (rounded) in constant year 2006 dollars.

Analyzed on a similar basis, Hawaii County's budget for the local government in fiscal year 2005-2006 is circa $284,048,832, which represents an escalation over time of more than four percent compounded annually since 1995.

The current de facto population on the Big Island is some 192,000 persons. The resulting de facto per capita county expenditure for this year is therefore anticipated to be about $1,479.

The construction and use of Waikoloa Highlands at build out would be about $1,580,000 (rounded) annually in costs to the county government on a stabilized basis (1,068 de facto residents x $1,479).

Total Public Costs -- On a per capita allowance cost basis, the state and county expenses associated with the subject development would range from $934,636 in year 3 of the project (the first year of home occupancy) to a stabilized maximum of $4,959,801 at build-out in year 10 and beyond, in constant 2006 dollars.

On an actual cost basis, which we acknowledge may be an atypical perspective and a minimized accounting of direct expenditures, the total governmental costs at build-out to the state and county would be $2,906,100 annually.

Public Fiscal Benefits

Real Property Taxes -- Property taxes paid by landowners in the subject project were calculated using the 2006 tax rates for both land and buildings, improved or unimproved.

The assessed values for the improvements were based upon the estimated direct costs for each unit, plus an allowance of 20 percent for indirect, financing, profits and other costs which would inure to the structures. The total estimated assessed values of the 398 finished homes upon completion is $336.7 million.

The assessed values for the land component was estimated at $50.7 million (700 acres at $50,000 per acre) for the site in its pre-developed state during year 1 of our model. This equates to an underlying assessed land value equal to $88,000 per proposed lot.

"As Is," it was assumed the site would be taxed as agricultural (or other non-homeowner vacant land type) at the rate of $9.85 per $1,000 assessed valuation. After subdivision, the house lots, prior to

improvement, would have an estimated value of $400,000 each, would be taxed at the same rate as long as they are vacant.

Once improved, the tax rate for the finished homes and lots changes and is different for full-time resident homeowners (60 percent of subject) and non-resident owners. For homeowners, the single-family homes and lots were assumed taxed at a rate of $5.55 per $1,000 in value, and for non-residents a rate of $9.10 per $1,000 was used.

All real property value of the subject holding is assumed to be vested in the completed "salable" and operating components, with no assessment placed against open spaces, roads, or other systems.

At stabilization, the effective overall tax rates for both the lands and improvements at Waikoloa Highlands using 2006 dollars and effective tax rates would be $6.97 per $1,000 of assessed value (the resulting mix of owner/occupant and non-resident rates). The total real property tax to be paid to Hawaii County in 2006 dollars ranges from $344,750 in year 1 of development, to a stabilized level of $3,456,479 at build-out after year 10. The aggregate real property taxes paid over the 10-year study time-frame will be $24.4 million.

State Income Tax -- The state will receive income taxes from three sources:

- the wages of the workers associated with the construction, maintenance, and "operation" of the Waikoloa Highlands components;
- the household incomes of full-time residents in the community; and
- the corporate profits from contractors and suppliers serving the construction phase of the development, and as generated by on-going maintenance and operations.

According to DBEDT data, individual State of Hawaii income tax liability as a ratio to gross income has ranged from 4.7 to 5.8 percent during the past decade, with the more current figures tending toward the mid to lower-end of the range. We have employed an effective tax rate of 5.00 percent of gross income for individual workers and full-time residents.

The effective tax rate for the corporate income is estimated at 1.00 percent of gross operating profits, based on available DBEDT statistics.

The total income tax revenues to be received by the state are projected at $252,830 in the first year of construction increasing to a maximum level at year 10 of $2.9 million annually in constant 2006 dollars.

On a stabilized basis, after build-out, the permanent maintenance workers, off-site workers, and full-time project residents would pay an annual state income tax of $2.5 million. Over the 10-year modeling period, the cumulative income taxes paid are estimated at $17.9 million.

We have not included any corporate income or other taxes which will be paid by the developers as a result of their profits from undertaking the subject development, or from the secondary jobs created by the discretionary spending of workers and businesses. Such items have the potential to be substantial contributions to the state coffers.

State Gross Excise Tax -- This 4.166 percent of expenditures tax was applied against:

- the total estimated construction contract costs;
- the total allocated gross sales maintenance, landscaping and renovations operations; and
- the discretionary expenditures of the de facto resident, guest and worker populations of the subject.

The anticipated state excise tax receipts arising from the subject development grow from an estimated $820,744 in the first year of development to a peak of $3.03 million. Over the 10-year study period, the receipts total $23.6 million and stabilize at circa $1.9 million per year.

We have not included any excise tax revenues associated with the direct, local "multiplier effect" expenditures on the Big Island, or those created in the secondary market by the suppliers to the maintenance operating or secondary worker expenditures.

Total Public Benefits (Revenues) -- In constant 2006 dollars, the aggregate annual tax revenues flowing from the subject development at full project build-out range from:

- $344,750 to $3.5 million per year for the county of Hawaii, stabilizing over time at $3,456,479 per year, totaling $24.4 million over the 10-year development projection model;
- $1,073,573 to $5.8 million annually for the State of Hawaii, stabilizing at $4.4 million per year, and cumulatively at $41.5 million over the 10-year forecast period; and
- $1,418,323 to $9.3 million per year for total tax receipts (county and state), totaling $65.9 million for the initial 10 years of the Waikoloa Highlands subdivision, and stabilizing at $7.9 million per year.

Correlation

Our public cost/benefit assessment model is displayed on Table 16, depicting the correlation of public service costs (per capita allocation basis) with the anticipated tax revenue benefits.

Table 17 summarizes our costs/benefits findings on both an actual cost and per capita allowance basis for the Waikoloa Highlands project.

As can be seen, regardless of the cost methodology adopted, in no single year do public coffers suffer a net loss resulting from subject development.

CERTIFICATION

The undersigned do hereby certify that, to the best of our knowledge and belief, the statements of fact contained in this report are true and correct. It is further certified that the reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions. We further certify that we have no present or prospective interest in the property that is the subject of this report, and have no personal interest with respect to the parties involved. We have no bias with respect to the property that is the subject of this report or the parties involved with this assignment. Our

TABLE 16

PUBLIC COST/BENEFIT SUMMARY TABLE
Economic Impact Analysis and Public Cost/Benefit Assessment
Market Study of Proposed Waikoloa Highlands Subdivision
Waikoloa Village, South Kohala, Hawaii
In Constant Year 2006 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Total Years 1 Through 10	Stabilized
PUBLIC BENEFITS (Revenues)												
1. REAL PROPERTY TAXES												
Cumulative Assessed Values (1) (2)												
Improvements		$29,610,000	$63,450,000	$105,750,000	$148,050,000	$190,350,000	$232,650,000	$274,950,000	$308,790,000	$336,708,000		$336,708,000
Land	$35,000,000	$159,200,000	$159,200,000	$159,200,000	$159,200,000	$159,200,000	$159,200,000	$159,200,000	$159,200,000	$159,200,000		$159,200,000
Total Assessed Value	$35,000,000	$188,810,000	$222,650,000	$264,950,000	$307,250,000	$349,550,000	$391,850,000	$434,150,000	$467,990,000	$495,908,000		$495,908,000
TOTAL REAL PROPERTY TAXES	$344,750	$1,766,542	$1,954,647	$2,201,718	$2,448,789	$2,679,940	$2,927,011	$3,174,082	$3,362,186	$3,493,095	$24,352,757	$3,456,479
2. STATE INCOME TAXES												
Taxable Personal Income	$4,780,776	$14,059,864	$22,042,360	$26,903,200	$33,107,200	$39,311,200	$45,515,200	$51,719,200	$54,362,960	$56,903,352	$348,705,312	$49,383,840
Taxable Corporate Profits	$1,379,070	$3,482,430	$3,860,291	$3,870,069	$4,431,096	$4,992,124	$5,553,151	$6,114,179	$6,055,101	$6,094,329	$45,831,840	$4,143,020
Personal Taxes Paid	$239,039	$702,993	$1,102,118	$1,345,160	$1,655,360	$1,965,560	$2,275,760	$2,585,960	$2,718,148	$2,845,168	$17,435,266	$2,469,192
Corporate Taxes Paid	$13,791	$34,824	$38,603	$38,701	$44,311	$49,921	$55,532	$61,142	$60,551	$60,943	$458,318	$41,430
TOTAL STATE INCOME TAXES	$252,830	$737,818	$1,140,721	$1,383,861	$1,699,671	$2,015,481	$2,331,292	$2,647,102	$2,778,699	$2,906,111	$17,893,584	$2,510,622
3. STATE GROSS EXCISE TAX												
Taxable Transactions												
Construction Contracts	$19,701,000	$49,749,000	$43,125,000	$35,250,000	$35,250,000	$35,250,000	$35,250,000	$35,250,000	$28,200,000	$23,265,000	$340,290,000	
Disposable Income Purchases			$7,335,413	$12,225,688	$17,115,963	$22,006,238	$26,896,513	$31,786,788	$35,699,008	$38,926,589	$191,992,197	$38,926,589
Home Maintenance			$1,350,000	$2,250,000	$3,150,000	$4,050,000	$4,950,000	$5,850,000	$6,390,000	$7,164,000	$35,154,000	$7,164,000
Total Taxable Transactions	$19,701,000	$49,749,000	$51,810,413	$49,725,688	$55,515,963	$61,306,238	$67,096,513	$72,886,788	$70,289,008	$69,355,589	$567,436,197	$46,090,589
TOTAL STATE EXCISE TAX	$820,744	$2,072,543	$2,158,422	$2,071,572	$2,312,795	$2,554,018	$2,795,241	$3,036,464	$2,928,240	$2,889,354	$23,639,392	$1,920,134
TOTAL GROSS PUBLIC REVENUES												
To County (Item #1)	$344,750	$1,766,542	$1,954,647	$2,201,718	$2,448,789	$2,679,940	$2,927,011	$3,174,082	$3,362,186	$3,493,095	$24,352,757	$3,456,479
To State (Items #2 & 3)	$1,073,573	$2,810,361	$3,299,143	$3,455,433	$4,012,466	$4,569,499	$5,126,532	$5,683,565	$5,706,939	$5,795,465	$41,532,976	$4,430,756
AGGREGATE TAX REVENUES	$1,418,323	$4,576,903	$5,253,789	$5,657,150	$6,461,254	$7,249,439	$8,053,543	$8,857,647	$9,069,125	$9,288,559	$65,885,733	$7,887,235
PUBLIC COSTS (Expenses)												
By County of Hawaii			$297,723	$496,205	$694,686	$893,168	$1,091,650	$1,290,132	$1,448,917	$1,579,915	$7,792,395	$1,579,915
By State of Hawaii			$636,913	$1,061,522	$1,486,131	$1,910,740	$2,335,348	$2,759,957	$3,099,644	$3,379,886	$16,670,141	$3,379,886
TOTAL PUBLIC COSTS			$934,636	$1,557,727	$2,180,817	$2,803,908	$3,426,998	$4,050,089	$4,548,561	$4,959,801	$24,462,537	$4,959,801
TOTAL NET PUBLIC BENEFITS												
To County of Hawaii	$344,750	$1,766,542	$1,656,924	$1,705,513	$1,754,102	$1,786,771	$1,835,361	$1,883,950	$1,913,269	$1,913,180	$16,560,361	$1,876,564
To State of Hawaii	$1,073,573	$2,810,361	$2,662,229	$2,393,911	$2,526,335	$2,658,759	$2,791,184	$2,923,608	$2,607,295	$2,415,579	$24,862,834	$1,050,870
AGGREGATE NET BENEFITS	$1,418,323	$4,576,903	$4,319,153	$4,099,424	$4,280,437	$4,445,531	$4,626,544	$4,807,558	$4,520,564	$4,328,758	$41,423,196	$2,927,434

Source: The Hallstrom Group, Inc.

TABLE 17

SUMMARY OF ANNUAL PRIMARY GOVERNMENTAL TAX RECEIPTS AND PUBLIC SERVICE COSTS
Economic Impact Analysis and Public Cost/Benefit Assessment
Market Study of Proposed Waikoloa Highlands Sub. Division
Waikoloa Village, South Kohala, Hawaii
In Constant Year 2006 Dollars

State of Hawaii

On Stabilized Basis At Build-Out	Actual Cost Comparison					Per Capita Allocation Comparison			
	Receipts	-	Costs	=	Net Benefits or (Costs)	Receipts	-	Costs	=	Net Benefits or (Costs)
Amount per Year	$4,430,756		($2,546,500)		$1,884,256	$4,430,756		($3,379,886)		$1,050,870

County of Hawaii

On Stabilized Basis At Build-Out	Actual Cost Comparison					Per Capita Allocation Comparison			
	Receipts	-	Costs	=	Net Benefits or (Costs)	Receipts	-	Costs	=	Net Benefits or (Costs)
Amount per Year	$3,456,479		($449,600)		$3,006,879	$3,456,479		($1,579,915)		$1,876,564

Source: The Hallstrom Group, Inc.

engagement in this assignment was not contingent upon developing or reporting predetermined results. Our compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal. The appraisal analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice. The use of this report is subject to the requirements of the Appraisal Institute relating to review by duly authorized representatives. The undersigned certify that they have made personal inspections of the property that is the subject of this report. No other persons provided significant real property appraisal assistance other than the undersigned.

The Appraisal Institute conducts programs of continuing education for their designated members. As of the date of this report, James E. Hallstrom, Jr. has completed the requirements of the continuing education program of the Appraisal Institute.

James E. Hallstrom, Jr., MAI, CRE
Hawaii State Certified
General Appraiser, CGA-178
Exp. Date December 31, 2007

Tom W. Holliday

/as

4694_R01

THE HALLSTROM GROUP INC.

REAL ESTATE CONSULTANTS & APPRAISERS

PROFESSIONAL BACKGROUND AND SERVICES

The Hallstrom Group, Inc. is a Honolulu based independent professional organization that provides a wide scope of real estate consulting services throughout the State of Hawaii with particular emphasis on valuation studies. The purpose of the firm is to assist clients in formulating realistic real estate decisions. It provides solutions to complex issues by delivering thoroughly researched, objective analyses in a timely manner. Focusing on specific client problems and needs, and employing a broad range of tools including after-tax cash flow simulations and feasibility analyses, the firm minimizes the financial risks inherent in the real estate decision making process.

The principals and associates of the firm have been professionally trained, are experienced in Hawaiian real estate, and are actively associated with the Appraisal Institute and the Counselors of Real Estate, nationally recognized real estate appraisal and counseling organizations.

The real estate appraisals prepared by The Hallstrom Group accomplish a variety of needs and function to provide professional value opinions for such purposes as mortgage loans, investment decisions, lease negotiations and arbitrations, condemnations, assessment appeals, and the formation of policy decisions. Valuation assignments cover a spectrum of property types including existing and proposed resort and residential developments, industrial properties, high-rise office buildings and condominiums, shopping centers, subdivisions, apartments, residential leased fee conversions, special purpose properties, and vacant acreage, as well as property assemblages and portfolio reviews.

Market studies are research-intensive, analytical tools oriented to provide insight into investment opportunities and development challenges, and range in focus from highest and best use determinations for a specific site or improved property, to an evaluation of multiple (present and future) demand and supply characteristics for long-term, mixed-use projects. Market studies are commissioned for a variety of purposes where timely market information, insightful trends analyses, and perceptive conceptual conclusions or recommendations are critical. Uses include the formation of development strategies, bases for capital commitment decisions, evidence of appropriateness for state and county land use classification petitions, fiscal and social impact evaluations, and the identification of alternative economic use/conversion opportunities.

ARBITRATION
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PROFESSIONAL QUALIFICATIONS OF JAMES E. HALLSTROM, JR., MAI, CRE

Business Background

President	The Hallstrom Group, Inc. Honolulu, Hawaii (1980 - Present)
Former Senior Vice President and Treasurer	Hastings, Martin, Hallstrom and Chew, Ltd., Honolulu, Hawaii (1972-1980)
Former Real Property Appraiser and Analyst	Administration, Inc., a subsidiary of C. Brewer and Company, Limited Honolulu, Hawaii (1971-1972)
Former Senior Real Property Appraiser and Analyst	Opitz Realty, Madison, Wisconsin (1969-1971)

National Designations and Memberships

- CRE Designation (1998) - The Counselors of Real Estate
- MAI Designation (1976) - American Institute of Real Estate Appraisers
- SRPA Designation (1975) - Society of Real Estate Appraisers

The American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated in 1991, forming the Appraisal Institute (AI).

Education

- M.S. (Real Estate Appraisal and Investment Analysis) 1971, University of Wisconsin at Madison
- B.A. (Economics) 1969, Brigham Young University at Provo
- Additional numerous specialized real estate studies in connection with qualifying for national professional designations, and uninterrupted Continuing Education.
- Completed Continuing Education requirements with the Appraisal Institute through 2006.

Professional Involvement

- Former President and Officer for Hawaii AIREA and SREA Chapters
- Instructor for Society of Real Estate Appraisers Course 101, "Introduction to Appraising Real Property" and Course 201, "Principles of Income Property Appraising"
- Contributing author to the "Hawaii Real Estate Investor"
- Lecturer at many professional seminars and clinics.
- Appointed numerous times as an Arbitrator and Mediator.

Qualified Expert Witness

Federal and State Courts
State Land Use and County Hearings
Arbitration Proceedings

State of Hawaii Certification

Certified General Appraiser, License Number CGA-178, Exp. Date December 31, 2007

Community Service

Active registered member of the Boy Scouts of America; former Director of Le Jardin Academy; former Advisory Board Member of the School of Business, Brigham Young University, Hawaii Campus; Director of Hawaii Reserves, Inc.

PROFESSIONAL QUALIFICATIONS OF THOMAS W. HOLLIDAY

Business Background

Senior Analyst	The Hallstrom Group, Inc. Honolulu, Hawaii
Former Staff Appraiser	Davis-Baker Appraisal Co. Avalon, Santa Catalina Island, California

Education

- B.A. (Communications/Journalism) 1978 California State University at Fullerton
- SREA Course 201- Principles of Income Property Appraising
- Expert witness testimony before State of Hawaii Land Use Commission and various state and county boards and agencies since 1983.
- Numerous professional seminars and clinics
- Contributing author to Hawaii Real Estate Investor, Honolulu Star Bulletin

On January 1, 1991, the American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated, forming the Appraisal Institute (AI).

Recent Maui Assignments (since 2000)

- Market Study, Economic Impact Analyses and Public Costs/Benefits Assessments
  - -- Wailea Ranch (Master Planned Community)
  - -- Palauea Bay (Resort/Residential)
  - -- Upcountry Town Center (Mixed-Use Planned Development)
  - -- Maui Lani (Residential and Industrial Components of Master Planned Community)
  - -- Maui Business Park, Phase II (Industrial/Commercial)
  - -- Four Seasons Private Estates and Residences Club (Resort/Residential)
  - -- Kualono Subdivision (Residential)
  - -- Kapalua Mauka (Master Planned Community)
  - -- Hailiimailii (Commercial)
  - -- Pulelehua (Master Planned Community)
  - -- Westin Kaanapali Ocean Villas Expansion (Resort/Timeshare)
- Major Valuation Assignments
  - -- Sheraton Maui Hotel
  - -- Outrigger Wailea Resort Hotel
  - -- Maui Lu Hotel
  - -- Coconut Grove Condominiums
  - -- Palauea Bay Holdings
  - -- Wailea Ranch
  - -- Maui Coast Hotel
  - -- Westin Maui Hotel
  - -- Maui Marriott Hotel
  - -- Waihee Beach
  - -- Kapalua Bay Hotel and The Shops at Kapalua

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APPENDIX E

Evaluation of Archaeological Potential at a 702.28-acre Parcel at Waikoloa, South Kohala District, Hawai‘i Island
Cultural Surveys Hawai‘i, April 2006

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Evaluation of Archaeological Potential at A 702.28-Acre Parcel at Waikoloa, South Kohala District, Hawai'i Island TMK: [3] 6-8-002:016

Prepared for
R.M. Towill Corporation

Prepared by

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Kailua, Hawai'i
(Job Code: Waiko 3)

September 2006

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Table of Contents

List of Figures

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Section 1 Project Background

Cultural Surveys Hawai'i entered into agreement with R.M. Towill Corporation to carry out an Archaeological Inventory Survey of an approximately 702.28-acre parcel in the uplands of Waikoloa, South Kohala, Hawai'i Island. Relatively quickly it was ascertained that a prior Archaeological Inventory Survey (Jensen 1990) had been carried out on the parcel. Upon consultation with R. M. Towill Corporation it was agreed that a summary report documenting the previous work and the status of that work with the regulatory State Historic Preservation Division (SHPD) was appropriate.

Section 2 Status of Archaeological Studies of the Parcel

To the best of our knowledge only two prior archaeological studies have been carried out in the present project area - Bevacqua 1972 and Jensen 1990. Because the Jensen study is far more detailed and relevant to future development of the parcel it is discussed first with reference to the Bevacqua study following.

2.1 Jensen (1990) Archaeological Inventory Survey

In March of 1990, Peter M. Jensen of Paul H. Rosendahl, Ph.D., Inc. produced a study entitled *Archaeological Inventory Survey Waikoloa Mauka Lands, Land of Waikoloa, South Kohala District, Island of Hawai'i* (Cover page is shown in Figure 1). Although the stated estimate of the acreage studied is "c. 600 acres" an overlay (see Figure 7) of the Jensen (1990) project area map (Figure 2) with the present project area map (Figures 3) finds that it is very similar to the present 702.28-acre parcel. Our overlay indicates that the project areas are basically the same (with minor vagaries as are the norm) except that the Jensen (1990) project area was larger including an additional tongue of land at the northwest corner.

2.2 State Historic Preservation Division Comments on the Jensen (1990) Archaeological Inventory Survey

Research with the State Historic Preservation Division (SHPD) located a letter from Don Hibbard, administrator dated 4/17/1990 (Figure 4) asserting that the Jensen (1990) study "adequately documents the survey findings." Although we understood this letter as an acceptance letter, further confirmation was sought from Ms. MaryAnne Maigret, Hawai'i Island archaeologist with the SHPD. We asked her (correspondence of 3/27/06 and 4/17/06) whether TMK parcel [3] 6-8-002:016 had any further SHPD requirements. Her e-mail response (Figure 5) concludes: "My inclination is that additional work is not necessary and that we [SHPD] could maintain our earlier acceptance of the Jensen report."

This response was however superceded by a formal SHPD response ten weeks later on July 3, 2006 (Figure 6). This letter (from Ms. Julie Taomia): 1) questioned the relationship between the Jensen (1990) study area and the present study area, and 2) called for a verification field inspection to: a) determine whether the site identified in the survey (Jensen's site T-1) still exists and b) to evaluate the site using the current State of Hawai'i statutes and rules.

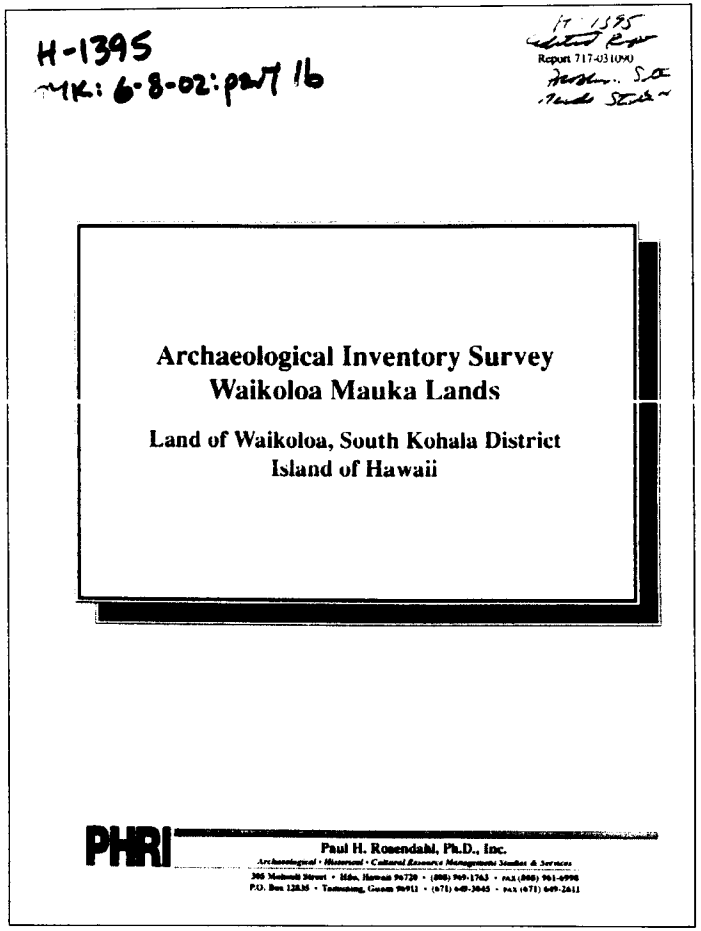

Figure 1. Title page of Jensen 1990 Archaeological Inventory Survey study addressing 702.28-acre project lands

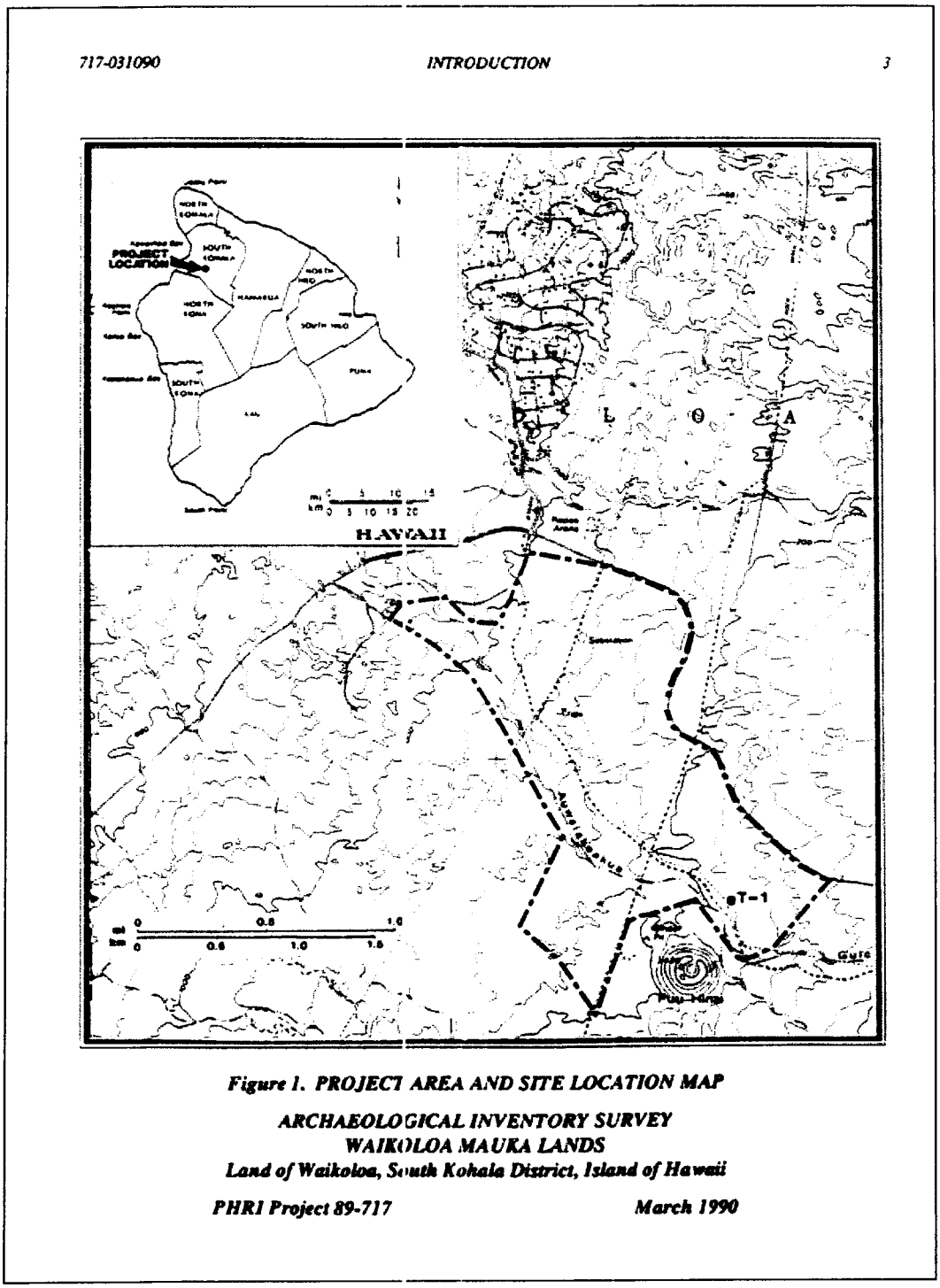

Figure 2. Map showing 1990 Archaeological Inventory Survey project area (from Jensen 1990:3)

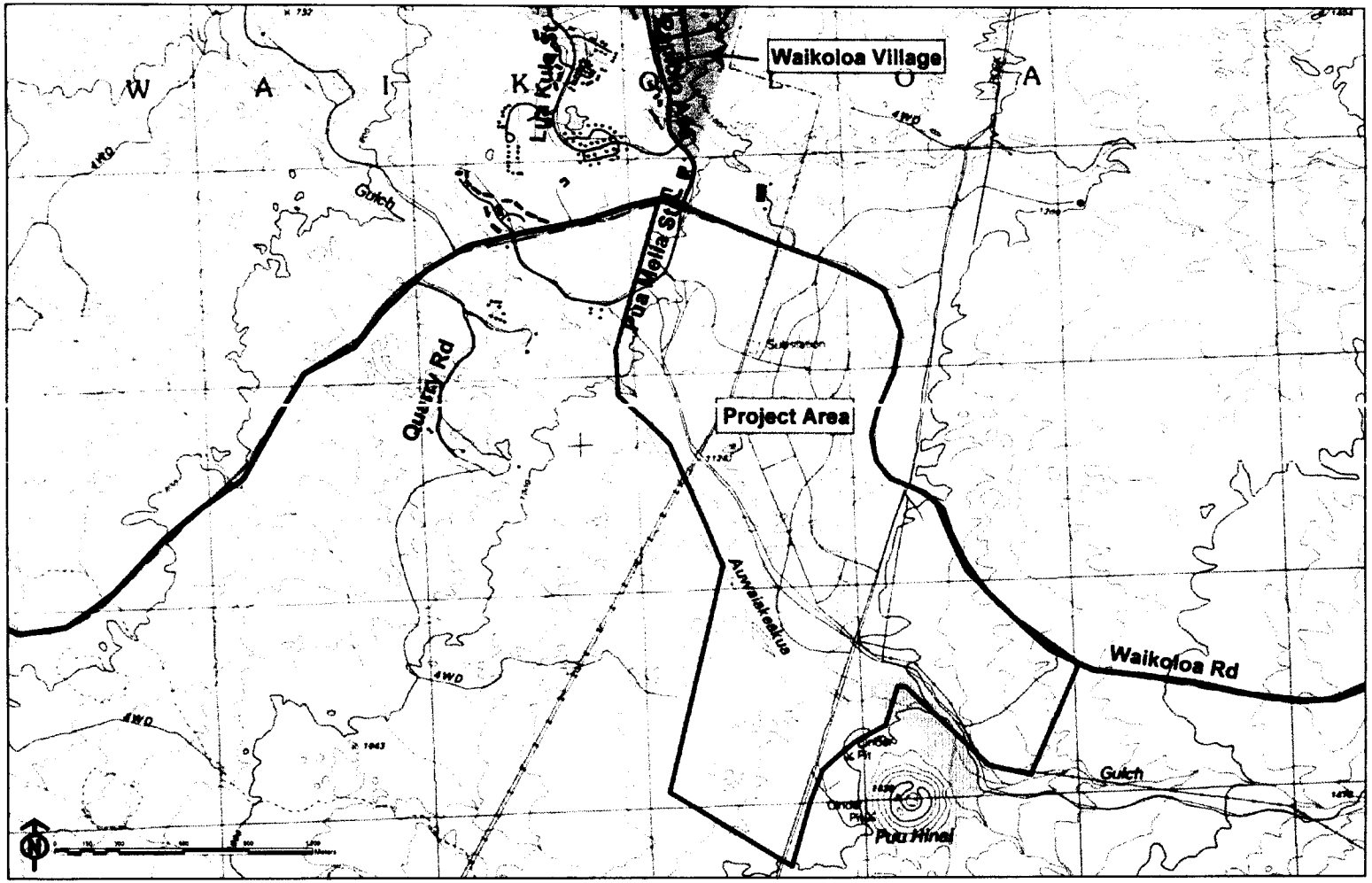

Figure 3 Present study area

April 17, 1990

Mr. Duane Kanuha, Director
Planning Department
County of Hawii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Kanuha:

SUBJECT: County of Hawaii, Use Permit #71 -- Condition 5
(Waikoloa Beach Resort -- Waikoloa Mauka Lands)
Waikoloa, South Kohala, Hawaii
TMK: 6-8-2: part 16

This is a follow-up to our letter of February 26, 1990, on this permit. Mr. Ken Melrose sent us on March 21, 1990, a copy of the final survey report covering the findings in this Waikoloa Mauka Lands area (P. Jensen 1990. Archaeological Inventory Survey, Waikoloa Mauka Lands. PHRI.). This report includes a location map and a site map, so the report adequately documents the survey findings. We believe the condition can be considered to be completely fulfilled at this time. Again, the findings indicate no significant historic sites are in the project areas.

To cover the slight possiblity of lava tube sites being uncovered, we recommend that you do remind the applicant that if such caves are encountered, the applicant should stop work in the immediate area and have a professional archaeologist check to see if historic remains are present. If remains are present, these should be documented and their significance evaluated. Then your office and our office should be contacted immediately, so we can assess the situation and make recommendations for mitigative action, if needed.

Sincerely,

/s/ DON HIBBARD

DON HIBBARD, Director
Historic Preservation Program

cc: K. Melrose, Waikoloa Beach Resort
P. Rosendahl, PHRI

RC:al 4/17/90
2588c/685

Figure 4. Letter from the State Historic Preservation Division of 4/17/1990 asserting that the Jensen (1990) study "adequately documents the survey findings"

David Shideler

From: MaryAnne.B.Maigret@hawaii.gov
Sent: Monday, April 17, 2006 10:56 AM
To: dshideler@culturalsurveys.com
Cc: Julie.M.Endicott-Taomia@hawaii.gov
Subject: Re: Follow-up to Request for clarification regarding no further SHPD requirement for TMK: [3] 6-8-002:016 in Mauka Waikoloa

"David Shideler" <dshideler@culturalsurveys.com>
04/17/2006 09:54 AM
Please respond to

To: <MaryAnne.B.Maigret@hawaii.gov>
cc:
bcc:
Subject: Follow-up to Request for clarification regarding no further SHPD requirement for TMK: [3] 6-8-002:016 in Mauka Waikoloa

David:

Hope you are well and keeping busy. We did receive your communique, and offer the following:

Several surveys, some more recent, continue to come up empty-handed in terms of findings in the Waikoloa area, with the few sites found consisting of c-shapes, a few isolated cave shelters, or military-related items. The sites I am aware of are on the 3000 acre parcel below Waikoloa Village, at a lower elevation than the Jensen parcel, though.

My inclination is that additional work is not neccessary and that we could maintain our earlier acceptance of the Jensen report. A letter to this effect will be drafted for Julie's review and division sign-off. We are still requiring inventories, however, on parcels that have not yet undergone a study.

MaryAnne

Aloha MaryAnne Maigret:

I am just following up on my letter to you dated March 27, 2006 entitled:"Request for clarification that a certain parcel TMK [3] 6-8-002:016 in Mauka Waikoloa, South Kohala, Hawaii Island has no further State Historic Preservation Division requirements." The letter was sent with a copy of the Jensen March 1990 Archaeological Inventory Survey of the parcel and a copy of the SHPD memo dated 4/17/90 signed by Don Hibbard addressing the Jensen
study.
I have no reason to believe there are any sites on this approximately 700-acre parcel.

The Hibbard letter would appear to indicate no further archaeological work is required. We do not wish to assume anything. We thus request clarification.

Is it reasonable to hope for an e-mail or memo clarifying the SHPD position?

Aloha David

4/25/2006

Figure 5. Copy of SHPD (MaryAnne Maigret) E-mail correspondence of 4/17/06 concluding "My inclination is that additional work is not necessary...."

LINDA LINGLE
GOVERNOR OF HAWAII

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BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

July 3, 2006

Mr. David Shideler
Cultural Surveys Hawaii Inc.
P.O. Box 1114
Kailua, Hawaii 96734

LOG NO: 2006.2189
DOC NO: 0606JT84
Archaeology

Dear Mr. Shideler:

SUBJECT: Chapter 6E-42 Historic Preservation Review –
Request for Clarification of Historic Preservation Requirements
Waikoloa Ahupua'a, South Kohala District, Island of Hawai'i
TMK: (3) 6-8-002:016

Thank you for requesting clarification of the requirements for historic preservation review for the above-named parcel. We have several comments regarding this request.

First, it is not clear that the same piece of land is referred to in the letter and the report. The current TMK map available online for the parcel named above does not match the project area indicated in the report. Among other indicators, the TMK map includes Puu Hinai within parcel 16, whereas Puu Hinai lies outside of, and adjacent to, the project area in the report that was submitted with this request (Jensen 1990). Please provide clarification of what area is under consideration here.

An additional concern is that the report submitted evaluated the site that was identified in the survey under the criteria for evaluation for nomination to the National Register of Historic Places. Currently, projects requiring State or County permits are reviewed under the Hawaii Revised Statutes and the Hawaii Administrative Rules. If the parcel under consideration is the same as that indicated in the report, it should at least be determined whether this site still exists, and, if so, it would need to be evaluated using the current State of Hawaii statutes and rules rather than the federal criteria for evaluation.

Thank you for your time and attention of these matters. Please contact Dr. Julie Taomia at 808-327-3691 if you have questions or concerns.

Aloha,

Melanie Chinen, Administrator
State Historic Preservation Division

JT:jen

Figure 6. State Historic Preservation Division letter of July 3, 2006 specifying further work

2.3 Comparison of the Jensen 1990 Project Area and the Present Waikoloa Highlands Project Area

The SHPD response (from Ms. Julie Taomia) of July 3, 2006 (Figure 6) questioned the relationship between the Jensen (1990) study area and the present study area. The relationship of the two project areas is shown in Figure 7. The project areas are suggested to be basically the same. Discrepancies on the southwest and north corners are suggested to be of the nature of minor vagaries as are the norm when comparing modern geo-referenced maps with hand drawn maps of c. 1990.

2.4 Comments on the Methodology and Finds in the Jensen (1990) Study

The Jensen study began with a low elevation aerial reconnaissance of the entire project area during which one site was identified. Subsequently pedestrian sweeps were carried out in three portions of the project area deemed particularly sensitive. These areas (Jensen 1990:9) were:

- Adjacent to the north side of Pu'u Hinai and involves the several streams which converge near the northeast perimeter of the *pu'u;*
- The southwestern portion of the project area in which numerous small caves were observed; and
- The vicinity of two shallow gulches which transect the project area from east to west. One of these originates on the south side of Pu'u Hinai while the other represents the coalesced flows from several small streams which flow around the north side of the *pu'u.*

The total of the areas of sensitivity traversed were estimated at 20% of the entire project area. Pedestrian transects were spaced at 30 – 40 m intervals in some areas while others "involved a cursory-level walk-through." (Jensen 1990:9). In at least one place (Jensen 1990:9) the PHRI fieldwork is referred to as "the present reconnaissance work" suggesting the possibility that the field crew may have understood they were doing a much less intensive study than the final title of the study indicates.

The Jensen (1990) study identified one archaeological feature a wall segment identified as Site T-1. The wall of unknown function was 2.5 meters long with a maximum height of 1.21 meters. For a number of reasons the Jensen study reasonably concludes this T-1 Site was not the same as the Site 22 documented by Bevaqua (discussed further below). The T-1 feature was so modest that no State Inventory of Historic Places site number was given and "no further treatment of any kind" was recommended (Jensen 1990:13). Otherwise there was no evidence of either pre- or post-contact use within the entire project area.

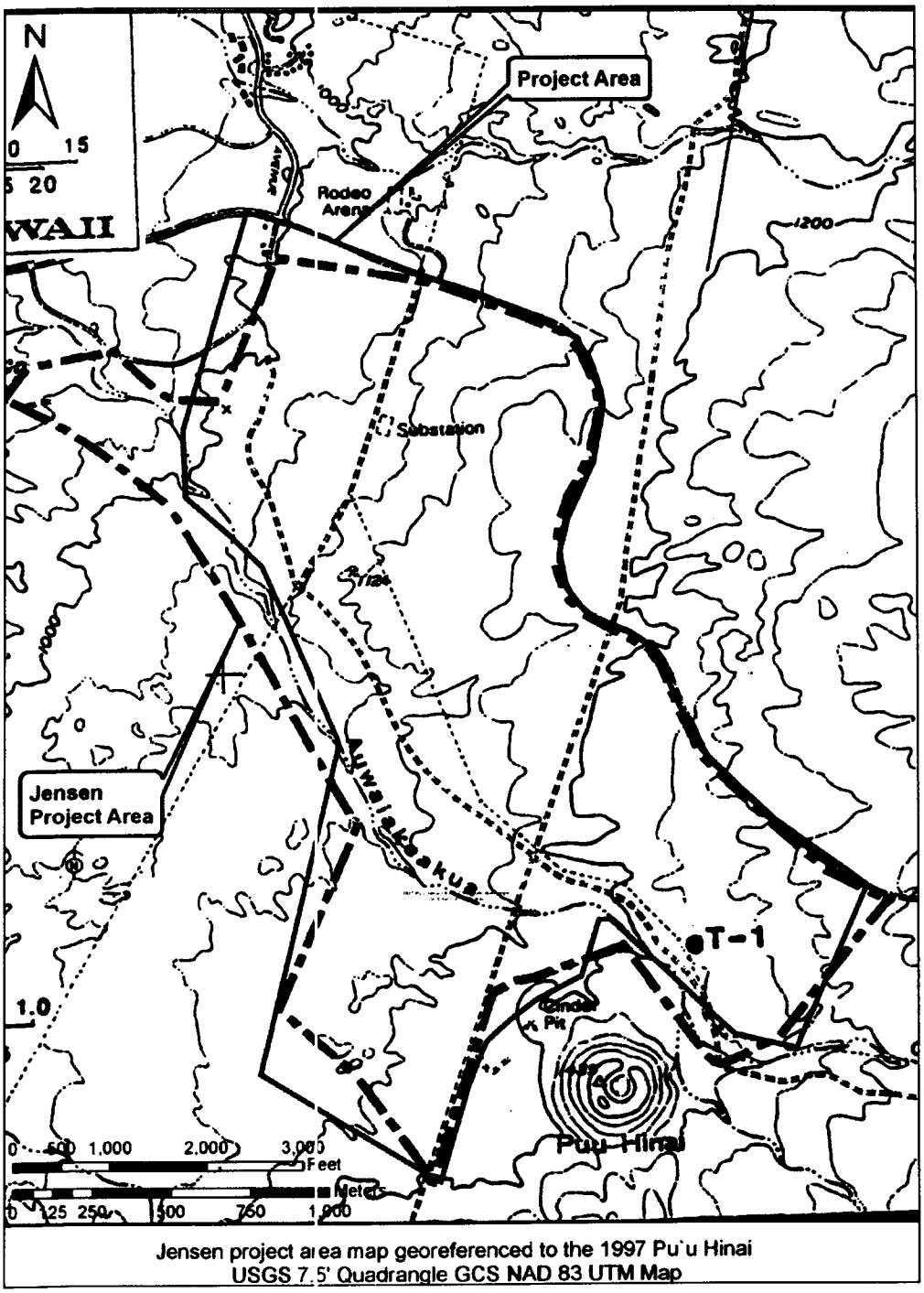

Figure 7. Overlay of Jensen (1990) project area (dashed line) with present Waikoloa Highlands project area (red line). They are suggested to be basically the same (with minor vagaries on the southwest and north corners)

2.5 Bevacqua 1972 Archaeological Study

In 1972 Robert F. Bevaqua carried out archaeological studies in a number of areas of Waikoloa that he designated as Survey Areas A through G. Of particular importance to the present study is his Survey Area G which the Jensen study (1990:5) concluded: "roughly corresponds to the present project area." His study area is described as follows:

> Survey Area G is situated slightly N of Pu'u Hinai, a prominent cinder cone in the center of Waikoloa. The exact location and configuration of this 300-acre parcel of land has not been determined by the developers; thus the survey encompasses only the approximate area of the parcel.

Bevaqua's map showing the location of his survey Area G (Figure 8) leaves much to be desired. Bevacqua (1972:12) identified only one site within his Survey Area G designated as Site 22 described as follows:

> Site 22 consists of a complex of walls, portions of which protrude above the flood plain. The dominant feature is a well-built bifaced wall, 45 meters long, running E-W. At the stream bank, the E end of the wall corners and extends N another 7.1 meters; the W end of the main wall corners and extends N 5.5 meters. East of the main wall an 11-meter-long, bifaced wall runs N-S and stands clearly above ground surface.

Bevacqua notes that: the vast majority of the site has been completely inundated by stream deposited soil, approximately 1.3 meters deep, thus making identification and description exceptionally difficult. He recommends a program of further work at this site.

The field crew on the Jensen study looked for Bevaqua's Site 22 even examining lands 250 meters beyond the perimeter of the project area. They conclude (Jensen 1990:10) "in view of clear evidence of recent erosion, it can reasonably be concluded that heavy runoff probably destroyed Site 22 sometime during the past 5-10 years."

It seems odd that a site nearly 50 feet long that presumably had been around for many decades could disappear in the course of eighteen years. It also, however, seems unlikely the Jensen crew would have missed Site 22. During the CSH field inspection on August 8, 2006 (subject of Section 3 of this study below) Bevaqua's Site 22 was also sought with no trace found. Perhaps it lies farther a field.

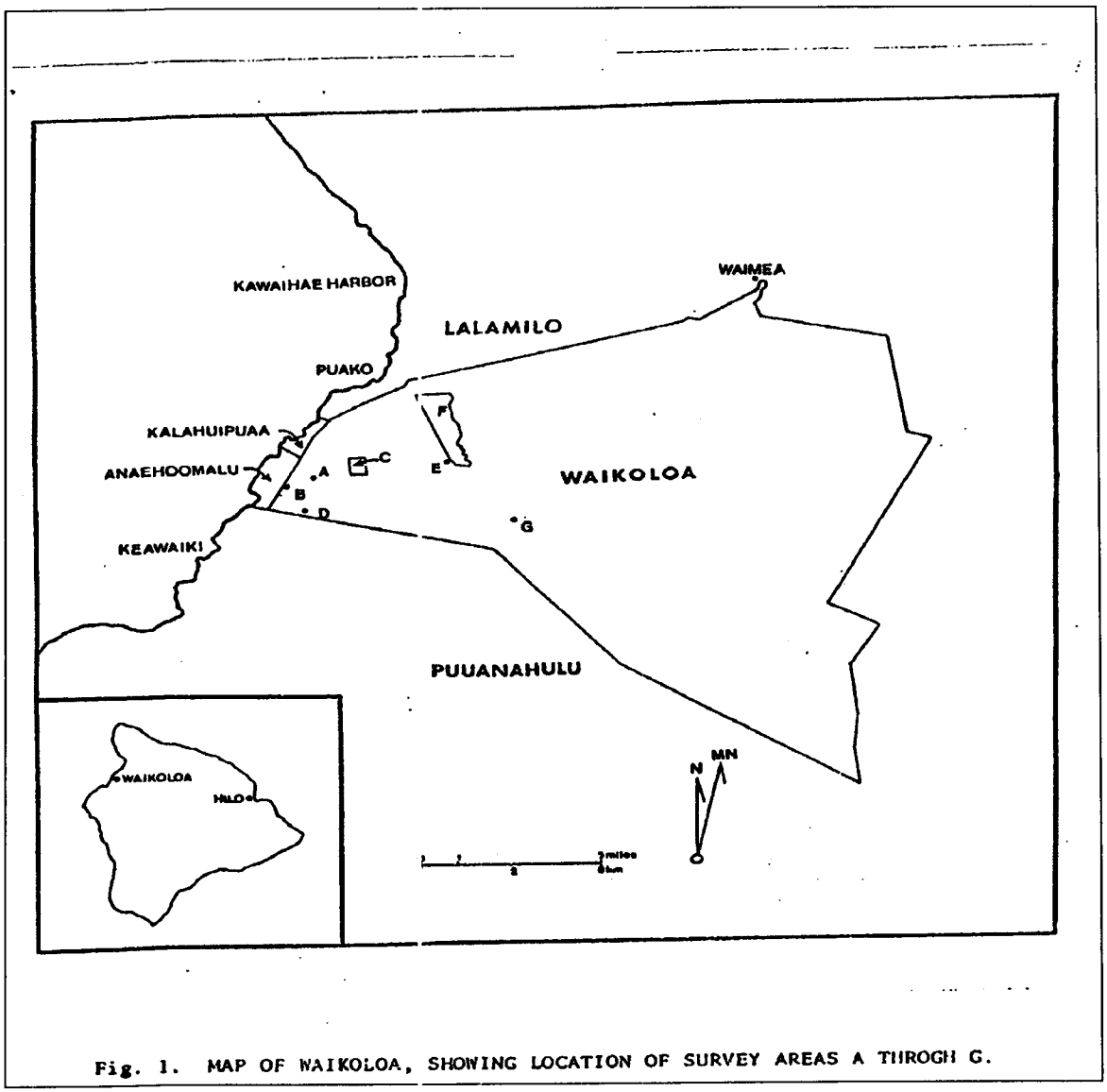

Figure 8. Bevaqua's map showing the location of his survey areas (Survey Area "G", shown as a dot, roughly corresponds to the present study area

Section 3 Results of CSH Field Check

In consultation with R.M. Towill, Cultural Surveys Hawai'i undertook a field inspection of the project area on August 8, 2006. The fieldwork was carried out by Todd Tulchin B.A. and David Shideler M.A. under the overall direction of Hallett H. Hammatt Ph.D. and took approximately 2-man-days including travel time. The fieldwork had two major objectives: 1) to relocate and describe the archaeological feature identified as "T-1" in the Jensen (1990) archaeological inventory survey, and 2) to search for any additional sites as might be present including a further effort to re-identify the Bevacqua (1972) "Site 22" wall feature that could not be found in the Jensen (1990) fieldwork.

The project area was approached from the main Waikoloa Village Road connecting Queen Ka'ahumanu Highway and the upper belt road. It was possible to drive in on an access road supporting the on-going quarry operations at Pu'u Hīna'i. The field inspection began by following 'Auwaiakeakua Gulch from the access road to the base of Pu'u Hīna'i. It was thought that the margins of this gulch were particularly likely locales for archaeological sites including Bevacqua's "Site 22" wall feature. The field crew then ascended to the summit of Pu'u Hīna'i to better view the landscape of the project area in hopes of observing indications of archaeological sites (Figures 9 & 10). Then both sides of the margins of 'Auwaiakeakua Gulch were explored to the southeast edge of the present study area and some distance beyond in search of the Bevacqua Site 22 or any other archaeological features. No archaeological sites were observed in this initial fieldwork.

Search for the Jensen T-1 feature was soon successful and the feature was located, photographed, sketched and described (Figures 11 to 15). No other archaeological features were observed or are believed to exist within the project area. The feature is described below and is evaluated according to current Hawai'i statutes and rules (specifically HAR 13-275-6)

Archaeological Feature T-1 (as identified by Jensen 1990) Description

Previous Site #s The Jensen 1990 Archaeological Inventory Survey study gave this site temporary site # T-1. It appears the State Historic Preservation Division

Location: Approximately 450 m northeast of the summit of Pu'u Hīna'i, approximately 100 m northeast of 'Auwaiakeakua Gulch and approximately 30 m north of a telephone line. The feature is located near a significant south-to-west bend of 'Auwaiakeakua Gulch near the summit of a low hill or *pu'u*.

Formal Type: Linear cairn

Description: The feature (Figures 11 to 15) consists of twelve loosely piled small *pāhoehoe* slab boulders in a linear arrangement 2.5 meters long with 1 to 3 courses and a maximum height of 1.21 meters and a width of 0.6 meters. The feature has the appearance of a short wall segment, one course thick arranged in an east/west direction parallel with the contour of the small hill. There was little soil at the base of the structure with the basal course lying on bedrock. No midden, artifacts or other features were observed in the vicinity. No subsurface deposits are believed to be present in the vicinity.

Function: The function of the small linear pile of boulders is not altogether clear. We believe it served as a cairn or directional marker. The location near a significant bend of 'Auwaiakeakua Gulch would seem to be significant. The cairn would serve as a marker for parties traversing from the Gulch to the Waimea area. It is located at a place where the view to the north is obscured by the rise in the slope and may have served to inform travelers where to leave the gulch to head for points to the north.

Significance: The feature was evaluated as significant under federal and state criterion "d" "have yielded, or is likely to yield, information important for research on prehistory or history" This feature is evaluated as significant for information content only.

Recommended Treatment We agree with the recommendation of Jensen (1990) that the feature has yielded the available information and that no further archaeological work is indicated.

The Jensen (1990) study did not give the one identified archaeological feature a formal SIHP site # but rather referred to it consistently as "Site T-1". The State Historic Preservation Division comment letter of April 17 1990 (Figure 4) makes no mention of the need for a formal site number. Our copy of the report from the SHPD library does however bear an SHPD annotation in the upper right hand corner of the cover page (see Figure 1) "Problem Site Needs State #"

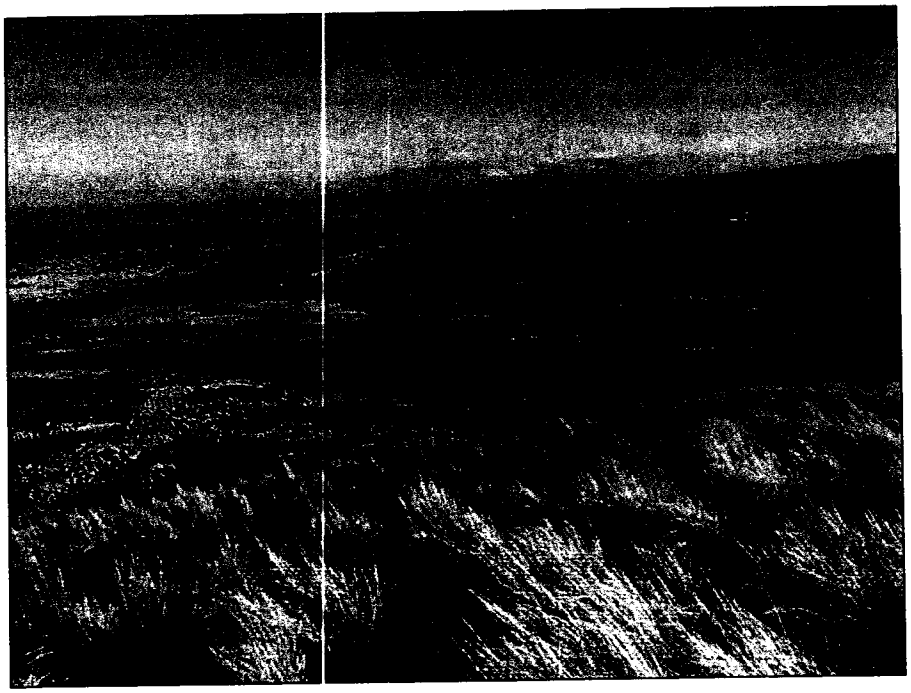

Figure 9. General view of project area from Pu'u Hīna'i, view to northwest (Waikoloa Town in background)

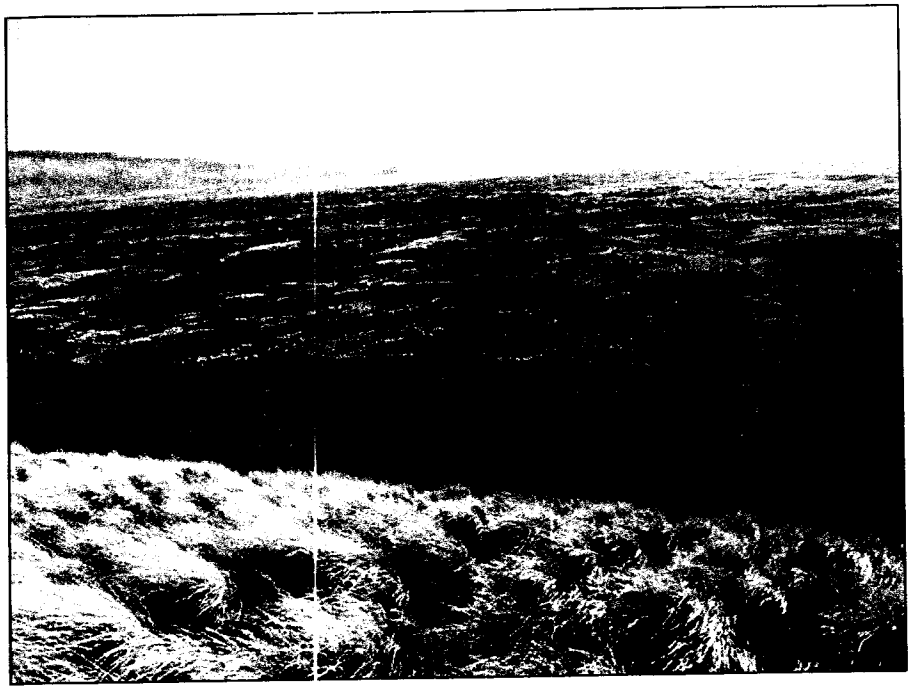

Figure 10. General view of project area from Pu'u Hīna'i, view to northeast

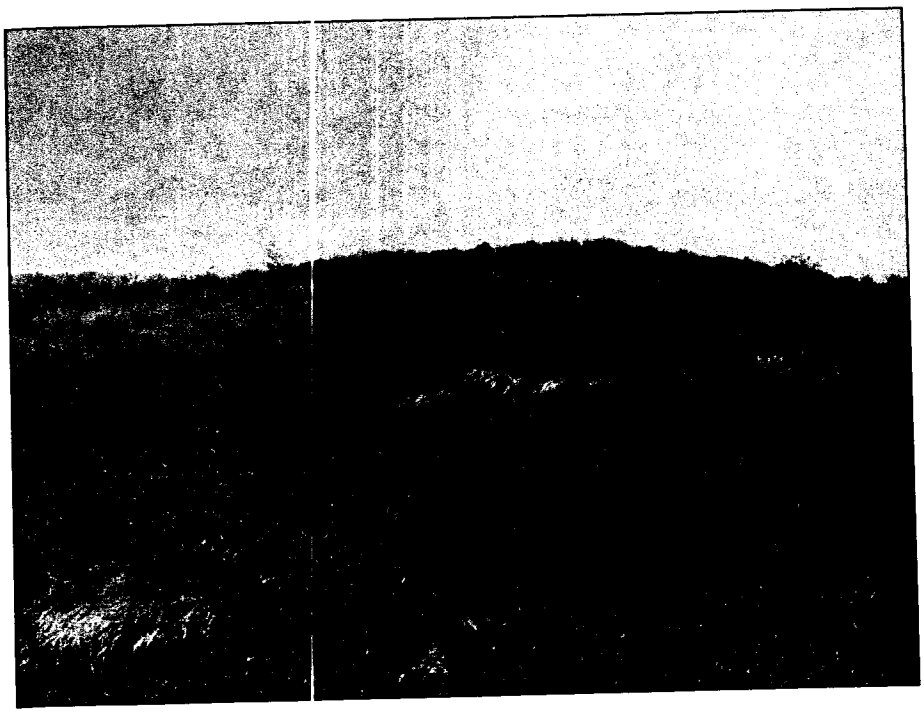

Figure 11. View of "T-1" archaeological feature (center); view to northeast

Figure 12. View of "T-1" archaeological feature, view to west

Figure 13 View of "T-1" archaeological feature (center); view to northeast

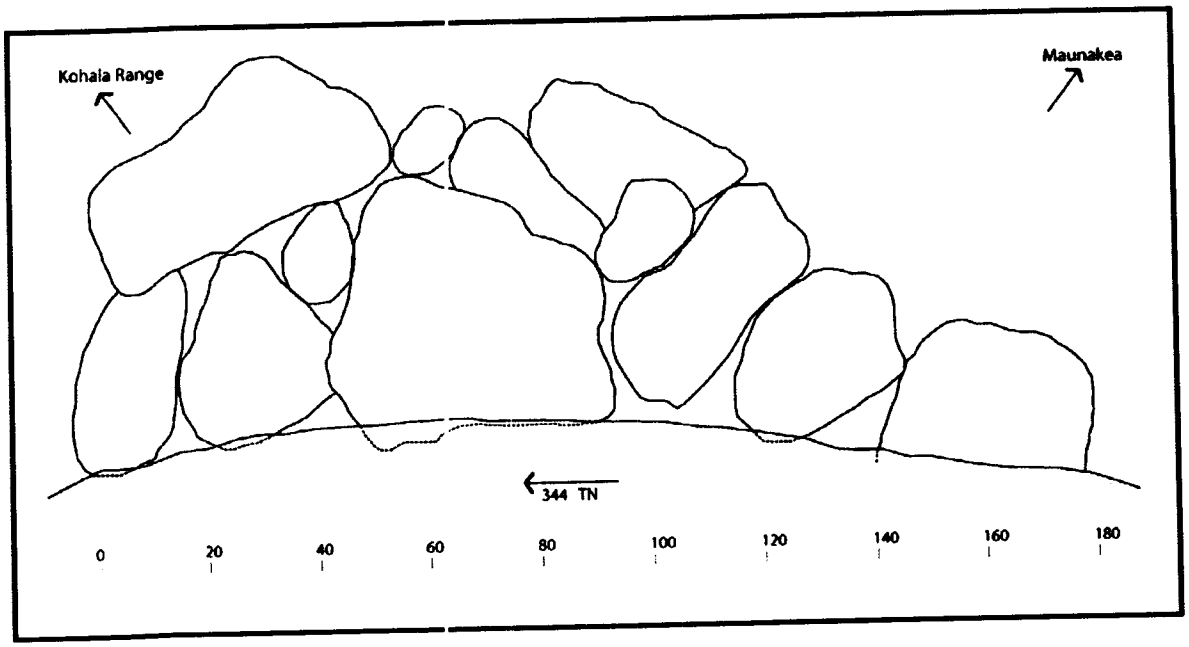

Figure 14. Profile sketch of "T-1" archaeological feature

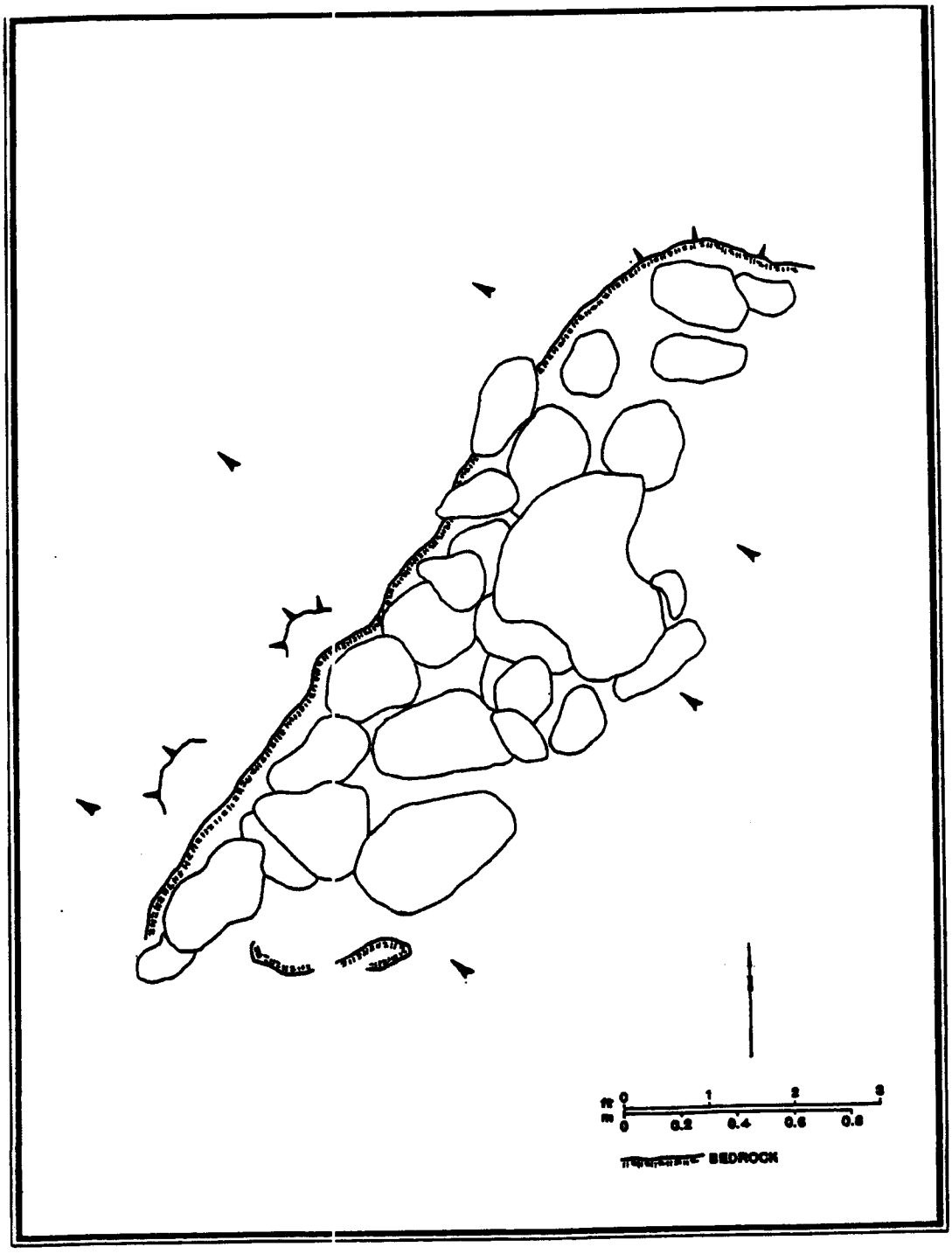

Figure 15. Plan view of the T-1 archaeological feature (adapted from Jensen 1990:11)

Section 4 Evaluation of Potential for Lava Tubes with in the Project Area

It is our understanding that at a public meeting c. August 4th 2006 a person in the audience expressed concern regarding a lava tube system in the vicinity of the Waikoloa Highlands project area. The Jensen 1990 study states that: "Several small habitable caves were observed both along the gulches and in the area of exposed pahoehoe. However, no evidence of occupation or other use was observed at any of the caves..."

During a different archaeological study to the west of the southwest corner of the present project area Cultural Surveys Hawai'i developed data on a lava tube system. This lava tube system was memorable as the main tube appeared to be huge – on the order of 20 m in diameter. Three entrances to the tube system were located and are shown on an aerial photograph (Figure 16) and a USGS map (Figure 17). The three entrances observed lie a kilometer or more to the west of the present project area.

We cannot be sure this lava tube system was the one the unknown party had in mind but it appears likely as this is truly an exceptional lava tube system. We also cannot be sure that the system does not continue under the present project area. It may be noted however that the lava tube system lies within a large area of ponded *pāhoehoe* lava (shown in the Figure 16 aerial photo as green) that is suggested as the source of the lava feeding the tube and that just barely extends into the southwest corner of the project area.

In summary on this point we note that 1) the Jensen 1990 study did not describe any lava tube system within their project lands, 2) no lava tube system was observed during the recent CSH field inspection, 3) that a very likely candidate for the lave tube system mentioned in the public forum is known to exist at a distance of a kilometer or more to the west, and 4) that the conditions that may have created this tube system (a deep lake of molten magma now manifest by a ponded *pāhoehoe* lava field) lie almost entirely outside (downslope) to the west of the present project area.

Our recommendation to address the unlikely possibility that this system extends into the project area and may have presently undocumented associated cultural resources there in is that the project proceed under the guidance previously supplied by the State Historic Preservation Division:

> To cover the slight possibility of lava tube sites being uncovered, we recommend that you do remind the applicant that if such caves are encountered, the applicant should stop work in the immediate area and have a professional archaeologist check to see if historic remains are present. (Hibbard letter of April 17, 1990; see Figure 4 of the present study)

Cultural Surveys made an attempt to locate a party knowledgeable about this lava tube system. We found something on the internet called the "Hawaii Speleological Survey". After some searching, we found an e-mail address associated with the organization and wrote to a Mr. William Halliday asking about the organization. The reply is given below:

From: William Halliday (bnawrh@webtv.net)

The HSS is a research organization. You may want to contact Ric Elhard. Chairman Hawaii Chapter of the National Speleological Society caver@hialoha.net. However you should be aware of the new state law which requires all persons entering any Hawaiian cave not on Federal land to have written permission from all its owners. And most of the managers of Federal lands in Hawaii require permits also.

WRH

Cultural Surveys has not pursued the matter further to this point in time. Clearly under law if we were to pursue the matter we would need to begin by pursuing landowner permission to access the lava tube system outside of the present project area.

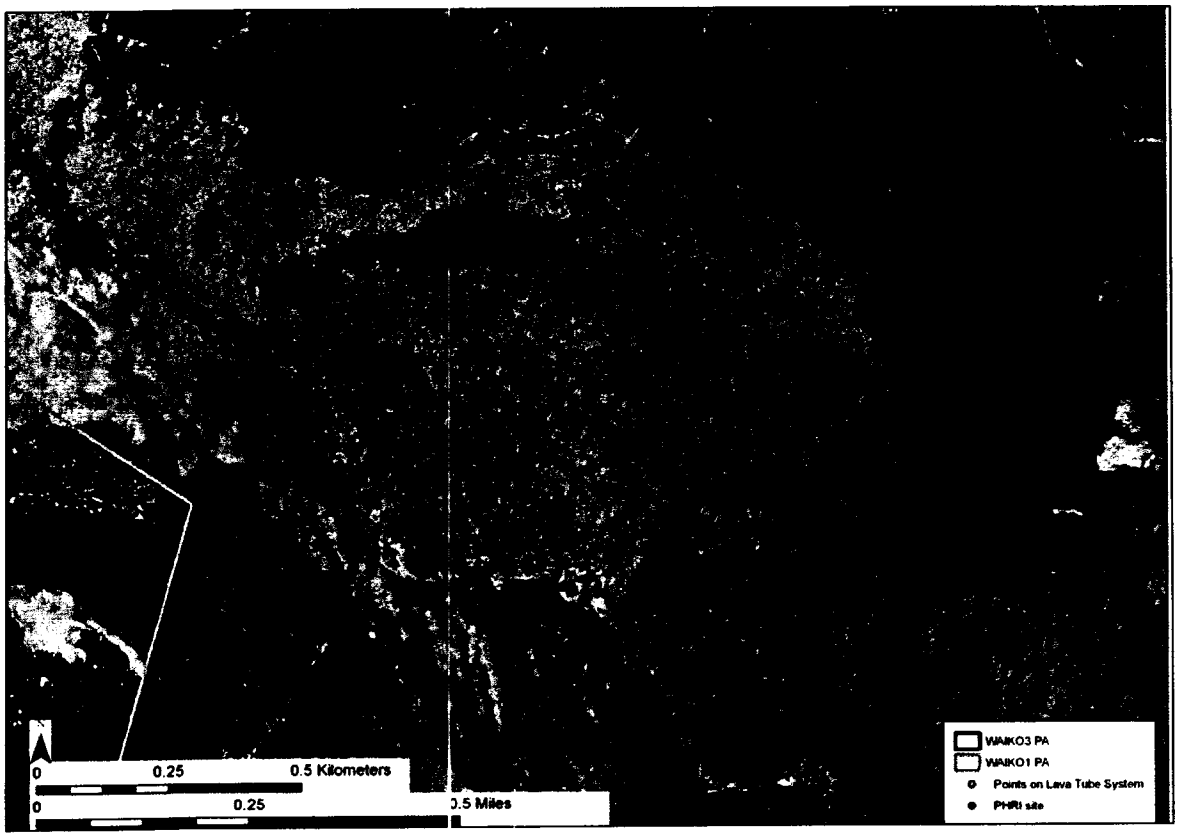

Figure 16. Aerial photograph showing relationship of lava tube system to southwest portion of the present project area (shown in red) The area around the tube system is a large area of ponded *pāhoehoe* lava (shown in this photo as green) that is suggested as the source of the lava feeding the tube and that just barely extends into the project area

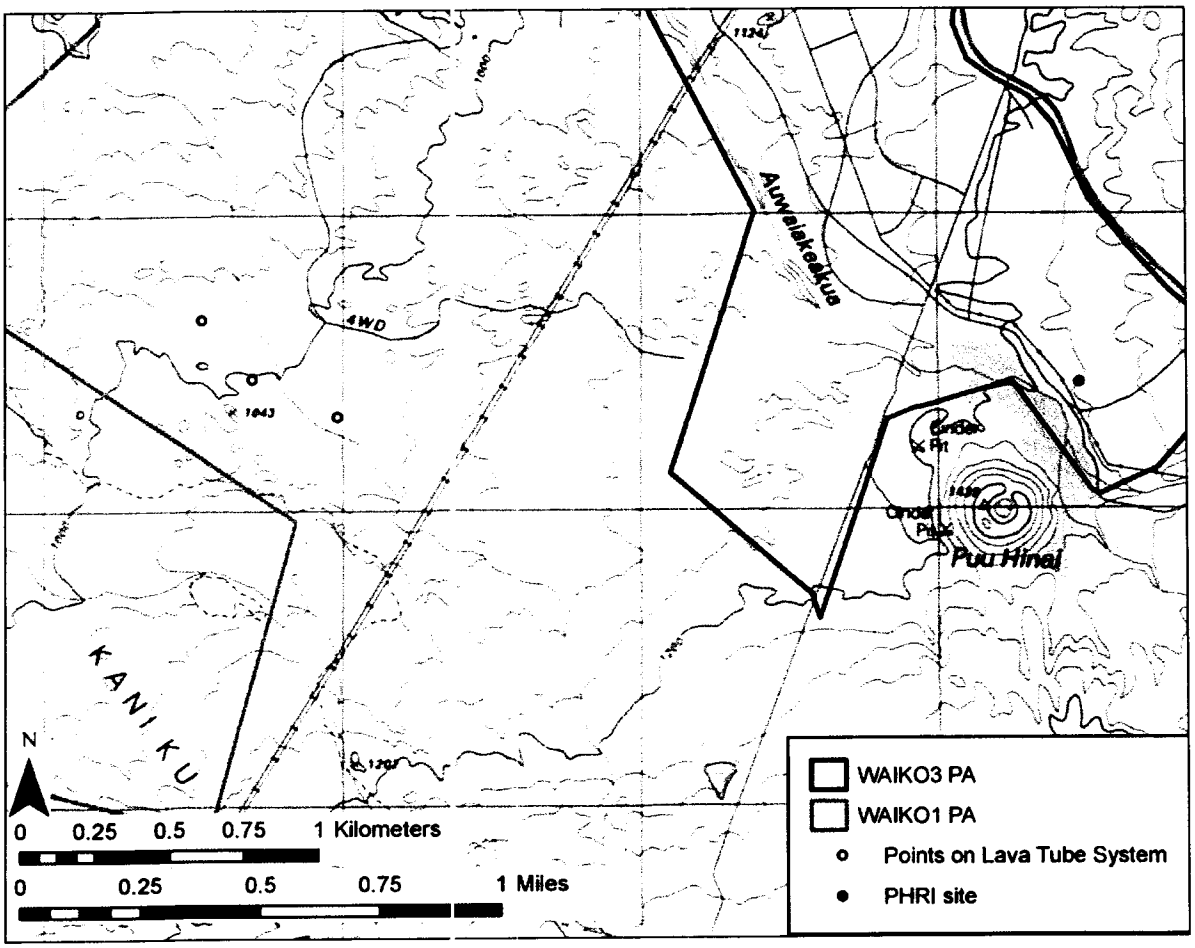

Figure 17. U.S. Geological Survey map showing relationship of known openings to the lava tube system to the southwest portion of the present project area

Section 5 General Conclusions from Other Archaeological Studies in the Vicinity

As Figure 18 below shows there have been a number of studies in the uplands of Waikoloa. Reported site densities are very low with several reports on large parcels finding no archaeological sites at all. Most of what few sites have been identified are either small traditional Hawaiian hard rock quarries on ridges, military sites related to army maneuvers between 1943 and 1945, or lava tubes. Many of these sites are quite subtle and would be easy to miss. A notable exception to the general pattern is a curious complex of 19 sites, mostly platforms, documented by Jensen and Burgett (1991) located approximately 2.5 kilometers west of the current project area. This complex of numerous platforms was thought to have a burial function. Although a number of these platforms were subtle enough to be missed in two helicopter reconnaissance flights by archaeologists it certainly seems unlikely that a complex of this scale could have been missed in the present study area.

Section 6 Concluding Remarks

The main point of this research is that a previous Archaeological Inventory Survey of the parcel (Jensen 1990) was accepted by the SHPD (4/17/1990) and that recent direction from consultation with the SHPD (7/306) has been addressed with the finds documented in the present study.

It is noted that during the inventory survey only 20% of the project area was actually traversed on foot by archaeologists. The spacing of the archaeologists in some of this 20% was at 40-meter (131 foot) intervals while pedestrian inspection of other portions of the 20% surveyed on foot: "involved a cursory-level walk-through." (Jensen 1990:9). Based on recent experience (Hammatt and Shideler 2006 3,600-acre study area; see Figure 18) many of the sites as might be expected would be quite subtle.

Thus a few sites might be expected to have been missed. Because only one site was observed in the Jensen helicopter reconnaissance no substantial surface structures would be expected. No further archaeological study appears to be warranted at this time. In the event that human remains, substantial lava tubes or any other significant finds are encountered during development all work in the area should cease and the SHPD should be promptly notified.

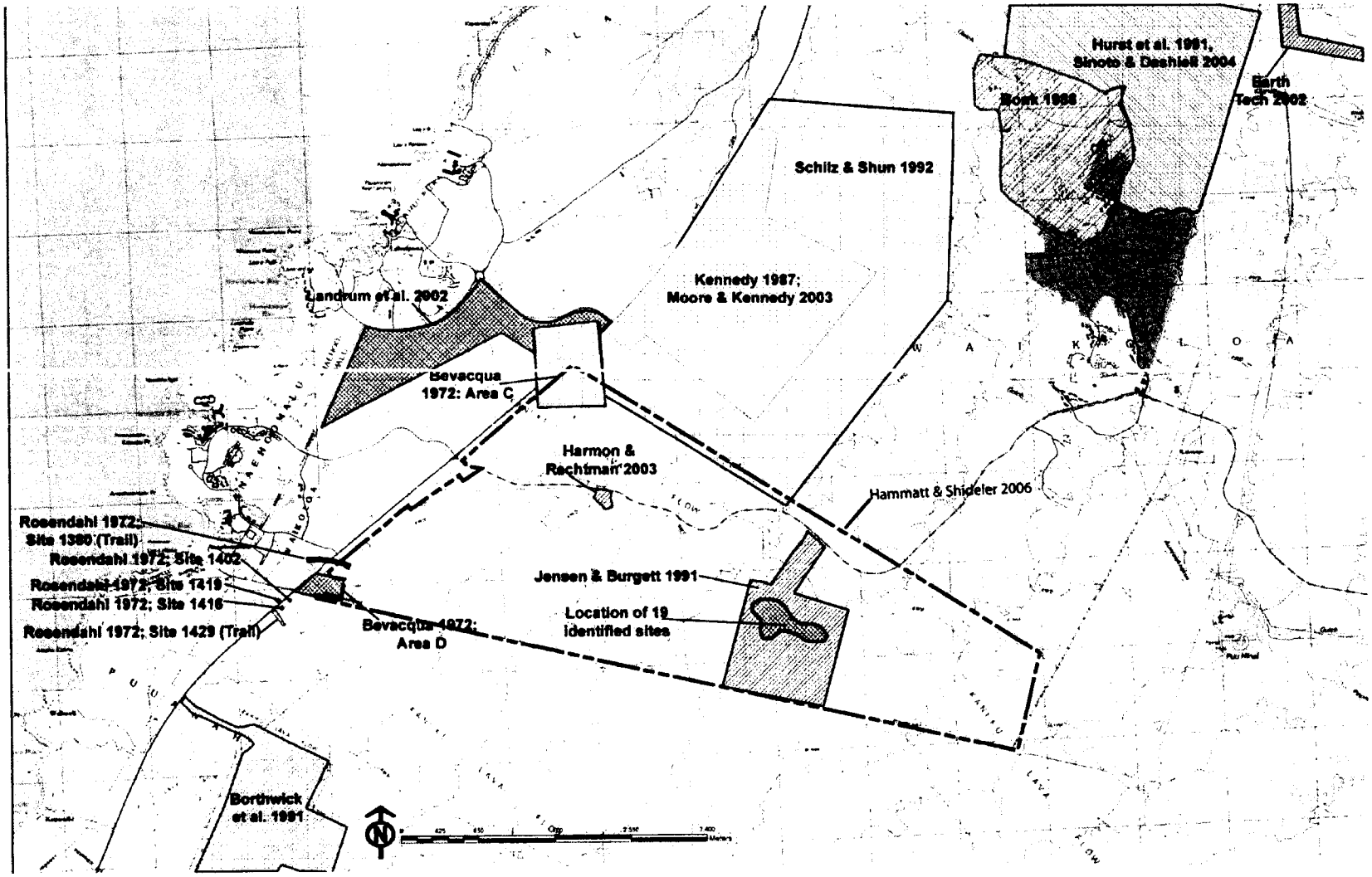

Figure 18. Map showing major previous archaeological studies in the vicinity of the present project area

APPENDIX F

Cultural Impact Assessment
Cultural Surveys Hawai‘i, September 2006.

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Cultural Impact Assessment

For An Approximately 700-Acre Project, Waikoloa Ahupua'a, South Kohala District, Hawai'i Island [TMK (3) 6-8-002: 016]

Prepared for

R.M. Towill Corporation, O'ahu Office

Prepared by

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai'i, Inc.

Kailua, Hawai'i

(Job Code: WAIKO 4)

September 2006

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Management Summary

Title	Cultural Impact Assessment of a 700-Acre Project Waikoloa Ahupua`a, South Kohala District, Hawai`i Island, [TMK (3) 6-8-002: 16]
Date	September 2006
Project Number (s)	Cultural Surveys Hawai`i Inc. (CSH) Job Code: WAIKO 4
Project Location	Waikoloa uplands are located in the *ahupua`a* of Waikoloa, South Kohala District, Island of Hawai`i [TMK (3) 6-8-002:16], located between the *ahupua`a* of Lalamilo on the north and Pu`uanahulu on the south. Waikoloa extedns from the coastal *`ili* of `Anaeho`omalu and Kalahuipua`a east of Waimea town.
Land Jurisdiction	R.M. Towill Corporation, O`ahu Office
Agencies	State of Hawai`i Department of Health/ Office of Environmental Quality Control (DOH/ OEQC)
Project Description	The proposed action is to subdivide and construct infrastructure improvements for a new 731.581-acre property in the South Kohala District, Island of Hawai'i. The property is located southeast of Waikoloa Village, an existing residential and commercial area. The proposed subdivision will create approximately 400 low-density, rural residential lots, each a minimum of one-acre in size. The project will also construct major roadways within the subdivision and provide water and electrical service to the property. Existing water courses through the subdivision will remain unchanged. Increases in surface runoff due to increased impervious areas will be addressed on-site through detention basins.
Project Acreage	700-Acres
Area of Potential Effect (APE) and Survey Acreage	700-Acres

Historic Preservation Regulatory Context	**The project requires compliance with the State of Hawai'i environmental review process [Hawai'i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project's effect on traditional cultural practices. At the request of Fifield Companies, CSH undertook this cultural impact assessment. It provides information pertinent to the assessment of the proposed project's cultural impacts [per HRS Chapter 343 and the Office of Environmental Quality's (OEQC) *Guidelines for Assessing Cultural Impacts*]. The document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS Chapter 6E-42 and Hawai'i Administrative Rules Chapter 13-284.**
Consultation Effort	**Hawaiian organizations, agencies and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the project area and the vicinity. Cultural anthropologist Aulii Mitchell conducted the consultation effort under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).**
Cultural Impact Recommendations	**As a result of this assessment, no ongoing traditional cultural practices were identified for the study area. It should be noted that subsurface properties associated with former traditional Hawaiian activities in the project area, such as burials, artifacts and cultural layers, may be present despite the previous archaeological research within the project area. As a precautionary measure, personnel involved in future development activities in the area should be informed of the possibility of inadvertent cultural finds, and should be made aware of the appropriate notification measures to follow.**

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corportation, O'ahu Office, Cultural Surveys Hawai'i Inc. has completed this cultural impact assessment report for the proposed 700-Acre Project, Waikoloa Ahupua`a, South Kohala District, Hawai`i Island [TMK (3) 6-8-002:016] (Figures 1, 2, & 3).

The proposed action is to subdivide and construct infrastructure improvements for a new 731.581-acre property in the South Kohala District, Island of Hawai'i. The property is located southeast of Waikoloa Village, an existing residential and commercial area. The proposed subdivision will create approximately 400 low-density, rural residential lots, each a minimum of one-acre in size. The project will also construct major roadways within the subdivision and provide water and electrical service to the property. Existing water courses through the subdivision will remain unchanged. Increases in surface runoff due to increased impervious areas will be addressed on-site through detention basins.

Access to the subdivision will be from two points along Waikoloa Road. An internal spine road will connect the two access points, and connect to smaller collector roads within the subdivision. All roads will be designed to applicable County standards. The proposed residential lots are oriented in relation to site topography, the open space element and views to the mountains and shoreline.

The purpose of the proposed action is to create a low-density, rural subdivision in the Waikoloa Village area of South Kohala. The proposed residential development is compatible with, and a logical extension of the nearby residential and commercial uses at Waikoloa Village.

In order to create this rural subdivision, the landowner is seeking a State Land Use District Boundary Amendment, from the Agricultural District to the Rural District. According to the State Land Use Commission ("Commission") Rules, the Agricultural District designation is intended for lands "with a high capacity for agricultural production" with "significant potential for grazing" or "surrounded by or contiguous to agricultural lands." Hawaii Administrative Rules ("HAR") §15-15-19. By comparison, standards for the Rural District include "areas consisting of small farms," "activities or uses as characterized by low-density residential lots...and where small farms are intermixed with the low-density residential lots." HAR §15-15-21.

The subject property is not considered high-capacity agricultural land typical of the Agricultural District. Surrounding land uses are those of Waikoloa Village and are commercial and residential in nature, rather than active agricultural areas. As such, a Rural District Designation would be more appropriate for the proposed low-density subdivision, and would be compatible with existing uses in the Waikoloa area.

The project requires compliance with the State of Hawai'i environmental review process [Hawai'i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project's effect on traditional cultural practices. At the request of Fifield Companies, CSH undertook this cultural impact assessment. It provides information pertinent to the assessment of the proposed project's cultural impacts [per HRS Chapter 343 and the Office of Environmental Quality's (OEQC) *Guidelines for Assessing Cultural Impacts*]. The document is intended to

support the project's environmental review and may also serve to support the project's historic preservation review under HRS Chapter 6E-42 and Hawai'i Administrative Rules Chapter 13-284.

1.2 Scope of Work

The scope for the cultural impact assessment includes:

1. Examination of historical documents, Land Commission Awards, historic maps, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal and other resources or agricultural pursuits as may be indicated in the historic record.

2. A review of the existing archaeological information pertaining to the sites on the property as they may allow us to reconstruct traditional land use activities and identify and describe the cultural resources, practices and beliefs associated with the parcel and identify present uses, if appropriate.

3. Conduct oral interviews with persons knowledgeable about the historic and traditional practices in the project area and region. We anticipate both formal and informal interviews.

4. Preparation of a report on items 1-3 summarizing the information gathered related to traditional practices and land use. The report will assess the impact of the proposed action on the cultural practices and features identified.

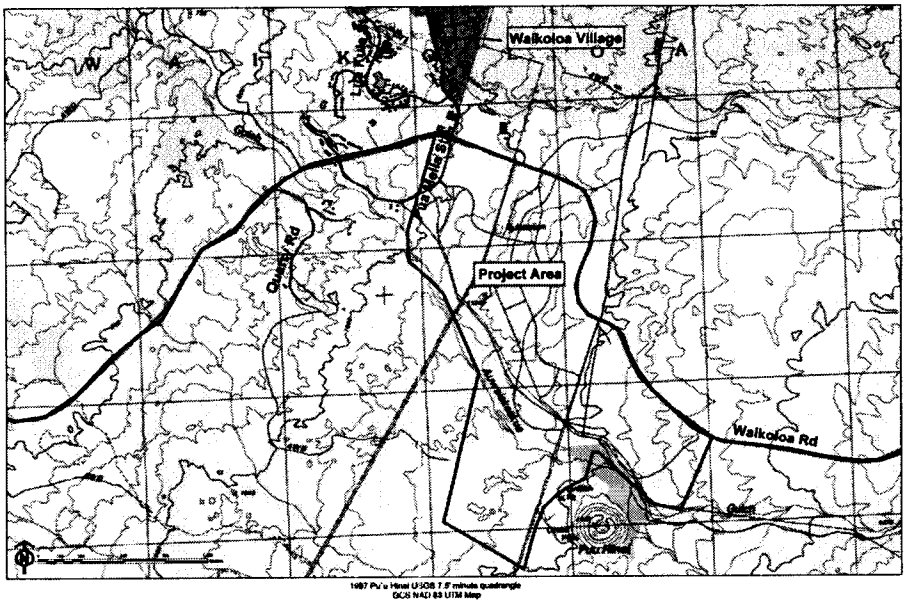

Figure 1 1997 Pu`u Hīna`i USGS 7.5 minute quadrangle GCS NAD 83 UTM Map

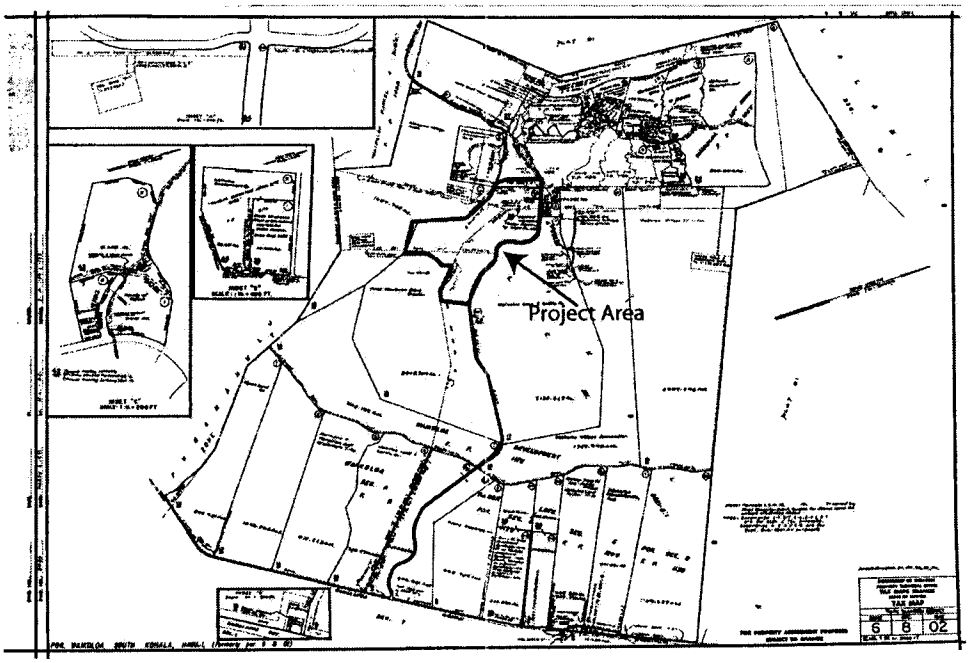

Figure 2 TMK Map 6-8-02 showing location of project area.

