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Figure 1. Island of Kaua'i

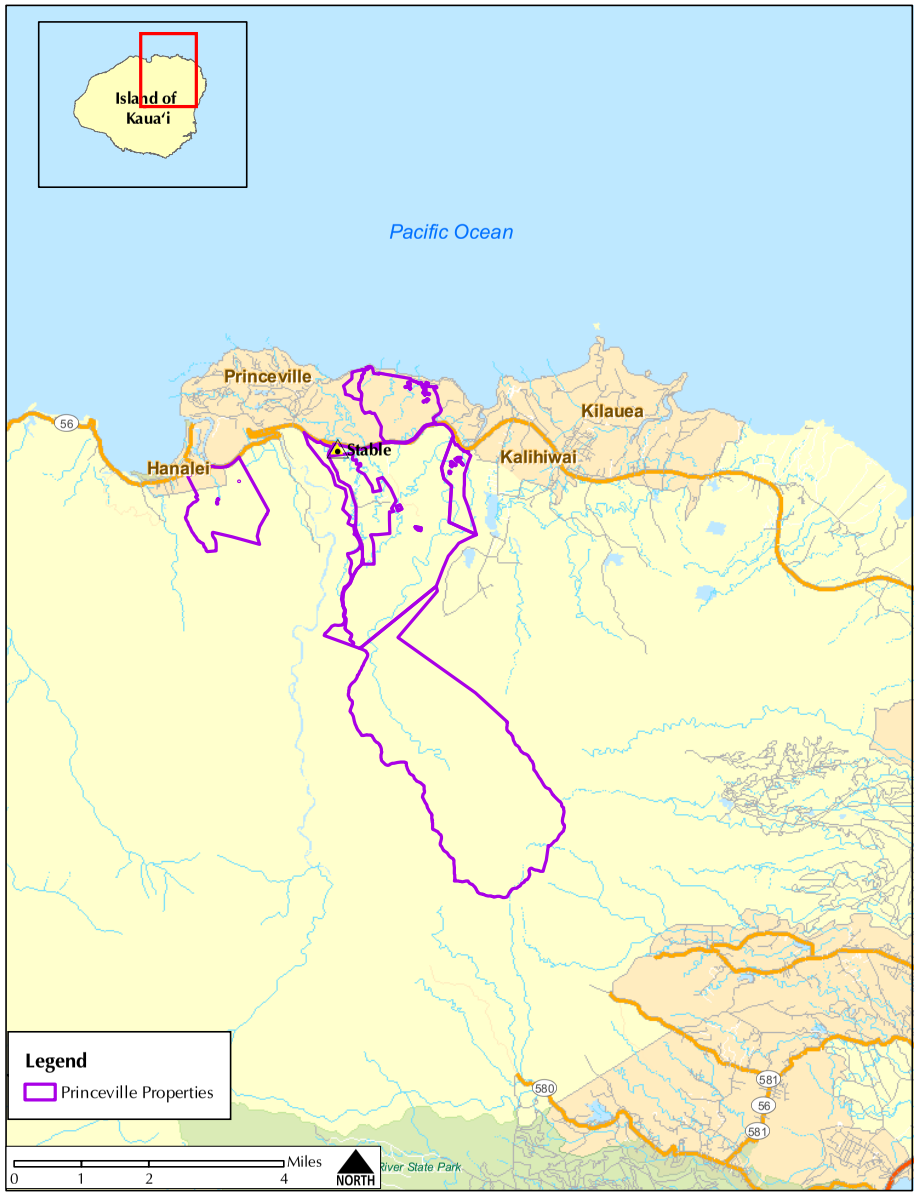
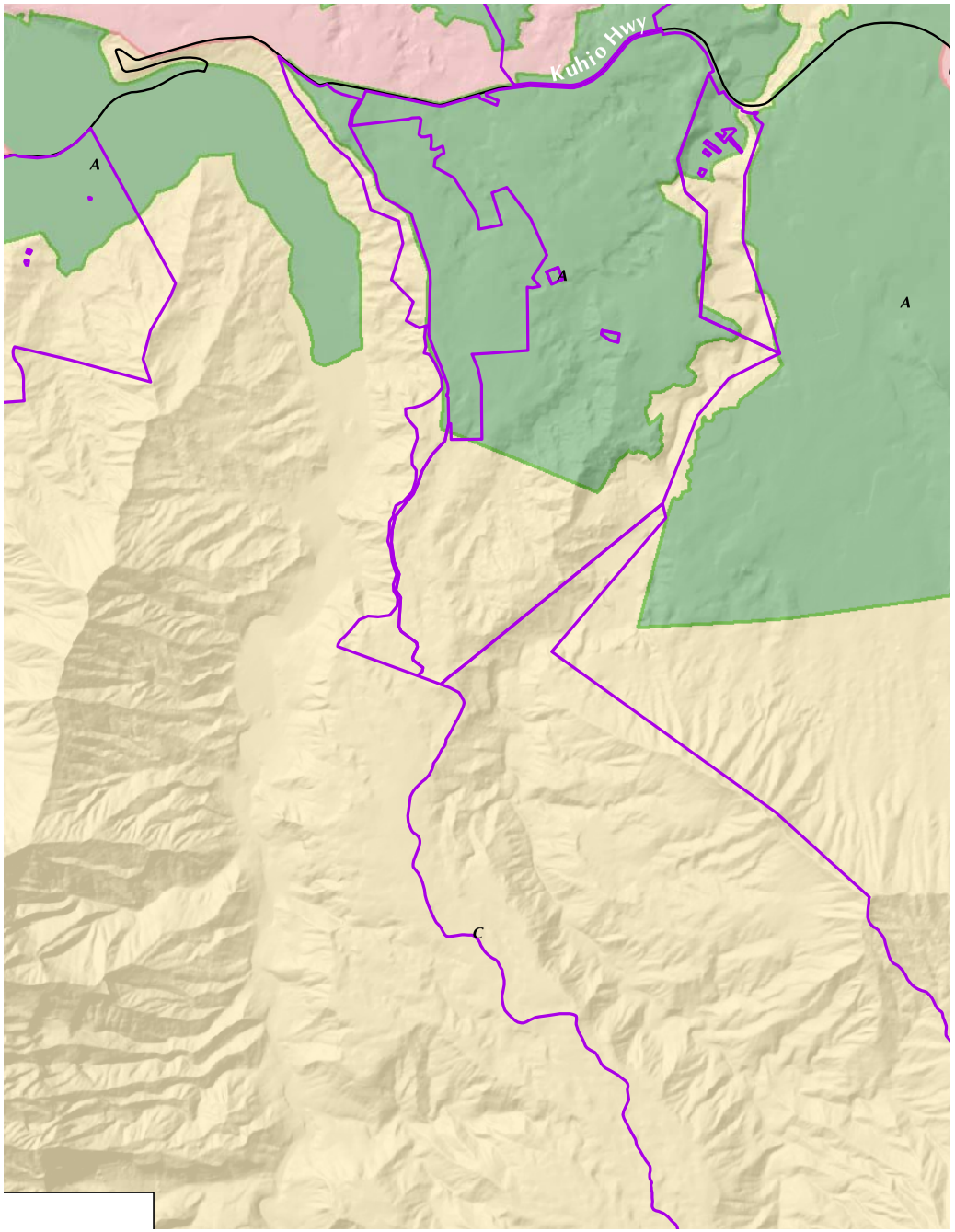


Figure 2. North Shore, Kaua'i



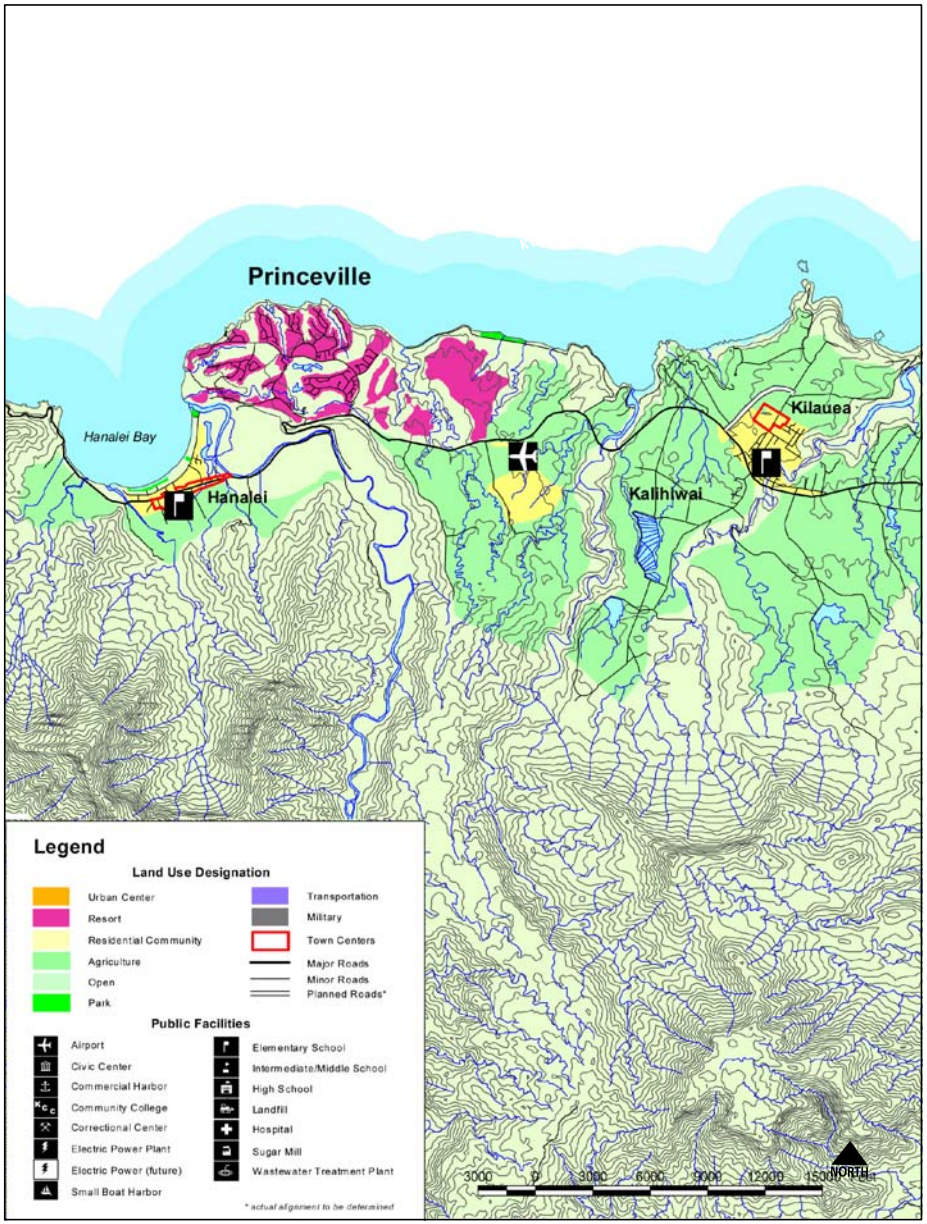


Figure 5. Kauai County General Plan Land Use (2000)

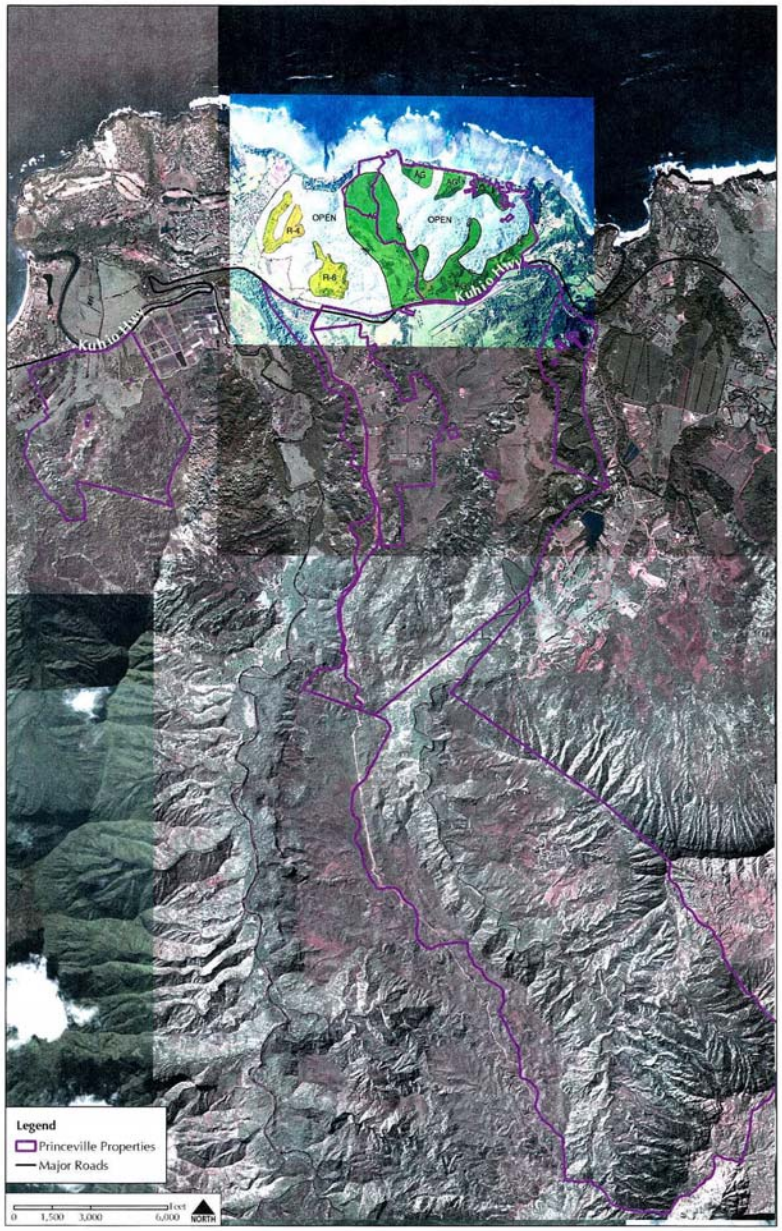
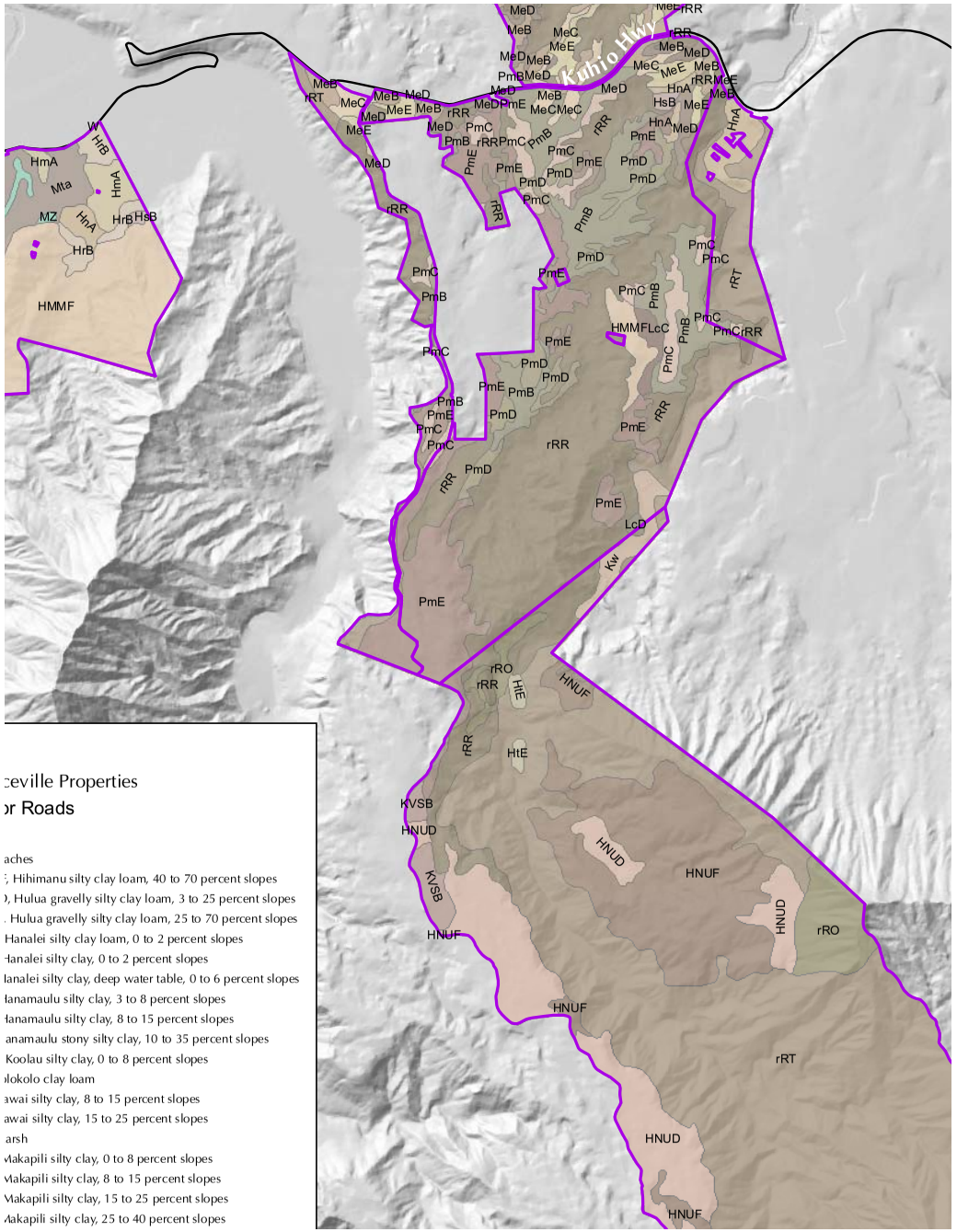
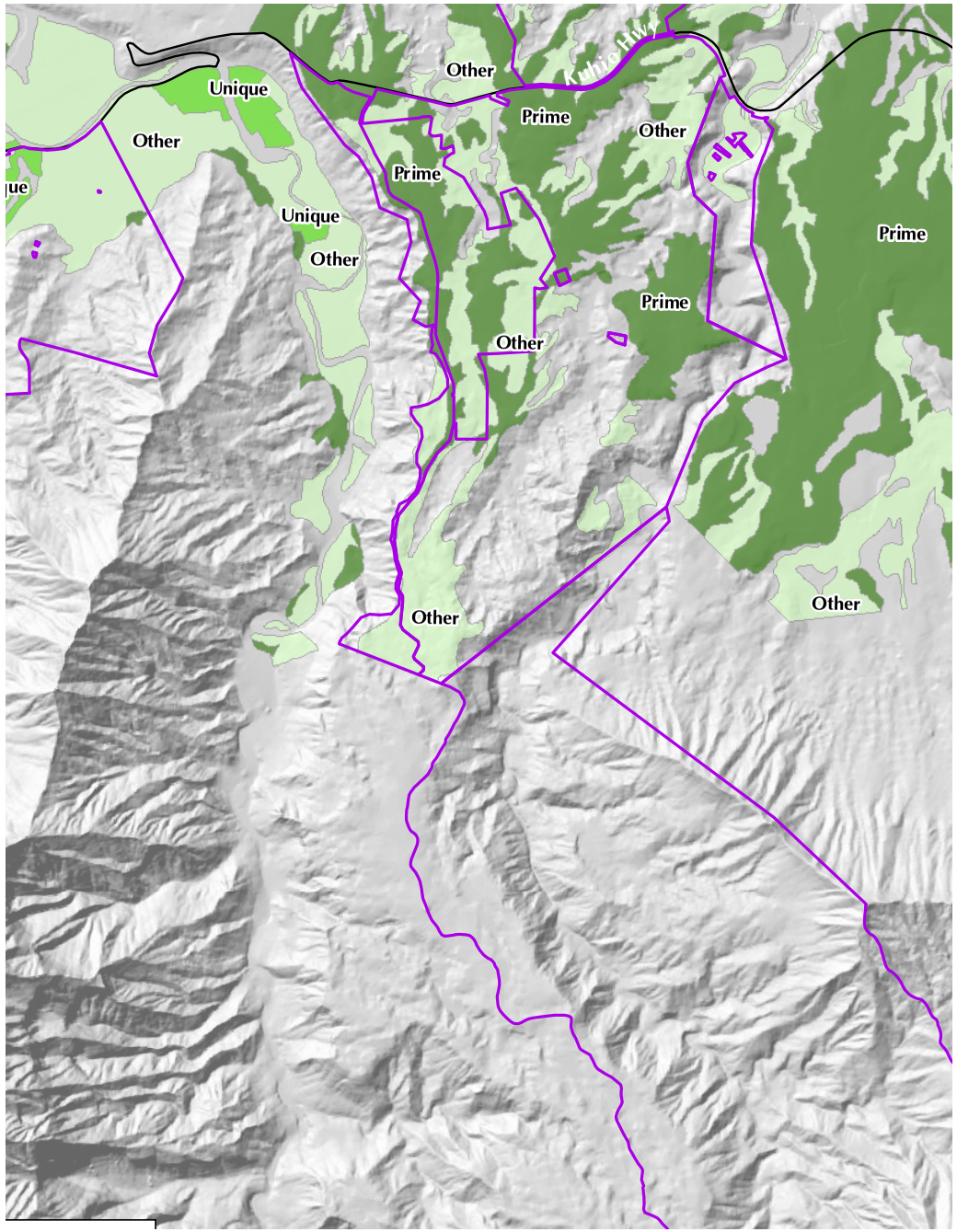