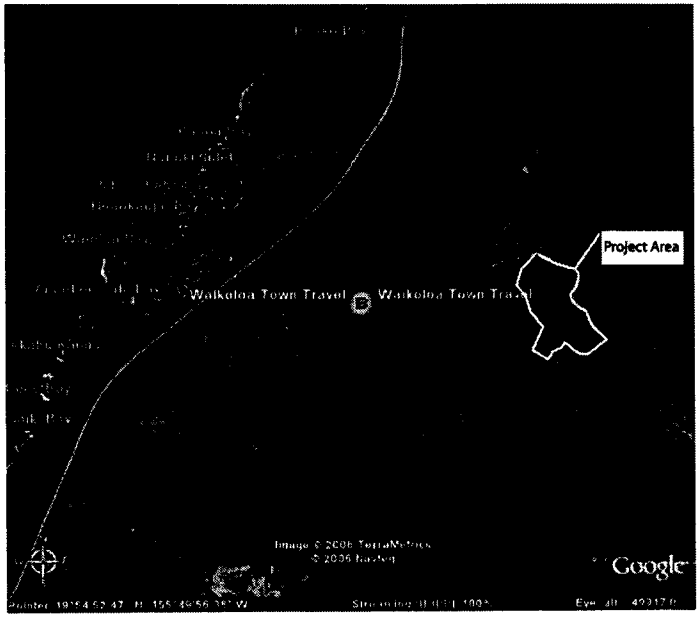

Figure 3 Aerial map showing location of project area, Image 2006 TerraMetrics, 2006 Navleg.

1.3 Environmental Setting

Waikoloa uplands are located in the *ahupua`a* of Waikoloa, South Kohala District, located between the *ahupua`a* of Lalamilo on the north and Pu`uanahulu on the south. Waikoloa extends from the coastal *`ili* of Anaeho`omalu and Kalahuipua`a east of Waimea Town.

The Waikoloa Ahupua`a has been sub-divided by major lava flows from Mauna Loa into areas of rough and broken *pahoehoe*, *`a`ā* flow, and areas in which recent flows have been covered with eroded sediments. The *ahupua`a* of Waikoloa is primarily *pāhoehoe* flow. Many small "islands" have formed where molten lava has risen to the surface through localized vents. The surface topography is pocked and scarred, protruded by blisters and stacks at numerous locations, due to the extensive nature of lava flows particularly along the coastal margins. Prevalent are pressure ridges, crevices, caves and lava tubes with some caves and lava tubes being lengthy and showing evidence of extensive utilization in prehistoric times. The most visible landmarks within the *ahupua`a* is Pu`u Hīna`I, a prominent cinder cone located near the center of Waikoloa (Jensen 1990:2).

The orographic rainfall figures for the project area, range between 10 and 20 inches. The aridity of the *ahupua`a* is reflected in the paucity of permanent water soures and particularly by local vegetation patterns. The most prevalent plant species are two introduced xerophytes, *kiawe* (*Prosopis pallida* Humb, and Bonpl. Ex. Willd.) and fountain grass (*Pennisetum secaceum* [Forsk.] Chiov). Introduced in the early 1900s as potential cattle feed. Fountain grass was introduced later than *kiawe* (circa. 1926), a native of North Africa. A few additional species are present with the project area, including *wiliwili* (*Erythrina sandwicensis*), *koa haole* (*Leucaena glauca* [L] Benth.), *`ilima* (*Sida fallax* Walp.), *`a`ali`i* (*Dodonaea,*all species), prickly pear cactus (*Opuntia megcantha* Salm-Dyck), and a variety of perennial grasses (Jensen 1990:2).

1.4 Methods

Numerous published and unpublished accounts, surveys, reports, maps and photographs found in public and private collections pertaining to Waikoloa Ahupua'a and the project area were investigated by Cultural Surveys Hawai'i Inc. Historical documents, maps and existing archaeological information pertaining to the sites in the vicinity of this project were researched at the State Historic Preservation Division library, Cultural Surveys Hawai'i Library, and the University of Hawai'i's Hamilton Library. The Office of Hawaiian Affairs, Hawaii Island Burial Council, and members of other community organizations were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the study area and the surrounding vicinity. The names of potential community contacts were also provided by colleagues at CSH and from the researcher's familiarity of the families who frequent the area. Some of the prospective community contacts were not available to be interviewed as part of this project. Cultural anthropologist Aulii Mitchell conducted the consultation effort under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). A discussion of the consultation process can be found in the following section on "Community Consultations". Please refer to (Table *) for a complete list of individuals and organizations contacted.

Section 2 Legendary and Historic Accounts Associated with Waikoloa

2.1 Keahualono

A boundary marker site located on the boundary of North Kona and South Kohala Districts known as Keahualono is traditionally associated with the ruling chief Lono-i-ka-makahiki (Fornander, 1916, 1917: 360-363):

> A pau ka Lonoikamakahiki olelo ana i keia mau olelo, kau aku la oia iluna o na waa a holo aku la. Ia imi ana a Lonoikamakahiki, halawai aku la oia me Kapaihiahilina ma Anaehoomalu, ma ke kaha, ma ka palena o Kona a me Kohala. A penei no ka mo'olelo oia imi ana a Lonoikamakahiki.
>
> I ka manawa i imi aku ai o ua O Lonoikamakahiki, ua pae mua aku o Kapaihiahilina i Anaehoomalu a mahope aku lakou nei (Lonoikamakahiki ma). A i ka manawa i ike aku ai o Lonoikamakahiki ia Kapaihiahilina a noho mai ana i kaha one, ma kahi e kau ana na waa o lakou (o Kapaihiahilina ma), alaila, uwe aku la o Lonoikamakahiki, ma ka uwe helu ana, e like me ka laua hele ana. A ike mai la no hoi o Kapaihiahilina i ka uwe helu aku a ke alii, alaila uwe helu mai la no hoi oia.
>
> A ia laua i halawai ai , a pau ka laua uwe ana a me ka laua kamailio ana, alaila kau iho la o Lonoikamakahiki i olelo hoohiki mawaena o laua, aole e loaa hou kekahi kue, aole hoi e hoolohe i na olelo akiaki a kona amu aialo. Aka, i mea e paa io ai ka laua hoohiki, nolaila, kukulu iho la o Lonoikamakahiki i wahi ahu pōhaku (heiau), i wahi no laua e pule ai me ka hoohiki imua o ke akua o Lonoikamakahiki, no ka hoopaa ana i ko laua hoohiki ana.
>
> A ike aku la o Kapaihiahilina ua hooiaio mai o Lonoikamakahiki i kana hoohiki ana, ia manawa ko Kapaihiahilina ae ana aku e hoi me Lonoikamakahiki. A pau ka laua kapu heiau ana malaila, hoi aku laua i Kona, a noho iho la ma Ka'awaloa, ma Kona Hema.
>
> (Ua oleloia ma ka moolelo o ko laua hana ana i oleleo hoohiki no ke kukulu ana i ke ahu pōhaku ma Anaehoomalu, ua kapaia ka inoa o ia palena mawaena o Kohala a me Kon "O Keahualon"; o ka inoa mau ia oia wahi a hiki mai i keia manawa; oia hoi ke kukulu ana o Lonoikamakahiki i ahu pōhaku). [Fornander, 1916, 1917: 360-363]
>
> Translation:
>
> Lonoikamakahiki have ceased his admonitions went aboard the canoes which awaited him and sailed away. In search he met Kapaihiahilina at Anaehoomalu at the seashore at the dividing line of Kona and Kohala. Thus runs the tradition concerning Lonoikamakahiki's search for his companion Kapaihiahilina:
>
> When Lonoikamakahiki set sail on his search for his friend, Kapaihiahilina had already arrived at Anaehoomalu and soon afterwards was followed by Lonoikamakahiki and others. Lonoikamakahiki saw Kapaihiahilina sitting on the sand beach when the canoes were being hauled ashore. Lonoikamakahiki immediately began to wail and also described their previous wanderings together. Kapaihiahilina recognizing the king also commenced wailing. When they came together and had ceased weeping and conversing, then Lonoikamakahiki made a covenant between them, that there would be no more strife, nor would he harden to the voice of slander which surrounds him, and in order that the understanding between them should be made binding, Lonoikamakahiki built a temple of rocks as a place for the offering of their prayers and the making of oaths to Lonoikamakahiki's god to fully seal the covenant.
>
> Kapaihiahilina observed that Lonoikamakahiki was sincere in his desires and at that moment gave his consent to return with Lonikamakahiki. After their religious observance at this place they returned to Kona and resided at Ka'awaloa, in South Kona.
>
> (Tradition says because of the covenant entered into for the erection of the mound of rocks at Anaehoolamlu, the boundary between Kohala and Kona was named signifying the erection of a mound of rocks by Lonoikamakahiki.) [Fornander, 1916, 1917: 360-363]

2.2 Early Historical Period Late 1700s – 1830

'Anaeho'omalu is an *'ili* (of about 800-acre size) of the *ahupua'a* of Waikoloa on the Island of Hawai'i, near the center of a shallow bight extending from Keahole Point in Kona to Upolu Point in Kohala. It is surrounded by miles of bleak lava fields, which impose a greater degree of isolation from neighboring communities than is found in vegetated areas. The southern boundary forms the northern boundary of the district of North Kona; on the west, 'Anaeho'omalu adjoins the ocean. On the north the *'ili* adjoins the *'ili* of Kalāhuipua'a. On the east it is bounded by the inland portion of the *ahupua'a* of Waikoloa, which boundary is closely paralleled by the paved Kiholo-Puako Trail.

Historical references are sufficient to indicate that Anaeho'omalu was probably permanently inhabited in prehistoric – that is, pre-Cook-times. In his 1779 description of the shoreline of Hawai'i, Lieutenant King of Captain Cook's expedition mentions (Barrère 1971:109):

> We now come to *Ko-Harra* [Kohala] the NW & last district...the s [sic] side is partook of the same nature as Kao [Ka-u]...(Beaglehole, 1967:608).
>
> ...Kàà [Ka-u]...is not only by far the worst part of the Island, but as barren waste looking a country as can be conceived [sic] to exist in the Neighborhood of a fine one, & this owing to the ravages of a Volcano...horrid & dismal as this part of the Island appears, yet there are many Villages interspersed, & it Struck us as being more populous than the part of Opoona [Puna] which joins Koa [Ka-u]. There are houses built even on the ruins [Lawa] we have describ'd. Fishing is a principal occupation with the Inhabitants... (Beaglehole, 1967:607).

The Reverend William Ellis made the same observation about the habitations along the sea coast nearly 25 years later (Barrère 1971:109):

> The population of this part of Puna [Kealakomo, near the Ka-u boundary], though somewhat numerous, did not appear to possess the means of subsistence in any great variety or abundance; and we have often been surprised to find the desolate coasts more thickly inhabited than some of the fertile tracts in the interior; a circumstance we can only account for, by supposing that the facilities which the former afford for fishing, induce the natives to prefer them as places of abode....

2.3 Mid 1800s (Land Commission Awards)

The land *mauka* of 'Anaeho'omalu, Waikoloa *nui* was given by Kamehameha I to one of his two *haole* chiefs, John Young or Isaac Davis; the record is contradictory on this point. Waikoloa was listed among John Young's lands at the time the kind and chiefs apportioned them to his heirs – his own children and three of Isaac Davis' children (Privy Council Records, 1848, 3:98-99). According to this record Waikoloa came to George Hueu Davis, son of Isaac, through

Young's bequest. However, in the adjudication of the boundaries of Waikoloa in 1867, Supreme Court Justice G. M. Robertson found that the land had been given to Isaac Davis by Kamehameha I and had been inherited by his son Hueu (Barrere 1971:112). Judge Robertson's decision read in part:

> The land...was granted by King Kamehameha I to his faithful friend and follower, Isaac Davis, the father of the appellant [George Hueu Davis], about the beginning of the present century. We consider it clear that in making the grant the King intended to give, and did give to Isaac Davis, a tract of land of very great extent, although not of proportionate value. There were no cattle or sheep in this country when the grant was made, and the land given to Isaac Davis only yielded what revue could be derived from wild birds and *pili* grass.
>
> By the terms of the grant...the land given to Isaac Davis was expressly deprived of any rights in the sea, i.e. of fishery, and was so bounded as to include scarcely any land fit for cultivation; and, as some of the witnesses expressed it, all the *pili* land extending out to the *aa* on the boundary of Kona, was given to Isaac Davis.
>
> There is one fact which we regard as clearly established...and that is the fact that for upwards of sixty years, the appellant and his father before him, exercised undisturbed lordship over the large tract of land which we feel bound to include in the boundaries of Waikoloa nui, as granted to Isaac Davis. No evidence has been given to contravene the fact of long and undisturbed control and occupancy (*Hawaiian Gazette*, Feb. 27, 1867).

Although we refer to Waikoloa as an *ahupua'a* today, older references classify it as an *'ili* of Waimea Ahupua'a. The following is part of testimony given by natives of the area:

> Waimea is an ahupuaa of Waimea, which is a kalana with eight divisions (Ehu).
>
> Waikoloa is an ili of Waimea ahupuaa; Waimea is an Okana (Kanehailua). (Boundary Commission Book No. 1 pp-12).

GeorgeHu'eu Davis himself referred to Waikoloa as an *'ili* (Hu'eu 1847). Several maps at the State Survey Office indicate this latter division to be the most common. An exception is Marion Kelly's citation of Waikoloa as an *'ili kupono* (land division paying tribute to the ruling chief), She writes:

> The other of these 'ilikupono, namely Waikoloa, was given by Kamehameha as a separated property to Isaac Davis.....(Kelly 1956:119).

It should be noted that the *'ili* of Anaeho'omalu and Kalahuipua'a were detached form Davis' award of Waikoloa and were awarded to Queen Kalama (Boundary Commission Book 1:8 in Jensen 1990, cited by Helen Wong Smith).

In the *Māhele*, Kamehameha III kept the *ahupua'a* of Waimea, Kohala as a crown land indicating that the Kamehameha dynasty had retained control of 'Anaeho'omalu up to that time.

Following the death of Kamehameha III in 1854 these lands were retained by his queen, Kalama Kapakuhaili Hakaleleponi (Hammatt 2001:14).

With the *'ili* of 'Anaeho'omalu and Kalāhuipua'a went *konohiki* fishing rights, under which the landholding chief held rights one mile out to sea (or to an offshore reef where there was one) for the full length of the *'ili* or *ahupua'a* in which he reserved either one species of fish or one third of each seasonal catch as his won, and made the rest free to the dwellers of the land (Barrere 1971:110). Barrere (1971:110) suggests that in the times of the Kamehamehas, there may have been periodic visits to 'Anaeho'omalu for the express purpose of collecting, and perhaps drying, quantities of fish to be sent to the households of these kings.

There were no commoner *kuleana* claims in coastal 'Anaeho'omalu (Hammatt 2001:14). Barrere (1971:110) suggests that "Perhaps the complete abandonment of 'Anaeho'omalu was hastened by the lava flow of 1859, which caused great destruction of fish. Barrere (1971:111) concludes that, as the informant regarding 'Anaeho'omalu in the Boundary Commission testimony of 1873 was from elsewhere, "That the last of the permanent inhabitants of 'Anaeho'omalu had died or moved away well before the last quarter of the century."

Barrere (1983) gives a complete review of Davis battle to settle the boundaries of his land (Smith in Jensen et al. 1990: 6). This was due to the Crown having lands also known as "Waikoloa." The end result was calling those lands belonging to the crown, "Lalamilo" and Waikoloa-iki."(Smith in Jensen et al. 1990: 6):

Interior Dept., Land Matters Doc. 381

The following ahupuaas for konohikis in Waimea and Hamakua. Waikoloa Leleihoku heir, "Other lands for C. Carr ½ acres in Waikoloa."

Interior Dept., Bk 15, p.117

In list of konohiki lands, showing that the above land belong to Awane Leleiokhoku & own a fishing right.

Interior Dept., Doc. 314

In list of lands, showing that R.P. 5671 was issured to Hueu, by name only on Land Claim No. 8521B, on above land Waimea, Hawaii.

Interior Dept., Doc 364

In list showing that Leleiohoku is the owner of the above ahupuaa. Also in list showing that the school is the owner of the above land,...

Public Instruction, Dec. 23, 1851

L. Lyons to Minister of Public Instruction. Has sold 180 acres to J.P. Parker, Jr. & c.

Interior Dept., Jan. 1, 1852

In original lease from Kamehameha III to C. Carr on a piece of land situated at the above place containing 68 periods and 7 rods for the term of 50 years at a rental of $70 a year. Receipt of the payment of one year's rent, attached.

Public Instruction, Apr. 23, 1852

L. Lyons to Minister of Public Instruction. Re. deed for Mr. Parker to above land, if ready to deliver same to his son Curtis. To consult with John Ii, re matter of surveying the following lands, belonging to Leleihoku.

Interior Dept., May 29, 1859

In letter form the Minister of Interior to the Chief Clerk of the Interior dept. re. dispute between Mr. Davis & MR. Parker over the boundaries of the above land.

Interior Dept., June 26, 1866

In letter form John P. Parker to J.O. Dominis informing him that Wistse is now engaged in surveying the above land.

Interior Dept., July 26, 1866

In letter from S.C. Wiltse to J.O. Dominis informing him that he has completed the survey of the above land & Waimea.

Interior Dept., Dept 19, 1866

In letter form George Davis to the Commissioners of Crown Lands informing them that he will commence the survey of the above ahupuaa o Sept. 30, 1866 &c.

Interior Dept. Oct. 4, '866

In petition by the Commissioner of Crown Lands to the Commissioner of Boundaries for the settlement of the boundaries of the ahupua'a of Waimea in S. Kohala. Also protest by G. D. Hueu against the settlement of boundaries along the above ahupuaa – Docs. Attached, testimony notes of survey, protest & c.

Interior Dept., Dec. 6, 1893

Surveyor General to Commissioner of Crown Lands. That the above land was awarded to G. D. Hueu, under Land Claim 8521B, & c.

As noted in several of the entries above, rancher John Parker had interest in the lands of Waikoloa. Cattle were introduced on the west coast of Hawai'i Island y Vancouver in 1794 and were allowed to roam free by Kamehameha I's decree so that they might multiply. A wall was built between the King's and Davis' land in Waikoloa c. 1815 in order to keep the roaming cattle out of the king's cultivated lands. The wall was named after the King's *konohiki*, Kauliokamoa (Barrere 1983:30 in Jensen et al. s1990, also cited by Helen Wong Smith). By the time Reverend William Ellis conducted his tour around the island in 1822 there were "immense herds of them, they do not attempt to tame any; and the only advantage they derive is by employing persons, principally foreigners, to shoot them, salt the meat in the mountains, and bring it down to the shore for the purpose of provisioning the natives vessels" (Ellis 1963:291 cited by Helen Wong Smith in et al. Jensen 1990).

Waikoloa *nui* eventually was bought by the Parker Ranch, and was used as grazing land for the Ranch. The ranches acquisition of Waikoloa lands was hindered by a dispute between Sam Parker and his manager Alfred Carter:

> An example of the situation is Carter's effort in 1903 to add to the pasturage of the ranch. He found ravines...The herbs and grasses which the soil produced in the rainy seasons were now mostly in the shriveled state, thinly scattered and by no means sufficient to cover the surface from the sun's powerful heat, so that I met with very few plants in flower in this excursion (Menzies 1920 IN Barrere 1983, also cited by Smith in Jensen 1990).

Use of this zone was probably for the most part limited to transportation routes, with most habitation temporary. Barrer, however, names three permanent settlements of the early 1800s:

> On the rising ground above the seacoast settlements, several main trails led past occasionally cultivated ground to the uplands of Waimea where there were, in the early 1820s, three major settlements about two miles apart. One was at Keaalii, one at Waikoloa, and one at Pu'ukapu. All three were concentrated where a major stream emptied itself upon the plateau (Barrere in Jensen s1990, cited by Smith).

2.4 Late 1800s

Queen Kalama died intestate in 1870. In the inventory of her estate (Probate 1562) the 869 acre *'ili* of 'Anaeho'omalu was appraised at $300.00 or about 35 cents per acre. Even in the terms of the evaluations of the time, this suggests 'Aaneho'omalu was considered nearly worthless land. Charles Kanaina was declared the legal heir of Queen Kalama in 1871. It appears that Charles Kanaina gave these lands to William Lunalilo but that following the death of King Lunalilo in 1874 the lands reverted back to Charles Kanaina. Following the dearth of Charles Kanaina, also intestate, in 1877 'Anaeho'omalu was purchased by Samuel Parker Ranch for $1,000.00 ($1.14 per acre). The generally deserted circumstance at 'Anaeho'malu in the last quarter of the nineteenth century is attested to by writer and editor George Bowser in his description of a traverse from Kalāhuipua'a south to Kīholo (which passed 'Anaeho'omalu on the "Kings Trail"(Hammatt 2001:15):

> From Kalāhuipua'a south to Kīholo, my next halting place, the road leaves the sea beach and turns inland in a southerly direction...There is nothing to be seen all the way but lava, lava to right of you, lava to left of you, lava ahead of you, lava behind you, and lava beneath you; the road for a dozen miles or more is composed of nothing but clinkers of every size.

2.5 Early 1900s To The Present

'Anaeho'omalu, perhaps from the time of its original purchase by Samuel Parker in 1877, appears to have served as a recreation and fishing area for parker Ranch employees and as a supply of pond fish for Ranch *lū'aus*. A caretaker of the fishponds lived there continuously, perhaps from well before that time. The "hut" shown on the Government Survey Map of 1880 (no. 824) was probably the first residence of the caretakers of Kuualii and Kahapapa ponds (Barrere 1971:113). Marion Kelly, while investigation Kaloko Fishpond in Kona (January 1970), was told by her informant Keanaaina that he and his father used to go to 'Anaeho'omalu in the later 1930s and early 1940s to get fry from the 'Anaeho'omalu ponds with which to restock Kaloko pond. The ponds were partially demolished by the tsunamis of 1946 and 1960, and the Ranch restored them to use. Since the last caretaker retired, in 1965 or 1966, the ponds have no longer been maintained (Barrere 1971:113).

Section 3 Previous Archaeology

While a number of archaeological survey's have been conducted along the *makai* (coastal) areas of the Waikoloa Ahupua'a, only two archaeological studies have been carried out in the present project area - Bevacqua 1972 and Jensen 1990. Because the Jensen study is far more detailed and relevant to future development of the parcel it is discussed first with reference to the Bevacqua study following.

3.1 Paul H. Rosendahl Inc. 1990 Archaeological Inventory Survey

In January of 1990, Peter Jensen of Paul H. Rosendahl Inc. conducted an archaeological inventory survey for Transcontinental Development Company. The firm produced a study of the findings in March of 1990 entitled *Archaeological Inventory Survey Waikoloa Mauka Land, Lands of Waikoloa, South Kohala District, Island of Hawai'i.* Although the stated estimate of the acreage studied is "c. 600 acres" an overlay of the Jensen (1990) project area map (Figure 4) with the present project area map (Figure 1) finds that it is actually a little larger than the present 702.28-acre parcel. Our overlay indicates that the project areas are the same (with minor vagaries as are the norm) except that the Jensen (1990) project area was larger including an additional tongue of land at the northwest corner.

3.2 Comments on the Methodology and Finds in the Jensen (1990) Study

The Jensen study began with a low elevation aerial reconnaissance of the entire project area during which one site was identified. Subsequently pedestrian sweeps were carried out in three portions of the project area deemed particularly sensitive. These areas (Jensen 1990:9) were:

1) Adjacent to the north side of Pu'u Hinai where several streams converge near the northeast perimeter of the *pu'u;*

2) The southwestern portion of the project area in which numerous small caves were observed; and

3) The vicinity of two shallow gulches which transect the project area from east to west. One of these originates on the south side of Pu'u Hinai while the other represents the coalesced flows from several small streams which flow around the north side of the *pu'u.*

The total of the areas of sensitivity traversed were estimated at 20% of the entire project area. Pedestrian transects were spaced at 30 – 40 m intervals in some areas while others "involved a cursory-level walk-through." (Jensen 1990: 9). In at least one place (Jensen 1990:9) the PHRI fieldwork is referred to as "the present reconnaissance work" suggesting the possibility that the field crew may have understood they were doing a much less intensive study than the final title of the study indicates.

The Jensen (1990) study identified only one archaeological feature a wall segment identified as Site T-1. An area located c. 300 meters north of Pu'u Hinai contained a "single low wall or of poorly stacked, rough pahoehoe cobbles and boulders" (Jensen 1990: *ii*). The wall of unknown

function was 2.5 meters long with a maximum height of 1.21 meters. For a number of reasons the Jensen study reasonably concludes this T-1 Site was not the same as the Site 22 documented by Bevacqua (discussed further below). The T-1 feature was so modest that no State Inventory of Historic Places site number was given and "no further treatment of any kind" was recommended (Jensen 1990:13). Otherwise there was no evidence of either pre- or post-contact use within the entire project area.

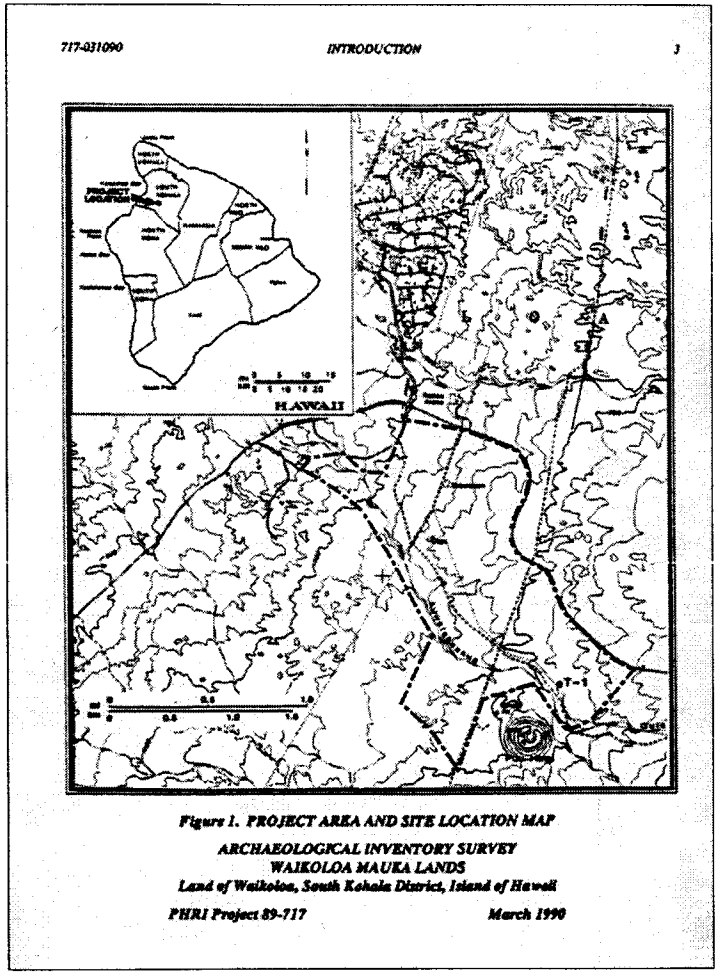

Figure 4 Map Showing 1990 Archaeological Inventory Survey project area (from Jensen 1990:3)

3.3 Robert F. Bevacqua's 1972 Archaeological Study

In 1972 Robert F. Bevacqua of the Bishop Museum carried out archaeological studies in a number of areas in the Waikoloa Ahupua'a that he designated as Survey Areas A through G. Of particular importance to the present study area is his Survey Area G which the Jensen study (1990:5) concluded "roughly corresponds to the present project area." His study area is described as follows:

> Survey Area G is situated slightly N of Pu'u Hinai, a prominent cinder cone in the center of Waikoloa. The exact location and configuration of this 300-acre parcel of land has not been determined by the developers; thus the survey encompasses only the approximate area of the parcel.

Bevacqua's map showing the location of his survey Area G (Figure 5) leaves much to be desired. Bevacqua (1972:12) identified one site designated as Site 22 within his Survey Area G described as follows:

> Site 22 consists of a complex of walls, portions of which protrude above the flood plain. The dominant feature is a well-built bifaced wall, 45 meters long, running E-W. At the stream bank, the E end of the wall corners and extends N another 7.1 meters; the W end of the main wall corners and extends N 5.5 meters. East of the main wall an 11-meter-long, bifaced wall runs N-S and stands clearly above the surface.

Bevacqua also notes this wall was directly associated with a stream where site T-1 of Jensen's study is located about 50 meters north of the most northerly streams in the area (Jenson 1990:10). Though in Jensen's study, he found no evidence of the former site 22 from Bevacqua's study. Jensen concludes that because "no evidence of this site was observed within or adjacent to any of the streams during the present project, and in view of clear evidence of extensive recent erosion, it can reasonably be concluded that heavy runoff probably destroyed Site 22 sometime in the past 5-10 years" (Jensen 1990:10).

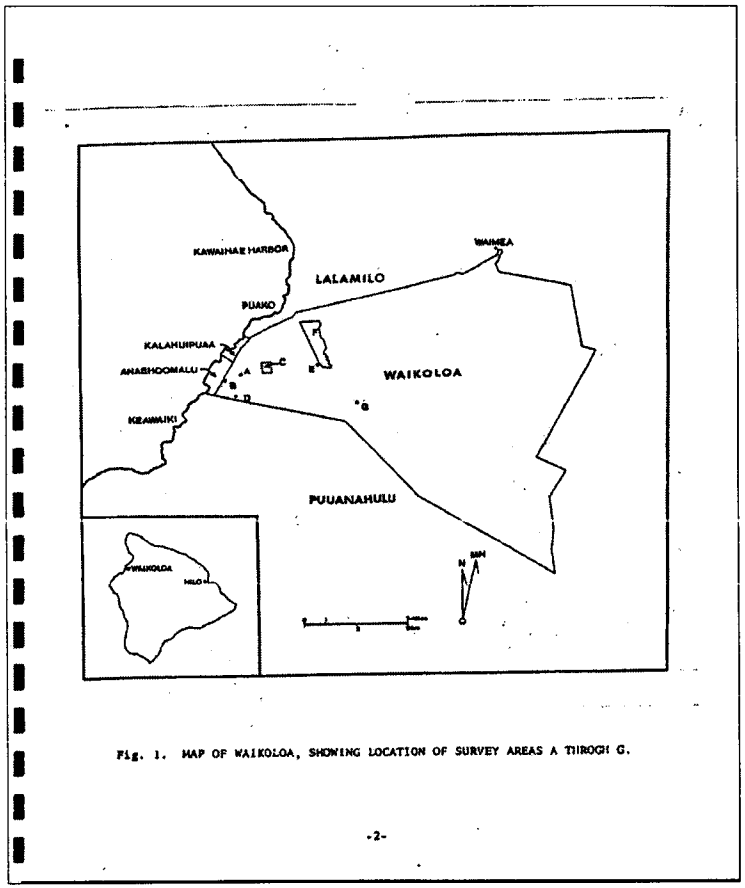

Figure 5 Bevacqua map of his survey areas; area G is in the vicinity of the present study area.

3.4 Hammatt 2006

Cultural Surveys Hawai'i entered into agreement with R.M. Towill Corporation to carry out an Archaeological Inventory Survey of an approximately 702.28-acre parcel in the uplands of Waikoloa, South Kohala, Hawai'i Island. Relatively quickly it was ascertained that a prior Archaeological Inventory Survey (Jensen 1990) had been carried out on the parcel. Upon consultation with R.M. Towill Corporation it was agreed that a summary report documenting the previous work and the status of that work with the regulatory State Historic Preservation Division (SHPD) was appropriate (Hammatt 2006:1).

3.5 General Conclusions from Other Archaeological Studies in the Vicinity

As Figure 6 below shows there have been a few studies in the uplands of Waikoloa Ahupau'a. Though, reported site densities are very low with several reports on large parcels finding no archaeological sites at all. Most of what few sites have been identified are either small traditional Hawaiian hard rock quarries on ridges, military sites related to army maneuvers between 1943 and 1945, or lava tubes. Many of these sites are quite subtle and would be easy to miss. A notable exception to the general pattern is a curious complex of 19 sites, mostly platforms, documented by Jensen and Burgett (1991) located approximately 2.5 kilometers west of the current project area. This complex of numerous platforms was thought to have a burial function. Although a number of these platforms were subtle enough to be missed in two helicopter reconnaissance flights by archaeologists it certainly seems unlikely that a complex of this scale could have been missed in the present study area.

3.6 Concluding Remarks

The main point of this research is that a previous Archaeological Inventory Survey of the parcel (Jensen 1990) was accepted by the SHPD (4/17/1990) and that recent consultation with the SHPD (4/17/06) has indicated no further work is required.

It is noted that during the inventory survey only 20% of the project area was actually traversed on foot by archaeologists. The spacing of the archaeologists in some of this 20% was at 40-meter (131 foot) intervals while pedestrian inspection of other portions of the 20% surveyed on foot: "involved a cursory-level walk-through." (Jensen 1990:9). Based on recent experience many of the sites as might be expected would be quite subtle.

Thus a few sites might be expected to have been missed. Because only one site was observed in the Jensen helicopter reconnaissance no substantial surface structures would be expected. No further archaeological study appears to be warranted at this time. In the event that human remains or any other significant finds are encountered during development all work in the area should cease and the SHPD should be promptly notified.

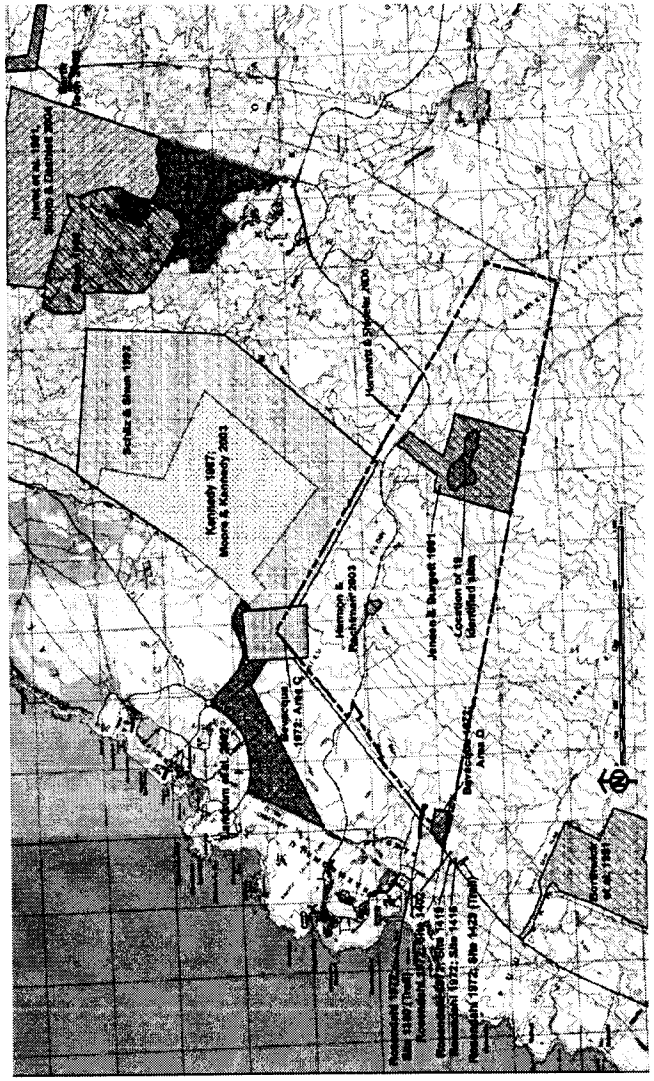

Figure 6. Map showing major previous archaeological studies in the vicinity of the present project area

Section 4 Community Contact Process

Throughout the course of this assessment, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices specifically related to the project area. This effort was made by letter, e-mail, telephone and in person contact. In the majority of cases, letters along with a map and aerial photograph of the project area were mailed with the following text:

> At the request of R.M. Towill Corporation, O'ahu Office, Cultural Surveys Hawai'i Inc. is conducting a cultural impact assessment for the proposed 700-Acre Project, Waikoloa Ahupua'a, South Kohala District, Hawai'i Island [TMK (3) 6-8-002:016] (Figures 1, 2, & 3).
>
> This cultural impact assessment is being undertaken by CSH to fulfill the laws set forth in the State Constitution, state laws and courts "require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups" (in Office of Environmental Quality Control, Guidelines for Assessing Cultural Impacts, Adopted by the Environmental Council, State of Hawai'i, November 19, 1997).
>
> Under Act 50, Chapter 343, Hawai'i Revised Statutes, 2000, the following protocol are encouraged when preparing a Cultural Impact Assessment.
>
> Identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or *ahupua'a;*
>
> Identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;
>
> Receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;
>
> Conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;
>
> Identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and
>
> Assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices, and beliefs identified.

The individuals, organizations, and agencies attempted to be contacted and the results of any consultations are presented in the table below.

Table 1. Community Contacts

Name	Background, Affiliation	Comments
Akau, William	*Kupuna* of Waikoloa	Letter sent on September 5, 2006.
Akima, Willette K.	President of the Waimea Hawaiian Civic Club	Letter sent on September 5, 2006.
Arakaki, Eric	Alakahakai National Historic Trail	Mr. Arakaki responded in an email dated, 9/14, 2006: "Mahalo for the subject request. I will forward it to my contacts who may be able to provide information on the cultural landscape of Waikoloa ahupua'a."
Ayau, Halealoha	Hui Mālama O Nā Kūpuna O Hawai'i Nei	Email with letter and maps sent on September 5, 2006.
Bon, Stan	Resource Manager Kaloko-Honokōhau National Historical Park	Letter sent on Septemeber 5, 2006.
Gorman, Ulu	South Kohala Burial Council	Letter sent on September 5, 2006.
Springer, Hannah	Cultural Practitioner, Historian	See Section 5.
Kawashima, Irv	Na Ala Hele Trails & Access Specialist Department of Land & Natural Resources	Letter sent on September 5, 2006.
Keakealani, Shirleyann	*Kama'āina* of Waikoloa	Letter sent on September 5, 2006.
Lindsey, Keola	State Historic Preservation Division/Department of Land and Natural Resources Burial Program Director	Letter sent on September 5, 2006.
MacDonald, Ruby	Office of Hawaiian Affairs, Hawai'i Island Community Resource Coordinator Council	Ms. Ruby MacDonald responded in an email dated, 9/5/06: "The following are

	Member/President of the AHCC Hawai'i Island Council	contacts for the various Hawaiian Civic Clubs within the Waimea and Kohala area. Desiree M. Yamamoto, President, South Kohala Civic Club, Mr. Analu Wynn, President , South Kohala Hawaiian Civic Club, Ms. Willette K. Akima, President, Waimea Hawaiian Civic Club, Ruby P. MacDonald, President AHCC Hawaiian Island Council."
Teri Rivera	National Park Service Chief Interpreter Pu'uhonua O Hōnaunau	Letter sent on September 5, 2006.
Ben Saldua	National Park Service Chief Ranger Pu'u Kohola	Letter sent on September 5, 2006.
Wynn, Analu	President of the South Kohala Hawaiian Civic Club	Letter sent on September 5, 2006.
Yamamoto, Desiree M.	President of South Kohala Civic Club	Letter sent on September 5, 2006.

Section 5 Community Contact Responses

Three individuals with knowledge of and/or ties to Waikoloa and the project area responded to Cultural Surveys Hawai'i's request for comment. Their responses are presented in full below.

5.1 Mr. Eric Arakaki

Mr. Eric Arakaki of the Alakahakai National Historic trail responded in an e-mail dated, September 14, 2006:

> "Mahalo for the subject request. I will forward it to my contacts who may be able to provide information on the cultural landscape of Waikoloa ahupua`a."

5.2 Ms. Ruby MacDonald

Ms. Ruby Macdonald the Resource Community Coordinator for the Office of Hawaiian Affairs Hawai'i Island and President of the AHCC Hawaiian Island Council responded in an email dated, September 5, 2006:

> "The following are contacts for the various Hawaiian Civic Clubs within the Waimea and Kohala area. Desiree M. Yamamoto, President, South Kohala Civic Club, Mr. Analu Wynn, President , South Kohala Hawaiian Civic Club, Ms. Willette K. Akima, President, Waimea Hawaiian Civic Club, Ruby P. MacDonald, President AHCC Hawaiian Island Council."

5.3 Ms. Hannah Springer

Cultural practitioner, and *kama`āina* to the lava lands Hannah Springer's family started Hu'ehu'e Ranch in the late 1800s; she and her husband live with their children today at Kukuiohiwai. Ms. Springer responded by telephone on September 12. 2006:

> "My concern is that we need to understand that the whole landscape is a cultural landscape which is an impact. Just because we do not find anything does not mean there is no cultural impact to a landscape. It is dependent on the cultural practitioners of those lands in order to see the depth of impact. It requires the people of the land. We, people who live and know lava lands look at the land with a different eye. We have a deeper familiarity with body forms of the lava lands. It does not diminish the impact. It is my hope that there will be attention made to the cultural landscape in its entirety. The Hill Puu Hīna`i 1 use as an example of degradation to our lands. To us it is about a sense of place and a sense of space, thus allowing the new people coming in to the breath in the spaciousness of the land."

Section 6 Traditional Cultural Practices

Traditional cultural practices are based on a profound awareness concerning harmony between man and our natural resources. The Hawaiians of old depended on these cultural practices for survival. Based on their familiarity with specific places and through much trial and error, Hawaiian communities were able to devise systems that fostered sustainable use of nature's resources. Many of these cultural practices have been passed down from generation to generation and are still practiced in some of Hawai`i's communities today.

This project seeks to assess traditional cultural practices as well as resources pertaining to the project area within Lāwa`i Ahupua`a. This section will assess the different types of traditional practices, cultural resources associated within the vicinity.

Discussion of specific aspects of traditional Hawaiian culture as they may relate to the project area and Lāwa`i Ahupua`a are presented below.

6.1 Marine Resources

Fishing and marine resource gathering practices continue to occur along the coastal areas of `Anaeho`omalu. In traditional Hawaiian times, the inhabitants of Waikoloa Ahupua`a would have utilized the abundant marine resources along the coastal regions of Waikoloa..

None of the community contacts queried identified any ongoing fishing activities associated with Waikoloa Ahupua`a.

Having noted the abundance of marine resources it is highly likely that the coastal area of `Anaeho`omalu are still being used for the gathering of marine resources today.

6.2 Stream Resources

Native stream animals supplied the Hawaiian diet with a rich source of protein.

In the vicinity of the project area, archaeological surveys by Jensen (1990) found that adjacent to the north side of Pu`u Hīnai where several streams converge near the northeast perimeter of the *pu`u*.

None of the community contacts queried identified any ongoing stream activities within the project area.

6.3 Gathering of Plant Resources

Hawaiians utilized upland resources for a multitude of purposes. Forest resources were gathered, not only for the basic needs of food and clothing, but for tools, weapons, canoe building, house construction, dyes, adornments, hula, medicinal and religious purposes.

Forest areas miles inland, would have been utilized for a variety of purposes, such as gathering of timber, avian resources, medicinal and ceremonial plants, and famine food resources. For example, *hala* and *kukui* were probably gathered from *mauka* regions.

None of the community contacts queried identified any ongoing gathering of plant resources specifically within the project area.

6.4 Traditional Hawaiian Sites

In the vicinity of the project area, archaeological surveys by the Jensen (1990) study identified only one archaeological feature a wall segment identified as Site T-1. An area located c. 300 meters north of Pu`u Hinai contained a "single low wall or of poorly stacked, rough pahoehoe cobbles and boulders" (Jensen 1990: *ii*). The wall of unknown function was 2.5 meters long with a maximum height of 1.21 meters. For a number of reasons the Jensen study reasonably concludes this T-1 Site was not the same as the Site 22 documented by Bevacqua (discussed further below). The T-1 feature was so modest that no State Inventory of Historic Places site number was given and "no further treatment of any kind" was recommended (Jensen 1990:13). Otherwise there was no evidence of either pre- or post-contact use within the entire project area.

Community member Hannah Springer contacted for this cultural impact assessment specifically commented, "My concern is that we need to understand that the whole landscape is a cultural landscape which is an impact. Just because we do not find anything does not mean there is no cultural impact to a landscape. It is dependent on the cultural practitioners of those lands in order to see the depth of impact. It requires the people of the land. We, people who live and know lava lands look at the land with a different eye. We have a deeper familiarity with body forms of the lava lands. It does not diminish the impact. It is my hope that there will be attention made to the cultural landscape in its entirety. The Hill Puu Hīna`i I use as an example of degradation to our lands. To us it is about a sense of place and a sense of space, thus allowing the new people coming in to the breath in the spaciousness of the land."

6.5 Settlement Patterns and Resource Exploitation

Kirch's Kalahuipua`a-based model is generally consistent with information from `Anaeho`omalu. Noting that agricultural pursuits were generally not feasible along the coast of West Hawai`i, (Kirch 1975:186 in et al. Jensen 1990) that either the prehistoric population also utilized upland arable lands for agricultural activities, or "...the population was in the unique position of being totally dependent on marine resources." Kirch felt that it was unlikely that the native population subsisted without a significant vegetable component. Moreover, the presence of upland plant remains at occupied coastal shelters seems to document extensive prehistoric contacts between these two ecological zones (Kirch 1975 in at al. Jensen 1990). Since arable uplands are only a few hours walk from the coast, Kirch argued that, "...a pattern of upland residence and agricultural activity, with repeated intermittent occupation of coastal sites in order to exploit marine resources, would be a maximizing strategy in the West Hawai`i ecosystem. Hommon (1982) subsequently upland agricultural contribution to the diet of the coastal Kalahuipua`a occupants.

In Kirch's model, the coastal shelter cave sites at 'Anaeho'omalu and Kalahuipua'a served as "...temporary residences for small groups exploiting the marine environment, for periods of a few days to perhaps several weeks or even months." In support of this hypothesis, Kirch observed that in excess of 75 percent of the artifact assemblage from coastal sites related directly or indirectly to marine exploitation, with shellfish representing approximately 90 percent of the total meat and energy value of the midden. This figure correlated closely with other temporary marine exploitation sites for which similar midden data was available, and was found to contrast with available midden data from sites associated with permanent agricultural fields (Jensen 1990: 4).

Collectively, these findings led Kirch to conclude that Kalahuipua'a represented the marine component of a much larger system, analogous to the ehtnohistoric *ahupua'a*, in which coastal and inland environment were linked in a pattern of economically and socially induced transhumance (Jensen 1990:4).

Additional evidence of this pattern of transhumance was acquired in conjunction with the archaeological survey and excavation work for the 23 mile-long Queen Ka'ahumanu Highway construction corridor between Kailua and Kawaihae. The corridor entered the *ahupua'a* of Waikoloa from the south at a point approximately 1.5 km east of the Kiholo-Puako Trail, and proceeded northward through Waikoloa following a broad eastward arc. That portion of the corridor passing by Kalahuipua'a was located in excess of 1,500 meters east of the shore, and thus provided some insight into the types of sites and features located within non-marine settings. Ching recorded a large number of sites along the inland highway corridor (Ching 1971 in et al. Jensen 1990:4), and salvage excavations were subsequently undertaken by Rosendahl at several of those located within Waikoloa (Rosendahl 1972 in et al. Jensen 1990:4). Rosendahl's work focused primarily on defining the nature of aboriginal Hawaiian residential occupation and exploitation within, "...the barren and seemingly inhospitable environment between the narrow, coastal habitation- and marine-resources exploitation zone and the more extensive, upland, habitation-and agricultural-exploitation zone" (Rosendahl 1972 in et al. Jensen 1990:5). Within this intermediate zone, Rosendahl characterized prehistoric patterns of land use, settlement and resources exploitation as follows (Rosendahl 1972: iii-vi in at. Jensen 1990:5):

1. Use of temporary shelters by people traveling between the coastal and upland habitation- and agricultural-exploitation zones;
2. Temporary and extended residential occupation by people engaged in marine and other exploitation activities, particularly in those areas situated closest to the ocean;
3. Storage facilities for marine exploitation gear and other recurrently used possessions;
4. Seasonal marginal agriculture in conjunction with coastal occupation and marine exploitation; and
5. Raw material procurement and initial fabrication of lava abrading tools within areas containing suitable raw material

Section 7 Summary and Recommendations

Reviewing the information provided by the elements of this cultural impact assessment – historical documentation, archaeological research, and community contacts – there emerges a more detailed picture of the traditional landscape of Waikoloa Ahupua'a and the present project area.

Nineteenth-century documents – Land Commission Award records and historic maps – The settlement pattern model for Waikoloa *Ahupua'a* includes the use of temporary shelters by people traveling between the coastal and upland habitation- and agricultural-exploitation zones; temporary and extended residential occupation by people engaged in marine and other exploitation activities, particularly in those areas situated closest to the ocean; storage facilities for marine exploitation gear and other recurrently used possessions; seasonal marginal agriculture in conjunction with coastal occupation and marine exploitation; and raw material procurement and initial fabrication of lava abrading tools within areas containing suitable raw material. The historical documentation, especially *Māhele* and *Kuleana* data, indicates that The land *mauka* of 'Anaeho'omalu, Waikoloa *nui* was given by Kamehameha I to one of his two *haole* chiefs, John Young or Isaac Davis; the record is contradictory on this point. Waikoloa was listed among John Young's lands at the time the kind and chiefs apportioned them to his heirs – his own children and three of Isaac Davis' children (Privy Council Records, 1848, 3:98-99).

By 1867, Supreme Court Justice G. M. Robertson found that the land had been given to Isaac Davis by Kamehameha I and had been inherited by his son Hueu . GeorgeHu'eu Davis himself referred to Waikoloa as an *'ili*. Several maps at the State Survey Office indicate this latter division to be the most common. An exception is Marion Kelly's citation of Waikoloa as an *'ili kupono*. It should be noted that the *'ili* of Anaeho'omalu and Kalahuipua'a were detached form Davis' award of Waikoloa and were awarded to Queen Kalama. Kamehameha III kept the *ahupua'a* of Waimea, Kohala as a crown land indicating that the Kamehameha dynasty had retained control of 'Anaeho'omalu up to that time. Following the death of Kamehameha III in 1854 these lands were retained by his queen, Kalama Kapakuhaili Hakaleleponi. In 1877 Waikoloa *nui* eventually was bought by the Parker Ranch, and was used as grazing land for the Ranch.

By the early decades of the 20th century, 'Anaeho'omalu, perhaps from the time of its original purchase by Samuel Parker in 1877, appears to have served as a recreation and fishing area for parker Ranch employees and as a supply of pond fish for Ranch *lū'au*s.

Archaeological studies suggest that there have been few studies in the uplands of Waikoloa Ahupau'a. Though, reported site densities are very low with several reports on large parcels finding no archaeological sites at all. Most of what few sites have been identified are either small traditional Hawaiian hard rock quarries on ridges, military sites related to army maneuvers between 1943 and 1945, or lava tubes. Many of these sites are quite subtle and would be easy to miss. A notable exception to the general pattern is a curious complex of 19 sites, mostly platforms, documented by Jensen and Burgett (1991) located approximately 2.5 kilometers west of the current project area. This complex of numerous platforms was thought to have a burial function. Although a number of these platforms were subtle enough to be missed in two helicopter reconnaissance flights by archaeologists it certainly seems unlikely that a complex of

this scale could have been missed in the present study area. The Jensen (1990) study identified only one archaeological feature a wall segment identified as Site T-1. An area located c. 300 meters north of Pu'u Hīnai contained a "single low wall or of poorly stacked, rough pahoehoe cobbles and boulders" (Jensen 1990: *ii*). The wall of unknown function was 2.5 meters long with a maximum height of 1.21 meters.

For the purpose of this cultural impact assessment, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about the project area. Cultural practitioner and *kama'āina* to Kukuiohiwai, Ms. Hannah Springer stated that there is a need to understand that the whole landscape is a cultural landscape which is an impact. Just because nothing is found does not mean there is no cultural impact to a landscape. It is dependent on the cultural practitioners of the lands in question in order to see the depth of impact. It requires the people of the land. People who live and know lava lands look at the land with a different eye, therefore there is a deeper familiarity with body forms of the lava lands. None of the community contacts queried for this assessment identified any on –going traditional cultural practices, cultural sites or concerns specifically within the project area.

Addressing the cultural concerns of Ms. Hannah Springer will help to minimize the impact of the project on Hawaiian culture, its practices and traditions.

Finally, it should be noted that subsurface properties associated with former traditional Hawaiian activities in the project area, such as burials, artifacts and cultural layers, may be present despite the previous archaeological research within the project area. As a precautionary measure, personnel involved in future development activities in the area should be informed of the possibility of inadvertent cultural finds, and should be made aware of the appropriate notification measures to follow.

Section 8 References

ACHP (Advisory Council on Historic Preservation)

1985 Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review. Washington, D.C.: Advisory Council on Historic Preservation. (Draft Report, August)

Barrere, D.B.

1971 Anaehoomalu: A Reconstruction of its History. IN Barrera 1971.

1983 Report 2: Notes on the Lands of Waimea and Kawaihae. IN Clark and Kirch 1983: 25-38.

Beagelhole, J.C.

1967 *Journals of Captain James Cook on His Voyages of Discovery. Vol. 3. The Voyage of the Resolution and Discovery 1776-1780.* The Hakluyt Society, Cambridge.

Bevacqua, R.F.

1972 Archaeological Survey of Portions of Waikoloa, South Kohala District, Island of Hawaii. Departmental Report Series 72-4. Dept. of Anthropology, B.P. Bishop Museum.

Board of Commissioners

1929 Indices of Awards made by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Honolulu.

Ellis, William

1963 Journal of William Ellis. Honolulu: Advertiser Publishing Co., Ltd.

Fornanader, Abraham

1916-1917 *Fornander Collection of Hawaiian Antiquities and Folk-Lore*, Vol. IV-Part II. Bishop Museum Press, Honolulu.

Hammatt, Hallett

2001

2006 Evaluation of Archaeological Protentional at a 702/28-Acre Parcel at Waikoloa, South Kohala District, Hawai'i Island TMK: [3] 6-8-002:016

Jensen, P.M.
1990 Archaeological Inventory Survey Waikoloa Mauka Lands, Lands of Waikoloa, South Kohala District, Island of Hawaii. PHRI Project 89-717. Prepared for Transcontinental Development Company.

Kelly, M.
1956 Changes in Land Tenure in Hawaii, 1778-1850. M.A. Thesis. University of Hawaii.

Menzies, Archibald
1920 Hawai'i Nei 128 Years Ago. Honolulu, Hawai'i.

APPENDIX G

Traffic Impact Analysis Report
Julian Ng, Incorporated, July 2005.

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TRAFFIC IMPACT ANALYSIS REPORT

Waikoloa Highlands Subdivision

Waikoloa, South Kohala, Hawai'i

July 28, 2006
Revised January 12, 2007

Prepared for:

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<HI PE stamp>

Expiration Date 4/30/2008

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Table of Contents

Traffic Impact Analysis Report
Waikoloa Highlands Subdivision
Waikoloa, South Kohala, Hawaii

July 28, 2006 DRAFT

Introduction

The proposed Waikoloa Highlands project will include the subdivision of approximately 732 acres to create approximately 400 one-acre residential lots (portions of the site will remain vacant). The project is located southeast of the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue and will be developed in two phases. This report summarizes the findings of a traffic study of the potential impacts of the entire project. The project location and the vicinity are shown in Figure 1.

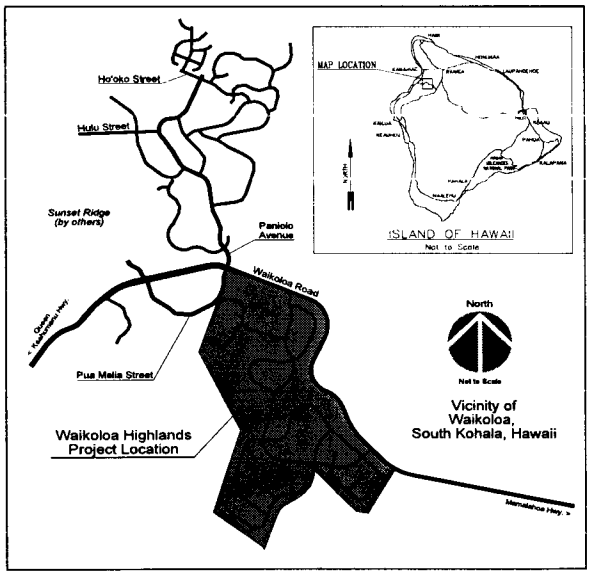

Figure 1 – Project Location

The project will provide a new traffic signal system to control vehicular and pedestrian movements at the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue, as conditioned by the zoning approval for the project. The preliminary subdivision layout proposes that three street connections provide vehicular access into the project. One project street will intersect with Pua Melia Street at a new "T"-intersection south of its intersection with Waikoloa Road; another project street will intersect with Waikoloa Road at two locations, at each location as the south leg of a new "T"-intersection. Future conditions at each of these new intersections, as well as the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue were determined. In addition, the project impact to Waikoloa Road to the west and to the east were identified and compared with growth that would otherwise be expected on Waikoloa Road.

The analyses were based on the concepts and the procedures for two-lane highways and for signalized and unsignalized intersections described in the *Highway Capacity Manual*. For two-lane highways, the level of service is determined based on potential delays due to the inability to pass a slow-moving vehicle.

At intersections, the *Highway Capacity Manual* defines "Levels of Service" using average delays. The analytical procedure computes intersection capacity based on intersection layout and other traffic characteristics, and traffic signal operation parameters at signalized intersections; average delays are also computed and used to identify the Levels of Service for each approach. An overall average delay is computed and an overall Level of Service for the intersection is determined for signalized intersections. Level of Service C is desirable, and Level of Service D is considered acceptable for urban conditions. Criteria for levels of service are:

	Average delay per vehicle (seconds)					
Level of Service	A	B	C	D	E	F
Signalized intersection	≤ 10	> 10 and ≤ 20	> 20 and ≤ 35	> 35 and ≤ 55	> 55 and ≤ 80	> 80
Unsignalized intersection	≤ 10	> 10 and ≤ 15	> 15 and ≤ 25	> 25 and ≤ 35	> 35 and ≤ 55	> 55
Reference: *Highway Capacity Manual 2000*						

Existing (2005) Traffic

Manual counts taken in the field during weekday morning and afternoon peak periods in October 2005 were used to represent existing AM Peak Hour and PM Peak Hour traffic volumes at the Waikoloa Road intersection with Pua Melia Street and Paniolo Avenue. The field data are summarized in the attached appendix. Existing lane arrangements and peak hour traffic volumes at these intersections are shown in Figure 2.

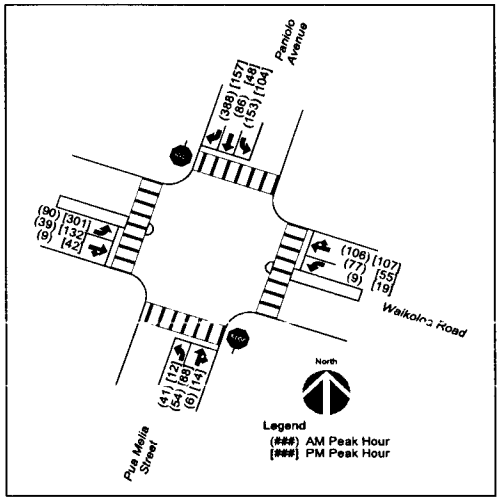

Figure 2 – Existing (2005) Peak Hour Traffic at Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

Stop signs control traffic on the Paniolo Avenue southbound approach and the Pua Melia Street northbound approach. Through traffic on Waikoloa Road have the right-of-way at this unsignalized intersection. Left turns from Waikoloa Road yield to opposing traffic, and a median is provided to separate opposing taffic on Waikoloa Road. There is sufficient capacity to serve even peak hour volumes, although left turns experience some long delays. Queues of up to four vehicles form in the southbound and northbound left turn lanes during

short periods within each the peak hour. The results of the analyses, shown in Table 1, correspond with conditions observed in the field.

Table 1 – Existing Conditions – Unsignalized Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

	AM Peak Hour			PM Peak Hour		
	v/c	AD	LOS	v/c	AD	LOS
Left turns from Waikoloa Road (yields)						
Westbound	0.01	7.4	A	0.02	7.7	A
Eastbound	0.08	8.0	A	0.24	8.5	A
Stopped southbound approach (Paniolo Avenue)						
Left turn lane	0.35	15.6	C	0.86	106.7	F
Through lane	0.18	13.0	B	0.22	24.0	C
Right turn lane	0.53	13.9	B	0.20	10.0	B
Approach (average)		14.2	B		44.7	E
Stopped northbound approach (Pua Melia Street)						
Left turn lane	0.41	55.0	F	0.08	29.0	D
Through / right turn lane	0.13	12.7	B	0.41	26.8	D
Approach (average)		29.9	D		27.0	D

v/c = volume/capacity ratio
AD = average delay (seconds)
LOS = Level of Service

Future Baseline Traffic Conditions (without Waikoloa Highlands)

Traffic on all roadways in the area will increase as development continues with several projects. The following projects are expected to be completed by 2010 and the traffic volumes generated by these projects have been estimated using methods similar to the methods used for project traffic (discussed later):

a. completion and full occupancy of 200 single-family detached dwelling units at Kilohana Kai (currently under construction).

b. completion of the Sunset Ridge project and a new bridge over Auwaiakeakua Gulch and linking roadways west of the existing Waikoloa Village, which will provide an alternative route for traffic from the existing Waikoloa Village via Hulu Street.

c. partial completion and occupancy of two projects located beyond the existing north end of Paniolo Avenue (the County of Hawaii workforce housing project and Waikoloa Heights, assuming a 50/50 mix of detached single-family units and multi-

family units, based on four years of product delivery at 10 units per month, or a total of 480 dwelling units).

Other projects, including infill of existing undeveloped property, are not expected to generate significant volumes of traffic. The new bridge over Auwaiakeakua Gulch is part of an ongoing development that has access directly to Waikoloa Road, but will also relieve traffic on Paniolo Avenue. The impact of the new bridge on peak hour traffic volumes at the intersection of Paniolo Avenue and Waikoloa Road has been based on traffic forecasts from the traffic report for that project*. Figure 3 shows the traffic assignments for 2010 at the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue.

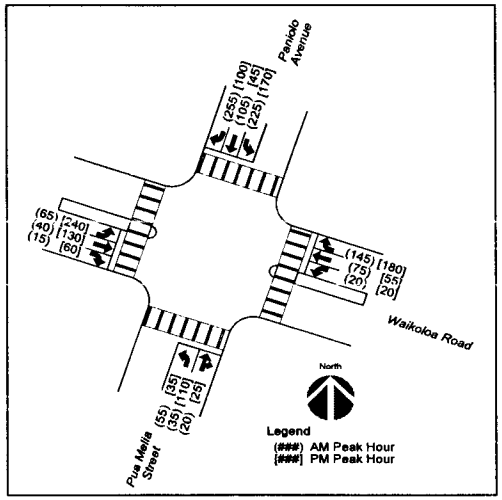

Figure 3 – 2010 Baseline Peak Hour Traffic
Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

* M&E Pacific, Inc., *Auwaiakeakua Gulch Bridge Crossing Traffic Study Update*, April 2004.

Table 2 shows the peak hour conditions at the intersection, assuming the existing paved shoulder areas on Waikoloa Road have been restriped as dedicated right turn lanes. Even with the separate right turn lanes, the changes in traffic volumes will result in over-capacity conditions at the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue.

Table 2 – 2010 Peak Hour Conditions
Unsignalized Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

	AM Peak Hour			PM Peak Hour		
	v/c	AD	LOS	v/c	AD	LOS
Left turns from Waikoloa Road (yields)						
Westbound	0.02	7.5	A	0.02	7.8	A
Eastbound	0.06	8.0	A	0.21	8.6	A
Stopped southbound approach (Paniolo Avenue)						
Left turn lane	0.46	16.5	C	1.17	179.9	F
Through lane	0.21	12.8	B	0.17	20.0	C
Right turn lane	0.32	10.7	B	0.12	9.2	A
Approach (average)		13.3	B		102.7	F
Stopped northbound approach (Pua Melia Street)						
Left turn lane	0.27	25.4	D	0.15	22.1	C
Through / right turn lane	0.10	11.6	B	0.45	24.6	C
Approach (average)		18.5	D		24.1	C

v/c = volume/capacity ratio
AD = average delay (seconds)
LOS = Level of Service

Figure 4 shows that traffic signals would be warranted with traffic volumes at the intersection for four hours of an average day, using projections based on the peak hour traffic assignments and the hourly distribution from the traffic counts.

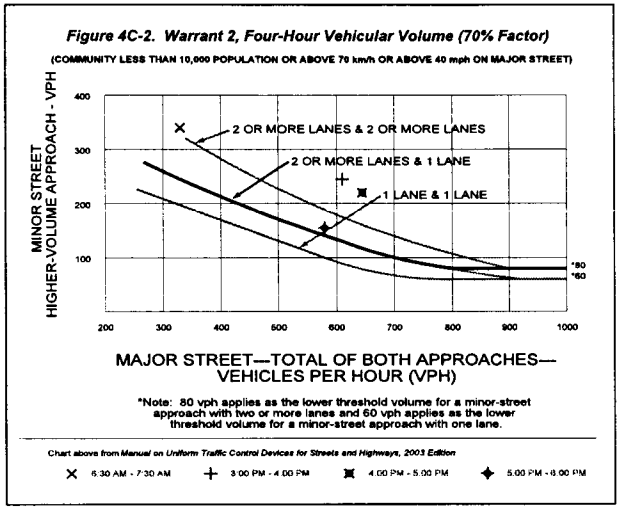

Figure 4 – Signal Warrant (2010 traffic) at Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

Traffic signals at the Waikoloa Road intersection with Paniolo Avenue and Pua Melia Street will distribute the delays to all movements, mitigating the over-capacity condition. Analyses of the intersection, assuming separate phases for left turns from Waikoloa Road, show that the intersection would operate at 60 percent of capacity in the AM Peak Hour and 80 percent of capacity in the PM Peak Hour. Table 3 shows the results of the analysis of this intersection as a signalized intersection.

Table 3 – 2010 Baseline Conditions
Signalized Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

	AM Peak Hour			PM Peak		
	v/c	AD	LOS	v/c	AD	LOS
overall intersection:	**0.39**	**27.4**	**C**	**0.45**	**37.7**	**D**
Southbound approach (Paniolo Avenue)		26.4	C		36.7	D
Left turn lane	0.63	34.6	C	0.54	48.9	D
Through lane	0.25	26.4	C	0.14	40.2	D
Right turn lane	0.39	17.2	B	0.14	14.2	B
Westbound approach (Waikoloa Road)		23.0	B		36.6	D
Left turn lane	0.13	37.4	D	0.09	45.5	D
Through lane	0.27	34.1	C	0.23	47.8	D
Right turn lane	0.25	15.3	B	0.39	32.1	C
Eastbound approach (Waikoloa Road)		38.1	D		36.6	D
Left turn lane	0.40	43.3	D	0.52	39.3	D
Through lane	0.15	32.2	C	0.27	33.9	C
Right turn lane	0.07	31.3	C	0.15	31.6	C
Northbound approach (Pua Melia Street)		30.2	C		44.4	D
Left turn lane	0.18	30.2	C	0.11	39.9	D
Through / right turn lane	0.18	30.2	C	0.42	45.5	D

v/c = volume/capacity ratio
AD = average delay (seconds)
LOS = Level of Service

Further development of the County workforce housing project and Waikoloa Heights is expected beyond 2010. Other projects may also be proposed and developed. For the purpose of estimating future traffic volumes beyond 2010, individual projects were not considered; rather, the traffic assignments for 2010 were increased at an average rate of 2.5% per year to account for the expected continued growth. Figure 5 shows the 2025 peak hour baseline (without Waikoloa Highlands) traffic assignments and Table 4 shows the results of the analyses..

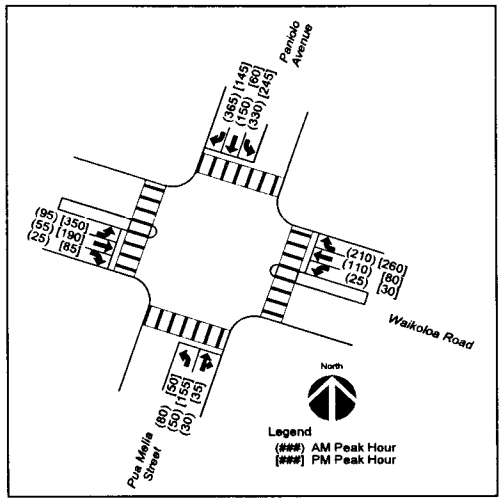

Figure 5 – 2025 Baseline Peak Hour Traffic
Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

Table 4 – 2025 Baseline Conditions
Signalized Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

	AM Peak Hour			PM Peak Hour		
	v/c	AD	LOS	v/c	AD	LOS
overall intersection:	**0.54**	**31.0**	**C**	**0.64**	**39.7**	**D**
Southbound approach (Paniolo Avenue)		31.3	C		30.3	C
Left turn lane	0.81	44.2	D	0.48	47.1	D
Through lane	0.35	27.9	C	0.21	41.4	D
Right turn lane	0.63	21.1	C	0.31	15.9	B
Westbound approach (Waikoloa Road)		24.2	C		40.2	D
Left turn lane	0.15	37.8	D	0.13	46.2	D
Through lane	0.40	36.4	D	0.34	50.0	D
Right turn lane	0.35	16.2	B	0.56	36.5	D
Eastbound approach (Waikoloa Road)		42.4	D		42.8	D
Left turn lane	0.59	50.6	D	0.76	48.9	D
Through lane	0.20	33.0	C	0.39	36.1	D
Right turn lane	0.11	31.8	C	0.21	32.3	C
Northbound approach (Pua Melia Street)		31.3	C		48.5	D
Left turn lane	0.26	31.3	C	0.16	40.6	D
Through / right turn lane	0.26	31.4	C	0.59	30.6	D

v/c = volume/capacity ratio
AD = average delay (seconds)
LOS = Level of Service

Future (2025) Traffic Conditions with Waikoloa Highlands

In order to assess the project impact to future traffic conditions, the additional traffic generated by the project during the morning (AM) and afternoon (PM) peak hours of a typical weekday were developed using factors for dwelling units from *Trip Generation, 7th Edition*, a publication of the Institute of Transportation Engineers. The applicable trip factors and directional distribution are shown in Table 5.

Table 5 – Trip Generation

	Trip rates per detached dwelling unit *		Trips Generated by 398 dwelling units	
Time Period	Vehicle trips	% entering	entering	exiting
Average Weekday	9.57	50%	1,900	1,900
AM Peak Hour	0.75	25%	75	224
PM Peak Hour	1.01	63%	252	149
* Source: Institute of Transportation Engineers, *Trip Generation, 7th Edition*				

The project traffic was distributed to local destinations within Waikoloa Village and onto Waikoloa Road in proportion to the existing turning movements at the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue. The project impact to Waikoloa Road are summarized in Tables 6 and 7.

Table 6 – Waikoloa Road Traffic Increases

EB = eastbound WB = westbound	West of Waikoloa Village				East of Waikoloa Village			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	EB	WB	EB	WB	EB	WB	EB	WB
Existing	140	505	475	225	200	190	250	180
2025 without project	300	800	900	450	415	345	470	370
Project impact	30	110	85	45	50	30	30	30
2025 with project	330	910	985	495	465	375	500	400
% increase in volume	10%	14%	9%	10%	12%	9%	6%	8%

Table 7 – Waikoloa Road Levels of Service

v/c = volume/capacity LOS=Level of Service	AM Peak Hour				PM Peak Hour			
	Eastbound		Westbound		Eastbound		Westbound	
	v/c	LOS	v/c	LOS	v/c	LOS	v/c	LOS
West of Waikoloa Village								
Existing (2005 counts)	0.14	D	0.36	E	0.34	F	0.16	D
2025 without project	0.13	D	0.39	F	0.42	F	0.20	D
2025 with project	0.16	D	0.47	F	0.48	F	0.23	D
East of Waikoloa Village								
Existing (2005 counts)	0.15	D	0.15	D	0.18	D	0.17	D
2025 without project	0.32	E	0.26	D	0.34	E	0.27	D
2025 with project	0.33	E	0.29	D	0.34	E	0.29	D

Figure 6 shows the 2025 peak hour traffic assignments.

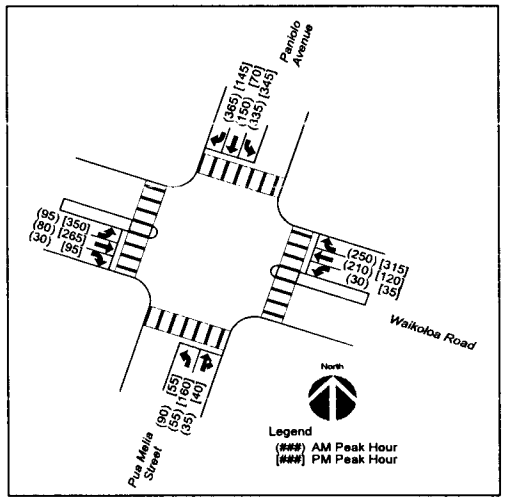

Figure 6 – 2025 Peak Hour Traffic with Waikoloa Highlands
Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

Table 8 shows the results of the analyses of the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue with the 2025 peak hour traffic assignments. While overall intersection level of service can be maintained within acceptable range, the high volume left turn movements (westbound and southbound) will experience very long delays and Level of Service E conditions.

Table 8 – 2025 With Waikoloa Highlands

Signalized Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

	AM Peak Hour			PM Peak Hour		
	v/c	AD	LOS	v/c	AD	LOS
overall intersection:	**0.63**	**33.3**	**C**	**0.73**	**44.0**	**D**
Southbound approach (Paniolo Avenue)		31.8	C		36.1	D
Left turn lane	0.82	45.3	D	0.73	55.5	E
Through lane	0.35	27.9	C	0.22	40.0	D
Right turn lane	0.63	21.1	C	0.29	13.6	B
Westbound approach (Waikoloa Road)		32.9	C		40.4	D
Left turn lane	0.18	38.4	D	0.16	46.6	D
Through lane	0.77	51.2	D	0.51	54.6	D
Right turn lane	0.42	16.9	B	0.41	31.3	C
Eastbound approach (Waikoloa Road)		41.6	D		49.3	D
Left turn lane	0.59	50.6	D	0.89	59.5	E
Through lane	0.29	34.4	C	0.52	37.5	D
Right turn lane	0.13	32.1	C	0.16	30.4	C
Northbound approach (Pua Melia Street)		31.9	C		53.3	D
Left turn lane	0.29	31.9	C	0.08	42.7	D
Through / right turn lane	0.29	31.9	C	0.59	54.6	D

v/c = volume/capacity ratio
AD = average delay (seconds)
LOS = Level of Service

On Waikoloa Road, at each approach to the intersection with Pua Melia Street and Paniolo Avenue, the left turn lane is separated from the through lane by a paved area that is striped as a traffic island. Conversion of this striped area on the eastbound approach to a second left turn lane into Paniolo Avenue, along with a retiming of the traffic signal, would mitigate the unacceptable Level of Service E conditions in the 2025 PM Peak Hour. Table 9 shows the results of the analyses of peak hour traffic volumes with these changes.

Table 9 – 2025 With Waikoloa Highlands (mitigated)

Signalized Intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue

	AM Peak Hour			PM Peak Hour		
	v/c	AD	LOS	v/c	AD	LOS
overall intersection:	**0.57**	**32.7**	**C**	**0.59**	**38.3**	**D**
Southbound approach (Paniolo Avenue)		31.8	C		31.8	C
Left turn lane	0.82	45.3	D	0.63	47.0	D
Through lane	0.35	27.9	C	0.19	36.4	D
Right turn lane	0.63	21.1	C	0.29	13.6	B
Westbound approach (Waikoloa Road)		32.9	C		40.4	D
Left turn lane	0.18	38.4	D	0.16	46.6	D
Through lane	0.77	51.2	D	0.51	54.6	D
Right turn lane	0.42	16.9	B	0.41	31.3	C
Eastbound approach (Waikoloa Road)		41.6	D		39.5	D
Left turn lane	0.30	38.9	D	0.52	38.8	D
Through lane	0.29	34.4	C	0.58	42.3	D
Right turn lane	0.13	32.1	C	0.18	33.4	C
Northbound approach (Pua Melia Street)		31.9	C		53.3	D
Left turn lane	0.29	31.9	C	0.08	42.7	D
Through / right turn lane	0.29	31.9	C	0.59	54.6	D

v/c = volume/capacity ratio
AD = average delay (seconds)
LOS = Level of Service

Three new intersections will be formed at the connections of the project roads with the existing street system. Westbound project traffic on the access road connected to Pua Melia Street will be controlled by a stop sign and the intersection has been analyzed with a single lane shared by left and right turn traffic. Figure 7 shows the year 2025 peak hour traffic assignments and Table 10 shows the results of the analyses.

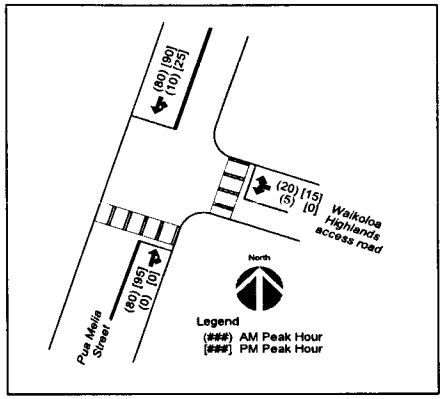

Figure 7 – 2025 Peak Hour Traffic with Waikoloa Highlands
Intersection of Pua Melia Street and Access Road Connection

Table 10 – Pua Melia Street and Access Road Unsignalized Intersection

v/c=volume/capacity 95% Q=design queue CD=control delay (sec)	AM Peak Hour				PM Peak Hour			
	v/c	95% Q	CD (sec)	LOS	v/c	95% Q	CD (sec)	LOS
Southbound left turn, Pua Melia Street (yield)	0.01	0.02	7.6	A	0.02	0.06	7.7	A
Westbound approach, Project Road (stop)	0.04	0.11	9.9	A	0.02	0.07	9.8	A

Traffic assignments for year 2025 at the two new intersections with Waikoloa Road are shown in Figures 8 and 9. At each intersection, the project street will be the stem of a "T"-intersection and traffic on this approach will be controlled by a stop sign. The approach is assumed to be wide enough to accommodate separate lanes for left turns and for right turns. On Waikoloa Road, a separate median left turn lane would be provided, and extended to the west to serve as a median shelter lane to provide a refuge area for drivers making the left turn onto Waikoloa Road. Results of the analyses of these unsignalized intersections are shown in Table 4.

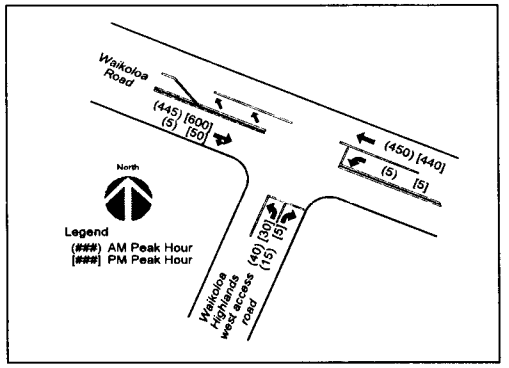

Figure 8 – 2025 Peak Hour Traffic with Waikoloa Highlands
Intersection of Waikoloa Road and West Access Road Connection

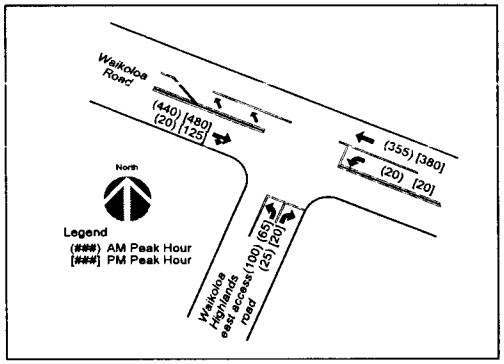

Figure 9 – 2025 Peak Hour Traffic with Waikoloa Highlands
Intersection of Waikoloa Road and East Access Road Connection

Table 11 – Waikoloa Road Unsignalized Intersections

v/c=volume/capacity 95% Q=design queue CD=control delay (sec) LOS=Level of Service	AM Peak Hour				PM Peak Hour			
	v/c	95% Q	CD (sec)	LOS	v/c	95% Q	CD (sec)	LOS
Waikoloa Road and West Access Road								
Westbound left turn, Waikoloa Road (yield)	0.00	0.01	8.5	A	0.01	0.02	9.3	A
Project Road northbound approach								
Shared lane, Case A	0.22	0.84	21.2	C	0.14	0.49	20.0	C
Shared lane, Case B	0.16	0.54	15.3	C	0.10	0.33	14.9	B
Separate left turn lane, Case A	0.19	0.70	23.2	C	0.13	0.45	20.7	C
Separate left turn lane, Case B	0.12	0.42	15.9	C	0.09	0.29	15.1	B
Separate lanes (right turn lane)	0.03	0.10	11.8	B	0.01	0.03	12.3	B
Waikoloa Road and East Access Road								
Westbound left turn, Waikoloa Road (yield)	0.02	0.07	8.6	A	0.02	0.07	8.7	A
Project Road northbound approach								
Shared lane, Case A	0.49	2.58	28.6	D	0.29	1.16	19.5	C
Shared lane, Case B	0.35	1.54	18.2	C	0.22	0.82	15.1	C
Separate left turn lane, Case A	0.44	2.13	28.9	D	0.25	0.94	20.3	C
Separate left turn lane, Case B	0.30	1.22	17.9	C	0.18	0.63	15.1	C
Separate lanes (right turn lane)	0.05	0.17	11.9	B	0.04	0.13	11.7	B
With single connection to Waikoloa Road								
Westbound left turn, Waikoloa Road (yield)	0.03	0.09	8.6	A	0.03	0.10	8.9	A
Single Project Road northbound approach								
Shared lane, Case A	0.70	4.90	40.8	E	0.43	2.06	24.0	C
Shared lane, Case B	0.50	2.71	21.7	C	0.32	1.35	17.0	C
Separate left turn lane, Case A	0.62	3.73	38.1	E	0.38	1.68	24.3	C
Separate left turn lane, Case B	0.41	1.98	20.4	C	0.26	1.05	16.7	C
Separate lanes (right turn lane)	0.08	0.27	12.0	B	0.05	0.17	12.0	B

Case A: undivided Waikoloa Road
Case B: median left turn lane and median shelter lane on Waikoloa Road

The 95% queue lengths represent the maximum length of the queue that could be expected with a 95% probability during the peak hour. This length is used to determine the minimum length of storage that should be provided for the affected movement. The queue lengths for the westbound left turns from Waikoloa Road are much less than the two-vehicle length that is used as a minimum storage length; therefore, a design using the minimum storage would be adequate. The queue lengths for the northbound approaches could be used to determine parking restrictions on those approaches to provide separate lanes for left and right turns.

Impacts at Queen Kaahumanu Highway and at Mamalahoa Highway

As indicated in Table 6, traffic volumes on Waikoloa Road are expected to increase as a result of the proposed project. Project impacts at the Waikoloa Road intersections with Queen Kaahumanu Highway and with Mamalahoa Highway were identified by estimating future peak hour traffic volumes at these intersections, adding the project impact, and evaluating future conditions with and without the project traffic.

Traffic volumes on both the Queen Kaahumanu Highway and Mamalahoa Highway have been steadily increasing. Recent estimates of the average daily traffic volumes were used with regression analyses to extrapolate future average daily volumes on each highway, as shown in Table 12.

Table 12 – Highway Average Daily Traffic (ADT) near Waikoloa Road

	Queen Kaahumanu Highway		Mamalahoa Highway	
Year	North of Waikoloa Road	South of Waikoloa Road	North of Waikoloa Road	South of Waikoloa Road
1994	8,949	8,526	4,320	2,437
1996	9,254	9,042	4,419	2,685
1998	9,268	10,760	3,995	2,534
2000	10,251	11,592	4,818	3,061
2002	10,393	12,403	5,794	3,609

Source: State of Hawaii, Department of Transportation, Highways Division. *Traffic Summary – Island of Hawaii 2002*

The average annual increases from the regression analyses and the extrapolations of future traffic volumes on these segments of roadways are shown in Table 13.

Table 13 – Extrapolation of Highway ADTs near Waikoloa Road

	Queen Kaahumanu Highway		Mamalahoa Highway	
Year	North of Waikoloa Road	South of Waikoloa Road	North of Waikoloa Road	South of Waikoloa Road
Annual increase	+2.0%	+5.1%	+3.4%	+4.7%
2007	11,510	16,230	6,270	4,280
2010	12,220	18,850	6,940	4,910
2025	16,520	39,850	11,500	9,770

The latest available "K" (peak hour volume divided by daily volume) and "D" (directional distribution) factors were applied to develop baseline future (2025) peak hour volumes on the segments of highways north and south of Waikoloa Road. While project traffic would likely be part of the future traffic, the increases in peak hour traffic from Table 6 were added to the future baseline traffic assignments for the "future with project" traffic assignments. The traffic assignments are shown in Figures 10 and 11.

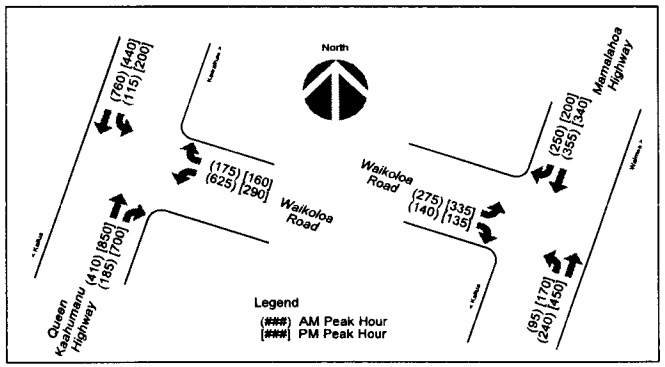

Figure 10 – 2025 Baseline Peak Hour Traffic Assignments at Highway Intersections

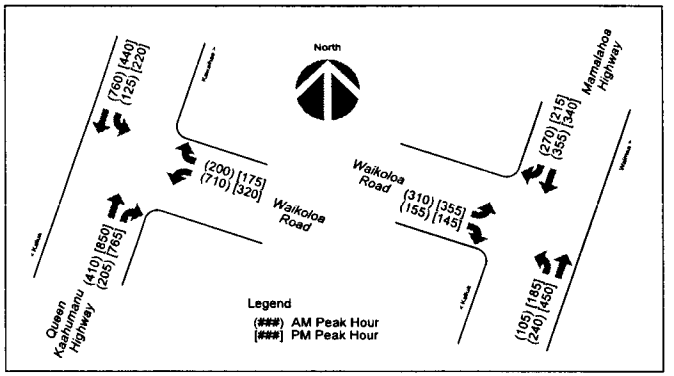

Figure 11 – 2025 With-Project Peak Hour Traffic Assignments at Highway Intersections

The analysis procedure described in the *Highway Capacity* Manual was applied to the existing intersection of Mamalahoa Highway and Waikoloa Road, where separate lanes are provided for each movement. Traffic signals would be needed for both the baseline and with-project traffic assignments, as capacity for left turns from Waikoloa Road would be exceeded. A critical movement analysis that had been described in an earlier edition of the *Highway Capacity* Manual was used to provide a planning-level evaluation of the signalized intersections. The critical movement analysis sums the peak hour volumes of the conflicting movements; sums of up to 1,200 passenger cars per hour indicate desirable "under capacity" conditions, sums greater than 1,200 and up to 1,400 describe "near capacity" conditions, and sums greater than 1,400 are "over capacity" requiring additional lanes or other improvements.

Table 14 shows the results of the critical movement analyses. At Queen Kaahumanu Highway, the daily traffic volumes indicate that widening of the existing two-lane highway to four lanes will be needed by year 2025. The high left turn volume from Waikoloa Road to Queen Kaahumanu Highway also indicate a need for a second turn lane; however, the sum of critical movements shown in Table 14 assume only a single turn lane is provided.

Table 14 – Results of Critical Movement Analyses of Signalized Intersections (2025)
Waikoloa Road and State Highways

	Queen Kaahumanu Highway		Mamalahoa Highway	
Peak Hour & Case	Sum	Condition	Sum	Condition
AM baseline	1,075	Under capacity	975	Under capacity
AM with-project	1,160	Under capacity	1,040	Under capacity
PM baseline	1,095	Under capacity	1,045	Under capacity
PM with project	1,145	Under capacity	1,095	Under capacity

Table 15 compares the project traffic with the baseline traffic volumes on the highways. Project traffic will be small compared to the expected growth of traffic from all development, as shown below (less than the traffic expected due from two years' growth on either highway, from first line in Table 13).

Table 15 – Comparison of Project Traffic with 2025 Baseline Traffic

	Queen Kaahumanu Highway		Mamalahoa Highway	
Peak Hour & Case	southbound	northbound	southbound	northbound
Annual growth to north	+2.0%		+3.4%	
AM to the north	1.1%	4.3%	3.3%	6.8%
PM to the north	3.1%	1.5%	2.8%	2.5%
Annual growth to south	+5.1%		+4.7%	
AM to the south	6.1%	3.4%	3.0%	3.0%
PM to the south	4.1%	4.2%	2.1%	2.4%

Traffic assignments were also made for year 2010, to provide estimates of the possible timing of the improvements that will be needed at each intersection. Figure 12 shows the 2010 baseline traffic assignments and Figure 13 shows the 2010 with-project traffic. The results of the unsignalized intersection analysis of the Mamalahoa Highway intersection are shown in Table 16 for the with-project traffic assignments. The very long delays for left turns onto Mamalahoa Highway in the PM Peak Hour could be mitigated by providing a shelter lane to allow left turn traffic to cross the southbound traffic and wait for a gap in the

northbound traffic before completing the turn. The shelter lane could be provided by restriping the existing median north of the intersection if the improvement is considered a temporary measure (the shelter lane will not be needed when the intersection is signalized; further discussion follows).

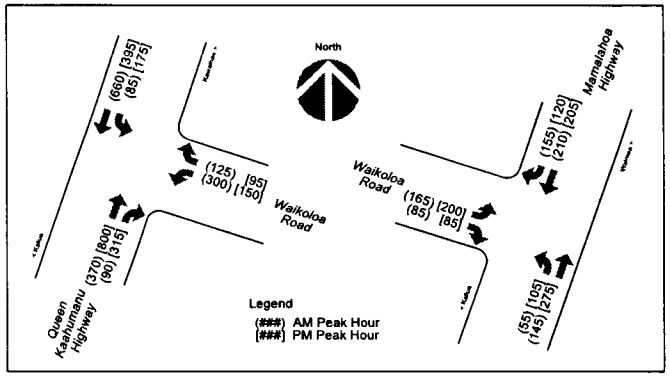

Figure 12 – 2010 Baseline Peak Hour Traffic Assignments at Highway Intersections

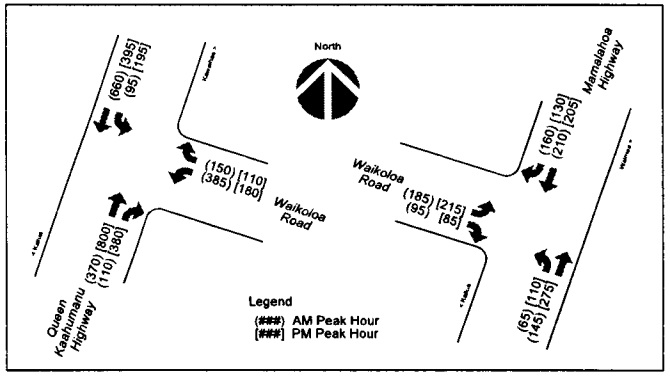

Figure 13 – 2010 With-Project Peak Hour Traffic Assignments at Highway Intersections

Table 16 – Results of Unsignalized Intersection Analysis (2010)

Waikoloa Road and Mamalahoa Highway

	AM Peak Hour			PM Peak Hour		
	Waikoloa Road		190NB	Waikoloa Road		190NB
Peak Hour & Case	Right Turn	Left Turn	Left Turn	Right Turn	Left Turn	Left Turn
With-project traffic and existing striping at Intersection						
Volume/capacity ratio	0.15	0.52	0.07	0.13	0.90	0.12
Average delay (seconds)	10.5	22.1	8.6	10.3	68.7	8.6
Level of Service	B	C	A	B	F	A
With-project traffic and improved intersection (shelter lane added)						
Volume/capacity ratio	0.15	0.43	0.07	0.13	0.67	0.12
Average delay (seconds)	10.5	17.1	8.6	10.3	31.2	8.6
Level of Service	B	C	A	B	D	A

190 NB = Highway 190 (Mamalahoa Highway) Northbound
RT = right turn (stop condition)
LT = left turn (stopped or yield)

The analyses of the unsignalized intersection also show that the intersection with the addition of a shelter lane could adequately serve peak hour traffic until the year 2014, with the assumed growth rates and a maximum volume-to-capacity ratio of 0.85. The project impact would be to accelerate the need for improvements at the intersection of Mamalahoa Highway and Waikoloa Road, such as traffic signals, by about 1½ years.