Figure 6. Kauai County Zoning for Makai Area

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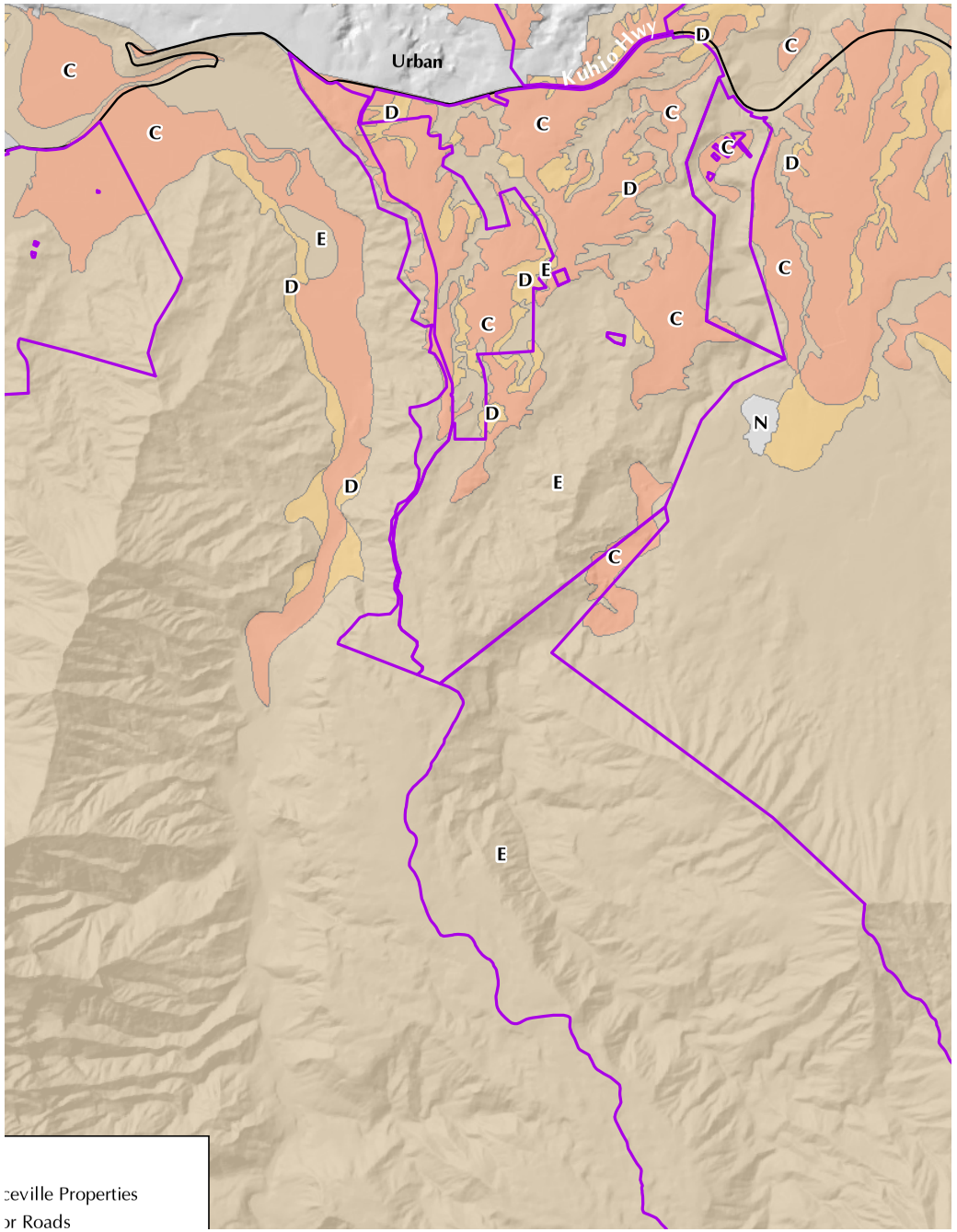
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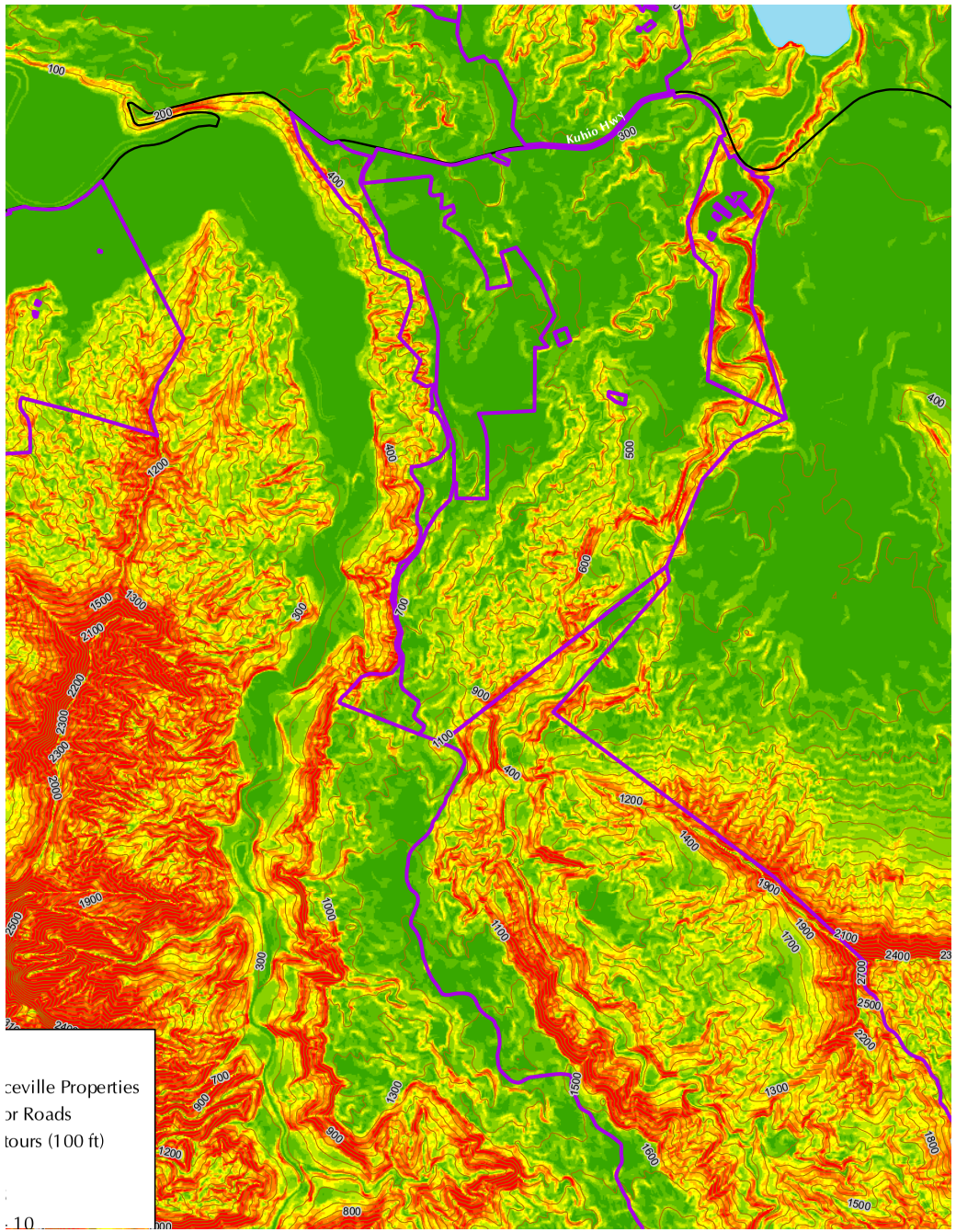
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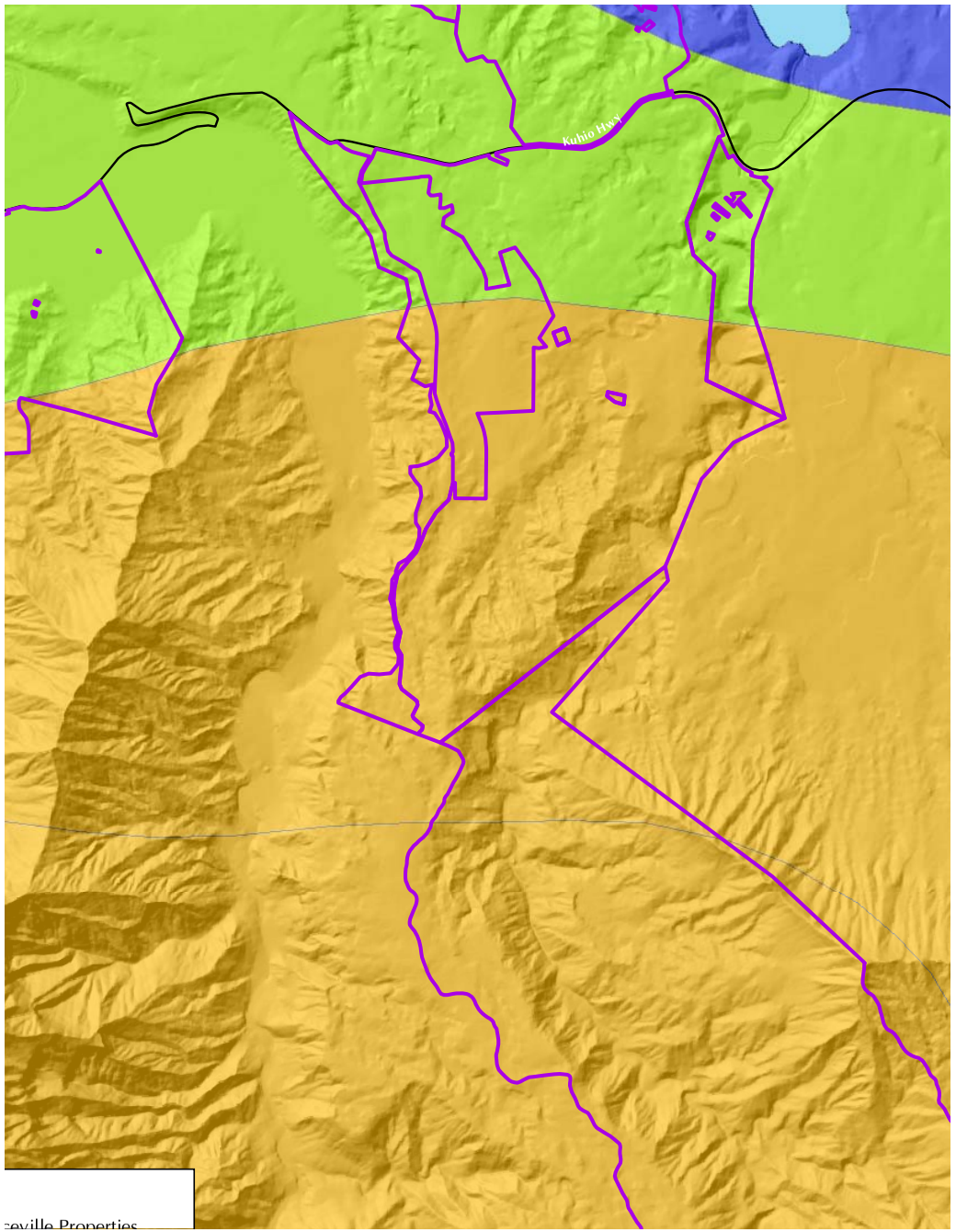
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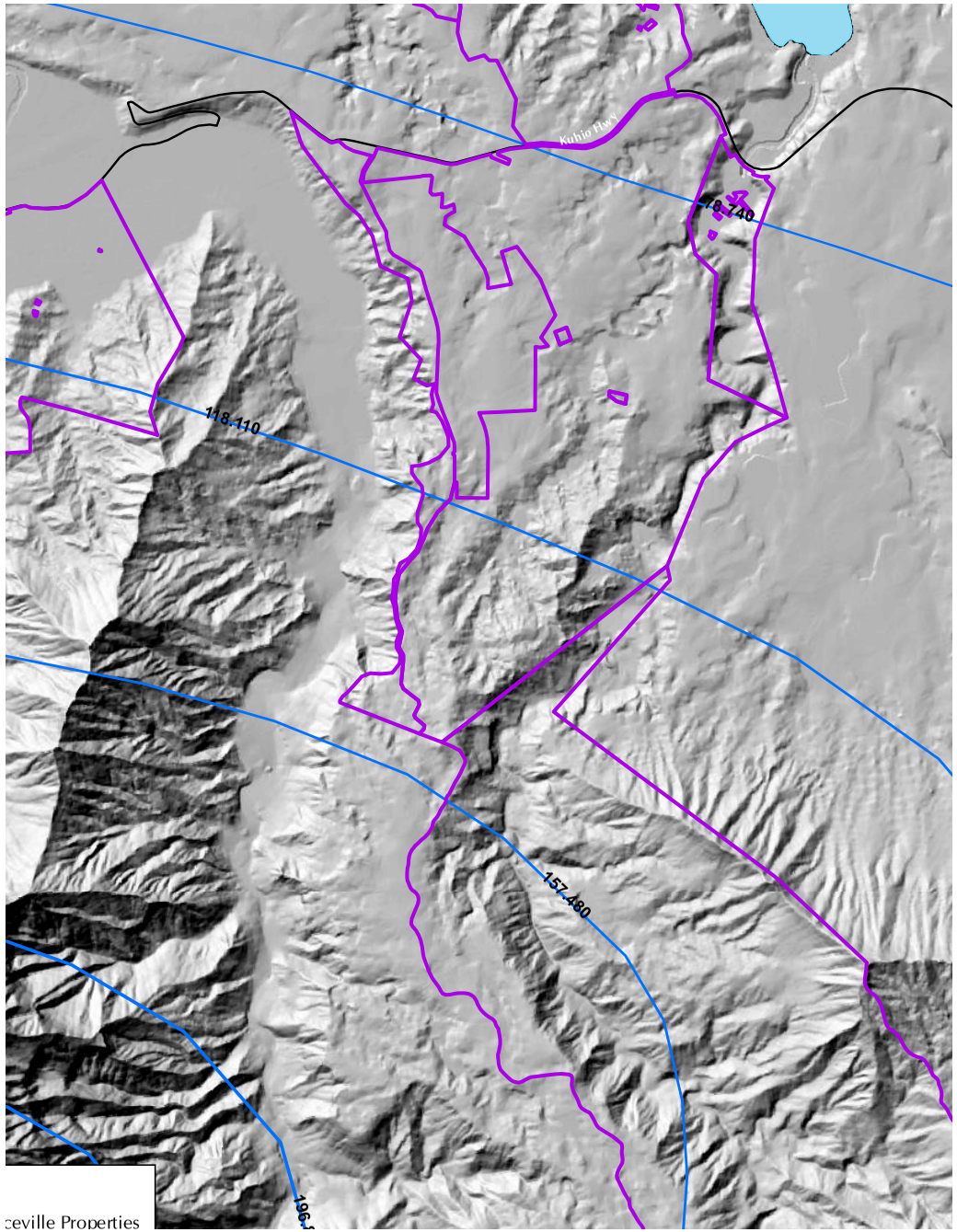
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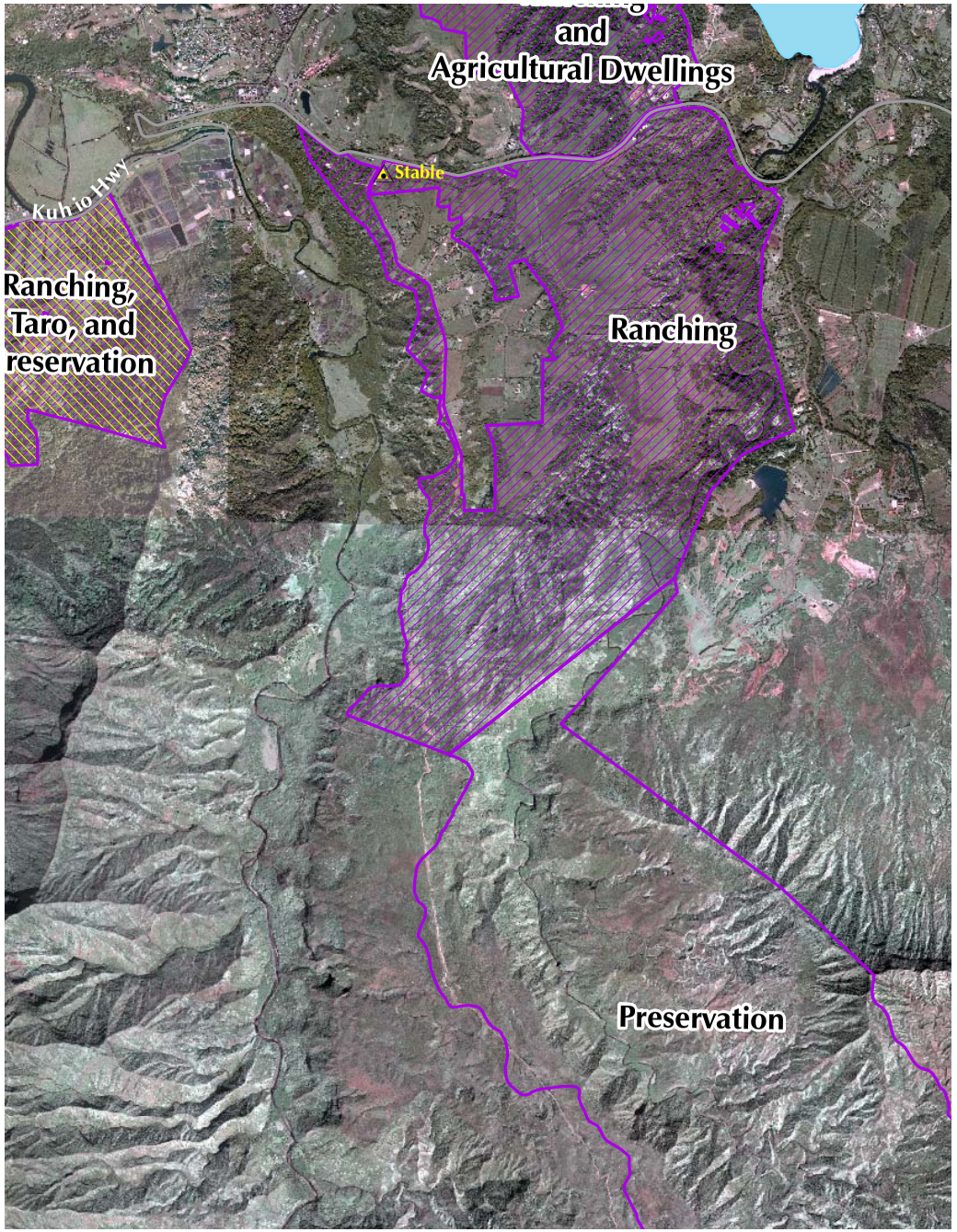
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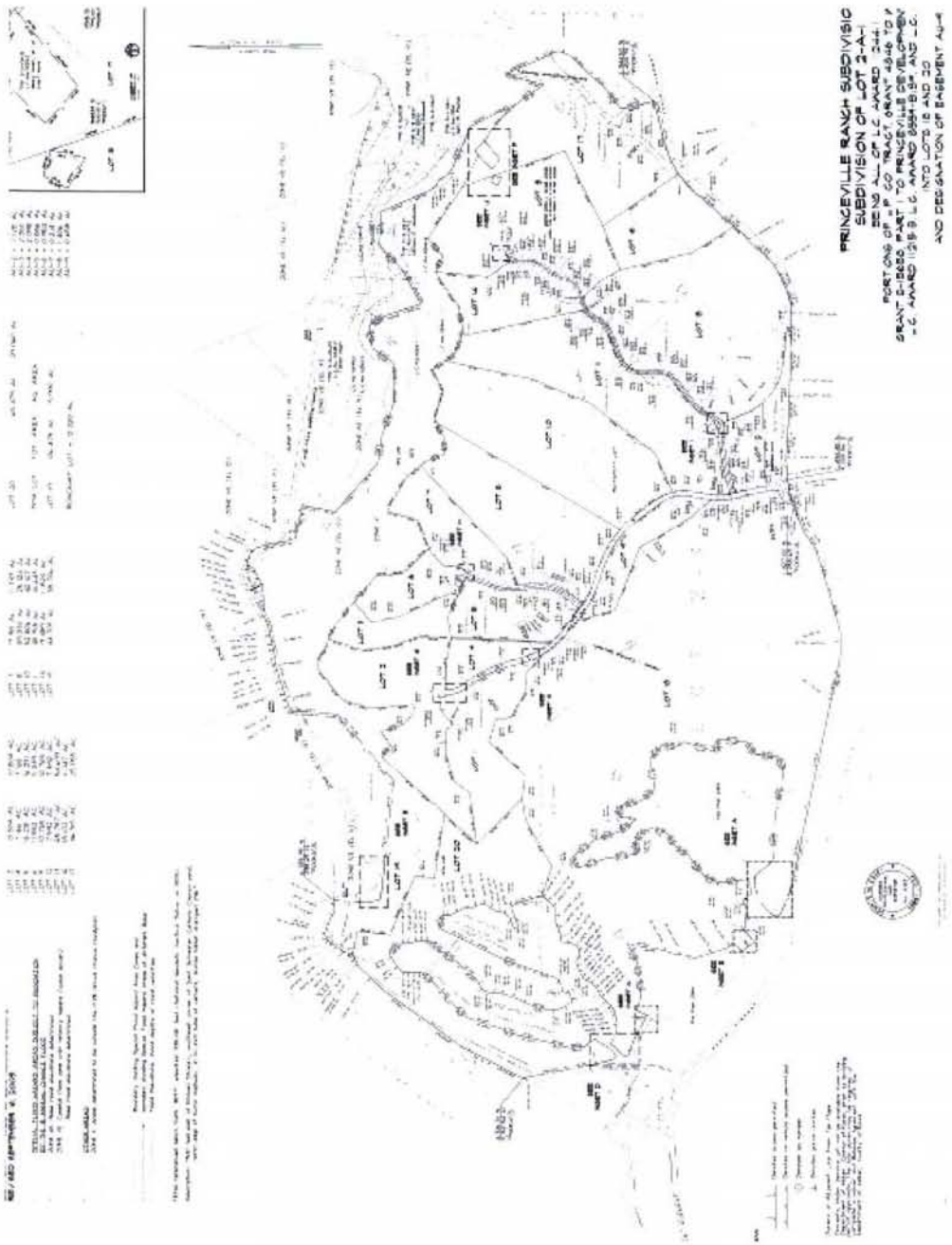

PRINCEVILLE RANCH SUBDIVISION (S-2008-21)
LOT SIZE AND RESIDENTIAL DENSITY RECAP

1/15/2010

		LOT SIZE (Acres)			FARM DWELLING DENSITY						
Lot	Ag/	Lot Sizes (Acres)			Allowable				Proposed		Comments
No	Open	AG (Ag)	OPEN (O)	TOTAL	Ag	O	TOTAL	w/8-8.6(b)1	Ag/O	Total	
1	O	11.218	12.447	23.665	4	2	6		4/2	6	
2	A	25.266	11.008	36.274	5	2	7		4/2	6	
3	A	10.804	0.000	10.804	4	0	4		4/0	4	
4	A	7.152	0.000	7.152	3	0	3		2/0	2	
5	A	16.231	0.000	16.231	5	0	5		4/0	4	
6	A	11.349	0.503	11.852	4	0	4		4/0	4	
7	O	5.408	11.747	17.155	2	2	4		2/1	3	
8	O	14.210	25.124	39.334	5	5	10		4/2	6	
9	A	10.765	0.000	10.765	4	0	4		4/0	4	
10	O	12.699	40.107	52.806	4	8	12		4/1	5	
11	O	7.275	41.643	48.918	3	8	11		2/3	5	
12	A	7.592	0.000	7.592	3	0	3		3/0	3	
13	A	54.693	11.094	65.787	5	2	7	2	7/0	7	Urban
14	O	7.668	11.821	19.489	2	2	4	1	3/0	3	
15	O	5.999	38.706	44.705	2	7	9		0/2	2	
16	A	11.047	7.055	18.102	4	1	5		3/1	4	
17	A	25.055	21.260	46.315	5	4	9		4/3	7	
18	O	105.015	157.442	262.457	5	31	36			0	Golf Course Lot
19	O	5.990	120.488	126.478	3	23	26			0	SMA Lot
20	O	29.060	36.419	65.479	5	5	10			0	Golf Course Lot
Roadway				11.952			0			0	
Total		384.496	546.864	943.312	77	102	179			75	
		74.940	1 thru 17	476.946							
			18 & 20	327.936							

Figure 15. Subdivision Lot Sizes and Residential Density

APPENDIX B. PRINCEVILLE RANCH ECONOMIC ANALYSIS

PRINCE ESTATES:
ECONOMIC AND FISCAL IMPACTS

Plasch Econ Pacific LLC

PRINCE ESTATES:
ECONOMIC AND FISCAL IMPACTS

PREPARED FOR:
Princeville Associates LLC and its subsidiary
Princeville Prince Golf Course LLC

PREPARED BY:
Plasch Econ Pacific LLC

July 2009

CONTENTS

EXECUTIVE SUMMARY

1. PROPOSED DEVELOPMENT

As part of the "Princeville Ranch Agricultural Master Plan," Princeville Associates LLC and its subsidiary Princeville Prince Golf Courses are requesting that the State Land Use Commission reclassify about 120 acres (the Petition Area) from the Urban District to the Agricultural District. The land will then be developed as part of Prince Estates ("the Project"), a 17-lot agricultural subdivision to be located on a 489-acre site in the Hanalei District of Kauai. The Project will include up to 75 ranch houses. However, in 20 years (the assumed analysis period), it is estimated that about 34 ranch houses will be built (an average of two homes per lot), with about nine of them being in the Petition Area.

2. EMPLOYMENT BENEFITS

a. Construction and Related Employment

During the 20-year analysis period, construction employment to provide the Project infrastructure and build the ranch houses is expected to average about 22 jobs, including about six jobs associated with development in the Petition Area. It is anticipated that most construction jobs associated with the Project will be filled by workers already living on Kauai. As other construction projects are completed on the island, Kauai construction workers will be hired to work on the various components of this Project, and will then move on to other Kauai projects. Thus, the Project will help keep Kauai's existing construction workers employed.