At the intersection of Queen Kaahumanu Highway and Waikoloa Road, the project impact would be a similar acceleration of needed improvements. If the project were completed and fully occupied by 2010, the additional traffic would not significantly affect conditions in 2010. With the sum of critical movements is increasing at about 3.5% per year at the intersection of Queen Kaahumanu Highway and Waikoloa Road, near-capacity conditions are projected to occur between 2012 and 2018 with the baseline traffic assignments, and between 2011 and 2017 with project traffic added to the baseline volumes. The net effect of adding the traffic generated by the project, therefore, is the accelerating of the need for

improvements by one year. Table 17 shows the results of the critical movement analyses of the 2010 peak hour traffic assignments for the existing lane configuration at the intersection of Queen Kaahumanu Highway and Waikoloa Road.

Table 17 – Results of Critical Movement Analyses of Signalized Intersection (2010)

Queen Kaahumanu Highway and Waikoloa Road

	AM Peak Hour		PM Peak Hour	
Peak Hour & Case	Sum	Condition	Sum	Condition
baseline	960	Under capacity	1,125	Under capacity
with-project	1,045	Under capacity	1,175	Under capacity

As discussed earlier, the daily traffic volumes on Queen Kaahumanu Highway indicate a need to widen the highway to four lanes before 2025. At the growth rates assumed in this study, daily volumes on the highway in 2015 will be greater than 13,500 vehicles per day north of Waikoloa Road and greater than 24,000 vehicles per day south of Waikoloa Road.

If the widening of Queen Kaahumanu Highway through the Waikoloa Road intersection does not occur by 2017, other improvements will be necessary to alleviate over-capacity conditions at the intersection. A second left turn lane from Waikoloa Road to Queen Kaahumanu Highway could reduce the sum of critical movements, but will require a second southbound lane to accept the second lane of turning traffic. Alternatives that would reduce the sum of critical movements by eliminating left turn conflicts (two examples are shown in Figure 14 with 2010 PM with-project traffic assignments) could also be considered.

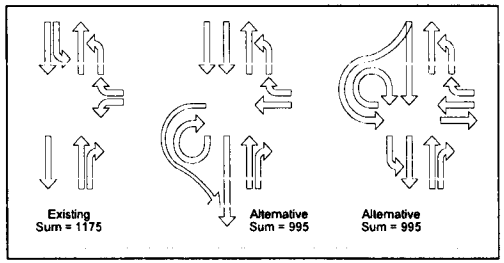

Figure 14 – Alternatives to Reduce Conflicts at Queen Kaahumanu Highway Intersection

Conclusions and Recommendations

The analyses show that while the proposed project will increase traffic volumes, the impact will not be significant enough to change the levels of service. In the short term, the installation of traffic signals at the intersection of Waikoloa Road, Pua Melia Street, and Paniolo Avenue will mitigate existing poor levels of service during the peak hours for left turns onto Waikoloa Road. With traffic signals and separate right turn lanes on Waikoloa Road, the intersection will have adequate capacity to serve peak hour volumes with the proposed project fully occupied. As traffic volumes increase due to other development in the Waikoloa area, peak hour conditions will worsen; a second eastbound left turn lane at the intersection is a mitigation measure that will improve conditions to acceptable levels for the peak hour volumes projected to year 2025.

The project road connections to Waikoloa Road and to Pua Melia Street will adequately serve peak hour volumes. Stop signs on the project road approaches will control turning movements at these "T"-intersections (left turns into the project would cross oncoming traffic and would yield). At the Waikoloa Road intersections, acceptable conditions will result from the provision of separate left turn lanes with median shelter lanes.

The addition of traffic from the proposed project will affect the Waikoloa Road intersections with Queen Kaahumanu Highway and with Mamalahoa Highway by accelerating the rate of growth of traffic volumes at each intersection. The analyses show that full occupancy of the project is expected to result in increases in traffic that would otherwise be expected in one to two more years. For the years 2010 and 2025, however, the addition of project traffic does not significantly change conditions at either intersection. The following improvements to State highway facilities are indicated by the analyses:

- add a shelter lane on Mamalahoa Highway for left turns from eastbound Waikoloa Road to northbound Mamalahoa Highway to serve expected growth in traffic (without project traffic) before 2010.
- signalize, when needed and warranted, the intersection of Mamalahoa Highway and Waikoloa Road; the analyses indicate that the most critical movement at the unsignalized intersection would exceed 85% of its capacity by 2014 (2013 with the addition of project traffic).
- widen Queen Kaahumanu Highway to a four-lane highway by 2015 (2014 with the addition of project traffic)

Appendix – Field Traffic Count Data

Unsignalized Intersection: Tuesday, October 25, 2005

Major Street, Waikoloa Road	West Leg (Eastbound approach)					East Leg (Westbound approach)				
	LEFT	THRU	RIGHT	PED	BIKE	LEFT	THRU	RIGHT	PED	BIKE
06:30 AM - 06:45 AM	14	5	4	0	0	2	30	18	1	0
06:45 AM - 07:00 AM	18	2	1	1	0	2	18	35	0	0
07:00 AM - 07:15 AM	20	9	4	1	0	1	20	17	0	0
07:15 AM - 07:30 AM	31	7	1	0	0	3	24	16	0	0
07:30 AM - 07:45 AM	17	7	1	0	0	2	15	37	0	0
07:45 AM - 08:00 AM	22	16	3	0	0	3	18	36	1	1
08:00 AM - 08:15 AM	16	11	3	0	0	2	11	20	0	0
08:15 AM - 08:30 AM	26	8	0	1	0	1	18	15	0	0
03:00 PM - 03:15 PM	43	27	8	2	0	2	6	23	0	0
03:15 PM - 03:30 PM	57	34	9	1	0	4	11	24	0	0
03:30 PM - 03:45 PM	71	22	7	2	0	3	10	34	0	0
03:45 PM - 04:00 PM	85	41	12	3	0	6	15	30	0	0
04:00 PM - 04:15 PM	68	31	12	2	0	4	21	19	0	0
04:15 PM - 04:30 PM	73	33	10	4	0	4	11	28	0	0
04:30 PM - 04:45 PM	75	27	8	0	0	5	8	30	0	0
04:45 PM - 05:00 PM	72	27	9	0	0	3	12	27	0	0
05:00 PM - 05:15 PM	76	21	11	0	0	4	11	31	0	0
05:15 PM - 05:30 PM	71	20	9	0	0	0	3	30	0	0
05:30 PM - 05:45 PM	75	17	6	1	0	0	8	31	0	0
05:45 PM - 06:00 PM	80	6	9	0	0	2	5	28	0	0
Minor Street (Paniolo Avenue and Pua Melia Street	North Leg (Southbound approach)					South Leg (Northbound approach)				
	LEFT	THRU	RIGHT	PED	BIKE	LEFT	THRU	RIGHT	PED	BIKE
06:30 AM -06:45 AM	30	13	105	0	0	5	10	2	0	0
06:45 AM -07:00 AM	37	7	80	0	0	3	4	1	0	0
07:00 AM -07:15 AM	51	53	97	0	0	17	23	1	0	0
07:15 AM -07:30 AM	45	10	106	0	0	7	17	2	2	0
07:30 AM -07:45 AM	35	13	96	4	0	9	4	2	1	0
07:45 AM -08:00 AM	22	10	89	0	0	8	10	1	1	1
08:00 AM -08:15 AM	31	12	70	0	0	4	10	2	0	0
08:15 AM -08:30 AM	33	16	47	0	0	3	6	1	0	0
03:00 PM -03:15 PM	24	22	46	0	0	2	16	1	0	0
03:15 PM -03:30 PM	30	15	28	1	0	4	27	1	0	0
03:30 PM -03:45 PM	34	9	36	0	0	1	21	4	0	0
03:45 PM -04:00 PM	24	18	40	0	0	5	22	2	0	0
04:00 PM -04:15 PM	30	12	40	0	0	5	19	7	0	0
04:15 PM -04:30 PM	28	9	32	0	0	2	23	1	0	0
04:30 PM -04:45 PM	22	9	45	0	0	0	24	4	0	0
04:45 PM -05:00 PM	40	9	37	0	0	3	17	2	0	0
05:00 PM -05:15 PM	24	4	28	0	0	2	20	3	0	0
05:15 PM -05:30 PM	25	4	30	0	0	1	17	2	0	0
05:30 PM -05:45 PM	22	3	35	0	0	0	11	1	1	0
05:45 PM -06:00 PM	21	7	33	0	0	1	17	0	0	0

Source: R. M. Towill Corporation

APPENDIX H

Flood Plain Limits and Flood Control Plan for the Waikoloa Highlands Subdivision
R.M. Towill Corporation, September 2006.

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WAIKOLOA HIGHLANDS SUBDIVISION

Waikoloa, Island of Hawaii
TMK: 6-8-02:16, 6-8-03:32
Subdivision No. 89-179
DPW Folder No. 6858

SEPTEMBER 2006

R. M. TOWILL CORPORATION

Prepared For:

Waikoloa Mauka, LLC

420 Waiakamilo Rd., Suite 411
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(808) 842-1133 • Fax: (808) 842-1937
(RMTC Ref: 1-20580-0-5)

R. M. TOWILL CORPORATION

FLOODPLAIN LIMITS AND FLOOD CONTROL PLAN

for the

WAIKOLOA HIGHLANDS SUBDIVISION

September, 2006

Prepared for:

Waikoloa Mauka, LLC

Prepared by:

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420 Waiakamilo Road, Suite 411
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TABLE OF CONTENTS

R. M. TOWILL CORPORATION

APPENDICES

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this study is to update a previous flood analyses report (Reference 1), prepared by R.M. Towill Corporation (RMTC) for the Waikoloa Highlands Subdivision. The analyses will determine the design flows for each Flood Route identified within the project site and size appropriate channels and culverts to pass the design flows. It will also include determining the floodplain limits for the Flood Routes through the project site.

1.2 PROJECT LOCATION AND DESCRIPTION

The project site is located 22 miles northeast of Keahole International Airport in Waikoloa, District of South Kohala, Island of Hawaii (Tax Map Key: Third Division 6-8-02:16, 6-8-03:32). The prpject consists of 744.4 acres located south of Waikoloa Villages, north of Puu Hinai Cinder Cone between Auwaiakeakua Gulch and Waikoloa Road. It consists of grading, construction of roadways and utilities for the purpose of 398 single-family residential lots for Phases 1 and 2 (Figures 1 and 2).

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2 GENERAL AND METHODOLOGY

There is one (1) major stream identified in this study, which is Auwaiakeakua Gulch. The gulch and its sub-tributaries pass south of the project site. A previous flood study conducted by R.M. Towill Corporation (RMTC, Reference 1) indicated that there were nine (9) Flood Routes within the project site (Auwaiakeakua Gulch and 8 tributaries). Figure 3, which is taken from Reference 1, shows the location of each Flood Route.

2.1 HYDROLOGIC CRITERIA AND METHODOLOGY

The RMTC report utilized the regression equation to calculate 100-year storm for the 9 Flood Routes. The regression equation was adopted in the 1995 Hawaii County Flood Insurance Study published by Federal Emergency Management Agency (FEMA, Reference 2). It was intended to incorporate basin and climatological characteristics to determine peak discharge-frequency relationships. Two groups of regression equations were established for windward and leeward areas. Waikoloa Highlands is located at leeward side (Figure 4).

For this study, the regression equation was mainly used to determine the 100-year peak discharges for Flood Routes originated off-site (Flood Routes 1, 3, and 5) and the culverts at roadway crossing. Flood Routes 2, 6, 7, 8, and 9, which originate onsite, are concentration areas contributing to the Auwaiakeakua Gulch (Flood Route 5. They have drainage areas considerably below 100 acres, and are not considered for flood mapping under proposed conditions. Instead, they will be considered as subdivision drainage, which is not the scope of this study.

Hydrologic Criteria

- Flood Mapping, Ditches, Culverts (off-site Flood Routes, area > 100acres)

Method	Regression Equation
Return Interval	100-year
Design Storm Duration	24-hour

Hydrologic Methodology

- Flood Mapping, Ditches, Culverts (off-site Flood Routes, area > 100acres)

$Q_{100} = 34.3\ (DA)^{0.77}\ (P24\text{-}2)^{2.26}$

where:

Q_{100}	=	Peak discharge with 100-year return interval (cfs)
DA	=	Drainage area (mi^2)
P24-2	=	2-year, 24-hour rainfall depth (inches)
	=	3" for Waikoloa Highlands area (Reference 1)

2.2 HYDROLOGIC ANALYSIS

Drainage areas were delineated and interpolated based on the field observation and previous report (Reference 1), and the watershed boundary was digitized on the USGS Quadrangle Map (Figure 5). Runoff quantities were calculated using the regression equation. The final tabulated results of hydrologic analysis were presented in Table 1

Table 1 Hydrologic Analysis Results

Location	Drainage Area (acres)	Q_{100} (cfs)
Flood Route 1		
at Waikoloa Road before entering project site	888	529
at Road "A" crossing	975	567
at d/s project boundary exiting project site	1,023	590
Flood Route 3		
at Waikoloa Road before entering project site	64.4	70
before confluence point with Flood Route 5	136	125
Flood Route 5		
before entering project site	32,217	8,396
before confluence point with Flood Route 3	32,685	8,489
after confluence point with Flood Route 3	32,821	8,516
at d/s project boundary exiting project site	33,314	8,615

2.3 HYDRAULIC CRITERIA AND METHODOLOGY

Hydraulic Criteria

- Culverts sizing

Method	CulvertMaster (Reference 5)
Entrance Type	Headwall
Max. HW/D	1.0 – 1.1
Material	CMP

- Ditches sizing

Method	HEC-RAS FlowMaster (Reference 6)
Flow Regime	Mixed Flow
Boundary Condition	Normal Depth
Manning's n	0.040 for rock channel 0.045 for overbank areas

- Flood Mapping:

Method	HEC-RAS
Flow Regime	Mixed Flow
Boundary Condition	Normal Depth, Known Water Surface Elevation
Manning's n	0.040 for rock channel 0.045 for overbank areas

Hydraulic Methodology

The standard step method, using the Corps of Engineer's hydraulic model HEC-RAS and GIS pre-process tool HEC-GeoRAS to take geometry data, was used to determine the bare floodwater surface elevations and 100-year flood limits.

The mixed flow regime method was in the analysis due to slopes generally observed in the field. As expected of watercourses in Hawaii, majority of the stream segments were under supercritical conditions.

Boundary conditions were determined using the normal depth and known water surface elevation options in HEC-RAS. The normal depth could be entering as energy slope. The energy slope could be approximated by calculating the channel bed slope.

Manning's roughness coefficient, n, was estimated from the Hawaii County's standard and field observation. The Hawaii County's standard suggested values of n between 0.035 to 0.04 for unlined channel with rock ranging from smooth and uniform to jagged and irregular. In this study, values of n for unlined channel and overbank areas were estimated to be 0.04 to 0.045. The higher n value was used to account for rougher surface as observed in the field.

With the given design flows from the hydrologic analysis, HEC-RAS and FlowMaster were utilized to size the ditches. Freeboard was provided for the ditches following the guideline stated in the Hawaii County Drainage Standard. Culverts sizing was performed by using CulvertMaster and entrance control nomograph (Reference 3).

2.4 HYDRAULIC ANALYSIS

With the given geometry and flow data, hydraulic analysis was performed by using the chosen computer programs and nomograph. Ditches and culverts information were presented in Appendex A. HEC-RAS output files and summary were prepared in Appendex B. The 100-year flood boundary was shown in Figure 6. Cross-section labels used in the HEC-RAS analysis was presented in Figure 7.

2.5 FLOODPLAIN MAPPING

The 100-year floodplain boundaries were delineated using the HEC-RAS modeling results. The HEC-RAS model provided water surface elevation and flood limits at each cross section of the stream. The HEC-RAS output files were imported back to HEC-GeoRAS for automatic floodplain delineation. Where there was disconnecting portion of the floodplain from HEC-GeoRAS outputs, the floodplain boundaries were drawn manually using engineer's judgment by checking left and right flood limit at said cross section and connected to downstream flood limits.

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3 EXISTING DRAINAGE CONDITIONS

The nine (9) Flood Routes stated in previous study (Reference 1) that impact the project site are Auwaiakeakua Gulch (Flood Route 5) and its tributaries (Flood Routes 1 to 4, 6 to 8) (see Figure 3). Auwaiakeakua Gulch, originating from the summit of Mauna Kea, flows in a northwest direction, ending up Pacific Ocean.

Auwaiakeakua Gulch passes south of project site and crosses Waikoloa Road further downstream of the project site. The existing topography consists of rolling terrain with flat to moderately steep slopes. Slopes are steep in the upper watershed areas and gradually reduce to flat through the project site. Ground cover primarily consists of low lying brush and scattered Kiawe trees. Flood Routes 1 and 3 originate off-site and enter the project site from east through culverts at Waikoloa Road. Flood Route 4 is located outside of the project site and is upstream of Auwaiakeakua Gulch. Other Flood Routes are minor tributaries originate onsite eventually contribute to Auwaiakeakua Gulch.

4 PROPOSED DRAINAGE PLAN

For this study, the main focus is to prepare a flood control plan for the future development of Waikoloa Highlands. Sizing culverts at the proposed roadway crossing and proposed diversion ditches will be discussed. A brief description of the proposed drainage improvements is summarized as follows:

Ditches:

- Ditch 1:

  Off-site Flood Route 1 enters the project site though existing 2 – 8'-2" x 5'-9" pipe arch culverts at Waikoloa Road. The proposed ditch will route Flood Route 1 flows along Waikoloa Road and pass through Culvert A at the proposed Road "A" crossing. The proposed ditch is 15' wide bottom width with a 2:1 side slope. The excavated ditch is a rock channel with maximum channel slope of 7%, and the design flow (Q_{100}) is 567 cfs. The ditch is designed to meet the requirement specified in the Hawaii County Drainage Standard.

Culverts:

- Culvert A

  Culver A (2-84" CMP) is located at STA. 2+11.33 of Road "A" crossing. The culverts are at the end of Ditch 1 and will pass the design flows to the existing terrain. The design peak discharge, (Q_{100}) calculated using regression equation, is 567 cfs.

- Culvert F (60" CMP) is located at STA. 44+55.64 of Road "A" crossing. The drainage area is part of Flood Route 3, which originates off-site. Flood Route 3 enters the project site through existing 42" CMP at Waikoloa Road. It flows in southwest direction, crossing proposed Road "A" and eventually connects to Flood Route 5 as its triburary. The design peak discharge, (Q_{100}) calculated using regression equation, is 125 cfs.

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5 SUMMARY AND CONCLUSION

To protect the project site from flooding problems, drainage improvements are proposed in this study to accommodate the design flows. This will increase the developable lands in the future Waikoloa Highlands development.

A proposed ditch (Ditch 1) will direct Flood Route 1 flow (567 cfs) along Waikoloa Road to downstream open area. There are 2 culverts (Culvert A and F) proposed at roadway crossing to pass the design 100-year flows to open area. Culvert A (2-84" CMP) is located at the proposed Road "A" crossing to pass Flood Route 1 flow. Culvert F (60" CMP) passes Flood Route 3 flow (125 cfs) at another Road "A" crossing. The proposed drainage improvements will decrease the risk of flooding problems in the Waikoloa Highlands development and are in compliance with current design standard.

6 REFERENCES

1. "Floodway Limits and Flood Control Plan for the Highlands Golf Estate at Waikoloa", R.M. Towill Corporation, 12/1992
2. "Flood Insurance Study for Hawaii County", Federal Emergency Management Agency, 6/2/1995
3. "Storm Drainage Standard", Department of Public Works, County of Hawaii, 10/1970
4. USGS Quadrangle (7.5 Minutes Series, 1:24K): Puu Hinai, Nohonaohae, Makahalau, Keamulu, Ahumoa, and Mauna Kea
5. CulvertMaster v3.1, Bently System, Inc., 12/2005
6. FlowMaster v7.0, Haestad Methods, Inc., 6/2003
7. "HEC-GeoRAS User's Manual", U.S. Army Corps of Engineers, v3.1, 10/2002
8. HEC-RAS v3.1.3, U.S. Army Corps of Engineers, 5/2005

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Appendix A

Culverts and Ditches

Route1 Proposed Channel
8/8/2006, StanfordACH.prj, Plan 4

River Station	Q (cfs)	Inv. Elevr (ft)	WS Elevr (ft)	Depth (ft)	Vel Total (fps)	FB (ft)	Elev Total (ft)	Remark
4255.067	567	1170.86	1172.77	2.11	13.95	2.45	1175.22	STA 20+28.34
4122.012	567	1170.86	1172.45	3.10	8.61	2.31	1173.81	STA 19+13.30
4108.726	567	1167.46	1169.76	2.32	12.45	2.41	1172.19	STA 19+00
4058.730	567	1163.96	1166.00	2.04	14.90	2.46	1168.46	HRC-RAS interpolated XS
4008.734	567	1160.46	1162.82	2.06	14.68	2.46	1165.28	STA 18+00
3908.738	567	1153.46	1155.51	2.05	14.68	2.46	1157.97	STA 17+00
3786.138	567	1143.48	1145.54	2.06	14.43	2.46	1148.00	STA 15+22.39
3631.330	567	1137.68	1140.19	2.51	11.26	2.38	1142.57	STA 14+22.58
3606.754	567	1136.71	1139.13	2.42	11.79	2.40	1141.53	STA 14+00
3506.758	567	1135.31	1137.48	2.17	13.49	2.44	1139.92	STA 13+80
3506.758	567	1129.73	1131.76	2.03	14.69	2.47	1134.23	STA 13+00
3406.757	567	1122.75	1124.82	2.07	14.27	2.45	1127.27	STA 12+00
3188.773	567	1107.40	1109.45	2.05	14.50	2.46	1111.91	STA 9+80
3008.784	567	1103.80	1106.88	3.08	8.67	2.32	1109.20	STA 9+00
2918.786	567	1102.00	1104.78	2.78	9.92	2.35	1107.13	STA 7+10
2898.787	567	1100.80	1103.08	2.28	12.71	2.42	1105.50	STA 6+90
2858.805	567	1098.40	1100.55	2.15	13.64	2.44	1102.99	STA 6+50
2808.793	567	1095.40	1097.55	2.15	13.70	2.44	1099.99	STA 6+00
2758.783	567	1090.60	1092.74	2.14	13.73	2.44	1095.18	STA 5+20
2498.798	567	1086.20	1088.30	2.10	8.64	2.31	1093.61	STA 4+00
2448.798	567	1085.00	1087.74	2.74	10.11	2.35	1090.09	STA 3+90
2453.790	567	1082.85	1084.84	2.00	14.02	2.47	1087.31	HRC-RAS interpolated XS
2408.796	567	1079.70	1081.77	2.07	14.30	2.46	1084.23	STA 2+90
2308.798	567	1072.70	1074.75	2.05	14.49	2.46	1077.21	STA 2+00
2252.798	567	1068.78	1075.84	7.06	2.71	2.13	1077.97	STA 1+90
2234.946	567	1068.68	1075.83	7.15	2.71	2.13	1077.96	STA 1+44
2200								3 - 84" CMP Culverts @ Road "A"
2121.564	567	1068.14	1070.99	2.85	7.99	2.28	1073.27	cls of culvert
2024.821	560	1062.00	1064.23	2.23	14.49	2.47	1066.70	
1975.048	560	1062.00	1064.70	2.70	12.78	2.44	1067.14	
1751.102	560	1042.00	1044.01	2.01	15.66	2.49	1046.50	
1592.063	560	1031.46	1034.46	3.00	12.74	2.48	1036.82	
1503.453	560	1026.00	1028.47	2.47	14.42	2.49	1030.96	
1368.255	560	1020.00	1022.36	2.36	11.91	2.40	1024.76	
1241.424	560	1018.00	1020.12	2.12	6.73	2.22	1022.34	
1058.547	560	1014.00	1016.04	2.04	8.10	2.26	1018.30	
851.962	560	1008.00	1010.80	2.80	8.82	2.31	1013.11	
806.114	560	1004.00	1006.43	2.43	7.27	2.24	1008.67	
441.491	560	1000.00	1002.47	2.47	1.64	2.06	1004.53	flow splits to right over bank
267.898	560	998.00	998.11	1.11	10.17	2.26	1001.37	
177.159	560	995.00	996.37	1.37	4.27	2.12	998.49	
20.877	560	989.77	992.90	3.13	0.98	2.04	994.94	

Culvert at Start of Road A
2-84" CMP, L = 107.83 ft
Slope = 0.5%

Culvert Calculator Report
90806 WH Culvert A Rd A (FR-1)

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	1,076.00 ft	Headwater Depth/Height	0.99
Computed Headwater Elevation	1,075.62 ft	Discharge	567.00 cfs
Inlet Control HW Elev.	1,075.15 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,075.62 ft	Control Type	Outlet Control

Grades			
Upstream Invert	1,068.68 ft	Downstream Invert	1,068.14 ft
Length	107.83 ft	Constructed Slope	0.005008 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	4.43 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	4.43 ft
Velocity Downstream	11.06 ft/s	Critical Slope	0.012714 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	7.00 ft
Section Size	84 inch	Rise	7.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,075.62 ft	Upstream Velocity Head	1.17 ft
Ke	0.20	Entrance Loss	0.23 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,075.15 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	77.0 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
90806 WH Culvert F Rd A (FR-3)

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	1,106.30 ft	Headwater Depth/Height	1.03
Computed Headwater Elevation	1,106.09 ft	Discharge	125.00 cfs
Inlet Control HW Elev.	1,105.63 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,106.09 ft	Control Type	Outlet Control

Grades			
Upstream Invert	1,100.94 ft	Downstream Invert	1,100.42 ft
Length	104.72 ft	Constructed Slope	0.004966 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	3.20 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	3.20 ft
Velocity Downstream	9.43 ft/s	Critical Slope	0.014379 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	5.00 ft
Section Size	60 inch	Rise	5.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	1,106.09 ft	Upstream Velocity Head	0.78 ft
Ke	0.20	Entrance Loss	0.16 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,105.63 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	19.6 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

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Appendix B

HEC-RAS Output

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Appendix B1

Flood Route 1

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Appendix B2

Flood Route 3

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Appendix B3

Flood Route 5

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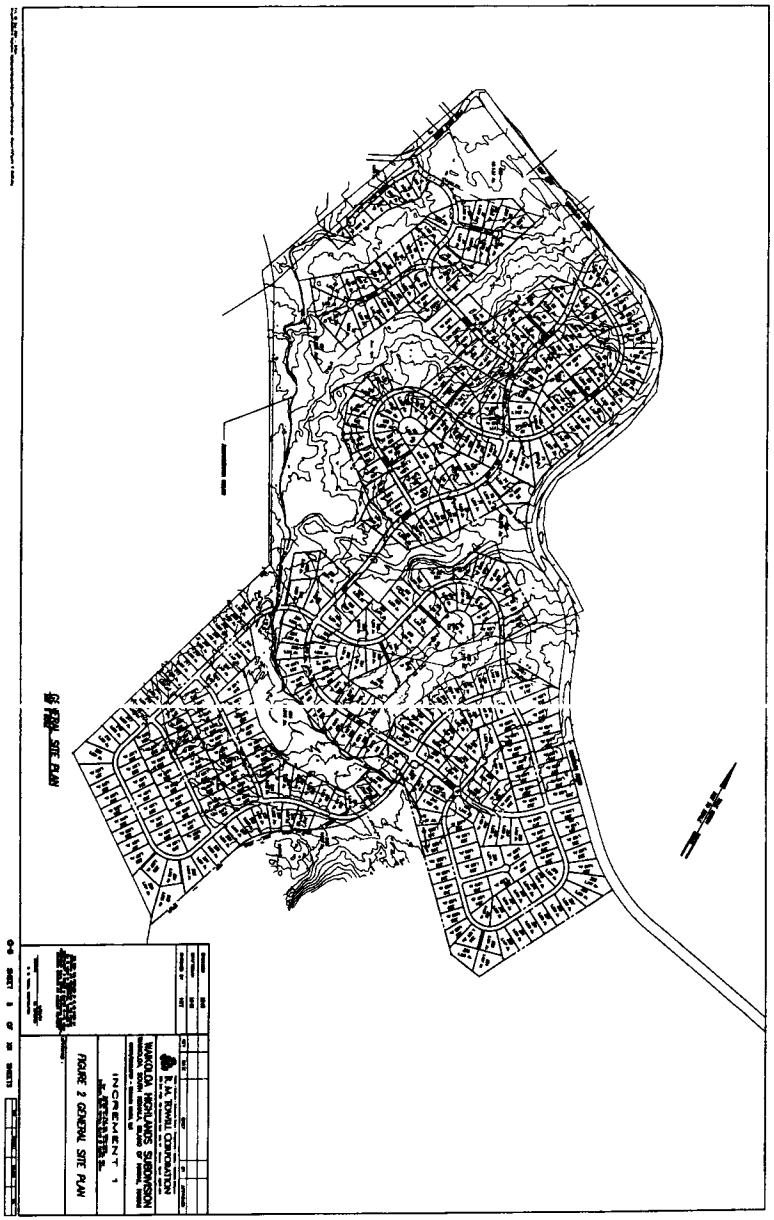
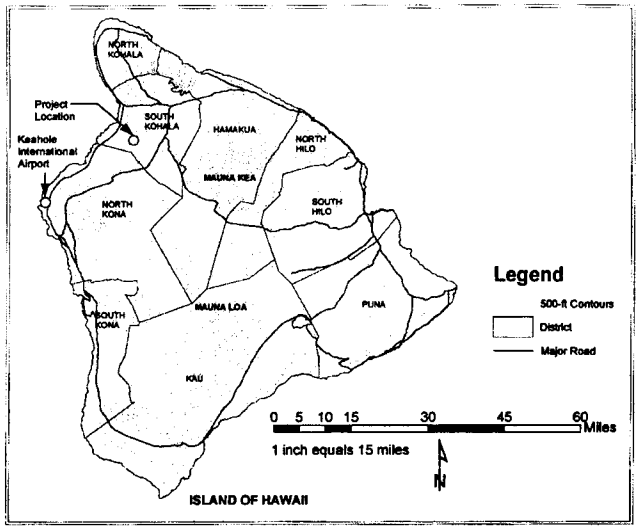
Appendix C

Figures





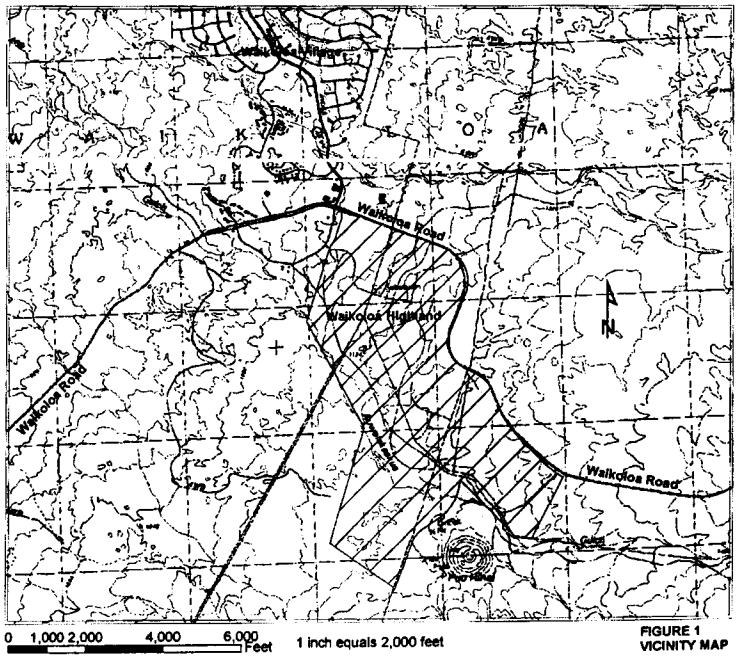
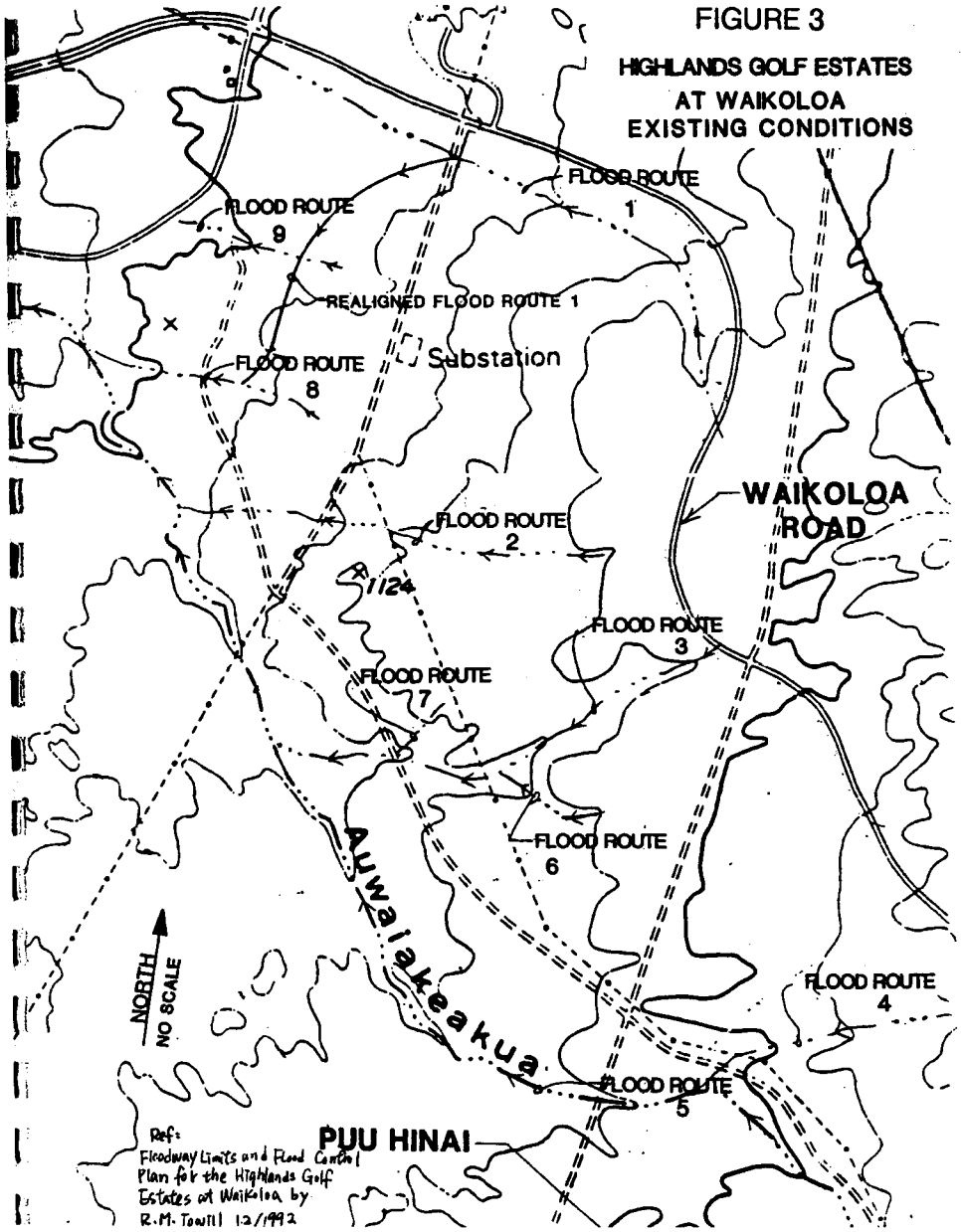


FIGURE 1
VICINITY MAP

FIGURE 3

HIGHLANDS GOLF ESTATES AT WAIKOLOA EXISTING CONDITIONS



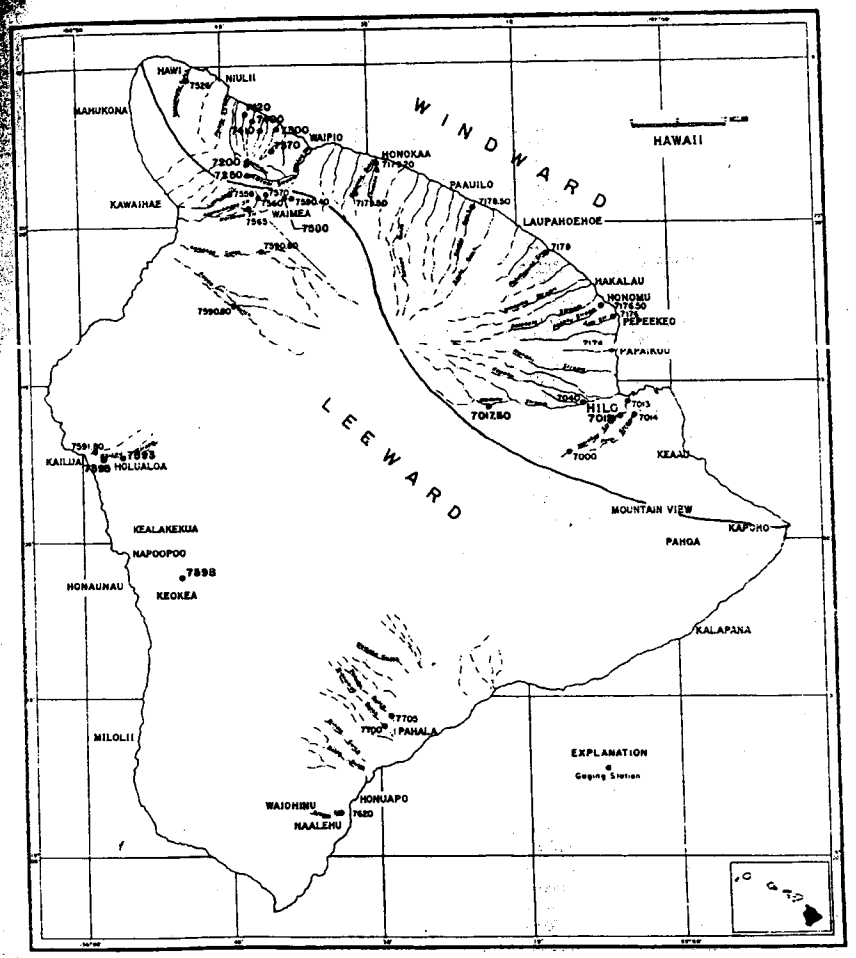


FIGURE 4 REGRESSION EQUATION GROUP

Source:
Hawaii County FIS 1995, FEMA

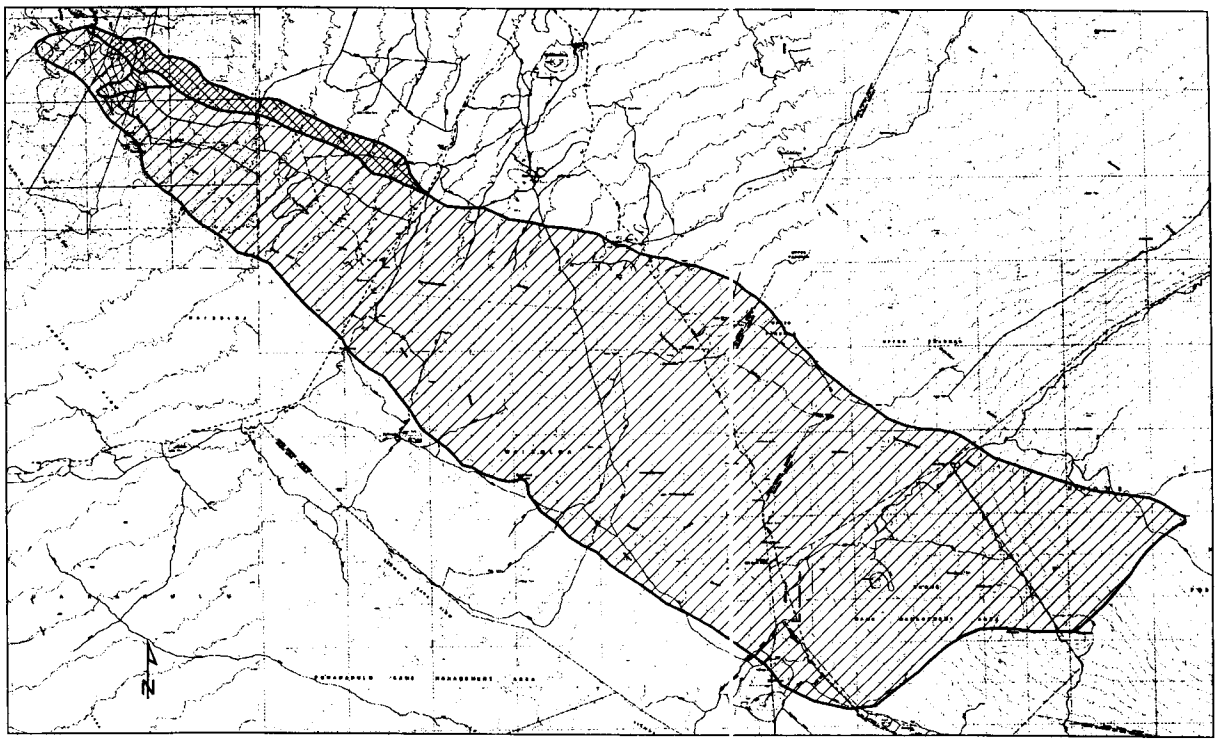
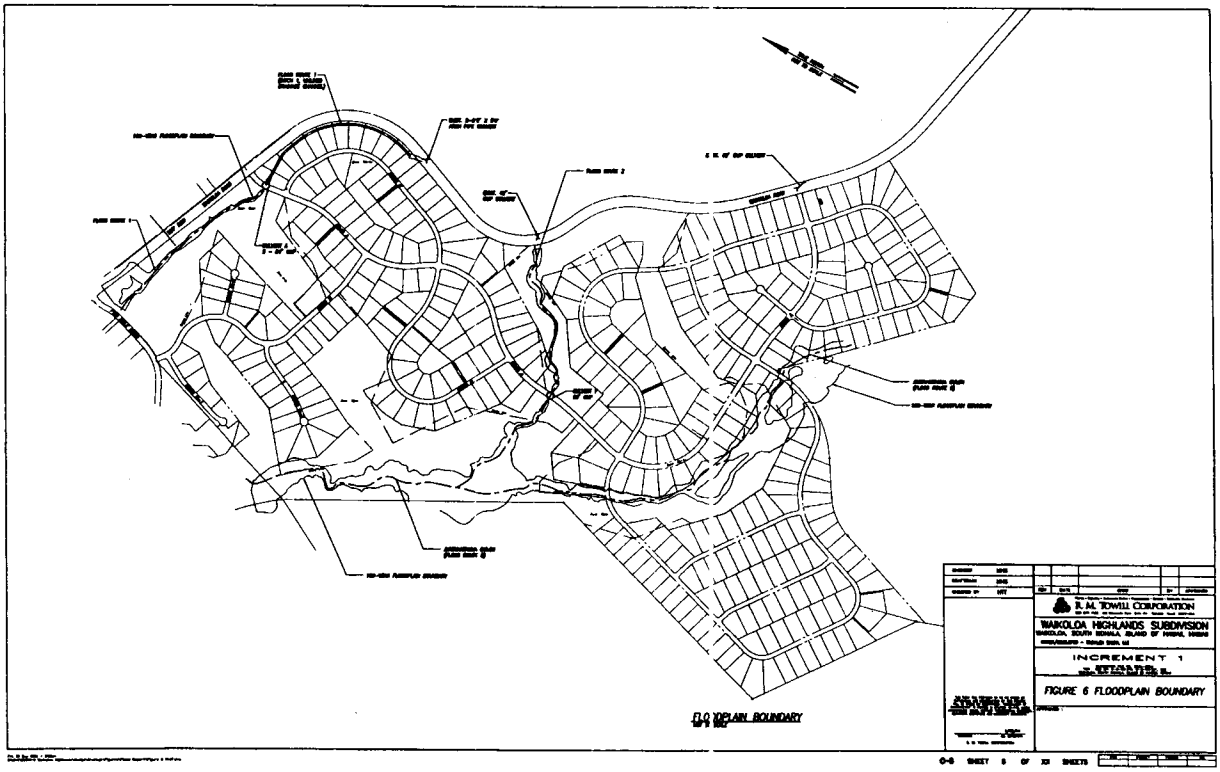
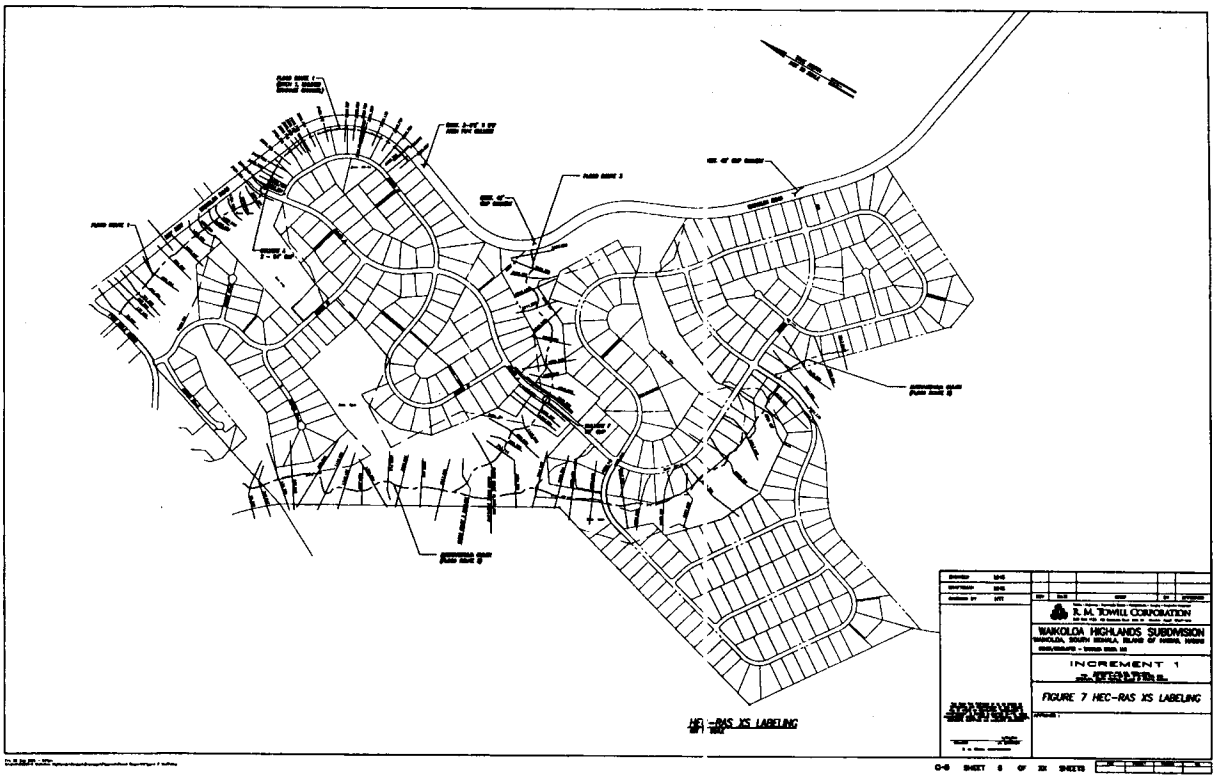


FIGURE 5 WATERSHED MAP





HEC-RAS XS LABELING

R. M. TOWILL CORPORATION

WAIKOLOA HIGHLANDS SUBDIVISION

INCREMENT 1

FIGURE 7 HEC-RAS XS LABELING

C-8 SHEET 8 OF XX SHEETS

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APPENDIX I

Drainage Report for the Waikoloa Highlands Subdivision, Phase 1
R.M. Towill Corporation, September 2006.

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WAIKOLOA HIGHLANDS SUBDIVISION
PHASE 1

Waikoloa, Island of Hawaii
TMK: 6-8-02:16, 6-8-03:32
Subdivision No. 89-179
DPW Folder No. 6858

SEPTEMBER 2006

R. M. TOWILL CORPORATION

Prepared For:

Waikoloa Mauka, LLC

420 Waiakamilo Rd., Suite 411
Honolulu, Hawaii 96817-4941
(808) 842-1133 • Fax: (808) 842-1937
(RMTC Ref: 1-26580-0-S)

R. M. TOWILL CORPORATION

DRAINAGE REPORT for the

WAIKOLOA HIGHLANDS SUBDIVISION, PHASE 1

September, 2006

Prepared for:

Waikoloa Mauka, LLC

Prepared by:

R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

TABLE OF CONTENTS

R. M. TOWILL CORPORATION

APPENDICES

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this study includes a brief description of the existing drainage patterns, proposed drainage improvements, and calculation for local subdivision drainage for the Phase 1 of Waikoloa Highlands Subdivision.

1.2 PROJECT LOCATION AND DESCRIPTION

The project site is located 22 miles northeast of Keahole International Airport in Waikoloa, District of South Kohala, Island of Hawaii (Tax Map Key: Third Division 6-8-02:16, 6-8-03:32). The project consists of 744.4 acres located south of Waikoloa Villages, north of Puu Hinai Cinder Cone between Auwaiakeakua Gulch and Waikoloa Road. Phase 1 is situated in the west portion of the Waikoloa Highlands Subdivision. It consists of grading, construction of roadways and utilities for the purpose of 149 single-family residential lots for Phase 1(Figures 1 and 2).

2 GENERAL AND METHODOLOGY

There is one (1) major stream identified in this study, which is Auwaiakeakua Gulch. The gulch and its sub-tributaries pass south of the project site. A previous drainage study conducted by R.M. Towill Corporation (RMTC, Reference 1) indicated that there were nine (9) Flood Routes within the project site (Auwaiakeakua Gulch and 8 tributaries). Figure 3, which is taken from Reference 1, shows the location of each Flood Route.

2.1 HYDROLOGIC CRITERIA AND METHODOLOGY

The RMTC report utilized the regression equation to calculate 100-year storm for the 9 flood routes. The regression equation was adopted in the 1995 Hawaii County Flood Insurance Study published by Federal Emergency Management Agency (FEMA, Reference 2). It was intended to incorporate basin and climatological characteristics to determine peak discharge-frequency relationships. Two groups of regression equations were established for windward and leeward areas. Waikoloa Highlands is located at leeward side (Figure 4).

For this study, the regression equation was mainly used to determine the 100-year peak discharges for culverts located at flood routes originated off-site. For culverts located at onsite flood routes and roadway drywells, the rational method was used to determine runoff quantities per County of Hawaii Storm Drainage Standard (Reference 3).

Hydrologic Criteria

- Culverts (off-site flood routes, area > 100acres):

Method	Regression Equation
Return Interval	100-year
Design Storm Duration	24-hour

- Culverts (onsite flood routes, area <100 acres):

Method	Rational Method
Return Interval	50-year
Design Storm Duration	1-hour

- Drywells:

Method	Rational Method
Return Interval	10-year
Design Storm Duration	1-hour
Maximum Capacity	6 cfs per drywell

Hydrologic Methodology

- Culverts (off-site flood routes):

$Q_{100} = 34.3\ (DA)^{0.77}\ (P24\text{-}2)^{2.26}$

where:

Q_{100}	=	Peak discharge with 100-year return interval (cfs)
DA	=	Drainage area (mi^2)
P24-2	=	2-year, 24-hour rainfall depth (inches)
	=	3" for Waikoloa Highlands area (Reference 1)

- Culverts (onsite flood routes) and Drywells:

$Q = C\ I\ A$

where:

Q	=	Flow rate (cfs)
C	=	Runoff coefficient (Reference 3 and Appendix B)
I	=	Rainfall intensity (in/hour) (Reference 3)
A	=	Drainage area (acres)

2.2 HYDRAULIC CRITERIA AND METHODOLOGY

Hydraulic Criteria and Methodology

- Culverts sizing

Method	CulvertMaster (Reference 5)
Entrance Type	Headwall
Max. HW/D	1.0 – 1.1
Material	CMP

3 EXISTING DRAINAGE CONDITIONS

The nine (9) Flood Routes stated in previous study (Reference 1) that impact the project site are Auwaiakeakua Gulch (Flood Route 5) and its tributaries (Flood Routes 1 to 4, 6 to 8) (see Figure 3). Auwaiakeakua Gulch, originating from the summit of Mauna Kea, flows in a northwest direction, ending up Pacific Ocean.

Auwaiakeakua Gulch passes south of project site and crosses Waikoloa Road further downstream of the project site. The existing topography consists of rolling terrain with flat to moderately steep slopes. Slopes are steep in the upper watershed areas and gradually reduce to flat through the project site. Ground cover primarily consists of low lying brush and scattered Kiawe trees. Flood Routes 1 and 3 originate off-site and enter the project site from east through culverts at Waikoloa Road. Flood Route 4 is located outside of the project site and is upstream of Auwaiakeakua Gulch. Other Flood Routes are minor tributaries originate onsite to eventually contribute to Auwaiakeakua Gulch.

4 PROPOSED DRAINAGE PLAN

For this study, the main focus is to size culverts at the proposed roadway crossing and determine the number of drywells required to be installed at Phase 1 of the project site. The onsite drainage area map was prepared and shown in Figure 5. The tabulated summaries of runoff quantities for culverts and drywells were presented in Appendices A and B. A brief description of the proposed drainage improvements is summarized as follows:

Culverts:

- Culvert A (2-84" CMP) is located at STA. 2+11.33 of Road "A" crossing. The drainage area is part of Flood Route 1, which originates off-site. The design peak discharge, (Q_{100}) calculated using the regression equation, is 567 cfs.

- Culvert B (30" CMP) is located at STA. 40+70.07 of Road "C" crossing. Culvert B is designed to pass onsite runoff generated by 50-year, 1-hour storm. The design peak discharge, calculated using the rational method, is 19.00 cfs.

- Culvert C (30" CMP) is located at STA. 4+96.19 of Road "B-3" crossing. Culvert C is designed to pass onsite runoff generated by 50-year, 1-hour storm. The design peak discharge, calculated using the rational method, is 16.34 cfs.

- Culvert D (30" CMP) is located at STA. 20+50.69 of Road "B" crossing. Culvert D is designed to pass onsite runoff generated by 50-year, 1-hour storm. The design peak discharge, calculated using the rational method, is 20.50 cfs.

- Culvert E (36" CMP) is located at STA. 2+30 of Road "B-1" crossing. Culvert E is designed to pass onsite runoff generated by 50-year, 1-hour storm. The design peak discharge, calculated using the rational method, is 35.05 cfs.

- Culvert F (60" CMP) is located at STA. 44+55.64 of Road "A" crossing. The drainage area is part of Flood Route 3, which originates off-site. The design peak discharge, (Q_{100}) calculated using the regression equation, is 125 cfs.

Drywells:

There are thirty-five (35) drywells proposed to be installed in road swales throughout the entire Phase 1 of the project site. The proposed will provide sufficient capacity foe the new development (Appendix B). They are designed for onsite runoff generated by 10-year, 1-year storm with maximum capacity of 6 cfs per drywell.

5 SUMMARY AND CONCLUSION

To protect the project site from flooding problems, drainage improvements are proposed in this study to accommodate the design flows. This will increase the developable lands in the Phase 1 of Waikoloa Highlands Subdivision development.

There are 6 culverts (Culvert A, B, C, D, E, and F) proposed at roadway crossing to pass the design flows to open area. Drywells will be installed in road swale s to take care of onsite runoff. Total number of drywells expected to be installed is 35. The proposed drainage improvements will decrease the risk of flooding problems in the Phase 1 of Waikoloa Highlands Subdivision development and are in compliance with current design standard.

6 REFERENCES

1. "Floodway Limits and Flood Control Plan for the Highlands Golf Estate at Waikoloa", R.M. Towill Corporation, 12/1992

2. "Flood Insurance Study for Hawaii County", Federal Emergency Management Agency, 6/2/1995

3. "Storm Drainage Standard", Department of Public Works, County of Hawaii, 10/1970

4. USGS Quadrangle (7.5 Minutes Series, 1:24K): Puu Hinai

5. CulvertMaster v3.1, Bentley Systems, Inc., 12/2005

R. M. TOWILL CORPORATION

Appendix A

Culverts

Culvert Calculator Report
90806 WH Culvert A Rd A (FR-1)

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	1,076.00 ft	Headwater Depth/Height	0.99
Computed Headwater Elevation	1,075.62 ft	Discharge	567.00 cfs
Inlet Control HW Elev.	1,075.15 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,075.62 ft	Control Type	Outlet Control

Grades			
Upstream Invert	1,068.68 ft	Downstream Invert	1,068.14 ft
Length	107.83 ft	Constructed Slope	0.005008 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	4.43 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	4.43 ft
Velocity Downstream	11.06 ft/s	Critical Slope	0.012714 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	7.00 ft
Section Size	84 inch	Rise	7.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,075.62 ft	Upstream Velocity Head	1.17 ft
Ke	0.20	Entrance Loss	0.23 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,075.15 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	77.0 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
90806 WH Culvert B Rd C

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	1,098.50 ft	Headwater Depth/Height	0.98
Computed Headwater Elevation	1,098.15 ft	Discharge	19.00 cfs
Inlet Control HW Elev.	1,097.82 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,098.15 ft	Control Type	Outlet Control

Grades			
Upstream Invert	1,095.69 ft	Downstream Invert	1,095.29 ft
Length	80.75 ft	Constructed Slope	0.004954 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	1.48 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.48 ft
Velocity Downstream	6.29 ft/s	Critical Slope	0.016948 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	1,098.15 ft	Upstream Velocity Head	0.29 ft
Ke	0.20	Entrance Loss	0.06 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,097.82 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	4.9 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
90806 WH Culvert C Rd B-3

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	1,036.10 ft	Headwater Depth/Height	0.97
Computed Headwater Elevation	1,036.03 ft	Discharge	16.34 cfs
Inlet Control HW Elev.	1,035.77 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,036.03 ft	Control Type	Entrance Control

Grades			
Upstream Invert	1,033.62 ft	Downstream Invert	1,031.97 ft
Length	82.54 ft	Constructed Slope	0.019990 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.28 ft
Slope Type	Steep	Normal Depth	1.28 ft
Flow Regime	Supercritical	Critical Depth	1.37 ft
Velocity Downstream	6.46 ft/s	Critical Slope	0.016114 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	1,036.03 ft	Upstream Velocity Head	0.55 ft
Ke	0.90	Entrance Loss	0.50 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,035.77 ft	Flow Control	Unsubmerged
Inlet Type	Projecting	Area Full	4.9 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Culvert Calculator Report
90806 WH Culvert D Rd B

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	1,015.70 ft	Headwater Depth/Height	0.93
Computed Headwater Elevation	1,015.57 ft	Discharge	20.50 cfs
Inlet Control HW Elev.	1,015.48 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,015.57 ft	Control Type	Entrance Control

Grades			
Upstream Invert	1,013.25 ft	Downstream Invert	1,011.17 ft
Length	104.04 ft	Constructed Slope	0.019992 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.47 ft
Slope Type	Steep	Normal Depth	1.47 ft
Flow Regime	Supercritical	Critical Depth	1.54 ft
Velocity Downstream	6.82 ft/s	Critical Slope	0.017487 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	1,015.57 ft	Upstream Velocity Head	0.65 ft
Ke	0.20	Entrance Loss	0.13 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,015.48 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	4.9 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
90806 WH Culvert E Rd B-1

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	986.00 ft	Headwater Depth/Height	1.00
Computed Headwater Elevation	985.78 ft	Discharge	35.05 cfs
Inlet Control HW Elev.	985.60 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	985.78 ft	Control Type	Outlet Control

Grades			
Upstream Invert	982.78 ft	Downstream Invert	981.75 ft
Length	102.73 ft	Constructed Slope	0.010026 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	1.92 ft
Slope Type	Mild	Normal Depth	2.38 ft
Flow Regime	Subcritical	Critical Depth	1.92 ft
Velocity Downstream	7.32 ft/s	Critical Slope	0.017093 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	985.78 ft	Upstream Velocity Head	0.54 ft
Ke	0.20	Entrance Loss	0.11 ft

Inlet Control Properties			
Inlet Control HW Elev.	985.60 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	7.1 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
90806 WH Culvert F Rd A (FR-3)

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	1,106.30 ft	Headwater Depth/Height	1.03
Computed Headwater Elevation	1,106.09 ft	Discharge	125.00 cfs
Inlet Control HW Elev.	1,105.63 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,106.09 ft	Control Type	Outlet Control

Grades			
Upstream Invert	1,100.94 ft	Downstream Invert	1,100.42 ft
Length	104.72 ft	Constructed Slope	0.004966 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	3.20 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	3.20 ft
Velocity Downstream	9.43 ft/s	Critical Slope	0.014379 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	5.00 ft
Section Size	60 inch	Rise	5.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	1,106.09 ft	Upstream Velocity Head	0.78 ft
Ke	0.20	Entrance Loss	0.16 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,105.63 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	19.6 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

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Appendix B

Drywells

Roadway Drainage Calculations (10-year storm, Rational Method, Drywells): Post-Development

Roadway Basin ID	Total Area (ac)	Lot Area (ac)	Roadway Area (ac)	Existing Land Area (ac)	Weighted Lot C	Roadway C	Existing Land C	Final Weighted C	Original I (Plate 1) T_M (in/hr)	Length (ft)	Slope (ft/ft)	Ground Type	Tc (min)	Adjusted I (Plate 4) (in/hr)	Q_{10} (cfs)
1	0.30	0.00	0.30	0.00	0.39	0.95	0.28	0.95	1.5	360	7.2%	paved	5.0	3.90	1.12
2	1.16	0.06	1.10	0.00	0.39	0.95	0.28	0.92	1.5	1770	5.5%	paved	10.0	3.10	3.30
3	2.65	1.90	0.75	0.00	0.39	0.95	0.28	0.55	1.5	1015	7.6%	avg grass	24.0	2.29	3.33
4	4.70	4.59	0.11	0.00	0.39	0.95	0.28	0.40	1.5	1110	7.6%	avg grass	24.0	2.29	4.31
5	5.19	4.75	0.44	0.00	0.39	0.95	0.28	0.44	1.5	1375	6.3%	avg grass	30.0	2.05	4.68
6	4.59	4.28	0.31	0.00	0.39	0.95	0.28	0.43	1.5	920	8.4%	avg grass	30.0	2.29	4.52
7	0.53	0.08	0.45	0.00	0.39	0.95	0.28	0.87	1.5	645	2.9%	paved	7.5	3.50	1.60
8	10.66	10.30	0.28	0.08	0.39	0.95	0.28	0.40	1.5	1425	2.2%	avg grass	35.0	1.96	8.36
9	3.68	3.09	0.29	0.31	0.39	0.95	0.28	0.42	1.5	690	4.1%	avg grass	24.0	2.29	3.54
10	4.80	3.96	0.85	0.00	0.39	0.95	0.28	0.49	1.5	945	3.2%	avg grass	31.0	1.93	4.54
										440	5.7%	paved	5.5		
11	0.55	0.00	0.55	0.00	0.39	0.95	0.28	0.95	1.5	395	1.5%	paved	10.0	3.61	1.90
12	2.71	2.07	0.65	0.00	0.39	0.95	0.28	0.52	1.5	630	3.7%	avg grass	26.0	2.02	2.85
										275	2.5%	paved	5.5		
13	2.28	1.04	1.24	0.00	0.39	0.95	0.28	0.69	1.5	1275	5.1%	paved	9.0	3.26	5.13
14	2.38	0.56	1.83	0.00	0.39	0.95	0.28	0.82	1.5	1650	2.2%	paved	12.0	2.97	5.81
15	2.76	2.46	0.31	0.00	0.39	0.95	0.28	0.45	1.5	615	6.2%	avg grass	21.0	2.41	3.00
16	0.79	0.03	0.76	0.00	0.39	0.95	0.28	0.93	1.5	580	5.2%	paved	6.5	3.63	2.65
17	2.29	1.76	0.53	0.00	0.39	0.95	0.28	0.62	1.5	460	2.6%	paved	6.8	2.37	2.82
										170	2.4%	avg grass	15.5		
18	4.93	4.47	0.46	0.00	0.39	0.95	0.28	0.44	1.5	795	5.9%	avg grass	22.0	2.37	5.14
19	4.83	4.57	0.25	0.00	0.39	0.95	0.28	0.42	1.5	725	6.6%	avg grass	23.0	2.33	4.72
20	0.28	0.02	0.26	0.00	0.39	0.95	0.28	0.91	1.5	285	2.1%	paved	5.5	3.82	0.96
21	0.92	0.07	0.84	0.00	0.39	0.95	0.28	0.91	1.5	1130	6.3%	paved	8.0	3.42	2.85
22	5.11	4.94	0.17	0.00	0.39	0.95	0.28	0.41	1.5	800	4.4%	avg grass	27.0	2.01	4.21
										215	2.5%	paved	5.0		
23	11.05	9.90	1.15	0.00	0.39	0.95	0.28	0.45	1.5	1466	7.4%	avg grass	29.0	2.09	10.39
24	1.39	0.77	0.62	0.00	0.39	0.95	0.28	0.64	1.5	570	2.8%	paved	7.0	3.58	3.19
25	3.50	2.94	0.00	0.55	0.39	0.95	0.28	0.37	1.5	670	5.4%	avg grass	23.0	2.33	3.01
26	0.47	0.00	0.47	0.00	0.39	0.95	0.28	0.95	1.5	450	2.2%	paved	6.5	3.63	1.61
27	2.11	0.47	1.64	0.00	0.39	0.95	0.28	0.83	1.5	2265	5.3%	paved	12.0	2.97	5.20
28	0.34	0.00	0.34	0.00	0.39	0.95	0.28	0.95	1.5	350	6.6%	paved	5.0	3.90	1.25
29	1.32	0.07	1.25	0.00	0.39	0.95	0.28	0.92	1.5	1520	4.1%	paved	10.0	3.10	3.77
30	0.60	0.00	0.60	0.00	0.39	0.95	0.28	0.95	1.5	825	3.3%	paved	8.5	3.34	1.89
31	0.83	0.00	0.66	0.17	0.39	0.95	0.28	0.81	1.5	965	3.3%	paved	9.0	3.34	2.24
32	1.88	1.15	0.32	0.41	0.39	0.95	0.28	0.46	1.5	595	3.2%	avg grass	25.0	2.25	1.95
33	7.82	4.82	0.13	2.87	0.39	0.95	0.28	0.36	1.5	1400	8.3%	avg grass	29.0	2.09	5.89
34	0.86	0.40	0.21	0.25	0.39	0.95	0.28	0.49	1.5	510	2.4%	avg grass	24.0	2.29	0.96
35	0.08	0.00	0.08	0.00	0.39	0.95	0.28	0.95	1.5	100	2.0%	paved	5.0	3.90	0.29
															174.54

Maximum capacity per drywell = 6 cfs

Roadway Drainage Calculations (10-year storm, Rational Method, Drywells): Pre-Development

Roadway Basin ID	Total Area (ac)	Lot Area (ac)	*Roadway Area (ac)	Existing Land Area (ac)	*Weighted Lot C	*Roadway C	Existing Land C	*Final Weighted C	Original I (Plate 1) T_M (in/hr)	Length (ft)	Slope (ft/ft)	Ground Type	Tc (min)	Adjusted I (Plate 4) (in/hr)	Q_{10} (cfs)
1	0.30	0.00	0.30	0.00	0.28	0.28	0.28	0.28	1.5	360	7.2%	avg grass	16.0	2.71	0.23
2	1.16	0.06	1.10	0.00	0.28	0.28	0.28	0.28	1.5	1770	5.5%	avg grass	33.0	2.00	0.65
3	2.65	1.90	0.75	0.00	0.28	0.28	0.28	0.28	1.5	1015	7.6%	avg grass	24.0	2.29	1.70
4	4.70	4.59	0.11	0.00	0.28	0.28	0.28	0.28	1.5	1110	7.6%	avg grass	24.0	2.29	3.01
5	5.19	4.75	0.44	0.00	0.28	0.28	0.28	0.28	1.5	1375	6.3%	avg grass	30.0	2.05	2.98
6	4.59	4.28	0.31	0.00	0.28	0.28	0.28	0.28	1.5	920	8.4%	avg grass	30.0	2.29	2.94
7	0.53	0.08	0.45	0.00	0.28	0.28	0.28	0.28	1.5	645	2.9%	avg grass	26.0	2.21	0.33
8	10.66	10.30	0.28	0.08	0.28	0.28	0.28	0.28	1.5	1425	2.2%	avg grass	35.0	1.96	5.85
9	3.68	3.09	0.29	0.31	0.28	0.28	0.28	0.28	1.5	690	4.1%	avg grass	24.0	2.29	2.36
10	4.80	3.96	0.85	0.00	0.28	0.28	0.28	0.28	1.5	945	3.2%	avg grass	31.0	1.68	2.26
										440	5.7%	avg grass	19.0		
11	0.55	0.00	0.55	0.00	0.28	0.28	0.28	0.28	1.5	395	1.5%	avg grass	24.0	2.29	0.36
12	2.71	2.07	0.65	0.00	0.28	0.28	0.28	0.28	1.5	630	3.7%	avg grass	26.0	1.79	1.36
										275	2.5%	avg grass	18.0		
13	2.28	1.04	1.24	0.00	0.28	0.28	0.28	0.28	1.5	1275	5.1%	avg grass	30.0	2.05	1.31
14	2.38	0.56	1.83	0.00	0.28	0.28	0.28	0.28	1.5	1650	2.2%	avg grass	39.0	1.89	1.26
15	2.76	2.46	0.31	0.00	0.28	0.28	0.28	0.28	1.5	615	6.2%	avg grass	21.0	2.41	1.87
16	0.79	0.03	0.76	0.00	0.28	0.28	0.28	0.28	1.5	580	5.2%	avg grass	21.0	2.41	0.53
17	2.29	1.76	0.53	0.00	0.28	0.28	0.28	0.28	1.5	460	2.6%	avg grass	23.0	1.90	1.22
										170	2.4%	avg grass	15.5		
18	4.93	4.47	0.46	0.00	0.28	0.28	0.28	0.28	1.5	795	5.9%	avg grass	22.0	2.37	3.27
19	4.83	4.57	0.25	0.00	0.28	0.28	0.28	0.28	1.5	725	6.6%	avg grass	23.0	2.33	3.15
20	0.28	0.02	0.26	0.00	0.28	0.28	0.28	0.28	1.5	285	2.1%	avg grass	16.0	2.58	0.20
21	0.92	0.07	0.84	0.00	0.28	0.28	0.28	0.28	1.5	1130	6.3%	avg grass	27.0	2.17	0.56
22	5.11	4.94	0.17	0.00	0.28	0.28	0.28	0.28	1.5	800	4.4%	avg grass	27.0	1.79	2.56
										215	2.5%	avg grass	17.0		
23	11.05	9.90	1.15	0.00	0.28	0.28	0.28	0.28	1.5	1466	7.4%	avg grass	29.0	2.09	6.47
24	1.39	0.77	0.62	0.00	0.28	0.28	0.28	0.28	1.5	570	2.8%	avg grass	24.0	2.29	0.89
25	3.50	2.94	0.00	0.55	0.28	0.28	0.28	0.28	1.5	670	5.4%	avg grass	23.0	2.33	2.28
26	0.47	0.00	0.47	0.00	0.28	0.28	0.28	0.28	1.5	450	2.2%	avg grass	23.0	2.33	0.30
27	2.11	0.47	1.64	0.00	0.28	0.28	0.28	0.28	1.5	2265	5.3%	avg grass	39.0	1.89	1.12
28	0.34	0.00	0.34	0.00	0.28	0.28	0.28	0.28	1.5	350	6.6%	avg grass	17.0	2.65	0.25
29	1.32	0.07	1.25	0.00	0.28	0.28	0.28	0.28	1.5	1520	4.1%	avg grass	35.0	1.96	0.73
30	0.60	0.00	0.60	0.00	0.28	0.28	0.28	0.28	1.5	825	3.3%	avg grass	28.0	2.13	0.36
31	0.83	0.00	0.66	0.17	0.28	0.28	0.28	0.28	1.5	965	3.3%	avg grass	30.0	2.05	0.47
32	1.88	1.15	0.32	0.41	0.28	0.28	0.28	0.28	1.5	595	3.2%	avg grass	25.0	2.25	1.18
33	7.82	4.82	0.13	2.87	0.28	0.28	0.28	0.28	1.5	1400	8.3%	avg grass	29.0	2.09	4.58
34	0.86	0.40	0.21	0.25	0.28	0.28	0.28	0.28	1.5	510	2.4%	avg grass	24.0	2.29	0.55
35	0.08	0.00	0.08	0.00	0.28	0.28	0.28	0.28	1.5	100	2.0%	avg grass	12.5	2.94	0.07
															103.45

Maximum capacity per drywell = 6 cfs

* all roadway and lot areas are considered as existing condition since this is pre-development

Roadway Drainage Calculations (50-year storm, Rational Method, Culverts)

Roadway	Total	Lot	Roadway	Existing	Weighted		Existing	Final	Original					Adjusted	
Basin	Area	Area	Area	Land Area	Lot	Roadway	Land	Weighted	I (Plate 1)	Length	Slope	Ground	Tc	I (Plate 4)	Q_{50}
ID	(ac)	(ac)	(ac)	(ac)	C	C	C	C	T_M (in/hr)	(ft)	(ft/ft)	Type	(min)	(in/hr)	(cfs)
*A (note 1)	15.18	15.18	0.00	0.00	0.39	0.95	0.28	0.39	2.0	2000	6.1%	avg grass	33.0	2.72	16.11
B	17.71	17.71	0.00	0.00	0.39	0.95	0.28	0.39	2.0	1535	4.3%	avg grass	32.0	2.75	19.00
C	18.75	9.37	0.00	9.38	0.39	0.95	0.28	0.33	2.0	1750	6.4%	avg grass	36.0	2.64	16.34
D	20.71	14.57	0.00	6.14	0.39	0.95	0.28	0.36	2.0	1950	6.7%	avg grass	32.0	2.75	20.50
*E (note 3)	14.59	9.06	0.00	5.53	0.39	0.95	0.28	0.35	2.0	1190	4.7%	avg grass	29.0	2.85	14.55
*F (note 2)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Note

*1 Onsite Basin A is part of Flood Roue 1, which originates off-site. Thus, the runoff quantity is calculated using the regression equation for Q100 = 567 cfs, 2-84" CMP
Drainage area at Road "A" crossing = 975 ac

*2 Onsite Basin F is part of Flood Roue 3, which originates off-site. Thus, the runoff quantity is calculated using the regression equation for Q100 = 125 cfs, 60" CMP
Drainage area before confluence point with Flood Route 5 = 136 ac

*3 Upstream area of Basin E is Basin D. The final runoff quantity for Culvert E is 20.50+14.55 = 35.05 cfs

For a typical lot in this study, the land use types are consisted of house pad, landscale, and existing land.

Assumption:
1. Typical lot = 1 acre = 43560 sf
2. 50% of the lot remains as existing condition, 50% of the lot is used for mass grading
3. Maximum house pad = 4500 sf, remaining portion is used for landscape...etc
4. Runoff coefficient for various land use types:

Existing land runoff coefficient

Watershed Characteristics	Description	Values
Infiltration	Medium	0.07
Relief	Rolling (5-15%)	0.03
Vegetal Cover	Good (10-50%)	0.03
Development Type	Agricultural	0.15
Total		0.28

Land Use Type	C
Existing Land	0.28
House Pad	0.90
Landscape	0.40
Paved Roadways	0.95

Weighted C for typical 1 acre lot

Total Lot Area =	43,560	sf	
Existing Land Area	21,780	sf	(50%)
House pad =	4,500	sf	(50%)
Landscape area =	17,280	sf	

$$\text{Weighted C} = \frac{(21780 \times 0.28) + (4500 \times 0.9) + (17280 \times 0.4)}{43560}$$

Weighted C= **0.39**

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Appendix C

Figures

FIGURE 1
VICINITY MAP

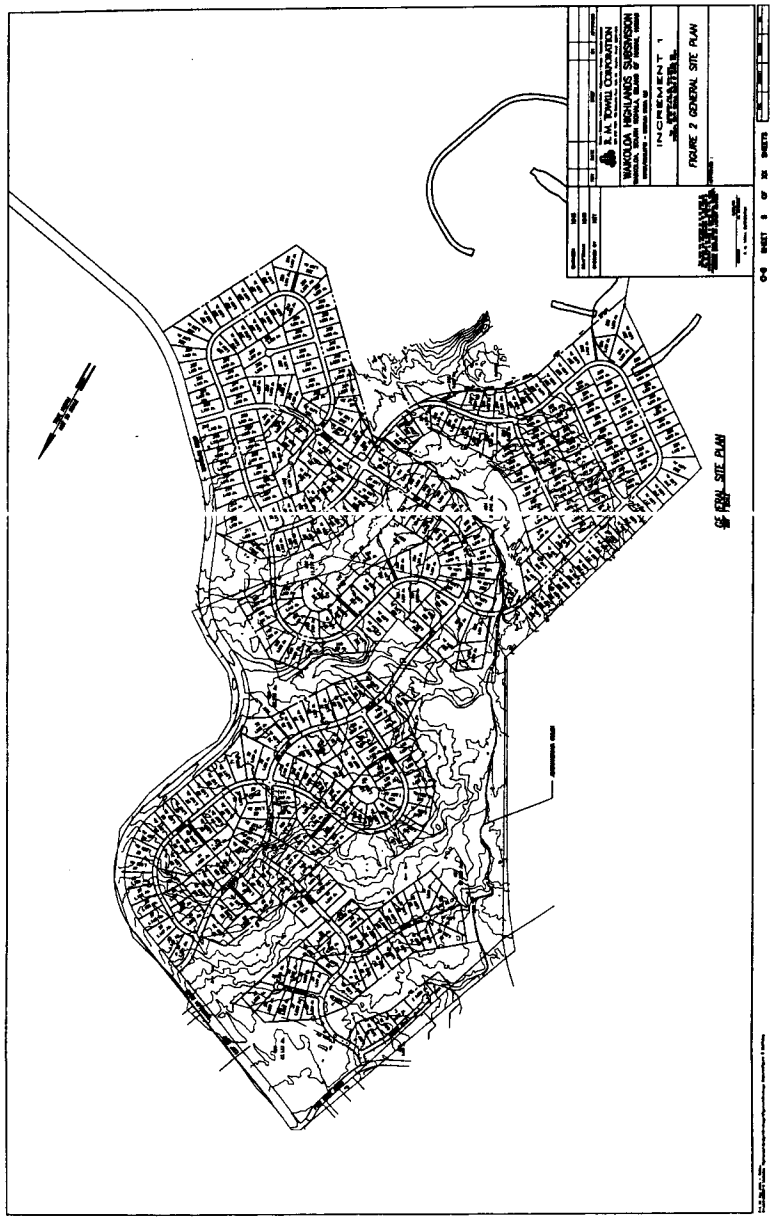
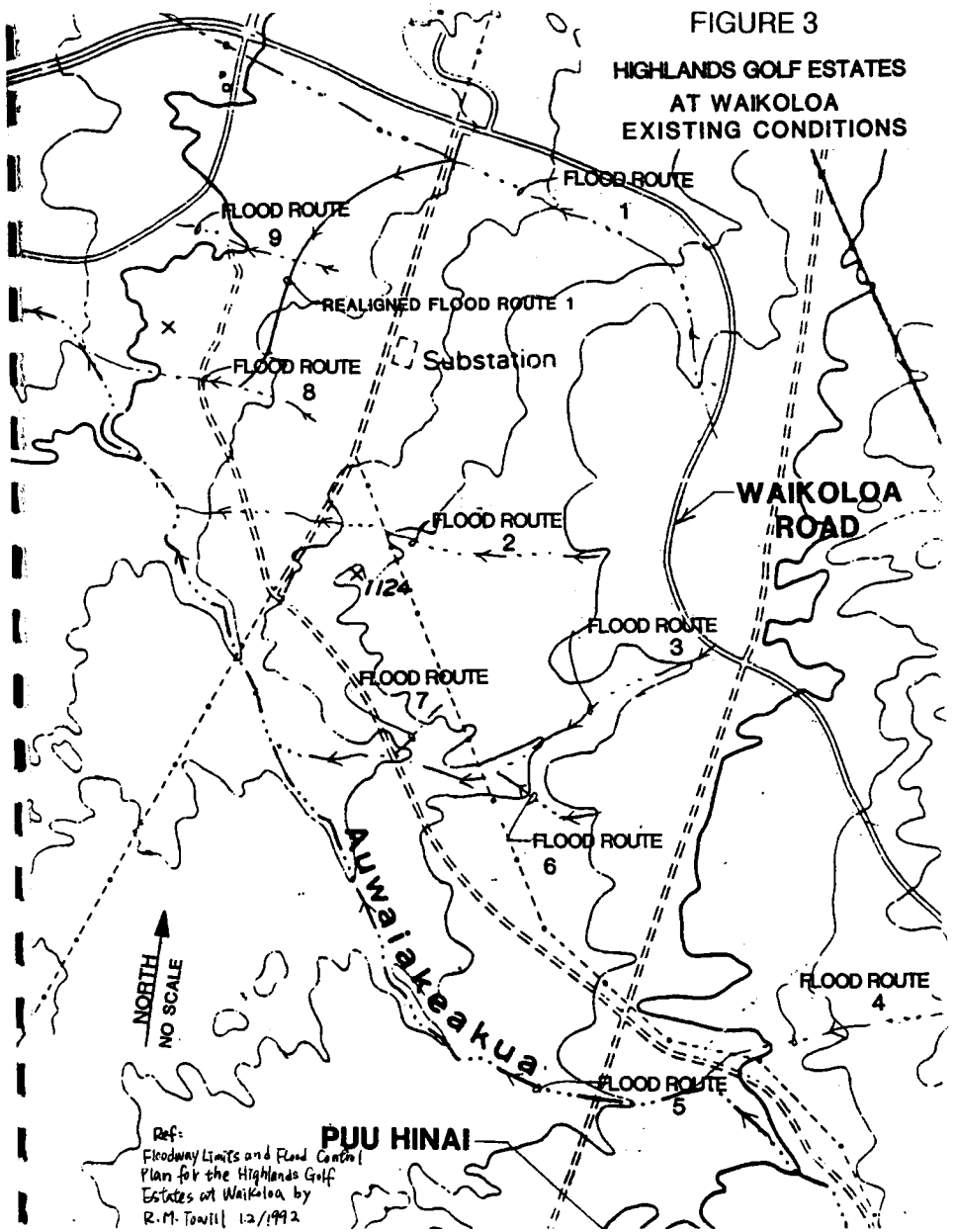


FIGURE 3

HIGHLANDS GOLF ESTATES
AT WAIKOLOA
EXISTING CONDITIONS



Ref:
Floodway Limits and Flood Control Plan for the Highlands Golf Estates at Waikoloa by R.M. Towill 12/1992

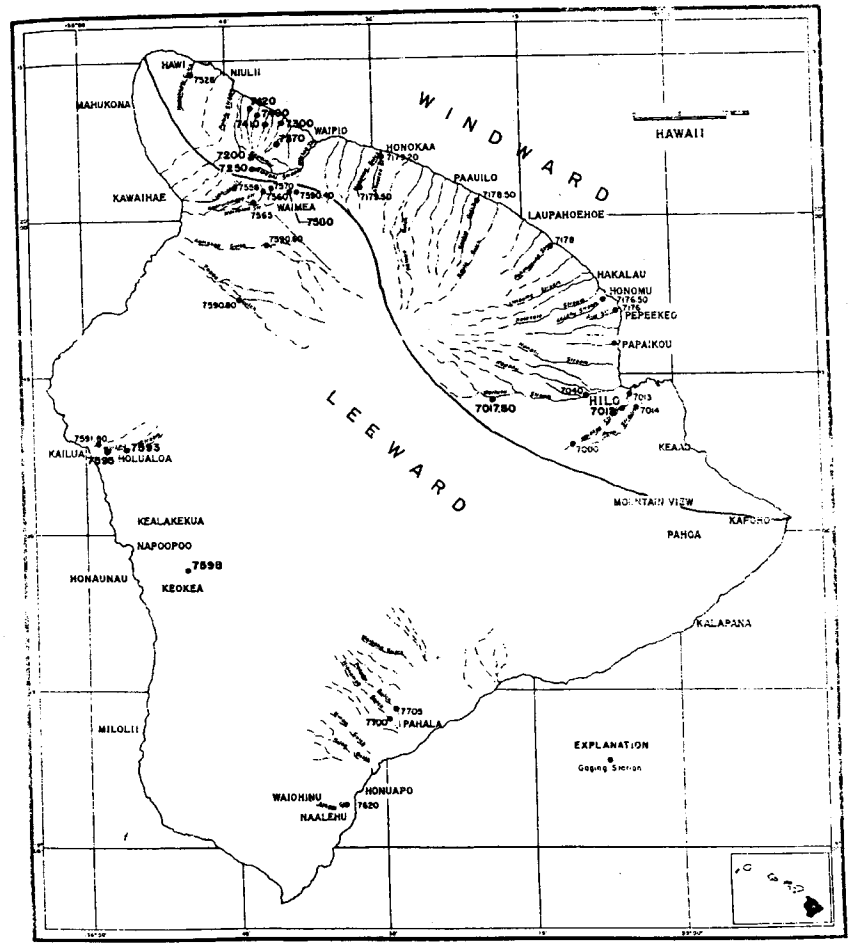
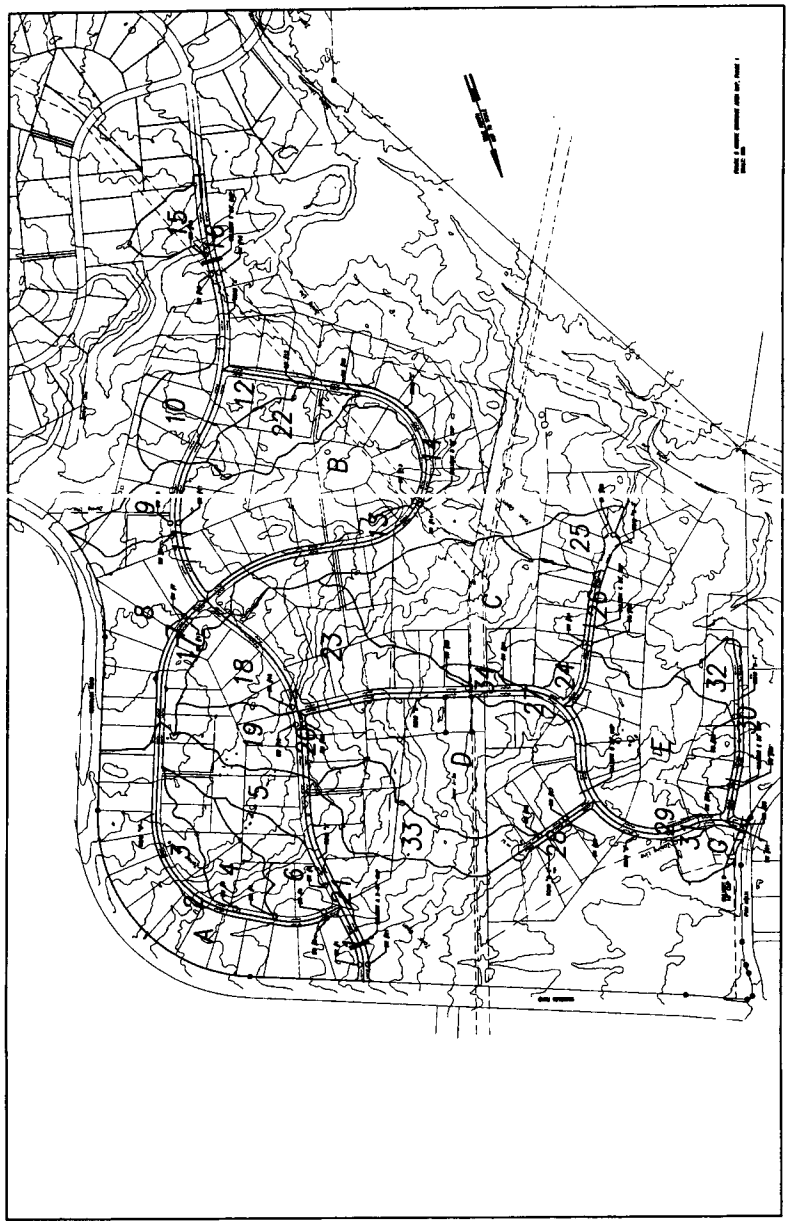


FIGURE 4 REGRESSION EQUATION GROUP

Source:
Hawaii County FIS 1995, FEMA



DRAFT
Waikoloa Highlands Water Distribution System

Waikoloa Highlands Subdivision
Waikoloa, South Kohala, Hawaii

SEPTEMBER 2006

Prepared For:

Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

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SINCE 1930

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(RMTC Ref: 1-20580-0-E)

WAIKOLOA HIGHLANDS WATER DISTRIBUTION SYSTEM

PROJECT NAME:	WAIKOLOA HIGHLANDS SUBDIVISION
LOCATION:	Waikoloa, South Kohala, Hawaii
TAX MAP KEY:	(3rd Div.) 6-8-02:16/6-8-03:32
ZONING:	RA - 1a
PROJECT AREA:	744.4 Acres
OWNER:	Waikoloa Mauka, LLC 120 Aspen Oak Lane Glendale, CA 91207
ENGINEERING CONSULTANT:	R. M. Towill Corporation 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817-4941 Phone: (808) 842-1133 Fax: (808) 842-1937
DATE:	September 2006

REFERENCES:

1. Waikoloa Water Master Plans, Tom Nance Water Resources Engineering, February 1991.

2. County of Hawaii Water Supply Standards, 2002.

1. INTODUCTION

The scope of this project includes: (1) the sizing of mains for the Waikoloa Highlands subdivision and (2) the use of existing water system components for the proposed Waikoloa Highlands Water Distribution System. The Waikoloa Highlands subdivision consists of 398 lots which are located from the 980-ft to 1310-ft elevation.

An existing tank with spillway elevation of 1210 ft will be used to service a portion of the lots. Two additional tanks however, are needed to service the remaining lots. In addition to these tanks, a booster pump is required for pumping water from the 1210' tank to fill the 1370' tank, while also distributing water during transmission.

The sizing of the mains and the booster pump is based on design criteria.

2. DESIGN CRITERIA

The design criteria used for the water system analysis is listed in Table 1 and is based on the Waikoloa Water Master Plans (Ref. 1). The design criteria follows the County of Hawaii Water Supply Standards (Ref.2) with the following deviations:

1. The maximum day demand factor of 1.25 is used instead of the County's 1.5 factor. To account for losses through the system, 12% was added to the maximum flow rates.

2. The peak demand factor of 3.0 is also used instead of the County's 5.0 factor.

3. The maximum velocity restriction of 7 feet per second is used instead of the County's 6 feet per second restriction for distribution mains without fire flow.

4. The maximum velocity restriction of 10 feet per second for distribution mains with fire flow is an additional County of Hawaii standard used for this design.

Table 1. Water System Facilities Sizing Criteria

Demand Factors

- Average Day Demand = Application of the water use rates of Table 2
- Maximum Day Demand = 1.25 * Average Day Demand
- Peak Demand = 3.0 * Average Day Demand

Fire Flow

- Single Family Residential: 500 gallons per minute (gpm)for 2 hours (lots > 10,000 sq. ft.)

Service Pressures

- Minimum of 40 psi (except during fire flow)
- Maximum of 125 psi
- 20 psi at critical fire hydrant for fire flow with coincident maximum daily demand

Pipeline Sizes

- Meet minimum pressure criterion at peak flowrate with a maximum of 7.0 feet per second (fps) velocity
- Meet minimum hydrant pressure criterion at fire plus maximum daily flowrate with no velocity restriction
- Compute pipeline pressure losses using Hazen-Williams formula with:
  C = 100 for 6" or smaller pipelines
  C = 110 for 8" and 12" pipelines

Well Pumping Capacity

- Provide the maximum daily demand, including unmetered supply, in a 24-hour pumping day with the largest well out of service.

Reservoir

- Provide the maximum daily demand, including unmetered supply but excluding controllable common area irrigation, with no credit for well inflow.
- Meet fire flow and coincident maximum daily demand for the duration of the fire flow with the largest reservoir 3/4 full at the start and the credit for well inflow with the largest pump out of service.

3. DESIGN ANALYSIS

The Waikoloa Highlands Water Distribution System services three zones within the site. The lower zone is served by the tank at the 1210-ft elevation. This zone serves 47 lots in addition to the existing Waikoloa Village, which has an average day demand of nearly 600,000 gallons per day (gpd) (Ref. 1). The proposed distribution system of this zone is comprised of 6-inch pipes. The 1210-ft elevation tank also serves the booster pump located at the 1060-ft elevation.