Indirect employment related to Project development is expected to average about 22 jobs on Kauai and 11 jobs on O'ahu. Thus, total direct-plus-indirect employment associated with the construction activities will average about 55 jobs per year, with about 44 of them being on Kauai. About 15 direct-plus-indirect jobs will be attributable to construction in the Petition Area. The actual annual job count will fluctuate over time depending upon the pace of construction.

b. Employment Generated by Consumption Expenditures

In 20 years, purchases of goods and services by occupants of the ranch houses are projected to support about 43 jobs, including about 39 new jobs on Kauai and four jobs on O`ahu. About 11 of these jobs will be attributable to purchases by residents of the ranch houses in the Petition Area. Onsite annual employment for home and yard maintenance and repair is projected to reach an estimated ten jobs, with about three of these jobs in the Petition Area.

3. FISCAL BENEFITS

a. County

Project development activity is expected to have a negligible impact on County finances inasmuch as the developer will provide an interior road, water distribution, drainage, etc., while home builders will provide individual wastewater disposal systems. Also, most construction workers are expected to be from Kauai so will not require additional services from the County.

In 20 years, net tax revenues to the County are projected to reach about $170,000 per year, including about $50,000 per year being attributable to residents living in the Petition Area. The positive fiscal return to the County reflects the high property values for the ranch houses and lots. This differs from typical residential communities where County services are partially subsidized by tax revenues from resort, resort-residential, commercial, and industrial properties.

b. State

Unlike the County, the State derives substantial net revenues from development activity. Over the 20-year analysis period, the State will net about $12.2 million from development activities associated with the Project, or an average of about $610,000 per year. About $3.2 million or nearly $160,000 per year will be attributable to development activity in the Petition Area. Net revenues are high because of the amount of economic activity associated with selling lots and building the ranch houses.

In 20 years, net tax revenues to the State are projected to reach about $570,000 per year for the Project and about $150,000 per year for the Petition Area. The positive return to the State reflects the high income and consumption levels of occupants of the ranch houses. This differs from typical residential communities for which State services are partially subsidized by tax revenues derived from resort and commercial activities.

PRINCE ESTATES:
ECONOMIC AND FISCAL IMPACTS

1. INTRODUCTION

a. Content and Purpose

Princeville Associates LLC and its subsidiary Princeville Prince Golf Course LLC are proposing to develop Prince Estates ("the Project"), an agricultural subdivision to be located in the Hanalei District of Kaua`i. The developer is requesting that the State Land Use Commission reclassify about 120 acres ("the Petition Area") from the Urban District to the Agricultural District.

This report addresses the economic and fiscal benefits and impacts of both the Project and that portion of the Project located in the Petition Area. The purpose of the report is to provide State and County officials with information relevant to their decisions about State districting, County approvals, and County zoning.

The economic impacts cover sales and expenditures, profits, employment, and payroll related to the (1) development activities and (2) operations at the end of the 20-year analysis period.

Fiscal impacts address the impact of the Project on County and State revenues and expenditures. The material covers the increase in County and State tax revenues, the increase in government support expenditures, and the resulting net revenues to the County and State.

b. Methodology

Multipliers

The proposed development is translated into economic and fiscal impacts based on a number of multipliers (for example, average value of a ranch house, indirect sales as a percentage of direct sales, jobs per $1 million in sales, indirect jobs per direct jobs, and tax rates). These multipliers reflect the professional judgment of the consultant, and were derived based on information from the following sources:

Hawai'i projects similar to the proposed Project; U.S. Census data for Kaua`i; the *State of Hawai'i Data Book; The 2002 Input-Output Study for Hawai'i; The Hawai'i Inter-County Input-Output Study: 2002 Benchmark Report;* employment and labor rates from the State Department of Labor and Industrial Relations (DLIR); County and State tax rates; and revenue and expenditure data from the County and the State.

2009 Dollars

Throughout the report, dollar amounts are expressed in terms of 2009 purchasing power and market conditions. Values, prices, costs and dollar amounts for prior years are adjusted for inflation to 2009 dollars based on the Honolulu Consumer Price Index (CPI) for Urban Consumers. Dollar amounts after 2009 are not increased to account for inflation, appreciation in property values, changes in labor rates, changes in building costs, or other changes in market conditions.

Accuracy of Estimates

Much of the analysis contained in this report is quantitative in nature, where numbers are used to help communicate anticipated impacts. However, these numbers should not be interpreted as precise predictions. Rather, they represent the best estimates of what is expected to occur based on available information about future development, market conditions, and tax rates. As a general rule, economic and fiscal impact estimates in this report are accurate within about 20%.

c. Organization of the Report

The material below gives the following information about the Project and its economic and fiscal impacts: a description of the Project, current State and County land-use entitlements, the economic impacts of the Project's development activities, the economic impacts of Project operations at the end of the analysis period, the impact on County revenues and expenditures, and the impact on State revenues and expenditures.

The detailed assumptions, multipliers, and calculations are shown in five tables at the end of the report. These tables cover the following:

- Table 1: Proposed Development
- Table 2: Economic Impacts of Development Activities
- Table 3: Economic Impacts of Operations at End of Analysis Period
- Table 4: Impacts on County Revenues and Expenditures
- Table 5: Impacts on State Revenues and Expenditures

The quantities appearing in **bold** in the tables highlight the more significant economic and fiscal impacts.

d. Economic Consultant

The analysis was conducted by Plasch Econ Pacific LLC, a Hawai'i-based economic-consulting firm specializing in economic development, land and housing economics, feasibility studies, valuations, market analysis, public policy analysis, and the economic and fiscal impacts of projects.

2. PROJECT DESCRIPTION[1,2]

a. Project Location and Area

The Project is planned for a 489-acre site in Princeville, Hanalei District of Kaua`i (see Figure 1). A bluff and the Pacific Ocean are on the makai side of the property, Kalihiwai Valley is to the east, Kuhio Highway borders the property on the mauka side, and Prince Golf Course and the developed portion of Princeville are to the west.

b. Ranch Lots and Houses

As shown in Figure 1, the Project is designed as an agricultural subdivision of 17 ranch lots ranging in size from about 7.2 acres to 65.8 acres. The County of Kaua'i Comprehensive Zoning Ordinance would allow up to 112 ranch houses to be built on the 17 lots. However, Princeville Associates will adopt a Declaration of Covenants, Conditions and Restrictions (CC&Rs) for the subdivision that will limit

1. Princeville Associates, LLC. 2009.
2. Group 70, International, Inc. 2009.

the total number of ranch houses to 75 units, each of which will be located within a designated 1-acre house site (see Figure 2).

Based on development activity of comparable agricultural subdivisions near the Project, the developer anticipates that, in 20 years (the assumed analysis period), about 34 ranch houses will be built (an average of two homes per lot), with about nine of them being in the Petition Area.

3. ENTITLEMENTS[3,4]

a. State Districts

About 369 acres of the Project area are in the State Agricultural District, and about 120 acres (the Petition Area) are in the Urban District (see Figures 1 and 2). In 1985, the State Land Use Commission reclassified the Petition Area from Agricultural to Urban, subject to the condition that the land be used for a golf course and a related golf clubhouse, restaurant and tennis/fitness complex. Subsequently, the Prince Golf Course and the Prince Clubhouse were developed, but the eastern plateau of the makai lands was not and will not be used for a golf course. Instead, this land is to be used for pasture and ranch houses. Accordingly, the developer is requesting that the State Land Use Commission change the districting for the Petition Area back to Agricultural.

b. County General Plan and Zoning

The Kaua'i General Plan designates most of the Project Area as Resort, Agriculture and Open, and would allow over 1,500 resort/residential units. Also, most of the Project lands are zoned Agriculture and Open, while about 63 acres are zoned Residential. The developer is requesting that the County change the General Plan and zoning so that all of the Project Area is designated Agriculture and Open.

3. Princeville.Associates, LLC. 2009.
4. Group 70, International, Inc. 2009.

4. ECONOMIC IMPACTS OF DEVELOPMENT ACTIVITIES

The development of the Project will involve the following activities: (1) grading and other work to prepare the site for development; (2) construction of an internal road, a water delivery system, utilities systems, etc.; (3) sale of ranch lots; and (4) construction of custom ranch houses. Table 2 summarizes the direct and indirect economic impacts of these development activities. The material in this table gives the analysis period, construction expenditures, indirect sales generated by the construction activity, property sales, profits, employment and payroll, and the number of residents and houses supported by the development activities.

a. Analysis Period

As indicated in Section 2.a of Table 2, the assumed analysis period is 20 years. However, the occasional development of ranch houses could continue after this period.

b. Construction Expenditures

Over the 20-year development period, total construction expenditures for the Project are estimated at about $97.4 million based on about $5.6 million for site improvements and an average of about $2.7 million per ranch house (see Section 2.c of Table 2). Construction expenditures attributable to the Petition area are estimated at about $25.7 million. These figures translate into average construction expenditures of about $4.87 million per year for the Project and about $1.28 million for the Petition Area. In practice, construction expenditures will vary from year to year.

In addition to construction costs, other development costs will be incurred for planning, permitting, design, financing, County and State exactions, marketing, and sales commissions. Estimates of these costs are not provided in Table 2.

c. Indirect Sales Generated by Construction Activity

In addition to construction expenditures, development activities will generate indirect sales associated with supplying goods and services to construction companies and to the families of construction workers. In turn, the companies supplying

goods and services, and the families of their employees, will purchase goods and services from other companies, and so on. These indirect sales will include sales by companies that supply building materials (cement, steel, lumber, roofing materials, plumbing equipment, electrical equipment, hardware supplies, lighting, flooring, etc.); rent out construction equipment; repair equipment; provide warehousing services; provide shipping and trucking services; etc. Indirect sales also include sales by grocery stores, drug stores, restaurants, service stations, beauty salons, medical providers, accountants, attorneys, insurance agents, etc.

Based on State economic multipliers, these indirect sales are expected to average about $4.0 million per year for the Project, of which about $2.44 million per year will be on Kaua`i (see Section 2.d of Table 2.). Corresponding figures for the Petition area are about $1.05 million per year for all indirect sales, of which about $640,000 per year will be on Kauai.

d. Lot Sales

Lot sales are expected to reach about $104.9 million for the Project, or an average of about $5.25 million per year during the 20-year development period (see Section 2.e of Table 2). Corresponding figures for the Petition area are about $26.4 million and about $1.32 million per year, respectively As indicated in the table, lot prices are based on about $230,000 per acre.

e. Summary of Expenditures and Sales

Section 2.f of Table 2 summarizes anticipated expenditures and sales. As indicated, combined lots sales, construction expenditures and indirect sales related to construction are expected to average about $14.11 million per year for the Project. About $11.43 million per year will be subject to the 4% excise tax on final sales, while about $2.68 million per year will be subject to the 0.5% excise tax on intermediate sales. Corresponding figures for the Petition Area are about $3.66 million per year for total sales, about $2.96 million per year for sales taxed at 4%, and about $690,000 taxed at 0.5%.

Development and sales in some years may be much higher or lower than the average, depending on market conditions.

f. Profits

Profits on these sales are estimated at about $1.65 million per year for the Project and about $430,000 per year for the Petition Area (see Section 2.g of Table 2).

g. Employment

During the Project's 20-year development period, construction employment is expected to average about 22 jobs for the Project and 6 jobs for the Petition Area (see Section 2.h of Table 2). Thus, the total effort to build the ranch houses will require about 440 man-years of labor (22 jobs x 20 years).

These construction jobs will include supervisors, heavy-equipment operators (grading, roads, water mains, sewer lines, etc.), cement workers to lay foundations, metal workers, carpenters, plumbers, electricians, roofers, glass and window installers, cabinet makers, carpet and tile layers, painters, equipment installers, interior decorators, landscapers, etc. Other jobs related to construction will include architects, civil engineers, draftsmen, government inspectors, etc. These jobs will range over a variety of skill levels, including entry-level, semiskilled, skilled, management, and professional positions.

As with indirect sales, development activities will generate indirect jobs associated with supplying goods and services to construction companies and to the families of construction workers. In turn, the companies supplying goods and services, and the families of their employees, will purchase goods and services from other companies, and so on. Indirect jobs will include those at companies that supply building materials (cement, steel, lumber, roofing materials, plumbing equipment, electrical equipment, hardware supplies, lighting, flooring, etc.); rent construction equipment; repair equipment; provide warehousing services; provide shipping and trucking services; etc. Other indirect jobs will include those involved with supplying goods and services to employees and their families: grocery workers, store clerks, restaurant workers, service-station workers, beauty technicians, barbers, bankers, druggists, veterinarians, computer technicians, medical workers, accountants attorneys, etc. The jobs will range over a variety of skill levels, including entry-level, semi-skilled, skilled, and management positions.

Based on State employment multipliers, indirect employment related to Project development is expected to average about 22 jobs on Kaua`i and 11 jobs on O'ahu. Corresponding figures for the Petition Area are 6 jobs on Kaua`i and 3 jobs on O`ahu.

Thus, total direct-plus-indirect employment associated with Project development activities will average about 55 jobs, of which about 44 jobs will be on Kaua`i. Corresponding figures for the Petition Area will average about 15 jobs, of which about 12 jobs will be on Kaua`i. The actual job count will fluctuate over time, depending on the pace of construction.

h. Payroll

Development activities are expected to generate a total payroll of about $2.39 million per year for the Project, of which about $1.16 million will be for construction workers, about $780,000 for indirect employment on Kaua`i, and about $450,000 for indirect employment on O'ahu (see Section 2.I of Table 2). Corresponding figures for the Petition Area are a total payroll of $650,000, of which about $320,000 will be for construction workers, about $210,000 for indirect employment on Kaua`i, and about $120,000 for indirect employment on O'ahu. These estimates are based on the average number of direct and indirect jobs multiplied by average wages as reported to the DLIR.

Wages will range from about $25,000 annually to over $100,000, and are expected to average about $52,700 per year for construction jobs, about $35,430 for indirect jobs on Kaua`i, and about $40,780 for indirect jobs on O'ahu.

i. Supported Population and Housing

During the 20-year development period, direct and indirect jobs provided by Project construction will support about 112 residents housed in about 38 houses (see Sections 2.j and 2.k of Table 2). Construction jobs will support about 44 residents and 15 homes, while the remainder will be supported by indirect jobs. Corresponding figures for the Petition Area are about about 31 residents housed in about 10 homes, including about 12 residents and 4 homes supported by construction jobs.

Most of the residents supported by the direct-plus-indirect jobs are expected to live on Kaua`i: about 88 residents housed in about 30 homes, of which about 24 residents housed in about 8 homes will be attributable to the Petition Area.

j. Sources of Construction Workers

As noted above, construction employment is expected to average about 22 jobs during the Project's 20-year development period. This is about 0.1% of the County's 1,870 construction jobs in 2007 (DLIR). In view of this small percentage, it is expected that the construction jobs for the Project will be filled by workers already living on Kaua`i. As other construction projects are completed on the island, Kaua`i construction workers will be hired to work on the various components of the Project infrastructure and house construction, then move on to other projects. Thus, the Project will help keep Kaua`i's existing construction workers employed.

Special programs to increase the number of construction workers on Kaua`i appear to be unwarranted since sufficient workers are already available.