The booster pump distributes water to the upper lots, in addition to supplying the 1370-ft service reservoir. In the middle service zone, 324 lots are served by the proposed 12-inch water main supplying the proposed tank at the 1370-ft elevation. The proposed tank at the 1370-ft elevation complies with the tank proposed in the Waikoloa Water Master Plans (Ref. 1). The third tank at the 1590-ft elevation also complies with the Waikoloa Water Master Plans (Ref. 1). This tank will serve the remaining 27 lots by gravity flow.

Analysis and design of the water system for this report were done using a water distribution modeling software system, WaterCAD by Haestad Methods Incorporated. This program allows the designer to develop a hydraulic model of a pressurized pipe system and was used for this report to perform the following analyses:

1. Steady-state analysis of the water system, including pipes, pumps, tanks, and reservoirs
2. Extended period simulation to analyze the system under varying supply and demand conditions
3. Fire flow analysis

The proposed distribution system shown in Figure 1 displays the nodes or pressure junctions that connect multiple pipes or are the end of a pipe segments. Demands were assigned to the nodes based on the number of lots that are being served at that particular node. The distribution of demands is listed in Table 2.

4. RESULTS

The distribution system was initially designed with 6-inch pipelines. The proposed distribution system in Figure 1 consists of a main pipeline connecting the lower tank to the booster pump and the booster bump to the tank at the 1370-ft elevation. This main line has various branches which are either cul-de-sacs or loops that service the various subdivisions within Waikoloa Highlands. The main line was tested as a 6-inch pipe and then sized up if the distribution system did not meet the minimum design criteria. The distribution was found to work with the main line as a 12-inch pipe. All of the other branches remained 6-inch pipes through-out the design process. The 12-inch main line effectively distributes water to the middle and upper sections. See Figure 2 and Figure 3 for schematics of the water system and the placement of the pressure junctions listed in Table 2.

Table 2. Distribution of Demands for Waikoloa Highlands

		Flowrates for Design (GPD)		
Node	Single Family Units	Average Day	Maximum Day	Peak
Serviced by Tank with Spillway EL = 1210 ft.				
J-2		567,360		
J-4	4	5,000	5,000	12,000
J-5	6	3,000	7,500	18,000
J-6	5	4,000	6,250	15,000
J-7	5	4,000	6,250	15,000
J-9	2	2,000	2,500	6,000
J-10	2	2,000	2,500	6,000
J-11	2	2,000	2,500	6,000
J-12	4	3,000	5,000	12,000
J-13	3	4,000	3,750	9,000
J-14	7	7,000	8,750	21,000
J-15	7	7,000	8,750	21,000
Total =	47	43,000	58,750	141,000
Serviced by Tank with Spillway EL = 1370 ft.				
J-16	8	8,000	10,000	24,000
J-17	6	6,000	7,500	18,000
J-18	6	6,000	7,500	18,000
J-19	9	9,000	11,250	27,000
J-20	9	9,000	11,250	27,000
J-21	9	9,000	11,250	27,000
J-22	25	25,000	31,250	75,000
J-23	13	13,000	16,250	39,000
J-24	16	16,000	20,000	48,000
J-25	4	4,000	5,000	12,000
J-27	7	7,000	8,750	21,000
J-28	14	14,000	17,500	42,000
J-29	6	6,000	7,500	18,000
J-30	12	12,000	15,000	36,000
J-31	9	9,000	11,250	27,000
J-32	7	7,000	8,750	21,000
J-33	13	13,000	16,250	39,000
J-34	8	8,000	10,000	24,000
J-35	7	7,000	8,750	21,000
J-36	8	8,000	10,000	24,000
J-37	9	9,000	11,250	27,000
J-38	9	9,000	11,250	27,000
J-39	16	16,000	20,000	48,000
J-40	15	15,000	18,750	45,000
J-41	14	14,000	17,500	42,000
J-42	12	12,000	15,000	36,000
J-43	10	10,000	12,500	30,000
J-46	9	9,000	11,250	27,000
J-47	5	5,000	6,250	15,000
J-48	4	4,000	5,000	12,000
J-49	15	15,000	18,750	45,000
J-50	10	10,000	12,500	30,000
Total =	324	324,000	405,000	972,000
Serviced by Tank with Spillway EL = 1590 ft.				
J-44	8	8,000	10,000	24,000
J-45	8	8,000	10,000	24,000
J-51	5	5,000	6,250	15,000
J-52	6	6,000	7,500	18,000
Total =	27	27,000	33,750	81,000

Watercad Simulation Results:

Maximum daily flow:
Under the maximum daily demand condition, analysis shows that the results satisfy the requirements set by the Waikoloa Water Master Plans (Ref.1). Velocities were well below 7 feet per second. Pressure junctions were also below the maximum allowable pressure.

Peak hour flow:
Under this condition, all the pressure junctions are required to meet the minimum pressure of 40 psi. The analysis proved this to be the case except for a couple of junctions directly connected to the booster pump.

Fire Flow:
According to the Water Supply Standards (Ref. 2), under the fire flow condition, the pressure at each junction should be at least 20 psi. Fire flow conditions were simulated by applying the fire flow demand to several pressure junctions. The results proved that the water system is sufficient to handle fire flow.

See the Appendix for calculations and results produced by WaterCAD.

APPENDIX

WaterCAD Results:

Tank 1: Spillway El=1210'

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,076.00	Demand	0	Fixed	0	1,209.67	57.83
J-2	1,032.00	Demand	567,360	Fixed	567,360	1,209.63	76.85
J-3	1,059.00	Demand	0	Fixed	0	1,209.63	65.17
J-4	1,060.00	Demand	5,000	Fixed	5,000	1,209.61	64.73
J-5	1,073.00	Demand	3,000	Fixed	3,000	1,209.61	59.10
J-6	1,047.00	Demand	4,000	Fixed	4,000	1,209.55	70.33
J-7	1,022.00	Demand	4,000	Fixed	4,000	1,209.53	81.13
J-8	1,020.00	Demand	0	Fixed	0	1,209.53	82.00
J-9	998.00	Demand	2,000	Fixed	2,000	1,209.52	91.52
J-10	1,004.00	Demand	2,000	Fixed	2,000	1,209.52	88.92
J-11	1,011.00	Demand	2,000	Fixed	2,000	1,209.52	85.89
J-12	1,022.00	Demand	3,000	Fixed	3,000	1,209.52	81.13
J-13	1,038.00	Demand	4,000	Fixed	4,000	1,209.52	74.21
J-14	1,044.00	Demand	7,000	Fixed	7,000	1,209.53	71.62
J-15	1,045.00	Demand	7,000	Fixed	7,000	1,209.53	71.18
J-16*	1,060.00	Demand	2,000	Fixed	2,000	1,209.61	64.73
J-17*	1,065.00	Demand	6,000	Fixed	6,000	1,209.62	62.57
J-18*	1,075.00	Demand	6,000	Fixed	6,000	1,209.63	58.25
J-19*	1,080.00	Demand	8,000	Fixed	8,000	1,209.67	56.10

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	R-1	J-1	4,400.00	20.0	100.0	Open	632,360	0.33	0.45
P-2	J-1	J-2	600.00	20.0	100.0	Open	602,927	0.04	0.43
P-3	J-2	J-3	1,556.00	16.0	100.0	Open	35,567	0.00	0.04
P-4	J-3	J-4	158.00	6.0	100.0	Open	35,567	0.02	0.28
P-5	J-4	J-5	183.00	6.0	100.0	Open	-4,433	0.00	0.03
P-6	J-4	J-6	518.00	6.0	100.0	Open	35,000	0.06	0.28
P-7	J-6	J-7	592.00	6.0	100.0	Open	17,000	0.02	0.13
P-8	J-7	J-8	239.00	6.0	100.0	Open	6,000	0.00	0.05
P-9	J-8	J-9	576.00	6.0	100.0	Open	6,000	0.00	0.05
P-10	J-9	J-10	561.00	6.0	100.0	Open	4,000	0.00	0.03
P-11	J-10	J-11	440.00	6.0	100.0	Open	2,000	0.00	0.02
P-12	J-7	J-12	305.00	6.0	100.0	Open	7,000	0.00	0.06
P-13	J-12	J-13	197.00	6.0	100.0	Open	4,000	0.00	0.03
P-14	J-6	J-14	547.00	6.0	100.0	Open	14,000	0.01	0.11
P-15	J-14	J-15	463.00	6.0	100.0	Open	7,000	0.00	0.06
P-16	J-5	J-16	283.00	6.0	100.0	Open	-7,433	0.00	0.06
P-17	J-16*	J-17*	551.00	6.0	100.0	Open	-9,433	0.01	0.07
P-18	J-17*	J-18*	463.00	6.0	100.0	Open	-15,433	0.01	0.12
P-19	J-18*	J-19*	817.00	6.0	100.0	Open	-21,433	0.04	0.17
P-20	J-19*	J-1	376.00	12.0	100.0	Open	-29,433	0.00	0.06

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,210.00	-632,360	1,210.00

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,076.00	Demand	0	Max day	0	1,208.36	57.26
J-2	1,032.00	Demand	567,360	Max day	709,200	1,208.19	76.23
J-3	1,059.00	Demand	0	Max day	0	1,207.91	64.42
J-4	1,060.00	Demand	5,000	Max day	6,250	1,204.46	62.50
J-5	1,073.00	Demand	723,000	Composite	723,000	1,201.10	55.42
J-6	1,047.00	Demand	4,000	Max day	5,000	1,204.37	68.08
J-7	1,022.00	Demand	4,000	Max day	5,000	1,204.34	78.89
J-8	1,020.00	Demand	0	Max day	0	1,204.34	79.75
J-9	998.00	Demand	2,000	Max day	2,500	1,204.33	89.27
J-10	1,004.00	Demand	2,000	Max day	2,500	1,204.33	86.67
J-11	1,011.00	Demand	2,000	Max day	2,500	1,204.33	83.64
J-12	1,022.00	Demand	3,000	Max day	3,750	1,204.33	78.89
J-13	1,038.00	Demand	4,000	Max day	5,000	1,204.33	71.96
J-14	1,044.00	Demand	7,000	Max day	8,750	1,204.35	69.37
J-15	1,045.00	Demand	7,000	Max day	8,750	1,204.34	68.94
J-16*	1,060.00	Demand	2,000	Max day	2,500	1,201.93	61.40
J-17*	1,065.00	Demand	6,000	Max day	7,500	1,203.70	60.01
J-18*	1,075.00	Demand	6,000	Max day	7,500	1,205.30	56.37
J-19*	1,080.00	Demand	8,000	Max day	10,000	1,208.31	55.51

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	R-1	J-1	4,400.00	20.0	100.0	Open	1,509,700	1.64	1.07
P-2	J-1	J-2	600.00	20.0	100.0	Open	1,280,915	0.17	0.91
P-3	J-2	J-3	1,556.00	16.0	100.0	Open	571,715	0.29	0.63
P-4	J-3	J-4	158.00	6.0	100.0	Open	571,715	3.44	4.51
P-5	J-4	J-5	183.00	6.0	100.0	Open	521,715	3.37	4.11
P-6	J-4	J-6	518.00	6.0	100.0	Open	43,750	0.10	0.34
P-7	J-6	J-7	592.00	6.0	100.0	Open	21,250	0.03	0.17
P-8	J-7	J-8	239.00	6.0	100.0	Open	7,500	0.00	0.06
P-9	J-8	J-9	576.00	6.0	100.0	Open	7,500	0.00	0.06
P-10	J-9	J-10	561.00	6.0	100.0	Open	5,000	0.00	0.04
P-11	J-10	J-11	440.00	6.0	100.0	Open	2,500	0.00	0.02
P-12	J-7	J-12	305.00	6.0	100.0	Open	8,750	0.00	0.07
P-13	J-12	J-13	197.00	6.0	100.0	Open	5,000	0.00	0.04
P-14	J-6	J-14	547.00	6.0	100.0	Open	17,500	0.02	0.14
P-15	J-14	J-15	463.00	6.0	100.0	Open	8,750	0.00	0.07
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
P-17	J-16*	J-17*	551.00	6.0	100.0	Open	-203,785	1.78	1.61
P-18	J-17*	J-18*	463.00	6.0	100.0	Open	-211,285	1.60	1.66
P-19	J-18*	J-19*	817.00	6.0	100.0	Open	-218,785	3.01	1.72
P-20	J-19*	J-1	376.00	12.0	100.0	Open	-228,785	0.05	0.45

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,210.00	-1,509,700	1,210.00

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,076.00	Demand	0	Peak	0	1,207.49	56.89
J-2	1,032.00	Demand	567,360	Peak	1,702,080	1,207.18	75.79
J-3	1,059.00	Demand	0	Peak	0	1,207.17	64.10
J-4	1,060.00	Demand	5,000	Peak	15,000	1,207.01	63.60
J-5	1,073.00	Demand	3,000	Peak	9,000	1,207.02	57.98
J-6	1,047.00	Demand	4,000	Peak	12,000	1,206.52	69.02
J-7	1,022.00	Demand	4,000	Peak	12,000	1,206.38	79.77
J-8	1,020.00	Demand	0	Peak	0	1,206.37	80.63
J-9	998.00	Demand	2,000	Peak	6,000	1,206.35	90.14
J-10	1,004.00	Demand	2,000	Peak	6,000	1,206.34	87.54
J-11	1,011.00	Demand	2,000	Peak	6,000	1,206.33	84.51
J-12	1,022.00	Demand	3,000	Peak	9,000	1,206.36	79.76
J-13	1,038.00	Demand	4,000	Peak	12,000	1,206.36	72.84
J-14	1,044.00	Demand	7,000	Peak	21,000	1,206.43	70.27
J-15	1,045.00	Demand	7,000	Peak	21,000	1,206.41	69.83
J-16*	1,060.00	Demand	2,000	Peak	6,000	1,207.03	63.61
J-17*	1,065.00	Demand	6,000	Peak	18,000	1,207.08	61.47
J-18*	1,075.00	Demand	6,000	Peak	18,000	1,207.17	57.18
J-19*	1,080.00	Demand	8,000	Peak	24,000	1,207.48	55.16

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	R-1	J-1	4,400.00	20.0	100.0	Open	1,897,080	2.51	1.35
P-2	J-1	J-2	600.00	20.0	100.0	Open	1,808,781	0.31	1.28
P-3	J-2	J-3	1,556.00	16.0	100.0	Open	106,701	0.01	0.12
P-4	J-3	J-4	158.00	6.0	100.0	Open	106,701	0.15	0.84
P-5	J-4	J-5	183.00	6.0	100.0	Open	-13,299	0.00	0.10
P-6	J-4	J-6	518.00	6.0	100.0	Open	105,000	0.49	0.83
P-7	J-6	J-7	592.00	6.0	100.0	Open	51,000	0.15	0.40
P-8	J-7	J-8	239.00	6.0	100.0	Open	18,000	0.01	0.14
P-9	J-8	J-9	576.00	6.0	100.0	Open	18,000	0.02	0.14
P-10	J-9	J-10	561.00	6.0	100.0	Open	12,000	0.01	0.09
P-11	J-10	J-11	440.00	6.0	100.0	Open	6,000	0.00	0.05
P-12	J-7	J-12	305.00	6.0	100.0	Open	21,000	0.01	0.17
P-13	J-12	J-13	197.00	6.0	100.0	Open	12,000	0.00	0.09
P-14	J-6	J-14	547.00	6.0	100.0	Open	42,000	0.09	0.33
P-15	J-14	J-15	463.00	6.0	100.0	Open	21,000	0.02	0.17
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
P-17	J-16*	J-17*	551.00	6.0	100.0	Open	-28,299	0.05	0.22
P-18	J-17*	J-18*	463.00	6.0	100.0	Open	-46,299	0.10	0.36
P-19	J-18*	J-19*	817.00	6.0	100.0	Open	-64,299	0.31	0.51
P-20	J-19*	J-1	376.00	12.0	100.0	Open	-88,299	0.01	0.17

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,210.00	-1,897,080	1,210.00

WaterCAD Results:

Tank 2: Spillway El=1370'

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-16	1,090.00	Demand	8,000	Fixed	8,000	1,386.73	128.38
J-17	1,140.00	Demand	6,000	Fixed	6,000	1,387.23	106.96
J-18	1,138.00	Demand	6,000	Fixed	6,000	1,387.60	107.99
J-19	1,168.00	Demand	9,000	Fixed	9,000	1,385.46	94.08
J-20	1,160.00	Demand	9,000	Fixed	9,000	1,383.74	96.80
J-21	1,138.00	Demand	7,000	Fixed	7,000	1,382.51	105.79
J-22	1,112.00	Demand	20,000	Fixed	20,000	1,378.35	115.24
J-23	1,185.00	Demand	25,000	Fixed	25,000	1,375.27	82.32
J-24	1,208.00	Demand	9,000	Fixed	9,000	1,374.38	71.98
J-25	1,255.00	Demand	9,000	Fixed	9,000	1,373.01	51.06
J-26	1,270.00	Demand	0	Fixed	0	1,372.30	44.26
J-27	1,110.00	Demand	7,000	Fixed	7,000	1,386.32	119.55
J-28	1,183.00	Demand	13,000	Fixed	13,000	1,385.81	87.75
J-29	1,185.00	Demand	7,000	Fixed	7,000	1,385.63	86.80
J-30	1,150.00	Demand	12,000	Fixed	12,000	1,384.69	101.54
J-31	1,121.00	Demand	10,000	Fixed	10,000	1,383.57	113.60
J-32	1,127.00	Demand	8,000	Fixed	8,000	1,382.94	110.73
J-33	1,125.00	Demand	14,000	Fixed	14,000	1,376.01	108.60
J-34	1,126.00	Demand	8,000	Fixed	8,000	1,375.75	108.06
J-35	1,145.00	Demand	7,000	Fixed	7,000	1,375.71	99.82
J-36	1,170.00	Demand	7,000	Fixed	7,000	1,375.68	88.99
J-37	1,180.00	Demand	7,000	Fixed	7,000	1,375.67	84.66
J-38	1,165.00	Demand	9,000	Fixed	9,000	1,375.67	91.15
J-39	1,168.00	Demand	13,000	Fixed	13,000	1,375.65	89.84
J-40	1,131.00	Demand	10,000	Fixed	10,000	1,377.58	106.68
J-41	1,190.00	Demand	19,000	Fixed	19,000	1,375.92	80.44
J-42	1,232.00	Demand	11,000	Fixed	11,000	1,374.96	61.85
J-43	1,250.00	Demand	8,000	Fixed	8,000	1,373.82	53.57
J-45	1,260.00	Demand	6,000	Fixed	6,000	1,374.35	49.47
J-46	1,225.00	Demand	7,000	Fixed	7,000	1,374.35	64.62
J-47	1,227.00	Demand	7,000	Fixed	7,000	1,374.38	63.76
J-48	1,255.00	Demand	2,000	Fixed	2,000	1,374.35	51.64
J-49	1,145.00	Demand	11,000	Fixed	11,000	1,375.78	99.85
J-50	1,148.00	Demand	10,000	Fixed	10,000	1,375.70	98.51
J-44	1,032.00	Demand	0	Fixed	0	1,209.84	76.94
J-51	1,060.00	Demand	0	Fixed	0	1,208.65	64.31
J-52	1,060.00	Demand	0	Fixed	0	1,390.81	143.13
J-53	1,061.00	Demand	0	Fixed	0	1,390.54	142.58
J-54	1,070.00	Demand	0	Fixed	0	1,389.61	138.28

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-17	J-16	J-17	691.00	6.0	100.0	Open	-90,659	0.50	0.71
P-18	J-17	J-18	455.00	6.0	100.0	Open	-96,659	0.37	0.76
P-19	J-18	J-19	860.00	12.0	100.0	Open	1,095,846	2.14	2.16
P-20	J-19	J-20	794.00	12.0	100.0	Open	1,019,008	1.72	2.01
P-21	J-20	J-21	574.00	12.0	100.0	Open	1,010,008	1.23	1.99
P-22	J-21	J-22	1,671.00	12.0	100.0	Open	1,096,504	4.16	2.16
P-23	J-22	J-23	2,109.00	12.0	100.0	Open	823,295	3.09	1.62
P-24	J-23	J-24	651.00	12.0	100.0	Open	792,880	0.89	1.56
P-25	J-24	J-25	1,083.00	12.0	100.0	Open	761,880	1.37	1.50
P-26	J-25	J-26	426.00	12.0	100.0	Open	877,504	0.70	1.73
P-27	J-26	R-1	1,400.00	12.0	100.0	Open	877,504	2.30	1.73
P-28	J-16	J-27	679.00	6.0	100.0	Open	82,659	0.41	0.65
P-29	J-27	J-28	992.00	6.0	100.0	Open	75,659	0.51	0.60
P-30	J-28	J-29	482.00	6.0	100.0	Open	62,659	0.17	0.49
P-31	J-29	J-19	595.00	6.0	100.0	Open	55,659	0.17	0.44
P-32	J-19	J-30	661.00	6.0	100.0	Open	139,496	0.77	0.97
P-33	J-30	J-31	1,068.00	6.0	100.0	Open	111,496	1.13	0.88
P-34	J-31	J-32	705.00	6.0	100.0	Open	101,496	0.63	0.80
P-35	J-32	J-21	566.00	6.0	100.0	Open	93,496	0.43	0.74
P-36	J-22	J-33	1,672.00	6.0	100.0	Open	129,854	2.34	1.02
P-37	J-33	J-34	709.00	6.0	100.0	Open	62,851	0.26	0.50
P-38	J-34	J-35	552.00	6.0	100.0	Open	26,926	0.04	0.21
P-39	J-35	J-36	639.00	6.0	100.0	Open	19,926	0.03	0.16
P-40	J-36	J-37	546.00	6.0	100.0	Open	12,926	0.01	0.10
P-41	J-37	J-38	758.00	6.0	100.0	Open	5,926	0.00	0.05
P-42	J-38	J-39	630.00	6.0	100.0	Open	14,851	0.02	0.12
P-43	J-39	J-23	2,061.00	6.0	100.0	Open	43,854	0.39	0.35
P-44	J-22	J-40	606.00	6.0	100.0	Open	123,355	0.77	0.97
P-45	J-40	J-41	1,523.00	6.0	100.0	Open	113,355	1.66	0.89
P-46	J-41	J-42	1,249.00	6.0	100.0	Open	94,355	0.97	0.74
P-47	J-42	J-43	777.00	6.0	100.0	Open	132,625	1.13	1.05
P-48	J-43	J-25	631.00	6.0	100.0	Open	124,625	0.82	0.98
P-51	J-45	J-46	623.00	6.0	100.0	Open	-6,000	0.00	0.05
P-53	J-24	J-47	429.00	6.0	100.0	Open	7,000	0.00	0.06
P-54	J-46	J-48	563.00	6.0	100.0	Open	2,000	0.00	0.02
P-55	J-23	J-42	1,338.00	6.0	100.0	Open	49,270	0.31	0.39
P-52	J-46	J-24	1,107.00	6.0	100.0	Open	-15,000	0.03	0.12
P-56	J-33	J-49	859.00	6.0	100.0	Open	53,003	0.23	0.42
P-57	J-49	J-39	750.00	6.0	100.0	Open	42,003	0.13	0.33
P-58	J-34	J-50	700.00	6.0	100.0	Open	27,925	0.06	0.22
P-59	J-50	J-38	753.00	6.0	100.0	Open	17,925	0.03	0.14
P-49	R-2	J-44	654.00	20.0	100.0	Open	1,198,504	0.16	0.85
P-50	J-44	J-51	1,653.00	16.0	100.0	Open	1,198,504	1.19	1.33
P-60	J-51	PMP-1	21.00	16.0	100.0	Open	1,198,504	0.02	1.33
P-61	PMP-1	J-52	21.00	12.0	100.0	Open	1,198,504	0.06	2.36
P-62	J-52	J-53	92.00	12.0	100.0	Open	1,198,504	0.27	2.36
P-63	J-53	J-54	317.00	12.0	100.0	Open	1,198,504	0.93	2.36
P-64	J-54	J-18	688.00	12.0	100.0	Open	1,198,504	2.02	2.36

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pump Report

Label	Elevation (ft)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpd)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	1,060.00	On	1,208.63	1,390.88	1,198,504	182.24	38.29

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,370.00	877,504	1,370.00
R-2	1,210.00	-1,198,504	1,210.00

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-16	1,090.00	Demand	8,000	Max day	10,000	1,382.00	126.33
J-17	1,140.00	Demand	6,000	Max day	7,500	1,382.53	104.93
J-18	1,138.00	Demand	6,000	Max day	7,500	1,382.93	105.97
J-19	1,168.00	Demand	9,000	Max day	11,250	1,380.78	92.06
J-20	1,160.00	Demand	9,000	Max day	11,250	1,379.08	94.79
J-21	1,138.00	Demand	7,000	Max day	8,750	1,377.88	103.79
J-22	1,112.00	Demand	20,000	Max day	25,000	1,373.84	113.29
J-23	1,185.00	Demand	25,000	Max day	31,250	1,370.90	80.43
J-24	1,208.00	Demand	9,000	Max day	11,250	1,370.04	70.11
J-25	1,255.00	Demand	9,000	Max day	11,250	1,370.04	49.77
J-26	1,270.00	Demand	0	Max day	0	1,370.03	43.28
J-27	1,110.00	Demand	7,000	Max day	8,750	1,381.58	117.50
J-28	1,183.00	Demand	13,000	Max day	16,250	1,381.08	85.70
J-29	1,185.00	Demand	7,000	Max day	8,750	1,380.92	84.77
J-30	1,150.00	Demand	12,000	Max day	15,000	1,379.99	99.50
J-31	1,121.00	Demand	10,000	Max day	12,500	1,378.86	111.57
J-32	1,127.00	Demand	8,000	Max day	10,000	1,378.27	108.71
J-33	1,125.00	Demand	14,000	Max day	17,500	1,371.38	106.60
J-34	1,126.00	Demand	8,000	Max day	10,000	1,371.12	106.05
J-35	1,145.00	Demand	7,000	Max day	8,750	1,371.08	97.81
J-36	1,170.00	Demand	7,000	Max day	8,750	1,371.06	86.99
J-37	1,180.00	Demand	7,000	Max day	8,750	1,371.05	82.66
J-38	1,165.00	Demand	9,000	Max day	11,250	1,371.05	89.15
J-39	1,168.00	Demand	13,000	Max day	16,250	1,371.05	87.85
J-40	1,131.00	Demand	10,000	Max day	12,500	1,373.12	104.75
J-41	1,190.00	Demand	19,000	Max day	23,750	1,371.63	78.58
J-42	1,232.00	Demand	11,000	Max day	13,750	1,370.87	60.08
J-43	1,250.00	Demand	8,000	Max day	10,000	1,370.36	52.08
J-45	1,260.00	Demand	726,000	Composite	727,500	1,310.06	21.66
J-46	1,225.00	Demand	7,000	Max day	8,750	1,331.27	45.98
J-47	1,227.00	Demand	7,000	Max day	8,750	1,370.04	61.89
J-48	1,255.00	Demand	2,000	Max day	2,500	1,331.27	33.00
J-49	1,145.00	Demand	11,000	Max day	13,750	1,371.16	97.85
J-50	1,148.00	Demand	10,000	Max day	12,500	1,371.07	96.51
J-44	1,032.00	Demand	0	Max day	0	1,209.84	76.94
J-51	1,060.00	Demand	0	Max day	0	1,208.63	64.30
J-52	1,060.00	Demand	0	Max day	0	1,386.19	141.13
J-53	1,061.00	Demand	0	Max day	0	1,385.92	140.58
J-54	1,070.00	Demand	0	Max day	0	1,384.97	136.27

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-17	J-16	J-17	691.00	6.0	100.0	Open	-93,617	0.53	0.74
P-18	J-17	J-18	455.00	6.0	100.0	Open	-101,117	0.40	0.80
P-19	J-18	J-19	860.00	12.0	100.0	Open	1,098,434	2.15	2.16
P-20	J-19	J-20	794.00	12.0	100.0	Open	1,010,906	1.70	1.99
P-21	J-20	J-21	574.00	12.0	100.0	Open	999,656	1.20	1.97
P-22	J-21	J-22	1,671.00	12.0	100.0	Open	1,079,551	4.04	2.13
P-23	J-22	J-23	2,109.00	12.0	100.0	Open	801,846	2.94	1.58
P-24	J-23	J-24	651.00	12.0	100.0	Open	780,253	0.86	1.54
P-25	J-24	J-25	1,083.00	12.0	100.0	Open	21,503	0.00	0.04
P-26	J-25	J-26	426.00	12.0	100.0	Open	85,801	0.01	0.17
P-27	J-26	R-1	1,400.00	12.0	100.0	Open	85,801	0.03	0.17
P-28	J-16	J-27	679.00	6.0	100.0	Open	83,617	0.42	0.66
P-29	J-27	J-28	992.00	6.0	100.0	Open	74,867	0.50	0.59
P-30	J-28	J-29	482.00	6.0	100.0	Open	58,617	0.15	0.46
P-31	J-29	J-19	595.00	6.0	100.0	Open	49,867	0.14	0.39
P-32	J-19	J-30	601.00	6.0	100.0	Open	126,146	0.80	0.99
P-33	J-30	J-31	1,068.00	6.0	100.0	Open	111,146	1.12	0.88
P-34	J-31	J-32	705.00	6.0	100.0	Open	98,646	0.59	0.78
P-35	J-32	J-21	566.00	6.0	100.0	Open	88,646	0.39	0.70
P-36	J-22	J-33	1,672.00	6.0	100.0	Open	133,344	2.46	1.05
P-37	J-33	J-34	709.00	6.0	100.0	Open	63,474	0.26	0.50
P-38	J-34	J-35	552.00	6.0	100.0	Open	26,731	0.04	0.21
P-39	J-35	J-36	639.00	6.0	100.0	Open	17,981	0.02	0.14
P-40	J-36	J-37	546.00	6.0	100.0	Open	9,231	0.01	0.07
P-41	J-37	J-38	758.00	6.0	100.0	Open	481	0.00	0.00
P-42	J-38	J-39	630.00	6.0	100.0	Open	3,474	0.00	0.03
P-43	J-39	J-23	2,061.00	6.0	100.0	Open	25,844	0.15	0.20
P-44	J-22	J-40	606.00	6.0	100.0	Open	119,362	0.73	0.94
P-45	J-40	J-41	1,523.00	6.0	100.0	Open	106,862	1.49	0.84
P-46	J-41	J-42	1,249.00	6.0	100.0	Open	83,112	0.77	0.65
P-47	J-42	J-43	777.00	6.0	100.0	Open	85,548	0.50	0.67
P-48	J-43	J-25	631.00	6.0	100.0	Open	75,548	0.32	0.60
P-51	J-45	J-46	623.00	6.0	100.0	Open	-727,500	21.21	5.73
P-53	J-24	J-47	429.00	6.0	100.0	Open	8,750	0.00	0.07
P-54	J-46	J-48	563.00	6.0	100.0	Open	2,500	0.00	0.02
P-55	J-23	J-42	1,338.00	6.0	100.0	Open	16,186	0.04	0.13
P-52	J-46	J-24	1,107.00	6.0	100.0	Open	-738,750	38.78	5.82
P-56	J-33	J-49	859.00	6.0	100.0	Open	52,369	0.22	0.41
P-57	J-49	J-39	750.00	6.0	100.0	Open	38,619	0.11	0.30
P-58	J-34	J-50	700.00	6.0	100.0	Open	26,743	0.05	0.21
P-59	J-50	J-38	753.00	6.0	100.0	Open	14,243	0.02	0.11
P-49	R-2	J-44	654.00	20.0	100.0	Open	1,207,051	0.16	0.86
P-50	J-44	J-51	1,653.00	16.0	100.0	Open	1,207,051	1.21	1.34
P-60	J-51	PMP-1	21.00	16.0	100.0	Open	1,207,051	0.02	1.34
P-61	PMP-1	J-52	21.00	12.0	100.0	Open	1,207,051	0.06	2.38
P-62	J-52	J-53	92.00	12.0	100.0	Open	1,207,051	0.27	2.38
P-63	J-53	J-54	317.00	12.0	100.0	Open	1,207,051	0.94	2.38
P-64	J-54	J-18	688.00	12.0	100.0	Open	1,207,051	2.04	2.38

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Pump Report

Label	Elevation (ft)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpd)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	1,060.00	On	1,208.61	1,386.25	1,207,051	177.64	37.59

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,370.00	85,801	1,370.00
R-2	1,210.00	-1,207,051	1,210.00

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-16	1,090.00	Demand	8,000	Peak	24,000	1,378.32	124.74
J-17	1,140.00	Demand	6,000	Peak	18,000	1,378.99	103.40
J-18	1,138.00	Demand	6,000	Peak	18,000	1,379.58	104.52
J-19	1,168.00	Demand	9,000	Peak	27,000	1,377.53	90.65
J-20	1,160.00	Demand	9,000	Peak	27,000	1,376.14	93.51
J-21	1,138.00	Demand	7,000	Peak	21,000	1,375.19	102.62
J-22	1,112.00	Demand	20,000	Peak	60,000	1,372.26	112.60
J-23	1,185.00	Demand	25,000	Peak	75,000	1,370.68	80.34
J-24	1,208.00	Demand	9,000	Peak	27,000	1,370.48	70.30
J-25	1,255.00	Demand	9,000	Peak	27,000	1,370.29	49.88
J-26	1,270.00	Demand	0	Peak	0	1,370.23	43.36
J-27	1,110.00	Demand	7,000	Peak	21,000	1,377.91	115.91
J-28	1,183.00	Demand	13,000	Peak	39,000	1,377.56	84.18
J-29	1,185.00	Demand	7,000	Peak	21,000	1,377.53	83.30
J-30	1,150.00	Demand	12,000	Peak	36,000	1,376.59	98.04
J-31	1,121.00	Demand	10,000	Peak	30,000	1,375.64	110.17
J-32	1,127.00	Demand	8,000	Peak	24,000	1,375.31	107.43
J-33	1,125.00	Demand	14,000	Peak	42,000	1,368.97	105.55
J-34	1,126.00	Demand	8,000	Peak	24,000	1,368.60	104.96
J-35	1,145.00	Demand	7,000	Peak	21,000	1,368.53	96.71
J-36	1,170.00	Demand	7,000	Peak	21,000	1,368.52	85.89
J-37	1,180.00	Demand	7,000	Peak	21,000	1,368.52	81.56
J-38	1,165.00	Demand	9,000	Peak	27,000	1,368.58	88.08
J-39	1,168.00	Demand	13,000	Peak	39,000	1,368.84	86.90
J-40	1,131.00	Demand	10,000	Peak	30,000	1,371.57	104.08
J-41	1,190.00	Demand	19,000	Peak	57,000	1,370.55	78.12
J-42	1,232.00	Demand	11,000	Peak	33,000	1,370.44	59.90
J-43	1,250.00	Demand	8,000	Peak	24,000	1,370.31	52.05
J-45	1,260.00	Demand	6,000	Peak	18,000	1,370.24	47.70
J-46	1,225.00	Demand	7,000	Peak	21,000	1,370.27	62.85
J-47	1,227.00	Demand	7,000	Peak	21,000	1,370.46	62.07
J-48	1,255.00	Demand	2,000	Peak	6,000	1,370.26	49.87
J-49	1,145.00	Demand	11,000	Peak	33,000	1,368.85	96.85
J-50	1,148.00	Demand	10,000	Peak	30,000	1,368.57	95.43
J-44	1,032.00	Demand	0	Peak	0	1,209.84	76.94
J-51	1,060.00	Demand	0	Peak	0	1,208.62	64.30
J-52	1,060.00	Demand	0	Peak	0	1,382.87	139.69
J-53	1,061.00	Demand	0	Peak	0	1,382.59	139.14
J-54	1,070.00	Demand	0	Peak	0	1,381.64	134.83

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-17	J-16	J-17	691.00	6.0	100.0	Open	-106,561	0.67	0.84
P-18	J-17	J-18	455.00	6.0	100.0	Open	-124,561	0.59	0.98
P-19	J-18	J-19	860.00	12.0	100.0	Open	1,070,589	2.05	2.11
P-20	J-19	J-20	794.00	12.0	100.0	Open	907,433	1.39	1.79
P-21	J-20	J-21	574.00	12.0	100.0	Open	880,433	0.95	1.73
P-22	J-21	J-22	1,671.00	12.0	100.0	Open	907,151	2.93	1.79
P-23	J-22	J-23	2,109.00	12.0	100.0	Open	574,017	1.58	1.13
P-24	J-23	J-24	651.00	12.0	100.0	Open	353,921	0.20	0.70
P-25	J-24	J-25	1,083.00	12.0	100.0	Open	260,921	0.19	0.51
P-26	J-25	J-26	426.00	12.0	100.0	Open	250,151	0.07	0.49
P-27	J-26	R-1	1,400.00	12.0	100.0	Open	250,151	0.23	0.49
P-28	J-16	J-27	679.00	6.0	100.0	Open	82,561	0.41	0.65
P-29	J-27	J-28	992.00	6.0	100.0	Open	61,561	0.35	0.49
P-30	J-28	J-29	482.00	6.0	100.0	Open	22,561	0.03	0.18
P-31	J-29	J-19	595.00	6.0	100.0	Open	1,561	0.00	0.01
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
P-33	J-30	J-31	1,068.00	6.0	100.0	Open	101,717	0.95	0.80
P-34	J-31	J-32	705.00	6.0	100.0	Open	71,717	0.33	0.57
P-35	J-32	J-21	566.00	6.0	100.0	Open	47,717	0.12	0.38
P-36	J-22	J-33	1,672.00	6.0	100.0	Open	156,219	3.30	1.23
P-37	J-33	J-34	709.00	6.0	100.0	Open	76,569	0.37	0.60
P-38	J-34	J-35	552.00	6.0	100.0	Open	34,547	0.07	0.27
P-39	J-35	J-36	639.00	6.0	100.0	Open	13,547	0.01	0.11
P-40	J-36	J-37	546.00	6.0	100.0	Open	-7,453	0.00	0.06
P-41	J-37	J-38	758.00	6.0	100.0	Open	-28,453	0.06	0.22
P-42	J-38	J-39	630.00	6.0	100.0	Open	-67,431	0.26	0.53
P-43	J-39	J-23	2,061.00	6.0	100.0	Open	-101,781	1.84	0.80
P-44	J-22	J-40	606.00	6.0	100.0	Open	116,914	0.70	0.92
P-45	J-40	J-41	1,523.00	6.0	100.0	Open	86,914	1.01	0.68
P-46	J-41	J-42	1,249.00	6.0	100.0	Open	29,914	0.12	0.24
P-47	J-42	J-43	777.00	6.0	100.0	Open	40,230	0.12	0.32
P-48	J-43	J-25	631.00	6.0	100.0	Open	16,230	0.02	0.13
P-51	J-45	J-46	623.00	6.0	100.0	Open	-18,000	0.02	0.14
P-53	J-24	J-47	429.00	6.0	100.0	Open	21,000	0.02	0.17
P-54	J-46	J-48	563.00	6.0	100.0	Open	6,000	0.00	0.05
P-55	J-23	J-42	1,338.00	6.0	100.0	Open	43,318	0.25	0.34
P-52	J-46	J-24	1,107.00	6.0	100.0	Open	-45,000	0.22	0.35
P-56	J-33	J-49	859.00	6.0	100.0	Open	37,651	0.12	0.30
P-57	J-49	J-39	750.00	6.0	100.0	Open	4,651	0.00	0.04
P-58	J-34	J-50	700.00	6.0	100.0	Open	18,021	0.03	0.14
P-59	J-50	J-38	753.00	6.0	100.0	Open	-11,979	0.01	0.09
P-49	R-2	J-44	654.00	20.0	100.0	Open	1,213,151	0.16	0.86
P-50	J-44	J-51	1,653.00	16.0	100.0	Open	1,213,151	1.22	1.34
P-60	J-51	PMP-1	21.00	16.0	100.0	Open	1,213,151	0.02	1.34
P-61	PMP-1	J-52	21.00	12.0	100.0	Open	1,213,151	0.06	2.39
P-62	J-52	J-53	92.00	12.0	100.0	Open	1,213,151	0.28	2.39
P-63	J-53	J-54	317.00	12.0	100.0	Open	1,213,151	0.95	2.39
P-64	J-54	J-18	688.00	12.0	100.0	Open	1,213,151	2.06	2.39

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pump Report

Label	Elevation (ft)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpd)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	1,060.00	On	1,208.60	1,382.93	1,213,151	174.33	37.08

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,370.00	250,151	1,370.00
R-2	1,210.00	-1,213,151	1,210.00

WaterCAD Results:

Tank 3: Spillway El=1590'

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-45	1,260.00	Demand	8,000	Fixed	8,000	1,589.87	142.72
J-44	1,285.00	Demand	8,000	Fixed	8,000	1,589.88	131.91
J-51	1,305.00	Demand	5,000	Fixed	5,000	1,589.90	123.26
J-52	1,290.00	Demand	6,000	Fixed	6,000	1,589.92	129.76
J-20	1,255.00	Demand	0	Fixed	0	1,589.94	144.91
J-21	1,270.00	Demand	0	Fixed	0	1,589.98	138.44

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-49	J-45	J-44	646.00	6.0	100.0	Open	-8,000	0.01	0.06
P-50	J-44	J-51	553.00	6.0	100.0	Open	-16,000	0.02	0.13
P-60	J-51	J-52	403.00	6.0	100.0	Open	-21,000	0.02	0.17
P-20	J-52	J-20	312.00	6.0	100.0	Open	-27,000	0.02	0.21
P-21	J-20	J-21	518.00	6.0	100.0	Open	-27,000	0.04	0.21
P-22	J-21	R-3	8,200.00	12.0	100.0	Open	-27,000	0.02	0.05

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-3	1,590.00	-27,000	1,590.00

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-45	1,260.00	Demand	8,000	Max day	10,000	1,535.22	119.08
J-44	1,285.00	Demand	8,000	Max day	10,000	1,535.23	108.26
J-51	1,305.00	Demand	725,000	Composite	726,250	1,535.25	99.62
J-52	1,290.00	Demand	6,000	Max day	7,500	1,549.64	112.33
J-20	1,255.00	Demand	0	Max day	0	1,560.98	132.38
J-21	1,270.00	Demand	0	Max day	0	1,579.81	134.04

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-49	J-45	J-44	646.00	6.0	100.0	Open	-10,000	0.01	0.08
P-50	J-44	J-51	553.00	6.0	100.0	Open	-20,000	0.02	0.16
P-60	J-51	J-52	403.00	6.0	100.0	Open	-746,250	14.38	5.88
P-20	J-52	J-20	312.00	6.0	100.0	Open	-753,750	11.34	5.94
P-21	J-20	J-21	518.00	6.0	100.0	Open	-753,750	18.83	5.94
P-22	J-21	R-3	8,200.00	12.0	100.0	Open	-753,750	10.19	1.48

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-3	1,590.00	-753,750	1,590.00

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

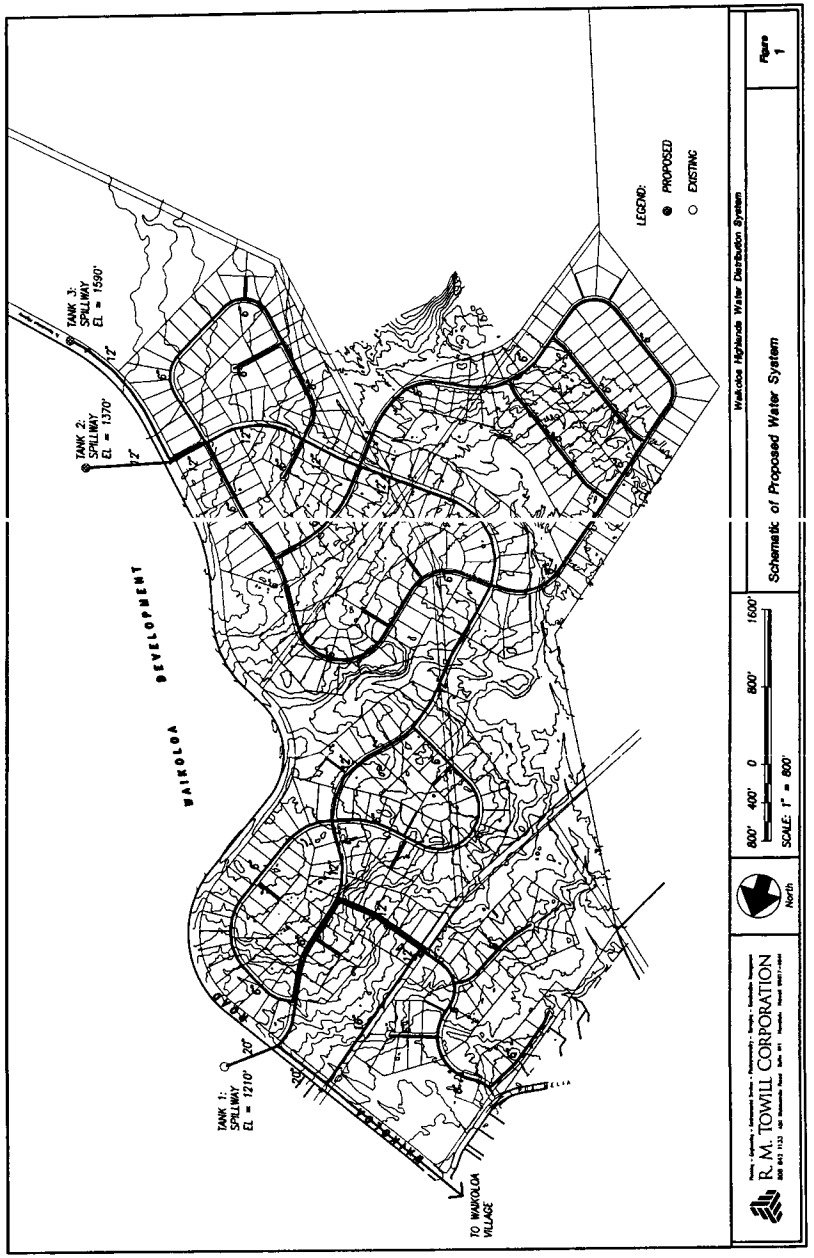
Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-45	1,260.00	Demand	8,000	Peak	24,000	1,589.04	142.36
J-44	1,285.00	Demand	8,000	Peak	24,000	1,589.08	131.56
J-51	1,305.00	Demand	5,000	Peak	15,000	1,589.20	122.96
J-52	1,290.00	Demand	6,000	Peak	18,000	1,589.35	129.52
J-20	1,255.00	Demand	0	Peak	0	1,589.53	144.74
J-21	1,270.00	Demand	0	Peak	0	1,589.84	138.38

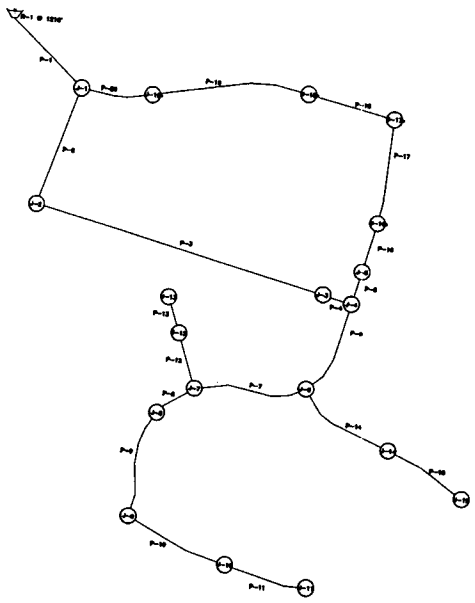
Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-49	J-45	J-44	646.00	6.0	100.0	Open	-24,000	0.04	0.19
P-50	J-44	J-51	553.00	6.0	100.0	Open	-48,000	0.12	0.38
P-60	J-51	J-52	403.00	6.0	100.0	Open	-63,000	0.15	0.50
P-20	J-52	J-20	312.00	6.0	100.0	Open	-81,000	0.18	0.64
P-21	J-20	J-21	518.00	6.0	100.0	Open	-81,000	0.30	0.64
P-22	J-21	R-3	8,200.00	12.0	100.0	Open	-81,000	0.16	0.16

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-3	1,590.00	-81,000	1,590.00





R. M. TOWILL CORPORATION

North

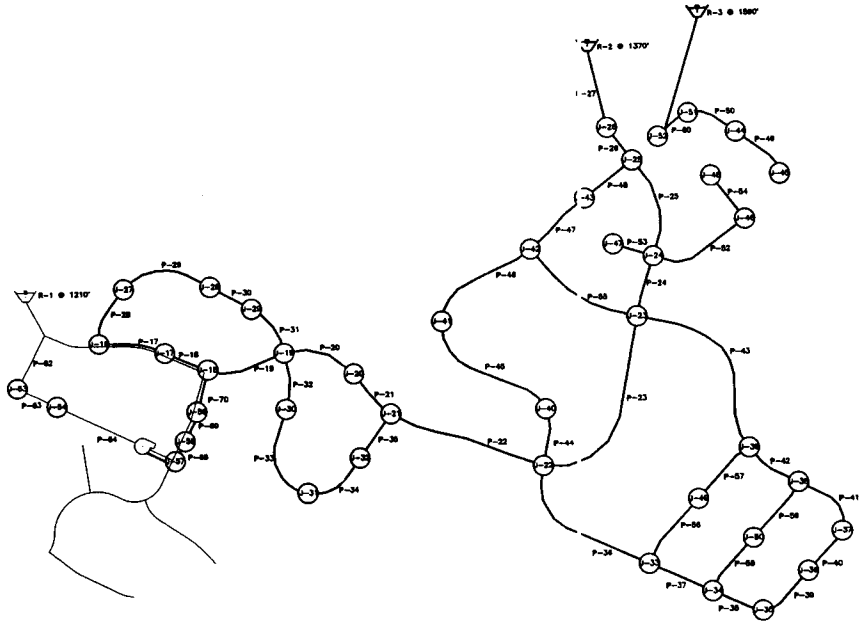
400' 200' 0 400' 800'

SCALE: 1" = 400'

Waikoloa Highlands Water Distribution System

Hydraulic Schematic of the Proposed Waikoloa Highlands System - 1

Figure 2



R. M. TOWILL CORPORATION

North

800' 400' 0 800' 1600'

SCALE: 1" = 800'

Waikoloa Highlands Water Distribution System

Hydraulic Schematic of the Proposed Waikoloa Highlands System - 2

Figure 3

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APPENDIX J

Waikoloa Highlands Water Distribution System, Waikoloa Highlands Subdivision
R.M. Towill Corporation, September 2006.

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Waikoloa Highlands Subdivision
Waikoloa, South Kohala, Hawaii

SEPTEMBER 2006

Prepared For:

Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

R. M. TOWILL CORPORATION
SINCE 1930

420 Waiakamilo Rd., Suite 411
Honolulu, Hawaii 96817-4941
(808) 842-1133 • Fax: (808) 842-1937
(RMTC Ref: 1-20580-0-E)

WAIKOLOA HIGHLANDS WATER DISTRIBUTION SYSTEM

PROJECT NAME:	WAIKOLOA HIGHLANDS SUBDIVISION
LOCATION:	Waikoloa, South Kohala, Hawaii
TAX MAP KEY:	(3rd Div.) 6-8-02:16/6-8-03:32
ZONING:	RA - 1a
PROJECT AREA:	744.4 Acres
OWNER:	Waikoloa Mauka, LLC 120 Aspen Oak Lane Glendale, CA 91207
ENGINEERING CONSULTANT:	R. M. Towill Corporation 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817-4941 Phone: (808) 842-1133 Fax: (808) 842-1937
DATE:	September 2006

REFERENCES:

1. Waikoloa Water Master Plans, Tom Nance Water Resources Engineering, February 1991.

2. County of Hawaii Water Supply Standards, 2002.

1. INTODUCTION

The scope of this project includes: (1) the sizing of mains for the Waikoloa Highlands subdivision and (2) the use of existing water system components for the proposed Waikoloa Highlands Water Distribution System. The Waikoloa Highlands subdivision consists of 398 lots which are located from the 980-ft to 1310-ft elevation.

An existing tank with spillway elevation of 1210 ft will be used to service a portion of the lots. Two additional tanks however, are needed to service the remaining lots. In addition to these tanks, a booster bump is required for pumping water from the 1210' tank to fill the 1370' tank, while also distributing water during transmission.

The sizing of the mains and the booster pump is based on design criteria.

2. DESIGN CRITERIA

The design criteria used for the water system analysis is listed in Table 1 and is based on the Waikoloa Water Master Plans (Ref. 1). The design criteria follows the County of Hawaii Water Supply Standards (Ref.2) with the following deviations:

1. The maximum day demand factor of 1.25 is used instead of the County's 1.5 factor. To account for losses through the system, 12% was added to the maximum flow rates.

2. The peak demand factor of 3.0 is also used instead of the County's 5.0 factor.

3. The maximum velocity restriction of 7 feet per second is used instead of the County's 6 feet per second restriction for distribution mains without fire flow.

4. The maximum velocity restriction of 10 feet per second for distribution mains with fire flow is an additional County of Hawaii standard used for this design.

Table 1. Water System Facilities Sizing Criteria

Demand Factors

- Average Day Demand = Application of the water use rates of Table 2
- Maximum Day Demand = 1.25 * Average Day Demand
- Peak Demand = 3.0 * Average Day Demand

Fire Flow

- Single Family Residential: 500 gallons per minute (gpm)for 2 hours (lots > 10,000 sq. ft.)

Service Pressures

- Minimum of 40 psi (except during fire flow)
- Maximum of 125 psi
- 20 psi at critical fire hydrant for fire flow with coincident maximum daily demand

Pipeline Sizes

- Meet minimum pressure criterion at peak flowrate with a maximum of 7.0 feet per second (fps) velocity
- Meet minimum hydrant pressure criterion at fire plus maximum daily flowrate with no velocity restriction
- Compute pipeline pressure losses using Hazen-Williams formula with:
  C = 100 for 6" or smaller pipelines
  C = 110 for 8" and 12" pipelines

Well Pumping Capacity

- Provide the maximum daily demand, including unmetered supply, in a 24-hour pumping day with the largest well out of service.

Reservoir

- Provide the maximum daily demand, including unmetered supply but excluding controllable common area irrigation, with no credit for well inflow.
- Meet fire flow and coincident maximum daily demand for the duration of the fire flow with the largest reservoir 3/4 full at the start and the credit for well inflow with the largest pump out of service.

3. DESIGN ANALYSIS

The Waikoloa Highlands Water Distribution System services three zones within the site. The lower zone is served by the tank at the 1210-ft elevation. This zone serves 47 lots in addition to the existing Waikoloa Village, which has an average day demand of nearly 600,000 gallons per day (gpd) (Ref. 1). The proposed distribution system of this zone is comprised of 6-inch pipes. The 1210-ft elevation tank also serves the booster pump located at the 1060-ft elevation.

The booster pump distributes water to the upper lots, in addition to supplying the 1370-ft service reservoir. In the middle service zone, 324 lots are served by the proposed 12-inch water main supplying the proposed tank at the 1370-ft elevation. The proposed tank at the 1370-ft elevation complies with the tank proposed in the Waikoloa Water Master Plans (Ref. 1). The third tank at the 1590-ft elevation also complies with the Waikoloa Water Master Plans (Ref. 1). This tank will serve the remaining 27 lots by gravity flow.

Analysis and design of the water system for this report were done using a water distribution modeling software system, WaterCAD by Haestad Methods Incorporated. This program allows the designer to develop a hydraulic model of a pressurized pipe system and was used for this report to perform the following analyses:

1. Steady-state analysis of the water system, including pipes, pumps, tanks, and reservoirs
2. Extended period simulation to analyze the system under varying supply and demand conditions
3. Fire flow analysis

The proposed distribution system shown in Figure 1 displays the nodes or pressure junctions that connect multiple pipes or are the end of a pipe segments. Demands were assigned to the nodes based on the number of lots that are being served at that particular node. The distribution of demands is listed in Table 2.

4. RESULTS

The distribution system was initially designed with 6-inch pipelines. The proposed distribution system in Figure 1 consists of a main pipeline connecting the lower tank to the booster pump and the booster bump to the tank at the 1370-ft elevation. This main line has various branches which are either cul-de-sacs or loops that service the various subdivisions within Waikoloa Highlands. The main line was tested as a 6-inch pipe and then sized up if the distribution system did not meet the minimum design criteria. The distribution was found to work with the main line as a 12-inch pipe. All of the other branches remained 6-inch pipes through-out the design process. The 12-inch main line effectively distributes water to the middle and upper sections. See Figure 2 and Figure 3 for schematics of the water system and the placement of the pressure junctions listed in Table 2.

Table 2. Distribution of Demands for Waikoloa Highlands

		Flowrates for Design (GPD)		
Node	Single Family Units	Average Day	Maximum Day	Peak
Serviced by Tank with Spillway El. = 1210 ft.				
J-2		567,360		
J-4	4	5,000	5,000	12,000
J-5	6	3,000	7,500	18,000
J-6	5	4,000	6,250	15,000
J-7	5	4,000	6,250	15,000
J-9	2	2,000	2,500	6,000
J-10	2	2,000	2,500	6,000
J-11	2	2,000	2,500	6,000
J-12	4	3,000	5,000	12,000
J-13	3	4,000	3,750	9,000
J-14	7	7,000	8,750	21,000
J-15	7	7,000	8,750	21,000
Total =	47	43,000	58,750	141,000
Serviced by Tank with Spillway El. = 1370 ft.				
J-16	8	8,000	10,000	24,000
J-17	6	6,000	7,500	18,000
J-18	6	6,000	7,500	18,000
J-19	9	9,000	11,250	27,000
J-20	9	9,000	11,250	27,000
J-21	9	9,000	11,250	27,000
J-22	25	25,000	31,250	75,000
J-23	13	13,000	16,250	39,000
J-24	16	16,000	20,000	48,000
J-25	4	4,000	5,000	12,000
J-27	7	7,000	8,750	21,000
J-28	14	14,000	17,500	42,000
J-29	6	6,000	7,500	18,000
J-30	12	12,000	15,000	36,000
J-31	9	9,000	11,250	27,000
J-32	7	7,000	8,750	21,000
J-33	13	13,000	16,250	39,000
J-34	8	8,000	10,000	24,000
J-35	7	7,000	8,750	21,000
J-36	8	8,000	10,000	24,000
J-37	9	9,000	11,250	27,000
J-38	9	9,000	11,250	27,000
J-39	16	16,000	20,000	48,000
J-40	15	15,000	18,750	45,000
J-41	14	14,000	17,500	42,000
J-42	12	12,000	15,000	36,000
J-43	10	10,000	12,500	30,000
J-46	9	9,000	11,250	27,000
J-47	5	5,000	6,250	15,000
J-48	4	4,000	5,000	12,000
J-49	15	15,000	18,750	45,000
J-50	10	10,000	12,500	30,000
Total =	324	324,000	405,000	972,000
Serviced by Tank with Spillway El. = 1590 ft.				
J-44	8	8,000	10,000	24,000
J-45	8	8,000	10,000	24,000
J-51	5	5,000	6,250	15,000
J-52	6	6,000	7,500	18,000
Total =	27	27,000	33,750	81,000

Watercad Simulation Results:

Maximum daily flow:
Under the maximum daily demand condition, analysis shows that the results satisfy the requirements set by the Waikoloa Water Master Plans (Ref.1). Velocities were well below 7 feet per second. Pressure junctions were also below the maximum allowable pressure.

Peak hour flow:
Under this condition, all the pressure junctions are required to meet the minimum pressure of 40 psi. The analysis proved this to be the case except for a couple of junctions directly connected to the booster pump.

Fire Flow:
According to the Water Supply Standards (Ref. 2), under the fire flow condition, the pressure at each junction should be at least 20 psi. Fire flow conditions were simulated by applying the fire flow demand to several pressure junctions. The results proved that the water system is sufficient to handle fire flow.

See the Appendix for calculations and results produced by WaterCAD.

APPENDIX

WaterCAD Results:

Tank 1: Spillway El=1210'

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,076.00	Demand	0	Fixed	0	1,209.67	57.83
J-2	1,032.00	Demand	567,360	Fixed	567,360	1,209.63	76.85
J-3	1,059.00	Demand	0	Fixed	0	1,209.63	65.17
J-4	1,060.00	Demand	5,000	Fixed	5,000	1,209.61	64.73
J-5	1,073.00	Demand	3,000	Fixed	3,000	1,209.61	59.10
J-6	1,047.00	Demand	4,000	Fixed	4,000	1,209.55	70.33
J-7	1,022.00	Demand	4,000	Fixed	4,000	1,209.53	81.13
J-8	1,020.00	Demand	0	Fixed	0	1,209.53	82.00
J-9	998.00	Demand	2,000	Fixed	2,000	1,209.52	91.52
J-10	1,004.00	Demand	2,000	Fixed	2,000	1,209.52	88.92
J-11	1,011.00	Demand	2,000	Fixed	2,000	1,209.52	85.89
J-12	1,022.00	Demand	3,000	Fixed	3,000	1,209.52	81.13
J-13	1,038.00	Demand	4,000	Fixed	4,000	1,209.52	74.21
J-14	1,044.00	Demand	7,000	Fixed	7,000	1,209.53	71.62
J-15	1,045.00	Demand	7,000	Fixed	7,000	1,209.53	71.18
J-16*	1,060.00	Demand	2,000	Fixed	2,000	1,209.61	64.73
J-17*	1,065.00	Demand	6,000	Fixed	6,000	1,209.62	62.57
J-18*	1,075.00	Demand	6,000	Fixed	6,000	1,209.63	58.25
J-19*	1,080.00	Demand	8,000	Fixed	8,000	1,209.67	56.10

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	R-1	J-1	4,400.00	20.0	100.0	Open	632,360	0.33	0.45
P-2	J-1	J-2	600.00	20.0	100.0	Open	602,927	0.04	0.43
P-3	J-2	J-3	1,556.00	16.0	100.0	Open	35,567	0.00	0.04
P-4	J-3	J-4	158.00	6.0	100.0	Open	35,567	0.02	0.28
P-5	J-4	J-5	183.00	6.0	100.0	Open	-4,433	0.00	0.03
P-6	J-4	J-6	518.00	6.0	100.0	Open	35,000	0.06	0.28
P-7	J-6	J-7	592.00	6.0	100.0	Open	17,000	0.02	0.13
P-8	J-7	J-8	239.00	6.0	100.0	Open	6,000	0.00	0.05
P-9	J-8	J-9	576.00	6.0	100.0	Open	6,000	0.00	0.05
P-10	J-9	J-10	561.00	6.0	100.0	Open	4,000	0.00	0.03
P-11	J-10	J-11	440.00	6.0	100.0	Open	2,000	0.00	0.02
P-12	J-7	J-12	305.00	6.0	100.0	Open	7,000	0.00	0.06
P-13	J-12	J-13	197.00	6.0	100.0	Open	4,000	0.00	0.03
P-14	J-6	J-14	547.00	6.0	100.0	Open	14,000	0.01	0.11
P-15	J-14	J-15	463.00	6.0	100.0	Open	7,000	0.00	0.06
P-16	J-5	J-16*	263.00	6.0	100.0	Open	-7,433	0.00	0.06
P-17	J-16*	J-17*	551.00	6.0	100.0	Open	-9,433	0.01	0.07
P-18	J-17*	J-18*	463.00	6.0	100.0	Open	-15,433	0.01	0.12
P-19	J-18*	J-19*	817.00	6.0	100.0	Open	-21,433	0.04	0.17
P-20	J-19*	J-1	376.00	12.0	100.0	Open	-29,433	0.00	0.06

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,210.00	-632,360	1,210.00

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,076.00	Demand	0	Max day	0	1,208.36	57.26
J-2	1,032.00	Demand	567,360	Max day	709,200	1,208.19	76.23
J-3	1,059.00	Demand	0	Max day	0	1,207.91	64.42
J-4	1,060.00	Demand	5,000	Max day	6,250	1,204.46	62.50
J-5	1,073.00	Demand	723,000	Composite	723,000	1,201.10	55.42
J-6	1,047.00	Demand	4,000	Max day	5,000	1,204.37	68.08
J-7	1,022.00	Demand	4,000	Max day	5,000	1,204.34	78.89
J-8	1,020.00	Demand	0	Max day	0	1,204.34	79.75
J-9	998.00	Demand	2,000	Max day	2,500	1,204.33	89.27
J-10	1,004.00	Demand	2,000	Max day	2,500	1,204.33	86.67
J-11	1,011.00	Demand	2,000	Max day	2,500	1,204.33	83.64
J-12	1,022.00	Demand	3,000	Max day	3,750	1,204.33	78.89
J-13	1,038.00	Demand	4,000	Max day	5,000	1,204.33	71.96
J-14	1,044.00	Demand	7,000	Max day	8,750	1,204.35	69.37
J-15	1,045.00	Demand	7,000	Max day	8,750	1,204.34	68.94
J-16*	1,060.00	Demand	2,000	Max day	2,500	1,201.93	61.40
J-17*	1,065.00	Demand	6,000	Max day	7,500	1,203.70	60.01
J-18*	1,075.00	Demand	6,000	Max day	7,500	1,205.30	56.37
J-19*	1,080.00	Demand	8,000	Max day	10,000	1,208.31	55.51

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	R-1	J-1	4,400.00	20.0	100.0	Open	1,509,700	1.64	1.07
P-2	J-1	J-2	600.00	20.0	100.0	Open	1,280,915	0.17	0.91
P-3	J-2	J-3	1,556.00	16.0	100.0	Open	571,715	0.29	0.63
P-4	J-3	J-4	158.00	6.0	100.0	Open	571,715	3.44	4.51
P-5	J-4	J-5	183.00	6.0	100.0	Open	521,715	3.37	4.11
P-6	J-4	J-6	518.00	6.0	100.0	Open	43,750	0.10	0.34
P-7	J-6	J-7	592.00	6.0	100.0	Open	21,250	0.03	0.17
P-8	J-7	J-8	239.00	6.0	100.0	Open	7,500	0.00	0.06
P-9	J-8	J-9	576.00	6.0	100.0	Open	7,500	0.00	0.06
P-10	J-9	J-10	561.00	6.0	100.0	Open	5,000	0.00	0.04
P-11	J-10	J-11	440.00	6.0	100.0	Open	2,500	0.00	0.02
P-12	J-7	J-12	305.00	6.0	100.0	Open	8,750	0.00	0.07
P-13	J-12	J-13	197.00	6.0	100.0	Open	5,000	0.00	0.04
P-14	J-6	J-14	547.00	6.0	100.0	Open	17,500	0.02	0.14
P-15	J-14	J-15	463.00	6.0	100.0	Open	8,750	0.00	0.07
P-16	J-5	J-16*	263.00	6.0	100.0	Open	-201,285	0.83	1.59
P-17	J-16*	J-17*	551.00	6.0	100.0	Open	-203,785	1.78	1.61
P-18	J-17*	J-18*	463.00	6.0	100.0	Open	-211,285	1.60	1.66
P-19	J-18*	J-19*	817.00	6.0	100.0	Open	-218,785	3.01	1.72
P-20	J-19*	J-1	376.00	12.0	100.0	Open	-228,785	0.05	0.45

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,210.00	-1,509,700	1,210.00

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,076.00	Demand	0	Peak	0	1,207.49	56.89
J-2	1,032.00	Demand	567,360	Peak	1,702,080	1,207.18	75.79
J-3	1,059.00	Demand	0	Peak	0	1,207.17	64.10
J-4	1,060.00	Demand	5,000	Peak	15,000	1,207.01	63.60
J-5	1,073.00	Demand	3,000	Peak	9,000	1,207.02	57.98
J-6	1,047.00	Demand	4,000	Peak	12,000	1,206.52	69.02
J-7	1,022.00	Demand	4,000	Peak	12,000	1,206.38	79.77
J-8	1,020.00	Demand	0	Peak	0	1,206.37	80.63
J-9	998.00	Demand	2,000	Peak	6,000	1,206.35	90.14
J-10	1,004.00	Demand	2,000	Peak	6,000	1,206.34	87.54
J-11	1,011.00	Demand	2,000	Peak	6,000	1,206.33	84.51
J-12	1,022.00	Demand	3,000	Peak	9,000	1,206.36	79.76
J-13	1,038.00	Demand	4,000	Peak	12,000	1,206.36	72.84
J-14	1,044.00	Demand	7,000	Peak	21,000	1,206.43	70.27
J-15	1,045.00	Demand	7,000	Peak	21,000	1,206.41	69.83
J-16*	1,060.00	Demand	2,000	Peak	6,000	1,207.03	63.61
J-17*	1,065.00	Demand	6,000	Peak	18,000	1,207.08	61.47
J-18*	1,075.00	Demand	6,000	Peak	18,000	1,207.17	57.18
J-19*	1,080.00	Demand	8,000	Peak	24,000	1,207.48	55.16

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	R-1	J-1	4,400.00	20.0	100.0	Open	1,897,080	2.51	1.35
P-2	J-1	J-2	600.00	20.0	100.0	Open	1,808,781	0.31	1.28
P-3	J-2	J-3	1,556.00	16.0	100.0	Open	106,701	0.01	0.12
P-4	J-3	J-4	158.00	6.0	100.0	Open	106,701	0.15	0.84
P-5	J-4	J-5	183.00	6.0	100.0	Open	-13,299	0.00	0.10
P-6	J-4	J-6	518.00	6.0	100.0	Open	105,000	0.49	0.83
P-7	J-6	J-7	592.00	6.0	100.0	Open	51,000	0.15	0.40
P-8	J-7	J-8	239.00	6.0	100.0	Open	18,000	0.01	0.14
P-9	J-8	J-9	576.00	6.0	100.0	Open	18,000	0.02	0.14
P-10	J-9	J-10	561.00	6.0	100.0	Open	12,000	0.01	0.09
P-11	J-10	J-11	440.00	6.0	100.0	Open	6,000	0.00	0.05
P-12	J-7	J-12	305.00	6.0	100.0	Open	21,000	0.01	0.17
P-13	J-12	J-13	197.00	6.0	100.0	Open	12,000	0.00	0.09
P-14	J-6	J-14	547.00	6.0	100.0	Open	42,000	0.09	0.33
P-15	J-14	J-15	463.00	6.0	100.0	Open	21,000	0.02	0.17
P-16	J-5	J-16*	263.00	6.0	100.0	Open	-22,299	0.01	0.18
P-17	J-16*	J-17*	551.00	6.0	100.0	Open	-28,299	0.05	0.22
P-18	J-17*	J-18*	463.00	6.0	100.0	Open	-46,299	0.10	0.36
P-19	J-18*	J-19*	817.00	6.0	100.0	Open	-64,299	0.31	0.51
P-20	J-19*	J-1	376.00	12.0	100.0	Open	-88,299	0.01	0.17

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,210.00	-1,897,080	1,210.00

WaterCAD Results:

Tank 2: Spillway El=1370'

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-16	1,090.00	Demand	8,000	Fixed	8,000	1,386.73	128.38
J-17	1,140.00	Demand	6,000	Fixed	6,000	1,387.23	106.96
J-18	1,138.00	Demand	6,000	Fixed	6,000	1,387.60	107.99
J-19	1,168.00	Demand	9,000	Fixed	9,000	1,385.46	94.08
J-20	1,160.00	Demand	9,000	Fixed	9,000	1,383.74	96.80
J-21	1,138.00	Demand	7,000	Fixed	7,000	1,382.51	105.79
J-22	1,112.00	Demand	20,000	Fixed	20,000	1,378.35	115.24
J-23	1,185.00	Demand	25,000	Fixed	25,000	1,375.27	82.32
J-24	1,208.00	Demand	9,000	Fixed	9,000	1,374.38	71.98
J-25	1,255.00	Demand	9,000	Fixed	9,000	1,373.01	51.06
J-26	1,270.00	Demand	0	Fixed	0	1,372.30	44.26
J-27	1,110.00	Demand	7,000	Fixed	7,000	1,386.32	119.55
J-28	1,183.00	Demand	13,000	Fixed	13,000	1,385.81	87.75
J-29	1,185.00	Demand	7,000	Fixed	7,000	1,385.63	86.80
J-30	1,150.00	Demand	12,000	Fixed	12,000	1,384.69	101.54
J-31	1,121.00	Demand	10,000	Fixed	10,000	1,383.57	113.60
J-32	1,127.00	Demand	8,000	Fixed	8,000	1,382.94	110.73
J-33	1,125.00	Demand	14,000	Fixed	14,000	1,376.01	108.60
J-34	1,126.00	Demand	8,000	Fixed	8,000	1,375.75	108.06
J-35	1,145.00	Demand	7,000	Fixed	7,000	1,375.71	99.82
J-36	1,170.00	Demand	7,000	Fixed	7,000	1,375.68	88.99
J-37	1,180.00	Demand	7,000	Fixed	7,000	1,375.67	84.66
J-38	1,165.00	Demand	9,000	Fixed	9,000	1,375.67	91.15
J-39	1,168.00	Demand	13,000	Fixed	13,000	1,375.65	89.84
J-40	1,131.00	Demand	10,000	Fixed	10,000	1,377.58	106.68
J-41	1,190.00	Demand	19,000	Fixed	19,000	1,375.92	80.44
J-42	1,232.00	Demand	11,000	Fixed	11,000	1,374.96	61.85
J-43	1,250.00	Demand	8,000	Fixed	8,000	1,373.82	53.57
J-45	1,260.00	Demand	6,000	Fixed	6,000	1,374.35	49.47
J-46	1,225.00	Demand	7,000	Fixed	7,000	1,374.35	64.62
J-47	1,227.00	Demand	7,000	Fixed	7,000	1,374.38	63.76
J-48	1,255.00	Demand	2,000	Fixed	2,000	1,374.35	51.64
J-49	1,145.00	Demand	11,000	Fixed	11,000	1,375.78	99.85
J-50	1,148.00	Demand	10,000	Fixed	10,000	1,375.70	98.51
J-44	1,032.00	Demand	0	Fixed	0	1,209.84	76.94
J-51	1,060.00	Demand	0	Fixed	0	1,208.65	64.31
J-52	1,060.00	Demand	0	Fixed	0	1,390.81	143.13
J-53	1,061.00	Demand	0	Fixed	0	1,390.54	142.58
J-54	1,070.00	Demand	0	Fixed	0	1,389.61	138.28

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-17	J-16	J-17	691.00	6.0	100.0	Open	-90,659	0.50	0.71
P-18	J-17	J-18	455.00	6.0	100.0	Open	-86,659	0.37	0.76
P-19	J-18	J-19	860.00	12.0	100.0	Open	1,095,846	2.14	2.16
P-20	J-19	J-20	794.00	12.0	100.0	Open	1,019,008	1.72	2.01
P-21	J-20	J-21	574.00	12.0	100.0	Open	1,010,008	1.23	1.99
P-22	J-21	J-22	1,671.00	12.0	100.0	Open	1,096,504	4.16	2.16
P-23	J-22	J-23	2,109.00	12.0	100.0	Open	823,295	3.09	1.62
P-24	J-23	J-24	651.00	12.0	100.0	Open	792,880	0.89	1.56
P-25	J-24	J-25	1,083.00	12.0	100.0	Open	761,880	1.37	1.50
P-26	J-25	J-26	426.00	12.0	100.0	Open	877,504	0.70	1.73
P-27	J-26	R-1	1,400.00	12.0	100.0	Open	877,504	2.30	1.73
P-28	J-16	J-27	679.00	6.0	100.0	Open	82,659	0.41	0.65
P-29	J-27	J-28	992.00	6.0	100.0	Open	75,659	0.51	0.60
P-30	J-28	J-29	482.00	6.0	100.0	Open	62,659	0.17	0.49
P-31	J-29	J-19	595.00	6.0	100.0	Open	55,659	0.17	0.44
P-32	J-19	J-30	601.00	6.0	100.0	Open	123,496	0.77	0.97
P-33	J-30	J-31	1,068.00	6.0	100.0	Open	111,496	1.13	0.88
P-34	J-31	J-32	705.00	6.0	100.0	Open	101,496	0.63	0.80
P-35	J-32	J-21	566.00	6.0	100.0	Open	93,496	0.43	0.74
P-36	J-22	J-33	1,672.00	6.0	100.0	Open	129,854	2.34	1.02
P-37	J-33	J-34	709.00	6.0	100.0	Open	62,851	0.26	0.50
P-38	J-34	J-35	552.00	6.0	100.0	Open	26,926	0.04	0.21
P-39	J-35	J-36	639.00	6.0	100.0	Open	19,926	0.03	0.16
P-40	J-36	J-37	546.00	6.0	100.0	Open	12,926	0.01	0.10
P-41	J-37	J-38	758.00	6.0	100.0	Open	5,926	0.00	0.05
P-42	J-38	J-39	630.00	6.0	100.0	Open	14,851	0.02	0.12
P-43	J-39	J-23	2,061.00	6.0	100.0	Open	43,854	0.39	0.35
P-44	J-22	J-40	606.00	6.0	100.0	Open	123,355	0.77	0.97
P-45	J-40	J-41	1,523.00	6.0	100.0	Open	113,355	1.66	0.89
P-46	J-41	J-42	1,249.00	6.0	100.0	Open	94,355	0.97	0.74
P-47	J-42	J-43	777.00	6.0	100.0	Open	132,625	1.13	1.05
P-48	J-43	J-25	631.00	6.0	100.0	Open	124,625	0.82	0.98
P-51	J-45	J-46	623.00	6.0	100.0	Open	-6,000	0.00	0.05
P-53	J-24	J-47	429.00	6.0	100.0	Open	7,000	0.00	0.06
P-54	J-46	J-48	563.00	6.0	100.0	Open	2,000	0.00	0.02
P-55	J-23	J-42	1,338.00	6.0	100.0	Open	49,270	0.31	0.39
P-52	J-46	J-24	1,107.00	6.0	100.0	Open	-15,000	0.03	0.12
P-56	J-33	J-49	859.00	6.0	100.0	Open	53,003	0.23	0.42
P-57	J-49	J-39	750.00	6.0	100.0	Open	42,003	0.13	0.33
P-58	J-34	J-50	700.00	6.0	100.0	Open	27,925	0.06	0.22
P-59	J-50	J-38	753.00	6.0	100.0	Open	17,925	0.03	0.14
P-49	R-2	J-44	654.00	20.0	100.0	Open	1,198,504	0.16	0.85
P-50	J-44	J-51	1,653.00	16.0	100.0	Open	1,198,504	1.19	1.33
P-60	J-51	PMP-1	21.00	16.0	100.0	Open	1,198,504	0.02	1.33
P-61	PMP-1	J-52	21.00	12.0	100.0	Open	1,198,504	0.06	2.36
P-62	J-52	J-53	92.00	12.0	100.0	Open	1,198,504	0.27	2.36
P-63	J-53	J-54	317.00	12.0	100.0	Open	1,198,504	0.93	2.36
P-64	J-54	J-18	688.00	12.0	100.0	Open	1,198,504	2.02	2.36

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pump Report

Label	Elevation (ft)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpd)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	1,060.00	On	1,208.63	1,390.88	1,198,504	182.24	38.29

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,370.00	877,504	1,370.00
R-2	1,210.00	-1,198,504	1,210.00

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-16	1,090.00	Demand	8,000	Max day	10,000	1,382.00	126.33
J-17	1,140.00	Demand	6,000	Max day	7,500	1,382.53	104.93
J-18	1,138.00	Demand	6,000	Max day	7,500	1,382.93	105.97
J-19	1,168.00	Demand	9,000	Max day	11,250	1,380.78	92.06
J-20	1,160.00	Demand	9,000	Max day	11,250	1,379.08	94.79
J-21	1,138.00	Demand	7,000	Max day	8,750	1,377.88	103.79
J-22	1,112.00	Demand	20,000	Max day	25,000	1,373.84	113.29
J-23	1,185.00	Demand	25,000	Max day	31,250	1,370.90	80.43
J-24	1,208.00	Demand	9,000	Max day	11,250	1,370.04	70.11
J-25	1,255.00	Demand	9,000	Max day	11,250	1,370.04	49.77
J-26	1,270.00	Demand	0	Max day	0	1,370.03	43.28
J-27	1,110.00	Demand	7,000	Max day	8,750	1,381.58	117.50
J-28	1,183.00	Demand	13,000	Max day	16,250	1,381.08	85.70
J-29	1,185.00	Demand	7,000	Max day	8,750	1,380.92	84.77
J-30	1,150.00	Demand	12,000	Max day	15,000	1,379.99	99.50
J-31	1,121.00	Demand	10,000	Max day	12,500	1,378.86	111.57
J-32	1,127.00	Demand	8,000	Max day	10,000	1,378.27	108.71
J-33	1,125.00	Demand	14,000	Max day	17,500	1,371.38	106.60
J-34	1,126.00	Demand	8,000	Max day	10,000	1,371.12	106.05
J-35	1,145.00	Demand	7,000	Max day	8,750	1,371.08	97.81
J-36	1,170.00	Demand	7,000	Max day	8,750	1,371.06	86.99
J-37	1,180.00	Demand	7,000	Max day	8,750	1,371.05	82.66
J-38	1,165.00	Demand	9,000	Max day	11,250	1,371.05	89.15
J-39	1,168.00	Demand	13,000	Max day	16,250	1,371.05	87.85
J-40	1,131.00	Demand	10,000	Max day	12,500	1,373.12	104.75
J-41	1,190.00	Demand	19,000	Max day	23,750	1,371.63	78.58
J-42	1,232.00	Demand	11,000	Max day	13,750	1,370.87	60.08
J-43	1,250.00	Demand	8,000	Max day	10,000	1,370.36	52.08
J-45	1,260.00	Demand	726,000	Composite	727,500	1,310.06	21.66
J-46	1,225.00	Demand	7,000	Max day	8,750	1,331.27	45.98
J-47	1,227.00	Demand	7,000	Max day	8,750	1,370.04	61.89
J-48	1,255.00	Demand	2,000	Max day	2,500	1,331.27	33.00
J-49	1,145.00	Demand	11,000	Max day	13,750	1,371.16	97.85
J-50	1,148.00	Demand	10,000	Max day	12,500	1,371.07	96.51
J-44	1,032.00	Demand	0	Max day	0	1,209.84	76.94
J-51	1,060.00	Demand	0	Max day	0	1,208.63	64.30
J-52	1,060.00	Demand	0	Max day	0	1,386.19	141.13
J-53	1,061.00	Demand	0	Max day	0	1,385.92	140.58
J-54	1,070.00	Demand	0	Max day	0	1,384.97	136.27

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-17	J-16	J-17	691.00	6.0	100.0	Open	-93,617	0.53	0.74
P-18	J-17	J-18	455.00	6.0	100.0	Open	-101,117	0.40	0.80
P-19	J-18	J-19	860.00	12.0	100.0	Open	1,098,434	2.15	2.16
P-20	J-19	J-20	794.00	12.0	100.0	Open	1,010,906	1.70	1.99
P-21	J-20	J-21	574.00	12.0	100.0	Open	999,656	1.20	1.97
P-22	J-21	J-22	1,671.00	12.0	100.0	Open	1,079,551	4.04	2.13
P-23	J-22	J-23	2,109.00	12.0	100.0	Open	801,846	2.94	1.58
P-24	J-23	J-24	651.00	12.0	100.0	Open	780,253	0.86	1.54
P-25	J-24	J-25	1,083.00	12.0	100.0	Open	21,503	0.00	0.04
P-26	J-25	J-26	426.00	12.0	100.0	Open	85,801	0.01	0.17
P-27	J-26	R-1	1,400.00	12.0	100.0	Open	85,801	0.03	0.17
P-28	J-16	J-27	679.00	6.0	100.0	Open	83,617	0.42	0.86
P-29	J-27	J-28	992.00	6.0	100.0	Open	74,867	0.50	0.59
P-30	J-28	J-29	482.00	6.0	100.0	Open	58,617	0.15	0.46
P-31	J-29	J-19	595.00	6.0	100.0	Open	49,867	0.14	0.39
P-32	J-19	J-30	601.00	6.0	100.0	Open	126,146	0.80	0.99
P-33	J-30	J-31	1,068.00	6.0	100.0	Open	111,146	1.12	0.88
P-34	J-31	J-32	705.00	6.0	100.0	Open	98,646	0.59	0.78
P-35	J-32	J-21	566.00	6.0	100.0	Open	88,648	0.39	0.70
P-36	J-22	J-33	1,672.00	6.0	100.0	Open	133,344	2.46	1.05
P-37	J-33	J-34	709.00	6.0	100.0	Open	63,474	0.26	0.50
P-38	J-34	J-35	552.00	6.0	100.0	Open	26,731	0.04	0.21
P-39	J-35	J-36	639.00	6.0	100.0	Open	17,981	0.02	0.14
P-40	J-36	J-37	546.00	6.0	100.0	Open	9,231	0.01	0.07
P-41	J-37	J-38	758.00	6.0	100.0	Open	481	0.00	0.00
P-42	J-38	J-39	630.00	6.0	100.0	Open	3,474	0.00	0.03
P-43	J-39	J-23	2,061.00	6.0	100.0	Open	25,844	0.15	0.20
P-44	J-22	J-40	606.00	6.0	100.0	Open	119,362	0.73	0.94
P-45	J-40	J-41	1,523.00	6.0	100.0	Open	106,862	1.49	0.84
P-46	J-41	J-42	1,249.00	6.0	100.0	Open	83,112	0.77	0.65
P-47	J-42	J-43	777.00	6.0	100.0	Open	85,548	0.50	0.67
P-48	J-43	J-25	631.00	6.0	100.0	Open	75,548	0.32	0.60
P-51	J-45	J-46	623.00	6.0	100.0	Open	-727,500	21.21	5.73
P-53	J-24	J-47	429.00	6.0	100.0	Open	8,750	0.00	0.07
P-54	J-46	J-48	563.00	6.0	100.0	Open	2,500	0.00	0.02
P-55	J-23	J-42	1,338.00	6.0	100.0	Open	16,186	0.04	0.13
P-52	J-46	J-24	1,107.00	6.0	100.0	Open	-738,750	38.78	5.82
P-56	J-33	J-49	859.00	6.0	100.0	Open	52,369	0.22	0.41
P-57	J-49	J-39	750.00	6.0	100.0	Open	38,619	0.11	0.30
P-58	J-34	J-50	700.00	6.0	100.0	Open	28,743	0.05	0.21
P-59	J-50	J-38	753.00	6.0	100.0	Open	14,243	0.02	0.11
P-49	R-2	J-44	654.00	20.0	100.0	Open	1,207,051	0.16	0.86
P-50	J-44	J-51	1,653.00	16.0	100.0	Open	1,207,051	1.21	1.34
P-60	J-51	PMP-1	21.00	16.0	100.0	Open	1,207,051	0.02	1.34
P-61	PMP-1	J-52	21.00	12.0	100.0	Open	1,207,051	0.06	2.38
P-62	J-52	J-53	92.00	12.0	100.0	Open	1,207,051	0.27	2.38
P-63	J-53	J-54	317.00	12.0	100.0	Open	1,207,051	0.94	2.38
P-64	J-54	J-18	688.00	12.0	100.0	Open	1,207,051	2.04	2.38

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Pump Report

Label	Elevation (ft)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpd)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	1,060.00	On	1,208.61	1,386.25	1,207,051	177.64	37.59

Scenario: Base
Extended Period Analysis: 2.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,370.00	85,801	1,370.00
R-2	1,210.00	-1,207,051	1,210.00

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-16	1,090.00	Demand	8,000	Peak	24,000	1,378.32	124.74
J-17	1,140.00	Demand	6,000	Peak	18,000	1,378.99	103.40
J-18	1,138.00	Demand	6,000	Peak	18,000	1,379.58	104.52
J-19	1,168.00	Demand	9,000	Peak	27,000	1,377.53	90.65
J-20	1,160.00	Demand	9,000	Peak	27,000	1,376.14	93.51
J-21	1,138.00	Demand	7,000	Peak	21,000	1,375.19	102.62
J-22	1,112.00	Demand	20,000	Peak	60,000	1,372.26	112.60
J-23	1,185.00	Demand	25,000	Peak	75,000	1,370.68	80.34
J-24	1,208.00	Demand	9,000	Peak	27,000	1,370.48	70.30
J-25	1,255.00	Demand	9,000	Peak	27,000	1,370.29	49.88
J-26	1,270.00	Demand	0	Peak	0	1,370.23	43.36
J-27	1,110.00	Demand	7,000	Peak	21,000	1,377.91	115.91
J-28	1,183.00	Demand	13,000	Peak	39,000	1,377.56	84.18
J-29	1,185.00	Demand	7,000	Peak	21,000	1,377.53	83.30
J-30	1,150.00	Demand	12,000	Peak	36,000	1,376.59	98.04
J-31	1,121.00	Demand	10,000	Peak	30,000	1,375.64	110.17
J-32	1,127.00	Demand	8,000	Peak	24,000	1,375.31	107.43
J-33	1,125.00	Demand	14,000	Peak	42,000	1,368.97	105.55
J-34	1,126.00	Demand	8,000	Peak	24,000	1,368.60	104.96
J-35	1,145.00	Demand	7,000	Peak	21,000	1,368.53	96.71
J-36	1,170.00	Demand	7,000	Peak	21,000	1,368.52	85.89
J-37	1,160.00	Demand	7,000	Peak	21,000	1,368.52	81.56
J-38	1,165.00	Demand	9,000	Peak	27,000	1,368.58	88.08
J-39	1,168.00	Demand	13,000	Peak	39,000	1,368.84	86.90
J-40	1,131.00	Demand	10,000	Peak	30,000	1,371.57	104.08
J-41	1,190.00	Demand	19,000	Peak	57,000	1,370.55	78.12
J-42	1,232.00	Demand	11,000	Peak	33,000	1,370.44	59.90
J-43	1,250.00	Demand	8,000	Peak	24,000	1,370.31	52.05
J-45	1,260.00	Demand	6,000	Peak	18,000	1,370.24	47.70
J-46	1,225.00	Demand	7,000	Peak	21,000	1,370.27	62.85
J-47	1,227.00	Demand	7,000	Peak	21,000	1,370.46	62.07
J-48	1,255.00	Demand	2,000	Peak	6,000	1,370.26	49.87
J-49	1,145.00	Demand	11,000	Peak	33,000	1,368.85	96.85
J-50	1,148.00	Demand	10,000	Peak	30,000	1,368.57	95.43
J-44	1,032.00	Demand	0	Peak	0	1,209.84	76.94
J-51	1,060.00	Demand	0	Peak	0	1,208.62	64.30
J-52	1,060.00	Demand	0	Peak	0	1,382.87	139.69
J-53	1,061.00	Demand	0	Peak	0	1,382.59	139.14
J-54	1,070.00	Demand	0	Peak	0	1,381.64	134.83