5. ECONOMIC IMPACTS OF OPERATIONS AT THE END OF THE ANALYSIS PERIOD

Table 3 summarizes the estimated number of residents who will live in Prince Estates at the end of the 20-year analysis period, taxable household income, and related economic activity generated by consumption expenditures.

a. Number of Ranch Houses and Residents

As shown in Sections 3.a and 3.b of Table 3, it is expected that, in 20 years, Prince Estates will host about 136 residents living in about 34 ranch houses, of which about 36 residents and 9 houses will be in the Petition Area.

b. Property Values

In 20 years, Prince Estates is expected to have a property value of about $196.7 million, of which about $50.7 million will be for the Petition Area (Table 3, Section 3.c). These values are based on an average of $2.7 million per ranch house and $230,000 per acre.

c. Taxable Household Income

Taxable household income of these families is projected to reach about $6.8 million per year in 20 years, of which about $1.8 million will be attributable to families living in the Petition Area (Table 3, Section 3.d).

d. Sales and Profits

In 20 years, consumption expenditures are estimated at about $3.4 million per year for all families at Prince Estates, indirect sales on Kaua`i are estimated at about $1.22 million per year; indirect sales on O`ahu are estimated at about $450,000 per year; for a total of about $ 5.07 million per year in Statewide direct-plus-indirect sales (Table 3, Section 3.a). For Kaua`i alone, direct-plus-indirect sales will total about $4.62 million per year. Corresponding figures for the Petition Area are about $900,000 per year in direct sales, about $320,000 per year in indirect sales on Kaua`i, about $120,000 per year in indirect sales on O`ahu, total Statewide direct-plus-indirect sales of about $1.34 million per year, and total Kaua`i direct-plus-indirect sales of about $1.22 million per year.

In 20 years, corresponding profits on direct and indirect sales are estimated at about $460,000 per year, of which about $120,000 per year will be attributable to the expenditures of families living in the Petition Area.

e. Employment and Payroll

In 20 years, consumption expenditures by families living at Prince Estates are estimated to support about 39 direct-plus-indirect jobs on Kaua`i, and about 4 indirect jobs on O`ahu, for a total of about 43 jobs Statewide (Table 3, Section 3.f). About 10 jobs will be located at Prince Estates, most of which will be for home and yard maintenance and repair. Other jobs will include: grocery workers, store clerks, restaurant workers, service-station workers, beauty technicians, barbers, bankers, druggists, veterinarians, computer technicians, medical workers, accountants attorneys, etc. The jobs will range over a variety of skill levels, including entry-level, semi-skilled, skilled, and management positions.

Wages will range from about $25,000 annually to over $100,000. Total payroll for these jobs is estimated at about $1.38 million per year for the jobs on Kaua`i, about $160,000 per year for the jobs on O`ahu, about $1.54 million per year for all jobs, and about $300,000 per year for on-site jobs (Table 3, Section 3.h).

Corresponding employment attributable to the Petition Area is estimated at about 10 direct-plus-indirect jobs on Kaua`i, about 1 indirect job on O`ahu, for a total of about 11 jobs Statewide. About 3 jobs will be located at Prince Estates. Payroll for these jobs is estimated at about $350,000 per year for the jobs on Kaua`i, about $40,000 per year for the jobs on O`ahu, about $390,000 per year for all jobs, and about $90,000 per year for on-site jobs.

f. Supported Population and Housing

The jobs generated by consumption expenditures will support Statewide about 87 residents living in about 31 homes (Table 3, Sections 3.h and 3.i). About 78 of these residents and 28 homes will be on Kaua`i, and the remainder on O`ahu. Corresponding figures attributed to the Petition Area are estimated at about 22 residents living in about 8 homes, including about 20 of these residents and 7 homes on Kaua`i, with the remainder of them on O'ahu.

6. IMPACTS ON COUNTY REVENUES AND EXPENDITURES

The impact of the Project on County finances is shown in Table 4. This table summarizes: (1) changes in the County's tax and expenditure base that is used to calculate revenues and expenditures, (2) revenues and expenditures related to development activities, and (3) revenues and expenditures related to operations in 20 years.

a. Development Activities

As with other major projects on Kaua`i, the developer and individual home builders will provide or finance their fair shares of infrastructure and facilities to support the Project. This will include interior roads, interior water distribution, drainage systems, wastewater disposal, etc.

An allowance is made for general unspecified improvements that result in the same per-capita level of cash capital outlay and debt service as that carried by other Kaua`i County residents. This cash capital outlay and debt service, which is shown in Section 4.c. of Table 4, amounts to about $27,000 and $11,000 per year, respectively. Although not shown in Table 4, this level of outlay would support improvements costing about $480,000, assuming financing with a 20-year bond at an interest rate of about 4.7%. The corresponding figure for the Petition Area is estimated at about $7,000 in cash capital outlay and $3,000 in debt service to support improvements costing about $130,000.

Construction activities require few on-site services from the County. Furthermore, construction companies will provide their own security, sanitation, transportation, etc.

As shown in Table 4, Section 4.b, Project development activity will result in a negligible impact on County finances.

b. Operations at the End of the Analysis Period

In 20 years, the Project will generate increased revenues to the County of about $330,000 per year (Table 4, Section 4.c). Most of this increase will come from additional property taxes of about $230,000 per year. An estimated $100,000 per year in additional revenues will be derived from other taxes and user fees, which are assumed to be proportional to the number of residents living in Prince Estates. These taxes and fees include: fuel taxes, motor vehicle weight taxes, water fees, solid-waste disposal fees, other departmental earnings, other licenses and fees, etc. Corresponding figures for the Petition Area are about $60,000 per year in additional property taxes, about $30,000 per year in other taxes and fees, for a total of about $90,000 per year.

County expenditures in support of operations are estimated at about $170,000 per year. About $130,000 of the expenditures will be for services, which are assumed to be proportional to the number of Prince Estates residents and at the same level of services as those provided to other County residents. These services include: general government, police, fire, road maintenance, operations and maintenance (O&M) of water delivery systems, solid waste disposal, recreation, etc. And, as

previously mentioned, there will be cash outlays and debt service on general improvements of about $30,000 and $11,000 per year, respectively. The resulting cash outlay and debt service will result in about the same per-capita level of expenditures as that carried by other residents of the County. Corresponding figures for the Petition Area are about $30,000 per year for services, about $7,000 per year in cash capital outlays, about $3,000 per year for debt service, for a total of about $44,000 per year.

In 20 years, the Project is projected to generate about $170,000 per year in net revenues to the County, of which about $50,000 will be attributable to the Petition Area. This differs from typical residential communities where, by design, County services are partially subsidized by tax revenues from resort, resort-residential, commercial, and industrial properties.

7. IMPACTS ON STATE REVENUES AND EXPENDITURES

The impact of the Project on State finances is shown in Table 5. This table summarizes: (1) changes in the State's tax and expenditure base that is used to calculate revenues and expenditures, (2) revenues and expenditures related to development activities, and (3) revenues and expenditures related to operations at the end of the analysis period.

a. Development Activities

Over the 20-year analysis period, Project development activities are expected to generate about $12.2 million in revenues for the State, of which about $3.2 million will be attributable to the Petition Area (Table 5, Section 5.c). Most of the revenues will be derived from (1) excise taxes, (2) corporate and personal income taxes, and (3) conveyance taxes.

State expenditures to support Project development activities are expected to be negligible. Infrastructure and facilities to support the Project are primarily a County responsibility, with most of the fair share provided or financed by the developer and home builders.

However, an allowance is made for general unspecified improvements that result in the same per-capita level of debt service as that carried by other residents in the State. This debt service, which is shown in Table 5, Section 5.c., amounts to about $30,000 per year. Although not shown in Section 5.b, this level of debt service would support improvements that cost about $380,000, assuming financing with a 20-year bond at an interest rate of about 4.7%.

Construction activities will require few on-site services from the State. Furthermore, most required services will be provided by construction companies.

Unlike the County, the State derives substantial net revenues from development activity. Over the 20-year analysis period, the State will net about $12.2 million from development activities associated with the Project, or an average of about $610,000 per year. Corresponding figures for the Petition Area are about $3.2 million in net revenues over 20 years, or an average of about $160,000 per year. Net revenues are high because of the amount of economic activity associated with selling lots and building ranch houses.

b. Operations at the End of the Analysis Period

In 20 years, the Project will generate increased revenues to the State of about $920,000 per year, of which about $240,000 will be attributable to the Petition Area (Table 5, Section 5.c). State revenues will include excise taxes, corporate and personal income taxes, and other revenues which are assumed to be proportional to the number of residents in the Project. Other revenues include: other sales taxes (cable television, telephone, etc.); fuel taxes; charges for various licenses, permits, and services; departmental earnings; etc.

State expenditures in support of operations are estimated at about $350,000 per year. About $320,000 of the expenditures will be on services, which are assumed to be proportional to the number of Prince Estates residents and at the same level of service as that provided to other Hawai`i residents. These services include: general government, education, health services, highway maintenance, natural resources, parks and recreation, and miscellaneous expenditures. And as previously mentioned, there will be debt service on general improvements of about $30,000 per year. This expenditure will result in about the same per-capita level of debt service as

carried by other residents of the State. Corresponding figures for the Petition Area are about $80,000 per year for services, about $9,000 per year for debt service, for a total of about $90,000 per year.

In 20 years, the Project is projected to generate about $570,000 per year in net revenues to the State, of which about $150,000 will be attributable to the Petition Area. This differs from typical residential communities where, by design, State services are partially subsidized by tax revenues from property development, visitor expenditures, and commercial actives.

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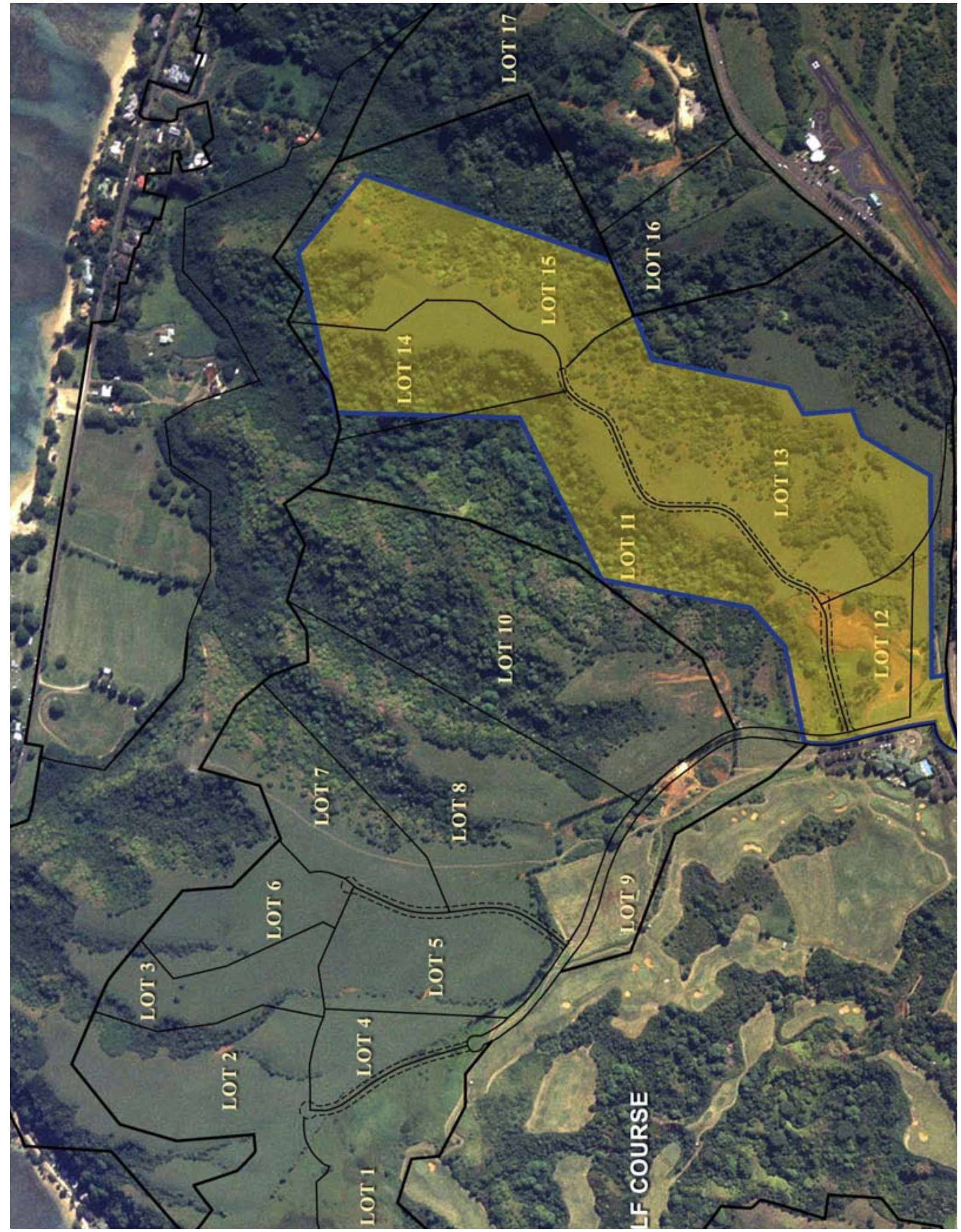
FIGURES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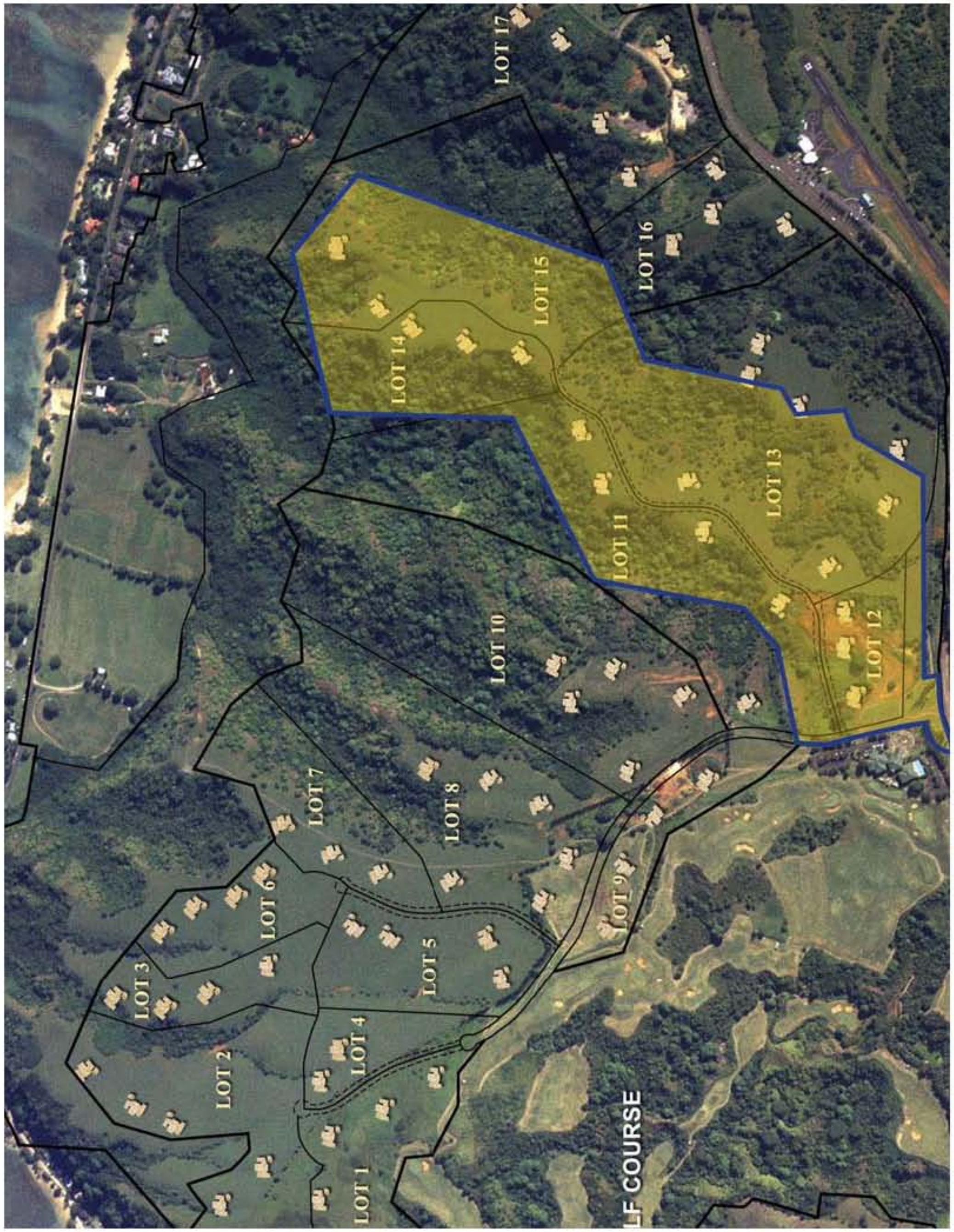
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TABLES