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-17	J-16	J-17	691.00	6.0	100.0	Open	-108,561	0.67	0.84
P-18	J-17	J-18	455.00	6.0	100.0	Open	-124,561	0.59	0.98
P-19	J-18	J-19	860.00	12.0	100.0	Open	1,070,589	2.05	2.11
P-20	J-19	J-20	794.00	12.0	100.0	Open	907,433	1.39	1.79
P-21	J-20	J-21	574.00	12.0	100.0	Open	880,433	0.95	1.73
P-22	J-21	J-22	1,671.00	12.0	100.0	Open	907,151	2.93	1.79
P-23	J-22	J-23	2,109.00	12.0	100.0	Open	574,017	1.58	1.13
P-24	J-23	J-24	651.00	12.0	100.0	Open	353,921	0.20	0.70
P-25	J-24	J-25	1,083.00	12.0	100.0	Open	260,921	0.19	0.51
P-26	J-25	J-26	426.00	12.0	100.0	Open	250,151	0.07	0.49
P-27	J-26	R-1	1,400.00	12.0	100.0	Open	250,151	0.23	0.49
P-28	J-16	J-27	679.00	6.0	100.0	Open	82,561	0.41	0.65
P-29	J-27	J-28	992.00	6.0	100.0	Open	61,561	0.35	0.49
P-30	J-28	J-29	482.00	6.0	100.0	Open	22,561	0.03	0.18
P-31	J-29	J-19	595.00	6.0	100.0	Open	1,561	0.00	0.01
P-32	J-19	J-30	601.00	6.0	100.0	Open	137,717	0.94	1.09
P-33	J-30	J-31	1,068.00	6.0	100.0	Open	101,717	0.95	0.80
P-34	J-31	J-32	705.00	6.0	100.0	Open	71,717	0.33	0.57
P-35	J-32	J-21	568.00	6.0	100.0	Open	47,717	0.12	0.38
P-36	J-22	J-33	1,672.00	6.0	100.0	Open	156,219	3.30	1.23
P-37	J-33	J-34	709.00	6.0	100.0	Open	76,569	0.37	0.60
P-38	J-34	J-35	552.00	6.0	100.0	Open	34,547	0.07	0.27
P-39	J-35	J-36	639.00	6.0	100.0	Open	13,547	0.01	0.11
P-40	J-36	J-37	546.00	6.0	100.0	Open	-7,453	0.00	0.06
P-41	J-37	J-38	758.00	6.0	100.0	Open	-28,453	0.06	0.22
P-42	J-38	J-39	630.00	6.0	100.0	Open	-67,431	0.26	0.53
P-43	J-39	J-23	2,061.00	6.0	100.0	Open	-101,781	1.84	0.80
P-44	J-22	J-40	606.00	6.0	100.0	Open	116,914	0.70	0.92
P-45	J-40	J-41	1,523.00	6.0	100.0	Open	86,914	1.01	0.68
P-46	J-41	J-42	1,249.00	6.0	100.0	Open	29,914	0.12	0.24
P-47	J-42	J-43	777.00	6.0	100.0	Open	40,230	0.12	0.32
P-48	J-43	J-25	631.00	6.0	100.0	Open	16,230	0.02	0.13
P-51	J-45	J-46	623.00	6.0	100.0	Open	-18,000	0.02	0.14
P-53	J-24	J-47	429.00	6.0	100.0	Open	21,000	0.02	0.17
P-54	J-48	J-48	563.00	6.0	100.0	Open	6,000	0.00	0.05
P-55	J-23	J-42	1,338.00	6.0	100.0	Open	43,316	0.25	0.34
P-52	J-46	J-24	1,107.00	6.0	100.0	Open	-45,000	0.22	0.35
P-56	J-33	J-49	859.00	6.0	100.0	Open	37,651	0.12	0.30
P-57	J-49	J-39	750.00	6.0	100.0	Open	4,651	0.00	0.04
P-58	J-34	J-50	700.00	6.0	100.0	Open	18,021	0.03	0.14
P-59	J-50	J-38	753.00	6.0	100.0	Open	-11,979	0.01	0.09
P-49	R-2	J-44	654.00	20.0	100.0	Open	1,213,151	0.16	0.86
P-50	J-44	J-51	1,653.00	16.0	100.0	Open	1,213,151	1.22	1.34
P-60	J-51	PMP-1	21.00	16.0	100.0	Open	1,213,151	0.02	1.34
P-61	PMP-1	J-52	21.00	12.0	100.0	Open	1,213,151	0.06	2.39
P-62	J-52	J-53	92.00	12.0	100.0	Open	1,213,151	0.28	2.39
P-63	J-53	J-54	317.00	12.0	100.0	Open	1,213,151	0.95	2.39
P-64	J-54	J-18	688.00	12.0	100.0	Open	1,213,151	2.06	2.39

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pump Report

Label	Elevation (ft)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpd)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	1,060.00	On	1,208.60	1,382.93	1,213,151	174.33	37.08

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-1	1,370.00	250,151	1,370.00
R-2	1,210.00	-1,213,151	1,210.00

WaterCAD Results:

Tank 3: Spillway El=1590'

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-45	1,260.00	Demand	8,000	Fixed	8,000	1,589.87	142.72
J-44	1,285.00	Demand	8,000	Fixed	8,000	1,589.88	131.91
J-51	1,305.00	Demand	5,000	Fixed	5,000	1,589.90	123.26
J-52	1,290.00	Demand	6,000	Fixed	6,000	1,589.92	129.76
J-20	1,255.00	Demand	0	Fixed	0	1,589.94	144.91
J-21	1,270.00	Demand	0	Fixed	0	1,589.98	138.44

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-49	J-45	J-44	646.00	6.0	100.0	Open	-8,000	0.01	0.06
P-50	J-44	J-51	553.00	6.0	100.0	Open	-16,000	0.02	0.13
P-60	J-51	J-52	403.00	6.0	100.0	Open	-21,000	0.02	0.17
P-20	J-52	J-20	312.00	6.0	100.0	Open	-27,000	0.02	0.21
P-21	J-20	J-21	518.00	6.0	100.0	Open	-27,000	0.04	0.21
P-22	J-21	R-3	8,200.00	12.0	100.0	Open	-27,000	0.02	0.05

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-3	1,590.00	-27,000	1,590.00

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-45	1,260.00	Demand	8,000	Max day	10,000	1,535.22	119.08
J-44	1,285.00	Demand	8,000	Max day	10,000	1,535.23	108.26
J-51	1,305.00	Demand	725,000	Composite	726,250	1,535.25	99.62
J-52	1,290.00	Demand	6,000	Max day	7,500	1,549.64	112.33
J-20	1,255.00	Demand	0	Max day	0	1,560.98	132.38
J-21	1,270.00	Demand	0	Max day	0	1,579.81	134.04

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-49	J-45	J-44	646.00	6.0	100.0	Open	-10,000	0.01	0.08
P-50	J-44	J-51	553.00	6.0	100.0	Open	-20,000	0.02	0.16
P-60	J-51	J-52	403.00	6.0	100.0	Open	-746,250	14.38	5.88
P-20	J-52	J-20	312.00	6.0	100.0	Open	-753,750	11.34	5.94
P-21	J-20	J-21	518.00	6.0	100.0	Open	-753,750	18.83	5.94
P-22	J-21	R-3	8,200.00	12.0	100.0	Open	-753,750	10.19	1.48

Scenario: Base
Extended Period Analysis: 18.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-3	1,590.00	-753,750	1,590.00

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Junction Report

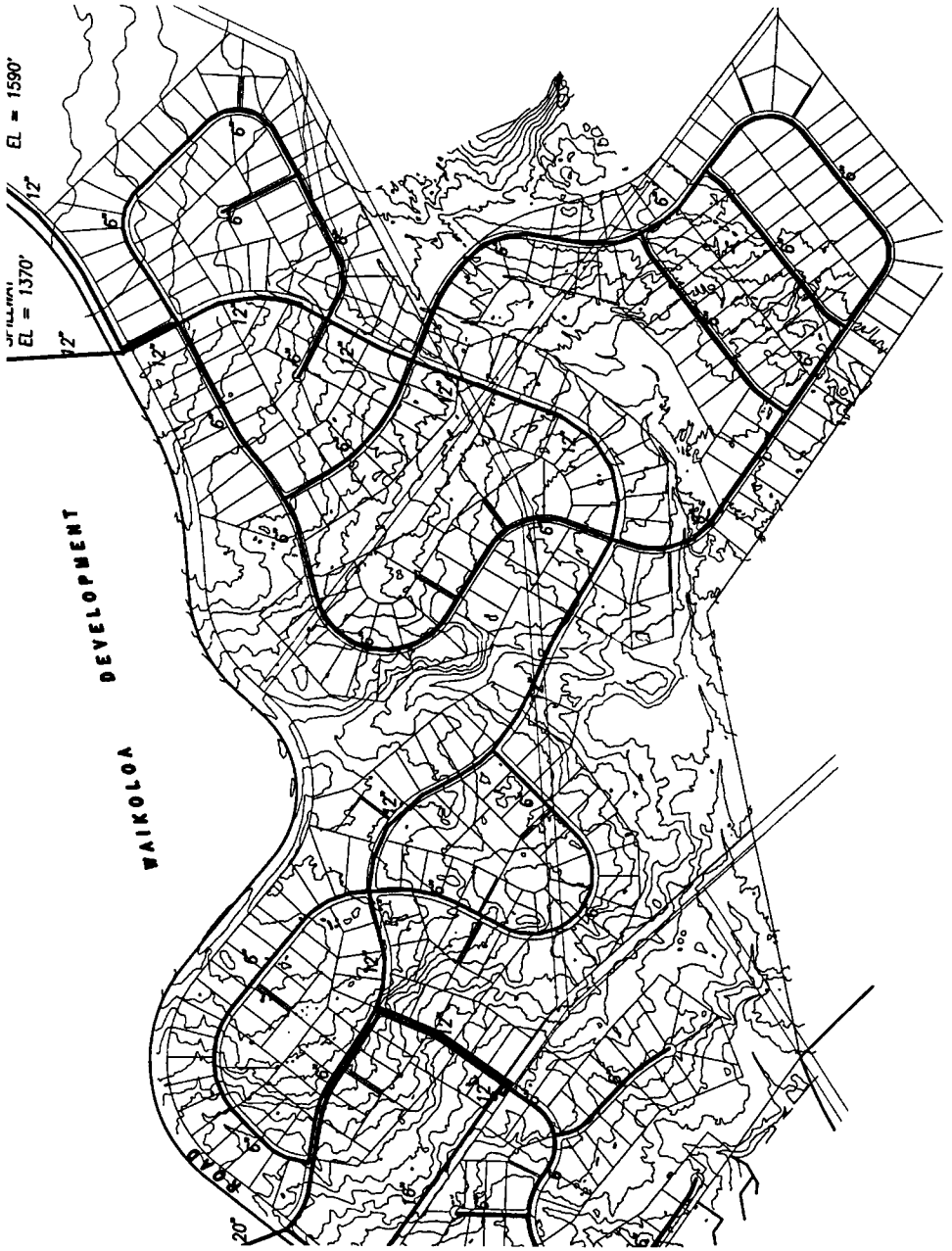
Label	Elevation (ft)	Type	Base Flow (gpd)	Pattern	Demand (Calculated) (gpd)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-45	1,260.00	Demand	8,000	Peak	24,000	1,589.04	142.36
J-44	1,285.00	Demand	8,000	Peak	24,000	1,589.08	131.56
J-51	1,305.00	Demand	5,000	Peak	15,000	1,589.20	122.96
J-52	1,290.00	Demand	6,000	Peak	18,000	1,589.35	129.52
J-20	1,255.00	Demand	0	Peak	0	1,589.53	144.74
J-21	1,270.00	Demand	0	Peak	0	1,589.84	138.38

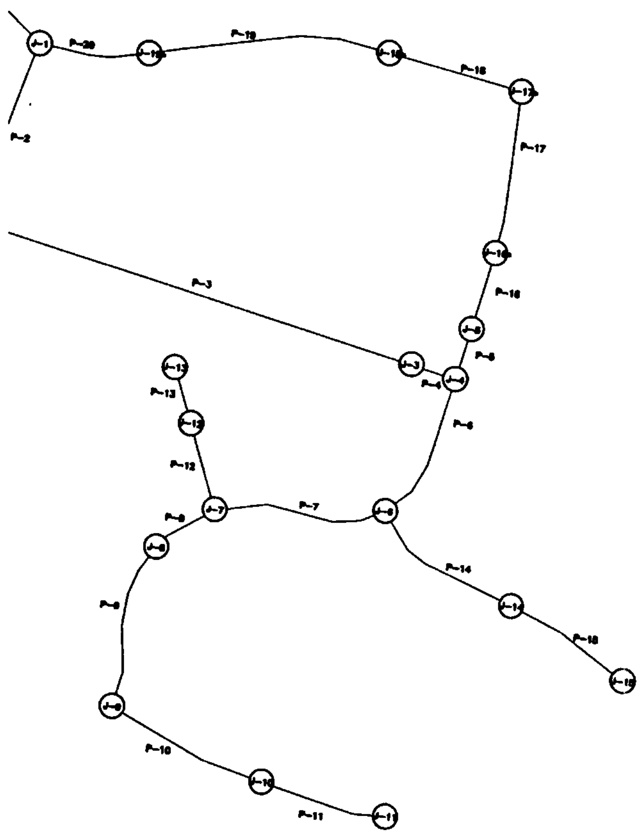
Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Pipe Report

Label	From Node	To Node	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpd)	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-49	J-45	J-44	646.00	6.0	100.0	Open	-24,000	0.04	0.19
P-50	J-44	J-51	553.00	6.0	100.0	Open	-48,000	0.12	0.38
P-60	J-51	J-52	403.00	6.0	100.0	Open	-63,000	0.15	0.50
P-20	J-52	J-20	312.00	6.0	100.0	Open	-81,000	0.18	0.64
P-21	J-20	J-21	518.00	6.0	100.0	Open	-81,000	0.30	0.64
P-22	J-21	R-3	8,200.00	12.0	100.0	Open	-81,000	0.16	0.16

Scenario: Base
Extended Period Analysis: 0.00 hr / 24.00
Reservoir Report

Label	Elevation (ft)	Inflow (gpd)	Calculated Hydraulic Grade (ft)
R-3	1,590.00	-81,000	1,590.00

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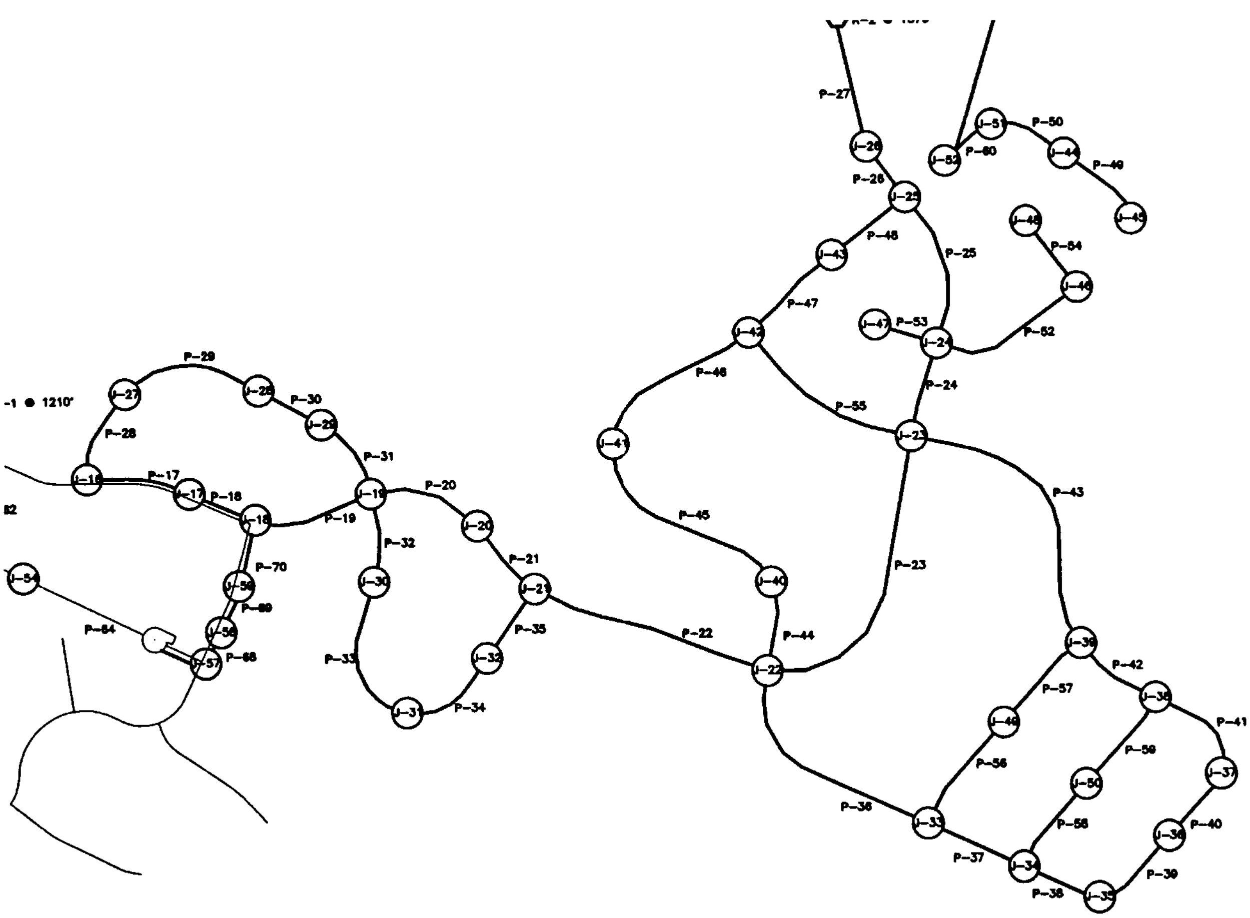
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P-36
P-59
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J-37
J-36
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J-34
P-38
J-35
P-39

APPENDIX K

Highlands Golf Estate Landscape Irrigation Water Study
Hawai‘i Design Associates, Inc., August 2005

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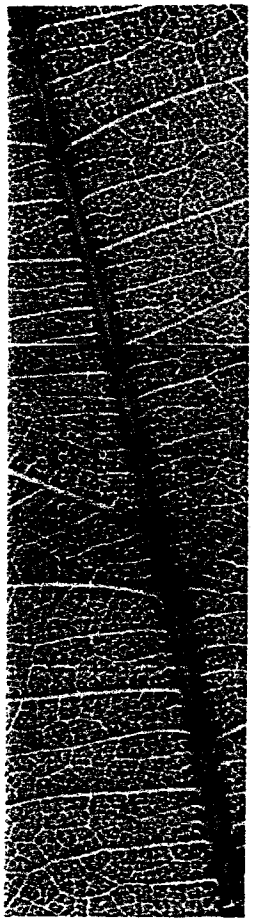
HIGHLANDS GOLF ESTATES LANDSCAPE IRRIGATION WATER STUDY

FOR

VITOIL INC.



BY

HAWAII DESIGN ASSOCIATES, INC.

AUGUST 2005

TABLE OF CONTENTS

1.1 INTRODUCTION

The purpose of this report is to closely examine the reality of the irrigation requirements for 'Highlands Golf Estates', a proposed development inclusive of 400 +1 acres of land in Waikoloa Village TMK# 6-8-2: 16 and 6-8-3: 32. Data will be presented on this area's monthly rainfall and evapo-transpiration rates. These numbers will then be used to show that it is possible to initiate this development with an allocation of 600 gallons of potable water for landscape irrigation per day, showing calculations on the size of area that can be irrigated with this amount. The report goes on to make further comparisons using different types of plant materials and water conservation methods to show the increase in landscape area that could be sustained on 600 gallons of potable water per day, discussing the methods and materials required to achieve this difference.

1.2 LANDSCAPING WATER REQUIREMENTS

Weather data for Waikoloa monthly rainfall and evapo-transpiration (ET) rates are listed as follows;

Month	Rainfall *	Depart*	ET Rate
January	1.07 in.	-0.81 in.	6.0
February	1.17 in.	-0.19 in.	6.0
March	0.79 in.	-0.27 in.	6.2
April	0.96 in.	-0.17 in.	6.0
May	0.04 in.	-0.64 in.	7.0
June	0.64 in.	0.17 in.	7.0
July	0.01 in.	-0.33 in.	8.37
August	0.09 in.	-0.24 in.	8.0
September	A 0.42 in.	n/a	6.5
October	0.14 in.	-0.71 in.	6.2
November	0.09 in.	-0.94 in.	6
December	3.05 in.	1.06 in.	5.5
Year Total	8.47 in	-3.63 in.	

Table 1
**Data taken from NOAA Climatological Data Annual Summary 2003, Vol. 99, No. 13*
ET rates are historic estimates provided from the Waikoloa Resort Golf Course.

The average yearly rainfall taking in to consideration the monthly deviation shows to be 12.1 inches.

1.3 CONSERVATION THROUGH XERISCAPING AND ALTERNATIVE PLANT SELECTION

Xeriscape landscaping is the practice of replacing water-intensive turfgrass and other exotic and nonnative plants with low-water use grasses, groundcovers and plants that are native to the local ecosystem, and looking at ways of using inorganic mulches to reduce the amount of landscaped areas needed to be irrigated. The list shown in appendix A is representative of some of the drought tolerant native plants that are adapted to the Waikoloa region and that are commercially available in the landscape industry in Hawaii.

It must be understood that the look of a xeriscape landscape does not appeal to everyone; grass is often substituted with rock mulch or native groundcovers, and some plants go dormant in times of drought, looking yellow or brown. But with this said there are many green, colorful plants that also fit the xeriscape garden, and if combined correctly with a high-efficiency irrigation system, water savings of 50% or a substantial increase in landscaped area can be achieved over a typical turfgrass. Refer to figure 1 and 2 for a visual comparison of the conventional turfgrass landscape and xeriscape landscape, using 600 gallons of potable water per day. See the design case table (xeriscape and rainwater harvesting) and base line case table (typical turfgrass lawn) examples in table 2 for comparison of area increase using the same 600 gallons of potable water per day (18,000 gallons for the month of July).

Figure 1

Figure 2

Evapotranspiration Table

ET_o	
July	6.37

Design Case Table — **Xeriscape and Rainwater Harvesting Example**

Landscape Type	Area	Species Factor		Density Factor		Microclimate Factor		K_L	ET_L	IE		TPWA
Trees	1,000	Low	0.2	Avg	1.0	Avg	1.0	0.2	1.67	Bubbl	0.800	2,093
Shrubs	450	Low	0.2	Avg	1.0	Avg	1.0	0.2	1.67	Bubbl	0.800	942
Groundcovers	5,000	Low	0.2	Avg	1.0	Avg	1.0	0.2	1.67	Drip	0.900	9,300
Mixed	0	Low	0.2	Avg	1.1	Avg	1.0	0.2	1.84	Spray	0.625	0
Turfgrass	1,000	Avg	0.7	Avg	1.0	Avg	1.0	0.7	5.86	Sprin	0.625	9,374
		–		–		–		0.0	0.00	Sprin	0.625	0
		–		–		–		0.0	0.00	Sprin	0.625	0
		–		–		–		0.0	0.00	Sprin	0.625	0
Total	**7,450**										**Subtotal [gal]**	21,709
											July Graywater Harvest [gal]	(3,750)
											Net GPWA [gal]	**17,959**

Baseline Case Table — **Typical Turfgrass Lawn Example**

Landscape Type	Area	Species Factor		Density Factor		Microclimate Factor		K_L	ET_L	IE		TPWA
Trees	0	Avg	0.5	Avg	1.0	Avg	1.0	0.5	4.19	Sprin	0.625	0
Shrubs	0	Avg	0.5	Avg	1.0	Avg	1.0	0.5	4.19	Sprin	0.625	0
Groundcovers	0	Avg	0.5	Avg	1.0	Avg	1.0	0.5	4.19	Sprin	0.625	0
Mixed	0	Avg	0.5	Avg	1.1	Avg	1.0	0.6	4.60	Sprin	0.625	0
Turfgrass	1,920	Avg	0.7	Avg	1.0	Avg	1.0	0.7	5.86	Sprin	0.625	17,999
		–		–		–		0.0	0.00	Sprin	0.625	0
		–		–		–		0.0	0.00	Sprin	0.625	0
		–		–		–		0.0	0.00	Sprin	0.625	0
Total	**1,920**										**Net GPWA [gal]**	**17,999**

*Table 2 *Data produced from Rainbird LEED v. 2.1Irrigation Calculator*

1.4 RAINWATER HARVESTING AND STORM WATER MANAGEMENT

Capturing rainwater for household and landscape use is not a new concept in Hawaii. In some of the more remote areas of the Big Island not serviced by municipal water, cisterns capturing roof runoff have been supplying much of the water needed for generations of Hawaiian families. 1" of rainwater per square foot of roof area will yield approximately 0.6 gallons (a 0.60 coefficient of efficiency is applied to calculate this number). Average rainfall data for this area is approximately 12" per year (see table 1). The collection area can be roughly estimated at a conservative 2000 square feet of roof area for the average home in this development and assume that all available roof runoff will be directed to rain harvesting. The calculation for potential rainwater harvest quantity for a housing development of 400 units is as follows:

(12"x 0.60)2000sq. ft = 14 520 gallons of potential harvested rainwater per year per 2000 square feet of roof area. x 400 UNITS = 5, 808,000 gallons per year

Rain water harvesting in such a dry landscape may need to take on a larger scale in the form of routing and storing stormwater. This can be accomplished through use of swales and drains from parking, roadways, and land areas, then storing in large on-site holding areas that take the form of ponds, retention basins, or some man-made underground storage in tanks or cells. To quantify this in terms of the study area, if a very conservative figure of $1/10^{th}$ of this 400 acre development (40 acres) was to be used for rainwater harvesting, by way of swale diversion, routing of stormwater drains from roadways and parking, the potential for rainwater harvest is as follows:

(12"x 0.60)1,742, 400sq. ft = 12,545,280 gallons of potential harvested rainwater per year per 40 acres.

If we then take these two numbers (the 40 acres and the roof collection of 400 homes) and apply them to an average gallonage of water per day per unit available, we see that approximately 125 gallons per day of non-potable water usage can be supplied from rainwater harvesting alone.

(12,545,280 + 5, 808,000)/ 400 = 45883 gallons per house per year.
45883/ 365= 125.7 gallons per house per day.

1.5 CONSERVATION THROUGH WATER-EFFICIENT IRRIGATION

The following are the key components for water-efficient landscape irrigation technologies and best management practices for applying and tracking water use in the landscape.

- ***Proper Irrigation Design***

The first step in achieving water savings through efficient irrigation is a properly designed irrigation plan. Different plants require different amounts of water so it is

important that users know exactly what plants they will be irrigating before designing their system.

- ***Divide by Zones***

For residential sites, landscape areas should be divided into separate irrigation zones to accommodate for watering needs of different plants. For example, many landscapes include turfgrass, shrubs and trees. Each of these plant types has different irrigation needs and should be treated as a separate hydrozone. In addition, the variation of exposure to the sun in a landscape (full sun versus shade) will also affect irrigation needs. Generally, turfgrass areas require more water to stay healthy than the shrubs and trees. If everything is on the same irrigation zone, the watering schedule will be dictated by the needs of the grass, however shrubs and trees will be over-watered.

- ***Use Automatic Irrigation Controllers with Water-Conserving Features***

Some of the water-conserving features available in automatic irrigation controllers and central control systems are:
Multiple Start Times and Multiple Independent Programs – allow for shorter and more precise run times based on the individual needs of the plants. This enables the landscape to better absorb water; reducing run-off and water waste. Run-off is a common water waste problem that occurs when water is applied faster than plants and soils can absorb it and the excess runs off unused.
Water Budget – provides an easy way for users to adjust their system based on the needs of the environment. For example, during the rainy season, a user can adjust his/her controller's "water budget" down to 15% of its peak setting to reduce water usage by 85%.
Rain Delay – allows a user to postpone watering when irrigation is not needed (typically during the wet season) and automatically resume schedules when appropriate. Cycle + Soak – applies water at a rate that the soil can more easily absorb, reducing run off, erosion and waste.
ET Programming – enables the controller to calculate daily evapotranspiration (ET) values and automatically adjust station run times to replace only the water needed by the plants. This technology is predominantly used in larger residential developments and golf courses mainly due to cost and system complexities.

More and more developments are moving towards a central control system for the management of their automatic controllers. A central control system essentially links all the controllers on the site together and sends the data the controller(s) and weather station is collecting back to a desktop computer. This computer now has all the data showing where any inefficiencies are in the system (leaks, excess water use etc.) and is extremely useful in troubleshooting and keeping accurate track of real water usage in the field, giving the water manager the control of shutting down any valve on the system remotely, via the desktop computer/ laptop. Part of the challenge in allocating only 600 gallons of potable water per house per day for irrigation use is the logistics of enforcing and tracking this target number, the use of a central control system makes this possible.

- ***Add a sub-meter to each lot to track irrigation use***

As previously discussed, one of the bigger challenges will be keeping track of the irrigation usage of each of the individual lots. A sub-meter after the potable water meter to the house specifically dedicated to track irrigation use serves two purposes; to track overall irrigation use and to allow the homeowner to deduct that number from the total household gallons used in order to save money on sewer fees, as that number can be deducted from their total household usage because it was used for irrigation and not put back into the sewer system. This self reporting method equates to long term savings for the homeowner and a tangible method in accountability for potable irrigation use.

- ***Add an Automatic Shut-Off Device to All Automatic Irrigation Controllers***

Adding an automatic shut-off device such as a rain or moisture sensor to an automatic controller can result in 15-20% or more in water savings. Sensors are available for both residential and commercial applications and automatically shut-off the system when it is raining or when sufficient soil moisture is detected.

- ***Use Low Volume Irrigation Whenever Possible***

Low volume irrigation systems (bubblers, micro and drip) are generally the most efficient method of irrigating non-turf areas because they deliver precise amounts of water slowly and evenly at the plant's roots, eliminating water waste, run-off and overspray on to roads, sidewalks, streets, waterways or drains. The slow, consistent application of water at or near the plants' roots reduces weeds and plant disease and helps plants thrive. In landscaping, low volume irrigation is often best for trees, shrubs, groundcover and other non-turf areas.

- ***Use Pressure Regulating Devices in High-Pressure Situations and Pumps in Low-Pressure Environments to Provide Optimum Pressure to the Watering Device***

In landscaping, water is often wasted through evaporation when systems appear to be "misting or fogging." This is generally a result of excessively high water pressure and can be reduced by pressure regulating nozzles, spray heads, valves and regulators. By utilizing the right products to address high water pressure in landscaping applications, every 5-psi (pounds per square inch) reduction in pressure reduces water usage by 6-8%. The savings in an area can be over 50% if a 70-psi spray zone is reduced to the recommended 30 psi. For low-pressure situations that can result in uneven coverage, use a high efficiency irrigation pump to boost the pressure to peak efficiency combined with pressure regulating system (PRS) spray heads to ensure efficient and complete coverage.

- ***Use High Efficiency Nozzles for Uniform Coverage***

Uniform water coverage is important. When coverage is not uniform, irrigation schedules are often run for longer periods of time to compensate for areas of weak coverage. This ultimately results in the over-watering of all other areas. In landscaping, high efficiency nozzles can reduce water usage by up to 30%.

- ***Proper Maintenance***

The last and ongoing step in conserving water through efficient irrigation is proper maintenance. Whether it means maintenance visits by irrigation professionals, or teaching end-users how to adjust their controllers when the seasons change, periodic monitoring is just as important as the design, products and installation. Over watering, uneven pressure, improper run times, broken pipelines and clogged sprinklers, sprayers or drippers can all defeat the best efforts to achieve water savings. Proper maintenance of a system would include the following practices:

a) Set systems to operate in the early morning hours

b) Early morning is the best time of day to irrigate. Water lost to evaporation tends to be less in the early hours versus midday.

- ***Do Routine Inspections of the Irrigation System***

Since lawns and gardens should be watered in the early morning hours, a problem may not be discovered until it is too late. A broken pipeline or spray head can waste significant amounts of water if left undetected

- ***Adjust Watering Schedules When the Seasons Change***

In landscaping, over-watering often occurs because end-users rarely adjust their watering schedules according to seasonal changes. Many of the controller features mentioned earlier and the installation of a rain sensor or moisture sensor make it very simple to reduce water use.

- ***Adjust Watering Schedules When Plants are Changed***

Similar to adjusting a system for weather changes, irrigation schedules also need to be adjusted when new plants are installed. If drought-tolerant, native plants are installed, it is likely that watering times would also be reduced.

1.6 COVENANTS, CONDITIONS, AND RESTRICTIONS

When setting up the legal framework for the development it is important to consider some of the following irrigation and planting related issues;

- Common vs. private area landscape and irrigation zoning and metering
- Water usage tracking and accountability (600 g.p.d monitoring and enforcement)
- Plant species restrictions/ water conservation requirements
- Homeowner associations and landscape and irrigation maintenance
- The inclusion of non-potable water system for landscape irrigation

1.7 SUMMARY

This report has shown that with an allocation of 600 gallons of potable water use per day for landscape irrigation, the 'Highlands Golf Estates' development inclusive of 400 +1 acres of land in Waikoloa Village TMK# 6-8-2: 16 and 6-8-3: 32 is possible. The varying size of landscape area able to be sustained on 600 gallons is a product of the choice of plant material, ground cover treatments, and irrigation efficiency/ water recycling that will be implemented in the development.

APPENDICIES

Hawaiian Name	Botanical Name	Use and Characteristics
Aalii	**Dodonaea viscosa**	Accent shrub or small tree/ok making/xeriscape
Aeae	Bacopa monnieri	Groundcover/ wet areas and along streams
Ahaeheo	**Chenopodium oahuense**	Accent shrub coastal/xeriscape
Ahinahina	**Artemisia mauiensis**	Accent shrub el making/fine silver leaves
Ahinahina	**Artemisia australis**	Accent shrub el making/gray leaves
Akia	**Wilkstromia uva-ursi**	Accent shrub groundcover/el making
Alahee	**Psydrax odoratum**	Shrub or tree coastal/fragrant white flowers/xeriscape
Awikiwiki	**Canavalia species**	Climbing vine beautiful flowers/el making
Black Coral Ilima	**Sida fallax var. "Black Coral"**	Upland shrub groundcover/ge.orange flo./sun or semi-shade
Ekaha	Asplenium nidus	Accent fern/s wide
Hala	**Pandanus tectorius**	A beautiful accent tree/coastal/xeriscape/unusual fruits
Hapuu	Cibotium splendens	Accent tree ft m
Hinahina	Achyranthes splendens	Accent shrub silver-grey leaves
Hinahina	**Achyranthes splendens var. splendens**	Accent shrub wavy silver-gray leaves
Hinahina	Heliotropium anomalum var. argenteum	Groundcover/ coastal/fragrant white flowers/el making
Hoawa	**Pittosporum confertiflorum**	Accent shrub small tree/fragrant flowers/interesting foliage and fruits
Hoawa	**Pittosporum hosmeri**	Accent shrub small tree/fragrant flowers/interesting fruits
Ihi	Portulaca molokiniensis	Accent plant/ coastal/yellow flowers/xeriscape
Ihi	Portulaca lutea	Accent plant/ coastal/yellow flowers/xeriscape
Ilee	Plumbago zeylanica	Groundcover/ coastal/white flowers/semi to deep shade
Ilima papa	**Sida fallax**	Groundcover/ coastal/el making
Poola nui	Bidens cosmoides	Accent shrub medicinal/large yellow flowers/el making
Ko olea ula	x Abutilon menziesii	Accent shrub red flowers/el making
Koa	Acacia koa	Large tree/e low flowers
Koaia	Acacia koaia	Small spread ng canopy tree/yellow flowers
Kokio	**Hib. kokio subsp. saintjohnianus var."yellow"**	Accent shrub vibrant yellow flowers/semi-shade
Kokio	**Hib. kokio subsp. saintjohnianus var. "Kealaula"**	Accent shrub yellow-orange flowers/semi-shade
Kokio keokeo	**Hibiscus arnottianus subsp. arnottianus**	Screening he jge/accent shrub/fragrant white flowers
Kokio keokeo	**Hibiscus arnottianus var. "Sadie Seymour"**	Screening he jge/accent shrub/large (6'+) complete white flowers
Kokio keokeo	**Hibiscus waimeae**	Screening he jge/accent shrub/very fragrant white flowers
Kokio ula	**Hibiscus kokio**	Screening he jge/accent shrub/red flowers/wind tolerant
Kolomona	Senna gaudichaudii	Accent shrub light yellow-green flowers/xeriscape
Kou	Cordia Subcordata	Small accent tree/light orange flowers/coastal/xeriscape
Kuluí	x Nototrichium humile	Screening he jge/accent shrub/xeriscape
Kuluí	**Nototrichium sandwicense**	Screening he jge/accent shrub/silver leaves
Kuluí	**Nototrichium sandwicense var. "Kauaiense"**	Screening he jge/accent shrub/gray leaves/pink stems
Kuluí	**Nototrichium virtde**	Screening he jge/accent shrub/xeriscape
Kupukupu	Nephrolepis cordifolia	Groundcover
Lonomea	Sapindus oahuensis	Medium upri ht tree/white bark/el making

Loulu	**Pritchardia species**	Single trunk fan palm
Maiapilo	Capparis sandwichiana	Accent shrub 'night blooming/fragrant white flowers/xeriscape
Malie	Alyxia oliviformis	Accent climb ng vine/lei making/semi-shade
Manele	Sapindus saponaria	Large accent tree/lei making
Mao	**Gossypium tomentosum**	Accent shrub 'groundcover/coastal/yellow flowers
Mao hau hele	x Hibiscus brackenridgei ssp. brackenridgei	Accent shrub 'yellow (State) flower
Mau aki aki	Fimbristylis cymosa	Accent sedge /coastal /xeriscape/use like mondo grass
Naio	Myoporum sandwicense	Accent shrub 'coastal/xerisacpe
Naio papa (prostrate)	**Myoporum sandwicense var. "papa"**	Dense groun lcover to 24" height/cascading shrub
Nanea	Vigna marina	Groundcover 'coastal/yellow flowers/aggressive growth
Nanu	x **Gardenia brighamii form "lau nui"**	Screening he dge/accent shrub/fragrant white flowers/sun/xeriscape
Naupaka kahakai	**Scaevola sericea**	Groundcover mass planting/coastal/white half flowers
Naupaka kuahiwi	**Scaevola gaudichaudii**	Accent shrub 'yellow half flowers/xeriscape
Naupaka kuahiwi	Scaevola gaudichaudiana	Accent shrub -small tree/white half flowers/upland
Nehe	Wollastonia integrifolia	Groundcover 'coastal/silver-gray leaves/yellow flowers
None Given	x Munroidendron racemosum	Small accent tree/yellow flowers/attractive fruits
Ohai	x **Sesbania tomentosa**	Shrub/coaste l/salmon flowers/very fragrant leaves/lei making
Ohai	x **Sesbania tomentosa var. molokaiensis**	Trailing g.c./c oastal/cascades/red flo./very fragrant leaves/lei making
Ohai	x Sesbania tomentosa var. from Polihale	Shrub/coaste l/red flowers/ fragrant leaves/lei making
Ohai	x **Sesbania tomentosa var. from Upolu Point**	Trailing g.c./c oastal/cascades/org.-yel. flowers/lei making
Ohe mauka	Tetraplasandra oahuensis	Medium acce nt tree
Ohia lehua	**Metrosideros polymorpha**	Accent vertic al tree/with red, yellow or orange flowers
Olulu	x Brighamia insignis	Accent shrub 'yellow fragrant flowers/coastal/unusual growth habit
Pauohilaka	Jacquemontia ovalifolia ssp. sandwicensis	Groundcover 'coastal/white-blue flowers
Pohinahina	**Vitex rotundifolia**	Groundcover 'coastal/purple flowers/xeriscape/lei making
Pohuehue	Ipomea pes-caprae ssp. brasiliensis	Groundcover 'purple to lavenderflowers/coastal
Uki uki	Dianella sandwicensis	Accent shrub 'groundcover/shade to full sun
Ulei	**Osteomeles anthyllidifolia**	Accent shrub 'groundcover/cascades/white flowers
Wiliwili	**Erythrina sandwicensis**	Accent canop y tree/various flower colors/lei making

STRAND flora affected by salt spray/seawater. COASTAL flora not influenced by direct salt spray.
The above species are recommended based on ornamental applications, field performance and av ilability**Highly recommended species,** shown in bold type.

x indicates endangered specie

Other Recommendations

Ahuawa	Mariscus javanicus	Sedge
Aki aki	Sporobolus virginicus	Groundcover 'coastal
Akulikuli	Sesuvium portulacastrum	Groundcover 'coastal
Makaloa	Cyperus laevigatus	Sedge

just that. Low-volume irrigation sales have increased 20 to 25 percent annually in the last five years while traditional irrigation systems have been rising in sales by nearly 6 percent each year, according to Stoll. "The significant increase we see on the low-volume side shows that more contractors are moving away from sprays and rotors," he says.

A HEALTHY DRIP. Property owners typically purchase irrigation systems because they want lush, green lawns and healthy plants. Although drip irrigation is distributed in low volumes, that doesn't mean plants will be underwatered and dry up. In fact, drip irrigation is said to make plants even healthier than overhead systems because they're designed to meet each plant's irrigation needs, whereas traditional systems distribute water over a wider area. Often referred to as point-source irrigation, this type of drip system features emitters the contractor would place at the plant's root zone. By placing the emitters exactly where the water is needed, the plants should receive more uniform coverage, resulting in quicker plant growth and less wasted water. "It's targeted, so there's no overspray or runoff," Reilly says.

As a result, drip systems can grow plants 50 percent faster than overhead systems, Stoll says. "Increased plant growth comes from putting the water at the root zone where it's needed," he explains.

Drip irrigation also contributes to plant health by reducing weed growth because the water isn't distributed to other areas where weeds may germinate, says Don Hendrickson, president, Hendrickson Bros., Corona, Calif. In addition, the water is being distributed underneath the mulch, whereas an overhead system wets the mulch, which could promote weed growth, Stoll says.

When irrigation contractor Larry Gross markets drip systems to potential clients he often points out how the system lowers landscape maintenance costs by reducing weed growth. "You put 3 inches of mulch down on it, and we experience 80 percent less weeding as a result," says Gross, general manager of Sunshine Nurseries, Riverside, Calif. "Weed growth is minimal – maybe two or three breaks a year."

Contractors who are trying to irrigate a wider range may opt for line-source or broadcast drip irrigation. This is where the emitter is premanufactured into the drip line every 12 to 18 inches, Stoll says. "This is good for dense planted areas where your plants are close to each other, so you're going to irrigate most of the ground," Reilly says. Because of its wider application range, line-source systems could be considered a replacement for conventional sprinklers, Stoll says. "We simply radiate the water through the soil and use the soil's capillary action, whereas a sprinkler uses water pressure and gravity to throw the water through the air," he explains.

In the long run, Reilly says contractors' clients will likely realize more savings from point-source irrigation because it's less wasteful. "This is because you're actually designing the system for each plant," she says.

LABOR DEMANDS. Contractors who are researching the drip-irrigation market may get mixed opinions regarding the system's required installation time. The type of pipe a contractor uses and the amount of digging involved impact how much labor is necessary. "It depends on the application," Reilly says. "It can be a lot easier to install if you're running polyethylene tubing and you have an odd-shaped area because you're not digging trenches and gluing all the PVC together."

Polyethylene tubing is more flexible and can be connected above ground so no trenching is required, Reilly adds. Stoll agrees that tubing can result in less labor. "For the most common application, which is putting the tubing into a garden area around a house or building, it's significantly easier," he says. "You simply roll the tubing out, staple it down and you're done."

However, polyethylene tubing isn't as rugged as PVC and may be more susceptible to damage from shovels or vandalism, which is why contractor Seth Rutherford says drip irrigation isn't always the ideal system. Rutherford uses overhead spray systems as much as possible because drip systems require too much maintenance from broken tubing and 25 percent more labor than traditional systems to install, he says. "I like drip for a fixed hedge or fixed hydrangea bed, but it tends to be a service problem," says Rutherford, president of Waterworks of Nantucket, Nantucket, Mass. "If a gardener is in there cultivating the beds, drip tubing just gets poked and poked because it all has to be buried a few inches down, and he doesn't see it."

Gross estimates that drip irrigation requires 15 to 20 percent more labor to install than overhead systems because there are more components involved, such as valves and clocks. But contractor Bill Jenkins says drip irrigation is less labor intensive than traditional sprinklers. "Where you might need a fairly large number of zones with a spray system just to water a given number of plants, drip can do the same with fewer valves, so it's very cost effective," says Jenkins, president, Think Green Irrigation, Scottsdale, Ariz. It's going to be simpler to trench and install, which means it will take less time and labor."

CONSERVATION COSTS. Like labor, personal experience will probably dictate whether drip irrigation is more expensive or less costly to install than traditional irrigation systems. Drip irri-

continued on page 114, sidebar on page 112

continued from page 80

gation is 25 percent less expensive than overhead systems, according to Bill Hutcheon, president of drip systems manufacturer Antelco Corp., Longwood, Fla. Hendrickson estimates drip irrigation is 10 to 15 percent less costly than overhead sprinklers.

But installation costs can vary depending on the area being irrigated. "With drip, it's difficult to say because planting beds are different, and you have different types of plant spacing," Reilly says. On average, Gross says he spends 25 percent more for drip components than he does for overhead systems. The higher cost means Gross must charge more for drip irrigation than other systems, but he says the client can easily recoup the added expense from water savings. "If they're spending $5,000 a month on water with an overhead system, they could be spending $200 a month on drip," he says.

Gross works mainly with developers who prefer that he break down the price per square foot. He first figures what his materials cost are and then adds a 30-percent markup. His fees are about $1 per square foot for a typical drip project compared with 60 to 70 cents per square foot for overhead systems. For smaller projects, less than 15,000 square feet, his average price is $4.50 per square foot, which is comparable to an overhead system. The narrower the area, the more cost effective a drip system will be in comparison to an overhead system because traditional spray systems require more heads spaced closer together, which is more labor intensive to install, Snoll says.

In the end, profitability on drip irrigation installations is about the same as other systems. Gross says. Jenkins agrees, saying, "All the work we do is bid to be profitable, and drip is certainly efficient to install, but it doesn't stand out as being any more profitable than any other type of system."

Many manufacturers and contractors point out that drip irrigation represents more than just profits – it's sometimes the most sensible solution. "We're choosing a system not just because it's cost-effective but because it's the most appropriate," Jenkins says. "In the Phoenix area we don't use overhead irrigation unless there are some extenuating circumstances. In other markets, overhead irrigation is popular because they're used to installing it that way. But with everyone being concerned about water usage, the benefit of drip irrigation is that you're using water efficiently."

[redacted]

Check out our July Online Extras section for more tips on proper operating procedures for drip irrigation systems, as well as information on disk and screen filters.

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APPENDIX L

Water Supply for the Highlands Estates at Waikoloa, Hawai'i
Waimea Water Services, November 2006

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P.O. Box 326, Kamuela, HI 96743
Phone (808) 885-5941 Fax (808) 885-7851
e-mail waiono@wws-ius.com

Water Supply for the Waikoloa Highlands, Waikoloa, Hawaii
November 2006 –rev. April 2007

Introduction

About 398- one acre residential lots are planned for the former Highlands project at Waikoloa, Hawaii. The new planned residential community has been renamed as Waikoloa Highlands. The original plans called for a golf course to be integrated within the community and this has now been replaced with open space.

The residential community of Waikoloa Village averages slightly more than 600 gallons per day (gpd) potable water consumption per household according to statistics filed on behalf of the West Hawaii Utility Company (WHUC) with the Public Utilities Commission (PUC). The Waikoloa Highlands project will involve larger 1-acre lots for a planned use of approximately 1,000 gpd per one acre residential lot or an estimated daily demand of about 400,000 gallons daily. The WHUC has planned on providing service to Waikoloa Highlands of 1,000 gpd.

The project lies with the services area of the West Hawaii Utility Company, a PUC regulated water and wastewater service company.

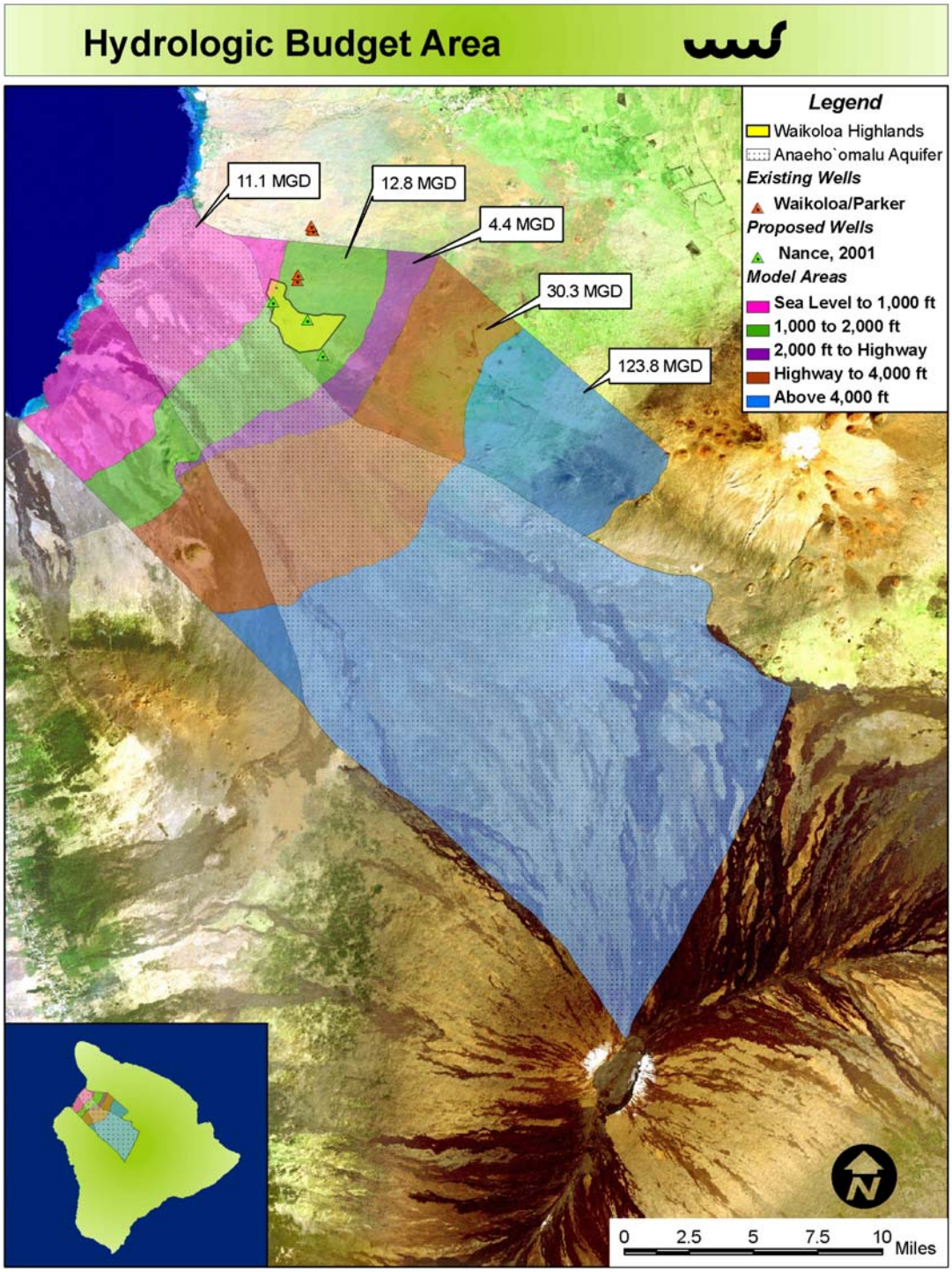
Services for water supply can be made available under the appropriate service agreement along with the submission of contributions in aid of construction (CIAC) as stipulated by the PUC. A second option would be for WM LLC to develop its own water sources and provide separate water and wastewater services.

Water Resources

The subject parcel is located between the elevation of 1000'and 1800'and is underlain by a basal lens of groundwater, where fresher water floats upon the underlying salt water. Above an elevation of about 1000 feet, the lens contains fresh water. Studies by Nance 2001 indicate that there may be high level groundwater beneath the upper portion of the Highlands Estates.

WMLLC contracted Waimea Water Services to prepare an evaluation of the water resources with a particular emphasis on the area potentially tributary to its (WM LLC) land holdings. The hydrologic budget model included portions of the Waimea and Kiholo Aquifer systems as designated by the Commission on Water Resource Management

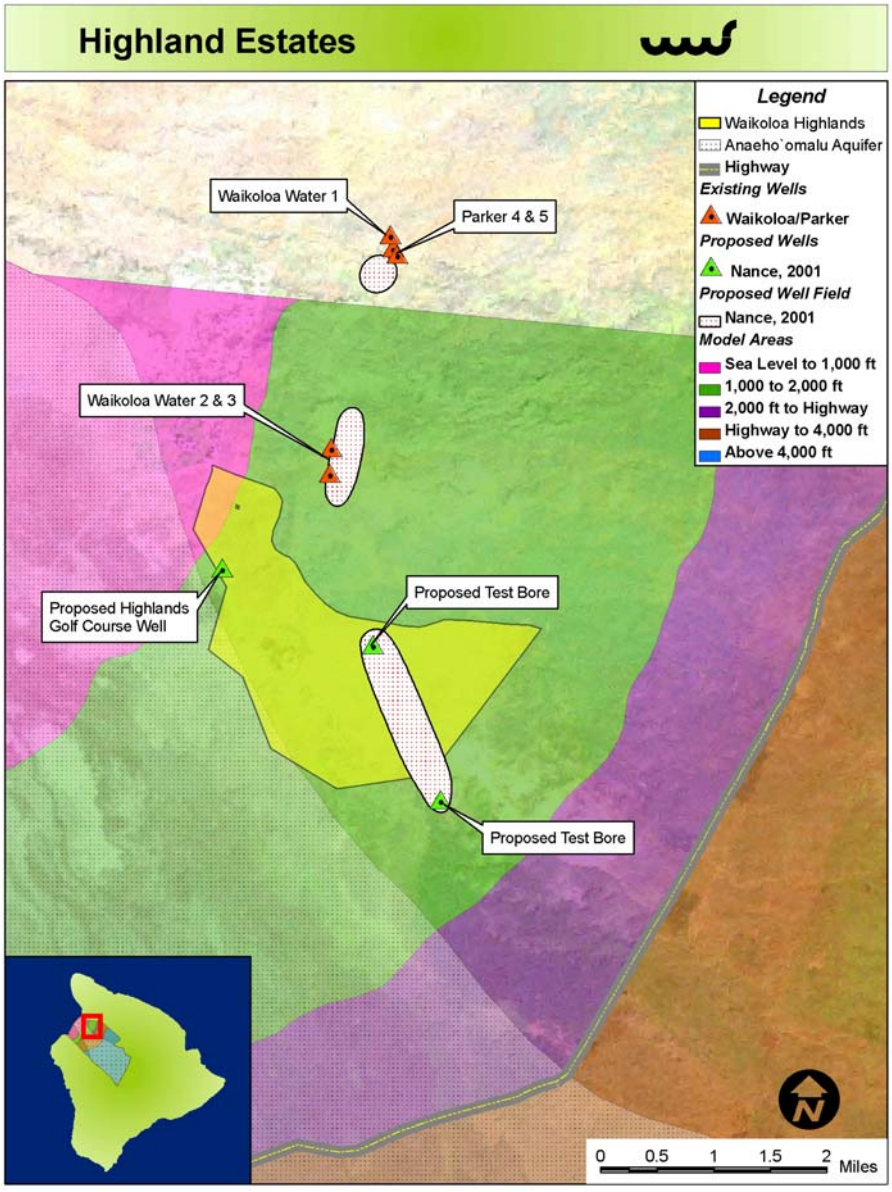
(CWRM). The estimated sustainable yield of each system is Waimea – 24 mgd, Kiholo – 18 mgd and Anaehoomalu – 30 mgd. The sustainable yield of a given aquifer system is a percentage of the groundwater recharge. The map below illustrates the area studied and the location of Waikoloa Highlands, as well as the existing and proposed well field of the West Hawai‘i Utility Company as recommended by Nance.



Each computation unit has a groundwater recharge estimate in mgd noted on the map. The entire Anaehoomalu Aquifer system is shown in the lighter tone.

Water Development

As indicated, it is planned that the Waikoloa Highlands will be served with water supplied by the WHUC. The following map illustrates the existing and proposed wells (well fields) which will supply the WHUC system, a portion of which would supply the approximately 400,000 gpd to the Waikoloa Highlands.



According to Nance (2001), there may also be high level groundwater found in the upper portion of the Waikoloa Highlands similar to that found in the Parker well field (number 1) of the WHUC.

The wells proposed in the Waikoloa Highlands are part of the water system design prepared for the WHUC system designed by Belt Collins and Associates, in 1990 for the then Waikoloa Water Company, Inc. The addition of Well # 6, at one of the sites recommended by Nance, will provide the 400,000 gpd estimated demand. There are adequate water resources available in the area of the proposed well field expansion. It is noted that the golf course wells shown within the Highlands are intended for irrigation other than golf course or they may be converted to potable use elsewhere in the project area.

In addition to the fresh water wells serving the potable water systems, there are 2 brackish wells located in the Waikoloa Village proper serving the village golf course with about 0.7 mgd and about there are 16 small brackish wells located along Queen Kaahumanu Highway which supply water to the golf courses around Anaehoomalu Bay. All of these wells are located at or below an elevation of 100 feet. About 8 mgd of golf course irrigation water is pumped from the wells on the average. Salinities are normally in the 600 mg/L chloride range (Nance 2001).

References

- Tom Nance Water Resource Engineering. 2001. Potable Well Development Opportunities for the Department of Water Supply in the South Kohala Coastal Area.
- Tom Nance Water Resource Engineering. 1991. Waikoloa Water Master Plans
- Belt Collins and Associates. 1991. Waikoloa Village Water Master Plan

APPENDIX M

Comments and Responses – EIS Preparation Notice

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APPENDIX M

COMMENTS AND RESPONSES – EIS PREPRATION NOTICE

An EIS Preparation Notice was prepared and notice published in the July 23, 2006 edition of the Office of Environmental Quality Control's (OEQC) The Environmental Notice, with the public comment deadline of August 22, 2006. The EISPN was distributed to the individuals and organizations listed below, with a request for comments on project purpose and need, alternatives, and the proposed scope of the analysis.

Those providing written comments are noted in bold type below. Copies of the letters are included at the end of this chapter. Copies of the comments received and response to the letters are follow.

Federal Agencies

Army Corps of Engineers, Honolulu Engineer District
Environmental Protection Agency
Federal Highway Administration
Natural Resources Conservation Service
Fish and Wildlife Service
U.S. Geological Survey

State Agencies

Department of Agriculture
Department of Accounting and General Services
Department of Business, Economic Development & Tourism, ~~Office of Planning~~
Resources and Technology Division
Office of Planning ~~Office~~
Hawai'i Housing Finance Development Corporation
State Land Use Commission
Department of Education
Department of Hawaiian Home Lands
Department of Land and Natural Resources
State Historic Preservation Division
Department of Health
Environmental Planning Office
Office of Environmental Quality Control (4 copies)
Department of Public Safety
Department of Transportation
Office of Hawaiian Affairs
University of Hawai'i, Environmental Center
University of Hawai'i, Marine Programs
University of Hawai'i, Water Resources Research Center

County of Hawai‘i

Department of Environmental Management
Fire Department
Department of Parks and Recreation
Planning Department
Police Department
Department of Public Works
Department of Water Supply

Elected Officials, Community Organizations, and Other Organizations

Elected Officials
- County Councilmember Pete Hoffman, County Council District 9
- Representative Cindy Evans, State House District 7
- Senator Paul Whalen Senate, State Senate District 3

Utility Companies
- Hawai‘i Electric Light Company, Inc.
- Hawaiian Telcom, Inc.
- Oceanic Time Warner Cable
- Waikoloa Water Company

Libraries
- Hawai‘i Documents Center, Hawai‘i State Library
- Bond Memorial Public Library
- Thelma Parker Memorial Library
- Kailua-Kona Public Library

Newspapers
- Hawai‘i Tribune Herald
- West Hawai‘i Today

Other
- Waimea Community Development Plan Committee
- Waikoloa Village Association
- Waikoloa Outdoor Circle
- Waikoloa Community Development Corporation
- Hawai‘i Leeward Planning Council
- West Hawai‘i Economic Development Council
- Chamber of Commerce
- Mauna Kea Soil and Water Conservation District

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

September 7, 2006

Regulatory Branch

File No. **POH-2006-334**

Chester T. Koga
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4950

Dear Mr. Koga:

This letter is in response to your request for comments on a Preparation for Notice for an Environmental Impact Statement (PNEIS) for proposed development in Waikoloa, South Kohala District, Hawaii TMK (3) 6-8-002:016 portion. We have reviewed the information you provided under the Corps' authority to issue Department of the Army (DA) permits pursuant to Section 404 of the Clean Water Act (CWA) (33 USC 1344) and Section 10 of the Rivers and Harbors Act (RHA) of 1899 (33 USC 403).

Based on the preliminary information provided to our office and available references, we are unable to determine whether a DA permit will be required for your project. It appears the subject property contains a water of the U.S., the Auwaiakeakua Gulch/Stream bisects; however, information contained within the PNEIS does not contain adequate detail on the potential direct or indirect impacts to the hydrological resources related to the project. In order provide a DA permit determination, we request that you submit a copy of the Draft EIS, project plans, site photos, and a project description of activities that may have a potential to directly or indirectly impact.

Thank you for your cooperation with our Regulatory Program. Should you have any questions please contact Ms. Joy Anamizu by phone at 438-7023, by facsimile at 438-4060, or by e-mail at *joy.n.anamizu@usace.army.mil* and refer to the file number above.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

September 25, 2006

Mr. George P. Young, P.E., Chief
Regulatory Branch
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawai'i 96858-5440

Dear Mr. Young:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

This letter is to acknowledge receipted of your letter dated September 7, 2006 noting that your agency has not been able to determine whether a Department of the Army permit will be required. A study of drainage and flood impacts of Auwaiakeakua Gulch will be prepared and included in the Draft EIS. Proposed improvements will be addressed in the study.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Pacific Islands Water Science Center
677 Ala Moana Blvd., Suite 415
Honolulu, HI 96813
Phone: (808) 587-2400/Fax: (808) 587-2401

August 16, 2006

Mr. Anthony Ching
State Land Use Commission
735 South King Street, Suite 402
Honolulu, Hawaii 96813

Dear Mr. Ching:

Subject: Environmental Impact Statement (EIS) Preparation Notice
Waikoloa Highlands – Residential Subdivision
Island of Hawaii, South Kohala District
Tax Map Key Numbers: (3) 6-8-002: 016 (portion)

Thank you for forwarding the subject Engineering Report for review and comment by the staff of the U.S. Geological Survey, Pacific Islands Water Science Center. We regret however, that due to prior commitments and lack of available staff, we are unable to review this document.

We appreciate the opportunity to participate in the review process.

Sincerely,

Gordon Tribble
Center Director

cc: Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, #411
Honolulu, Hawaii 96817

Mr. Kevin Kellow, Manager
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

PREPARATION NOTICE
FOR AN ENVIRONMENTAL IMPACT STATEMENT
Prepared in Accordance with Requirements of Chapter 343, Hawai'i Revised Statutes

WAIKOLOA HIGHLANDS
State Land Use Boundary Amendment
Waikoloa, South Kohala District, Island of Hawaii

TMK (3) 6-8-002: 016 (por.)

June 27, 2006

Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

PREPARATION NOTICE
FOR AN ENVIRONMENTAL IMPACT STATEMENT
WAIKOLOA HIGHLANDS – RESIDENTIAL SUBDIVISION

July 23, 2006

Dear Reviewer:

Attached for your review is an environmental impact statement (EIS) Preparation Notice which was prepared pursuant to Chapter 343 Hawaii Revised Statutes, and the EIS rules (Hawai'i Administrative Rules, Title 11, Chapter 200).

TITLE OF PROJECT:	Waikoloa Highlands – Residential Subdivision
LOCATION:	Island of Hawai'i, South Kohala District
TAX MAP KEY NUMBERS:	(3) 6-8-002: 016 (portion)
AGENCY ACTION:	
Accepting Authority:	State Land Use Commission
Address:	735 South King Street, Suite 402, Honolulu, Hawai'i 96813
Contact:	Mr. Anthony Ching, Phone: (808) 587-3822
Applicant:	Waikoloa Mauka, LLC
Address:	120 Aspen Oak Lane, Glendale, CA 91207
Contact:	Mr. Kevin Kellow, Manager
Consultant:	R.M. Towill Corporation
Address:	420 Waiakamilo Road # 411, Honolulu, Hawai'i 96817
Contact:	Mr. Chester Koga, Phone:(808) 842-1133 Fax: 808-842-1937 Email: chesterk@rmtowill.com
ENVIRONMENTAL NOTICE PUBLICATION DATE:	JULY 23, 2006
REVIEW COMMENT DEADLINE:	AUGUST 22, 2006

Please send your written comments and inquiries to the Applicant, Accepting Authority, and Consultant. If you wish to receive a copy of the Draft EIS when it becomes available, please contact the Consultant.

Thank you for your participation in the review of this EISPN.

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

September 25, 2006

Mr. Gordon Tribble, Director
U.S. Geological Services
677 Ala Moana Boulevard, Suite 415
Honolulu, Hawai'i 96813

Dear Mr. Tribble:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

This letter is to acknowledge receipted of your letter of August 16, 2006 noting that your agency in unable to review the EISPN. We will forward a copy of the Draft EIS for your agency's review when it becomes available.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

GENEVIEVE SALMONSON
DIRECTOR

August 21, 2006

Mr. Anthony Ching, Executive Officer
State Land Use Commission
235 South Beretania Street, 4th Floor
Honolulu, Hawai'i 96813

Dear Mr. Ching:

Subject: EISPN for Waikoloa Highlands, Island of Hawa'ii

Thank you for the opportunity to review the subject document. We have the following comments.

1. The applicant should consult with the Department of Health concerning the proposal to build 400 individual wastewater systems.

2. How will this project be affected by the proposed fire emergency road? Will the road be sufficient with 400 new homes?

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Director

c: Waikoloa Mauka
RM Towill

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

September 25, 2006

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

Dear Ms. Salmonson:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 21, 2006 relating to the subject project.

We are in contact with the Department of Health (DOH) regarding wastewater disposal for the proposed subdivision. The DOH has recommended consideration of a centralized wastewater treatment system or consideration of individual wastewater systems (IWS) in accordance with Chapter 11-62, Hawai'i Administrative Rules. As homes will be developed by each lot owner, the use of IWSs is the preferred method of wastewater disposal.

The proposed emergency fire road proposed by the County of Hawai'i is not in the immediate vicinity of the proposed project. The road is located to the north and west of the project site. When the road is developed, the residents of this subdivision will be beneficiaries as with the rest of Waikoloa Village.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
EPO-06-118a

August 21, 2006

Mr. Anthony Ching
State Land Use Commission
735 South King Street, Suite 402
Honolulu, Hawaii 96813

Dear Mr. Ching:

SUBJECT: State Land Use Boundary Amendment (A06-767) and Environmental Impact Statement Preparation Notice
Applicant: Waikoloa Mauka, LLC
Request: Agricultural to Rural
TMK: (3) 6-8-002: 16 (portion)

Thank you for allowing us to review and comment on the subject documents. The documents were routed to the various branches of the Environmental Health Administration. We have the following Wastewater Branch and Safe Drinking Water Branch comments.

Wastewater Branch

We have reviewed the subject petition which proposes to subdivide the area into approximately 400 low-density, rural, residential lots with each lot a minimum of one (1) acre.

The subject project is located in the Critical Wastewater Disposal Area (CWDA) with five (5) acre lot exception as determined by the Hawaii County Wastewater Advisory Committee. Therefore, the use of new cesspools is not allowed.

For such a large development, we recommend use of a centralized wastewater system. However, treatment individual wastewater systems (IWSs) such as septic tanks for each lot can be utilized.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater System." We do reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should you have any questions, please contact the Planning & Design Section of the Wastewater Branch at (808) 586-4294.

Safe Drinking Water Branch (SDWB)

We have reviewed the Petition and the Environmental Impact Statement (EIS) Preparation Notice for the subject project. The Petition states that the project will construct support infrastructure for the proposed subdivision, including providing water. Furthermore, the Notice states that the Waikoloa Water Company will provide water to the project. We request that additional information be provided in the EIS which would describe in detail how the Applicant will provide safe drinking water to the proposed subdivision.

Should you have any questions, please contact Mr. Kumar Bhagavan of the SDWB Compliance Section at 586-4258 in Honolulu, or call from Hawaii the direct toll free number 974-4000, extension 64258.

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this application should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

C: EPO
Ms. Laura H. Thielen, State Office of Planning
Mr. Kevin Kellow, Waikoloa Mauka, LLC
Mr. Chester Koga, R.M. Towill Corporation

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Construction Management

September 25, 2006

Mr. Kelvin H. Sunada, Manager
Environmental Planning Office
Department of Health
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Dear Mr. Sunada:

Environmental Impact Statement Preparation Notice (EISPN) for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 21, 2006 relating to the subject project.

Wastewater
Because the subject project is located in the Critical Wastewater Disposal Area, we are aware that cesspools are not allowed. The developer will be proposing the use of individual wastewater systems (IWS) for each lot in accordance with Chapter 11-62, Hawai'i Administrative Rules. The developer is not considering the development of a centralized wastewater system.

Safe Drinking Water
As stated in the EISPN, water service will be provided to each lot in the subdivision by the Waikoloa Water Company. We have included additional information on the water system in the forthcoming draft EIS.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

LINDA LINGLE
GOVERNOR

PATRICIA HAMAMOTO
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF THE SUPERINTENDENT

August 9, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, #411
Honolulu, Hawaii 96817

Dear Mr. Koga:

Subject: Environmental Impact Statement Preparation Notice for Waikoloa Highlands, South Kohala, TMK: 6-8-002: por. 016

The Department of Education (DOE) has reviewed Environmental Impact Statement Preparation Notice (EISPN) for Waikoloa Highlands in South Kohala. In the Draft Environmental Impact Statement (DEIS), the DOE will need to know if accessory residential units will be permitted within the project. We would also like to know the size of the lots. Finally, we would like to get some estimate of the actual cost of the lots and whether there will be a minimum required price for homes built in the project. The costs of the homes and property have a bearing on the number of public school students we estimate will eventually reside in the project.

The DOE would like to provide the following information for inclusion into the DEIS. It illustrates recent enrollment growth in the schools serving Waikoloa and projected growth which does not include enrollment generated by Waikoloa Highlands.

Waikoloa schools: actual enrollment, facility capacity and projected enrollment, school years '03-'04 to '11-'12

	Actual Enrollment			Capacity	Projected Enrollment		
	'03-'04	'04-'05	05-'06		'06-'07	'08-'09	'11-'12
Waikoloa Elementary	593	586	566	601	544	620	738
Waimea Middle Public Charter	537	497	516	516	534	550	565
Kealakehe High	1440	1450	1530	1480	1543	1531	1395

The enrollment data are compared to the 2005-2006 facility capacity number. Last school year, the actual enrollment exceeded the facility capacity at Kealakehe High School. Enrollment at Waimea Middle Public Charter School was at its facility capacity last year. There was some excess capacity at Waikoloa Elementary last year.

We expect that during the current 2006-2007 school year or the following year, the student enrollment at all three schools will exceed the facility capacity.

The EISPN states that the current, primary target markets for Waikoloa Highlands are retirees and second home owners. We would like the DEIS to include best estimates of the number of homes expected to be occupied at any given time and the number of homes expected to be occupied full time when the project is completely built out.

If accessory dwellings are permitted, the DEIS should provide the number of those units that would also be expected to be occupied at any one time and the number expected to be occupied full time.

The DOE expects that this project will have an enrollment impact on the public schools serving Waikoloa. Once we have a better idea of the total number of residential units that can be built and the number of units expected to be occupied full time, we will be able to make a more specific estimate of the number of students that will be generated by the project.

We look forward to reviewing the DEIS and providing more detailed comments at that time.

Thank you for an opportunity to comment on your plans. If you have any questions, please call Heidi Meeker of the Facilities Development Branch at 733-4862.

Very truly yours,

Patricia Hamamoto
Superintendent

PH:jmb

cc: Randolph Moore, Acting Assistant Superintendent, OBS
Duane Kashiwai, Public Works Manager, FDB
Art Souza, CAS, Honokaa/Kealakehe/Kohala/Kona Complex Areas
Anthony Ching, SLUC, DBEDT
Kevin Kellow, Waikoloa Mauka, LLC

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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September 25, 2006

Ms. Patricia Hamamoto
Department of Education
P.O. Box 2360
Honolulu, Hawai'i 96804

Dear Ms. Hamamoto:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 9, 2006 relating to the subject project.

We have included the information provided relating to current enrollment at Waikoloa Elementary, Waimea Middle Public Charter, and Kealakehe High. We also noted that two of the schools are currently at capacity and the third reaching capacity in the next school year.

We anticipate that infrastructure improvements for the first increment of the project will start for our project towards the end of 2007, subject to receiving required development approvals. Home construction could begin as early as late 2008 or early 2009.

We have been in contact with your Facilities Development Branch to discuss our preliminary plans. As our plans evolve, we will be in contact with your office to discuss potential impacts and mitigation measures that can be taken. Your comment letter is included in the Draft EIS.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

LINDA LINGLE
GOVERNOR

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
FRANCIS PAUL KEENO
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

STP 8.2225

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

July 31, 2006

Mr. Christopher J. Yuen
Director
Planning Department
County of Hawaii
101 Pauahi Street, Suite 3
Hilo, Hawaii 96720-3043

Dear Mr. Yuen:

Subject: Waikoloa Mauka LLC
Waikoloa Highlands
State Land District Boundary Amendment (A06-67) with
Environmental Impact Statement Preparation Notice
TMK: 6-8-2: portion 16

We have the following comments in response to your request for our review of the subject boundary petition for the proposed development project:

1. The project will have an impact on our two highways (Queen Kaahumanu and Mamalahoa) which will be used by the Waikoloa community for its access. We are an interested party and look forward to receiving at least four (4) copies of the forthcoming Draft EIS.

2. A traffic impact analysis report (TIAR) covering the project's impacts and the project's contribution to the cumulative impact from Waikoloa should be prepared by the applicant and included in the Draft EIS. The TIAR should also describe the traffic mitigation measures and roadway improvements necessary to address the project and cumulative impacts. We will be particularly interested in the impacts and recommendations at and around our highway intersections.

3. In the Draft EIS, the project should be discussed relative to the past, current, and future development projects and growth for Waikoloa.

We appreciate the opportunity to provide our comments.

Very truly yours,

RODNEY K. HARAGA
Director of Transportation

c: Laura Thielen, Office of Planning, DBEDT
Chester Koga, R.M. Towill Corporation

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

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September 25, 2006

Mr. Rodney K. Haraga, Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813

Dear Mr. Haraga:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated July 31, 2006 relating to the subject project.

We note that your letter suggests that there may be impacts to the two State facilities, Queen Kaahumanu Highway, and Mamalahoa Highway. We will evaluate the traffic generated from the project and will evaluate the impacts.

We are preparing an traffic impact assessment report (TIAR) for the proposed project. The findings are documented in the forthcoming Draft EIS.

We will be documenting, based on available information, proposed development in the Waikoloa area in the Draft EIS.

We note that you have requested four (4) copies of the forthcoming Draft EIS.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

RUSS K. SAITO
COMPTROLLER

KATHERINE H. THOMASON
DEPUTY COMPTROLLER

(P)1156.6

AUG - 4 2006

Mr. Chester Koga
R. M. Towill Corporation
420 Waikamilo Road #411
Honolulu, HI 96817

Dear Mr. Koga:

Subject: Waikoloa Highlands - Residential Subdivision
Environmental Impact Statement Preparation Notice
Island of Hawaii, South Kohala District
TMK: (3) 6-8-002:016 (por)

Thank you for the opportunity to review the information regarding the subject project. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities and we have no comments to offer.

If you have any questions regarding the above, please have your staff call Mr. David DePonte of the Planning Branch at 586-0492.

Sincerely,

ERNEST Y. W. LAU
Public Works Administrator

DD:mo
c: Waikoloa Mauka, LLC
Ms. Genevieve Salmonson, OEQC
State Land Use Commission
Office of Planning

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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September 25, 2006

Mr. Ernest Y.W. Lau, Public Works Administrator
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawai'i 96810

Dear Mr. Lau:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

This letter is to acknowledge receipted of your letter of August 4, 2006 noting that the proposed project will not impact any existing or proposed projects under the jurisdiction of your Department.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR
LAURA H. THIELEN
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-11488

September 6, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road #411
Honolulu, Hawaii 96817

Dear Mr. Koga.

Subject: Proposed Infrastructure Improvements and Subdivision of Property into Approximately 400 Low-density, Rural Residential Lots
Environmental Impact Statement Preparation Notice (EISPN)
TMK: (3) 6-8-002: 016 por.
Waikoloa, South Kohala, Hawaii
Land Use Commission Docket No. A06-767

Thank you for sending the Office of Planning the Environmental Impact Statement Preparation Notice (EISPN) for the above referenced proposal to reclassify approximately 731.581 acres of land from the State Agricultural District to the State Rural District to develop 400 low-density, rural residential lots of minimum one-acre size.

The Office of Planning will be coordinating the State's position on areas of cross-cutting state concern. I am writing to request that the Draft Environmental Impact Statement (DEIS) consider the impacts of the proposed project on the following issues:

1. **Water Supply** — Water resource protection and quality is a critical state issue. Please include information on the drinking water and non-potable water sources that will be available for the project. If the proposed project is within a designated Water Management Area, please address the additional measures that will be taken to address water resource limitations.

2. **Agricultural lands** — Preservation of important agricultural lands is a priority for the State and counties. The agricultural potential should be discussed based on the soil type, climate and availability of water.

3. **Affordable Housing** — Increasing the supply of affordable housing is a critical State and County issue. Please discuss specifically how the Petitioner plans to meet the county affordable housing requirements, including the length of time the units will remain affordable and how that guarantee will be met.

4. **Public Health** — If the project will have the potential to generate hazardous materials or petroleum contamination of the air, soil or water, please discuss how public health and safety will be protected.

5. **Ocean Resources** — The State has an affirmative duty to project Hawaii's nearshore waters. Please discuss how stormwater and wastewater generated by the project will be prevented from reducing the quality of nearshore water.

6. **Cultural/Historic Resources** — Please include an inventory of cultural and historic sites with monitoring and preservation plans approved by the State Historic Preservation Division. Please discuss how access for Native Hawaiians for traditional and customary practices will be preserved to include visual landmarks if applicable

7. **Environmental, Recreational and Scenic Resources** -- Please include an inventory of flora and fauna on the project site and any required protections. Please include a description of recreational uses on or near the project site. A description of scenic resources should be included.

8. **Coastal Zone Management** — The State oversees protection of natural and cultural resources within the coastal zone. Please discuss how the proposed project will balance the competing values of economic development and preservation of coastal resources, including protection from hurricanes, floods, volcanic hazards, and soil erosion.

The Office of Planning looks forward to receiving the DEIS with the potential impacts and mitigation measures for the above issues addressed. Please send us all comments received during the EISPN process. If you have any questions, please call Lorene Maki of the Land Use Division at 587-2888.

Sincerely,

Laura H. Thielen
Director

c: Anthony Ching, LUC

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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September 25, 2006

Ms. Laura H. Thielen, Director
Office of Planning
Department of Business, Economic Development & Tourism
235 South Beretania Street, 6th Floor
Honolulu. Hawai'i 96813

Dear Ms. Thielen:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

This letter is to acknowledge receipted of your letter of September 6, 2006 regarding the subject project.

The following is in response to your comments:

1. Water Supply – Information on the water system proposed for the project will be included in the Draft EIS. No non-potable systems are proposed for the project.
2. Agricultural lands – We note that the agricultural potential of the proposed lands have been limited to pasture use due in part to the low rainfall in the area and that water needs to be brought into the area.
3. Affordable housing – The developer will provide affordable housing according to the standards required under the County of Hawai'i's affordable housing policy as defined in Chapter 11 Article 1 of the Hawai'i County Code.
4. Public health – Impacts to air quality, noise impacts and water quality will be addressed in the Draft EIS. We are not currently aware that the project will be generating hazardous materials.
5. Ocean resources – The proposed project is not anticipated to impact ocean resources because of its distance from the ocean.
6. Cultural/historic resources – A study of archeological resources and cultural impacts of the project site was conducted and the findings reported in the Draft EIS.
7. Environmental, recreational an scenic resources – an study of flora and fauna of the area will be conducted for the project area. Recreational resource proposed and other means to mitigate impact will be discussed in the Draft EIS.

8. Coastal zone management – The proposed project is not in close proximity to coastal resources and is also not the County's Special Management Area or within the shoreline setback area.
9. Copies of all comments received during the EISPN process are appended.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

Harry Kim
Mayor

County of Hawaii
PLANNING DEPARTMENT
101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-3043
(808) 961-8288 • FAX (808) 961-8742

Christopher J. Yuen
Director
Brad Kurokawa, ASLA
LEED® AP
Deputy Director

August 10, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, # 411
Honolulu, HI 96817

Dear Mr. Koga:

Waikoloa Highlands – Residential Subdivision
Environmental Impact Statement – Preparation Notice
Waikoloa, South Kohala, Hawaii
TMK: 6-8-002: 016 (por)

This is in response to your letter dated July 23, 2006, requesting comments regarding the Environmental Impact Statement (EIS) Preparation Notice for the above-referenced project.

The proposed project involves infrastructure improvements and the subdivision of a 731.581-acre portion of an approximately 2,443.734-acre property into approximately 400 low density rural residential lots. Each lot will be a minimum of one acre in size. The applicant will file a petition with the State Land Use Commission from the Agricultural to the Rural District.

The project site is situated in the State Land Use Agricultural District, and zoned Residential and Agricultural 1-acre (RA-1a) and Open (O) by the County. The General Plan Land Use Pattern Allocation Guide Map (LUPAG) designates the area as Rural. The project site is not located in the Special Management Area (SMA).

Thank you for the opportunity to provide preliminary comments. Please forward us a copy of the Draft EIS upon its availability. If you have any questions, please contact Norman Hayashi of this department at 961-8288.

Sincerely,

CHRISTOPHER J. YUEN
Planning Director

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Hawai'i County is an Equal Opportunity Provider and Employer.

420 Waiakamilo Road
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September 25, 2006

Mr. Chris Yuen, Director
Planning Department
County of Hawaii
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720

Dear Mr. Yuen:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 10, 2006 relating to the subject project.

We have reviewed the comments you provided and appreciated the information on existing zoning and General Plan Land Use Pattern Allocation Guide. We acknowledge that the subject project is not in the Special Management Area.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

Harry Kim
Mayor

County of Hawaii
PLANNING DEPARTMENT
101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-3043
(808) 961-8288 • FAX (808) 961-8742

Christopher J. Yuen
Director

Brad Kurokawa, ASLA
LEED® AP
Deputy Director

August 29, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, # 411
Honolulu, HI 96817

Dear Mr. Koga:

Subject: State Land Use Boundary Amendment (A06-767) and EISPN
Applicant: Waikoloa Mauka, LLC
Request: Agricultural to Rural
TMK: 6-8-002: 016 (por)

For your information, we are transmitting the Department of Health's comments regarding the above-referenced project.

If you have any questions, please contact Norman Hayashi of this department at 961-8288.

Sincerely,

CHRISTOPHER J. YUEN
Planning Director

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Enclosure

Hawai'i County is an Equal Opportunity Provider and Employer.

LINDA LINGLE
GOVERNOR OF HAWAII

2006 AUG 24 PM 1 23

PLANNING DEPARTMENT
COUNTY OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPO-06-118

August 21, 2006

Mr. Christopher J. Yuen, Director
County of Hawaii
Planning Department
101 Pauahi Street, Suite 3
Hilo, Hawaii 96720-3043

Dear Mr. Yuen:

SUBJECT: State Land Use Boundary Amendment (A06-767) and Environmental Impact Statement Preparation Notice
Applicant: Waikoloa Mauka, LLC
Request: Agricultural to Rural
TMK: (3) 6-8-002: 16 (portion)

Thank you for allowing us to review and comment on the subject documents. The documents were routed to the various branches of the Environmental Health Administration. We have the following Wastewater Branch and Safe Drinking Water Branch comments.

Wastewater Branch

We have reviewed the subject petition which proposes to subdivide the area into approximately 400 low-density, rural, residential lots with each lot a minimum of one (1) acre.

The subject project is located in the Critical Wastewater Disposal Area (CWDA) with five (5) acre lot exception as determined by the Hawaii County Wastewater Advisory Committee. Therefore, the use of new cesspools is not allowed.

For such a large development, we recommend use of a centralized wastewater system. However, treatment individual wastewater systems (IWSs) such as septic tanks for each lot can be utilized.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater System." We do reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should you have any questions, please contact the Planning & Design Section of the Wastewater Branch at (808) 586-4294.

Safe Drinking Water Branch (SDWB)

We have reviewed the Petition and the Environmental Impact Statement (EIS) Preparation Notice for the subject project. The Petition states that the project will construct support infrastructure for the proposed subdivision, including providing water. Furthermore, the Notice states that the Waikoloa Water Company will provide water to the project. We request that additional information be provided in the EIS which would describe in detail how the Applicant will provide safe drinking water to the proposed subdivision.

Should you have any questions, please contact Mr. Kumar Bhagavan of the SDWB Compliance Section at 586-4258 in Honolulu, or call from Hawaii the direct toll free number 974-4000, extension 64258.

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this application should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

C: EPO
WWB
SDWB
EH-Hawaii

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

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September 25, 2006

Mr. Chris Yuen, Director
Planning Department
County of Hawaii
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720

Dear Mr. Yuen:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 29, 2006 relating to the subject project.

We have reviewed the comments you forwarded from the State Department of Health (DOH). We also received the same letter directly from the DOH. We have attached our response to the DOH for your information.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga
Project Coordinator

Cc: Waikoloa Mauka, LLC

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

September 25, 2006

Mr. Kelvin H. Sunada, Manager
Environmental Planning Office
Department of Health
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Dear Mr. Sunada:

Environmental Impact Statement Preparation Notice (EISPN) for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 21, 2006 relating to the subject project.

Wastewater
Because the subject project is located in the Critical Wastewater Disposal Area, we are aware that cesspools are not allowed. The developer will be proposing the use of individual wastewater systems (IWS) for each lot in accordance with Chapter 11-62, Hawai'i Administrative Rules. The developer is not considering the development of a centralized wastewater system.

Safe Drinking Water
As stated in the EISPN, water service will be provided to each lot in the subdivision by the Waikoloa Water Company. We have included additional information on the water system in the forthcoming draft EIS.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

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

August 11, 2006

Mr. Chester Kona
R.M. Towill Corporation
420 Waiakamilo Road, #411
Honolulu, HI 96817

ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
APPLICANT – WAIKOLOA MAUKA, LLC
PROJECT: WAIKOLOA HIGHLANDS – RESIDENTIAL SUBDIVISION
TAX MAP KEY 6-8-002:016 (PORTION)

We have reviewed the subject Environmental Impact Statement Preparation Notice and have the following comments.

Please be informed that the water system in the area is privately owned and operated. Water availability and necessary offsite water system improvements should be determined from Waikoloa Water Company, Inc. The Department does not have any existing or proposed programs for water development in the area as the existing water system is owned and operated by a private water purveyor.

Pursuant to Section 23-84 of the Hawaii County Code regulating subdivisions, the following minimum requirements must be complied with for subdivision approval:

1. Provide a water system designed to deliver water at adequate pressure and volume under peak-flow and fire-flow conditions in accordance with the Water System Standards, State of Hawai'i, and the Rules and Regulations of the Department of Water Supply. The water system shall include, but not be limited to, the installation of the necessary distribution pipelines, fire hydrants, and service laterals.

2. Submit construction plans to our Department for review and approval.

3. Pay a fee of four-tenths of one percent of the estimated cost for the construction of the water system, but not less than $50.00, to cover the costs for plan review, testing, and inspection.

Should there be any questions, please contact Mr. Finn McCall of our Water Resources and Planning Branch at 961-8070, extension 255.

Sincerely yours,

Milton D. Pavao, P.E.
Manager

FM:sco

copy - Waikoloa Mauka, LLC
State Land Use Commission

... Water brings progress...

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

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Photogrammetry
Surveying
Construction Management

September 25, 2006

Mr. Milton D. Pavao, P.E., Manager
Department of Water Supply
County of Hawai'i
345 Kekuanaoa Street, Suite 20
Hilo, Hawai'i 96720

Dear Mr. Pavao:

Environmental Impact Statement Preparation Notice (EISPN) for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 11, 2006 relating to the subject project.

As stated in the EISPN, water service will be provided to each lot in the subdivision by the Waikoloa Water Company. We have included additional information on the water system in the forthcoming draft EIS.

As stated in your letter:

1. The water system will be developed in accordance with the Water System Standards of the State of Hawai'i and the Department of Water Supply,
2. Construction plans will be submitted to your office when they are available, and
3. Payment of a fee of four-tenths of one percent of the estimated costs for the construction of the water system, but not less than $50 to cover the costs of plan review, testing and inspection.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

Harry Kim
Mayor

Barbara Bell
Director

Nelson Ho
Deputy Director

County of Hawaii

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

25 Aupuni Street, Room 210 • Hilo, Hawai'i 96720-4252
(808) 961-8083 • Fax (808) 961-8086
email: cohdem@co.hawaii.hi.us

August 14, 2006

Mr. Kevin Kellow, Manager
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

Subject: Waikoloa Highlands – Residential Subdivision
Preparation Notice for an Environmental Impact Statement

Dear Mr. Kellow,

Please find enclosed our comments for the subject Subdivision Project.

Thank you for allowing us to comment. If you have further questions, please don't hesitate to contact Michael Dworsky, Solid Waste Division Chief, at 961-8515.

Sincerely,

Barbara Bell
DIRECTOR

cc: Anthony Ching, State Land Use Commission, 735 South King Street, Suite 402, Honolulu, HI 96813
Chester Koga, R.M. Towill Corporation, 420 Waiakamilo Road #411, Honolulu, HI 96817
Michael Dworsky, SWD Chief

enclosures

Hawai'i County is an equal opportunity provider and employer.

0576A

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

SOLID WASTE DIVISION

COUNTY OF HAWAII – 108 RAILROAD AVENUE – HILO, HI 96720
HILO (808) 961-8514 WAIMEA (808) 887-3018 KONA (808) 327-3507

MEMORANDUM

DATE : July 31, 2006

TO : Barbara Bell, DIRECTOR

FROM : Michael Dworsky, CHIEF

SUBJECT : Comments on EISPN for Waikoloa Highlands – Residential Subdivision

Recommend that the Draft EIS address the Solid Waste issue by including in the EIS the information requested in a Solid Waste Management Plan (attach guidelines). In particular 400 new homes in a residential subdivision should develop some type of mandatory curbside pick-up with a high level of recycling available. Expecting 400 individual families to transport their garbage to one of the transfer stations, or the landfill is impractical.

Hawai'i County is an equal opportunity provider and employer.

Harry Kim
Mayor

Barbara Bell
Director

Michael Dworsky P.E.
Solid Waste Division Chief

County of Hawai'i

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
25 Aupuni Street, Room 210 • Hilo, Hawai'i 96720-4252
(808) 961-8083 • Fax (808) 961-8086

June 6, 2006

SOLID WASTE MANAGEMENT PLAN
Guidelines

INTENT AND PURPOSE

This is to establish guidelines for reviewing solid waste management plans, for which special conditions are placed on developments. The solid waste management plan will be used to: (1) encourage recycling and recycling programs, (2) predict the waste generated by the proposed development to anticipate the loading on County transfer stations, landfills and recycling facilities, and (3) predict the additional traffic being generated because of waste and recycling transfers.

REPORT

The consultant's report will contain the following:

1. Description of the project and the potential waste it may be generating: i.e. analysis of anticipated waste volume and composition. This includes waste generated during the construction and operational phases. Greenwastes will be included in this report for both construction grubbing and future operational landscape maintenance.

2. Description and location of the possible sites for waste disposal or recycling. We will not allow the use of the County transfer stations for any commercial development; commercial development as defined under the policies of the Department of Environmental Management, Solid Waste Division.

3. Since the Department of Environmental Management promotes recycling, indicate onsite source separation facilities by waste stream; i.e. source separation bins of glass, metal, plastic, cardboard, aluminum, etc. Provide ample and equal space for rubbish and recycling.

4. Identification of the proposed disposal site and transportation methods for the various components of the waste disposal and recycling system, including the number of truck traffic and the route that truck will be using to transport the waste and recycled materials.

PREPARATION NOTICE
FOR AN ENVIRONMENTAL IMPACT STATEMENT
WAIKOLOA HIGHLANDS – RESIDENTIAL SUBDIVISION

July 23, 2006

Dear Reviewer:

Attached for your review is an environmental impact statement (EIS) Preparation Notice which was prepared pursuant to Chapter 343 Hawaii Revised Statutes, and the EIS rules (Hawai'i Administrative Rules, Title 11, Chapter 200).

TITLE OF PROJECT:	Waikoloa Highlands – Residential Subdivision
LOCATION:	Island of Hawai'i, South Kohala District
TAX MAP KEY NUMBERS:	(3) 6-8-002: 016 (portion)
AGENCY ACTION:	
Accepting Authority:	State Land Use Commission
Address:	735 South King Street, Suite 402, Honolulu, Hawai'i 96813
Contact:	Mr. Anthony Ching, Phone: (808) 587-3822
Applicant:	Waikoloa Mauka, LLC
Address:	120 Aspen Oak Lane, Glendale, CA 91207
Contact:	Mr. Kevin Kellow, Manager
Consultant:	R.M. Towill Corporation
Address:	420 Waiakamilo Road # 411, Honolulu, Hawai'i 96817
Contact:	Mr. Chester Koga, Phone:(808) 842-1133 Fax: 808-842-1937 Email: chesterk@rmtowill.com
ENVIRONMENTAL NOTICE PUBLICATION DATE:	JULY 23, 2006
REVIEW COMMENT DEADLINE:	AUGUST 22, 2006

Please send your written comments and inquiries to the Applicant, Accepting Authority, and Consultant. If you wish to receive a copy of the Draft EIS when it becomes available, please contact the Consultant.

Thank you for your participation in the review of this EISPN.