Table 1. Proposed Development

(Values in 2009 dollars)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
1.a. LAND AREA				
Ranch Lots	Princeville	476.95	120.00	acres
Roads	"	11.95		"
Total Area		**488.90**	**120.00**	acres
Share of Project			24.5%	
1.b. RANCH LOTS				
Full Lots	Princeville	17	1	
Partial Lots	"	-	4	
Total Lots		**17**	**5**	
1.C. RANCH HOUSES				
Range of Development				
Low	Princeville	17	4.5	houses
High	"	75	17.5	"
Expected Houses in 20 Years	PEP	**34**	**9.0**	"
Share of Project			26.5%	
1.d. LAND USE IN 20 YEARS				
Ranch Houses	1 acre per home	34.00	9.00	
Pasture	PEP	327.50	34.70	
Gulch	"	115.45	76.30	
Roads	Section 1.a	11.95	-	
Total		488.90	120.00	

Table 2. Economic Impacts of Development Activities

(Values in 2009 dollars)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
2.a. ANALYSIS PERIOD	PEP	**20**	**20**	years
2.b. CONSTRUCTION EXPENDITURES, KAUAI				
Expenditures Over Analysis Period				
Site Improvements (land clearing, grading, roads, water, electrical, drainage, etc.)	Princeville	$ 5,600,000	$ 1,372,000	
Ranch Houses (approximate average cost, subject to change)	$ 2,700,000 per home	$ 91,800,000	$ 24,300,000	
Total Construction Expenditures		**$ 97,400,000**	**$ 25,672,000**	
Annual Construction Expenditures (average)		**$ 4,870,000**	**$ 1,283,600**	**per year**
2.c. OTHER DEVELOPMENT EXPENDITURES [1]		n.e.	n.e.	
2.d. INDIRECT SALES GENERATED BY CONSTRUCTION ACTIVITY				
Kauai	82% of const. exp. 61%	$ 2,435,974	$ 642,057	per year
Oahu	82% of const. exp. 39%	$ 1,557,426	$ 410,495	"
Total Indirect Sales		**$ 3,993,400**	**$ 1,052,552**	**per year**
2.e. LOT SALES				
Lot Sales (approximate, subject to change)				
Home Sites	$ 220,000 per acre	$ 7,480,000	$ 1,980,000	
Pasture	$ 220,000 "	$ 72,050,000	$ 7,634,000	
Gulch	$ 220,000 "	$ 25,399,000	$ 16,786,000	
Total Lot Sales		**$ 104,929,000**	**$ 26,400,000**	
Annual Lot Sales		**$ 5,246,450**	**$ 1,320,000**	**per year**
2.f. SUMMARY OF EXPENDITURES & SALES				
Final Sales (taxed at 4%)				
Lot Sales	Section 2.e	$ 5,246,450	$ 1,320,000	per year
Construction Expenditures	Section 2.b	$ 4,870,000	$ 1,283,600	"
Consumption Expenditures	55% of payroll Section 2.i	$ 1,313,153	$ 358,133	"
Total Sales at 4%		$ 11,429,603	$ 2,961,733	per year
Intermediate Sales (taxed at 0.5%)				
Indirect Sales Related to Construction	Section 2.d	$ 3,993,400	$ 1,052,552	"
Less Consumption	above	$ (1,313,153)	$ (358,133)	"
Total Sales at 0.5%		$ 2,680,247	$ 694,419	per year
Total Sales		**$ 14,109,850**	**$ 3,656,152**	**per year**
2g. PROFITS				
Profits on Total Sales	10.0% of sales	$ 1,410,985	$ 365,615	per year
Risk Premium for Construction	5.0% of construction	$ 243,500	$ 64,180	"
Total Profit from Construction & Related Activity		**$ 1,654,485**	**$ 429,795**	**per year**

[1] Before realizing profits, developers must pay a number of development-related costs in addition to construction costs. These "Other Development Costs" include planning, permitting, design, financing, County and State exactions, and sales commissions.

Table 2. Economic Impacts of Development Activities

(Values in 2009 dollars)
(continued)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
2.h. EMPLOYMENT (on-site & off-site)				
Kauai				
Construction Jobs	4.56 x sales/$1 mil	22	6	jobs
Indirect Employment Generated by Construction	1.52 x direct jobs 67%	22	6	"
Total Kauai Employment		44	12	jobs
Oahu, Indirect Employment Generated by Construction	1.52 x direct jobs 33%	11	3	"
Total Employment		**55**	**15**	**jobs**
2.i. PAYROLL				
Kauai				
Construction Payroll	$ 52,703 per job	$ 1,159,466	$ 316,218	per year
Payroll for Indirect Employment	$ 35,430 "	$ 779,460	$ 212,580	"
Total Kauai Payroll		$ 1,938,926	$ 528,798	per year
Oahu, Payroll for Indirect Employment	$ 40,784 per job	$ 448,624	$ 122,352	"
Total Payroll		**$ 2,387,550**	**$ 651,150**	**per year**
2.j. POPULATION SUPPORTED BY DEVELOPMENT ACTIVITIES				
Kauai Residents				
Supported by Construction Jobs	2.0 per job	44	12	residents
Supported by Indirect Jobs	2.0 "	44	12	"
Total Kauai Residents		88	24	residents
Oahu Residents Supported by Indirect Jobs	2.2 per job	24	7	"
Total Residents Supported		**112**	**31**	**residents**
2.k. HOUSING FOR SUPPORTED POPULATION				
Kauai Homes				
Supported by Construction Jobs	0.35 per resident	15	4	homes
Supported by Indirect Jobs	0.35 "	15	4	"
Total Homes		30	8	homes
Oahu Homes Supported by Indirect Jobs	0.34 per resident	8	2	"
Total Homes Supported		**38**	**10**	**homes**

Table 3. Economic Impacts of Operations at End of Analysis Period

(Values in 2009 dollars)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
3.a. RANCH HOUSES	Section 1.c	**34**	**9**	**houses**
3.b. POPULATION (on-site)	4 people/home	**136**	**36**	**residents**
3.c. PROPERTY VALUES				
Ranch Houses (structures only)	$ 2,700,000 per home	$ 91,800,000	$ 24,300,000	
Home Sites	$ 220,000 per acre	$ 7,480,000	$ 1,980,000	
Pasture	$ 220,000 "	$ 72,050,000	$ 7,634,000	
Gulch	$ 220,000 "	$ 25,399,000	$ 16,786,000	
Total Value of Houses and Lots		**$ 196,729,000**	**$ 50,700,000**	
3.d. TAXABLE HOUSEHOLD INCOME	$ 200,000 per home	**$ 6,800,000**	**$ 1,800,000**	**per year**
3.e. SALES				
Kauai				
Consumption Expenditures	50% of income	$ 3,400,000	$ 900,000	per year
Indirect Sales	49% of consumption 73%	$ 1,216,180	$ 321,930	"
Total Kauai Sales		$ 4,616,180	$ 1,221,930	per year
Oahu Indirect Sales	49% of consumption 27%	$ 449,820	$ 119,070	"
Total Sales		**$ 5,066,000**	**$ 1,341,000**	**per year**
3.f. PROFITS	10% of sales	**$ 461,618**	**$ 122,193**	**per year**
3.f. EMPLOYMENT				
Kauai				
Direct, from Consumption Expenditures	8.22 x consumption/$1 mil	28	7	jobs
Indirect	0.53 x direct jobs 76%	11	3	"
Total Kauai Employment		39	10	jobs
Oahu Indirect Employment	0.53 x direct jobs 24%	4	1	"
Total Employment		**43**	**11**	**jobs**
On-site, Kauai	0.30 job/home	10	3	"
3.g. PAYROLL				
Kauai Payroll	$ 35,430 per job	$ 1,381,770	$ 354,300	per year
Oahu Payroll	$ 40,784 "	$ 163,136	$ 40,784	"
Total Payroll		**$ 1,544,906**	**$ 395,084**	**per year**
On-site Payroll	$ 30,000 per job	$ 300,000	$ 90,000	"
3.h. POPULATION SUPPORTED BY OPERATIONS				
Kauai Residents				
Supported by Direct Jobs	2.0 per job	56	14	residents
Supported by Indirect Jobs	2.0 "	22	6	"
Total Kauai Residents		78	20	residents
Oahu Residents Supported by Indirect Jobs	2.2 per job	9	2	"
Total Residents Supported		**87**	**22**	**residents**
3.i. HOUSING FOR SUPPORTED POPULATION				
Kauai Homes				
Supported by Construction Jobs	0.35 per resident	20	5	homes
Supported by Indirect Jobs	0.35 "	8	2	"
Total Homes		28	7	homes
Oahu Homes Supported by Indirect Jobs	0.34 per resident	3	1	"
Total Homes Supported		**31**	**8**	**homes**

Table 4. Impacts on County Revenues and Expenditures

(Values in 2009 dollars)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
4.a. TAX & EXPENDITURE BASE				
Property Value, 2009	$ 30,000 per acre	$ 14,667,000	$ 3,600,000	
Development Activities		-	-	
Activities at End of Analysis Period				
Analysis Period		20	20	years
Ranch Houses		34	9	houses
Land Use				
Ranch Houses		34.00	9.00	acres
Pasture		327.50	34.70	acres
Gulch		115.45	76.30	"
Population		136	36	people
Taxable Value				
Ranch Houses (structures only)				
Gross Value	Table 3, Section 3.b	$ 91,800,000	$ 24,300,000	
Less Owner Exemptions	$ 96,000 per home	$ (3,264,000)	$ (864,000)	
Net Value		$ 88,536,000	$ 23,436,000	
Home Sites	Table 3, Section 3.b	$ 7,480,000	$ 1,980,000	
Pasture Land (10-year dedication)	$ 425 per acre	$ 139,188	$ 14,748	
Gulch	$ 10 "	$ 1,155	$ 763	
Total Taxable Value		$ 96,156,343	$ 25,431,511	
4.b. DEVELOPMENT ACTIVITIES				
Revenues, Cumulative				
Total Revenues, Cumulative [1]		n.e.		
Expenditures, Cumulative				
Infrastructure and Facilities				
Infrastructure [1]				
Interior Roads		$ -		
Interior Water Distribution		$ -		
Drainage Systems		$ -		
Wastewater Disposal		$ -		
General Improvements		see text		
Services		$ -		
Total Expenditures		**$ -**		
Net Revenues, Cumulative		**$ -**		

[1] Most infrastructure will be built by the developer, or the Project's fair share will be financed via connect charges and user fees.

Table 4. Impacts on County Revenues and Expenditures

(Values in 2009 dollars)
(continued)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
4.c. ACTIVITIES AT END OF ANALYSIS PERIOD				
Revenues, Annual				
Property Taxes				
Ranch Houses, Net Value	$ 3.44 per $1,000	$ 304,564	$ 80,620	per year
Home Sites	$ 4.00 "	$ 29,920	$ 7,920	"
Pasture	$ 6.90 "	$ 960	$ 102	"
Gulch	$ 6.90 "	$ 8	$ 5	"
Less Current Taxes	$ 6.90 "	$ (101,202)	$ (24,840)	"
Total Property Taxes		$ 234,250	$ 63,807	per year
Other Revenues	$ 715 per person	$ 97,240	$ 25,740	"
Total Revenues		**$ 331,490**	**$ 89,547**	**per year**
Expenditures, Annual				
Services	$ 940 per person	$ (127,840)	$ (33,840)	per year
Cash Capital Outlay, General Improvements	$ 200 "	$ (27,200)	$ (7,200)	"
Debt Service, General Improvements	$ 80 "	$ (10,880)	$ (2,880)	"
Total Expenditures		**$ (165,920)**	**$ (43,920)**	**per year**
Net Revenues, Annual		**$ 165,570**	**$ 45,627**	**per year**

Table 5. Impacts on State Revenues and Expenditures

(Values in 2009 dollars)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
5.a. TAX & EXPENDITURE BASE				
Development Activities				
Duration	Table 2, Section 2.a	20	20	years
Lot Sales (for Conveyance Tax)				
Annual Average	Table 2, Section 2.e	$ 5,246,450	$ 1,320,000	per year
Cumulative		$ 104,929,000	$ 26,400,000	
Final Sales (taxed at 4%)				
Annual Average	Table 2, Section 2.f	$ 11,429,603	$ 2,961,733	per year
Cumulative		$ 228,592,060	$ 59,234,660	
Intermediate Sales (taxed at 0.5%)				
Annual Average	Table 2, Section 2.f	$ 2,680,247	$ 694,419	per year
Cumulative		$ 53,604,940	$ 13,888,380	
Profits				
Annual Average	Table 2, Section 2.g	$ 1,654,485	$ 429,795	per year
Cumulative		$ 33,089,700	$ 8,595,900	
Payroll				
Annual Average	Table 2, Section 2.i	$ 2,387,550	$ 651,150	per year
Cumulative		$ 47,751,000	$ 13,023,000	
Activities at End of Analysis Period				
Population	Table 3, Section 3.c	136	36	residents
Sales				
Consumption Expenditures (taxed at 4%)	Table 3, Section 3.e	$ 3,400,000	$ 900,000	per year
Indirect Sales (taxed at 0.5%)	Residual	$ 1,666,000	$ 441,000	"
Total		$ 5,066,000	$ 1,341,000	per year
Household Income	Table 3, Section 3.d	$ 6,800,000	$ 1,800,000	"
Profits	Table 3, Section 3.f	$ 461,618	$ 122,193	"
5.b. DEVELOPMENT ACTIVITIES				
Revenues, Cumulative				
Conveyance Tax on Lot Sales	0.30% of sales	$ 314,787	$ 79,200	
Excise Tax				
Final Sales	4.0% of sales	$ 9,143,682	$ 2,369,386	
Intermediate Sales	0.5% "	$ 268,025	$ 69,442	
Total Excise Tax		$ 9,411,707	$ 2,438,828	
Corporate Income Taxes	1.0% of profits	$ 330,897	$ 85,959	
Personal Income Taxes	4.4% of income	$ 2,101,044	$ 573,012	
Total State Tax Revenues		**$ 12,158,435**	**$ 3,176,999**	
Expenditures, Cumulative				
General Improvements		see text	see text	
Services		$ -	$ -	
Total Expenditures		**$ -**	**$ -**	
Net Revenues, Cumulative		**$ 12,158,435**	**$ 3,176,999**	
Annual Average		**$ 607,922**	**$ 158,850**	**per year**

Table 5. Impacts on State Revenues and Expenditures

(Values in 2009 dollars)
(continued)

Item	Source or Multiplier	Amount		Units
		Project	Petition Area	
5.c. ACTIVITIES AT END OF ANALYSIS PERIOD				
Revenues, Annual				
Excise Tax Generated by:				
Consumption Expenditures (consumer share)	4.0% of sales	$ 136,000	$ 36,000	per year
Indirect Sales	0.5% of rents	$ 8,330	$ 2,205	"
Personal Income Tax	5.90% of income	$ 401,200	$ 106,200	"
Corporate Income Tax	1.0% of profit	$ 4,616	$ 1,222	"
Other Revenues	$ 2,720 per person	$ 369,920	$ 97,920	"
Total Revenues		**$ 920,066**	**$ 243,547**	**per year**
Expenditures, Annual				
Services	$ 2,350 per person	$ (319,600)	$ (84,600)	per year
Debt Service, General Improvements	$ 250 "	$ (34,000)	$ (9,000)	"
Total Expenditures		**$ (353,600)**	**$ (93,600)**	**per year**
Net Revenues, Annual		**$ 566,466**	**$ 149,947**	**per year**

APPENDIX C. AIR QUALITY ANALYSIS SUPPLEMENTAL LETTER

B.D. NEAL & ASSOCIATES
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November 4, 2008

Mr. Tom Eisen
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813

Subject: Princeville Ranch Agricultural Subdivision Project
Air Quality Impact Assessment

Dear Mr. Eisen:

In response to your request, we have examined the potential air quality impacts related to the proposed Princeville Ranch Agricultural Subdivision Project located at Princeville, Kauai. The results of this examination along with background information related to this issue and recommended mitigation measures are summarized below.

Project Description

Princeville Prince Golf Course, LLC is proposing to develop the Princeville Ranch Agricultural Subdivision on the island of Kauai at Princeville. The project includes approximately 942 acres of land adjacent to Kuhio Highway between Anini Drive and Ka Haku Road which will be subdivided into 21 lots. The proposed subdivision will include 17 agricultural lots with an expected 75 new residential dwelling units, two golf course lots, one special management area lot, and a roadway lot. It is expected that the proposed project would be fully developed and occupied by the year 2018.

Ambient Air Quality Standards

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are comparable to the national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and Local Climatology

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the Princeville area is very much affected by its windward and near coastal situation and by nearby mountains. Winds are predominantly trade winds from the east or northeast and provide good ventilation much of the time. Wind speeds typically vary between about 10 and 25 miles per hour. Temperatures in the Princeville area are generally very consistent and moderate with an average daily temperature of about 70°F to 75°F. Average annual rainfall in the area amounts to about 75 to 85 inches.

Existing Air Quality Conditions

Air quality in the vicinity of the project presently is mostly affected by emissions from natural, industrial, agricultural and/or vehicular sources with the latter probably being the dominant factor. The little air quality monitoring data available for the area from the Department of Health suggest that air quality standards are currently being met. Air quality in the Princeville area is believed to be good at the present time.

Air Quality Impacts of Project

Short-term direct and indirect impacts on air quality could potentially occur during project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from soil excavation, aggregate processing and vehicle movement; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term air quality impacts from the disruption of traffic on nearby roadways, from slow-moving construction equipment traveling to and from the project site, and from a temporary increase in local traffic caused by commuting construction workers.

Fugitive dust emissions from construction activities are difficult to estimate accurately because of their elusive nature of emission and because the potential for dust generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind

speed. The U.S. EPA has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions from project construction would likely be somewhere near this level. In any case, State of Hawaii Air Pollution Control Regulations prohibit visible emissions of fugitive dust from construction activities at the project property line. Thus, an effective dust control plan for the project construction phase should be prepared.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in active construction areas from becoming significant sources of dust. On days without rainfall, construction areas should be watered at least twice during the workday to help keep dust to a minimum. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials likely to give rise to airborne dust. Haul trucks tracking dirt onto paved streets from unpaved areas are oftentimes a significant source of dust in construction areas. Some means to alleviate this problem, such as tire washing or road cleaning, may be appropriate. Dust monitoring could be considered as a means to quantitatively evaluate the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Indirectly, slow-moving construction vehicles on roadways leading to and from the project site could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are increased. This impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, the schedules of commuting construction workers can be adjusted to avoid peak hours in the project vicinity.

After the period of construction, long-term impacts on air quality from motor vehicle exhausts can potentially occur at or near any project that attracts large volumes of motor vehicle traffic. Carbon monoxide emissions are usually the primary issue, and public areas near traffic-congested intersections are the main concern. Access to the project will be provided via Anini Vista Drive and the existing Prince Golf Course Road. The project traffic study examined these two roadway intersections with Kuhio Highway as well as the nearby intersections of Kapaka Street and Ka Haku Road with Kuhio Highway. The project traffic study indicates that with the project, traffic volumes at Kapaka Street and at Ka Haku Road intersections with Kuhio Highway would likely increase by about 1 to 2 percent, while traffic volumes at Anini Vista Drive and at Prince Golf Course Road would increase by about 5 to 6 percent. The traffic study also indicates that traffic level-of-service at these intersections is presently good and that by the year 2018, with or without the project, traffic conditions would remain essentially unchanged.

Based on extensive experience in assessing traffic-related air quality impacts, traffic volume increases of less than about 5 percent or less than about 100 vehicles per hour and traffic approach volumes of less than about 1,000 vehicles per hour do not cause any significant impacts on air quality if adequate traffic level-of-service is provided. The project traffic study indicates that traffic volumes in the project area should remain well within these criteria. Considering the small project-related traffic volumes that are expected, traffic from the proposed project should have no measurable long-term impacts on air pollution levels in the project area. Although a detailed air quality modeling study could be performed to quantitatively predict project impacts, such an analysis is probably unwarranted.

In summary, short-term impacts from fugitive dust during project construction may potentially occur. Because of this, an effective dust control plan for the period of construction should be prepared and implemented. After construction, any long-term impacts on air quality from motor vehicle traffic related to this project will likely be negligible.

Please call me if you have any questions concerning the information presented herein or if you wish to discuss this matter further.

Very truly yours,

Barry D. Neal
Certified Consulting
Meteorologist

cc: Michael Y.M. Loo (Princeville)

APPENDIX D. BIOLOGICAL SURVEYS OF A PORTION OF TMK (4) 5-3-006:014 PRINCEVILLE RANCH, HANALEI DISTRICT, ISLAND OF KAUA'I

Biological Surveys of a Portion of TMK (4) 5-3-006:014 Princeville Ranch, Hanalei District, Island of Kaua‘i.

Prepared for:

Group 70 International, Inc.
925 Bethel Street
Honolulu, Hawaii, 96813-4398

Prepared by:

Reginald E. David
Rana Biological Consulting, Inc.
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&

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June 1, 2009

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Introduction

The Princeville Prince Golf Course, LLC, is seeking to downzone approximately 120-acres of land at Princeville from State Land Use zoning designation of Urban to Agriculture. The land is identified as TMK (4) 5-3-006: por. 014. The property is located in Princeville, Hanlei District, Island of Kauaʻi (Figure 1). This report presents the results of the botanical, avian and mammalian surveys, which were conducted on the project site, as part of the environmental disclosure process in support of Princeville's State Land Use Commission motion to revert from Urban to Agriculture zoning.

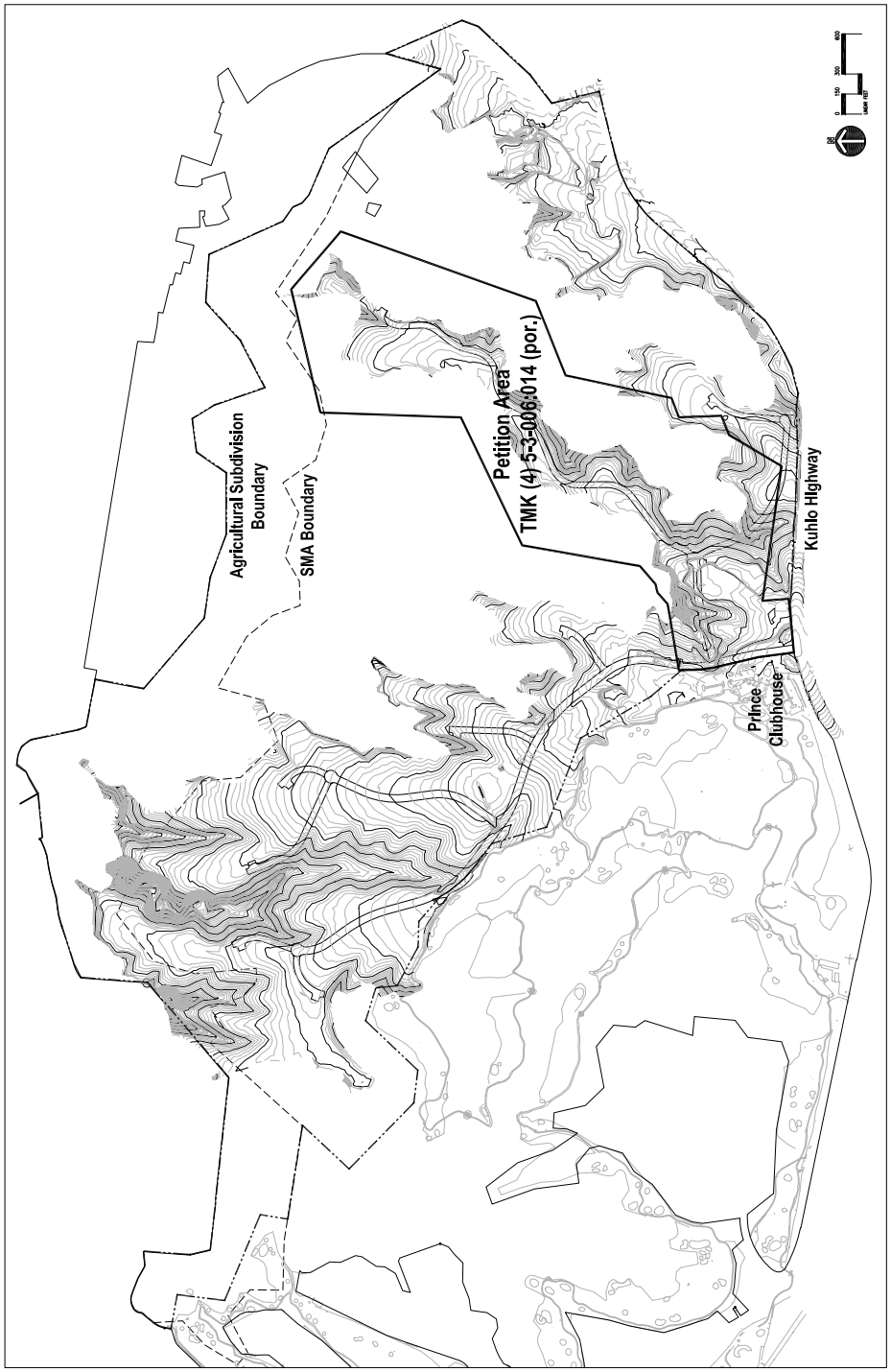
The primary purpose of the surveys was to determine if there are any botanical, avian or mammalian species currently listed, or proposed for listing under either federal or State of Hawaiʻi endangered species statutes within or adjacent to the study area. We were also asked to evaluate the potential impacts that the development of the project might pose to any sensitive or protected native botanical, avian or mammalian species, and to propose appropriate minimization and or mitigative measures that could be implemented to reduce or eliminate any such impacts. The federal and State of Hawaiʻi listed species status follows species identified in the following referenced documents, (Department of Land and Natural Resources (DLNR) 1998, Federal Register 2005, U. S. Fish & Wildlife Service (USFWS) 2005, 2008). Fieldwork was conducted on April 6, and 7, and May 29, 2009.

The avian phylogenetic order and nomenclature used in this report follows *The American Ornithologists' Union Checklist of North American Birds 7th Edition* (American Ornithologists' Union 1998), and the 42nd through the 49th supplements to *Check-list of North American Birds* (American Ornithologists' Union 2000; Banks et al. 2002, 2003, 2004, 2005, 2006, 2007, 2008). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Hawaiʻi's Ferns and Fern Allies* (Palmer, 2003) for ferns, *Manual of the Flowering Plants of Hawaiʻi* (Wagner et al., 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for crop and ornamental plants. Place names follow *Place Names of Hawaii* (Pukui et al. 1974).

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 18.

General Site Description

The approximately120-acre site is located at Princeville, in the Hanalei District, on the Island of Kauaʻi, directly across the street from the Princeville Airport. The petition area is bound to the south by Kūhiō Highway, to the west by the Prince Golf Course and to the north and east by undeveloped land. The petition area consists of a relatively flat plateau bound by gulches on both the west and east sides.



The habitat present on the site can be roughly divided into two major types: open pasture and more or less closed secondary forest. The bulk of the site is a grassy plateau, which is currently being used as an active pasture for cattle and horses. Grazing by these animals presently controls the vegetation growing on the ridgeline (Figure 2).

Figure 2. View from edge of pasture across a portion of the forested eastern gulch to the *makai* end of the pasture ridge.

Botanical Survey Methods

The botanical survey was undertaken on April 6 and 7, 2009 utilizing wandering transects that traversed most parts of the subject parcel. The site was revisited on May 29 to confirm the occurrence of certain native trees. The route of the botanical survey was recorded by GPS as the survey progressed, so that missed areas could be minimized. The steepness of some mid-to-lower gulch areas limited access in these areas, although for the most part these steep slopes are either beyond the proposed developed area or undevelopable due to their steepness. The survey was conducted in the wet season and therefore plants typical of this site, including annuals, were readily observed and identified. Only some of the pasture grasses proved difficult to identify because of a lack of flowers (some grasses mature and/or flower as the season becomes drier in late Spring or early Summer). For a few specimens not recognized in the field, photographs were taken and material collected for identification in the laboratory.

Botanical Survey Results

A plant checklist (Table 1) was compiled from field observations, with entries arranged alphabetically under plant family names (standard practice). Included in the list are scientific

name, common name, and status (whether native or non-native) for each species observed on the property. 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 1 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 present there in numbers exceeding just a few individuals. For example, an abundance rating of "R" indicates a plant encountered only once or twice during the entire survey. An "R2" indicates a plant encountered in just one or two places, but with several to many individuals present where encountered. An "R3" would be a plant seldom encountered (i.e., rare), but locally abundant in one or more of the locations where it was encountered.

The project area supports two basic types of vegetation: open grass pasture and forested slopes. Pasture areas are actively supporting some cattle and horses. Abundance ratings in Table 1 are given for these two different vegetation types on the property: the low sloping pasture areas along the top of the ridge ("PA") and the steeper margins of the gulches on surrounding the pastures and covered by forest ("FO"). Less steep margin areas, particularly along the eastern gulch grade between open pasture and forest, and many of the plant species observed were most abundant along the boundary between forest and pasture (Table 1, note <2>). Another distinctive aspect of the species distributions is a number of species limited to the uppermost part of the project area (and particularly the graded area outside of the active pasture). These are weedy species (marked in Table 1 with note <1>) that tend to be found in highly disturbed sites.

The forest along the sides of the gulches is dominated by Java plum (*Syzygium cumnii*), strawberry guava (*wi* or *Psidium cattleianum* var. *littorale*), Christmas berry (*Schinus terebinthefolius*), scattered mango (*Mangifera indica*) and pandanus (*hala* or *Pandanus tectorius*). Understory growth is dense in many places, with strawberry guava (*P. cattleianum*) and shoebutton ardesia (*Ardesia elliptica*) the dominant shrubs. Ferns are especially dense on the steeper, western gulch margin. Ferns found in localized abundance on these slopes are *Nephrolepis multiflora*, *Sphenumerous chinensis*, *Blechnum appendiculatum*, *Phymatosorus scolopendria, and uluhe* or *Dicranopteris linearis* in scattered openings in the forest. Here also, where open areas occur on the steep upper slope, tufted beardgrass (*Schizachyrium condensatum*) forms nearly impenetrable stands. These grass stands tend to be more open along the eastern gulch margin because the more gently sloping ground there allows access by grazing horses and cattle.

A total of 100 species of ferns and flowering plants were identified as occurring in the project area during the course of our survey. Included are 12 (12%) native species (indigenous and endemic species). These native plants are common species on lowland Kaua'i, although three are endemic species. These three species, (*koai'a* or *Acacia koaia*, *'ōhi'a* or *Metrosideros polymorpha*, and a tree fern or *hapu'u*, *Cibotium glaucum*) were initially observed by S. L. Montgomery, who conducted the invertebrate survey of the property along the *makai* margin of the shorter eastern ridge within a part of the project area missed during the April 6-7 botanical survey. This area was revisited on May 29 and the presence of *'ōhi'a* and *koai'a* on the property further confirmed.

Table 1. Flora Recorded on the Princeville Petition Area, April 2009.