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Environmental Services
Photogrammetry
Surveying
Construction Management

September 25, 2006

Ms. Barbara Bell, Director
Department of Environmental Management
County of Hawai'i
25 Aupuni Street, Room 210
Hilo, Hawai'i 96720

Dear Ms. Bell:

Environmental Impact Statement Preparation Notice (EISPN) for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 14, 2006 relating to the subject project.

Solid waste collection and disposal plans have not been formalized at this state of the process. The future homeowners of this subdivision will develop its solid waste management plan along with the development of recycling program.

The efforts of this subdivision will be further coordinated with the Waikoloa Village Association.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

Harry Kim
Mayor

Bruce C. McClure
Director

Jiro Sumada
Deputy Director

County of Hawaii
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 · Hilo, Hawaii 96720-4224
(808) 961-8321 · Fax (808) 961-8630

August 14, 2006

Mr. Kevin Kellow, Manager
Waikoloa Mauka , LLC
120 Aspen Oak Lane
Glendale, CA 91207

Subject: Environmental Impact Statement Preparation Notice
Waikoloa Highlands Residential Subdivision
TMK: 6-8-002:016 (portion)

We reviewed the subject and our comments are as follows:

1. All development generated runoff shall be disposed of on-site and shall not be directed toward any adjacent properties.

2. We appreciate from the EISPN review that base flood studies for numerous watercourses will be conducted and included in the Draft EIS.

2. All earthwork and grading shall conform to Chapter 10, Erosion and Sediment Control, of Hawaii County Code. 3.The applicant should consult with the Natural Resources Conservation Service, formerly known as, Soil Conservation Service).

4. We appreciate that a Traffic Impact Analysis Report (TIAR) prepared by a licensed professional traffic engineer will be submitted with the Draft EIS.

We prefer to withhold detailed comments until review of the draft Environmental Impact Statement.

Should there be any questions concerning this matter, please feel free to contact Kiran Emler of our Kona Engineering Division office at 327-3530.

Galen M. Kuba, Division Chief
Engineering Division

KE
copy: State Land Use Commission- Mr. Anthony Ching
R.M. Towill Corporation- Mr. Chester Koga
ENG-HILO/KONA

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

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Environmental Services
Photogrammetry
Surveying
Construction Management

September 25, 2006

Mr. Galen Kuba, Division Chief
Department of Public Works
County of Hawaii
101 Pauahi Street, Suite 7
Hilo, Hawai'i 96720

Dear Mr. Kuba:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 14, 2006 relating to the subject project.

We have reviewed your comments and offer response as follows:

1. Development Generated Run-off. As your letter stated, on-site generated runoff will not be directed towards adjacent properties, rather they will be directed to detention basins, dry-well, and natural drainage ways.
2. Flood Study. A flood study has been prepared and the findings are published in the Draft EIS.
3. Earthwork and grading work will conform to Chapter 10 of the Hawai'i County Code.
4. The findings of the traffic impact assessment report (TIAR) is included in the Draft EIS.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga
Project Coordinator

Cc: Waikoloa Mauka, LLC

Harry Kim
Mayor

Darryl J. Oliveira
Fire Chief

Desmond K. Wery
Deputy Fire Chief

County of Hawai'i
FIRE DEPARTMENT
25 Aupuni Street • Suite 103 • Hilo, Hawai'i 96720
(808) 961-8297 • Fax (808) 961-8296

August 14, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waikamilo Rd #411
Honolulu, HI 96817

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
PROJECT: WAIKOLOA HIGHLANDS – RESIDENTIAL SUBDIVISION
ISLAND OF HAWAII, SOUTH KOHALA DISTRICT
TAX MAP KEY: (3)6-8-002:016 (PORTION)

In regards to the above-mentioned environmental impact statement preparation notice, the following shall be in accordance:

Fire apparatus access roads shall be in accordance with UFC Section 10.207:

"Fire Apparatus Access Roads

"**Sec. 10.207.** (a) **General.** Fire apparatus access roads shall be provided and maintained in accordance with the provisions of this section.

"(b) **Where Required.** Fire apparatus access roads shall be required for every building hereafter constructed when any portion of an exterior wall of the first story is located more than 150 feet from fire department vehicle access as measured by an unobstructed route around the exterior of the building.

"**EXCEPTIONS:** 1. When buildings are completely protected with an approved automatic fire sprinkler system, the provisions of this section may be modified.

"2. When access roadways cannot be installed due to topography, waterways, nonnegotiable grades or other similar conditions, the chief may require additional fire protection as specified in Section 10.301 (b).

"3. When there are not more than two Group R, Division 3 or Group M Occupancies, the requirements of this section may be modified, provided, in the opinion of the chief, fire-fighting or rescue operations would not be impaired.

"More than one fire apparatus road may be required when it is determined by the chief that access by a single road may be impaired by vehicle congestion, condition of terrain, climatic conditions or other factors that could limit access.

"For high-piled combustible storage, see Section 81.109.

"(c) **Width.** The unobstructed width of a fire apparatus access road shall meet the requirements of the appropriate county jurisdiction.

"(d) **Vertical Clearance.** Fire apparatus access roads shall have an unobstructed vertical clearance of not less than 13 feet 6 inches.

"**EXCEPTION:** Upon approval vertical clearance may be reduced, provided such reduction does not impair access by fire apparatus and approved signs are installed and maintained indicating the established vertical clearance.

"(e) **Permissible Modifications.** Vertical clearances or widths required by this section may be increased when, in the opinion of the chief, vertical clearances or widths are not adequate to provide fire apparatus access.

"(f) **Surface.** Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus and shall be provided with a surface so as to provide all-weather driving capabilities." (20 tons)

"(g) **Turning Radius.** The turning radius of a fire apparatus access road shall be as approved by the chief." (45 feet)

"(h) **Turnarounds.** All dead-end fire apparatus access roads in excess of 150 feet in length shall be provided with approved provisions for the turning around of fire apparatus.

"(i) **Bridges.** When a bridge is required to be used as access under this section, it shall be constructed and maintained in accordance with the applicable sections of the Building Code and using designed live loading sufficient to carry the imposed loads of fire apparatus.

"(j) **Grade.** The gradient for a fire apparatus access road shall not exceed the maximum approved by the chief." (15%)

"(k) **Obstruction.** The required width of any fire apparatus access road shall not be obstructed in any manner, including parking of vehicles. Minimum required widths and clearances established under this section shall be maintained at all times.

"(l) **Signs.** When required by the fire chief, approved signs or other approved notices shall be provided and maintained for fire apparatus access roads to identify such roads and prohibit the obstruction thereof or both."

Water supply shall be in accordance with UFC Section 10.301(c):

"(c) **Water Supply.** An approved water supply capable of supplying required fire flow for fire protection shall be provided to all premises upon which buildings or portions of buildings are hereafter constructed, in accordance with the respective county water requirements. There shall be provided, when required by the chief, on-site fire hydrants and mains capable of supplying the required fire flow.

"Water supply may consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

"The location, number and type of fire hydrants connected to a water supply capable of delivering the required fire flow shall be protected as set forth by the respective county water requirements. All hydrants shall be accessible to the fire department apparatus by roadways meeting the requirements of Section 10.207.

Given the historical record of wildland fires in the proposed area, as well as with respect to the vicinity climate, wildland urban interface, and organic fuel loading, the establishment of sustainable defensible space would be greatly appreciated and provide for emergency wildfire mitigation.

The Fire Department would welcome the opportunity to work directly with the design consultant and developer to address this issue in the planning process.

DARRYL OLIVEIRA
Fire Chief

AY:lpc

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

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September 25, 2006

Chief Darryl Oliveira
Fire Department
County of Hawaii
25 Aupuni Street, Suite 101
Hilo, Hawai'i 96720

Dear Chief Oliveira:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 14, 2006 relating to the subject project.

We have reviewed the comments and note that the proposed project will be developed in accordance with UFC Section 10.207 relating to fire apparatus access.

In addition, the project will be developed in accordance with UFC Section 10.301(c) relating to water supply.

Consideration for the prevention, containment and establishment of defensive spaces relating to wildland fires have not been developed at this time. When plans are developed, we will consult with your department.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

Harry Kim
Mayor

County of Hawaii
POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2389

Lawrence K. Mahuna
Police Chief

Harry S. Kubojiri
Deputy Police Chief

August 16, 2006

Mr. Kevin Kellow
Manager – Waikoloa Mauka LLC
120 Aspen Oak Lane
Glendale, CA 91207

Dear Mr. Kellow:

RE: Preparation Notice for an Environmental Impact Statement
Waikoloa Highlands – Residential Subdivision

This is in response to your request for comments on the proposed Waikoloa Highlands residential subdivision.

Staff has reviewed the Environmental Impact Statement Preparation Notice that was sent to the Police Department and has the following comments.

Section 3.7 - Transportation/Traffic

The lower access point into the proposed subdivision is in close proximity to the main intersection of Waikoloa Road and Paniolo Drive. Additional traffic generated by this project will exacerbate the present congestion level at this intersection, which is the only access point into Waikoloa Village. Traffic improvements will be required to mitigate the impact of your proposed roadway and the increased traffic generated by this proposed subdivision.

Section 3.8 - Utilities, Public Facilities and Services

The proposed development and associated population increase will significantly increase the demand for police services in the Waikoloa area. The proposed development will impact the need for additional police personnel and police facilities to service the Waikoloa area.

Thank you for allowing us to comment. Should you have any questions, please contact Captain Lawrence Balberde, the South Kohala District Commander, at 887-3080, or Major John Dawrs, Area II Operations, at 326-4646, ext. 299.

Sincerely,

LAWRENCE K. MAHUNA
POLICE CHIEF

c: State Land Use Commission
R.M. Towill Corporation

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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Construction Management

September 25, 2006

Chief Lawrence K. Mahuna
Police Department
County of Hawaii
349 Kapi'olani Street
Hilo, Hawai'i 96720

Dear Chief Mahuna:

Environmental Impact Statement Preparation Notice for Waikoloa Highlands
South Kohala, Island of Hawai'i
Tax Map Key: (3) 6-8-002: 016 (por.)

We thank you for your letter dated August 16, 2006 relating to the subject project.

We have reviewed your comments and offer the following response:

Section 3.7 Transportation/Traffic
The developer has committed to improving the intersection at Waikoloa Road and Paniolo Avenue and will include additional traffic signals and turn lanes. Details of the proposed improvements are provided in the Draft EIS along with a traffic impact assessment report (TIAR) that will evaluate existing and future traffic with and without the proposed project.

Section 3.8 Utilities, Public Facilities, and Services
As part of the mitigation measures for this project, the developer has been required to pay impact fees to mitigate impacts on utilities, public facilities and services.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: Waikoloa Mauka, LLC

APPENDIX N

Comments and Responses – Draft EIS

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APPENDIX N

COMMENTS AND RESPONSES – DRAFT EIS

A Draft EIS was prepared and notice of availability published in the October 23, 2006 edition of the OEQC's Environmental Notice, with the public comment deadline of December 8, 2006.

Individuals, organization and agencies providing comments to the Draft EIS are identified with an asterisk '*' below. Copies of letters received and responses to the letters, follows the list.

Federal Agencies

Army Corps of Engineers, Honolulu Engineer District
Environmental Protection Agency
Federal Highway Administration
Natural Resources Conservation Service
Fish and Wildlife Service
U.S. Geological Survey*

State Agencies

Department of Agriculture
Department of Accounting and General Services*
Department of Business, Economic Development & Tourism, ~~Office of Planning~~
    Resources and Technology Division
    Office of Planning ~~Office*~~
    Hawai'i Housing Finance Development Corporation*
State Land Use Commission*
Department of Education*
Department of Hawaiian Home Lands
Department of Land and Natural Resources
State Historic Preservation Division
Department of Health
    Environmental Planning Office*
    Office of Environmental Quality Control (4 copies)*
Department of Public Safety
Department of Transportation*
Office of Hawaiian Affairs
University of Hawai'i, Environmental Center*
University of Hawai'i, Marine Programs
University of Hawai'i, Water Resources Research Center

County of Hawai'i

Department of Environmental Management*

Fire Department*
Department of Parks and Recreation
Planning Department*
Police Department*
Department of Public Works*
Department of Water Supply*

Elected Officials, Community Organizations, and Other Organizations

Elected Officials
- County Councilmember Pete Hoffman, County Council District 9
- Representative Cindy Evans, State House District 7
- Senator Paul Whalen Senate, State Senate District 3

Utility Companies
- Hawai‘i Electric Light Company, Inc.
- Hawaiian Telcom, Inc.
- Oceanic Time Warner Cable
- Waikoloa Water Company

Libraries
- Hawai‘i Documents Center, Hawai‘i State Library
- Bond Memorial Public Library
- Thelma Parker Memorial Library
- Kailua-Kona Public Library

Newspapers
- Hawai‘i Tribune Herald
- West Hawai‘i Today

Other
- Waimea Community Development Plan Committee
- Waikoloa Village Association
- Waikoloa Outdoor Circle
- Waikoloa Community Development Corporation
- Hawai‘i Leeward Planning Council
- West Hawai‘i Economic Development Council
- Chamber of Commerce
- Mauna Kea Soil and Water Conservation District*

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Pacific Islands Water Science Center
677 Ala Moana Blvd., Suite 415
Honolulu, Hawaii 96813
Phone: (808) 587-2400/Fax: (808) 587-2401

November 30, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, #411
Honolulu,, Hawaii 96817

Dear Mr. Koga:

Subject: Draft Environmental Impact Statement
Waikoloa Highlands – Residential Subdivision, Island of Hawaii, South Kohala District

Thank you for forwarding the DEIS for review and comment by the staff of the U.S. Geological Survey, Pacific Islands Water Science Center. We regret however, that due to prior commitments and lack of available staff, we are unable to review this document.

We appreciate the opportunity to participate in the review process.

Sincerely,

Gordon Tribble
Center Director

cc: Mr. Kevin Kellow, Manager
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

Mr. Anthony Ching
State Land Use Commission
735 South King Street, Suite 402
Honolulu, HI 96813

Office of Environmental Quality Control
235 S. Beretania St., Suite 702
Honolulu, HI 969813

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4958
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Surveying
Construction Management

DRAFT ENVIRONMENTAL IMPACT STATEMENT
WAIKOLOA HIGHLANDS – RESIDENTIAL SUBDIVISION

October 23, 2006

Dear Reviewer:

Attached for your review is a draft environmental impact statement (DEIS) prepared pursuant to Chapter 343 Hawaii Revised Statutes, and the Title 11, Chapter 200, Hawai'i Administrative Rules, for a 398-lot low density residential subdivision. A land use boundary amendment is being sought to change the State land use from Agriculture to Rural.

TITLE OF PROJECT:	Waikoloa Highlands – Residential Subdivision
LOCATION:	Island of Hawai'i, South Kohala District
TAX MAP KEY NUMBERS:	(3) 6-8-002: 016 (portion)
AGENCY ACTION:	
Accepting Authority:	State Land Use Commission
Address:	735 South King Street, Suite 402, Honolulu, Hawai'i 96813
Contact:	Mr. Anthony Ching, Phone: (808) 587-3822
Applicant:	Waikoloa Mauka, LLC
Address:	120 Aspen Oak Lane, Glendale, CA 91207
Contact:	Mr. Kevin Kellow, Manager
Consultant:	R.M. Towill Corporation
Address:	420 Waiakamilo Road # 411, Honolulu, Hawai'i 96817
Contact:	Mr. Chester Koga, Phone:(808) 842-1133 Fax: 808-842-1937 Email: chesterk@rmtowill.com
ENVIRONMENTAL NOTICE PUBLICATION DATE:	OCTOBER 23, 2006
REVIEW COMMENT DEADLINE:	DECEMBER 7, 2006

Please send your written comments and inquiries to the Applicant, Accepting Authority, OEQC and Consultant. If you wish to receive a copy of the Final EIS when it becomes available, please contact the Consultant.

Thank you for your participation in the review of this DEIS.

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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Planning
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January 31, 2007

Mr. Gordon Tribble, Director
U.S. Geological Services
677 Ala Moana Boulevard, Suite 415
Honolulu, Hawai'i 96813

Dear Mr. Tribble:

Draft Environmental Impact Statement
Waikolua Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 30, 2006 indicating that your agency was not able to review and comment on the Draft EIS.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikolua Mauka, LLC

LINDA LINGLE
GOVERNOR

PATRICIA HAMAMOTO
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF BUSINESS SERVICES

November 6, 2006

Mr. Kevin Kellow, Manager
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, California 91207

Dear Mr. Kellow:

SUBJECT: Draft Environmental Impact Statement for Waikoloa Highlands
Residential Subdivision, South Kohala, Hawaii TMK: 6-8-002: por 16

The Department of Education (DOE) has reviewed the Draft Environmental Impact Statement (DEIS) for Waikoloa Highlands, a 398-lot, rural subdivision. The DOE is limited in its ability to estimate the impact of the proposed project on public schools, because the DEIS does not make clear how many dwelling units would be permitted in the project. The DOE initially raised this issue in my August 9, 2006, letter to Mr. Chester Koga, which is included in Section 5 of the DEIS.

Neither the social impact assessment nor the market study included in the DEIS explains how it was determined that the project would generate an additional 233 students.

The DEIS does accurately describe past enrollment, facility capacity, and future enrollment projections of the three schools that would serve the future residents of Waikoloa Highlands. The proposed project would have a significant impact on the future enrollment of the schools which are expected to exceed their facility capacity in the next several years.

To mitigate the impact of additional students attending the public schools serving Waikoloa Highlands, DOE requests that the State Land Use Commission impose a school fair-share condition. The proposed wording that will permit the DOE to collect a fair-share condition based on the actual number of dwelling unit in the project is as follows:

> The Applicant shall contribute to the development, funding, and/or construction of school facilities, on a fair-share basis, as determined by and to the satisfaction of the Department of Education. Terms of the contribution shall be agreed upon in writing by the Applicant and the Department of Education prior to final plan approval for any area of development.

The DOE has met with representatives of Waikoloa Mauka, LLC, and is confident that we will be able to determine a school fair-share contribution provided the standard condition is imposed.

The DOE appreciates the opportunity to review the plans for Waikoloa Highlands. If you have any questions, please call Heidi Meeker of the Facilities Development Branch at 733-4862.

Very truly yours,

Patricia Hamamoto
Superintendent

PH:jmb

cc: Randolph Moore, Acting Assistant Superintendent, OBS
Duane Kashiwai, Public Works Manager, FDB
Arthur Souza, CAS, Honokaa/Kohala/Kona Complex Areas
Anthony Ching, SLUC
✓ Chester Koga, R.M.Towill
Laura H.Thielen, Office of Planning

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R. M. TOWILL CORPORATION
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Environmental Services
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Construction Management

January 31, 2007

Ms. Patricia Hamamoto, Superintendent
Department of Education
P.O. Box 2360
Honolulu, Hawai'i 96804

Dear Ms. Hamamoto:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 6, 2006 relating to the subject project. We offer the following responses to your inquiries:

1. Number of dwelling units in the project. The proposed subdivision envisions only one (1) dwelling unit per lot of record. We will include this statement in the Final EIS.

2. Student enrollment projection. At the time that the DEIS was written, we were under the impression that .576 students per household was the formula used by the DOE. In recent discussions with Heidi Meeker we understand this is no longer the case, and in its place the DOE requests discussions and negotiations on a project-by-project basis with the assumption that each project is unique. We understand that position and look forward to detailed discussions that permit us to estimate the impact of our project on education facilities, and to mutually arrive at a fair-share contribution.

3. We have reviewed the proposed fair-share education condition and find it acceptable. We will include your proposal in the Final EIS.

We will continue to work with DOE staff to reach an equitable fair-share solution to meet the needs of school children in the area.

Should you have questions, please contact the undersigned.

Sincerely,

Chester Koga

Chester Koga, AICP

Cc: LUC, Waikoloa Mauka LLC

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
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Fax 808 842 1937
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Planning
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June 13, 2007

Ms. Patricia Hamamoto
Superintendent
Department of Education
State of Hawai'i
P. O. Box 2360
Honolulu, Hawai'i 96804

Dear Ms. Hamamoto:

Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i

Thank you for your letter dated November 6, 2006 concerning the subject project. We have prepared the following revised response to our earlier mailing to you to provide further clarification and detail. Your comments are *italicized* for reference:

1. *The DOE is limited in its ability to estimate the impact of the proposed project on public schools, because the DEIS does not make clear how many dwelling units would be permitted in the project.*

The Waikoloa Highlands project will consist of 398 lots with one dwelling per lot as prescribed in Ordinance 05-157, County of Hawai'i, a copy of which is attached for your reference.

2. *Neither the social impact assessment nor the market study included in the DEIS explains how it was determined that the project would generate an additional 233 students.*

Since our last correspondence, we have been in contact with your staff and have been provided with the following information regarding anticipated student enrollment. Based on the number of units planned and the projected population, the DOE estimates that the project will contribute 24 additional elementary school students, 9 middle school students, and 7 high school students. The DOE staff also concluded due to the small number of additional students, that the project will not require additional school facilities. This information will be provided in the Final EIS, Section 3.7.4, Schools, Pages 3-60 to 3-62.

3. *To mitigate the impact of additional students attending the public schools serving Waikoloa Highlands, DOE requests that the State Land Use Commission impose a school fair-share condition. The proposed wording that will permit the DOE to collect a fair-share condition based on the actual number of dwelling unit in the project is as follows:*

   The Applicant shall contribute to the development, funding, and/or construction of school facilities, on a fair-share basis, as determined by and to the satisfaction of the Department of Education. Terms of the contribution shall be agreed upon in writing by the Applicant and the Department of Education prior to final plan approval for any area of development.

We have reviewed the proposed fair-share education condition and find it acceptable. We will continue to work with DOE staff to reach an equitable fair-share solution to meet the needs of school children in the area.

Thank you for taking the time to share your comments and allowing us this opportunity to respond. Any further written comments may be directed to the undersigned.

Sincerely,

for Chester Koga, AICP

Attachment: Ordinance 05-157

cc: Waikoloa Mauka LLC
Imanaka Kudo & Fujimoto

LINDA LINGLE
GOVERNOR

ANTHONY J.H. CHING
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, Hawaii 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

October 31, 2006

Mr. Kevin Kellow
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, California 91207

Dear Mr. Kellow:

Subject: LUC Docket No. A06-767/Waikoloa Mauka, LLC ("Petitioner")
Draft Environmental Impact Statement ("DEIS")
South Kohala, Hawai'i
TMK No.: [3] 6-8-002-016 (por.)

We have reviewed the DEIS for the development of approximately 398 low-density rural residential lots, supporting infrastructure and open space recreational areas (the "Project") on 731.581 acres of land (the "Petition Area") in addition to 12.819 acres of land impacted by drainage improvements and have the following comments:

1. Please include a figure in the Final Environmental Impact Statement ("FEIS") that identifies the location of the 12.819 acres of land impacted by drainage improvements in relation to the Petition Area.

   Please also confirm if the above-mentioned 12.819 acres are a portion of TMK No.: 6-8-003: 032 and make changes to the FEIS to include this TMK, as appropriate.

2. The Executive Summary of the FEIS should include a discussion of the Project impacts and mitigation to include cumulative and secondary impacts.

3. In reference to Section 1.2 of the DEIS, please clarify which state or county lands (not including those associated with the connection of planned roadways to existing

county or state roads) may be impacted by the Project. Additionally, please indicate if the Project requires the use of any public funds or lands.

4. Please clarify the phasing and development timetable of the project. Approximately how long will phase 2 take to complete?

5. As you may be aware, the Petition For Land Use District Boundary Amendment filed with the Land Use Commission on June 28, 2006, indicated that a golf course and related amenities are a "projected use" within the open space recreational areas of the Project. However, Section 2.5 of the DEIS notes that a golf course *was considered* but *will not* be included as a component of the Project; whereas Section 4.1.2 of the DEIS states that "[a] golf course may be proposed in appropriately-zoned areas of the property."

   The Petitioner should resolve this inconsistency in the FEIS. If a golf course is proposed as a component of the Project, the environmental impacts and mitigation measures must be disclosed in the context of the Project as a whole. The inclusion of a golf course in the Project sometime after the completion of the environmental review process would undermine the spirit and intent of chapter 343, Hawai'i Revised Statues ("HRS") and violate sections 11-200-7 and 11-200-17(i), of the Hawai'i Administrative Rules.

6. Please identify the current landowner of the large cinder quarry at the base of Pu'u Hina'i and the approximate date that quarry operations were terminated.

7. Please include a figure in the FEIS that depicts the location, acreage and unit count of the proposed affordable housing. Please also describe why the affordable units were not integrated into the layout of the Project. Depending on the location of any affordable housing units which are developed as a function of the Project, it may be appropriate to discuss the development of the offsite affordable units and the associated infrastructure improvements within the scope of the FEIS.

8. Please include a figure in the FEIS depicting the Underground Injection Control ("UIC") line in relation to the Petition Area. The FEIS should include a discussion of the Project's location in relation to the UIC line and how that may impact underground injection disposal of stormwater and/or wastewater.

9. The FEIS should include an estimate of the "soft costs" (impact fees and fair-share contributions) with its projected development cost to more accurately portray what the total development costs of the Project might equal.

10. Please provide a figure in the FEIS depicting the potential location of the new upper elevation well, which is under consideration as an optional water source for the Project. Again, the location of any such well might dictate that this item is included in the scope of the FEIS. However, no further discussion of the matter (other than a statement to that effect) may be necessary if the location and development of the drinking water source is construed to be another separate project.

11. Please include a figure in the FEIS that demonstrates the potential location and acreage of the school site across Waikoloa Road on the Waikoloa Village side, which is under consideration by the Petitioner and the state Department of Education ("DOE").

12. Please note that the statement made by Ms. Maigret of the State Historic Preservation Division ("SHPD") in her April 17, 2006 email correspondence (Figure 5 of Appendix E) that it is her *inclination* "that additional work is not necessary...", reads as a tentative approval which will require review and sign-off by Ms. Maigret's supervisor. However, on page 3-34, the DEIS states that SHPD recently "confirmed that additional work was not necessary..."

    Please also note that page 15 of the Cultural Impact Statement (Appendix F) states that "...recent consultation with the SHPD (4/17/06) has indicated that no further work is necessary." Please provide documentation to evidence this confirmation from SHPD.

13. Please add a figure to the FEIS to describe the locations of the proposed on-site reservoirs. Please also clarify how reservoir water levels will be maintained in an area with low annual rainfall (in relation to a relatively high mean annual evapotranspiration rate) and where soil permeability ranges from moderate to rapid.

14. Please add a subsection to the FEIS to segregate the description of the Project's irrigation water from the Project's drinking water. Please also clarify if nonpotable water will be used to irrigate landscaping associated with the Project.

    Please note that Appendix K is a recommended irrigation scheme for the Highlands Golf Estate, which is a development that does not directly correlate to the description of the Project as defined in the DEIS. Please clarify if the Project will utilize the recommendations of Appendix K, despite this discrepancy.

    Please clarify the relationship of the Waikoloa Water Master Plan dated February 1991 (Appendix A) to the drinking and irrigation water needs of the Project. Additionally, please describe which parts of the Waikoloa Water Master Plan will or will not apply to the Project. For example, the Project does not appear to adhere to the recommendation that "sewage treatment effluent be reused for irrigation wherever possible, to reduce groundwater pumping, reduce pumping costs, and to demonstrate and effort to conserve water to the State Water Commission."

    The FEIS should describe the Project's drinking water source, storage, and transmission requirements in the body of the document without referring the reader to Appendix A.

15. The FEIS should acknowledge that the state Department of Health, in its Environmental Impact Statement Preparation Notice ("EISPN") comment letter dated August 21, 2006, recommended that the Project utilize a centralized wastewater system. The FEIS should also discuss why a centralized wastewater system was not considered for the Project. Please also clarify if septic tanks are the sole option considered for Individual Wastewater System disposal for the Project.

16. Please clarify what is meant by the statement that with a "full staff" of police officers for the South Kohala Police Station in Waimea, the Project would be adequately serviced. Is the police station currently not fully staffed?

    Taking into the consideration the comments from the police department that the Project "will impact the need for additional police personnel and police facilities to service the Waikoloa area", how many additional police officers (and related facilities) are needed for the Project to be adequately serviced?

17. The FEIS should provide a breakdown of the number of elementary, middle school, and high school students the Project is expected to generate.

18. The FEIS should respond to the DOE's request in its EISPN comment letter (dated August 9, 2006) to provide:

    - a confirmation whether or not accessory dwellings will be permitted in the Project;
    - the range of lots sizes and minimum required price for homes built in the Project (if any); and
    - best estimates of the number of homes [to include accessory dwellings, if permitted] expected to be occupied at any given time and the number of homes expected to be occupied full time when the Project is completely built out.

19. If accessory dwellings will be permitted in the Project, please revise the Project's impacts and mitigation measures accordingly in the FEIS to account for the potential increase in the Project's density.

20. Please clarify what studies (and projected timeframes for such studies) would be necessary to determine the feasibility of relocating the existing electric transmission lines to the perimeter of the Petition Area.

21. The FEIS should describe the Project's applicability (or not) to each of the coastal zone management program policies and objectives defined in chapter 205A-2, HRS.

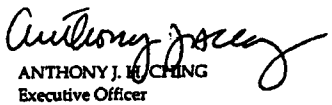
22. If Ordinance No. 05-157 amended Ordinance No. 95-51 please clarify the relevance of Ordinance No. 95-157 to the Project. Please include the applicable rezoning ordinances as appendices to the FEIS.

23. In the DEIS, the Project's drainage impacts and mitigation reference Appendix I (Drainage Report for the Waikoloa Highlands Subdivision, Phase 1). The FEIS should address drainage impact and mitigation measures in terms of the sum impact (i.e., both phases) of the Project.

24. The FEIS should include a discussion of the interrelationships and cumulative environmental impacts of the Project to other related projects.

Thank you for the opportunity to comment on the subject DEIS. Should you have any questions, please feel free to call me or Max Rogers of our office at 587-3822.

Sincerely,



ANTHONY J. H. CHING
Executive Officer

c: Genevieve Salmonson, OEQC
Chester T. Koga, R. M. Towill Corporation

420 Waiakamilo Road
Suite 411
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R. M. TOWILL CORPORATION
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Planning
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Environmental Services
Photogrammetry
Surveying
Construction Management

June 13, 2007

Anthony J.H. Ching, Executive Officer
Land Use Commission
State Department of Business, Economic Development & Tourism
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Ching:

Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i

Thank you for your letter dated October 31, 2006 concerning the subject project. We have prepared the following revised response to our earlier mailing to you to provide further clarification and detail. Your comments are *italicized* for reference:

1. *Please include a figure in the Final Environmental Impact Statement ("FEIS") that identifies the location of the 12.819 acres of land impacted by drainage improvements in relation to the Petition Area.*

   Please also confirm if the above-mentioned 12.819 acres are a portion of TMK No.: 6-8-003: 032 and make changes to the FEIS to include this TMK, as appropriate.

The 12.819 acres located at the northernmost portion of the subject property at the intersection of Waikoloa Road and Pua Melia Road is not required and will be excluded from this project. This parcel is designed as Tax Map Key: (3) 6-8-002, portion of parcel 016. During the initial phases of project design the 12.819-acre area was intended to be used for drainage improvements to handle the additional stormwater that would be generated from the proposed project. However, after further examination of infrastructure requirements it was determined that sufficient drainage improvements could be handled within the larger 731.581 acre property. The 12.819-acre area is now removed from this project. The new project acreage and petition area comprises 731.358 acres. This change will be reflected in the Final EIS in the following sections:

Section 1, Executive Summary, Proposed Action
Section 1.3, Introduction
Figure 1, Project Location
Figure 2, Site Plan
Figure 3, Tax Map
Figure 4, Subdivision Plan

2. *The Executive Summary of the FEIS should include a discussion of the Project impacts and mitigation to include cumulative and secondary impacts.*

The Final EIS, Executive Summary, starting from Page ES-5, provides a summary of these changes that include:

Secondary Impacts
Secondary impacts that are anticipated include: a potential increase in retail sales in Waikoloa Village; a decrease in available agricultural land; and changes in the landscape from open space to developed land.

Increase in retail sales
It is anticipated that there will be increased retail sales at the Waikoloa Village Shopping area based on an increase in population. This will also result in increased demand for services.

Decrease in available agricultural land
The proposed project will have the effect of decreasing the availability of agricultural lands in the area. Recent agricultural uses have been limited to use pasturage activities.

Change in the landscape
The principal change in the landscape will be from a pastoral to a more rural setting. Where open space now occurs, there will be residences.

Cumulative Impacts
Cumulative impacts that are anticipated include: increased water demand (an additional 398,000 gallons per day); additional traffic on Waikoloa Road (an additional 50 eastbound and 110 westbound trips would be generated during the AM peak, and 85 eastbound and 45 westbound trips would be generated during the PM peak); additional demand on public services, e.g. police, fire, schools, solid waste, and parks use based on an increase in population by 1,068 persons; and an increase in housing stock by 398 units.

In each instance where impacts are anticipated, mitigation measures are identified and include the proposed use of traffic signals at the intersection of Waikoloa Road and Paniolo Avenue, and the provision of affordable housing in accordance with Ordinance 05-157, calling for the assessment of impact fees for public services that include affordable housing, parks, roadways, police service, fire service and solid waste. We add that we are continuing to discuss this project with the state Department of Education to determine the fair share contribution to meet public education requirements.

3. *In reference to Section 1.2 of the DEIS, please clarify which state or county lands (not including those associated with the connection of planned roadways to existing county or state roads) may be impacted by the Project. Additionally, please indicate if the Project requires the use of any public funds or lands.*

The FEIS, Section 1.2, Purpose of This Final Environmental Impact Statement, Page 1-2, will provide information on how the use of County of Hawai'i roadway facilities (lands) will be affected by the proposed project. These locations have been identified and include: (1) the intersection of Waikoloa Road and Paniolo Drive where traffic signals will be installed and the intersection will be re-striped; (2) a new intersection proposed along Pua Melia Road; and (3) a new intersection proposed where turn-lanes will be installed on Waikoloa Road, east of Paniolo Avenue. Section 1.2, will also include a statement to clarify that state or county funds will not be required to complete the roadway improvements.

4. *Please clarify the phasing and development timetable of the project. Approximately how long will phase 2 take to complete?*

The FEIS, Section 2.2.2, Phasing Plan, Page 2-3, will clarify the phasing and development timetable for the project as follows:

The infrastructure improvements planned for Phase 1 will take approximately 8-10 months from the receipt of development permits from the County of Hawai'i which include: subdivision approval and plan approval for infrastructure improvements (grading, roadway and water line installation). Subdivision application has been filed with the County of Hawai'i and is currently pending. Infrastructure plans and roadway improvement plans are currently under preparation and will be submitted to the County of Hawai'i for review by Summer 2007. Completion of the Phase 1 improvements will involve 319.081 acres and is anticipated to be completed by Fall 2008, assuming a fall 2007 construction start.

Phase 2 improvements will involve 412.5 acres. Phase 2 plan preparation will commence in Spring 2007 and will be submitted to the County of Hawai'i following approval of the Phase 1 plans in Fall 2007. It is anticipated that the Phase 2 improvements will also take 8 to 10 months, with completion anticipated by Fall 2009 or early 2010.

5. *As you may be aware, the Petition For Land Use District Boundary Amendment filed with the Land Use Commission on June 28,2006, indicated that a golf course and related amenities are a "projected use" within the open space recreational areas of the Project. However, Section 2.5 of the DEIS notes that a golf course was considered but will not be included as a component of the Project; whereas Section 4.1.2 of the DEIS states that "[a] golf course may be proposed in appropriately-zoned areas of the property."*

The Petitioner should resolve this inconsistency in the FEIS. If a golf course is proposed as a component of the Project, the environmental impacts and mitigation measures must be disclosed in the context of the Project as a whole. The inclusion of a golf course in the Project sometime after the completion of the environmental review process would undermine the spirit and intent of chapter 343, Hawai'i Revised Statues ("HRS") and violate sections 11-200-7 and 11-200-17(i), of the Hawai'i Administrative Rules.

The golf course identified in the DEIS was cited in error and is not a part of the proposed project based on major additional infrastructure requirements and the uncertain market for another new golf course in the region. The golf course will not be developed and will be removed as a proposed part of the project from the FEIS.

6. *Please identify the current landowner of the large cinder quarry at the base of Pu'u Hina'i and the approximate date that quarry operations were terminated.*

Pu'u Hīna'i is owned by Waikoloa Mauka, LLC. The Draft EIS reported incorrectly that the quarry operations were terminated. The quarry is currently permitted by Special Use Permit No. SP70-85, and is operated by Deluz Trucking and Gravel, LLC. An amendment to the permit was approved by the LUC on January 9, 2006 which extended the life of the permit from December 11, 2005 to December 11, 2010. This information will be provided in the Final EIS, Section 3.2.3, Topography, Page 3-2.

7. *Please include a figure in the FEIS that depicts the location, acreage and unit count of the proposed affordable housing. Please also describe why the affordable units were not integrated into the layout of the Project. Depending on the location of any affordable housing units which are developed as a function of the Project, it may be appropriate to discuss the development of the offsite affordable units and the associated infrastructure improvements within the scope of the FEIS.*

A new figure will be provided in the Final EIS identifying Tax Map Key: (3) 6-8-003: Parcel 031, comprising 3.710 acres, as the location for an affordable housing parcel. Section 4.2.5, County Affordable Housing (Hawai'i County Code, Chapter 11, Article 1), Page 4-12, will provide detail on compliance with the affordable housing requirements of the Hawaii County Code (HCC). In summary: (1) a total of 80 affordable housing units will be provided. This represents 20 percent of the planned 398 units of the project in accordance with Section 11-4, HCC; and (2) the location of the parcel is within 15 miles of the project site in accordance with Section 11-5, HCC.

Section 3.8.3, Affordable Housing, Page 3-63, will further describe the basis for the selection of the site according to the underlying 1-acre zoning of the planned Waikoloa Highlands project, and the developer's ownership of other nearby property that possessed the necessary zoning for affordable housing uses.

The Waikoloa Highlands project site is zoned RA-1a (Residential and Agricultural, Minimum 1-acre) and O (Open). In order to be used for affordable housing a rezoning of the site to a higher density would be required. The proposed affordable housing site is owned by the developer, is in close proximity to Waikoloa Highlands of less than half a mile, and is already zoned RM-1.5 (Multi-Family Residential, 1,500 square foot land/unit), which supports the development of affordable units without need for further rezoning.

Although the developer owns other property within a 15 mile radius that could be used to meet the affordable housing requirements of the HCC, the proposed site possesses zoning that is more consistent with surrounding land uses that also include multifamily, single-family, and village commercial land uses. In contrast, land uses surrounding Waikoloa Highlands are a combination of Open and A-5a (Agricultural, 5 acre minimum), that would make it less consistent with the underlying and surrounding zoning.

8. *Please include a figure in the FEIS depicting the Underground Injection Control ("UIC") line in relation to the Petition Area. The FEIS should include a discussion of the Project's location in relation to the UIC line and how that may impact underground injection disposal of stormwater and/or wastewater.*

The location of the UIC line in relation to the proposed project will be provided on Figure 20, Underground Injection Control Line, Page 3-54, of the Final EIS. The UIC line demarcates the limit of where wastewater injection into the ground is permitted. The area within the UIC zone is normally restricted from underground injection of wastewater. However, exceptions are made for areas that are not within a groundwater recharge area, are within a site that is not adjacent to a drinking water well, and/or the project contains large lots, greater than approximately one acre in size.

We note that the proposed project would be generally consistent with these exceptions: (1) the proposed project is not located within a groundwater recharge area; (2) the project location is downgradient of drinking water sources such as wells; and (3) the project is principally comprised of lots that are slightly greater than one acre in size. Discussion of these exceptions and additional information pertaining to underground injection of stormwater and/or wastewater is provided in the Final EIS, in Section 3.5.5, Wastewater, Page 3-53.

9. *The FEIS should include an estimate of the "soft costs" (impact fees and fair-share contributions) with its projected development cost to more accurately portray what the total development costs of the Project might equal.*

An estimate of the project's soft costs will be provided in the Final EIS, Table 2-3, Additional Costs, Page 2-7 and below. Table 2-3, identifies the impact fees and fair-share contributions that can be quantified at this time:

Table 2-3: Additional Costs*

Recreation Fee ($4,817.93 per lot)	$1,917,536
Affordable Housing (20% of 398 total lots = 80 units)	TBD
Police Impact Fee ($232.42 per lot x 398)	$92,503
Solid Waste Fee ($200.98 per lot x 398)	$79,990
Water Development Fee	TBD
Road and Traffic Fees ($4,280.82 per lot x 398)	$1,703,766
School Impact Fee**	TBD
Fire Impact Fee ($459.06 per lot x 398)	$182,705
TOTAL ESTIMATED	$3,976,500

* Fees estimated based on Ordinance 05-157. Fees may be adjusted, if required, by providing land or facilities and the final payment amount will be adjusted by the Honolulu Consumer Price Index at the time of Final Subdivision approval.
** Discussions with DOE are ongoing.
TBD = to be determined

10. *Please provide a figure in the FEIS depicting the potential location of the new upper elevation well, which is under consideration as an optional water source for the Project. Again, the location of any such well might dictate that this item is included in the scope of the FEIS. However, no further discussion of the matter (other than a statement to that effect) may be necessary if the location and development of the drinking water source is construed to be another separate project.*

The development of off-site improvements is the responsibility of West Hawai'i Utility Company (WHUC), a Public Utilities Commission regulated utility company, who will designate the specific locations of well(s) and reservoirs. Although the specific locations of these well(s) and reservoirs are not known by the project developer, information that is known includes the approximate elevation of the reservoirs so that sufficient pressure can be provided to meet water system requirements. The Final EIS, Appendix A, Waikoloa Water Master Plan, 1991, identifies these water storage elevations at 1,300 feet and 1,800 feet relative to mean sea level (msl).

The applicant will be required to pay a fee to the WHUC for their share of off-site development costs based on the projected amount of water that will be used.

The system that will provide for the distribution of water will be the responsibility of the applicant. A preliminary plan is provided in the Final FEIS, in Section 3.5.3, Drinking Water, Pages 3-49 to 3-52; Figure 19, Water Distribution Plan, Page 3-51; and in Appendix J, Waikoloa Highlands Water Distribution System, September 2006.

11. *Please include a figure in the FEIS that demonstrates the potential location and acreage of the school site across Waikoloa Road on the Waikoloa Village side, which is under consideration by the Petitioner and the state Department of Education ("DOE").*

The DEIS, Section 3.8.2, Schools, previously indicated that 3.6-acres of developable land would be considered to meet school educational requirements. This proposal has since been revised based on a change in the formula used by the DOE to estimate school enrolment. DOE reports that based on the number of units planned that the proposed Waikoloa Highlands project will contribute 24 additional elementary school students, 9 middle school students, and 7 high school students. The DOE has determined that due to the small number of additional students, that no additional schools will be needed.

The petitioner is continuing to discuss their fair-share requirement with the DOE and as required, will contribute their fair-share to mitigate the potential for adverse impacts on the provision of public educational services.

The FEIS, Section 3.7.4, Schools, Page 3-60 to 3-62, will provide further discussion on this item.

12. *Please note that the statement made by Ms. Maigret of the State Historic Preservation Division ("SHPD") in her April 17,2006 email correspondence (Figure 5 of Appendix E) that it is her inclination "that additional work is not necessary. . .", reads as a tentative approval which will require review and sign-off by Ms. Maigret's supervisor. However, on page 3-34, the DEIS states that SHPD recently "confirmed that additional work was not necessary. . . "*

Please also note that page 15 of the Cultural Impact Statement (Appendix F) states that "...recent consultation with the SHPD (4/17/06) has indicated that no further work is necessary." Please provide documentation to evidence this confirmation from SHPD.

We have requested a clarification of the requirements of the SHPD and will forward their response to the LUC upon our receipt. We are aware that Ms. Mary Anne Maigret, Hawai'i Island Archaeologist, has since left the SHPD and her assignments have been transferred. We are in communication with the SHPD and intend to provide documentation concerning this item as soon as possible.

See FEIS, Section 3.4.5, Archaeological, Historic, and Cultural Resources, Page 3-36.

13. *Please add a figure to the FEIS to describe the locations of the proposed on-site reservoirs. Please also clarify how reservoir water levels will be maintained in an area with low annual rainfall (in relation to a relatively high mean annual evapotranspiration rate) and where soil permeability ranges from moderate to rapid.*

Proposed reservoirs (tanks) to serve this project are located off-site on property owned by the applicant. The general location of the proposed reservoirs will be provided in the Final FEIS, in Figure 19, Water Distribution Plan, Page 3-51, as well as in Appendix J, Waikoloa Highlands Water Distribution System, September 2006. The water source for this project will be from the West Hawai'i Utilities well field number 2 and 3. The approximately 400,000 gallons per day of water required for this project will be stored in covered tanks that will minimize water losses through evaporation.

14. *Please add a subsection to the FEIS to segregate the description of the Project's irrigation water from the Project's drinking water. Please also clarify if nonpotable water will be used to irrigate landscaping associated with the Project.*

The Final EIS, Section 3.5.3, Drinking Water, Page 3-49 to 3-51, will clarify that the proposed project will utilize a potable water system to meet irrigation and domestic water needs.

Please note that Appendix K is a recommended irrigation scheme for the Highlands Golf Estate, which is a development that does not directly correlate to the description of the Project as defined in the DEIS. Please clarify if the Project will utilize the recommendations of Appendix K, despite this discrepancy.

We confirm that the recommendations of Appendix K, Highlands Golf Estates Landscape Irrigation Water Study, August 2005, are intended to help guide the use of water conservation measures and do not imply the development of a golf course, which is not now a part of the proposed project.

Please clarify the relationship of the Waikoloa Water Master Plan dated February 1991 (Appendix A) to the drinking and irrigation water needs of the Project. Additionally, please describe which parts of the Waikoloa Water Master Plan will or will not apply to the Project. For example, the Project does not appear to adhere to the recommendation that "sewage treatment effluent be reused for irrigation wherever possible, to reduce groundwater pumping, reduce pumping costs, and to demonstrate and [sic] effort to conserve water to the State Water Commission."

The FEIS, Section 3.2.8, Hydrology, Pages 3-12 to 3-14, provides further discussion of the relationship between the proposed project and the Waikoloa Water Master Plan (WWMP), 1991. In summary, the WWMP was reviewed and an update of the applicability of the plan to the proposed project was undertaken in 2007, by Waimea Water Services, Inc. According to the WWSI update there is sufficient water resource capacity to meet the project demand of 1,000 gallons per day (gpd) per lot, or approximately 400,000 gpd for the project (1,000 gpd x approximately 400 lots).

The proposed water system will provide a separate water meter for each lot that will provide metering for both domestic and irrigation needs up to a water allowance of 1,000 gallons per day per lot.

Wastewater reuse is not possible with the adoption of the proposed Individual Wastewater Systems for the project. However, in order to promote water conservation the developer does intend to implement other measures that will include separate metering of domestic and irrigation water, and the use of water restrictions to promote conservation and discourage waste. Homeowners will be advised to use drought tolerant plants when landscaping, and if water uses exceed 1,000 gallons per day, the homeowner will be assessed a higher fee for any water usage over the daily allowance.

The developer is currently in negotiation with the WHUC to determine the water allocation for domestic and irrigation needs, and the facilities development charge for the source well(s), storage, and transmission facilities.

The FEIS should describe the Project's drinking water source, storage, and transmission requirements in the body of the document without referring the reader to Appendix A.

Please refer to our response to Item 13, above.

15. *The FEIS should acknowledge that the state Department of Health, in its Environmental Impact Statement Preparation Notice ("EISPN") comment letter dated August 21, 2006, recommended that the Project utilize a centralized wastewater system. The FEIS should also discuss why a centralized wastewater system was not considered for the Project. Please also clarify if septic tanks are the sole option considered for Individual Wastewater System disposal for the Project.*

The following is a summary of information provided in the Final EIS, Section 3.5.5, Wastewater, page 3-53 to 3-55:

A centralized wastewater treatment system was considered for the proposed project as an alternative means of wastewater treatment, but was rejected from consideration in favor of use of individual wastewater systems (IWS). The reasons that supported this included: (1) IWS systems are allowed by the state Department of Health on large lots greater than 10,000 square feet as an environmentally sound method for treatment of wastewater, (2) A centralized wastewater treatment plant would need to be established as a private facility that would be the responsibility and liability of a homeowners' association; (3) the topography of the site would require the construction and use of wastewater lift stations across several lots. The several gulches crossing the project site would also require tunneling under drainageways that would significantly raise the cost of wastewater infrastructure development; and (4) the schedule for the development of the site would be phased over time. This would require a centralized wastewater treatment plant to operate at less than optimal efficiency during the initial years, at a relatively fixed and high operating cost.

16. *Please clarify what is meant by the statement that with a "full staff" of police officers for the South Kohala Police Station in Waimea, the Project would be adequately serviced. Is the police station currently not fully staffed?*

Taking into the consideration the comments from the police department that the Project "will impact the need for additional police personnel and police facilities to service the Waikoloa area", how many additional police officers (and related facilities) are needed for the Project to be adequately serviced?

A summary of the following will be provided in the Final EIS, Section 3.7.1, Police, page 3-58:

There are currently two patrol officers per watch that are dispatched from Waimea that serve the entire South Kohala District (Waikoloa, Kawaihae, and hotels along the Queen Kaahumanu Highway). The Police Department is currently authorized to have another 5 officers. Because these positions are vacant there are delays in service. If additional officers are needed, they are generally dispatched from Waimea. The Waimea area, however, is also only served by 2 officers suggesting that if these officers are called, there will be delayed service in the Waimea service area. In accordance with Ordinance 05-157, the applicant is required to pay fees to the County of Hawai'i for each lot to mitigate impacts to Police service. Until such time that the vacant police positions can be filled, the applicant will: (1) encourage an active community neighborhood watch program; (2) utilize private security personnel to perform random site and drive-through inspections; and/or (3) provide a gate at the entry to the development until such time that approximately 50 percent or more of the lots have been developed so that there is greater community and neighborhood presence in the development.

17. *The FEIS should provide a breakdown of the number of elementary, middle school, and high school students the Project is expected to generate.*

A summary of the following will be provided in the Final EIS, Section 3.7.4, Schools, Pages 3-60 to 3-62:

Until 2006, the Department of Education utilized a formula based on residential unit counts to estimate the number of pubic school students that a project would generate. The results of this formula, which were previously provided in the DEIS (and Appendix C, Social Impact Assessment, SMS Research, September 2006), have since been revised by the DOE. The current DOE practice involves analyzing the impacts of development projects based on a wider variety of factors to obtain a better estimate of the number of public

school students generated and the resultant impact on school facilities. DOE reports that based on the number of units planned that the proposed Waikoloa Highlands project will contribute 24 additional elementary school students, 9 middle school students, and 7 high school students. The DOE has determined that no additional schools will be needed based on this projection.

According to discussions with Heidi Meeker, DOE, the DOE will request that the Land Use Commission impose a school fair-share condition similar to such conditions that the Land Use Commission has imposed on other recent developments. The petitioner is continuing to discuss their fair-share requirement with the DOE and as required, will contribute their fair-share to mitigate the potential for adverse impacts on the provision of public educational services.

18. *The FEIS should respond to the DOE's request in its EISPN comment letter (dated August 9, 2006) to provide:*
    - *a confirmation whether or not accessory dwellings will be permitted in the Project;*
    - *the range of lots sizes and minimum required price for homes built in the Project (if any); and*
    - *best estimates of the number of homes [to include accessory dwellings, if permitted] expected to be occupied at any given time and the number of homes expected to be occupied full time when the Project is completely built out.*

The FEIS will provide the following information as referenced:

> Section 2.2.1, Subdivision Plan, Page 2-1: One single family home will be permitted in the development for each lot of record in accordance with Ordinance 05-157. Restrictions on additional units will be stated in the Covenants, Conditions and Restrictions (CC&Rs) for the project.
>
> Section 3.4.3, Socio-Economic Environment, Page 3-28: The 1-acre lots at Waikoloa Highlands will sell for between approximately $768,600 to $1,058,400.
>
> Executive Summary, Page ES-2: The developer has assumed that the buyers of the lots will be owner occupants with a preliminary estimate of full-time occupancy at build out of approximately 40 percent.

19. *If accessory dwellings will be permitted in the Project, please revise the Project's impacts and mitigation measures accordingly in the FEIS to account for the potential increase in the Project's density.*

Accessory dwellings or multiple dwellings on the lot are not permitted in accordance with Ordinance 05-157 (2005).

20. *Please clarify what studies (and projected timeframes for such studies) would be necessary to determine the feasibility of relocating the existing electric transmission lines to the perimeter of the Petition Area.*

The FEIS, Section 3.5.4, Electrical and Telecommunications, Page 3-52, will provide the following information:

According to Hawai'i Electric Light Company (HELCO), the planning, design and relocation of the existing transmission lines to the perimeter of the petition area is anticipated to take two years. Appropriate studies will be prepared during the planning and design process to review the specific project requirements. This is not anticipated to impact the planned construction of the project infrastructure.

21. *The FEIS should describe the Project's applicability (or not) to each of the coastal zone management program policies and objectives defined in chapter 205A-2, HRS.*

The FEIS, Section 4.2.4, Coastal Zone Management/Special Management Area, starting on Page 4-11, will indicate the applicability of the project to each of the coastal zone management program policies and objectives.

22. *If Ordinance No. 05-157 amended Ordinance No. 95-51 please clarify the relevance of Ordinance No. 95-157 to the Project. Please include the applicable rezoning ordinances as appendices to the FEIS.*

Ordinance 95-157 does not have any relevance to this project and was a typographic error. It will be corrected in the Final EIS. The correct Ordinance number is 05-157.

23. *In the DEIS, the Project's drainage impacts and mitigation reference Appendix I (Drainage Report for the Waikoloa Highlands Subdivision, Phase 1). The FEIS should address drainage impact and mitigation measures in terms of the sum impact (i.e., both phases) of the Project.*

The major concern involving stormflows across both phases of the project was provided in the DEIS, Appendix H, Floodplain Limits and Flood Control Plan. According to this plan a combination of ditches and culverts were identified for drainage improvement to protect the site from flooding and flood associated impacts that include loss or destruction of property or life, and erosion of soils and sediments discharging downstream to state waters.

The plan identifies the specific drainage improvements that will be used for both phases of the project and include ditch and culvert controls to ensure stormflows are properly managed and addressed, in accordance with state and county regulations. In this regard, the potential for drainage impacts as well as the consideration and provision of appropriate mitigation measures are provided.

The controls that will integrate drainage into the flood control system was completed for Phase 1 of the project, and was included in the DEIS as Appendix I, Drainage Report, Waikoloa Highlands Subdivision, Phase 1. The drainage control features included the use of drywells and road culverts. Similar controls will be used for Phase 2 and a separate Drainage Report is currently under preparation. We add that the drainage controls will also meet the drainage standards of the County of Hawai'i, that requires no increase in runoff leaving the project site from the 10 and 50-year design storm.

The major concern involving the controls described above are anticipated to be during construction. The FEIS, Section 3.5.2, Drainage, will provide a list of appropriate best management practices considered for use at the site to ensure environmental protection and control of stormwater runoff. The list of controls that will ultimately be used will address the stormwater runoff control requirements of Chapter 11-55, Water Pollution Control, Hawaii Administrative Rules.

24. *The FEIS should include a discussion of the interrelationships and cumulative environmental impacts of the Project to other related projects.*

The FEIS, Executive Summary, will provide further discussion of secondary and cumulative impacts as a result of the proposed project, starting on page ES-5.

Thank you for taking the time to share your comments and allowing us this opportunity to respond. Any further written comments may be directed to the undersigned.

Sincerely,

for Brian Takeda

Chester Koga, AICP

cc: Waikoloa Mauka LLC
Imanaka Kudo & Fujimoto

420 Waiakamilo Road
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January 31, 2007

Mr. Anthony Ching, Executive Officer
Land Use Commission
P.O. Box 2359
Honolulu, Hawai'i 96804

Dear Mr. Ching:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of October 31, 2006 relating to the subject project. We offer the following responses to your inquiries:

1. Location of the 12.819 acres. Since the publication of the Draft EIS, we find that this 12.819 acres will no longer be required for this project and will be excluded. Therefore, the project area and petition area is 731.358. We will amend the EIS accordingly.
2. Secondary and cumulative impacts. We will include additional discussion on the secondary and cumulative impacts of the project in the Final EIS.
3. Referencing Section 1.2 relating to state or county lands that may be impacted by the project. There are three locations where this project will impact County of Hawai'i lands (roadway) – at the intersection of Waikoloa Road and Paniolo Drive where improvements (installation of signals) will be made, and at the new proposed intersection (along Pua Melia Road); and the new intersection proposed where turn-lanes will be installed on Waikoloa Road, east of Paniolo Avenue.
4. Project phasing, page 2-3. The infrastructure improvements planned for Phase 2 will take approximately 8-10 months from the completion of the Phase 1 improvements.
5. Land use petition and proposed golf course, page 2-7. As stated in the DEIS, the inclusion of a golf course was considered as an alternative for the project, however, as stated in the DEIS, page 2-8, the golf course is not part of this project.
6. Landowner of Pu'u Hinai. The land owner of the Pu'u Hinai is Waikoloa Mauka, LLC. The quarry operation is permitted via a Special Use Permit No. SP70-85. The most recent amendment was approved by the LUC on January 9, 2006. This amendment extended the life of the permit from December 11, 2005 to December 11, 2010.
7. Location of affordable housing. We will include a map showing the location of the proposed affordable housing in the Final EIS. The provision of affordable housing, according to the County of Hawai'i, can be made through the accumulation of "credits" which can be accrued by construction of units on-site or off-site or the payment of fees. The developer has elected to provide units on his adjoining parcel zoned for multi-family units.
8. Location of underground injection control (UIC) line. We will include a map showing the location of the UIC line in the Final EIS.

9. Estimate of "soft costs." We will be including an estimate of the "soft cost" that can be quantified at this time and will include them in the Final EIS. These cost center about fees established in the Ordinance 05-157.
10. Location of upper elevation well. The development of off-site improvements are the responsibility of West Hawai'i Utilities and therefore the specific location of wells and reservoirs proposed are not information that is available to the project developer. Information available is the approximate elevation at which the reservoirs need to be developed in order that sufficient pressure can be obtained.
11. Location and acreage of school site. Will include a map showing the potential location of a proposed school site. Note that the location has not been confirmed with the Department of Education (DOE). We will, however, continue discussions with the DOE regarding impacts to the school system in the area as a result of this project.
12. Statement by State Historic Preservation Division. We will clarify the language with SHPD and forward their response to your office.
13. Map showing locations of on-site reservoirs. There are no on-site reservoirs. Proposed reservoirs (tanks) that are off-site are depicted in Appendix J. Because the tanks are covered, evaporation will be minimized.
14. Add section on irrigation system separate from drinking water system. To clarify, there will not be a separate non-potable water system developed for this project for irrigation purposes. What is being planned is a separate water meter (from the potable line) that will be dedicated for irrigation. Each homeowner will be given a "water allowance" for irrigation apart from drinking water needs.
15. Use of centralized wastewater system. The use of a centralized wastewater treatment system was considered as an alternative but was rejected in favor of individual wastewater systems (IWS). There were several reasons for this choice: 1) the IWS's were allowed by the Department of Health, 2) operations of the treatment plant as a private facility would be the responsibility of the homeowners; 3) site topography required the utilization of lift stations for several lots and the gulches required tunneling under the stream; and 4) cost of the system would be greater than the IWS.
16. Staffing of Police to service the area. There are currently two patrol officers per watch that are dispatched from Waimea that serve the entire South Kohala District (Waikoloa, hotels along Queen Kaahumanu, and Kawaihae). The Department is currently authorized for another 5 officers. Because these positions are vacant there are delays in service. If additional officers are needed, they are generally dispatched from Waimea. The Waimea area, however, is also only served by 2 officers suggesting that if these officers are called, then there will be delayed service in the Waimea service area. In accordance with Ordinance 05-157 the applicant is required to pay fees to the County of Hawai'i for each lot to mitigate impacts to Police service.
17. School enrollment by grades. Until 2006, the Department of Education utilized a formula based merely on unit count to estimate the number of pubic school students that a project would generate. We utilized that formula in the DEIS. The DOE has since begun a new practice of custom analyzing the impacts of a project based on a much wider variety of factors to obtain a better estimation of the number of public school students and their impact. Neither under the old system, nor under the new, does DOE breakdown their estimate of students by elementary, intermediate or high school. Therefore, we cannot either. According to discussions with Heidi Meeker of the DOE, the total impact cannot be estimated at this time and it will require further discussion and negotiation at a later date. They have further requested that the Land Use Commission impose a school fair-share condition similar to such conditions that the Land Use Commission has imposed on other recent developments.

18. Response to Department of Education. We have attached a copy of our response to the DOE. Only single family homes will be permitted in the development per lot of record and restrictions will be listed in the CC&R for the project. The average lot size in the project is one (1) acre and the range of costs of the lots is projected to be sold between $768,600 and $1,058,400. The total number of units is 398. The developer has assumed that the lot buyers will be owner occupants and have not estimated the percent of full-time occupants. Establishing a percentage at this time would be speculative at best.
19. Accessory dwellings. Accessory dwelling will not be permitted.
20. Relocation of existing transmission lines. The planning, design and relocation of the existing transmission lines is anticipated to take two years according to Hawai'i Electric and Light Company. The relocation will not impact the planned project infrastructure.
21. Applicability to program policies and objectives of Chapter 205A. We will note in the Final EIS the applicability of the policies and objectives of 205A.
22. Relating to Ordinance 05-157. A reference to Ordinance 95-157 was a typographic error and will be corrected in the Final EIS.
23. Drainage impacts. Drainage improvements proposed for Phase 1 as reported in the DEIS has considered flows from Phase 2. Additional improvements planned include drywells along the roadways. No additional improvements are planned along the drainageways. We will note these changes in the Executive Summary and Section 3.5.
24. Interrelationships and cumulative impacts of the Project to other related projects. The proposed project will add an additional 398 residential units and approximately 1,068 persons to the Waikoloa Village housing stock and population. As discussed above, the proposed project will place demands on the services currently available, such as roadways, schools and parks. In each instance where impacts are anticipated measures are being taken or will be taken to mitigate these impacts. As examples, the proposed intersection improvements at Waikoloa Road and Paniolo Avenue and the provision of affordable housing. Further, impact fees have been assessed for the provision of public services, such as parks. In addition, discussions are continuing to provide land or money to mitigate educational needs. The developer of the project is attempting to mitigate the impacts of the project by providing his fair-share along with other developers in the area.

Should you have questions, please contact the undersigned.

Sincerely,

Chester Koga

Chester Koga, AICP

Cc: Waikoloa Mauka LLC

LINDA LINGLE
GOVERNOR

ORLANDO "DAN" DAVIDSON
EXECUTIVE DIRECTOR

STATE OF HAWAII

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM
HAWAII HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
Honolulu, Hawaii 96813
FAX: (808) 587-0600

IN REPLY REFER TO:
06:PEO/190

November 16, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Dear Mr. Koga:

Re: Draft Environmental Impact Statement (EIS) for Waikoloa Highlands – Residential Subdivision

We have reviewed the subject EIS and note the following:

- The proposed Waikoloa Highlands will offer approximately 398 low-density, rural residential lots of a minimum of one acre in size for residents and second-home buyers. The market study assumes that 60 percent of the lots will be "used by full-time residences and 40 percent by part-time/second home users." Purchasers will need incomes in the range of $192,000 to $264,000 to purchase the lots with anticipated selling prices ranging from $768,000 to $1,058,000.

- Discussions regarding the provision of affordable housing are ongoing with the County. The Applicant has indicated that it will comply with the County's affordable housing requirements per Ordinance 95-157/Bill 25.

It appears that the affordable housing units may be provided on a site located west of the subject project, in an area designated for multi-family residential units. Please elaborate on this, particularly in relationship to the Hawaii State Plan policy of increasing homeownership and rental opportunities and choices in terms of quality, location, cost densities, style and size of housing.

Sincerely,

Orlando "Dan" Davidson
Executive Director

c: Anthony Ching, State Land Use Commission
Kevin Kellow, Waikoloa Mauka, LLC
Office of Environmental Quality Control

420 Waiakamilo Road
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January 31, 2007

Mr. Orlando Davidson, Executive Director
Hawai'i Housing Finance and Development Corporation
677 Queen Street, Suite 300
Honolulu, Hawai'i 96813

Dear Mr. Davidson:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 16, 2006 relating to the subject project. We offer the following responses to your inquiries:

1. Number of Unit and Sales Price. We acknowledge that the subject project will include 398 low-density rural residential units. The selling prices as stated (between $768,000 to $1,078,000) are subject to change, however.

2. Relationship to State Plan. We have stated in the EIS that affordable housing will be provided off-site in an area immediately west of the subject project in an area currently designated multifamily. The exact nature of the affordable housing has not been formalized at this time. Alternatives being considered are: a) rental units, b) town homes for purchase, or c) a combination of rentals and multifamily units. The project needs to generate 20% affordable housing credits/units as required by the County of Hawai'i Housing Code. This requirement will be satisfied on a parcel owned by the applicant, wherein the units will either be rented or sold, subject to meeting with the County's affordable housing requirement. By providing the housing units described the objectives of the State Plan will be met by meeting location, type, size and cost of various housing type. Further, these units will be built according to current State and County regulations.

Should you have questions, please contact the undersigned.

Sincerely,

Chester Koga

Chester Koga, AICP

Cc: LUC, Waikoloa Mauka LLC

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Planning
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Construction Management

June 13, 2007

Mr. Orlando "Dan" Davidson
Executive Director
Hawaii Housing Finance & Development
Corporation, DBEDT
State of Hawai'i
677 Queen Street, Suite 300
Honolulu, Hawai'i 96813

Dear Mr. Davidson:

Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i

Thank you for your letter dated November 16, 2006 concerning the subject project. We have prepared the following revised response to our earlier mailing to you to provide further clarification and detail. Your comments are *italicized* for reference:

1. *The proposed Waikoloa Highlands will offer approximately 398 low-density, rural residential lots of a minimum of one acre in size for residents and second-home buyers. The market study assumes that 60 percent of the lots will be "used by full-time residences and 40 percent by part-time second home users." Purchasers will need incomes in the range of $192,000 to $264,000 to purchase the lots with anticipated selling prices ranging from $768,000 to $1,058,000.*

We acknowledge that the subject project will include 398 low-density rural residential units. The anticipated selling prices as stated in Section 3.4.3, Socioeconomic Environment, Page 3-28, are between $768,600 to $1,058,400.

2. *Discussions regarding the provision of affordable housing are ongoing with the County. The Applicant has indicated that it will comply with the County's affordable housing requirements per Ordinance 95-157 (Bill 25).*

Ordinance 05-157 (not 95-157) requires the developer to accrue housing "credits" equal to 20% of the total number of units being proposed. Chapter 11 of the Hawai'i County Code allows the accrual of credits by building affordable housing, providing in-lieu fees, and/or the provision of land. The developer has elected to provide land on a parcel adjacent to the subject project. This parcel of land is designated as Tax Map Key (3) 6-8-003: parcel 31. The land is owned by the applicant and is zoned for multifamily residences.

3. *It appears that affordable housing units may be located on a site located west of the subject project, in an area designated for multifamily housing units. Please elaborate on this, particularly in relationship to Hawai'i State Plan policy of increasing homeownership and rental opportunities and choices in terms of quality, location, cost densities, style and size of housing.*

While the provision of affordable housing addresses the Hawai'i State Plan policy of increasing homeownership, the site location is designed to comply with the requirements of the Hawaii County Code (HCC). In summary: (1) a total of 80 affordable housing units will be provided. This represents 20 percent of the planned 398 units of the project in accordance with Section 11-4, HCC; and (2) the location of the parcel is within 15 miles of the project site in accordance with Section 11-5, HCC.

The factors that influenced the selection of the site included the underlying 1-acre zoning of the planned Waikoloa Highlands project, and the developer's ownership of other nearby property that possessed the necessary zoning for affordable housing uses.

The Waikoloa Highlands project site is zoned RA-1a (Residential and Agricultural, Minimum 1-acre) and O (Open). In order to be used for affordable housing a rezoning of the site to a higher density would be required. The proposed affordable housing site is owned by the developer, is in close proximity to Waikoloa Highlands of less than half a mile, and is already zoned RM-1.5 (Multi-Family Residential, 1,500 square foot land/unit), which supports the development of affordable units without need for further rezoning.

Although the developer owns other property within a 15 mile radius that could be used to meet the affordable housing requirements of the HCC, the proposed site possesses zoning that is more consistent with surrounding land uses that also include multifamily, single-family, and village commercial land uses. In contrast, land uses surrounding Waikoloa Highlands are a combination of Open and A-5a (Agricultural, 5 acre minimum), that would make it less consistent with the underlying and surrounding zoning.

Thank you for taking the time to share your comments and allowing us this opportunity to respond. Any further written comments may be directed to the undersigned.

Sincerely,

for Chester Koga, AICP

cc: Waikoloa Mauka LLC
Imanaka Kudo & Fujimoto

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE: (808) 586-4185
FACSIMILE: (808) 586-4186
E-mail: oeqc@health.state.hi.us

November 22, 2006

Mr. Anthony Ching, Executive Officer
State Land Use Commission
235 South Beretania Street, 4th Floor
Honolulu, Hawai'i 96813

Dear Mr. Ching:

Subject: DEIS for Waikoloa Highlands, Island of Hawa'ii

Thank you for the opportunity to review the subject document. We have the following comments.

1. What is the estimate percentage of the homes that will be purchased by second-home buyers?
2. Please describe whether this residential project will provide affordable housing units?
3. Where will the residents shop? Is the nearest shopping area within walking distance?
4. Will potential home buyers be notified of the potential unexploded bombs on this site?
5. Please explain how the introduction of residents with more than 4 times the median income changes the social fabric of the community. What are the potential impacts of this change?
6. Please explain more clearly how this project will create a more balanced community as described on page 3-26 of the EIS.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson

Genevieve Salmonson
Director

c: Waikoloa Mauka
R.M. Towill

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Photogrammetry
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Construction Management

January 31, 2007

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Room 701
Honolulu, Hawai'i 96813

Dear Ms. Salmonson:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 22, 2006 relating to the subject project. We offer the following responses to your inquiries:

1. Estimate of the percentage of second home buyers. It has been estimated that approximately 40% of the lots will be purchased by second home buyers (Hallstrom, pg. 32).
2. Will the project provide affordable housing? Affordable housing will be provided by this project on a site adjacent to the planned development (see DEIS, Section 3.8.3). Specific development plans will be developed in consultation with the County of Hawai'i.
3. Where will residents shop? No commercial-retail amenities are planned as part of this development. Currently, the closest shopping area is in the Waikoloa Village, and the closest lots are approximately ¼ miles, while the furthest is approximately ½ mile from the shopping area. Additional retail is proposed on properties west of the proposed development.
4. Will the potential home buyers be notified of the potential of unexploded bombs? The project site has been cleared of unexploded ordnance by the Army Corps of Engineers, however, in the interest of public safety, homebuyers will be advised of the potential risk.
5. How will the introduction of residents with more than 4 times the median income changes the social fabric of the community? We do not believe that this development will necessarily change the social fabric of the community because the total number of families that will be added to the Waikoloa community is small, less than 5 percent. These new residents, along with current residents, will place demands on services available in the community, but not disproportionately.
6. Please explain more clearly how this project will create a more balance community as described on page 3-26. Household incomes in Waikoloa Village are highly concentrated around the mean; households with incomes of $150,000 or higher make up only 2.1 percent of the population. After assuming probable construction costs, one can see that nearly every household that buys into the project will need an income of $150,000 thereby increasing that category, flattening the income curve and enabling a more heterogeneous population.

7. There are numerous studies that indicate that the more heterogeneous a population – whether measured by income, ethnicity, age, home of origin, etc. – the more dynamic the community, the more diverse the idea and discourse, the richer the events and activities of that community.

Should you have questions, please contact the undersigned.

Sincerely,

Chester Koga

Chester Koga, AICP
Cc: LUC, Waikoloa Mauka LLC

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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Planning
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Photogrammetry
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Construction Management

June 13, 2007

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
235 South Beretania Street, Suite 703
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i

Thank you for your letter dated November 22, 2006 concerning the subject project. We have prepared the following revised response to our earlier mailing to you to provide further clarification and detail. Your comments are *italicized* for reference:

1. *What is the estimate [SIC] percentage of the homes that will be purchased by second-home buyers?*

According to the DEIS, approximately 40% of the lots will be purchased by second home buyers (Appendix D, Market Study, Economic Impact Analysis and Public Cost/Benefits Assessment, The Hallstrom Group, Inc., May 2006, Page 32).

2. *Please describe whether this residential project will provide affordable housing units?*

The Final EIS (FEIS) will indicate in Section 3.8.3, Affordable Housing, Page 3-62, that the developer will provide affordable housing as required by Ordinance 05-157, by providing land on an adjoining parcel that is entitled for multifamily use. The parcel is identified by Tax Map Key (3) 6-8-03, parcel 31 and is located west of the proposed project area.

3. *Where will the residents shop? Is the nearest shopping area within walking distance?*

No commercial or retail amenities are proposed as part of this development. Currently, the closest shopping area is in Waikoloa Village, with the closest lots approximately ¼ miles to approximately ½ miles from the shopping area. Additional retail may be planned on properties west of the proposed development.

4. *Will potential home buyers be notified of the potential unexploded bombs on this site?*

The Final EIS (FEIS) will indicate in Section 3.2.7, Man Made Hazards, Page 3-10, that the project site has been cleared of unexploded ordnance by the U.S. Army Corps of Engineers. However, the developer will notify prospective homeowners of prior clearing activities and the potential for discovery of unexploded ordnance as part of the lot sales program.

5. *Please explain how the introduction of residents with more than 4 times the median income changes the social fabric of the community. What are the potential impacts of this change?*; and

The potential impact to the community will involve the development of a more heterogenous and diverse socioeconomic population than presently exists. Household incomes in Waikoloa Village are highly concentrated around the mean; households with incomes of $150,000 or higher make up only 2.1 percent of the population. After assuming probable construction costs, one can see that many households that buy into this project will need the incomes as estimated in the DEIS in the range of $192,000 to $264,000 annually, thereby increasing that category, flattening the income curve and enabling a more heterogeneous population.

In this regard, it is anticipated that greater balance within the Waikoloa community will result from having a greater mix of housing types with residents from diverse socioeconomic backgrounds. It is the developer's expectation that the more heterogeneous a population – whether measured by income, ethnicity, age, home of origin, etc. – the more dynamic the community, the more diverse the social interaction, and the richer the events and activities of that community. We add that this is expected to be facilitated with the greater provision of public services for all residents that will also result from the increased tax revenues made possible with this project.

6. *Please explain more clearly how this project will create a more balanced community as described on page 3-26 of the EIS.*

Please refer to our response to Item No. 5, above.

Thank you for taking the time to share your comments and allowing us this opportunity to respond. Any further written comments may be directed to the undersigned.

Sincerely,

for Chester Koga, AICP

cc: Waikoloa Mauka LLC

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

KATHERINE H. THOMASON
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

(P)1294.6

NOV 24 2006

Mr. Chester Koga
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Dear Mr. Koga:

Subject: Waikoloa Highlands – Residential Subdivision
Draft Environmental Impact Statement
South Kohala District, Island of Hawaii
TMK: (3) 6-8-002:016

Thank you for the opportunity to review the information regarding the subject project. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities and we have no comments to offer.

If you have any questions regarding the above, please have your staff call Mr. David DePonte of the Planning Branch at 586-0492.

Sincerely,

ERNEST Y.W. LAU
Public Works Administrator

DD:mo
c: Ms. Genevieve Salmonson, OEQC
Mr. Kevin Kellow, Waikoloa Mauka, LLC
Mr. Anthony Ching, State Land Use Commission

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
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Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

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January 31, 2007

Mr. Ernest Y.W. Lau
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawai'i 96810

Dear Mr. Lau:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges receipt of your letter of November 24, 2006 noting that your Department does not have comments to offer.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka LLC

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR
LAURA H. THIELEN
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-11589

December 8, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road #411
Honolulu, Hawaii 96817

Dear Mr. Koga:

Subject: Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands – Residential Subdivision
A06-767 Waikoloa Mauka, LLC, Agricultural to Rural District
Infrastructure improvements and subdivision of property in approximately 398 low-density, rural residential lots. Each lot will be a minimum of one acre in size. TMK: 6-8-002: 16 por.. 731.581 acres

Thank you for sending the Office of Planning the Draft Environmental Impact Statement (DEIS) for the above referenced proposal. We have the following comments to offer for your consideration.

Visual and Scenic Resources. Page ES-3, pages 3-37 and 3-38. We note that the DEIS indicates that there will be an impact on views from Waikoloa Road toward Pu'u Hina'i cinder cone, and to Mauna Kea. The DEIS indicates that setbacks and landscaping along Waikoloa Road will help to minimize adverse visual impacts. We request that you include a visual analysis with photos of the views from different locations within and outside of the project area.

Thank you for the opportunity to comment. If you have any questions, please call Lorene Maki at 587-2888.

Sincerely,

Laura H. Thielen
Director

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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Surveying
Construction Management

January 31, 2007

Ms. Laura H. Thielen, Director
Office of Planning
Department of Business, Economic Development and Tourism
235 South Beretania, 6th Floor
Honolulu, Hawai'i 96804

Dear Ms. Thielen:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of December 8, 2006. We would like to offer the following response to your comment relating to visual and scenic resources.

We will include photographs of the project site from Waikoloa Road towards Pu'u Hinai to document the existing views. We believe that the views of the Pu'u Hinai from Waikoloa Road will not be impacted by the proposed project as the height of the residential structures will be limited to a maximum height of 35 feet as provided by zoning. Further, the homes will be built on 1-acre lots and will be spaced far enough apart from each other, rather than clustered, thereby allowing views between the homes.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka LLC

420 Waiakamilo Road
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R. M. TOWILL CORPORATION
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June 13, 2007

Ms. Laura H. Thielen
Director
Office of Planning
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Ms. Thielen:

Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i

Thank you for your letter dated December 8, 2006 concerning the subject project. We have prepared the following revised response to our earlier mailing to you to provide further clarification and detail. Your comments are *italicized* for reference:

> *Visual and Scenic Resources. Page ES-3, pages 3-37 and 3-38. We note that the DEIS indicates that there will be an impact on views from Waikoloa Road toward Pu'u Hina'i cinder cone, and to Mauna Kea. The DEIS indicates that setbacks and landscaping along Waikoloa Road will help to minimize adverse visual impacts. We request that you include a visual analysis with photos of the views from different locations within and outside of the project area.*

Photographs and discussion of the project site from Waikoloa Road towards Pu'u Hīna'i to document the existing views and planned mitigation have been incorporated in the Final EIS (FEIS), Section 3.4.6, Visual and Scenic Resources, Page 3-40, and Figure 17, Site Photos, Page 3-40. The photographs are of Pu'u Hīna'i from two different locations – one from the north, and one from the south along Waikoloa Road. The views of Pu'u Hīna'i from Waikoloa Road are not anticipated to be adversely impacted by the proposed project based on the following:

(1) The height of the residential structures will be limited to a maximum height of 35 feet as provided by zoning. Unless one is directly in back of a residential structure, views of Pu'u Hīna'i will not be obstructed; and

(2) The homes will be constructed on 1-acre lots and spaced far enough apart from each other, rather than clustered, that views will be readily available between the homes. Further assurance that views of Pu'u Hīna'i from Waikoloa Road are not blocked will be accomplished by prohibiting landscaping involving the use of tall trees along Waikoloa Road that would block northern views toward the ocean, south toward the mountain, and west toward Pu'u Hīna'i.

Thank you for taking the time to share your comments and allowing us this opportunity to respond. Any further written comments may be directed to the undersigned.

Sincerely,

for Brian Takeda

Chester Koga, AICP

cc: Waikoloa Mauka LLC
Imanaka Kudo & Fujimoto

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
EPO-06-118d

December 5, 2006

Mr. Anthony Ching
State Land Use Commission
735 South King Street, Suite 402
Honolulu, Hawaii 96813

Dear Mr. Ching:

SUBJECT: Draft Environmental Impact Statement (DEIS) for Waikoloa Highlands-Residential Subdivision, South Kohala District, Island of Hawaii, Hawaii
TMK: (3) 6-8-002: 16 (portion)

Thank you for allowing us to review and comment on the subject document. The document was routed to the various branches of the Environmental Health Administration. We have the following Safe Drinking Water Branch comments.

Safe Drinking Water Branch (SDWB)

General Comments to Section 3.5.3-Drinking Water

There is insufficient information to determine whether these proposed subdivision will be a regulated public water system (PWS) or not. The DEIS cites the planned use of West Hawaii Utilities (WHU) water but also implies that other well sources may be developed for the subdivision.

Will these new well resources and associated reservoir, booster station and distribution system improvements be turned over to WHU or will they remain separate and under the subdivision association as a new regulated PWS?

Should the subdivision's system be designated a regulated PWS, they must meet the following conditions prior to operation of the water system:

Use of Approved Sources of Potable Water

In accordance with Hawaii Administrative Rules Title 11, Chapter 20, all new regulated PWSs must utilize approved sources of water for consumptive use and demonstrate technical, managerial and financial capacity. Specific sections include: HAR 11-20-29 Use of new

sources of raw water for public water systems and HAR 11-20-29.5 Capacity demonstration and evaluation.

Unapproved sources must obtain source approval through water quality testing and the submittal of an engineering report by a licensed professional engineer, as outlined in the Safe Drinking Water Branch's "Guidelines for Preparation of Engineering Reports for New Potable Water Sources."

Capacity Demonstration (for New Public Water System)

All new community public water systems and new non-transient non-community public water systems must demonstrate adequate technical, managerial, and financial capacity to produce and deliver drinking water in compliance with State and Federal drinking water regulations.

1. Technical capacity refers to the physical infrastructure of the water system, including but not limited to the adequacy of the source water, infrastructure (source, treatment, storage, and distribution), and the ability of system personnel to adequately operate and maintain the system and to otherwise implement technical knowledge.

2. Managerial capacity refers to the management structure of the water system, including but not limited to ownership accountability, staffing and organization, and effective linkages to customers and regulatory agencies.

3. Financial capacity refers to the financial resources of the water system, including but not limited to revenue sufficiency, credit worthiness, and fiscal controls.

Operator Certification

Operator certification will require certified operators to operate the treatment facilities and/or distribution systems of public water systems.

Construction Plan Review

Construction plans for all onsite and offsite water system improvements for this subdivision, including connections to the WHU infrastructure, must be reviewed and approved by the Department of Health Safe Drinking Water Branch.

If you have any questions, please contact Mr. Michael Miyahira of the SDWB Engineering Section at 586-4258

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this application should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

C: EPO
SDWB
Mr. Kevin Kellow, Waikoloa Mauka, LLC
Mr. Chester Koga, R.M. Towill Corporation

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
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eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
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Planning
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January 31, 2007

Mr. Kelvin H. Sunada, Manager
Environmental Planning Office
Department of Health
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Dear Mr. Sunada:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of December 5, 2006 relating to drinking water requirements of the project.

As stated in the DEIS, water service will be provided to each lot in the subdivision by the West Hawai'i Utility (WHU) Company, a Public Utilities Commission, regulated company. The developer will not be developing a separate water system. Therefore, we believe that all Safe Drinking Water Standards are being met if the development uses water from WHU. We have included information on the water distribution system in the DEIS (Section 3.5.3). No wells are currently planned to be dug within the project limits. Further, the reservoirs identified in the developer's plans will become part of the West Hawai'i Utility water system. Construction plans will be submitted to the Department of Health when they become available.

As directed, we have reviewed the standards comments posted on Health Department's web site and do not have any comments to offer.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka, LLC

LINDA LINGLE
GOVERNOR

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
FRANCIS PAUL KEENO
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

STP 8.2339

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

December 5, 2006

Mr. Kevin Kellow
Manager
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, California 91207

Dear Mr. Kellow:

Subject: Waikoloa Highlands – Residential Subdivision
Draft Environmental Impact Statement (DEIS)
TMK: (3) 6-8-002: 016 (portion)

We have the following comments on your subject project as presented in the Draft EIS:

1. The TIAR did not contain a discussion of the project's contribution to the traffic conditions and impacts at the intersections with our two State highways (Queen Kaahumanu and Mamalahoa), including the project's factor in the cumulative traffic from other land developments in Waikoloa at the intersections. A supplement should be prepared addressing the impact to the highways and submitted to us for our review and approval.

2. It is our recommendation to the approving/accepting agencies that, the master developer/landowner and/or each independent or sub-developer of projects at Waikoloa should provide the traffic improvements and mitigation measures for impacts from the projects, and participate in and contribute their fair share for regional transportation improvements.

3. The development of each project in Waikoloa, such as the subject project, affects the applicable drainage basin leading toward the ocean and Queen Kaahumanu Highway. In the each respective land development project, there should be a discussion of and addressing of any downstream impact reaching the highway accumulating from the collective development of the lands in Waikoloa.

We appreciate the opportunity to provide our comments.

Very truly yours,

for RODNEY K. HARAGA
Director of Transportation

c: Laura Thielen, Office of Planning
Christopher Yuen, Hawaii Planning Department
Anthony Ching, Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control
[redacted]

420 Waiakamilo Road
Suite 411
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eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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January 31, 2007

Mr. Barry Fukunaga, Acting Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813

Dear Mr. Fukunaga:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of December 5, 2006. We would like to offer the following responses to your comments.

1. Potential Impacts to Mamalahoa and Queen Ka'ahumanu Highway Intersections. We note that your letter suggests that there may be impacts to the two State facilities, Queen Ka'ahumanu Highway, and Mamalahoa Highway. Based on our projections of traffic generation within the time frames of this project we estimate that this project will add an additional 5 percent to the east bound traffic and 10 percent to the westbound traffic volume (see Table 6, Appendix G). We note that the Waikoloa Road and Mamalahoa Highway intersection is currently operating under capacity. We acknowledge that the intersection at Queen Ka'ahumanu and Waikoloa Road will require improvements in the future because of development along the highway corridor. We will continue our discussions with your Department other developers along both highway corridors to find an equitable and reasonable solution to mitigate traffic delays at this important intersection.
2. Improvements on Waikoloa Road. As stated in the Draft EIS, the developer of the project is currently contributing to improvements along Waikoloa Road as a pre-condition of development.
3. Drainage impacts. We would like to state at the outset that the proposed development will not increase flood flows down stream of the project as we are required by County Ordinances to retain or detain the flows caused by the increase of impervious surfaces or through modifications of the drainageways. The proposed project, however, will not be correcting deficiencies in the drainageways that were preexisting.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka, LLC

PHONE (808) 594-1888 FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

December 7, 2006 HRD06/2529B

Chester T. Koga, Project Manager
R.M. Towill Corporation
420 Waikamilo Road, Suite 411
Honolulu, Hawai'i 96817

RE: Petition to Amend State Land Use District Boundaries, Agricultural to Rural, Waikoloa Mauka, LLC, South Kohala, Hawai'i, TMK: 6-8-002:016 (por.)

Dear Mr. Koga,

The Office of Hawaiian Affairs (OHA) is in receipt of the Draft Environmental Impact Statement (DEIS) for the Waikoloa Highlands project in South Kohala. The developer proposes to build 398 residents on 731.581 acres. To facilitate these plans, the developer seeks a District Boundary Amendment from Agricultural to Rural, and this DEIS supports that application.

We appreciate that the applicant has prepared an EIS, and is seeking a land use amendment, instead of attempting to force the project into the current land use definitions. We also appreciate that the applicant contacted Ruby McDonald of our Kona Office as a part of the cultural impact assessment. We do, however, have several concerns.

First, the hydrology and potable water analyses are inadequate. The Waikoloa Water Master Plan, prepared in 1991, is outdated and does not address the specific project under consideration. The DEIS does not estimate how much water will be needed for the Waikoloa Highlands at full build-out. Further, the DEIS notes on page 3-12 that there is a regional water resource limitation, and a cooperative water allocation solution is required. There is no indication whether the applicant has taken any steps toward such a solution or other mitigation measures. Because fresh water issues are often contentious in our island state, the potential impacts must be identified and addressed at the earliest possible time to prevent costly delays.

Second, the DEIS at page 3-35 states that "the project will have no effect on archaeological resources" and "no substantial structures are expected." Yet the report prepared by Cultural Surveys Hawai'i (CSH) at page 10 reveals that a previous archaeological study by Bevacqua in 1972 uncovered a "complex of walls," including a "well-built bifaced wall, 45 meters long." Although CSH could not locate this complex, it is possible that it could be re-discovered during construction. With such a large and possibly significant archeological feature potentially onsite, we take exception to the blanket statement that no archaeological resources will be affected, especially since CSH spent only "2-man-days including travel time" to survey over 730 acres. More field work needs to be done, and, at a minimum, the EIS should note that the project could potentially affect archeological resources. We further request that mitigation measures be considered and planned for now to ensure protection of the archeological site, rather than waiting until construction has already commenced.

Also on page 3-35, the DEIS states that "the SHPD has recently reconfirmed that no further work in the project area is required." From page 3-24, it appears that this statement arises from correspondence with Hawai'i Island State Historic Preservation Division (SHPD) archaeologist Mary Anne Maigret. Although the e-mail correspondence from Ms. Maigret dated April 17, 2006 does state her opinion that additional work may not be necessary, the official SHPD letter, dated July 3, 2006 from Melanie Chinen, did identify concerns and did not explicitly state that no further work was required. Please clarify this section of the EIS and ensure that the official SHPD letter is referenced and addressed.

We appreciate that the applicant has flagged potable water development and affordable housing as unresolved issues. We reserve the right to comment on these issues once they have been fully addressed. Thank you for the opportunity to comment, and we look forward to reviewing the final EIS. If you have any further questions or concerns please contact Koa Kaulukukui at (808) 594-0244 or koalanik@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

c:

Anthony Ching
State Land Use Commission
P.O. Box 2359
Honolulu, Hawai'i 96813

Ruby McDonald
OHA Kona Office
75-5706 Hanama Place, Suite 107
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January 31, 2007

Mr. Clyde W. Namu'o, Director
Office of Hawaiian Affairs
711 Kapi'olani Boulevard, Suite 500
Honolulu, Hawai'i 96813

Dear Mr. Namu'o:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of December 7, 2006. We would like to offer the following responses to your comments.

1. Hydrology and Potable Water. We acknowledge your concern that the Waikoloa Water Master Plan was prepared in 1991. We would like to note, however, that the master plan did include this project in their water development plans (see Appendix A, references to this project is "Highlands"). Further, we would like to note that the water demand originally projected was greater than currently projected for this projected (page 3-12). A separate study was conducted by Waimea Water Service (November 2006) for this project to ascertain the availability of water. Water service will be provided by West Hawai'i Utilities and the developer is currently in discussion with them to establish the cost of the services and the cost of storage. The project plans do include provisions for additional storage and distribution, however, along with other developers in the area, the developer of this project is required to contribute to the development of additional water resources to West Hawai'i Utilities.

2. Archaeological investigations, page 3-35. Another ground and aerial survey of the area was conducted by Cultural Surveys Hawai'i to locate the site identified by Bevacqua. The site, however, was not located within the project limits. The findings are described in Appendix E. The findings will be confirmed with the State Historic Preservation Division.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka, LLC

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R. M. TOWILL CORPORATION
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Construction Management

June 13, 2007

Mr. Clyde W. Namu'o
Administrator
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namu'o:

Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i

Thank you for your letter dated December 7, 2006 concerning the subject project. We have prepared the following revised response to our earlier mailing to you to provide further clarification and detail. Your comments are *italicized* for reference:

1. *First, the hydrology and potable water analyses are inadequate. The Waikoloa Water Master Plan, prepared in 1991, is outdated and does not address the specific project under consideration. The DEIS does not estimate how much water will be needed for the Waikoloa Highlands at full build-out. Further, the DEIS notes on page 3- 12 that there is a regional water resource limitation, and a cooperative water allocation solution is required. There is no indication whether the applicant has taken any steps toward such a solution or other mitigation measures. Because fresh water issues are often contentious in our island state, the potential impacts must be identified and addressed at the earliest possible: time to prevent costly delays.*

An update to the 1991 Tom Nance Water Resources Engineering study was commissioned by the project owners to Waimea Water Services, Inc. (WWSI). This update will be included in the Final EIS (FEIS) as Appendix L. The 2007 study examined the 1991 water development plan as well as the current development plans of the West Hawai'i Utility Company (WHUC), a water utility company serving the Waikoloa region and regulated by the State Public Utilities Commission. According to the WWSI update there is sufficient water resource capacity to meet the project demand of approximately 400,000 gpd.

The developer is currently in negotiation with the WHUC to determine the water allocation, and the facilities development charge for the source well(s), storage, and transmission facilities. In addition, the developer will pay for the water distribution network that will be required to distribute water within the project.

You may refer to the FEIS, Section 3.2.8, Hydrology, pages 3-12 to 3-14, for further discussion of these items.

2. *Second, the DEIS at page 3-35 states that "the project will have no effect on archaeological resources" and "no substantial structures are expected." Yet the report prepared by Cultural Surveys Hawaii (CSH) at page 10 reveals that a previous archaeological study by Bevacqua in 1972 uncovered a "complex of walls," including a "well-built bifaced wall, 45 meters long." Although CSH could not locate this complex, it is possible that it could be re-discovered during construction. With such a large and possibly significant archeological feature potentially onsite, we take exception to the blanket statement that no archaeological resources will be affected, especially since CSH spent only "2-man-days including travel time" to survey over 730 acres. More field work needs to be done, and, at a minimum, the EIS should note that the project could potentially affect archeological resources. We further request that mitigation measures be considered and planned for now to ensure protection of the archeological site, rather than waiting until construction has already commenced.*

The DEIS documents a total of three surveys undertaken in 1972, 1990, and most recently in 2006, by Cultural Surveys Hawai'i (CSH), Archaeologists, who conducted a ground and aerial survey of the area. The CSH archeologists determined that the site identified by Bevacqua, as Site 22, in 1972 may be located outside of the project boundary and based their conclusion on the limited detail provided by the Bevacqua maps. However, because of potential concern for the inadvertent discovery of Site 22 during construction activities the developer will promote the use of a an on-call archaeological monitor in the event of a field discovery. The monitor will coordinate archaeological reporting responsibilities for the project and notify the SHPD immediately of any inadvertent discoveries of significant artifacts or human remains. Upon the discovery of a significant site or human remains work will cease until the SHPD has been notified and appropriate action is taken.

You may refer to the FEIS, Section 3.4.5, Archaeological, Historic, and Cultural Resources, Pages 3-35 to 3-37, for further discussion.

3. *Also on page 3-35, the DEIS states that "the SHPD has recently reconfirmed that no further work in the project area is required." From page 3-24, it appears that this statement arises from correspondence with Hawai'i Island State Historic Preservation Division (SHPD) archaeologist Mary Anne Maigret. Although the e-mail correspondence from Ms. Maigret dated April 17, 2006 does state her opinion that additional work may not be necessary, the official SHPD letter, dated July 3, 2006 from Melanie Chinen, did identify concerns and did not explicitly state that no further work was required. Please clarify this section of the EIS and ensure that the official SHPD letter is referenced and addressed.*

At the request of the State Land Use Commission, we have forwarded a request to the SHPD to provide a letter of clarification to specifically state that the project would not have any effect to historic properties. The response to our request is pending.

Documentation of this item is provided in the FEIS, Section 3.4.5, Archaeological, Historic, and Cultural Resources, Page 3-36.

Thank you for taking the time to share your comments and allowing us this opportunity to respond. Any further written comments may be directed to the undersigned.

Sincerely,

for Chester Koga, AICP

cc: Waikoloa Mauka LLC
Imanaka Kudo & Fujimoto

UNIVERSITY OF HAWAI'I AT MANOA
Environmental Center

December 14, 2006

Mr. Kevin Kellow
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

Dear Mr. Kellow:

The Environmental Center submitted comments on the Waikoloa Highlands Development DEIS on December 7, 2006. We have revised our letter for your consideration to include comments from two faculty members who submitted their comments after the deadline. We realize the review period ended a week ago and that you are not obligated to accept our revised letter. It does, however, contain some issues that you may wish to address in the final document.

I would like to add that the Environmental Center is assisted in its reviews of various environmental documents by faculty and staff from various university departments systemwide. Their participation is voluntary and usually the end of the semester is a busy time for most faculty and staff at the University. The Environmental Center's reviews do offer a third party perspective on projects which we limit to technical issues. We apologize for any delays in the process we may have caused.

Thank you for consideration.

Sincerely,

Peter Rappa
Environmental Review Coordinator

cc: OEQC
Anthony Ching, State Land Use Commission
Chester Koga, R.M. Towill
James Moncur

2500 Dole Street, Krauss Annex 19, Honolulu, Hawai'i 96822-2319
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

UNIVERSITY OF HAWAI'I AT MANOA
Environmental Center

December 14, 2006
RE:0757 Revised

Mr. Kevin Kellow
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

Dear Mr. Kellow:

Draft Environmental Impact Statement
Waikoloa Highlands – Residential Subdivision
Waikoloa, Hawaii

Waikoloa Mauka proposes to subdivide and construct infrastructure improvements for a new 744.40-acre property in the South Kohala District, Island of Hawai'i. The property is located southeast of Waikoloa Village, an existing residential and commercial area. The proposed subdivision will create approximately 398 low-density, rural residential lots, each a minimum of one-acre in size. The project will also construct roadways within the subdivision and provide water and electrical service to the property. Existing water courses through the subdivision will mostly remain unchanged. Increases in surface runoff due to increased impervious areas will be addressed on-site through detention basins and drywells.

This review was conducted with the assistance of Sara Peck and Richard Brock (Sea Grant College Program) and Jene Michaud (UH Hilo Geology Department).

General Comments

One of our main concerns was the potential for sediments from the proposed development reaching the anchialine ponds in the shoreline area of Waikoloa. However, the proposed project is far enough mauka that we believe there will be no impacts on the pond system.

We would also like to point out that the County is in the midst of developing community plans as part of the General Plan process. You mention that in the DEIS, but indicate the process is not complete. It is, however, an important process that may have impacts on development on the west side of the Big Island. We wonder if you are aware of how far along the community development plans are and whether they address the area around Waikoloa. We also note that the Office of Planning is examining how development will occur in the state's rural areas. They may some preliminary results which may be applied to the proposed development at Waikoloa.

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An Equal Opportunity/Affirmative Action Institution

We also have a question about the market for the housing that is proposed for this project. The DEIS states on page 3-26 that a family purchasing a house in this development will need to have an income of between $192,000 and $264,000. How many people on the Big Island have the income needed to purchase a house in the proposed development? If the number is small, then this project will not really be addressing the need for housing in the local market. What is the target market for this development? Who will live in these expensive houses?

We have a number of specific comments below.

Climate and Air Quality (p. 3-7)

In the first paragraph under Existing Conditions, the rainfall range is stated as being between 10 to 20 inches and two lines below it is given as 10 to 15 inches. Which is correct?

Natural Hazards (p. 3-9)

It is stated in the section on Existing Conditions that the project falls within Zone 3 on the U.S. Geological Survey hazard classification map. This indicates a medium-high risk of damage to the proposed development from lava flows. In the section on Project Impacts and Mitigation, it is stated that the project will have no effect on the occurrence of natural hazards or the level of public risk. This may be true, but if people move into the area won't they be at risk in the event that an eruption occurs on Mauna Loa? Is there a planned evacuation strategy for residents in the event of an eruption?

Residents will also be exposed to earthquake hazards. Until recently, the United States was mapped into five earthquake hazard zones. The entire island of Hawaii met the criteria for the most hazardous zone. The largest historical earthquake on the island is the fourth largest in U.S. history when earthquakes from Alaska are excluded.

Hydrology (p. 3-11 – 3-12)

The DEIS states at the bottom of page 3-12 that the Waikoloa Water Master Plan recommends that sewage treatment effluent be reused for irrigation wherever possible to reduce groundwater pumping etc. Will the proposed development be reusing wastewater effluent in an attempt to conserve limited water resources in the area?

Botanical Resources (p. 3-15)

The DEIS states on page 3-15 that there are native species, three dozen 'akia (*Wikstroemima pulcherrima*), 'Uhaloa (*Waltheria indica*) and 'Aheahea(*Chenopodium*

ohaunense). Later on page 3-37, it contradicts the above statement under Project Impacts and Mitigation stating that "the project area has changed and there are no native plants . . . ."

Recently, botanists have found endemic and native plants growing in areas where they were not recorded previously, possibly due to the revitalization of dormant of seed stock caused by a change in environmental conditions and rainfall. We suggest that botanical resources should be reassessed and if any rare, threatened or endangered species are found then the impacts of the proposed project on these botanical resources should be mitigated. We recommend that the Waikoloa Outdoor Circle be included in this discussion.

Housing (p. 3-24)

In this section, the DEIS states that as of 2000 "there were 5,348 residential units in South Kohala. On page 3-22 in the section on Demographic Characteristics, it is stated that as of 2000 there was a resident population of 13,079 in 4,648 households. Why is there such a large difference between the two figures? Is the difference attributable to absentee owners or just vacant units?

Social Impacts (p. 3-25)

In the section on Waikoloa Village, the DEIS states that the Highland project would only contribute 9% to all the new development proposed. Where did the figure of 4,533 proposed units come from? Going back to pages 3-20 to 3-21, we can only count 2,496 new units being proposed for this area. A chart of all new developments and the number of new units proposed would be most helpful in section 3.4 Social and Built Environment.

Community Balance (p. 3-25 - 3-26)

In this section, the DEIS claims that a better balanced community would result from having a number of wealthy people move into the area. Using this logic it could be said that every low income community would do well to have high income people move into the area. This is putting a positive spin on what should be an issue of potential concern. Communities do well when people with a range of incomes and interest move into an area. This analysis is disingenuous at best.

Public Coast vs. Benefits Assessment (p. 3-30 – 3-33)

The DEIS states on page 3-30 in the section on *Methodology*, "the project represents only a fraction of the County and State residential inventory and is unlikely that the Waikoloa Highlands residents will themselves create the need for expansion of public services. That is, no new schools, parks, highways, recreational facilities, service agencies or other public services will be required specifically because of the Waikoloa Highlands development." On the previous page in the section on Public Fiscal Impacts, the DEIS states that SMS Research,

2006 noted that "no major new commitment of County or State funds is needed to support the project."

The document recognizes that five other developments are underway or in active preparation, estimated to add approximately 2120 more units, possibly 4,000 more people. This project of 398 lots is expected to produce 907 full time residents of which 233 would be students. This document also recognizes (p. 3-31) the cumulative effect of increased housing inventory. By presenting this project as a 'small fraction' of the overall housing unit inventory, this DEIS is obscuring the fact that this project contributes to the cumulative effect and should be held responsible for mitigation measures where necessary.

Though the state and county apparently did not require any level of participation in public services, the project's proposers should not consider themselves exempt from providing public services and should strive to collaborate with the community to establish services or facilities needed by the community. Such needs, well documented through the Hawaii County Community Development Process currently underway include: a middle school, a high school, a community center, an emergency medical care facility, a public library, better staffed emergency responders (fire and police), etc. An area should be set aside for future public use, possibly 50 acres as required for a high school.

Proposed Supply (p.3-32)

We had a hard time making the figures on the top of the page add up. The units listed don't add up to 3,456. On page 3-21, the DEIS stated that the County is planning to develop 1,000 affordable units in the area with 207 being planned for 2007. Where did the figure of 225 County planned units come from? The figures on what is planned changes several time throughout the DEIS. They should be consistent throughout the document. A few tables would be really helpful.

Archaeology (p. 3-35)

The DEIS states "although the Jensen field crew looked for Bevacqua's Site 22, even examining lands 250 meters beyond the perimeter of the project area, it could not be located. Other than Site T-1, no other evidence of pre or post-contact use was found within the project area. Jensen concluded that the Bevacqua's Site 22 was probably destroyed sometime during the preceding 5-10 years." In the following paragraph Cultural Surveys Hawaii, in their 2006 review, noted "*It seems odd that a site nearly 150 feet long that presumably had been around for many decades could disappear in the course of 18 years. It also, however, seems unlikely the Jensen crew would have missed Site 22. Perhaps it lies further afield.*" We believe that Site 22 may be significant and suggest that the search for it be reinitiated using Hawaiian kupuna with local knowledge.

Pu'u Hinai, which is mentioned several times in this and the following section of the DEIS is currently being excavated for building material. Hawaiian residents have indicated that area pu'us are of cultural significance. This issue should be explored more fully in the DEIS perhaps after conferring with Hawaiian kupuna.

Traffic (p. 3-39)

The DEIS notes on page 3-39 that the TIAR noted that other projects are not expected to generate significant traffic volumes, then goes on to say "Even with the creation of dedicated right turn lanes, the change in traffic volumes will result in over-capacity conditions at the intersection of Waikoloa Road, Pua Melia Street and Paniolo Avenue. Traffic signals would be warranted for four hours of an average day." This project should be responsible, in some part, for the cost of traffic mitigation. When the county council exteaded the entitlements for this project for 10 years, it was with the condition that one or more traffic lights will be installed by this project.

It is also unclear that the number of entrances and exits to this project on Waikoloa Road and Pua Melia are adequate. Community members indicate that the understanding with the developer is that there will be at least three intersections.

We would also point out that since some of the residents of the proposed subdivision will work and shop in Kailua-Kona, it should be acknowledged that the subdivision will contribute to traffic congestion in Kailua-Kona.

Drainage (p. 3-42)

The county regulations require that dry wells be sized to handle runoff from the 10-year flood. If a more severe flood occurs (20-year or 50-year flood), the drywells may be inadequate to handle the runoff. In such a case it is possible that runoff would enter the stream. It is an established principle that the largest floods have by far the greatest loads of sediment and pollutants picked up from roads, driveways, and yards. Further, because some of the lots border on the stream, it is possible that runoff from roofs and yards will drain towards the stream rather than the street. Such runoff would not be mitigated by the dry wells. Residents with lots bordering the streams should be encouraged to maintain vegetated buffer strips along the edge of the stream. The DEIS should acknowledge that it is possible that under certain circumstances the subdivision will contribute excess storm runoff and associated sediment to the streams, although this would probably occur rarely.

Wastewater (p. 3-48 – 3-49)

There is no estimate of the amount of wastewater that the proposed development will generate. Approximately how much will be generated and will any of it be reused?

Also, effluent from the septic tanks will contribute to groundwater pollution, at least in some measure because the effluent travels downwards until it reaches the water table. Septic tank waste does contain nutrients and possible pathogens. However, we acknowledged that the proposed development meets the county wastewater regulations, which allow septic tanks in low density subdivisions.

Solid Waste (p. 3-49 – 3-50)

The landfills capacity is given in cubic yards of space, but the amount of waste generated by the proposed development is given in pounds per day. This makes it difficult to determine how much of the landfill's capacity is taken up by the waste stream generated by the proposed project. It would be helpful if the authors could convert one or the other measure or give a rough equivalent so that a calculation can be made.

The DEIS states in the last paragraph that given the "projected capacity of the County landfill, the project is not expected to have an adverse impact on the landfill." Although the amount of solid waste generates by the development is small it will have an adverse impact on the landfill, it will help fill it up and shorten the life of the facility.

The DEIS mentions that "the project's developers will encourage practices such as recycling and composting to reduce and divert materials from the waste stream." What will the developer do to encourage this behavior?

Public Service and Facilities (p. 3-50 – 3-54)

It would be helpful to show the service areas of each of the public services discussed in this section. Each fire station, for example, has a service area which it covers. The same can be said for police and emergency medical service. It would be helpful to see what these areas are in relation to the proposed development. It would also be helpful to know the capacity of these services and how much of that capacity the proposed development will take up. The discussion on the schools on page 3-53 is a good example of how each of these services should be discussed.

The DEIS noted on the bottom of page 3-52 that Waikoloa is currently underserved by parks. The proposed subdivision will worsen this situation. This could be mitigated by building a small neighborhood park in the open areas planned for the subdivision. This would

enhance the attractiveness of the subdivision to potential buyers.

Thank you for the opportunity to review this Draft EIS

Sincerely,

Peter Rappa
Environmental Review Coordinator

cc: OEQC
Anthony Ching, State Land Use Commission
Chester Koga, R.M. Towill
James Moncur
Sara Peck
Jene Michaud
Dick Brock

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January 31, 2007

Mr. Peter Rappa
Environmental Center
University of Hawai'i at Mānoa
2500 Done Street, Kraus Annex 19
Honolulu, Hawai'i 96822

Dear Mr. Rappa:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of December 14, 2006. We offer the following responses to your comments.

1. General Comments
   a. Drainage impacts. As stated in your letter we do not anticipate sediments from this project will reach the coastline. We are incorporating sediment basins in the project to assist in this process.
   b. Community Development Plan (CDP). Representatives of this development are currently in contact with members of the community and are aware of community issues. The CDP process is still in its infancy but the landowner is committed to stay involved with the community.
   c. Market for housing, how many people on the Big Island has the income needed to purchase a house in the proposed development? Purchasing capability is not merely a question of income. It includes other factors such as accumulated reserves, equity in real property already owned, financing capabilities and the availability and cost of money. Further, to limit the potential buyers to only people on the Big Island would be short-sighted on our part. We note that there are vacant lots in Waikoloa villages that ranging in size between 10,000 and 50,000 square feet are on the market between $515,000 and $719,000 (see Appendix F). This project will be marketing 1 acre lots.
2. Climate and Air Quality, page 3-7. Rainfall should be between 10 to 15 inches per year.
3. Natural Hazards, page 3-39. We acknowledge that the residents of this subdivision are at risk should Mauna Loa erupt, and they are subject to earthquake as recently experienced. Until very recently, there was only one exit out of the Waikoloa community, now there are two. Unless the hazard is sudden and catastrophic, residents of this area will have time to evacuate the area, if necessary.

4. Hydrology. Regarding wastewater re-use, this project will not be considering wastewater re-use at this time as the house lots will be developed with individual wastewater systems. Individual homeowners, however, can choose to install aerobic systems that can allow the production of R-2 quality irrigation water.
5. Botanical Resources. We acknowledge that during the botanical survey, native plant species were located on the project site. These plants are not currently listed as endangered. We will correct page 3-37 to remove the note indicating that there are no native plant species in the project site.
6. Households vs. Residential Units. Please note that the differences in numbers between page 3-22 and 3-24 equates to the number of households in the South Kohala District versus the number of residential units in the District. Both figures come from the 2000 Census. There is no information within the Census that would allow us to definitively answer your questions regarding the reason for the "vacancy." One should note, however, that if one were to combine units available for rental, units available for sale, and units owned by second-home/vacation buyers, 13% would not have been an unusually high "vacancy" in 2000.
7. Social Impact. The total projected units in Waikoloa are 4,533 units (2,400 existing and 2,133 proposed, excluding the 398 proposed by this project).
8. Community Balance. We do not believe that this development will necessarily change the social fabric of the community because the total number of families that will be added to the Waikoloa community is small, less than 5 percent. Household incomes in Waikoloa Village are highly concentrated around the mean; households with incomes of $150,000 or higher make up only 2.1 percent of the population. After assuming probable construction costs, one can see that nearly every household that buys into the project will fall into that category, resulting in a flatter income curve and a more heterogeneous population. Please note that this is a comment of a public official and not the conclusion of an analysis. Perhaps it is in the wrong place in the report and should have been included in the collection of other public comments. But we don't see that his position differs significantly from yours.
9. Public Cost vs. Benefits Assessment. The section on public costs, beginning page 3-30, did not suggest that the project proponents will not be contributing to the incremental increase to the demand for public facilities. Elsewhere in the document, we have noted that the developer will be contributing to school facilities, affordable housing, and traffic improvements. In addition, there are impact fees assessed by the County for police, fire, and recreation.
10. Proposed Supply, page 3-32. To clarify, there are 2,400 residential units currently in Waikoloa Village. An additional 2,133 (excluding the proposed 398 units of this project) are proposed. The section on "proposed supply" will be modified to match the unit count shown on page 3-20.
11. Archaeology. Another aerial and ground survey to locate Site 22 was undertaken and the site was not found. The review of cultural impacts of the area, Pu'u Hinai was not mentioned in the literature or via informant interviews.
12. Traffic. There will be three entrances into the proposed subdivision. Two will be from Waikoloa Road, and the third from Pua Melia. We acknowledge that residents of this project will contribute to the overall traffic volume along the major highway corridors, particularly Queen Ka'ahumanu. Specific impacts to traffic congestion in Kailua-Kona were not studied as part of this project.
13. Drainage. As noted in the DEIS, stormwater flows will continue as currently directed. Drywells will be installed along the roadways to accommodate rainfall from a 10-year storm as prescribed by the County of Hawai'i. During 20 or 50-year storms, it is anticipated that the excess stormwater will continue into the existing drainage channels.

There are no plans to change the drainage channels, except at roadway crossings. The channels will remain in its current vegetated state. We acknowledge, that during severe storm events, sediments from the developed lots will enter the gulches.

14. Wastewater, page 3-48 – 3-49. As stated earlier, the proposed development will be developed using individual wastewater systems.
15. Solid Waste, page 3-49-3-50. The projected solid waste volume per year is approximately 2,192 cubic yards (1068 persons x 4.5 pounds per person per day = 877.09 tons per year x 1.25 cover factors x 2 cubic conversion = 2,192 cubic yards per year. Encouragement for recycling will be stated in the homeowners covenants. A solid waste management plan will be prepared in consultation with the County of Hawai'i and will contain provisions for recycling. This Plan will be submitted for review prior to final subdivision approval.
16. Public Service and Facilities and Coverage (Fire, Police, Emergency Services, and Schools). A new figure will be included in Section 3.6 showing the location of the cited public facilities. As noted above, the developer will be contributing to the mitigation of impacts to public facilities.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka LLC

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June 13, 2007

Mr. Peter Rappa
Environmental Review Coordinator
University of Hawaii at Manoa
Environmental Center
2500 Dole Street, Krauss Annex 19
Honolulu, Hawaii 96822

Dear Mr. Rappa:

Draft Environmental Impact Statement (DEIS)
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i

Thank you for your letter dated December 14, 2006 concerning the subject project. We have prepared the following revised response to our earlier mailing to you to provide further clarification and detail. Your comments are *italicized* for reference:

General Comments

1. *One of our main concerns was the potential for sediments from the proposed development reaching the anchialine ponds in the shoreline areas of Waikoloa. However, the proposed project is far enough mauka that we believe there will be no impacts on the pond system.*

We acknowledge your comment and similarly do not anticipate that sediments from this project will reach the coastline. As noted in the DEIS, Section 3.5.2, Drainage, Page 3-46, "The project will not increase off-site flows or have an adverse drainage impact off-site."

2. *We would also like to point out that the County is in the midst of developing community plans as part of the General Plan process. You mention that in the DEIS, but indicate the process is not complete. It is, however, an important process that may have impacts on development on the west side of the Big Island. We wonder if you are aware of how far along the community development plans are and whether they address the area around Waikoloa. We also note that the Office of Planning is examining how development will occur in the stare's rural areas. They may some preliminary results which may be applied to the proposed development at Waikoloa.*

Representatives of the proposed project remain in contact with members of the community who have shared their concerns and issues. Although the Community Development Plan process is currently in its infancy, the landowner is committed to staying involved with the community.

3. *We also have a question about the market for the housing that is proposed for this project. The DEIS states on page 3-26 that a family purchasing a house in this development will need to have an income of between $192,000 and $264,000. How many people on the Big Island have the income needed to purchase a house in the proposed development? If the number is small, then this project will not really be addressing the*

need for housing in the local market. What is the target market for this development? Who will live in these expensive houses?

We do not have the data that identifies the specific number of people on the Big Island with the income needed to purchase the lots associated with the proposed project. We do note, however, that the ability to purchase a home does not only involve income. Other factors are involved that include accumulated reserves, equity in real property already owned, financing capabilities, and the availability and cost of borrowing money.

If income is the sole determinant of purchasing capacity, then the target market will be families with incomes, as noted in the DEIS, of between $192,000 and $264,000 annually.

The families that will purchase and live in this development are expected to include those with space requirements that would not ordinarily be met by the existing vacant lots in Waikoloa Villages. These lots range in size from 10,000 to 50,000 square feet, with the majority of lots far smaller than 1-acre or 43,560 square feet. The proposed project will instead be providing 1-acre lots that will meet a unique demand offering opportunities for land ownership that are not now readily available in the region.

Climate and Air Quality (p. 3-7)

4. *In the first paragraph under Existing Conditions, the rainfall range is stated as being between 10 to 20 inches and two lines below it is given as 10 to; 15 inches. Which is correct?*

Rainfall is between 10 to 15 inches per year. The FEIS, Section 3.2.5, Climate and Air Quality, Page 3-6, will provide this corrected information.

Natural Hazards (p. 3-9)

5. *It is stated in the section on Existing Conditions that the falls within Zone 3 on the US. Geological Survey hazard classification map. This indicates a medium high risk of damage to the proposed development from lava flows. In the selection on Project Impacts and Mitigation, it is stated that the project will have no effect on the occurrence of natural hazards or the level of public risk. This may be true, but if people move into the area won't they be at risk in the event that an eruption occurs on Mauna Loa? Is there a planned evacuation strategy for residents in the event of an eruption?*

   Residents will also be exposed to earthquake hazards. Until recently, the United States was mapped into five earthquake hazard zones. The entire island of Hawaii met the criteria for the most hazardous zone. The largest historical earthquake on the island is the fourth largest in U.S. history when earthquakes from Alaska are excluded.

The residents of the proposed project, as well as surrounding developments will be at risk in the event of an eruption of Mauna Loa. Area residents will also be subject to earthquakes. Until very recently, there was only one exit out of the Waikoloa community, now there are two. Unless the hazard is sudden and catastrophic, residents of this area will have time to evacuate the area, as required. The FEIS, Section 3.2.6, Natural Hazards, starting on Page 3-9, will reflect this situation as follows (deleted text is lined out and new text is underlined):

> "According to the USGS, defining hazard zones for the effects of earthquakes is more difficult than for eruptions and has not been attempted for the Island of Hawai'i. The island experiences

thousands of earthquakes each year; most so small that they are only detectable by instruments. Most of Hawai'i's earthquakes are directly related to volcanic activity and are caused by magma moving beneath the earth's surface. These earthquakes tend to be concentrated beneath Kilauea and Mauna Loa, the island's active volcanoes, particularly their south flanks and in the region between them. In order to facilitate evacuation from the Waikoloa Village area, the County of Hawai'i developed in 2006 a secondary evacuation route to the northwest of Waikoloa Village."

Hydrology (p. 3-11 - 3-12)

6. *The DEIS states at the bottom of page 3-12 that the Waikoloa Water Master Plan recommends that sewage treatment effluent be reused for irrigation wherever possible to reduce groundwater pumping etc. Will the proposed development be reusing wastewater effluent in an attempt to conserve limited water resources in the area?*

Wastewater reuse is not possible with the adoption of the proposed Individual Wastewater Systems for the project. However, in order to promote water conservation the developer does intend to implement other measures that will include separate metering of domestic and irrigation water, and the use of water restrictions to promote conservation and discourage waste. Homeowners will be advised to use drought tolerant plants when landscaping, and if water uses exceed 1,000 gallons per day, the homeowner will be assessed a higher fee for any water usage over the daily allowance.

Regarding sufficiency of water resources, the FEIS, Section 3.2.8, Hydrology, Pages 3-12 to 3-14, will provide further discussion. In summary, the Waikoloa Water Master Plan (WWMP), 1991, was reviewed and an update of the applicability of the plan to the proposed project was undertaken in 2007, by Waimea Water Services, Inc. (WWSI). According to the update there is sufficient water to meet a minimum project demand of 1,000 gallons per day (gpd) per lot, or approximately 400,000 gpd for the project (1,000 gpd x approximately 400 lots).

Botanical Resources (p. 3-15)

7. *The DEIS states on page 3-15 that there are native species, three dozen 'akia (Wikstroenima pulcherrima), 'Uhaloa (Waltheria indica) and 'Aheahea (Chenopodium ohaunense). Later on page 3-37, it contradicts the above statement under Project Impacts and Mitigation stating that "the project area has changed and there aye no native plants . . .".*

The FEIS, Section 3.4.5, Archaeology, Cultural Resources, Impacts and Mitigation, Impacts and Mitigation, Page 3-38, will revise the DEIS, as follows:

"Historical evidence suggests that the land in Waikoloa was not intensively used, and if used, was a corridor between the mauka lands of Waimea and the coastal areas during historic times and for cattle in latter periods. The vegetation in the project area has changed over the years to a point were there are ~~no~~ very few native plants due in part to cattle grazing and wildland fires."

8. *Recently, botanists have found endemic and native plants growing in areas where they were not recorded previously, possibly due to the revitalization pf dormant of seed stock caused by a change in environmental conditions and rainfall. We suggest that botanical resources should be reassessed and if any rare, threatened or endangered species are found then the impacts of the proposed project on these botanical resources should be mitigated. We recommend that the Waikoloa Outdoor Circle be included in this discussion.*

We have forwarded our botanical study to the Waikoloa Outdoor Circle for review and comment. At this writing a response has not yet been received.

Housing (p. 3-24)

9. *In this section, the DEIS states that as of 2000 there were 5,348 residential units in South Kohala. On page 3-22 in the section on Demographic Characteristics, it is stated that as of 2000 there was a resident population of 13,079 in 4,648 households. Why is there such a large difference between the two figures? Is the difference attributable to absentee owners or just vacant units?*

The difference in numbers between page 3-22 and 3-24 of the DEIS relates to the number of households in the South Kohala District and the number of residential units in the District. Both figures come from the 2000 Census. There is no information in the Census that allows us to definitively answer your questions regarding the reason for the "vacancy." It should be noted, however, that combining the units available for rental, the units available for sale, and the units owned by second-home/vacation buyers, that 13 percent would not be an unusually high "vacancy" for the year 2000 based on the information provided by SMS Research.

Social Impacts (p. 3-25)

10. *In the section on Waikoloa Village, the DEIS states that the Highland project would only contribute 9% to all the new development proposed. Where did the figure of 4,533 proposed units come from? Going back to pages 3-20 to 3-21, we can only count 2,496 new units being proposed for this area. A chart of all new developments and the number of new units proposed would be most helpful in section 3.4 Social and Built Environment.*

The FEIS, Section 3.4.4, Marketing Plan, starting on Page 3-33, will revise the DEIS, as follows to clarify the total number of units:

" There are five major projects in-development, approved or proposed in the Waikoloa Village area. These projects are: Wehilani (~~473~~ 756 units), 17th Fairway (27 units), Sunset Ridge (~~201~~ 120 units), and Kilohana Kai (230 units). These project have the potential of providing a maximum of ~~3,456~~ 1,133 units (combined single family and multi-family units) to the housing inventory of the area. The County of Hawai'i is also planning a housing project with ~~225~~ 1,000 units in the area. Combined, there are approximately ~~4,079~~ 2,133 units proposed for a total of 4,533 units (existing [2,400] and proposed [2,133])."

Community Balance (p. 3-25 - 3-26)

11. *In this section, the DEIS claims that a better balanced community would result from having a number of wealthy people move into the area. Using this logic it could be said that every low income community would do well to have high income people move into the area. This is putting a positive spin on what should be an issue of potential concern. Communities do well when people with a range of incomes and interests move into an area. This analysis is disingenuous at best.*

The proposed project will provide the opportunity for a more heterogeneous and diverse socioeconomic population than presently exists. Household incomes in Waikoloa Village are highly concentrated around the mean; households with incomes of $150,000 or higher make up only 2.1 percent of the population.

After assuming probable construction costs, one can see that many households that buy into this project will need the incomes as estimated in the DEIS in the range of $192,000 to $264,000 annually, thereby increasing that category, flattening the income curve and enabling a more heterogeneous population.

In this regard, it is anticipated that greater balance within the Waikoloa community will result from having a greater mix of housing types with residents from diverse socioeconomic backgrounds. It is the developer's expectation that the more heterogeneous a population – whether measured by income, ethnicity, age, home of origin, etc. – the more dynamic the community, the more diverse the social interaction, and the richer the events and activities of that community. We add that this is expected to be facilitated with the greater provision of public services for all residents that will also result from the increased tax revenues made possible with this project.

Public Cost vs. Benefits Assessment (p. 3-30 - 3-33)

12. *The DEIS states on page 3-30 in the section on Methodology, "the project represents only a fraction of the County and State residential inventory and is unlikely that the Waikoloa Highlands residents will themselves create the need for expansion of public services. That is, no new schools, parks, highways, recreational facilities, services agencies or other public services will be required specifically because of the Waikoloa Highlands development." On the previous page in the section on Public Fiscal Impacts, the DEIS states that SMS Research, 2006 noted that "no major new commitment of County or State funds is needed to support the project."*

    The document recognizes that five other developments are underway or in active preparation, estimated to add approximately 2120 more units, possibly 4,000 more people. This project of 398 lots is expected to product 907 full time residents of which 233 would be students. This document also recognizes (p. 3-31) the cumulative effect of increased housing inventory. By presenting this project as a 'small fraction' of the overall housing unit inventory, this DEIS is obscuring the fact that this project contributes to the cumulative effect and should be held responsible for mitigation measures where necessary.

    Though the state and county apparently did not require any level of participation in public services, the project's proposers should not consider themselves exempt from providing public services and should strive to collaborate with the community to establish services or facilities needed by the community. Such needs, well documented through the Hawaii County Community Development Process currently underway include: a middle school, a high school, a community center, an emergency medical care facility, a public library, better staffed emergency responders (fire and police), etc. An area should be set aside for future public use, possibly 50 acres as required for a high school.

The developer of the Waikoloa Highlands project is cognizant of their responsibility to provide adequate services to new residents of the area and the Waikoloa community in general. We do not suggest that the developer is exempt from providing public services and has in fact been in consultation with many of the agencies responsible for providing public services. A summary of actions taken and the mitigation proposed is summarized below. These findings will be reported in the FEIS.

Education: In Section 3.7.4, Schools, Page 3-60. The FEIS will note that the DOE has determined that no additional schools will be needed as a result of the project impact of 24 additional elementary school students, 9 middle school students and 5 high school students. According to discussions with Heidi Meeker of the DOE, the DOE will request that the Land Use Commission impose a school fair-share condition similar to such conditions that the Land Use Commission has imposed on other recent developments. Discussions are continuing with the DOE to determine an appropriate resolution.

Impact Fees: Section 2.2.6, Development Costs, Page 2-7. The FEIS will state that the developer has agreed, as a condition of Ordinance 05-157, to paying impact fees to the County of Hawai'i according to the following schedule:

Recreation Fee ($4,817.93 per lot)	$1,917,536
Affordable Housing (20% of total = 80)	TBD
Police Impact Fee ($232.42 per lot)	$92,503
Solid Waste Fee ($200.98 per lot)	$79,990
Water Development Fee	TBD
Road Fees and Traffic Fee ($4,280.82 per lot)	$1,703,766
School Impact Fee	TBD
Fire Impact Fee ($459.06 per lot)	$182,705
TOTAL ESTIMATED	$3,976,500

* Fees estimated based on Ordinance 05-157. Fees may be adjusted by providing land or facilities and the final payment amount will be adjusted by the Honolulu Consumer Price Index at the time of Final Subdivision approval.
TBD = to be determined

Affordable Housing. Section 3.8.3, Affordable Housing, Page 3-62. The FEIS will state, "The Petitioner is committed to meeting its affordable housing requirement per Ordinance 05-157 and Chapter 11, HCC, through the provision of land adjacent to the project site. To date, discussions with the County have centered on providing the housing off-site and within the 15-mile radius required in Section 11-4 (HCC). The land that is being proposed meets the affordable housing requirement and is located to the west (Tax Map Key 3-6-8-03, portion of parcel 31) of the subject project within the 15-mile radius in an area zoned for multi-family residential units. This parcel is owned by Petitioner.

Traffic Improvements. Section 3.5.1, Transportation and Traffic, Page 3-41. The developer will be improving the intersection at Waikoloa Road, Pua Melia and Paniolo Avenue by installing new traffic signals and re-striping the roadway. According to the project's traffic consultant, Julian Ng, these improvements will mitigate poor levels of service during the peak hours for left turns onto Waikoloa Road. With traffic signals and separate right-turn lanes, the intersection will have adequate capacity to serve peak hour volumes at project build out. As traffic volumes increase due to other developments in the Waikoloa area, peak hour conditions will worsen. A second eastbound left-turn lane at the intersection is a mitigation that will improve conditions to acceptable levels for the peak hour volumes projected to year 2025.

Proposed Supply (p. 3-32)

13. *We had a hard lime making the figures on the top of the page add up. The units listed didn't add up to 3,456. On page 3-21, the DEIS stated that the County is planning to develop 1,000 affordable units in the area with 207 being planned for 2007. Where did the figure of 2125 County planned units come from? The figures on what is planned changes several time throughout the DEIS. They should be consistent throughout the document. A few tables would be really helpful.*

Please refer to our response to Item No. 10, above.

Archaeology (p. 3-35)

14. The DEIS states "although the Jensen field crew looked for Bevacqua's Site 22, even examining lands 250 meters beyond the perimeter on the project area, it could not be located. Other than Site T-1, no other evidence of pre or post-contact use was found within the project area. Jensen concluded that the Bevacqua's Site 22 was probably destroyed sometime during the preceding 5-10 years." In the following paragraph Cultural Surveys Hawaii, in their 2006 review, noted "It seems odd that a site nearly 150 feet long that presumably had been around for many decades could disappear in the course of 18 years. It also, however, seems unlikely the Jensen crew would have missed Site 22. Perhaps it lies further afield." We believe that Site 22 may be significant and suggest that the search for it be reinitiated using Hawaiian kupuna with local knowledge.

Section 3.4.5, Archaeology, Page 3-35. The FEIS will note that in November 2006, Cultural Surveys Hawai'i undertook another survey of the project area to determine if Site 22 could be located. As a result of both a pedestrian survey and aerial survey, Site 22 was not located and was presumed be destroyed or is located outside of the project area. However, because of potential concern for the inadvertent discovery of Site 22 during construction activities the developer will promote the use of a an on-call archaeological monitor in the event of a field discovery. The monitor will coordinate archaeological reporting responsibilities for the project and notify the SHPD immediately of any inadvertent discoveries of significant artifacts or human remains. Upon the discovery of a significant site or human remains work will cease until the SHPD has been notified and appropriate action is taken.

15. Pu'u Hinai, which is mentioned several times in this and the following section of the DEIS is currently being excavated for building material. Hawaiian residents have indicated that area pu'us are of cultural significance. This issue should be explored more fully in the DEIS perhaps after conferring with Hawaiian kupuna.

Pu'u Hīna'i is currently outside of the boundary limits of this project. During the research into cultural practices in the area informants identified Pu'u Hīna'i as being culturally significant. The quarrying operations are planned to cease as development progresses on the subject project. State Land Use Commission records for the use of the site indicate that following termination of use that the operator will be responsible for restoring the site.

Traffic (p. 3-39)

16. The DEIS notes on page 3-39 that the TIAR noted that other projects are not expected to generate significant traffic volumes, then goes on to say "Even with the creation of dedicated right turn lanes, the change in traffic volumes will result in over-capacity conditions at the intersection of Waikoloa Road, Pua Melia Street and Paniolo Avenue. Traffic signals would be warranted for four hours of an average day." This project should be responsible, in some part, for the cost of traffic mitigation. When the county council extended the entitlements for this project for 10 years, it was with the condition that one or more traffic lights will be installed by this project.

Please refer to our response in Item No. 12, above.

17. It is also unclear that the number of entrances and exits to this project on Waikoloa Road and Pua Melia are adequate. Community members indicate that the understanding with the developer is that there will be at least three intersections.

Section 2.2.3, Access and Circulation, of the Draft EIS describes the three (3) intersections that are proposed for the subject project. One of the access points is the Waikoloa Road, Pua Melia, Paniolo Avenue intersection described above in comment 16. The second access is along Waikoloa Road approximately 2,000 feet east of the Waikoloa Road, Pua Melia, and Paniolo Avenue intersection. This second access into the subdivision will required the approval of the Hawai'i County Council. This proposed is currently pending before the Planning Department.

18. We would also point out that since some of the residents of the proposed subdivision will work and shop in Kailua-Kona, it should be acknowledged that the subdivision will contribute to traffic congestion in Kailua-Kona.

We acknowledge that residents of this project will contribute to the overall traffic volume along the major highway corridors, particularly Queen Ka'ahumanu. Specific impacts to traffic congestion in Kailua-Kona were not studied as part of this project.

Drainage (p. 3-42)

19. The county regulations require that dry wells be sized to handle runoff from the 10-year flood. If a more severe flood occurs (20-year or 50-year flood), the drywells may be inadequate to handle the runoff. In such a case it is possible that runoff would enter the stream. It is an established principle that the largest floods have by far the greatest loads of sediment and pollutants picked up from roads, driveways, and yards. Further because some of the lots border on the stream, it is possible that runoff from roofs and yards will drain towards the stream rather than the street. Such runoff would not be mitigated by the dry wells. Residents with lots bordering the streams should be encouraged to maintain vegetated buffer strips along the edge of the stream. The DEIS should acknowledge that it is possible that under certain circumstances the subdivision will contribute excess storm runoff and associated sediment to the streams, although this would probably occur rarely.

Section 3.5.2, Drainage, Page 3-46. The FEIS will describe on-site drainage improvements including the use of drywells, which will be used to dispose of any increase in roadway surface flows in accordance with state and county regulations.

We also note that under extreme storm conditions that it is possible that drywells, and drainage control structures such as vegetated buffer strips, will not be capable of handling the stormflows. There is occasional evidence of this throughout the state along coastal areas when stormflows eventually reach coastal and low lying areas as a result of heavy storms.

Wastewater (p. 3-48 - 3-49)

20. There is no estimate of the amount of wastewater that the proposed development will generate. Approximately how much will be generated and will any of it be reused?

We anticipate an approximate wastewater generation of 1,000 gallons per day per 1-acre lot. According to Chapter 11-23, Hawaii Administrative Rules, the provision of an individual wastewater system will be permitted by DOH. Although opportunities for wastewater reuse for the proposed project are not possible,

the developer does intend to implement water conservation measures. Please refer to our response to Item No. 6, above.

21. *Also, effluent from the septic tanks will contribute to groundwater pollution, at least in some measure because the effluent travels downwards until it reaches the water table. Septic tank waste does contain nutrients and possible pathogens. However, we acknowledged that the proposed development meets the county wastewater regulations, which allow septic tanks in low density subdivisions.*

We acknowledge your comment that septic tanks are an accepted method for the disposal of wastewater that complies with County and State regulatory requirements.

Solid Waste (p. 3-49 - 3-50)

22. *The landfills capacity is given in cubic yards of space, but the amount of waste generated by the proposed development is given in pounds per day. This makes it difficult to determine how much of the landfill's capacity is taken up by the waste stream generated by the proposed project. It would be helpful if the authors convert one or the other measure or give a rough equivalent so that a calculation can be made.*

The DEIS, Section 3.5.6, Solid Waste, notes that the proposed Waikoloa Highlands subdivision is estimated to have an average population at build out of 1,068 persons (The Hallstrom Group, 2006). Using the federal Environmental Protection Agency's per capita estimate of 4.5 pounds of municipal solid waste (MSW) generated per day, the subdivision residents will generate approximately 4,806 pounds of MSW per day. We will provide further information for this section in the FEIS, Page 3-55, that the projected solid waste volume per year is approximately 2,192 cubic yards (1068 persons x 4.5 pounds per person per day = 877.09 tons per year x 1.25 cover factors x 2 cubic yard conversion = 2,192 cubic yards per year).

23. *The DEIS states in the last paragraph that given the "projected capacity of the County landfill, the project is not expected to have an adverse impact on the landfill." Although the amount of solid waste generates [sic] by the development is small it will have an adverse impact on the landfill, it will help fill it up and shorten the life of the facility.*

We acknowledge that given the current and projected capacity of the County landfill, that the proposed project is not expected to have an adverse impact. However, the developer recognizes that it is in the interest of the greater community to encourage recycling and composting to reduce and divert materials from the waste stream thereby helping to prolong the life of the landfill.

The FEIS, Section 3.5.6, Solid Waste, Page 3-55, will begin this process of appropriately managing the solid waste issues associated with the proposed project through the preparation of a Solid Waste Management Plan for review by the County Department of Environmental Management.

24 *The DEIS mentions that 'the project's developers will encourage practices such as recycling and composting to reduce and divert materials from the waste stream." What will the developer do to encourage this behavior?*

Please see our response to Item No. 23, above.

25 *It would be helpful to show the service areas of each of the public services discussed in this section. Each fire station, for example, has a service area which it covers. The same can be said for police and emergency medical service. It would be helpful to see what these areas are in relation to the proposed*

development. It would also be helpful to know the capacity of these services and how much of that capacity the proposed development will take up. The discussion on the schools on page 3-53 is a good example of haw each of these services should be discussed

The FEIS, Section 3.6, Public Services and Facilities, will revise the DEIS with a figure depicting the general locations of police facilities, fire facilities, emergency services, recreation facilities and schools. The map will be referenced in the FEIS, as Figure 21, Public Facilities, Page 3-57.

26. *The DEIS noted on the bottom of page 3-52 that Waikoloa is currently underserved by parks. The proposed subdivision will worsen this situation. This could be mitigated by building a small neighborhood park in the open areas planned for the subdivision. This would enhance the attractiveness of the subdivision to potential buyers.*

As stated in our response to Comment No. 12 above, the developer is required to contribute approximately $1.9 million to the County of Hawai'i for the purposes of developing recreation facilities.

Thank you for taking the time to share your comments and allowing us this opportunity to respond. Any further written comments may be directed to the undersigned.

Sincerely,

Brian Takeda
for
Chester Koga, AICP

cc: Waikoloa Mauka LLC
Imanaka Kudo & Fujimoto

Harry Kim
Mayor

County of Hawaii
PLANNING DEPARTMENT
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Christopher J. Yuen
Director

Brad Kurokawa, ASLA
LEED® AP
Deputy Director

November 24, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, # 411
Honolulu, HI 96817

Dear Mr. Koga:

Draft Environmental Impact Statement
Waikoloa Highlands
<u>TMK: (3) 6-8-2:16 (portion)</u>

We have reviewed the Draft Environmental Impact Statement (DEIS) and have the following comments:

1. Throughout the document, reference is made to Change of Zone Ordinance No. <u>95</u>-157. The correct Ordinance No. is <u>05</u>-157. This ordinance amended Ordinance No. 95-51, which amended Ordinance No. 90-160. We suggest that the referenced ordinances (90-160, 95-51 and 05-157) be attached as Appendices. Enclosed for your information and use are copies of the ordinances.

2. There is a discrepancy as to the number of lots proposed. Page ES-1 states that the project will include 398 one-acre sized lots. However, on page 2-7 (section 2.5), 286 one to two-acre lots are proposed. Please make the necessary correction as to the number of lots proposed.

3. On page ES-1 (Proposed Action), the second sentence referenced a <u>744.40- acre project site</u>. However, the next sentence states that the area to be reclassified is <u>731.581 acres</u>. Please explain this discrepancy.

4. On the top of page 3-2, reference is made to "Richard Smart, <u>present</u> owner of Parker Ranch." Mr. Smart has passed on.

5. Section 3.2.3 on page 3-2 states that the lease for Puu Hinai cinder quarry was terminated. Is this the quarry that Edwin DeLuz Trucking and Gravel LLC received an extension last year to operate under Special Permit 70-85?

6. Page 3-35 (3rd paragraph) states that Cultural Surveys Hawaii, in their 2006 review, noted that *"It seems odd that a site nearly 150 feet long that presumably had been around for many decades could disappear in the course of 18 years. It also, however, seems unlikely the Jensen crew would have missed Site 22. Perhaps, it lies farther afield."* Has someone done a futher survey to determine the location of Site 22?

Thank you allowing us to comment on the DEIS. We look forward to receiving a copy of the Final EIS. Should you have any questions regarding our comments, please contact Norman Hayashi of this office at (808) 961-8288 x205.

Sincerely,

CHRISTOPHER J. YUEN
Planning Director

Enclosures – Ordinance Nos. 90-160, 95-51, 05-157

cc: Anthony Ching, Executive Officer, State Land Use Commission
Kevin C. Kellow, Manager, Waikoloa Mauka, LLC
Benjamin Kudo, Esq.

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January 31, 2007

Mr. Christopher Yuen, Director
Planning Department
County of Hawaii
25 Aupuni Street, Suite 13
Hilo, Hawai'i 96720

Dear Mr. Yuen:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 24, 2006 relating to the subject project. We offer the following responses to your inquiries:

1. Reference to Ordinance 05-157. We will correct references in the Final EIS relating to Ordinance 05-157. Further, the references provided by your Department will be appended to the Final EIS.

2. Number of Lots. The proposed project is for 398 lots as stated on page ES-1. The reference to 286 lots (page 2-7) was for an alternative that was considered but rejected.

3. The differences in area, 744.40 acres versus 731.581 acres. The project plans have been modified since the issuance of the Draft EIS. The project area and the Land Use Boundary Petition Area are now 731.581 acres, not 744.40 acres. The Boundary Amendment Petition is requesting the redesignation of 731,358 acres from the State Agricultural District to the State Rural District.

4. Page 3-2. We will correct the reference to lands owned by Parker Ranch.

5. Section 3.2.3, page 3-2. The Draft EIS incorrectly stated that the lease for quarrying at Pu'u Hinai was terminated. We will correct this reference in the Final EIS.

6. Page 3-35 relating to survey of Site 22. Archaeologist from Cultural Surveys Hawai'i conducted additional surveys since the publication of the Draft EIS of the project area and have not been able to locate the site identified by Bevaqua (1972), however, the site identified by Jensen was located and features noted (see Appendix E, page 12).

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka LLC

COUNTY OF HAWAII STATE OF HAWAII

BILL NO. 354

ORDINANCE NO. 90 160

AN ORDINANCE AMENDING SECTION 25-95A (NORTH AND SOUTH KOHALA DISTRICTS ZONE MAP) AND SECTION 25-95H (WAIKOLOA VILLAGE ZONE MAP) ARTICLE 3, CHAPTER 25 (ZONING CODE) OF THE HAWAII COUNTY CODE, BY CHANGING THE DISTRICT CLASSIFICATION FROM UNPLANNED (U) AND MULTIPLE FAMILY RESIDENTIAL (RM-1.5) TO OPEN (O) AND RESIDENTIAL-AGRICULTURAL (RA-1a) AT WAIKOLOA, SOUTH KOHALA, HAWAII, COVERED BY TAX MAP KEY 6-8-02:PORTION OF 16 AND 6-8-03:PORTION OF 32.

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

SECTION 1. Section 25-95A, Article 3, Chapter 25 (Zoning Code) of the Hawaii County Code, is amended to change the district classification of properties described hereinafter as follows:

The district classification of the following area situated at Waikoloa, South Kohala, Hawaii, shall be Residential-Agricultural (RA-1a):

PARCEL A:

Beginning at the Southeast corner of this parcel of land, on the Southwesterly side of Waikoloa Road, the coordinates of which referred to Government Survey Triangulation Station "PUU HINAI" being 1,933.36 feet North and 2,611.01 feet East, and running by azimuths measured clockwise from true South:

1.	27°	56'	00"	1,777.88	feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
2.	98°	52'	20"	408.28	feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
3.	135°	05'	56"	2,023.07	feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
4.	87°	40'	00"	27.80	feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
5.	3°	20'	00"	24.45	feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

6. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the right with a radius of 1200.00 feet, the chord azimuth and distance being:

30° 35' 00" 1,098.90 feet;

7.	57°	50'	00"	440.00	feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

8. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 720.00 feet, the chord azimuth and distance being:

38° 46' 00" 470.40 feet;

9.	19°	42'	00"	1,301.88 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
10.	160°	02'	36"	95.45 feet along Lot 3, Waikoloa Development, File Plan 1172;
11.	124°	52'	31"	2,011.22 feet along Lot 3, Waikoloa Development, File Plan 1172;
12.	196°	43'	02"	2,730.87 feet along Lot 3, Waikoloa Development, File Plan 1172;
13.	347°	04'	00"	584.90 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
14.	307°	46'	00"	593.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
15.	0°	00'	00"	115.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
16.	314°	06'	00"	400.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
17.	295°	38'	00"	512.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
18.	266°	18'	00"	720.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

19.	210°	25'	00"	570.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
20.	166°	36'	00"	74.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
21.	147°	12'	00"	172.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
22.	93°	20'	00"	70.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
23.	38°	30'	00"	234.72 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
24.	68°	50'	00"	341.39 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
25.	110°	00'	00"	780.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
26.	119°	28'	00"	115.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
27.	131°	20'	00"	570.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;
28.	167°	04'	00"	346.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

29. 157° 36' 00" 185.31 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

30. 154° 22' 00" 550.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

31. 244° 12' 00" 119.90 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

32. 285° 16' 00" 304.53 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

33. 309° 10' 00" 380.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

34. 283° 46' 00" 130.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

35. 193° 46' 00" 368.75 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

36. 102° 38' 00" 214.76 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

37. 185° 42' 00" 190.12 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

38. 161° 18' 00" 941.20 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

39. 123° 38' 00" 899.98 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

40. 211° 44' 00" 510.12 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

41. 263° 34' 00" 586.98 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

42. 200° 30' 00" 906.27 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

43. 108° 03' 00" 749.90 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

44. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the right with a radius of 360.00 feet, the chord azimuth and distance being:

113° 01' 44" 62.49 feet;

45. 21° 58' 00" 700.74 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

46. 25° 53' 00" 447.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

47. 16° 24' 00" 414.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

48. 119° 30' 00" 246.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

49. 140° 19' 00" 590.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

50. 137° 43' 00" 257.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

51. 230° 36' 00" 757.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

52. 202° 00' 00" 760.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

53. 197° 00' 00" 197.04 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

54. 218° 00' 00" 267.26 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

55. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 400.00 feet, the chord azimuth and distance being:

111° 05' 00" 331.54 feet;

56. 86° 36' 00" 38.27 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

57. 0° 42' 00" 227.69 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

58. 40° 26' 00" 390.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

59. 22° 00' 00" 516.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

60. 76° 14' 00" 273.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

61. 198° 03' 09" 1,228.12 feet along Lot 2 and Lot 1 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

62. Thence along the Southeasterly side of Puu Melia Road, on a curve to the left with a radius of 630.00 feet, the chord azimuth and distance being:

28° 02' 49" 114.54 feet;

63. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 30.00 feet, the chord azimuth and distance being:

350° 26' 20.5" 40.45 feet;

64. 308° 02' 49" 45.13 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

65. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 300.00 feet, the chord azimuth and distance being:

287° 19' 24.5" 212.31 feet;

66. 266° 36' 00" 604.24 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

67. 256° 32' 00" 733.17 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

68. 18° 03' 09" 1,383.49 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

69. 288° 03' 09" 225.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

70. 288° 03' 00" 160.35 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

71. 219° 08' 00" 435.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

72. 200° 46' 00" 365.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

73. 230° 58' 00" 463.49 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

74. 172° 30' 00" 201.81 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

75. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the right with a radius of 410.00 feet, the chord azimuth and distance being:

187° 07' 00" 206.93 feet;

76. 201° 44' 00" 23.09 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

77. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 30.00 feet, the chord azimuth and distance being:

156° 44' 03.5" 42.43 feet;

78. 291° 44' 07" 700.57 feet along the Southwesterly side of Waikoloa Road;

79. Thence along the southwesterly side of Waikoloa Road, on a curve to the right with a radius of 910.00 feet, the chord azimuth and distance being:

336° 31' 44.5" 1,282.29 feet;

80. 21° 19' 22" 982.30 feet along the Southwesterly side of Waikoloa Road;

81. Thence along the Southwesterly side of Waikoloa Road, on a curve to the left with a radius of 840.00 feet, the chord azimuth and distance being:

353° 57' 41" 772.13 feet;

82. 108° 50' 00" 362.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

83. 32° 28' 00" 770.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

84. 52° 42' 00" 701.33 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

85. 4° 20' 00" 92.76 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

86. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the right with a radius of 2,030.00 feet, the chord azimuth and distance being:

9° 03' 00" 333.85 feet

87. 13° 46' 00" 85.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

88. 283° 46' 00" 364.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

89. 189° 14' 00" 484.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

90. 236° 26' 00" 540.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

91. 206° 34' 00" 506.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

92. 255° 10' 00" 70.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

93. 313° 58' 00" 506.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

94. 302° 46' 00" 520.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

95. 327° 58' 00" 184.96 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

96. 64° 00' 00" 187.18 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

97. 79° 28' 00" 230.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

98. 45° 34' 00" 716.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

99. 15° 26' 00" 812.89 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

100. 315° 06' 00" 298.74 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

101. 3° 20' 00" 81.77 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

102. 273° 20' 00" 70.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

103. 183° 20' 00" 90.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

104. 147° 38' 00" 150.39 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

105. 204° 08' 00" 691.97 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

106. 219° 14' 00" 718.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

107. 289° 32' 00" 276.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

108. 257° 08' 00" 467.87 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

109. Thence along the Southwesterly side of Waikoloa Road, on a curve to the left with a radius of 2,090.00 feet, the chord azimuth and distance being:

324° 37' 57" 692.32 feet;

110. 315° 05' 56" 1,029.38 feet along the Southwesterly side of Waikoloa Road;

111. Thence along the Southwesterly side of Waikoloa Road, on a curve to the left with a radius of 2,090.00 feet, the chord azimuth and distance being:

306° 30' 58" 623.82 feet

to the point of beginning and containing an area of 532.608 Acres. (Refer to Parcel A as shown on Exhibit "A")

The district classification of the following area situated at Waikoloa, South Kohala, Hawaii shall be Open (O):

PARCEL B:

Beginning at the North corner of this parcel of land, on the Southerly side of Waikoloa Road, the coordinates of which referred to Government Survey Triangulation Station "PUU HINAI" being 8,417.43 feet North and 1,916.32 feet West, and running by azimuths measured clockwise from true South:

1. 291° 44' 07" 861.23 feet along the Southerly side of Waikoloa Road;

2. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the right with a radius of 30.00 feet, the chord azimuth and distance being:

336° 44' 03.5" 42.43 feet;

3. 21° 44' 00" 23.09 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

4. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 410.00 feet, the chord azimuth and distance being:

7° 07' 00" 206.93 feet;

5. 352° 30' 00" 201.81 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

6. 50° 58' 00" 463.49 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

7. 20° 46' 00" 365.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

8. 39° 08' 00" 435.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

9. 108° 03' 00" 160.35 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

10. 198° 03' 09" 200.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172 (Hawaii Electric Light Company Lot);

11. 108° 03' 09" 150.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172 (Hawaii Electric Light Company Lot);

12. 18° 03' 09" 200.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172 (Hawaii Electric Light Company Lot);

13. 108° 03' 09" 75.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

14. 198° 03' 09" 1,383.49 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

15. 76° 32' 00" 733.16 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

16. 86° 36' 00" 604.24 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

17. Thence along remainder of Lot 2B, Waikoloa Development, Fuel Plan 1172, on a curve to the right with a radius of 300.00 feet, the chord azimuth and distance being:

107° 19' 24.5" 212.31 feet;

18. 128° 02' 49" 45.13 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

19. Thence along remainder of Lot 2B, Waikoloa Devlopment, File Plan 1172, on a curve to the right with a radius of 30.00 feet, the chord azimuth and distance being:

170° 26' 20.5" 40.45 feet;

20. Thence along the Easterly side of Puu Melia Road, on a curve to the left with a radius of 630.00 feet, the chord azimuth and distance being:

205° 26' 30.5" 162.05 feet;

21. 259° 46' 00" 1,406.63 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172 to the point of beginning and containing an area 34.192 Acres. (Refer to Parcel B as shown on Exhibit "A")

The district classification of the following area situated at Waikoloa, South Kohala, Hawaii shall be Open (O):

PARCEL C:

Beginning at the Northwest corner of this parcel of land, on the Southeast corner of Lot 2, Waikoloa RM 1.5, Unit 1, File Plan 1378, the coordinates of which referred to Government Survey Triangulation Station "PUU HINAI" being 6,763.33 feet North and 3,821.37 feet West, and running by azimuths measured clockwise from true South:

1. 256° 14' 00" 273.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

2. 202° 00' 00" 516.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

3. 220° 26' 00" 390.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

4. 180° 42' 00" 227.69 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

5. 266° 36' 00" 38.27 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

6. Thence along remainder of Lot 2B, Waikoloa Devlopment, File Plan 1172, on a curve to the right with a radius of 400.00 feet, the chord azimuth and distance being:

291° 05' 00" 331.54 feet;

7. 38° 00' 00" 267.26 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

8. 17° 00' 00" 197.04 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

9. 22° 00' 00" 760.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

10. 50° 36' 00" 757.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

11. 317° 43' 00" 257.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

12. 320° 19' 00" 590.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

13. 299° 30' 00" 246.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

14. 196° 24' 00" 414.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

15. 205° 53' 00" 447.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

16. 201° 58' 00" 700.74 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

17. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 360.00 feet, the chord azimuth and distance being:

293° 01' 44" 62.49 feet;

18. 288° 03' 00" 749.90 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

19. 20° 30' 00" 906.27 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

20. 83° 34' 00" 586.98 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

21. 31° 44' 00" 510.12 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

22. 303° 38' 00" 899.98 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

23. 341° 18' 00" 941.20 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

24. 5° 42' 00" 190.12 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

25. 282° 38' 00" 214.76 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

26. 13° 46' 00" 368.75 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

27. 103° 46' 00" 130.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

28. 129° 10' 00" 380.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

29. 105° 16' 00" 304.53 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

30. 64° 12' 00" 119.90 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

31. 334° 22' 00" 550.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

32. 337° 36' 00" 185.31 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

33. 347° 04' 00" 346.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

34. 311° 20' 00" 570.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

35. 299° 28' 00" 115.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

36. 290° 00' 00" 780.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

37. 248° 50' 00" 341.39 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

38. 218° 30' 00" 234.72 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

39. 273° 20' 00" 70.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

40. 327° 12' 00" 172.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

41. 346° 36' 00" 74.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

42. 30° 25' 00" 570.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

43. 86° 18' 00" 720.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

44. 115° 38' 00" 512.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

45. 134° 06' 00" 400.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

46. 180° 00' 00" 115.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

47. 127° 46' 00" 593.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

48. 167° 04' 00" 584.90 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

49. 196° 43' 02" 328.43 feet long Lot 3, Waikoloa Development, File Plan 1172;

50. 150° 55' 16" 3,143.20 feet long Lot 3, Waikoloa Development, File Plan 1172;

51. 198° 03' 09" 827.03 feet along Lot 5, Waikoloa RM 1.5, Unit 1, File Plan 1378 to the point of beginning and containing an area of 120.570 Acres. (Refer to Parcel C as shown on Exhibit "A")

The district classification of the following area situated at Waikoloa, South Kohala, Hawaii shall be Open (O):

PARCEL D:

Beginning at the Northwest corner of this parcel of land, on the Southwesterly side of Waikoloa Road, the coordinates of which referred to Government Survey Triangulation Station "PUU HIMAI" being 4,979.96 feet North and 230.81 feet West, and running by azimuths measured clockwise from true South:

1. Along the Southwesterly side of Waikoloa Road, on a curve to the left with a radius of 840.00 feet, the chord azimuth and distance being:

311° 14' 42" 444.86 feet;

2. 295° 53' 24" 250.22 feet along the Southwesterly side of Waikoloa Road;

3. Thence along the Southwesterly side of Waikoloa Road, on a curve to the right with a radius of 910.00 feet, the chord azimuth and distance being:

316° 58' 38.5" 654.82 feet;

4. 338° 03' 53" 399.34 feet along the Southwesterly side of Waikoloa Road;

5. Thence along the Southwesterly side of Waikoloa Road, on a curve to the left with a radius of 2,090.00 feet, the chord azimuth and distance being:

336° 06' 55.5" 142.18 feet;

6. 77° 08' 00" 467.87 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

7. 109° 32' 00" 276.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

8. 39° 14' 00" 718.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

9. 24° 08' 00" 691.97 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

10. 327° 38' 00" 150.39 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

11. 3° 20' 00" 90.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

12. 93° 20' 00" 70.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

13. 183° 20' 00" 81.77 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

14. 135° 06' 00" 298.74 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

15. 195° 26' 00" 812.89 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

16. 225° 34' 00" 716.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

17. 259° 28' 00" 230.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

18. 244° 00' 00" 187.18 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

19. 147° 58' 00" 184.96 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

20. 122° 46' 00" 520.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

21. 133° 58' 00" 506.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

22. 75° 10' 00" 70.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

23. 26° 34' 00" 506.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

24. 56° 26' 00" 540.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

25. 9° 14' 00" 484.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

26. 103° 46' 00" 364.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

27. 193° 46' 00" 85.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

28. Thence along remainder of Lot 2B, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 2,030.00 feet, the chord azimuth and distance being:

189° 03' 00" 333.85 feet;

29. 184° 20' 00" 92.76 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

30. 232° 42' 00" 701.33 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

31. 212° 28' 00" 770.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172;

32. 288° 50' 00" 362.00 feet along remainder of Lot 2B, Waikoloa Development, File Plan 1172 to the point of beginning and containing an area of 43.518 Acres. (Refer to Parcel D as shown on Exhibit "A")

SECTION 2. Section 25-95H, 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 Waikoloa, South Kohala, Hawaii shall be Open (O):

PARCEL E:

Beginning at the Northeast corner of this parcel of land, on the Southeast corner of Lot 2, Waikoloa RM 1.5, Unit 1, File Plan 1378, the coordinates of which referred to Government Survey Triangulation Station "PUU HINAI" being 6,763.33 feet North and 3,821.37 feet West, and running by azimuths measured clockwise from true South:

1. 18° 03' 09" 827.03 feet along Lot 2B of Waikoloa Development, File Plan 1172;

2. Thence along Lot 3, Waikoloa Development, File Plan 1172, on a curve to the left with a radius of 2,900.00 feet, the chord azimuth and distance being:

130° 19' 05.5" 1,282.88 feet;

3. 117° 32' 22" 952.00 feet along Lot 3 of Waikoloa Development, File Plan 1172;

4. 207° 32' 00" 260.00 feet along remainder of Lot 5 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

5. 247° 48' 00" 777.48 feet along remainder of Lot 5 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

6. 324° 03' 36" 30.17 feet along the Westerly side of Puu Melia Road;

7. 27° 32' 22" 87.91 feet along Lot 4 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

8. 325° 42' 30" 127.67 feet along Lot 4 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

9. 352° 13' 50" 98.31 feet along Lot 4 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

10. 3° 46' 00" 144.58 feet along Lot 4 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

11. 304° 37' 35" 78.70 feet along Lot 4 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

12. 291° 52' 20" 179.87 feet along Lot 4 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

13. 298° 45' 00" 108.48 feet along Lot 4 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

14. 264° 02' 05" 203.62 feet along Lots 4 and 3A of Waikoloa RM 1.5, Unit 1, File Plan 1378;

15. 302° 41' 35" 68.70 feet along Lot 3A of Waikoloa RM 1.5, Unit 1, File Plan 1378;

16. 281° 00' 00" 72.77 feet along Lot 3A of Waikoloa RM 1.5, Unit 1, File Plan 1378;

17. 301° 22' 15" 110.23 feet along Lot 3B of Waikoloa RM 1.5, Unit 1, File Plan 1378;

18. 312° 55' 00" 127.57 feet along Lot 3B of Waikoloa RM 1.5, Unit 1, File Plan 1378;

19. 287° 10' 00" 96.36 feet along Lot 3B of Waikoloa RM 1.5, Unit 1, File Plan 1378;

20. 348° 09' 45" 71.37 feet along Lot 3B of Waikoloa RM 1.5, Unit 1, File Plan 1378;

21. 312° 49' 15" 146.55 feet along Lots 3B and 2 of Waikoloa RM 1.5, Unit 1, File Plan 1378;

22. 280° 18' 30" 127.50 feet along Lot 2 of Waikoloa RM 1.5, Unit 1, File Plan 1378 to the point of beginning and containing an area of 29.609 Acres. (Refer to Parcel E as shown on Exhibit "A")

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

SECTION 3. These changes in district classification are conditioned upon the following: (A) the applicant, successors or its assigns shall be responsible for complying with all of

the stated conditions of approval: (B) the RA zoned area shall be subdivided in three increments. The first and second increment shall consist of a maximum of 175 one-acre lots each and the third increment, the remaining area. Subdivision plans shall be submitted for successive increments only after development has occurred in the preceding 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 lots proposed for the first increment. In lieu of actual construction, the applicant may enter into an agreement with the Planning Department 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 Planning Department. Upon final execution of such agreement and filing of the security with the County, subdivision plans for the next increment may be submitted prior to the actual construction of the dwellings in the first increment; (C) subdivision plans for the first increment shall be submitted within one year from the effective date of the change of zone. Final subdivision approval shall be secured within one year from the date of receipt of tentative subdivision approval. Plans for infrastructural improvements,

including off-site roadway improvements, shall be submitted in conjunction with construction drawings for final subdivision approval of the first increment; (D) access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to one roadway from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized meeting with the requirements of the Department of Public Works. These improvements together with other roadway improvements required by the Department of Public Works based upon a Traffic Impact Analysis Report dated December 1989 shall be provided prior to opening of the golf course or in conjunction with final subdivision approval of the first increment, whichever occurs first, or as otherwise provided by Chapter 23 (Subdivision Control); (E) to ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall secure the concurrence of the County Housing Agency, upon the recommendation of the Office of Housing and Community Development, that the applicant's affordable housing requirements, if any, have been fulfilled prior to the issuance of final subdivision approval; (F) a drainage system shall be installed in accordance with the requirements of the Department of Public Works and other affected agencies; (G) comply with all applicable laws, rules, regulations and requirements, including conditions of Use Permit No. 71; (H) 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 may, at the developer's election, be satisfied by performance in accordance with the requirements of the Unified Impact Fees Ordinance; (I) an annual progress report shall be submitted to the Planning Director prior to the anniversary date of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied and the Planning Director acknowledges that further reports are not required; and, (J) an 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 applicant, 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 shall initiate rezoning of the area to its original or more appropriate designation.

SECTION 4. In the event that any portion of this ordinance is declared invalid, such invalidity shall not affect the other parts of this ordinance.

SECTION 5. This ordinance shall take effect upon its approval.

INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAII

Hilo, Hawaii

Date of Introduction: December 5, 1990
Date of 1st Reading: December 5, 1990
Date of 2nd Reading: December 19, 1990
Effective Date: December 27, 1990

JOHN A. WAGNER
County Clerk

ROBERT S. SHIOJI
Deputy County Clerk

HARRY A. TAKAHASHI
Legislative Auditor

OFFICE OF THE COUNTY CLERK
County of Hawaii
Hawaii County Building
25 Aupuni Street
Hilo, Hawaii 96720

NOTE

On Bill No. 354, Ordinance No. 90-160, reference is made to a map attached hereto, marked Exhibit "A".

Said Exhibit is not part of the duplicate copies of this ordinance, due to its size, but is available for viewing in the Office of the County Clerk.

If further information is needed, call 961-8255.

John A. Wagner
COUNTY CLERK

COUNTY OF HAWAII STATE OF HAWAII

BILL NO. 34
(Draft 2)

ORDINANCE NO. 95 51

AN ORDINANCE AMENDING SECTION 25-95A (NORTH AND SOUTH KOHALA DISTRICTS ZONE MAP) AND SECTION 25-95H (WAIKOLOA VILLAGE ZONE MAP), ARTICLE 3, CHAPTER 25 (ZONING CODE) OF THE HAWAII COUNTY CODE, RELATING TO THE MODIFICATION OF CONDITIONS B AND C OF ORDINANCE NO. 90-160, WHICH RECLASSIFIED APPROXIMATELY 761 ACRES OF LAND FROM AN UNPLANNED (U) AND MULTIPLE FAMILY RESIDENTIAL (RM-1.5) TO OPEN (O) AND RESIDENTIAL-AGRICULTURAL (RA-1a) AT WAIKOLOA, SOUTH KOHALA, HAWAII, COVERED BY TAX MAP KEY 6-8-02: PORTION OF 16 AND 6-8-03: PORTION OF 32.

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

SECTION 1. Ordinance No. 90-160 is amended as follows:

"SECTION 3. This change in district classification is conditioned upon the following:

A. The applicant, successors or its assigns shall be responsible for complying with all of the stated conditions of approval;

[B. the RA zoned area shall be subdivided in three increments. The first and second increment shall consist of a maximum of 175 one-acre lots each and the third increment, the remaining area. Subdivision plans shall be submitted for successive increments only after development has occurred in the preceding 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 lots proposed for the first increment. In lieu of actual construction, the applicant may enter into an agreement with the Planning Department 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 Planning Department. Upon final execution of such agreement and filing of the security with the County, subdivision plans for the next increment may be submitted prior to the actual construction of the dwellings in the first increment;]

[C]B. [Subdivision plans for the first increment shall be submitted within one year from the effective date of the change of zone.] Final subdivision approval for not less than 175 lots shall be secured within [one year from the date of receipt of tentative subdivision approval] five (5) years from the effective date of this amendment. Plans for infrastructural improvements, including off-site roadway improvements required in Condition C, shall be submitted in conjunction with construction drawings for final subdivision approval [of the first increment] for any portion of the subject property. Prior to June 30, 1996, construction of the channelization improvements to the Waikoloa/Pua Melia/Paniolo Avenue intersection (including acceleration/deceleration and left turn storage lanes and pavement and shoulder widening) meeting with the requirements of the Department of Public Works, shall be completed and dedicated to the county. In addition, the applicant shall install and dedicate the traffic signalization improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the chief engineer. In lieu of actual construction of infrastructural improvements required herein, except for

Condition C, the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements;

[D]C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to one roadway from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized meeting with the requirements of the Department of Public Works. These improvements together with other roadway improvements required by the Department of Public Works based upon a Traffic Impact Analysis Report dated December 1989 shall be provided prior to opening of the golf course or in conjunction with final subdivision approval of the first increment, whichever occurs first, or as otherwise provided by Chapter 23 (Subdivision Control);

[E]D. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall secure the concurrence of the County Housing Agency, upon the recommendation of the Office of Housing and Community Development, that the applicant's affordable housing requirements, if any, have been fulfilled prior to the issuance of final subdivision approval;

[F]E. A drainage system shall be installed in accordance with the requirements of the Department of Public Works and other affected agencies;

[G]F. Comply with all applicable laws, rules, regulations and requirements, including conditions of Use Permit No. 71;

[H]G. 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 may, at the developer's election, be satisfied by performance in accordance with the requirements of the Unified Impact Fees Ordinance;

[I]G. An annual progress report shall be submitted to the Planning Director prior to the anniversary date of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied and the Planning Director acknowledges that further reports are not required;

[J]H. An 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 applicant, 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 shall 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 this ordinance is declared invalid, such invalidity shall not affect the other parts of this ordinance.

SECTION 4. This Ordinance shall be effective upon its approval.

INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAII

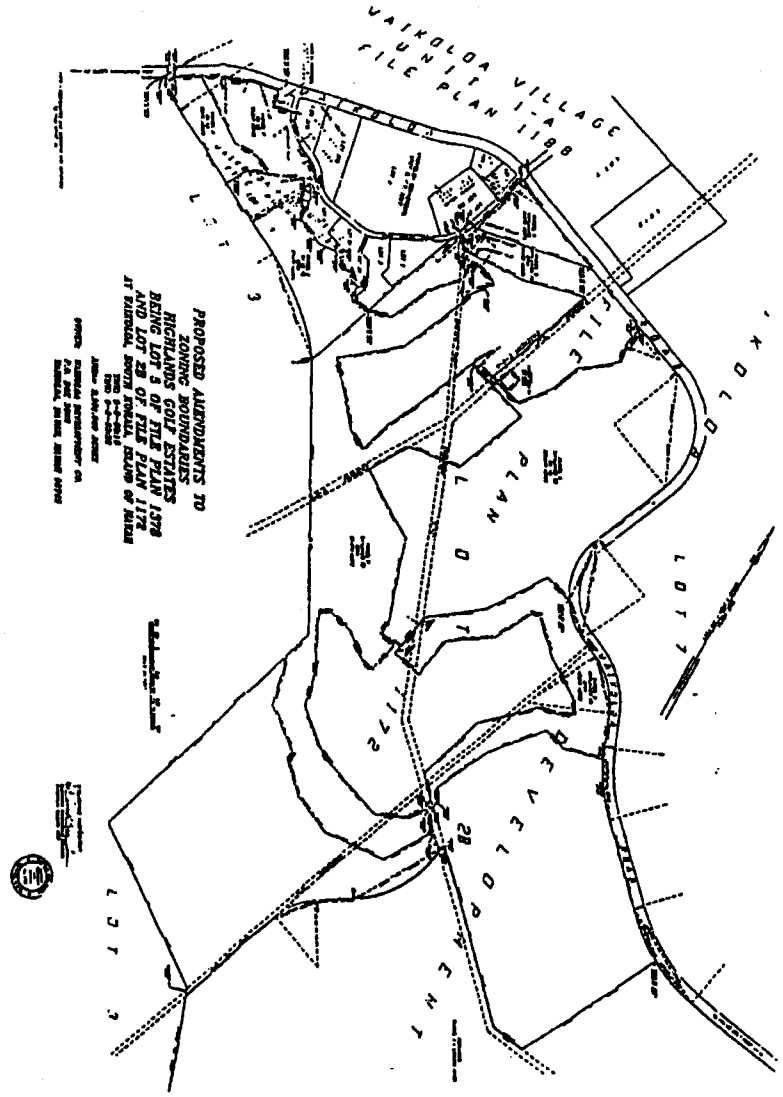
Hilo, Hawaii

Date of Introduction: March 1, 1995
Date of 1st Reading: March 1, 1995
Date of 2nd Reading: March 15, 1995
Effective Date: March 21, 1995

APPROVED AS TO FORM AND LEGALITY:

CORPORATION COUNSEL

DATED: 3/10/95



OFFICE OF THE COUNTY CLERK
County of Hawaii
Hilo, Hawaii

(DRAFT 2)

Introduced By: Keole Childs
Date Introduced: March 1, 1995
First Reading: March 1, 1995
Published: N/A

REMARKS:

ROLL CALL VOTE				
	AYES	NOES	ABS	EX
Arakaki	X			
Bonk-Abramson	X			
Childs	X			
De Lima	X			
Domingo			X	
Osorio	X			
Rath	X			
Ray	X			
Smith	X			
	8	0	1	0

Second Reading: March 15, 1995
To Mayor: March 16, 1995
Returned: March 21, 1995
Effective: March 21, 1995
Published: March 28, 1995

REMARKS:

ROLL CALL VOTE				
	AYES	NOES	ABS	EX
Arakaki	X			
Bonk-Abramson	X			
Childs	X			
De Lima	X			
Domingo	X			
Osorio	X			
Rath	X			
Ray	X			
Smith	X			
	9	0	0	0

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

APPROVED as to FORM and LEGALITY
CORPORATION COUNSEL
COUNTY OF HAWAII
Date MAR 2 0 1995

COUNCIL CHAIRMAN

COUNTY CLERK

Approved / Disapproved this 21 *day of* March, 19 95.

MAYOR, COUNTY OF HAWAII

Bill No.: 34 (Draft 2)
Reference: C- 158/PC-33
Ord. No.: 95 51

COUNTY OF HAWAI'I STATE OF HAWAI'I

BILL NO. 89
Draft 3

ORDINANCE NO. 05 157

AN ORDINANCE AMENDING ORDINANCE NO. 95 51 AMENDING ORDINANCE NO. 90-160, WHICH RECLASSIFIED LANDS FROM AN UNPLANNED (U) AND MULTIPLE FAMILY RESIDENTIAL (RM-1.5) TO OPEN (O) AND RESIDENTIAL-AGRICULTURAL (RA-1a) AT WAIKOLOA, SOUTH KOHALA, HAWAI'I, COVERED BY TAX MAP KEY 6-8-02:PORTION OF 16 AND 6-8-03:PORTION OF 32.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAI'I:

SECTION 1. Ordinance No. 95 51 is amended as follows:

"SECTION 3. This change in district classification is conditioned upon the following.

A. The applicant, successors or its assigns shall be responsible for complying with all of the stated conditions of approval;

B. Final subdivision approval for not less than 175 lots shall be secured within [~~five (5)~~] ten (10) years from the effective date of this new amendment. Plans for infrastructural improvements, including off-site roadway improvements required in Condition C, shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property. [~~Prior to June 30, 1996, construction of the channelization improvements to the Waikoloa/ Pua Melia/ Paniolo Avenue intersection (including acceleration/ deceleration and left turn storage lanes and pavement and shoulder widening) meeting with the requirements of the Department of Public Works, shall be completed and dedicated to the county. In addition,~~] The applicant shall install and dedicate the traffic signalization improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the [~~chief engineer~~]director of public works. In lieu of actual construction of infrastructural

improvements required herein, except for Condition C, the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.

C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to one roadway from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report ~~[dated December 1989]~~ shall be provided ~~[prior to the opening of the golf course or]~~ in conjunction with final subdivision approval of the first increment, ~~[whichever occurs first,]~~ or as otherwise provided by Chapter 23 (Subdivision Control);

D. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall comply with the requirements of Chapter 11, Article 1, Hawaii County Code relating to Affordable Housing Policy. This requirement shall be approved by the County Housing Agency prior to final subdivision approval. ~~[secure the concurrence of the County Housing Agency, upon the recommendation of the Office of Housing and Community Development, that the applicant's affordable housing requirements, if any, have been fulfilled prior to the issuance of final subdivision approval]~~;

E. A drainage system shall be installed in accordance with the requirements of the Department of Public Works and other affected agencies;

F. Comply with all applicable County, State and Federal laws, rules, regulations and requirements~~[, including conditions of Use Permit No. 71]~~;

G. ~~[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 may, at the developer's election, be satisfied by performance in accordance with the requirements of the Unified Impact Fees Ordinance;~~

~~G. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied and the Planning Director acknowledges that further reports are not required;~~

~~H. An extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances: The non-performance is the result of conditions that could not have been foreseen or are beyond the control of the applicant, successors or assigns, and that are not the result of their fault or negligence;~~

~~1. Granting of the time extension would not be contrary to the General Plan or Zoning Code;~~

~~2. Granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;~~

~~3. 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~~

~~4. 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,~~]

Restrictive covenants in the deeds of all proposed lots within the property shall give notice that the terms of the zoning ordinance prohibit the construction of a second dwelling unit and condominium property regimes on each 1-acre lot. This restriction may be removed by amendment of this ordinance by the County Council. The owner of the property may also, in addition, impose private covenants restricting the number of dwellings. A copy of the proposed covenant(s) to be recorded with the State Bureau of Conveyances shall be submitted to the Planing Director for review and approval prior to the issuance of Final Subdivision Approval. A copy of the recorded document shall be filed with the Planning Department upon its receipt from the Bureau of Conveyances;

H. Before final subdivision approval, applicant must obtain reclassification of the RA-1a zoned area from the State Land Use Commission to the Rural or Urban district. Prior to the submittal of plans for a grading or any associated permit for a golf course to the County for review and approval, the applicant shall consult with the Waikoloa Village Association and the County Council relative to the timing and propriety of such a use. This condition, except for the consultation requirement for any golf course, may be waived by the Planning Director, after consultation with Corporation Counsel, if an appellate judicial decision, or substantive change to Chapter 205, Hawaii Revised Statutes, clearly establishes the legality of this project in the Agricultural State Land Use district, including the residential uses of the lots;

I. The applicant shall make its fair share contribution to mitigate the potential regional impacts of the property with respect to parks and recreation, fire, police, solid waste disposal facilities and roads. The fair share contribution shall be initially based on the representations contained within the change of zone application and may be increased or reduced proportionally if the lot counts are adjusted. The fair share contribution shall become due and payable prior to receipt of Final Plan Approval or within five years from the effective date of this amended change of zone ordinance, whichever occurs first. The fair share contribution for each lot shall be based on a maximum density for each lot as

determined by the zoning resulting from this change of zone. The fair share contribution in a form of cash, land, facilities or any combination thereof shall be determined by the County Council. The fair share contribution may be adjusted annually beginning three years after the effective date of the amendment to the ordinance, based on the percentage change in the Honolulu Consumer Price Index (HCPI). The fair share contribution shall have a maximum combined value of $9,991.21 per single-family residential unit. Based upon the applicant's representation of intent to develop a total of one hundred and seventy five (175) single-family residential units, the indicated total of fair share contribution is $1,748,461.75 for the single-family residential units. However, the total amount shall be increased or reduced in proportion with the actual number of units according to the calculation and payment provisions set forth in this condition. The fair share contribution per single-family residential unit shall be allocated as follows:

- $4,817.93 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $843,137.75 to the County to support park and recreational improvements and facilities;
- $232.42 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $40,673.50 to the County to support police facilities;
- $459.06 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $80,335.50 to the County to support fire facilities;
- $200.98 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $35,171.50 to the County to support solid waste facilities;
- $4,280.82 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $749,143.50 to the County to support road and traffic improvements;

In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies and approval of the County Council;

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

K. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied with and the Planning Director acknowledges that further reports are not required;

L. Should any of the conditions not be met or substantially complied with in a timely fashion, the Director [~~shall~~] may initiate rezoning of the area to its original or more appropriate designation.

SECTION 2. Material to be deleted is bracketed and material to be added is underscored.

SECTION 3. In the event that any portion of this 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 HAWAI'I

INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAI'I

Kona, Hawai'i
Date of Introduction: November 22, 2005
Date of 1st Reading: November 22, 2005
Date of 2nd Reading: December 7, 2005
Effective Date: December 15, 2005

REFERENCE: Comm. 230.9

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŌANAO'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

December 8, 2006

Mr. Chester Koga
R. M. Towill Corporation
420 Waiakamilo Road, #411
Honolulu, HI 96817

DRAFT ENVIRONMENTAL IMPACT STATEMENT
APPLICANT – WAIKOLOA MAUKA, LLC
PROJECT: WAIKOLOA HIGHLANDS – RESIDENTIAL SUBDIVISION
TAX MAP KEY 6-8-002:016 (PORTION)

We have reviewed the subject Draft Environmental Impact Statement and have the following comments.

As the applicant has indicated that water will be provided via a private water system, we have no objection to the proposed application.

Pursuant to Section 23-84 of the Hawai'i County Code regulating subdivisions, the following minimum requirements must be complied with for subdivision approval:

1. Provide a water system designed to deliver water at adequate pressure and volume under peak-flow and fire-flow conditions in accordance with the Water System Standards, State of Hawai'i, and the Rules and Regulations of the Department of Water Supply. The water system shall include, but not be limited to, the installation of the necessary distribution pipelines, fire hydrants, and service laterals.

2. Submit construction plans to our Department for review and approval.

3. Pay a fee of four-tenths of one percent of the estimated cost for the construction of the water system, but not less than $50.00, to cover the costs for plan review, testing, and inspection.

Should there be any questions, please contact Mr. Finn McCall of our Water Resources and Planning Branch at 961-8070, extension 255.

Sincerely yours,

Milton D. Pavao, P.E.
Manager

FM:sco

copy – Waikoloa Mauka, LLC
Planning Department
State Land Use Commission, State of Hawai'i
Office of Environmental Quality Control

... Water brings progress...

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

January 31, 2007

Mr. Milton D. Pavao, P.E., Manager
Department of Water Supply
County of Hawai'i
345 Kekuanaoa Street, Suite 20
Hilo, Hawai'i 96720

Dear Mr. Pavao:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of December 8, 2006. We would like to offer the following responses to your comments.

As stated in the Draft EIS, water service will be provided to each lot in the subdivision by the West Hawai'i Utility Company. We have included additional information on the water system in Final EIS that includes:

1. The water system will be developed in accordance with the Water System Standards of the State of Hawai'i and the Department of Water Supply.
2. Construction plans will be submitted to your office when they become available.
3. Payment of a fee of four-tenths of one percent of the estimated costs for the construction of the water system, but not less than $50 to cover the costs of plan review, testing and inspection.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka, LLC

Harry Kim
Mayor

Barbara Bell
Director

Nelson Ho
Deputy Director

County of Hawaii
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
25 Aupuni Street, Room 210 • Hilo, Hawai'i 96720-4252
(808) 961-8083 • Fax (808) 961-8086
email: oshjem@co.hawaii.hi.us

November 27, 2006

Mr. Kevin Kellow, Manager
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, CA 91207

Subject: Waikoloa Highlands – Residential Subdivision
TMK:6-8-002:016 (portion)
Draft Environmental Impact Statement

Dear Mr. Kellow.

Following are our comments regarding the subject Draft EIS:

1) The Department's Solid Waste Management Plan Guidelines were incompletely reproduced as part of your Draft EIS document. The second page of the Solid Waste Management Plan Guidelines was not included. The complete document has been enclosed.

2) We are disappointed that you did not comply with our request to prepare a Solid Waste Management Plan. To say that "The future homeowners of this subdivision will develop its solid waste management plan along with the development of recycling program." is not a satisfactory response. Please submit a comprehensive plan that addresses the items in the Guidelines.

At a minimum, all projects in Hawai'i County must adhere to the following requirements:

- Commercial operations, State and Federal agencies, religious entities and non-profit organizations may not use transfer stations for disposal.
- Aggregates and any other construction/demolition waste should be responsibly reused to its fullest extent.
- Ample and equal room should be provided for rubbish and recycling.

9856A

Harry Kim
Mayor

Barbara Bell
Director

Michael Dworsky P.E.
Solid Waste Division Chief

County of Hawai'i
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
25 Aupuni Street, Room 210 • Hilo, Hawai'i 96720-4252
(808) 961-8083 • Fax (808) 961-8086

June 6, 2006

SOLID WASTE MANAGEMENT PLAN
Guidelines

INTENT AND PURPOSE

This is to establish guidelines for reviewing solid waste management plans, for which special conditions are placed on developments. The solid waste management plan will be used to: (1) encourage recycling and recycling programs, (2) predict the waste generated by the proposed development to anticipate the loading on County transfer stations, landfills and recycling facilities, and (3) predict the additional traffic being generated because of waste and recycling transfers.

REPORT

The consultant's report will contain the following:

1. Description of the project and the potential waste it may be generating: i.e. analysis of anticipated waste volume and composition. This includes waste generated during the construction and operational phases. Greenwastes will be included in this report for both construction grubbing and future operational landscape maintenance.

2. Description and location of the possible sites for waste disposal or recycling. We will not allow the use of the County transfer stations for any commercial development; commercial development as defined under the policies of the Department of Environmental Management, Solid Waste Division.

3. Since the Department of Environmental Management promotes recycling, indicate onsite source separation facilities by waste stream; i.e. source separation bins of glass, metal, plastic, cardboard, aluminum, etc. Provide ample and equal space for rubbish and recycling.

4. Identification of the proposed disposal site and transportation methods for the various components of the waste disposal and recycling system, including the number of truck traffic and the route that truck will be using to transport the waste and recycled materials.

5. The report will include any impacts to County waste and recycling facilities, and the appropriate mitigation measures. All recommendations and mitigation measures will be addressed.

6. Description of the waste reduction component that analyzes techniques to be employed to achieve a reduction goal.

7. Analysis will be based on the highest potential use or zoning of the development.

REQUIREMENTS AND CONDITIONS

1. A solid waste management plan will be done for all commercial developments, as defined under the policies of the Department of Environmental Management, Solid Waste Division.

2. We will require the developer to provide or resolve all recommendations and mitigation measures as outlined in the report; besides any conditions placed on the applicant by the Department of Environmental Management.

3. A licensed environmental or civil engineer will draft and certify the solid waste management plan.

CONCUR:

Barbara Bell

Barbara Bell
DIRECTOR

10/13/03
Revised 06/06/06

Hawai'i County is an Equal Opportunity Provider and Employer.

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R. M. TOWILL CORPORATION
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January 31, 2007

Ms. Barbara Bell, Director
Department of Environmental Management
County of Hawai'i
25 Aupuni Street, Room 210
Hilo, Hawai'i 96720

Dear Ms. Bell:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 27, 2006 relating to the subject project. We offer the following responses to your inquiries:

1. We acknowledge receipt of your Departments Solid Waste Management Guidelines which will be included in the Final EIS.
2. We will develop a Solid Waste Management Plan and submit it for your review and approval prior to receipt of final subdivision approval. This Plan will include recycling and other waste reduction efforts. We will continue our discussions with your Department on the development of the Solid Waste Management Plan. We are also aware of the efforts of the Waikoloa Village Association to develop a waste management plan and will be in discussion with them to determine if there are mutually beneficial actions that can be taken.
3. We do not anticipate that construction material – aggregate and rocks – will be disposed off-site from this project.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka, LLC

Harry Kim
Mayor

Darryl J. Oliveira
Fire Chief

Glen P. I. Honda
Deputy Fire Chief

County of Hawai'i

FIRE DEPARTMENT
25 Aupuni Street • Suite 103 • Hilo, Hawai'i 96720
(808) 961-8297 • Fax (808) 961-8296

November 6, 2006

Mr. Chester Koga
R.M. Towill Corporation
420 Waikamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR WAIKOLOA HIGHLANDS - RESIDENTIAL SUBDIVISION, SOUTH KOHALA DISTRICT, TMK: (3) 6-8-002:016 (PORTION)

In regards to the above-mentioned draft environmental impact statement, the following shall be in accordance:

Fire apparatus access roads shall be in accordance with UFC Section 10.207:

"**Fire Apparatus Access Roads**

"**Sec. 10.207. (a) General.** Fire apparatus access roads shall be provided and maintained in accordance with the provisions of this section.

"(b) **Where Required.** Fire apparatus access roads shall be required for every building hereafter constructed when any portion of an exterior wall of the first story is located more than 150 feet from fire department vehicle access as measured by an unobstructed route around the exterior of the building.

"EXCEPTIONS: 1. When buildings are completely protected with an approved automatic fire sprinkler system, the provisions of this section may be modified.

"2. When access roadways cannot be installed due to topography, waterways, nonnegotiable grades or other similar conditions, the chief may require additional fire protection as specified in Section 10.301 (b).

"3. When there are not more than two Group R, Division 3 or Group M Occupancies, the requirements of this section may be modified, provided, in the opinion of the chief, fire-fighting or rescue operations would not be impaired.

"More than one fire apparatus road may be required when it is determined by the chief that access by a single road may be impaired by vehicle congestion, condition of terrain, climatic conditions or other factors that could limit access.

"For high-piled combustible storage, see Section 81.109.

"(c) **Width.** The unobstructed width of a fire apparatus access road shall meet the requirements of the appropriate county jurisdiction.

"(d) **Vertical Clearance.** Fire apparatus access roads shall have an unobstructed vertical clearance of not less than 13 feet 6 inches.

"EXCEPTION: Upon approval vertical clearance may be reduced, provided such reduction does not impair access by fire apparatus and approved signs are installed and maintained indicating the established vertical clearance.

"(e) **Permissible Modifications.** Vertical clearances or widths required by this section may be increased when, in the opinion of the chief, vertical clearances or widths are not adequate to provide fire apparatus access.

"(f) **Surface.** Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus and shall be provided with a surface so as to provide all-weather driving capabilities." (20 tons)

"(g) **Turning Radius.** The turning radius of a fire apparatus access road shall be as approved by the chief." (45 feet)

"(h) **Turnarounds.** All dead-end fire apparatus access roads in excess of 150 feet in length shall be provided with approved provisions for the turning around of fire apparatus.

"(i) **Bridges.** When a bridge is required to be used as access under this section, it shall be constructed and maintained in accordance with the applicable sections of the Building Code and using designed live loading sufficient to carry the imposed loads of fire apparatus.

"(j) **Grade.** The gradient for a fire apparatus access road shall not exceed the maximum approved by the chief." (15%)

"(k) **Obstruction.** The required width of any fire apparatus access road shall not be obstructed in any manner, including parking of vehicles. Minimum required widths and clearances established under this section shall be maintained at all times.

"(l) **Signs.** When required by the fire chief, approved signs or other approved notices shall be provided and maintained for fire apparatus access roads to identify such roads and prohibit the obstruction thereof or both."

Water supply shall be in accordance with UFC Section 10.301(c):

"(c) **Water Supply.** An approved water supply capable of supplying required fire flow for fire protection shall be provided to all premises upon which buildings or portions of buildings are hereafter constructed, in accordance with the respective county water requirements. There shall be provided, when required by the chief, on-site fire hydrants and mains capable of supplying the required fire flow.

"Water supply may consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

"The location, number and type of fire hydrants connected to a water supply capable of delivering the required fire flow shall be protected as set forth by the respective county water requirements. All hydrants shall be accessible to the fire department apparatus by roadways meeting the requirements of Section 10.207.

DARRYL OLIVEIRA
Fire Chief

PBW:lpc

CC: Waikoloa Mauka, LLC, Kevin Kellow
State Land Use Commission, Anthony Ching

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
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Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

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January 31, 2007

Chief Darryl Oliveira
Fire Department
County of Hawaii
25 Aupuni Street, Suite 101
Hilo, Hawai'i 96720

Dear Chief Oliveira:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 22, 2006 relating to the subject project. We offer the following responses to your inquiries:

We have reviewed the comments and note that the proposed project will be developed in accordance with UFC Section 10.207 relating to fire apparatus access.

In addition, the project will be developed in accordance with UFC Section 10.301(c) relating to water supply.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

Cc: LUC, Waikoloa Mauka LLC

Harry Kim
Mayor

Lawrence K. Mahuna
Police Chief

Harry S. Kubojiri
Deputy Police Chief

County of Hawaii

POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2389

November 15, 2006

Mr. Kevin Kellow
Manager
Waikoloa Mauka, LLC
120 Aspen Oak Lane
Glendale, California 91207

Reference: Waikoloa Highlands – Residential Subdivision
Tax Map Key: (3) 6-8-002:016 (portion)

Dear Mr. Kellow:

Staff has reviewed the Draft Environmental Impact statement for the Waikoloa Highlands – Residential Subdivision and has the following comments. Development of this area will:

1. Create an increase in motor vehicle traffic that will have an affect on adjacent subdivisions. The increase in motor vehicle traffic will potentially increase the amount of motor vehicle collisions that occur in the area, which in turn will adversely affect the vehicular traffic of commuters traveling to/from places of employment that use the Waikoloa Road as their route of travel. In addition to commuter traffic, the Waikoloa Road is also used by trucking companies, delivery businesses, tourists, and other motorists extensively.

2. Calls for police service will increase in direct proportion to the increase in population in this area. Due to the location of the major population areas in that portion of the district, police response to calls for service may be delayed due to the increase.

Sincerely,

LAWRENCE K. MAHUNA
POLICE CHIEF

DEREK D. PACHECO
ASSISTANT CHIEF
AREA II OPERATIONS

LB

cc: Mr. Anthony Ching, State Land Use Commission
Mr. Chester Koga, R.M. Towill Corporation

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4950
Telephone 808 842 1133
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January 31, 2007

Chief Lawrence K. Mahuna
Police Department, County of Hawai'i
349 Kapi'olani Street
Hilo, Hawai'i 96720

Dear Chief Mahuna:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of November 15, 2006 relating to the subject project. We offer the following responses to your inquiries:

1. Regarding increase in traffic. We acknowledge that the proposed project will increase the overall volume of traffic on the streets and roads in the area. To mitigate the impact resulting from this project, the developer will be upgrading the intersection at Waikoloa Road and Paniolo Avenue. The proposed improvements will assist traffic movement through this important intersection.

2. Increases in service call. We further acknowledge that with the general increase in population in the area, the Police Department will be faced with additional calls for service. In order to mitigate this impact and as provided by Ordinance 05-157, the developer will be paying an impact fee to the County of Hawai'i for police services and facilities.

Should you have questions, please contact the undersigned.

Sincerely,

Chester Koga

Chester Koga, AICP

Cc: LUC, Waikoloa Mauka LLC

Mauna Kea Soil & Water Conservation District

December 6, 2007

R.M. Towill Corporation
420 Waiakamilo Rd., #411
Honolulu, HI 96817

Dear Sirs,

The Mauna Kea Soil & Water Conservation District has reviewed the Draft Environmental Impact Statement for the proposed Waikoloa Highlands Residential Subdivision and after checking with area engineers find the references to drainage mitigation does not deal with the increasen cumulative run off effects on down stream properties. particularly the flood proven Puako community. The narrative only deals with the conveyance off-site and no mitigation to down-stream communities are dealt. The Mauna Kea SWCD encourages the ahupuaa approach to watersheds and their components.

Sincerely,

MFB for Pete Hendricks

Pete Hendricks, Chair, Mauna Kea Soil & Water Conservation District

PO Box 2975 Kamuela, HI 96743 808-885-6602 FAX 808-885-4420

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4950
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R. M. TOWILL CORPORATION
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January 31, 2007

Mr. Pete Hendricks, Chair
Mauna Kea Soil and Water Conservation District
P.O. Box 2975
Kamuela, Hawai'i 96743

Dear Mr. Hendricks:

Draft Environmental Impact Statement
Waikoloa Highlands Residential Subdivision
South Kohala, Hawai'i
Tax Map Key: (3) 6-8-002, Portion of 16

This letter acknowledges your letter of December 6, 2006. We would like to offer the following response to your comment relating to potential drainage impacts.

We would like to state at the outset that the proposed development will not increase flood flows down stream of the project as we are required by County of Hawai'i regulations to retain or detain the flows caused by the increase of impervious surfaces or through modifications of the drainageways. The analysis conducted for this project does take into account the drainage requirements of the entire watershed which can be likened to an ahupua'a. The proposed project, however, will not be correcting deficiencies in the drainageways that were preexisting.

Please contact the undersigned if you have additional questions.

Sincerely,

Chester Koga

Chester Koga, AICP
Project Coordinator

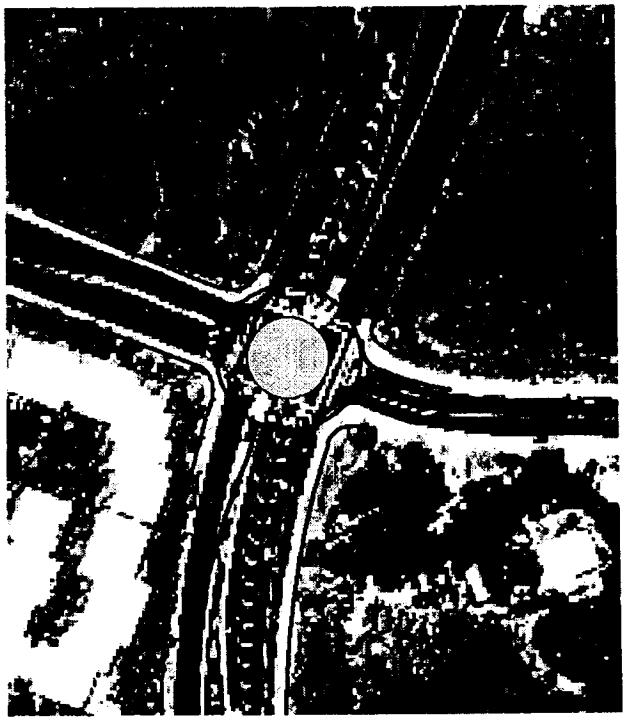
Cc: LUC, Waikoloa Mauka LLC

Chester Koga

From: RonThiel [rthiel@co.hawaii.hi.us]
Sent: Tuesday, January 09, 2007 12:46 PM
To: Chester Koga
Cc: McClure, Bruce
Subject: Waikaloa-Paniolo Intersection

Waikaloa-Paniolo Intersection ... Waikaloa-Paniolo Intersection ...

Thanks for the information. Here are some pictures of potential improvements at this intersection.



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APPENDIX O

Correspondence from County of Hawai‘i
Planning Department, February 8, 2007, relating to Amendment to Change of Zone Ordinance 05-157.

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Harry Kim
Mayor

Christopher J. Yuen
Director

Brad Kurokawa, ASLA
LEED® AP
Deputy Director

County of Hawaii
PLANNING DEPARTMENT
101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-3043
(808) 961-8288 • FAX (808) 961-8742

February 8, 2007

Mr. Sidney Fuke
100 Pauahi Street, Suite 212
Hilo, HI 96720

Dear Mr. Fuke:

Change of Zone (REZ 678)
Applicant: Waikoloa Mauka, LLC
Request: Amendment to Change of Zone Ordinance No. 05-157
(Conditions B, C and I)
Tax Map Key: 6-8-2:portion 16 and 6-8-3:portion 32

This is to acknowledge receipt of your request to amend Change of Zone Ordinance No. 05-157 on January 26, 2007. Enclosed is your receipt for the filing fee.

Please be informed, that in accordance with the Hawaii County Zoning Code, Chapter 25-2-4, within ten (10) days after the request has been filed with this office, you are required to notify all owners and lessees with a recorded interest in property within 500 feet of the perimeter boundary of the entire property that your request has been filed with the Planning Department.

In addition, upon notice by our department that the hearing date has been set, you are required to again notify all owners and lessees with a recorded interest in property within 500 feet. This second notice shall be served within ten (10) days after receiving notice of the hearing date and not less than ten (10) days prior to the hearing.

Both notices shall include the following information:

1) Name of the applicant;

2) Precise location of the property, including tax map key identification, location map and/or site plan;

3) Nature of the request and the proposed use of the property;

4) Date on which the request was filed with the director or the commission;

5) Date, time and place the public hearing will be held to consider the request (to be included in the second notice); and

6) Contact name and phone number should there be any questions.

Please also inform the owner that the request is also available at the Planning Department for public review.

Prior to the date of the hearing, the applicant is required to file with the Commission an affidavit or other similar proof of mailing of said notices.

Please be further advised that in accordance with Chapter 25 (Zoning Code), Article 2, Division 1, Section 25-2-12, Hawaii County Code 1983 (2005 Edition) and/or Planning Commission Rules of Practice and Procedure, within ten (10) days from your receipt of this letter, you shall post a sign on the subject property. The sign shall include:

1) The nature of the request;

2) The proposed use of the property;

3) The size of the property;

4) The tax map key(s) of the property;

5) That the public may contact the Planning Department for additional information; and

6) The address and telephone number of the Planning Department.

The sign shall be not less than nine square feet and not more than twelve square feet in area, with letters not less than one inch high. No pictures, drawings, or promotional materials shall be permitted on the sign.

The sign shall be posted at or near the property boundary adjacent to a public road bordering the property and shall be readable from said public road. If more than one public road borders the property, the applicant shall post the sign to be visible from the more heavily traveled public road.

The sign shall, in all other respects, be in compliance with Chapter 3 (Signs), Hawaii County Code 1983 (2005 edition).

The applicant shall file an affidavit with the Planning Department not more than five (5) days after posting the sign stating that a sign has been posted, and that the applicant will not remove the sign until the request has been granted, denied, or withdrawn. A photograph of the sign in place shall accompany the affidavit.

The sign shall remain posted until the request has been granted, denied, or withdrawn. The applicant shall remove the sign promptly after such action.

According to the Zoning Code, Chapter 25, Hawaii County Code, the Planning Director has 120 days in which to provide a recommendation to the Planning Commission. The Commission's review process consists of a public hearing. After such hearing is conducted, the request and the Commission's recommendation will be forwarded to the County Council which has final authority to grant any changes of zone.

We will notify you as to the date, time and place of the public hearing as soon as it has been scheduled.

Should you have any questions regarding the above, please do not hesitate to contact Norman Hayashi of this department at 961-8288, x205.

Sincerely,

CHRISTOPER J. YUEN
Planning Director

Enclosure
Lwaikoloamauka01gyw

SidneyFuke, Planning Consultant
100 Pauahi Street, Suite 212 • Hilo, Hawaii 96720
Telephone: (808) 969-1522 • Fax: (808) 969-7996
E-mail: sidfuke@verizon.net
Planning • Variance • Zoning
Subdivision • Land Use Permits
Environmental Reports

January 26, 2007

Mr. Christopher Yuen, Director
Planning Department
COUNTY OF HAWAI'I
101 Pauahi Street
Hilo, HI 96720

Dear Mr. Yuen:

RE: Amendment to Ord. No. 05 157 – Waikoloa Mauka, LLC
TMK: 6-8-02: Portion of 16 and 6-8-03: Portion of 32

The property owner and applicant, Waikoloa Mauka, LLC, is requesting two sets of amendments to rezoning. The first relates to conditions B and C of the rezoning Ordinance No. 05 157 relating to the nature of improvements at the intersection of Paniolo Avenue/Pua Melia Street and Waikoloa Road as well as the number of accesses to Waikoloa Road. The other is to make clear that the recreational portion of the applicant's impact fee can be used for a multi-use community center.

General Background

In 1990, the former owners of the subject property, Waikoloa Development Company, requested and received rezoning approval (Ordinance No. 90 160) for approximately 761 acres of land from Unplanned (U) and Multiple-family Residential (RM-1.5) to Residential-Agriculture (RA-1a) and Open (O). This action allowed the development of a golf course residential subdivision consisting of 400 1-acre sized lots. The approval was subject to a number of conditions, including development timetable.

In 1995, conditions B and C of Ordinance No. 90 160 were amended. The amendments (Ordinance No. 95 51) required that final subdivision approval of no less than 175 lots be secured within a 5-year period. It further required the construction of channelized improvements at the intersection of Waikoloa Road and Pua Melia Street/Paniolo Avenue before June 30, 1996, as well as the construction of traffic signalization improvements when the number of lots exceeded 350 or as may be required by the Department of Public Works.

Pursuant to the above ordinance and its amendment, tentative subdivision approval was initially granted in 1993 and subsequently amended on March 3, 1994. The channelization improvements were completed in 1996. As allowed by the rezoning ordinance, an administrative time extension was granted by the Planning Director on May 9, 2000 to secure final subdivision approval. This extension was to March 21, 2005.

On January 5, 2005, the former owner requested an amendment to Condition B of Ordinance No. 95 51 which would allow final subdivision approval to be secured before March 21, 2015. During the time the request was being considered by the County Council, the applicant purchased the subject property on or about September 2005. The applicant proceeded to address the Council's concerns, which resulted in the approval of Ordinance No. 05 157, a copy of which is attached.

Nature of Request

In proceeding to finalize the subdivision, the applicant elected to abandon plans for the golf course. To some extent, this decision was designed to address the Waikoloa Village Association's concern over having another golf course in this area at this time. Accordingly, revised subdivision plans were submitted to the County Planning Department reflecting the project being developed into a 398-lot subdivision with natural open space to replace the planned golf course. The project would be developed in two phases, the first consisting of 149 lots and the remaining 249 lots. A copy of the revised subdivision map is enclosed.

Conditions B and C required signalized improvements at the intersection of Waikoloa Road with Pua Melia Street/Paniolo Avenue. The applicant is prepared to make said improvements. However, based on discussions with some area residents, the area councilperson (Pete Hoffmann), and the Director of Department of Public Works (Bruce McClure), it appeared that a "roundabout" instead of signalized intersection may be more appropriate.

Please note that Condition B requires the submittal of the signalized plans in conjunction with the on-site infrastructural plans. The latter has been completed and submitted to the County for review, whereas the completion of the former plans are now being suspended, pending a decision on the type of improvements. In that regard, the applicant is requesting that while this condition be so amended to allow for such an option, it also requests that a determination be made within a reasonable period so as not to hold up the applicant's development schedule and that the applicant – because of the potential delay - to bond said improvements.

Additionally, Condition C limits the project to only one access along Waikoloa Road, which is planned for the *makai* end of the project site. Another access is planned at Pua Melia Street. However, those accesses effectively would service only the lower portion of the project. In the event of an emergency, the *mauka* area may have difficulty getting out of the subdivision. While the concern for limiting access along Waikoloa Road is understandable, it should be noted that the project's frontage stretches more than a mile. The distance between the two planned accesses would still be in excess of a mile

of each other. As such, having another access should not impede normal traffic flow along Waikoloa Road.

As such, the applicant respectfully requests amendments to Conditions B and C of Ordinance No. 05 157 to accomplish the above. A suggested language could be as follows:

> "B. Final subdivision approval for not less than 175 lots shall be secured within ten (10) years from the effective date of this new amendment. Plans for [infrastructural improvements, including] the off-site intersectional roadway improvements required in Condition C, shall be submitted no later than six months after a determination of the type of improvements (i.e., signalized or roundabout) is made by the director of the Department of Public Works [shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property]. The applicant shall install and dedicate the [traffic signalization] intersectional improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the director of public works. In lieu of actual construction of infrastructural improvements required herein, [except for Condition C,] the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.
>
> "C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to [one roadway] two roadways from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized or improved by a "roundabout" system meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report shall be provided in conjunction with final subdivision approval of the first increment or as otherwise provided by Chapter 23 (Subdivision Control);"

The applicant has been working with the community and another developer to identify pressing community facility needs wherein its impact fees could be utilized to facilitate construction of these needed facilities. One of the identified needs has been a multi-use community center. In that regard, the applicant is proposing that the recreational portion

of the impact fee outlined in Condition I be expanded and/or made clear to allow consideration for a multi-use community center.

Accordingly, the applicant requests that the recreational assessment portion Condition I be amended as follows:

> "In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, which may include a multi-purpose community center, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies, and approval of the County Council."

In the event your office believes the requests to be reasonable, the applicant has no objections to alternative language to accomplish the applicant's objective. This objectives, in sum, are to a) allow consideration for a roundabout instead of a signalized intersection, while giving the applicant sufficient time to prepare these plans and bond these improvements; b) allow another access from Waikoloa Road; and c) allow consideration for the applicant to participate in the construction of a community facility to satisfy its recreational impact fee obligation.

Pursuant to the Zoning Code requirements, please find enclosed 20 copies of this letter request, with enclosures; list of surrounding property owners within 500 feet of the subject property; and the filing fee of $250.

Should you have any questions on this matter, please feel free to contact me. Thank you very much.

Sincerely,

SIDNEY M. FUKE
Planning Consultant

Enclosures
Copy – Waikoloa Mauka, LLC w/ enclosures

COUNTY OF HAWAI'I STATE OF HAWAI'I

BILL NO. 89
Draft 3

ORDINANCE NO. 05 157

AN ORDINANCE AMENDING ORDINANCE NO. 95 51 AMENDING ORDINANCE NO. 90-160, WHICH RECLASSIFIED LANDS FROM AN UNPLANNED (U) AND MULTIPLE FAMILY RESIDENTIAL (RM-1.5) TO OPEN (O) AND RESIDENTIAL-AGRICULTURAL (RA-1a) AT WAIKOLOA, SOUTH KOHALA, HAWAI'I, COVERED BY TAX MAP KEY 6-8-02:PORTION OF 16 AND 6-8-03:PORTION OF 32.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAI'I:

SECTION 1. Ordinance No. 95 51 is amended as follows:

"SECTION 3. This change in district classification is conditioned upon the following.

A. The applicant, successors or its assigns shall be responsible for complying with all of the stated conditions of approval;

B. Final subdivision approval for not less than 175 lots shall be secured within [~~five (5)~~] ten (10) years from the effective date of this new amendment. Plans for infrastructural improvements, including off-site roadway improvements required in Condition C, shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property. [~~Prior to June 30, 1996, construction of the channelization improvements to the Waikoloa/ Pua Melia/ Paniolo Avenue intersection (including acceleration/ deceleration and left turn storage lanes and pavement and shoulder widening) meeting with the requirements of the Department of Public Works, shall be completed and dedicated to the county. In addition, t~~]The applicant shall install and dedicate the traffic signalization improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the [~~chief engineer~~]director of public works. In lieu of actual construction of infrastructural

improvements required herein, except for Condition C, the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.

C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to one roadway from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report [~~dated December 1989~~] shall be provided [~~prior to the opening of the golf course or~~] in conjunction with final subdivision approval of the first increment, [~~whichever occurs first.~~] or as otherwise provided by Chapter 23 (Subdivision Control);

D. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall comply with the requirements of Chapter 11, Article 1, Hawaii County Code relating to Affordable Housing Policy. This requirement shall be approved by the County Housing Agency prior to final subdivision approval. [~~secure the concurrence of the County Housing Agency, upon the recommendation of the Office of Housing and Community Development, that the applicant's affordable housing requirements, if any, have been fulfilled prior to the issuance of final subdivision approval~~];

E. A drainage system shall be installed in accordance with the requirements of the Department of Public Works and other affected agencies;

F. Comply with all applicable County, State and Federal laws, rules, regulations and requirements[~~, including conditions of Use Permit No. 71~~];

G. [~~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 may, at the developer's election, be satisfied by performance in accordance with the requirements of the Unified Impact Fees Ordinance;~~

~~G. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval.~~

~~ondition shall remain in effect until all of the conditions of approval have been complied and the Planning Director acknowledges that further reports are not required;~~

~~H. An extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances:~~

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

~~1. Granting of the time extension would not be contrary to the General Plan or Zoning Code;~~

~~2. Granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;~~

~~3. 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~~

~~4. 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.~~]

Restrictive covenants in the deeds of all proposed lots within the property shall give notice that the terms of the zoning ordinance prohibit the construction of a second dwelling unit and condominium property regimes on each 1-acre lot. This restriction may be removed by amendment of this ordinance by the County Council. The owner of the property may also, in addition, impose private covenants restricting the number of dwellings. A copy of the proposed covenant(s) to be recorded with the State Bureau of Conveyances shall be submitted to the Planing Director for review and approval prior to the issuance of Final Subdivision Approval. A copy of the recorded document shall be filed with the Planning Department upon its receipt from the Bureau of Conveyances;

H. Before final subdivision approval, applicant must obtain reclassification of the RA-1a zoned area from the State Land Use Commission to the Rural or Urban district. Prior to the submittal of plans for a grading or any associated permit for a golf course to the County for review and approval, the applicant shall consult with the Waikoloa Village Association and the County Council relative to the timing and propriety of such a use. This condition, except for the consultation requirement for any golf course, may be waived by the Planning Director, after consultation with Corporation Counsel, if an appellate judicial decision, or substantive change to Chapter 205, Hawaii Revised Statutes, clearly establishes the legality of this project in the Agricultural State Land Use district, including the residential uses of the lots;

I. The applicant shall make its fair share contribution to mitigate the potential regional impacts of the property with respect to parks and recreation, fire, police, solid waste disposal facilities and roads. The fair share contribution shall be initially based on the representations contained within the change of zone application and may be increased or reduced proportionally if the lot counts are adjusted. The fair share contribution shall become due and payable prior to receipt of Final Plan Approval or within five years from the effective date of this amended change of zone ordinance, whichever occurs first. The fair share contribution for each lot shall be based on a maximum density for each lot as determined by the zoning resulting from this change of zone. The fair share contribution in a form of cash, land, facilities or any combination thereof shall be determined by the County Council. The fair share contribution may be adjusted annually beginning three years after the effective date of the amendment to the ordinance, based on the percentage change in the Honolulu Consumer Price Index (HCPI). The fair share contribution shall have a maximum combined value of **$9,991.21** per single-family residential unit. Based upon the applicant's representation of intent to develop a total of one hundred and seventy five (175) single-family residential units, the indicated total of fair share contribution is **$1,748,461.75** for the single-family residential units. However, the total amount shall be increased or reduced in proportion with the actual number of units according to the calculation and payment provisions set forth in this condition. The fair share contribution per single-family residential unit shall be allocated as follows:

- $4,817.93 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $843,137.75 to the County to support park and recreational improvements and facilities;
- $232.42 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $40,673.50 to the County to support police facilities;
- $459.06 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $80,335.50 to the County to support fire facilities;
- $200.98 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $35,171.50 to the County to support solid waste facilities;
- $4,280.82 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $749,143.50 to the County to support road and traffic improvements;

In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies and approval of the County Council;

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

K. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied with and the Planning Director acknowledges that further reports are not required;

L. Should any of the conditions not be met or substantially complied with in a timely fashion, the Director [~~shall~~] may initiate rezoning of the area to its original or more appropriate designation.

SECTION 2. Material to be deleted is bracketed and material to be added is underscored.

SECTION 3. In the event that any portion of this 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 HAWAI'I

INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAI'I

Kona, Hawai'i
Date of Introduction: November 22, 2005
Date of 1st Reading: November 22, 2005
Date of 2nd Reading: December 7, 2005
Effective Date: December 15, 2005

REFERENCE: Comm. 230.9

OFFICE OF THE COUNTY CLERK
County of Hawai'i
Kona, Hawai'i

(Draft 3)

Introduced By: Pete Hoffmann/K.Angel Pilago
Date Introduced: November 22, 2005
First Reading: November 22, 2005
Published: December 4, 2005

REMARKS:

ROLL CALL VOTE				
	AYES	NOES	ABS	EX
Arakaki	X			
Higa	X			
Hoffmann	X			
Holschuh	X			
Ikeda	X			
Isbell	X			
Jacobson		X		
Pilago	X			
Safarik	X			
	8	1	0	0

Second Reading: December 7, 2005
To Mayor: December 9, 2005
Returned: December 15, 2005
Effective: December 15, 2005
Published: December 22, 2005

REMARKS:

ROLL CALL VOTE				
	AYES	NOES	ABS	EX
Arakaki	X			
Higa	X			
Hoffmann	X			
Holschuh	X			
Ikeda	X			
Isbell	X			
Jacobson		X		
Pilago	X			
Safarik	X			
	8	1	0	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 HAWAI'I
Date 12/3/05

COUNCIL CHAIRMAN

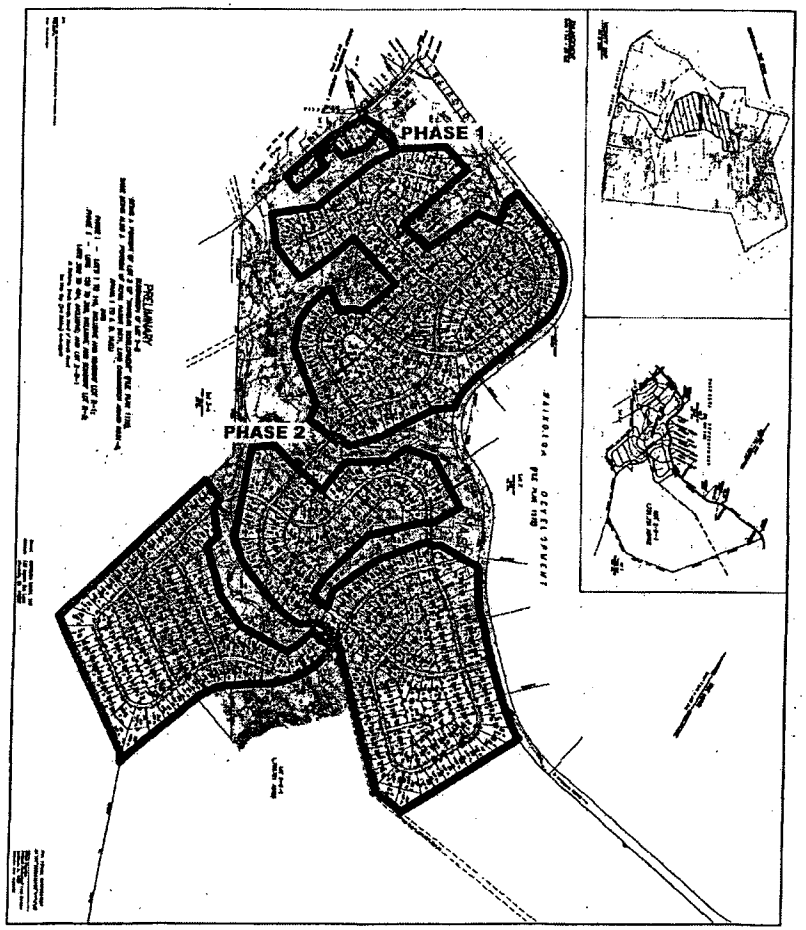
COUNTY CLERK

Bill No.: 89 (Draft 3)
Reference: C-230.9/PC-44
Ord No.: 05 157

Approved/Disapproved this 15th *day*
of December, *20* 05.

MAYOR, COUNTY OF HAWAI'I

Waikoloa Highlands
TMK (3) 6-8-002:016 (portion)
Waikoloa, South Kohala, Hawai'i



SUBDIVISION PLAN

Harry Kim
Mayor

Christopher J. Yuen
Director

Brad Kurokawa, ASLA
LEED® AP
Deputy Director

County of Hawaii
PLANNING DEPARTMENT
101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-3043
(808) 961-8288 • FAX (808) 961-8742

February 8, 2007

Mr. Sidney Fuke
100 Pauahi Street, Suite 212
Hilo, HI 96720

Dear Mr. Fuke:

Change of Zone (REZ 678)
Applicant: Waikoloa Mauka, LLC
Request: Amendment to Change of Zone Ordinance No. 05-157
(Conditions B, C and I)
Tax Map Key: 6-8-2:portion 16 and 6-8-3:portion 32

This is to acknowledge receipt of your request to amend Change of Zone Ordinance No. 05-157 on January 26, 2007. Enclosed is your receipt for the filing fee.

Please be informed, that in accordance with the Hawaii County Zoning Code, Chapter 25-2-4, within ten (10) days after the request has been filed with this office, you are required to notify all owners and lessees with a recorded interest in property within 500 feet of the perimeter boundary of the entire property that your request has been filed with the Planning Department.

In addition, upon notice by our department that the hearing date has been set, you are required to again notify all owners and lessees with a recorded interest in property within 500 feet. This second notice shall be served within ten (10) days after receiving notice of the hearing date and not less than ten (10) days prior to the hearing.

Both notices shall include the following information:

1) Name of the applicant;

2) Precise location of the property, including tax map key identification, location map and/or site plan;

3) Nature of the request and the proposed use of the property;

4) Date on which the request was filed with the director or the commission;

5) Date, time and place the public hearing will be held to consider the request (to be included in the second notice); and

6) Contact name and phone number should there be any questions.

Please also inform the owner that the request is also available at the Planning Department for public review.

Prior to the date of the hearing, the applicant is required to file with the Commission an affidavit or other similar proof of mailing of said notices.

Please be further advised that in accordance with Chapter 25 (Zoning Code), Article 2, Division 1, Section 25-2-12, Hawaii County Code 1983 (2005 Edition) and/or Planning Commission Rules of Practice and Procedure, within ten (10) days from your receipt of this letter, you shall post a sign on the subject property. The sign shall include:

1) The nature of the request;

2) The proposed use of the property;

3) The size of the property;

4) The tax map key(s) of the property;

5) That the public may contact the Planning Department for additional information; and

6) The address and telephone number of the Planning Department.

The sign shall be not less than nine square feet and not more than twelve square feet in area, with letters not less than one inch high. No pictures, drawings, or promotional materials shall be permitted on the sign.

The sign shall be posted at or near the property boundary adjacent to a public road bordering the property and shall be readable from said public road. If more than one public road borders the property, the applicant shall post the sign to be visible from the more heavily traveled public road.

The sign shall, in all other respects, be in compliance with Chapter 3 (Signs), Hawaii County Code 1983 (2005 edition).

The applicant shall file an affidavit with the Planning Department not more than five (5) days after posting the sign stating that a sign has been posted, and that the applicant will not remove the sign until the request has been granted, denied, or withdrawn. A photograph of the sign in place shall accompany the affidavit.

The sign shall remain posted until the request has been granted, denied, or withdrawn. The applicant shall remove the sign promptly after such action.

According to the Zoning Code, Chapter 25, Hawaii County Code, the Planning Director has 120 days in which to provide a recommendation to the Planning Commission. The Commission's review process consists of a public hearing. After such hearing is conducted, the request and the Commission's recommendation will be forwarded to the County Council which has final authority to grant any changes of zone.

We will notify you as to the date, time and place of the public hearing as soon as it has been scheduled.

Should you have any questions regarding the above, please do not hesitate to contact Norman Hayashi of this department at 961-8288, x205.

Sincerely,

CHRISTOPER J. YUEN
Planning Director

Enclosure
Lwaikoloamauka01gyw

SidneyFuke, Planning Consultant
100 Pauahi Street, Suite 212 • Hilo, Hawaii 96720
Telephone: (808) 969-1522 • Fax: (808) 969-7996
E-mail: sidfuke@verizon.net
Planning • Variance • Zoning
Subdivision • Land Use Permits
Environmental Reports

January 26, 2007

Mr. Christopher Yuen, Director
Planning Department
COUNTY OF HAWAI'I
101 Pauahi Street
Hilo, HI 96720

Dear Mr. Yuen:

RE: Amendment to Ord. No. 05 157 – Waikoloa Mauka, LLC
TMK: 6-8-02: Portion of 16 and 6-8-03: Portion of 32

The property owner and applicant, Waikoloa Mauka, LLC, is requesting two sets of amendments to rezoning. The first relates to conditions B and C of the rezoning Ordinance No. 05 157 relating to the nature of improvements at the intersection of Paniolo Avenue/Pua Melia Street and Waikoloa Road as well as the number of accesses to Waikoloa Road. The other is to make clear that the recreational portion of the applicant's impact fee can be used for a multi-use community center.

General Background

In 1990, the former owners of the subject property, Waikoloa Development Company, requested and received rezoning approval (Ordinance No. 90 160) for approximately 761 acres of land from Unplanned (U) and Multiple-family Residential (RM-1.5) to Residential-Agriculture (RA-1a) and Open (O). This action allowed the development of a golf course residential subdivision consisting of 400 1-acre sized lots. The approval was subject to a number of conditions, including development timetable.

In 1995, conditions B and C of Ordinance No. 90 160 were amended. The amendments (Ordinance No. 95 51) required that final subdivision approval of no less than 175 lots be secured within a 5-year period. It further required the construction of channelized improvements at the intersection of Waikoloa Road and Pua Melia Street/Paniolo Avenue before June 30, 1996, as well as the construction of traffic signalization improvements when the number of lots exceeded 350 or as may be required by the Department of Public Works.

Pursuant to the above ordinance and its amendment, tentative subdivision approval was initially granted in 1993 and subsequently amended on March 3, 1994. The channelization improvements were completed in 1996. As allowed by the rezoning ordinance, an administrative time extension was granted by the Planning Director on May 9, 2000 to secure final subdivision approval. This extension was to March 21, 2005.

On January 5, 2005, the former owner requested an amendment to Condition B of Ordinance No. 95 51 which would allow final subdivision approval to be secured before March 21, 2015. During the time the request was being considered by the County Council, the applicant purchased the subject property on or about September 2005. The applicant proceeded to address the Council's concerns, which resulted in the approval of Ordinance No. 05 157, a copy of which is attached.

Nature of Request

In proceeding to finalize the subdivision, the applicant elected to abandon plans for the golf course. To some extent, this decision was designed to address the Waikoloa Village Association's concern over having another golf course in this area at this time. Accordingly, revised subdivision plans were submitted to the County Planning Department reflecting the project being developed into a 398-lot subdivision with natural open space to replace the planned golf course. The project would be developed in two phases, the first consisting of 149 lots and the remaining 249 lots. A copy of the revised subdivision map is enclosed.

Conditions B and C required signalized improvements at the intersection of Waikoloa Road with Pua Melia Street/Paniolo Avenue. The applicant is prepared to make said improvements. However, based on discussions with some area residents, the area councilperson (Pete Hoffmann), and the Director of Department of Public Works (Bruce McClure), it appeared that a "roundabout" instead of signalized intersection may be more appropriate.

Please note that Condition B requires the submittal of the signalized plans in conjunction with the on-site infrastructural plans. The latter has been completed and submitted to the County for review, whereas the completion of the former plans are now being suspended, pending a decision on the type of improvements. In that regard, the applicant is requesting that while this condition be so amended to allow for such an option, it also requests that a determination be made within a reasonable period so as not to hold up the applicant's development schedule and that the applicant – because of the potential delay - to bond said improvements.

Additionally, Condition C limits the project to only one access along Waikoloa Road, which is planned for the *makai* end of the project site. Another access is planned at Pua Melia Street. However, those accesses effectively would service only the lower portion of the project. In the event of an emergency, the *mauka* area may have difficulty getting out of the subdivision. While the concern for limiting access along Waikoloa Road is understandable, it should be noted that the project's frontage stretches more than a mile. The distance between the two planned accesses would still be in excess of a mile

of each other. As such, having another access should not impede normal traffic flow along Waikoloa Road.

As such, the applicant respectfully requests amendments to Conditions B and C of Ordinance No. 05 157 to accomplish the above. A suggested language could be as follows:

> "B. Final subdivision approval for not less than 175 lots shall be secured within ten (10) years from the effective date of this new amendment. Plans for [infrastructural improvements, including] the off-site intersectional roadway improvements required in Condition C, shall be submitted no later than six months after a determination of the type of improvements (i.e., signalized or roundabout) is made by the director of the Department of Public Works [shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property]. The applicant shall install and dedicate the [traffic signalization] intersectional improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the director of public works. In lieu of actual construction of infrastructural improvements required herein, [except for Condition C,] the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.
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> "C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to [one roadway] two roadways from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized or improved by a "roundabout" system meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report shall be provided in conjunction with final subdivision approval of the first increment or as otherwise provided by Chapter 23 (Subdivision Control);"

The applicant has been working with the community and another developer to identify pressing community facility needs wherein its impact fees could be utilized to facilitate construction of these needed facilities. One of the identified needs has been a multi-use community center. In that regard, the applicant is proposing that the recreational portion

of the impact fee outlined in Condition I be expanded and/or made clear to allow consideration for a multi-use community center.

Accordingly, the applicant requests that the recreational assessment portion Condition I be amended as follows:

> "In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, which may include a multi-purpose community center, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies, and approval of the County Council."

In the event your office believes the requests to be reasonable, the applicant has no objections to alternative language to accomplish the applicant's objective. This objectives, in sum, are to a) allow consideration for a roundabout instead of a signalized intersection, while giving the applicant sufficient time to prepare these plans and bond these improvements; b) allow another access from Waikoloa Road; and c) allow consideration for the applicant to participate in the construction of a community facility to satisfy its recreational impact fee obligation.

Pursuant to the Zoning Code requirements, please find enclosed 20 copies of this letter request, with enclosures; list of surrounding property owners within 500 feet of the subject property; and the filing fee of $250.

Should you have any questions on this matter, please feel free to contact me. Thank you very much.

Sincerely,

SIDNEY M. FUKE
Planning Consultant

Enclosures
Copy – Waikoloa Mauka, LLC w/ enclosures

COUNTY OF HAWAI'I STATE OF HAWAI'I

BILL NO. 89
Draft 3

ORDINANCE NO. 05 157

AN ORDINANCE AMENDING ORDINANCE NO. 95 51 AMENDING ORDINANCE NO. 90-160, WHICH RECLASSIFIED LANDS FROM AN UNPLANNED (U) AND MULTIPLE FAMILY RESIDENTIAL (RM-1.5) TO OPEN (O) AND RESIDENTIAL-AGRICULTURAL (RA-1a) AT WAIKOLOA, SOUTH KOHALA, HAWAI'I, COVERED BY TAX MAP KEY 6-8-02:PORTION OF 16 AND 6-8-03:PORTION OF 32.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAI'I:

SECTION 1. Ordinance No. 95 51 is amended as follows:

"SECTION 3. This change in district classification is conditioned upon the following.

A. The applicant, successors or its assigns shall be responsible for complying with all of the stated conditions of approval;

B. Final subdivision approval for not less than 175 lots shall be secured within [~~five (5)~~] ten (10) years from the effective date of this new amendment. Plans for infrastructural improvements, including off-site roadway improvements required in Condition C, shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property. [~~Prior to June 30, 1996, construction of the channelization improvements to the Waikoloa/ Pua Melia/ Paniolo Avenue intersection (including acceleration/ deceleration and left turn storage lanes and pavement and shoulder widening) meeting with the requirements of the Department of Public Works, shall be completed and dedicated to the county. In addition, t~~]The applicant shall install and dedicate the traffic signalization improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the [~~chief engineer~~]director of public works. In lieu of actual construction of infrastructural

improvements required herein, except for Condition C, the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.

C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to one roadway from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report [~~dated December 1989~~] shall be provided [~~prior to the opening of the golf course or~~] in conjunction with final subdivision approval of the first increment, [~~whichever occurs first.~~] or as otherwise provided by Chapter 23 (Subdivision Control);

D. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall comply with the requirements of Chapter 11, Article 1, Hawaii County Code relating to Affordable Housing Policy. This requirement shall be approved by the County Housing Agency prior to final subdivision approval. [~~secure the concurrence of the County Housing Agency, upon the recommendation of the Office of Housing and Community Development, that the applicant's affordable housing requirements, if any, have been fulfilled prior to the issuance of final subdivision approval~~];

E. A drainage system shall be installed in accordance with the requirements of the Department of Public Works and other affected agencies;

F. Comply with all applicable County, State and Federal laws, rules, regulations and requirements[~~, including conditions of Use Permit No. 71~~];

G. [~~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 may, at the developer's election, be satisfied by performance in accordance with the requirements of the Unified Impact Fees Ordinance;~~

~~G. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval.~~

~~ondition shall remain in effect until all of the conditions of approval have been complied and the Planning Director acknowledges that further reports are not required;~~

~~H. An extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances:~~

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

~~1. Granting of the time extension would not be contrary to the General Plan or Zoning Code;~~

~~2. Granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;~~

~~3. 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~~

~~4. 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.~~]

Restrictive covenants in the deeds of all proposed lots within the property shall give notice that the terms of the zoning ordinance prohibit the construction of a second dwelling unit and condominium property regimes on each 1-acre lot. This restriction may be removed by amendment of this ordinance by the County Council. The owner of the property may also, in addition, impose private covenants restricting the number of dwellings. A copy of the proposed covenant(s) to be recorded with the State Bureau of Conveyances shall be submitted to the Planing Director for review and approval prior to the issuance of Final Subdivision Approval. A copy of the recorded document shall be filed with the Planning Department upon its receipt from the Bureau of Conveyances;

H. Before final subdivision approval, applicant must obtain reclassification of the RA-1a zoned area from the State Land Use Commission to the Rural or Urban district. Prior to the submittal of plans for a grading or any associated permit for a golf course to the County for review and approval, the applicant shall consult with the Waikoloa Village Association and the County Council relative to the timing and propriety of such a use. This condition, except for the consultation requirement for any golf course, may be waived by the Planning Director, after consultation with Corporation Counsel, if an appellate judicial decision, or substantive change to Chapter 205, Hawaii Revised Statutes, clearly establishes the legality of this project in the Agricultural State Land Use district, including the residential uses of the lots;

I. The applicant shall make its fair share contribution to mitigate the potential regional impacts of the property with respect to parks and recreation, fire, police, solid waste disposal facilities and roads. The fair share contribution shall be initially based on the representations contained within the change of zone application and may be increased or reduced proportionally if the lot counts are adjusted. The fair share contribution shall become due and payable prior to receipt of Final Plan Approval or within five years from the effective date of this amended change of zone ordinance, whichever occurs first. The fair share contribution for each lot shall be based on a maximum density for each lot as determined by the zoning resulting from this change of zone. The fair share contribution in a form of cash, land, facilities or any combination thereof shall be determined by the County Council. The fair share contribution may be adjusted annually beginning three years after the effective date of the amendment to the ordinance, based on the percentage change in the Honolulu Consumer Price Index (HCPI). The fair share contribution shall have a maximum combined value of **$9,991.21** per single-family residential unit. Based upon the applicant's representation of intent to develop a total of one hundred and seventy five (175) single-family residential units, the indicated total of fair share contribution is **$1,748,461.75** for the single-family residential units. However, the total amount shall be increased or reduced in proportion with the actual number of units according to the calculation and payment provisions set forth in this condition. The fair share contribution per single-family residential unit shall be allocated as follows:

- $4,817.93 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $843,137.75 to the County to support park and recreational improvements and facilities;
- $232.42 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $40,673.50 to the County to support police facilities;
- $459.06 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $80,335.50 to the County to support fire facilities;
- $200.98 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $35,171.50 to the County to support solid waste facilities;
- $4,280.82 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $749,143.50 to the County to support road and traffic improvements;

In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies and approval of the County Council;

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

K. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied with and the Planning Director acknowledges that further reports are not required;

L. Should any of the conditions not be met or substantially complied with in a timely fashion, the Director [~~shall~~] may initiate rezoning of the area to its original or more appropriate designation.

SECTION 2. Material to be deleted is bracketed and material to be added is underscored.

SECTION 3. In the event that any portion of this 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 HAWAI'I

INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAI'I

Kona, Hawai'i
Date of Introduction: November 22, 2005
Date of 1st Reading: November 22, 2005
Date of 2nd Reading: December 7, 2005
Effective Date: December 15, 2005

REFERENCE: Comm. 230.9

OFFICE OF THE COUNTY CLERK
County of Hawai'i
Kona, Hawai'i

(Draft 3)

Introduced By: Pete Hoffmann/K.Angel Pilago
Date Introduced: November 22, 2005
First Reading: November 22, 2005
Published: December 4, 2005

REMARKS:

ROLL CALL VOTE				
	AYES	NOES	ABS	EX
Arakaki	X			
Higa	X			
Hoffmann	X			
Holschuh	X			
Ikeda	X			
Isbell	X			
Jacobson		X		
Pilago	X			
Safarik	X			
	8	1	0	0

Second Reading: December 7, 2005
To Mayor: December 9, 2005
Returned: December 15, 2005
Effective: December 15, 2005
Published: December 22, 2005

REMARKS:

ROLL CALL VOTE				
	AYES	NOES	ABS	EX
Arakaki	X			
Higa	X			
Hoffmann	X			
Holschuh	X			
Ikeda	X			
Isbell	X			
Jacobson		X		
Pilago	X			
Safarik	X			
	8	1	0	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 HAWAI'I
Date 12/3/05

COUNCIL CHAIRMAN

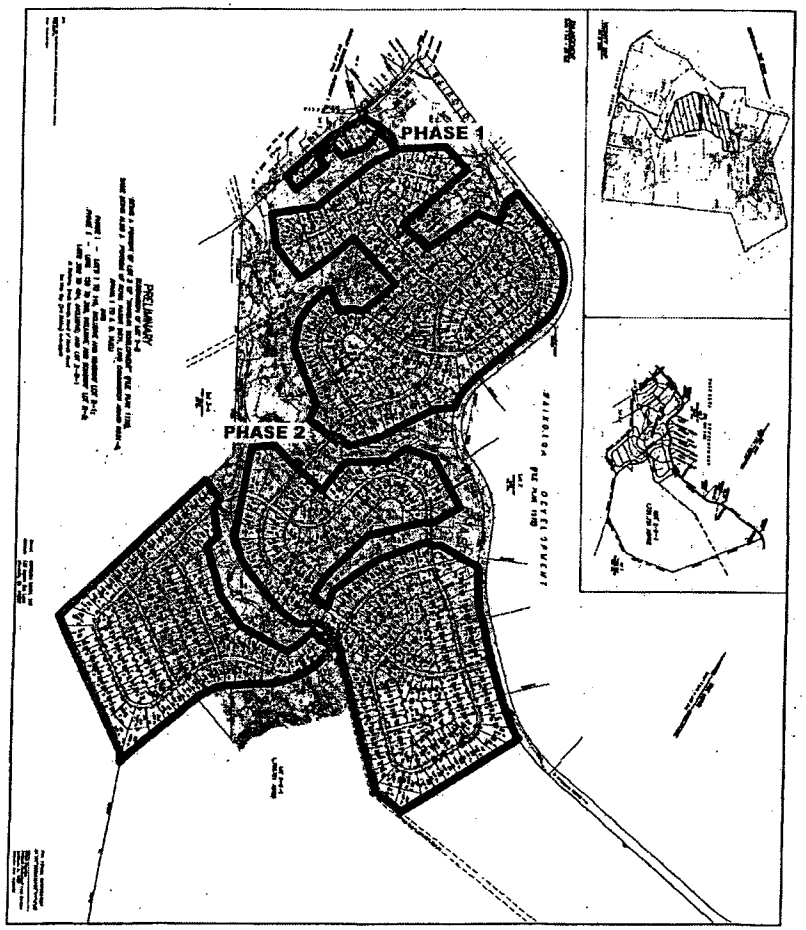
COUNTY CLERK

Bill No.: 89 (Draft 3)
Reference: C-230.9/PC-44
Ord No.: 05 157

Approved/Disapproved this 15th *day*
of December, *20* 05.

MAYOR, COUNTY OF HAWAI'I

Waikoloa Highlands
TMK (3) 6-8-002:016 (portion)
Waikoloa, South Kohala, Hawai'i



SUBDIVISION PLAN

Harry Kim
Mayor

Christopher J. Yuen
Director

Brad Kurokawa, ASLA
LEED® AP
Deputy Director

County of Hawaii
PLANNING DEPARTMENT
101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-3043
(808) 961-8288 • FAX (808) 961-8742

February 8, 2007

Mr. Sidney Fuke
100 Pauahi Street, Suite 212
Hilo, HI 96720

Dear Mr. Fuke:

Change of Zone (REZ 678)
Applicant: Waikoloa Mauka, LLC
Request: Amendment to Change of Zone Ordinance No. 05-157
(Conditions B, C and I)
Tax Map Key: 6-8-2:portion 16 and 6-8-3:portion 32

This is to acknowledge receipt of your request to amend Change of Zone Ordinance No. 05-157 on January 26, 2007. Enclosed is your receipt for the filing fee.

Please be informed, that in accordance with the Hawaii County Zoning Code, Chapter 25-2-4, within ten (10) days after the request has been filed with this office, you are required to notify all owners and lessees with a recorded interest in property within 500 feet of the perimeter boundary of the entire property that your request has been filed with the Planning Department.

In addition, upon notice by our department that the hearing date has been set, you are required to again notify all owners and lessees with a recorded interest in property within 500 feet. This second notice shall be served within ten (10) days after receiving notice of the hearing date and not less than ten (10) days prior to the hearing.

Both notices shall include the following information:

1) Name of the applicant;

2) Precise location of the property, including tax map key identification, location map and/or site plan;

3) Nature of the request and the proposed use of the property;

4) Date on which the request was filed with the director or the commission;

5) Date, time and place the public hearing will be held to consider the request (to be included in the second notice); and

6) Contact name and phone number should there be any questions.

Please also inform the owner that the request is also available at the Planning Department for public review.

Prior to the date of the hearing, the applicant is required to file with the Commission an affidavit or other similar proof of mailing of said notices.

Please be further advised that in accordance with Chapter 25 (Zoning Code), Article 2, Division 1, Section 25-2-12, Hawaii County Code 1983 (2005 Edition) and/or Planning Commission Rules of Practice and Procedure, within ten (10) days from your receipt of this letter, you shall post a sign on the subject property. The sign shall include:

1) The nature of the request;

2) The proposed use of the property;

3) The size of the property;

4) The tax map key(s) of the property;

5) That the public may contact the Planning Department for additional information; and

6) The address and telephone number of the Planning Department.

The sign shall be not less than nine square feet and not more than twelve square feet in area, with letters not less than one inch high. No pictures, drawings, or promotional materials shall be permitted on the sign.

The sign shall be posted at or near the property boundary adjacent to a public road bordering the property and shall be readable from said public road. If more than one public road borders the property, the applicant shall post the sign to be visible from the more heavily traveled public road.

The sign shall, in all other respects, be in compliance with Chapter 3 (Signs), Hawaii County Code 1983 (2005 edition).

The applicant shall file an affidavit with the Planning Department not more than five (5) days after posting the sign stating that a sign has been posted, and that the applicant will not remove the sign until the request has been granted, denied, or withdrawn. A photograph of the sign in place shall accompany the affidavit.

The sign shall remain posted until the request has been granted, denied, or withdrawn. The applicant shall remove the sign promptly after such action.

According to the Zoning Code, Chapter 25, Hawaii County Code, the Planning Director has 120 days in which to provide a recommendation to the Planning Commission. The Commission's review process consists of a public hearing. After such hearing is conducted, the request and the Commission's recommendation will be forwarded to the County Council which has final authority to grant any changes of zone.

We will notify you as to the date, time and place of the public hearing as soon as it has been scheduled.

Should you have any questions regarding the above, please do not hesitate to contact Norman Hayashi of this department at 961-8288, x205.

Sincerely,

CHRISTOPER J. YUEN
Planning Director

Enclosure
Lwaikoloamauka01gyw

SidneyFuke, Planning Consultant
100 Pauahi Street, Suite 212 • Hilo, Hawaii 96720
Telephone: (808) 969-1522 • Fax: (808) 969-7996
E-mail: sidfuke@verizon.net
Planning • Variance • Zoning
Subdivision • Land Use Permits
Environmental Reports

January 26, 2007

Mr. Christopher Yuen, Director
Planning Department
COUNTY OF HAWAI'I
101 Pauahi Street
Hilo, HI 96720

Dear Mr. Yuen:

RE: Amendment to Ord. No. 05 157 – Waikoloa Mauka, LLC
TMK: 6-8-02: Portion of 16 and 6-8-03: Portion of 32

The property owner and applicant, Waikoloa Mauka, LLC, is requesting two sets of amendments to rezoning. The first relates to conditions B and C of the rezoning Ordinance No. 05 157 relating to the nature of improvements at the intersection of Paniolo Avenue/Pua Melia Street and Waikoloa Road as well as the number of accesses to Waikoloa Road. The other is to make clear that the recreational portion of the applicant's impact fee can be used for a multi-use community center.

General Background

In 1990, the former owners of the subject property, Waikoloa Development Company, requested and received rezoning approval (Ordinance No. 90 160) for approximately 761 acres of land from Unplanned (U) and Multiple-family Residential (RM-1.5) to Residential-Agriculture (RA-1a) and Open (O). This action allowed the development of a golf course residential subdivision consisting of 400 1-acre sized lots. The approval was subject to a number of conditions, including development timetable.

In 1995, conditions B and C of Ordinance No. 90 160 were amended. The amendments (Ordinance No. 95 51) required that final subdivision approval of no less than 175 lots be secured within a 5-year period. It further required the construction of channelized improvements at the intersection of Waikoloa Road and Pua Melia Street/Paniolo Avenue before June 30, 1996, as well as the construction of traffic signalization improvements when the number of lots exceeded 350 or as may be required by the Department of Public Works.

Pursuant to the above ordinance and its amendment, tentative subdivision approval was initially granted in 1993 and subsequently amended on March 3, 1994. The channelization improvements were completed in 1996. As allowed by the rezoning ordinance, an administrative time extension was granted by the Planning Director on May 9, 2000 to secure final subdivision approval. This extension was to March 21, 2005.

On January 5, 2005, the former owner requested an amendment to Condition B of Ordinance No. 95 51 which would allow final subdivision approval to be secured before March 21, 2015. During the time the request was being considered by the County Council, the applicant purchased the subject property on or about September 2005. The applicant proceeded to address the Council's concerns, which resulted in the approval of Ordinance No. 05 157, a copy of which is attached.

Nature of Request

In proceeding to finalize the subdivision, the applicant elected to abandon plans for the golf course. To some extent, this decision was designed to address the Waikoloa Village Association's concern over having another golf course in this area at this time. Accordingly, revised subdivision plans were submitted to the County Planning Department reflecting the project being developed into a 398-lot subdivision with natural open space to replace the planned golf course. The project would be developed in two phases, the first consisting of 149 lots and the remaining 249 lots. A copy of the revised subdivision map is enclosed.

Conditions B and C required signalized improvements at the intersection of Waikoloa Road with Pua Melia Street/Paniolo Avenue. The applicant is prepared to make said improvements. However, based on discussions with some area residents, the area councilperson (Pete Hoffmann), and the Director of Department of Public Works (Bruce McClure), it appeared that a "roundabout" instead of signalized intersection may be more appropriate.

Please note that Condition B requires the submittal of the signalized plans in conjunction with the on-site infrastructural plans. The latter has been completed and submitted to the County for review, whereas the completion of the former plans are now being suspended, pending a decision on the type of improvements. In that regard, the applicant is requesting that while this condition be so amended to allow for such an option, it also requests that a determination be made within a reasonable period so as not to hold up the applicant's development schedule and that the applicant – because of the potential delay - to bond said improvements.

Additionally, Condition C limits the project to only one access along Waikoloa Road, which is planned for the *makai* end of the project site. Another access is planned at Pua Melia Street. However, those accesses effectively would service only the lower portion of the project. In the event of an emergency, the *mauka* area may have difficulty getting out of the subdivision. While the concern for limiting access along Waikoloa Road is understandable, it should be noted that the project's frontage stretches more than a mile. The distance between the two planned accesses would still be in excess of a mile

of each other. As such, having another access should not impede normal traffic flow along Waikoloa Road.

As such, the applicant respectfully requests amendments to Conditions B and C of Ordinance No. 05 157 to accomplish the above. A suggested language could be as follows:

> "B. Final subdivision approval for not less than 175 lots shall be secured within ten (10) years from the effective date of this new amendment. Plans for [infrastructural improvements, including] the off-site intersectional roadway improvements required in Condition C, shall be submitted no later than six months after a determination of the type of improvements (i.e., signalized or roundabout) is made by the director of the Department of Public Works [shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property]. The applicant shall install and dedicate the [traffic signalization] intersectional improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the director of public works. In lieu of actual construction of infrastructural improvements required herein, [except for Condition C,] the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.
>
> "C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to [one roadway] two roadways from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized or improved by a "roundabout" system meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report shall be provided in conjunction with final subdivision approval of the first increment or as otherwise provided by Chapter 23 (Subdivision Control);"

The applicant has been working with the community and another developer to identify pressing community facility needs wherein its impact fees could be utilized to facilitate construction of these needed facilities. One of the identified needs has been a multi-use community center. In that regard, the applicant is proposing that the recreational portion

of the impact fee outlined in Condition I be expanded and/or made clear to allow consideration for a multi-use community center.

Accordingly, the applicant requests that the recreational assessment portion Condition I be amended as follows:

> "In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, which may include a multi-purpose community center, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies, and approval of the County Council."

In the event your office believes the requests to be reasonable, the applicant has no objections to alternative language to accomplish the applicant's objective. This objectives, in sum, are to a) allow consideration for a roundabout instead of a signalized intersection, while giving the applicant sufficient time to prepare these plans and bond these improvements; b) allow another access from Waikoloa Road; and c) allow consideration for the applicant to participate in the construction of a community facility to satisfy its recreational impact fee obligation.

Pursuant to the Zoning Code requirements, please find enclosed 20 copies of this letter request, with enclosures; list of surrounding property owners within 500 feet of the subject property; and the filing fee of $250.

Should you have any questions on this matter, please feel free to contact me. Thank you very much.

Sincerely,

SIDNEY M. FUKE
Planning Consultant

Enclosures
Copy – Waikoloa Mauka, LLC w/ enclosures

COUNTY OF HAWAI'I STATE OF HAWAI'I

BILL NO. 89
Draft 3

ORDINANCE NO. 05 157

AN ORDINANCE AMENDING ORDINANCE NO. 95 51 AMENDING ORDINANCE NO. 90-160, WHICH RECLASSIFIED LANDS FROM AN UNPLANNED (U) AND MULTIPLE FAMILY RESIDENTIAL (RM-1.5) TO OPEN (O) AND RESIDENTIAL-AGRICULTURAL (RA-1a) AT WAIKOLOA, SOUTH KOHALA, HAWAI'I, COVERED BY TAX MAP KEY 6-8-02:PORTION OF 16 AND 6-8-03:PORTION OF 32.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAI'I:

SECTION 1. Ordinance No. 95 51 is amended as follows:

"SECTION 3. This change in district classification is conditioned upon the following.

A. The applicant, successors or its assigns shall be responsible for complying with all of the stated conditions of approval;

B. Final subdivision approval for not less than 175 lots shall be secured within [~~five (5)~~] ten (10) years from the effective date of this new amendment. Plans for infrastructural improvements, including off-site roadway improvements required in Condition C, shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property. [~~Prior to June 30, 1996, construction of the channelization improvements to the Waikoloa/ Pua Melia/ Paniolo Avenue intersection (including acceleration/ deceleration and left turn storage lanes and pavement and shoulder widening) meeting with the requirements of the Department of Public Works, shall be completed and dedicated to the county. In addition, t~~]The applicant shall install and dedicate the traffic signalization improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the [~~chief engineer~~]director of public works. In lieu of actual construction of infrastructural

improvements required herein, except for Condition C, the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.

C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to one roadway from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report [~~dated December 1989~~] shall be provided [~~prior to the opening of the golf course or~~] in conjunction with final subdivision approval of the first increment, [~~whichever occurs first.~~] or as otherwise provided by Chapter 23 (Subdivision Control);

D. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall comply with the requirements of Chapter 11, Article 1, Hawaii County Code relating to Affordable Housing Policy. This requirement shall be approved by the County Housing Agency prior to final subdivision approval. [~~secure the concurrence of the County Housing Agency, upon the recommendation of the Office of Housing and Community Development, that the applicant's affordable housing requirements, if any, have been fulfilled prior to the issuance of final subdivision approval~~];

E. A drainage system shall be installed in accordance with the requirements of the Department of Public Works and other affected agencies;

F. Comply with all applicable County, State and Federal laws, rules, regulations and requirements[~~, including conditions of Use Permit No. 71~~];

G. [~~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 may, at the developer's election, be satisfied by performance in accordance with the requirements of the Unified Impact Fees Ordinance;~~

~~G. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval.~~

~~ondition shall remain in effect until all of the conditions of approval have been complied and the Planning Director acknowledges that further reports are not required;~~

~~H. An extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances:~~

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

~~1. Granting of the time extension would not be contrary to the General Plan or Zoning Code;~~

~~2. Granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;~~

~~3. 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~~

~~4. 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.~~]

Restrictive covenants in the deeds of all proposed lots within the property shall give notice that the terms of the zoning ordinance prohibit the construction of a second dwelling unit and condominium property regimes on each 1-acre lot. This restriction may be removed by amendment of this ordinance by the County Council. The owner of the property may also, in addition, impose private covenants restricting the number of dwellings. A copy of the proposed covenant(s) to be recorded with the State Bureau of Conveyances shall be submitted to the Planing Director for review and approval prior to the issuance of Final Subdivision Approval. A copy of the recorded document shall be filed with the Planning Department upon its receipt from the Bureau of Conveyances;

H. Before final subdivision approval, applicant must obtain reclassification of the RA-1a zoned area from the State Land Use Commission to the Rural or Urban district. Prior to the submittal of plans for a grading or any associated permit for a golf course to the County for review and approval, the applicant shall consult with the Waikoloa Village Association and the County Council relative to the timing and propriety of such a use. This condition, except for the consultation requirement for any golf course, may be waived by the Planning Director, after consultation with Corporation Counsel, if an appellate judicial decision, or substantive change to Chapter 205, Hawaii Revised Statutes, clearly establishes the legality of this project in the Agricultural State Land Use district, including the residential uses of the lots;

I. The applicant shall make its fair share contribution to mitigate the potential regional impacts of the property with respect to parks and recreation, fire, police, solid waste disposal facilities and roads. The fair share contribution shall be initially based on the representations contained within the change of zone application and may be increased or reduced proportionally if the lot counts are adjusted. The fair share contribution shall become due and payable prior to receipt of Final Plan Approval or within five years from the effective date of this amended change of zone ordinance, whichever occurs first. The fair share contribution for each lot shall be based on a maximum density for each lot as determined by the zoning resulting from this change of zone. The fair share contribution in a form of cash, land, facilities or any combination thereof shall be determined by the County Council. The fair share contribution may be adjusted annually beginning three years after the effective date of the amendment to the ordinance, based on the percentage change in the Honolulu Consumer Price Index (HCPI). The fair share contribution shall have a maximum combined value of **$9,991.21** per single-family residential unit. Based upon the applicant's representation of intent to develop a total of one hundred and seventy five (175) single-family residential units, the indicated total of fair share contribution is **$1,748,461.75** for the single-family residential units. However, the total amount shall be increased or reduced in proportion with the actual number of units according to the calculation and payment provisions set forth in this condition. The fair share contribution per single-family residential unit shall be allocated as follows:

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- $200.98 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $35,171.50 to the County to support solid waste facilities;
- $4,280.82 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $749,143.50 to the County to support road and traffic improvements;

In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies and approval of the County Council;

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

K. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied with and the Planning Director acknowledges that further reports are not required;

L. Should any of the conditions not be met or substantially complied with in a timely fashion, the Director [~~shall~~] may initiate rezoning of the area to its original or more appropriate designation.

SECTION 2. Material to be deleted is bracketed and material to be added is underscored.

SECTION 3. In the event that any portion of this 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 HAWAI'I

INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAI'I

Kona, Hawai'i
Date of Introduction: November 22, 2005
Date of 1st Reading: November 22, 2005
Date of 2nd Reading: December 7, 2005
Effective Date: December 15, 2005

REFERENCE: Comm. 230.9

OFFICE OF THE COUNTY CLERK
County of Hawai'i
Kona, Hawai'i

(Draft 3)

Introduced By: Pete Hoffmann/K.Angel Pilago
Date Introduced: November 22, 2005
First Reading: November 22, 2005
Published: December 4, 2005

REMARKS:

ROLL CALL VOTE				
	AYES	NOES	ABS	EX
Arakaki	X			
Higa	X			
Hoffmann	X			
Holschuh	X			
Ikeda	X			
Isbell	X			
Jacobson		X		
Pilago	X			
Safarik	X			
	8	1	0	0

Second Reading: December 7, 2005
To Mayor: December 9, 2005
Returned: December 15, 2005
Effective: December 15, 2005
Published: December 22, 2005

REMARKS:

ROLL CALL VOTE				
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Ikeda	X			
Isbell	X			
Jacobson		X		
Pilago	X			
Safarik	X			
	8	1	0	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 HAWAI'I
Date 12/3/05

COUNCIL CHAIRMAN

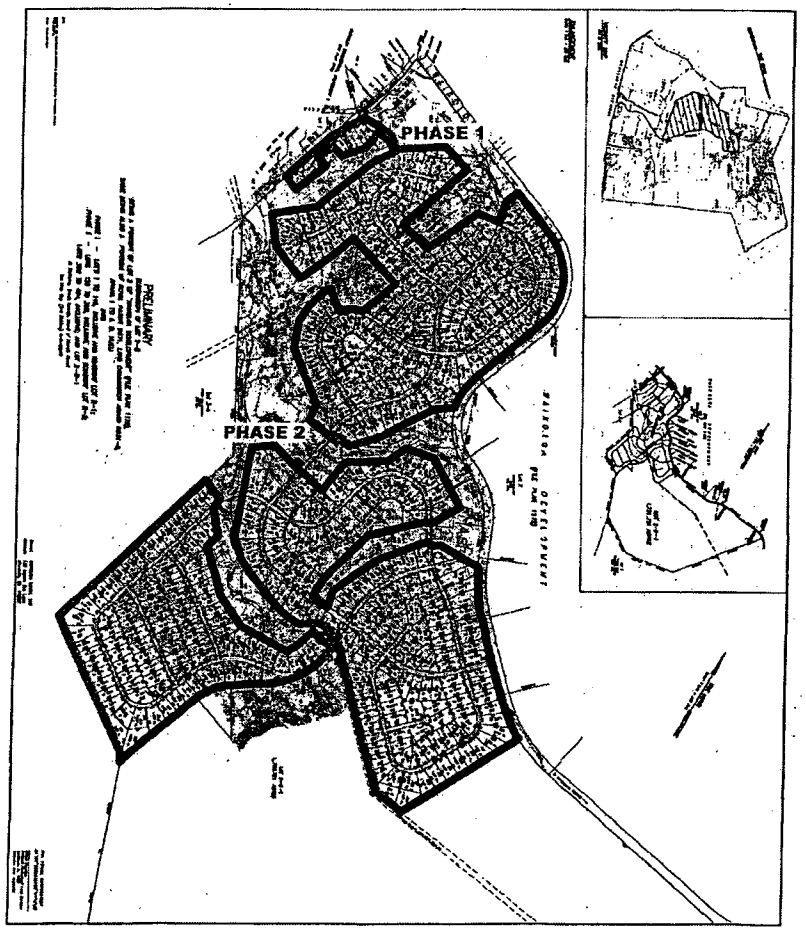
COUNTY CLERK

Bill No.: 89 (Draft 3)
Reference: C-230.9/PC-44
Ord No.: 05 157

Approved/Disapproved this 15th *day*
of December, *20* 05.

MAYOR, COUNTY OF HAWAI'I

Waikoloa Highlands
TMK (3) 6-8-002:016 (portion)
Waikoloa, South Kohala, Hawai'i



SUBDIVISION PLAN

Harry Kim
Mayor

Christopher J. Yuen
Director

Brad Kurokawa, ASLA
LEED® AP
Deputy Director

County of Hawaii
PLANNING DEPARTMENT
101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-3043
(808) 961-8288 • FAX (808) 961-8742

February 8, 2007

Mr. Sidney Fuke
100 Pauahi Street, Suite 212
Hilo, HI 96720

Dear Mr. Fuke:

Change of Zone (REZ 678)
Applicant: Waikoloa Mauka, LLC
Request: Amendment to Change of Zone Ordinance No. 05-157
(Conditions B, C and I)
Tax Map Key: 6-8-2:portion 16 and 6-8-3:portion 32

This is to acknowledge receipt of your request to amend Change of Zone Ordinance No. 05-157 on January 26, 2007. Enclosed is your receipt for the filing fee.

Please be informed, that in accordance with the Hawaii County Zoning Code, Chapter 25-2-4, within ten (10) days after the request has been filed with this office, you are required to notify all owners and lessees with a recorded interest in property within 500 feet of the perimeter boundary of the entire property that your request has been filed with the Planning Department.

In addition, upon notice by our department that the hearing date has been set, you are required to again notify all owners and lessees with a recorded interest in property within 500 feet. This second notice shall be served within ten (10) days after receiving notice of the hearing date and not less than ten (10) days prior to the hearing.

Both notices shall include the following information:

1) Name of the applicant;

2) Precise location of the property, including tax map key identification, location map and/or site plan;

3) Nature of the request and the proposed use of the property;

4) Date on which the request was filed with the director or the commission;

5) Date, time and place the public hearing will be held to consider the request (to be included in the second notice); and

6) Contact name and phone number should there be any questions.

Please also inform the owner that the request is also available at the Planning Department for public review.

Prior to the date of the hearing, the applicant is required to file with the Commission an affidavit or other similar proof of mailing of said notices.

Please be further advised that in accordance with Chapter 25 (Zoning Code), Article 2, Division 1, Section 25-2-12, Hawaii County Code 1983 (2005 Edition) and/or Planning Commission Rules of Practice and Procedure, within ten (10) days from your receipt of this letter, you shall post a sign on the subject property. The sign shall include:

1) The nature of the request;

2) The proposed use of the property;

3) The size of the property;

4) The tax map key(s) of the property;

5) That the public may contact the Planning Department for additional information; and

6) The address and telephone number of the Planning Department.

The sign shall be not less than nine square feet and not more than twelve square feet in area, with letters not less than one inch high. No pictures, drawings, or promotional materials shall be permitted on the sign.

The sign shall be posted at or near the property boundary adjacent to a public road bordering the property and shall be readable from said public road. If more than one public road borders the property, the applicant shall post the sign to be visible from the more heavily traveled public road.

The sign shall, in all other respects, be in compliance with Chapter 3 (Signs), Hawaii County Code 1983 (2005 edition).

The applicant shall file an affidavit with the Planning Department not more than five (5) days after posting the sign stating that a sign has been posted, and that the applicant will not remove the sign until the request has been granted, denied, or withdrawn. A photograph of the sign in place shall accompany the affidavit.

The sign shall remain posted until the request has been granted, denied, or withdrawn. The applicant shall remove the sign promptly after such action.

According to the Zoning Code, Chapter 25, Hawaii County Code, the Planning Director has 120 days in which to provide a recommendation to the Planning Commission. The Commission's review process consists of a public hearing. After such hearing is conducted, the request and the Commission's recommendation will be forwarded to the County Council which has final authority to grant any changes of zone.

We will notify you as to the date, time and place of the public hearing as soon as it has been scheduled.

Should you have any questions regarding the above, please do not hesitate to contact Norman Hayashi of this department at 961-8288, x205.

Sincerely,

CHRISTOPER J. YUEN
Planning Director

Enclosure
Lwaikoloamauka01gyw

SidneyFuke, Planning Consultant
100 Pauahi Street, Suite 212 • Hilo, Hawaii 96720
Telephone: (808) 969-1522 • Fax: (808) 969-7996
E-mail: sidfuke@verizon.net
Planning • Variance • Zoning
Subdivision • Land Use Permits
Environmental Reports

January 26, 2007

Mr. Christopher Yuen, Director
Planning Department
COUNTY OF HAWAI'I
101 Pauahi Street
Hilo, HI 96720

Dear Mr. Yuen:

RE: Amendment to Ord. No. 05 157 – Waikoloa Mauka, LLC
TMK: 6-8-02: Portion of 16 and 6-8-03: Portion of 32

The property owner and applicant, Waikoloa Mauka, LLC, is requesting two sets of amendments to rezoning. The first relates to conditions B and C of the rezoning Ordinance No. 05 157 relating to the nature of improvements at the intersection of Paniolo Avenue/Pua Melia Street and Waikoloa Road as well as the number of accesses to Waikoloa Road. The other is to make clear that the recreational portion of the applicant's impact fee can be used for a multi-use community center.

General Background

In 1990, the former owners of the subject property, Waikoloa Development Company, requested and received rezoning approval (Ordinance No. 90 160) for approximately 761 acres of land from Unplanned (U) and Multiple-family Residential (RM-1.5) to Residential-Agriculture (RA-1a) and Open (O). This action allowed the development of a golf course residential subdivision consisting of 400 1-acre sized lots. The approval was subject to a number of conditions, including development timetable.

In 1995, conditions B and C of Ordinance No. 90 160 were amended. The amendments (Ordinance No. 95 51) required that final subdivision approval of no less than 175 lots be secured within a 5-year period. It further required the construction of channelized improvements at the intersection of Waikoloa Road and Pua Melia Street/Paniolo Avenue before June 30, 1996, as well as the construction of traffic signalization improvements when the number of lots exceeded 350 or as may be required by the Department of Public Works.

Pursuant to the above ordinance and its amendment, tentative subdivision approval was initially granted in 1993 and subsequently amended on March 3, 1994. The channelization improvements were completed in 1996. As allowed by the rezoning ordinance, an administrative time extension was granted by the Planning Director on May 9, 2000 to secure final subdivision approval. This extension was to March 21, 2005.

On January 5, 2005, the former owner requested an amendment to Condition B of Ordinance No. 95 51 which would allow final subdivision approval to be secured before March 21, 2015. During the time the request was being considered by the County Council, the applicant purchased the subject property on or about September 2005. The applicant proceeded to address the Council's concerns, which resulted in the approval of Ordinance No. 05 157, a copy of which is attached.

Nature of Request

In proceeding to finalize the subdivision, the applicant elected to abandon plans for the golf course. To some extent, this decision was designed to address the Waikoloa Village Association's concern over having another golf course in this area at this time. Accordingly, revised subdivision plans were submitted to the County Planning Department reflecting the project being developed into a 398-lot subdivision with natural open space to replace the planned golf course. The project would be developed in two phases, the first consisting of 149 lots and the remaining 249 lots. A copy of the revised subdivision map is enclosed.

Conditions B and C required signalized improvements at the intersection of Waikoloa Road with Pua Melia Street/Paniolo Avenue. The applicant is prepared to make said improvements. However, based on discussions with some area residents, the area councilperson (Pete Hoffmann), and the Director of Department of Public Works (Bruce McClure), it appeared that a "roundabout" instead of signalized intersection may be more appropriate.

Please note that Condition B requires the submittal of the signalized plans in conjunction with the on-site infrastructural plans. The latter has been completed and submitted to the County for review, whereas the completion of the former plans are now being suspended, pending a decision on the type of improvements. In that regard, the applicant is requesting that while this condition be so amended to allow for such an option, it also requests that a determination be made within a reasonable period so as not to hold up the applicant's development schedule and that the applicant – because of the potential delay - to bond said improvements.

Additionally, Condition C limits the project to only one access along Waikoloa Road, which is planned for the *makai* end of the project site. Another access is planned at Pua Melia Street. However, those accesses effectively would service only the lower portion of the project. In the event of an emergency, the *mauka* area may have difficulty getting out of the subdivision. While the concern for limiting access along Waikoloa Road is understandable, it should be noted that the project's frontage stretches more than a mile. The distance between the two planned accesses would still be in excess of a mile

of each other. As such, having another access should not impede normal traffic flow along Waikoloa Road.

As such, the applicant respectfully requests amendments to Conditions B and C of Ordinance No. 05 157 to accomplish the above. A suggested language could be as follows:

> "B. Final subdivision approval for not less than 175 lots shall be secured within ten (10) years from the effective date of this new amendment. Plans for [infrastructural improvements, including] the off-site intersectional roadway improvements required in Condition C, shall be submitted no later than six months after a determination of the type of improvements (i.e., signalized or roundabout) is made by the director of the Department of Public Works [shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property]. The applicant shall install and dedicate the [traffic signalization] intersectional improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the director of public works. In lieu of actual construction of infrastructural improvements required herein, [except for Condition C,] the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.
>
> "C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to [one roadway] two roadways from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized or improved by a "roundabout" system meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report shall be provided in conjunction with final subdivision approval of the first increment or as otherwise provided by Chapter 23 (Subdivision Control);"

The applicant has been working with the community and another developer to identify pressing community facility needs wherein its impact fees could be utilized to facilitate construction of these needed facilities. One of the identified needs has been a multi-use community center. In that regard, the applicant is proposing that the recreational portion

of the impact fee outlined in Condition I be expanded and/or made clear to allow consideration for a multi-use community center.

Accordingly, the applicant requests that the recreational assessment portion Condition I be amended as follows:

> "In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, which may include a multi-purpose community center, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies, and approval of the County Council."

In the event your office believes the requests to be reasonable, the applicant has no objections to alternative language to accomplish the applicant's objective. This objectives, in sum, are to a) allow consideration for a roundabout instead of a signalized intersection, while giving the applicant sufficient time to prepare these plans and bond these improvements; b) allow another access from Waikoloa Road; and c) allow consideration for the applicant to participate in the construction of a community facility to satisfy its recreational impact fee obligation.

Pursuant to the Zoning Code requirements, please find enclosed 20 copies of this letter request, with enclosures; list of surrounding property owners within 500 feet of the subject property; and the filing fee of $250.

Should you have any questions on this matter, please feel free to contact me. Thank you very much.

Sincerely,

SIDNEY M. FUKE
Planning Consultant

Enclosures
Copy – Waikoloa Mauka, LLC w/ enclosures

COUNTY OF HAWAI'I STATE OF HAWAI'I

BILL NO. 89
Draft 3

ORDINANCE NO. 05 157

AN ORDINANCE AMENDING ORDINANCE NO. 95 51 AMENDING ORDINANCE NO. 90-160, WHICH RECLASSIFIED LANDS FROM AN UNPLANNED (U) AND MULTIPLE FAMILY RESIDENTIAL (RM-1.5) TO OPEN (O) AND RESIDENTIAL-AGRICULTURAL (RA-1a) AT WAIKOLOA, SOUTH KOHALA, HAWAI'I, COVERED BY TAX MAP KEY 6-8-02:PORTION OF 16 AND 6-8-03:PORTION OF 32.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAI'I:

SECTION 1. Ordinance No. 95 51 is amended as follows:

"SECTION 3. This change in district classification is conditioned upon the following.

A. The applicant, successors or its assigns shall be responsible for complying with all of the stated conditions of approval;

B. Final subdivision approval for not less than 175 lots shall be secured within [~~five (5)~~] ten (10) years from the effective date of this new amendment. Plans for infrastructural improvements, including off-site roadway improvements required in Condition C, shall be submitted in conjunction with construction drawings for final subdivision approval for any portion of the subject property. [~~Prior to June 30, 1996, construction of the channelization improvements to the Waikoloa/ Pua Melia/ Paniolo Avenue intersection (including acceleration/ deceleration and left turn storage lanes and pavement and shoulder widening) meeting with the requirements of the Department of Public Works, shall be completed and dedicated to the county. In addition, t~~]The applicant shall install and dedicate the traffic signalization improvements required in Condition C prior to the Final Subdivision Approval for more than 350 lots of twenty acres or less, or sooner in the event the warrants for such installation are justified by the [~~chief engineer~~]director of public works. In lieu of actual construction of infrastructural

improvements required herein, except for Condition C, the applicant may enter into an agreement with the County to assure the County that the infrastructural improvements will be constructed together with the appropriate bond, surety, or other security deemed acceptable to the Planning Director and the Corporation Counsel. Upon execution of such agreement and/or filing of the security with the County, final subdivision approval for the subject property or portions thereof shall be granted prior to the actual construction of required infrastructural improvements.

C. Access shall meet with the requirements of the Department of Public Works. Direct access to Waikoloa Road shall be limited to one roadway from the project site. Waikoloa Road-Pua Melia Street-Paniolo Avenue intersection shall be channelized and signalized meeting with the requirements of the Department of Public Works. These improvements together with other improvements required by the Department of Public Works based upon a current Traffic Impact Analysis Report [~~dated December 1989~~] shall be provided [~~prior to the opening of the golf course or~~] in conjunction with final subdivision approval of the first increment, [~~whichever occurs first.~~] or as otherwise provided by Chapter 23 (Subdivision Control);

D. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall comply with the requirements of Chapter 11, Article 1, Hawaii County Code relating to Affordable Housing Policy. This requirement shall be approved by the County Housing Agency prior to final subdivision approval. [~~secure the concurrence of the County Housing Agency, upon the recommendation of the Office of Housing and Community Development, that the applicant's affordable housing requirements, if any, have been fulfilled prior to the issuance of final subdivision approval~~];

E. A drainage system shall be installed in accordance with the requirements of the Department of Public Works and other affected agencies;

F. Comply with all applicable County, State and Federal laws, rules, regulations and requirements[~~, including conditions of Use Permit No. 71~~];

G. [~~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 may, at the developer's election, be satisfied by performance in accordance with the requirements of the Unified Impact Fees Ordinance;~~

~~G. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval.~~

~~ondition shall remain in effect until all of the conditions of approval have been complied and the Planning Director acknowledges that further reports are not required;~~

~~H. An extension of time for the performance of conditions within the ordinance may be granted by the Planning Director upon the following circumstances:~~

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

~~1. Granting of the time extension would not be contrary to the General Plan or Zoning Code;~~

~~2. Granting of the time extension would not be contrary to the original reasons for the granting of the change of zone;~~

~~3. 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~~

~~4. 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.~~]

Restrictive covenants in the deeds of all proposed lots within the property shall give notice that the terms of the zoning ordinance prohibit the construction of a second dwelling unit and condominium property regimes on each 1-acre lot. This restriction may be removed by amendment of this ordinance by the County Council. The owner of the property may also, in addition, impose private covenants restricting the number of dwellings. A copy of the proposed covenant(s) to be recorded with the State Bureau of Conveyances shall be submitted to the Planing Director for review and approval prior to the issuance of Final Subdivision Approval. A copy of the recorded document shall be filed with the Planning Department upon its receipt from the Bureau of Conveyances;

H. Before final subdivision approval, applicant must obtain reclassification of the RA-1a zoned area from the State Land Use Commission to the Rural or Urban district. Prior to the submittal of plans for a grading or any associated permit for a golf course to the County for review and approval, the applicant shall consult with the Waikoloa Village Association and the County Council relative to the timing and propriety of such a use. This condition, except for the consultation requirement for any golf course, may be waived by the Planning Director, after consultation with Corporation Counsel, if an appellate judicial decision, or substantive change to Chapter 205, Hawaii Revised Statutes, clearly establishes the legality of this project in the Agricultural State Land Use district, including the residential uses of the lots;

I. The applicant shall make its fair share contribution to mitigate the potential regional impacts of the property with respect to parks and recreation, fire, police, solid waste disposal facilities and roads. The fair share contribution shall be initially based on the representations contained within the change of zone application and may be increased or reduced proportionally if the lot counts are adjusted. The fair share contribution shall become due and payable prior to receipt of Final Plan Approval or within five years from the effective date of this amended change of zone ordinance, whichever occurs first. The fair share contribution for each lot shall be based on a maximum density for each lot as determined by the zoning resulting from this change of zone. The fair share contribution in a form of cash, land, facilities or any combination thereof shall be determined by the County Council. The fair share contribution may be adjusted annually beginning three years after the effective date of the amendment to the ordinance, based on the percentage change in the Honolulu Consumer Price Index (HCPI). The fair share contribution shall have a maximum combined value of **$9,991.21** per single-family residential unit. Based upon the applicant's representation of intent to develop a total of one hundred and seventy five (175) single-family residential units, the indicated total of fair share contribution is **$1,748,461.75** for the single-family residential units. However, the total amount shall be increased or reduced in proportion with the actual number of units according to the calculation and payment provisions set forth in this condition. The fair share contribution per single-family residential unit shall be allocated as follows:

- $4,817.93 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $843,137.75 to the County to support park and recreational improvements and facilities;
- $232.42 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $40,673.50 to the County to support police facilities;
- $459.06 per single-family residential unit for one hundred and seventy five (175) single-family residential units for an indicated total of $80,335.50 to the County to support fire facilities;
- $200.98 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $35,171.50 to the County to support solid waste facilities;
- $4,280.82 per single-family residential unit for the one hundred and seventy five (175) single-family residential units for an indicated total of $749,143.50 to the County to support road and traffic improvements;

In lieu of paying the fair share contribution, the applicant may contribute land and/or construct improvements/facilities related to parks and recreation, fire, police, solid waste disposal facilities and roads within the region impacted by the proposed development, subject to the review and recommendation of the Planning Director, upon consultation with the appropriate agencies and approval of the County Council;

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

K. An annual progress report shall be submitted to the Planning Director prior to the anniversary of the effective date of the change of zone. The report shall address the status of the development and the compliance with the conditions of approval. This condition shall remain in effect until all of the conditions of approval have been complied with and the Planning Director acknowledges that further reports are not required;

L. Should any of the conditions not be met or substantially complied with in a timely fashion, the Director [~~shall~~] may initiate rezoning of the area to its original or more appropriate designation.

SECTION 2. Material to be deleted is bracketed and material to be added is underscored.

SECTION 3. In the event that any portion of this 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 HAWAI'I

INTRODUCED BY:

COUNCIL MEMBER, COUNTY OF HAWAI'I

Kona, Hawai'i
Date of Introduction: November 22, 2005
Date of 1st Reading: November 22, 2005
Date of 2nd Reading: December 7, 2005
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REFERENCE: Comm. 230.9

OFFICE OF THE COUNTY CLERK
County of Hawai'i
Kona, Hawai'i

(Draft 3)

Introduced By: Pete Hoffmann/K.Angel Pilago
Date Introduced: November 22, 2005
First Reading: November 22, 2005
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Second Reading: December 7, 2005
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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 HAWAI'I
Date 12/3/05

COUNCIL CHAIRMAN

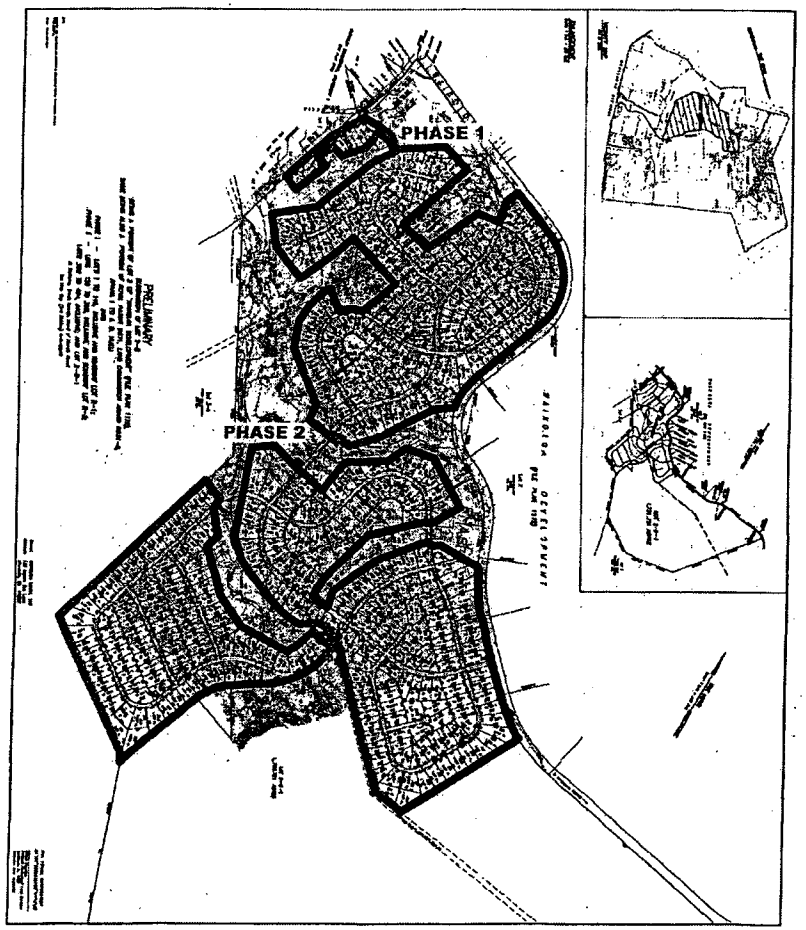
COUNTY CLERK

Bill No.: 89 (Draft 3)
Reference: C-230.9/PC-44
Ord No.: 05 157

Approved/Disapproved this 15th *day*
of December, *20* 05.

MAYOR, COUNTY OF HAWAI'I

Waikoloa Highlands
TMK (3) 6-8-002:016 (portion)
Waikoloa, South Kohala, Hawai'i



SUBDIVISION PLAN