Species	*Common name*	*Status*	*Abundance* PA	FO	*Notes*
	FERNS and FERN ALLIES				
BLECHNACEAE					
Blechnum appendiculatum Willd.	---	Nat	--	O3	
CYATHEACEAE					
Sphaeropteris cooperi (Hook. ex F. Muell.) R. M. Tryon	Australian tree fern	Nat	--	R	<3>
DICKSONIACEAE					
Cibotium glaucum (Sm.) Hook. & Arn.	*hāpu'u*	**End**	--	R	<3>
GLEICHENIACEAE					
Dicranopteris linearis (Burm. f.) Underw.	*uluhe*	**Ind**	--	U3	<2>
LINDSAEACEAE					
Sphenomerus chinensis (L.) Maxon	*pala'ā*	**Ind**	--	A	
NEPHROLEPIDACEAE					
Nephrolepis cordifolia (L.) Presl	---	**Ind**	R	--	<1>
Nephrolepis multiflora (Roxb.) F.M. Jarrett ex C.V. Morton	---	Nat	O	A	<2>
POLYPODIACEAE					
Phymatosorus scolopendria (Burm.) Pic.-Ser.	*lauaʻe*	Nat		C3	
PTERIDACEAE					
Pteris cretica L.	Cretan break	**Ind**	--	R2	
THELYPTERIDACEAE					
Christella dentata (Forssk.) Brownsey & Jermy	oak fern	Nat	O	C	
	FLOWERING PLANTS DICOTYLEDONE				
ACANTHACEAE					
Justicia betonica L.	white shrimp plant	Nat	R3	--	
Thunbergia fragrans Roxb.	sweet clock vine	Nat	--	R	<4>
ANACARDIACEAE					
Mangifera indica L.	mango	Nat	--	O	
Schinus terebinthefolius Raddi	Christmas berry	Nat	U	C	<2>
APIACEAE					
Centella asiatica (L.) Urb.	Asiatic pennywort	Nat	U	--	
Ciclospermum leptophyllum (Pers.) Sprague	fir-leaved celery	Nat	R	--	<1>
ARALIACEAE					
Schefflera actinophylla (Endl.) Harms	octopus tree	Nat	--	R	
ASTERACEAE (COMPOSITAE)					
Ageratum conyzoides L.	ageratum	Nat	U2	U	<1>
Ageratum houstonianum Mill.	*maile honohono*	Nat	U2	--	<2>
Bidens alba (L.) DC	beggartick	Nat	U2	--	<1>
Bidens pilosa L.	beggartick	Nat	R	--	<1>

Table 1 Continued

Species	*Common name*	*Status*	*Abundance* PA	FO	*Notes*
Conyza bonariensis (L.) Cronq.	hairy horseweed	Nat	R	--	<1>
Crassocephalum crepidioides (Benth.) S. Moore	---	Nat	O	U	
Elephantopus mollis Kunth	elephant's foot	Nat	A	C	<2>
Emilia fosbergii Nicolson	Flora's paintbrush	Nat	U	--	<1,2>
Pluchea carolinensis (Jacq.) G. Don	sourbush	Nat	R	U	<2>
Sonchus oleraceus L.	sow thistle	Nat	R	--	
Sphagneticola trilobata (L.) Pruski	wedelia	Nat	AA	C	<1>
Taraxacum officinale W.W. Weber ex Wigg.	common dandelion	Nat	R	--	<1>
Youngia japonica (L.) DC	oriental hawksbeard	Nat	R	--	<1>
Xanthium strumarium L.	*kīkānia*, cocklebur	Nat	R2	--	<1>
CAMPANULACEAE					
Hippobroma longiflora (L.) G. Don	star-of-Bethlehem	Nat	R1		<1>
CASUARINACEAE					
Casuarina equisetifoilia L.	ironwood	Nat	R2	--	<1>
CECROPIACEAE					
Cecropia obtusifolia Bertol.	guarumo	Nat	--	U	
EUPHORBIACEAE					
Phylanthus debilis Klein ex Willd.	niruri	Nat	R	--	<1>
Ricinus communis L.	castor bean	Nat	U3	--	<1>
FABACEAE					
Acacia confusa Merr.	Formosan koa	Nat	R	--	<1>
Acacia koaia Hillebr.	*koaiʻa*	**End**	--	R1	<3>
Caesalpinia decapetala (Roth) Alston	wait-a-bit	Nat	R	--	<1,2>
Canavalia sp.	---	--	--	R	<4>
Chamaecrista nictitans (L.) Moench	partridge pea	Nat	O	--	
Crotalaria pallida Aiton	smooth rattlepod	Nat	U	R	<1,2>
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	R	--	<1>
Desmodium incanum DC	Spanish clover	Nat	A	O	
Desmodium trifolium (L.) DC	---	Nat	C	--	
Falcateria moluccana (Miq). Barneby & Grimes	albizia	Nat	--	R	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	U2	--	<1>
Melilotus indica (L.) All.	yellow sweet clover	Nat	R	--	<1>
Mimosa pudica L.	sensitive plant	Nat	A	O	
Neonotonia wightii (Wight & Arnott) Lackey	---	Nat	O3	--	<1,2>
Senna pendula (Humb. & Bonpl. ex Willd.) H. Irwin & Barneby	---	Nat	R	R	<2,4>
LAURACEAE					
Cassytha filiformis L.	*kauna'oa pehu*	**Ind**	--	R	<2,4>
LYTHRACEAE					
Cuphea carthagenensis (Jacq.) Macbr.	tarweed	Nat	C	--	

Table 1 Continued

Species	***Common name***	***Status***	***Abundance*** PA	FO	***Notes***
MALVACEAE					
Hibiscus tiliaceus L.	*hau*	**Ind**	R	--	
Malvastrum coromandelianum (L.) Garcke	false mallow	Nat	R	--	<1>
Sida acuta N.L. Burm.	---	Nat	R	R3	<2>
Urena lobata L.	aramina	Nat	U1	---	
Sida rhombifolia L.	Cuba jute	Nat	U	--	<1>
MELASTOMATACEAE					
Clidemia hirta (L.) D. Don	Koster's curse	Nat	U	O	
Dissotus rotundifolia (Sm.) Triana	---	Nat	U2	--	<3>
MORACEAE					
Ficus microcarpa L. fil.	Chinese banyan	Nat	--	U	
MYRSINACEAE					
Ardesia elliptica Thunb.	shoebutton ardesia	Nat	U	AA	
MYRTACEAE					
Eucalyptus robusta Sm.	swamp mahagony	Nat	U	--	<3>
Metrosideros polymorpha Gaud.	*'ōhi'a*	**End**	--	R1	<3>
Psidium cattleianum Sabine	strawberry guava	Nat	R	AA	
Psidium cattleianum var. *littorale* Raddi	*waiawī*	Nat	--	C	
Psidium guajava L.	guava	Nat	--	O	
Syzygium cumini (L.) Skeels	Java plum	Nat	R	AA	
PLANTAGINACEAE					
Plantago major L.	common plantain	Nat	U2	--	<1>
Plantago lanceolata L.	narrow-leaved plantain	Nat	U	--	<1>
POLYGALACEAE					
Polygala paniculata L.	milkwort	Nat	C	--	<1>
PROTEACEAE					
Grevilia robusta A. Cunn. Ex R. Br.	silk oak	Nat	--	U	
PRIMULACEAE					
Anagallis arvensis L.	scarlet pimpernel	Nat	O2	--	<1>
RUBIACEAE					
Spermacoce assurgens Ruiz & Pavon	buttonweed	Nat	A	--	
SAPOTACEAE					
Chrysophyllum oliviforme L.	satin leaf	Nat	--	R	
SOLANACEAE					
Solanum americanum Mill.	*pōpolo*	**Ind**	R	--	<1>
STERCULIACEAE					
Waltheria indica L.	*'uhaloa*	**Ind**	--	R	<2>
TILIACEAE					
Triumfetta semitriloba Jacq.	Sacramento bur	Nat	O2	U	<2>
VERBENACEAE					
Lantana camara L.	lantana	Nat	U	U	
Stachytarpheta cayennensis (Rich.) Vahl	---	Nat	O	A	
MONOCOTYLEDONE					
AGAVACEAE					
Cordyline fruticosa (L.) A. Chev.	*ki*, ti	Pol	--	R	

Table 1 Continued

Species	***Common name***	***Status***	***Abundance*** PA	FO	***Notes***
ARECACEAE					
Livistona chinensis (Jacq.) R. Br. ex Mart.	Chinese fan palm	Nat	--	R	
COMMELINACEAE					
Commelina diffusa N.L. Burm.	dayflower	Nat	U		<1>
ORCHIDACEAE					
Spathoglottis plicata Blume	Malayan ground orchid	Nat	--	U	<2>
PANDANACEAE					
Pandanus tectorius S. Parkinson ex Z	*hala*	**Ind**	--	O	
POACEAE (GRAMINEAE)					
Axonopus fisifolius (Raddi) Kuhlm.	narrow-leaved carpet grass	Nat	A	O	<2>
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	R	--	
Eleusine indica (L.) Gaertn.	beach wiregrass	Nat	U2	--	<1>
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat	O2	--	<1>
Melinus minutiflora P. Beauv.	molasses grass	Nat	U2	--	<1>
Oplismenus hirtellus (L.) P. Beauv.	basket grass	Nat	--	U3	
Paspalum conjugatum Bergius	Hilo grass	Nat	O	--	
Paspalum fimbriatum Kunth	Panama paspallum	Nat	R	--	<1>
Paspalum sp.	indet. grass	Nat	AA	--	<4>
Sacciolepis indica (L.) Chase	Glenwood grass	Nat	O		
Schizachyrium condensatum (Kunth) Nees	tufted beardgrass	Nat	C3	O3	<2>
Setaria cf. *gracilis* Kunth	yellow foxtail	Nat	R	--	
Sporobolus africanus (Poir.) Robyns & Tournay	African dropseed	Nat	C	--	
Urochloa maxima (Jacq.) Webster	Guinea grass	Nat	U3	--	<1>
Urochloa mutica (Forsk.) Nguyen	para grass	Nat	U3	--	<1>
indet.	---	Nat	U3	--	<1>

Legend to Table 1

Status = distributional status
- **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.
- **Pol** = Polynesian introduction before 1778.

Abundance = occurrence ratings for plants by area in April 2009 (Area PA = pasturerland (ridge top); more or less level or low-sloping ground subject to grazing by horses and cattle. Area FO = steep sloping, mostly forested area along both sides of the ridgeline; very steep in some places.

- R – Rare - only one or two plants seen.
- U - Uncommon - several to a dozen plants observed.
- O - Occasional - found regularly, but not abundant anywhere.
- C - Common - considered an important part of the vegetation and observed numerous times.
- A - Abundant - found in large numbers; may be locally dominant.
- AA - Abundant - abundant and dominant; a defining vegetation type.

A number following an abundance rating adjusts the occurrence to account for plants that are more numerous within a small or local area. Thus, R1 reflects a plant species seen in only one or two locations, but each location had several individuals; U2 is a plant seen several to perhaps a dozen times, but usually in clusters of many individuals; R3 is a plant seen in perhaps only one localized place, but very abundant at that local.

Notes:
- <1> Plants generally limited to the upper, disturbed area of parcel.
- <2> Particularly characteristic of forest/pasture boundary areas.

<3> Mostly or entirely beyond the survey parcel boundary.
<4> Vegetative tissues only; no flowers or fruit observed in April 2009.

Avian Survey Methods

On April 6, 2009, the zoologist walked the entire property to become familiar with the site, the avian and mammalian species present, and the different habitats present within the petition area. On April 7, 2009, he sited eight avian count stations spaced approximately equidistant from each other across the petition area. Eight-minute point counts were made at each station. Stations were each counted once. Field observations were made with the aid of Leitz 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated between 7:15 a.m. and 9:30 a.m., the peak of daily bird activity. Time not spent counting was used to search the rest of the site for species and habitats not detected during count sessions.

Avian Survey Results

A total of 332 individual birds of 19 species, representing 15 separate families, were recorded during station counts (Table 2). One of the species recorded, Hawaiian Goose, or *Nēnē* (*Branta sandvicensis*) is listed as an endangered species under both Federal and State of Hawaii endangered species statutes survey (DLNR 1998, Federal Register 2005, USFWS 2005, 2008). One other species, Pacific Golden-Plover (*Pluvialis fulva*), is an indigenous migratory shorebird species. The remaining 17 species recorded are all considered to be alien to the Hawaiian Islands.

Avian diversity and densities were in keeping with the locations and the habitat present on the site. Four species, Western Meadowlark (*Sturnella neglecta*), Nutmeg Mannikin (*Lonchura punctulata*), Japanese White-eye (*Zosterops japonicus*), and Common Myna (*Acridotheris tristis*), accounted for 50% of the total number of all birds recorded during station counts. The most commonly recorded species was Western Meadowlark, which accounted for slightly more than 14% of the total number of individual birds recorded. An average of 42 birds were detected per station count.

Table - 2 Avian Species Detected on the Princeville Petition Area, April 2009

Common Name	***Scientific Name***	***ST***	***RA***
	ANSERIFORMES		
	ANATIDAE - Ducks, Geese & Swans		
	Anserinae - Geese & Swans		
Hawaiian Goose (Nēnē)	*Branta sandvicensis*	**EE**	1.13
	GALLIFORMES		
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Red Junglefowl	*Gallus gallus*	A	3.75

Table 2 Continued

Common Name	***Scientific Name***	***ST***	***RA***
Ring-necked Pheasant	*Phasianus colchicus*	A	0.50
	CICONIIFORMES		
	ARDEIDAE - Herons, Bitterns & Allies		
Cattle Egret	*Bubulcus ibis*	A	1.75
	CHARADRIIFORMES		
	CHARADRIIDAE - Lapwings & Plovers		
	Charadriinae - Plovers		
Pacific Golden-Plover	*Pluvialis fulva*	IM	0.25
	COLUMBIFORMES		
	COLUMBIDAE – Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	0.63
Zebra Dove	*Geopelia striata*	A	0.88
	PASSERIFORMES		
	SYLVIIDAE – Old World Warblers & Gnatcatchers		
	Sylviinae – Old World Warblers		
Japanese Bush-Warbler	*Cettia diphone*	A	1.50
	TURDIDAE – Thushes		
White-rumped Shama	*Copsychus malabaricus*	A	1.25
	TIMALIIDAE – Babblers		
Greater Necklaced Laughingthrush	*Garrulax pectoralis*	A	0.25
Hwamei	*Garrulax canorus*	A	1.38
	ZOSTEROPIDAE – White-Eyes		
Japanese White-eye	*Zosterops japonicus*	A	5.00
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	4.63
	EMBERIZIDAE – Emberizids		
Red-crested Cardinal	*Paroaria coronata*	A	1.75
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	2.13
	ICTERIDAE - Blackbirds		
Western Meadowlark	*Sturnella neglecta*	A	5.88
	FRINGILLIDAE – Fringilline And Cardueline Finches & Allies		
	Carduelinae – Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	2.88
	ESTRILDIDAE – Estrildid Finches		
	Estrildinae – Estrildine Finches		
Nutmeg Mannikin	*Lonchura punctulata*	A	5.25
Chestnut Munia	*Lonchura atricapilla*	A	0.75

Key to Table 2.

ST	Status
EE	Endangered Endemic species -
A	Alien species – introduced to Hawai‘i by humans, and have become established in the wild
IM	Indigenous Migratory species -
RA	Relative Abundance: Number of birds detected divided by the number of count stations (8)

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *‘ōpe‘ape‘a* as it is know locally, all terrestrial mammals currently found on the Island of Kaua’i are alien species, and 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.

Mammalian Survey Results

Four mammalian species were detected during the course of this survey. Several horses (*Equus c. caballus*) were seen to the west of the site, additionally, domestic cattle (*Bos taurus*) were heard from lands to the east of the site, as were several dogs (*Canis f. familiaris*). Additionally, scat, tracks and sign of horse, cattle, dog and pig (Sus s. scrofa) were observed at numerous locations within the petition area. The endangered Hawaiian hoary bat was not seen during the course of this survey.

No mammalian species protected or proposed for protection under either the Federal or State of Hawai‘i endangered species programs were detected during the course of this survey (DLNR 1998, Federal Register 2005, USFWS 2005, 2008).

Discussion

Botanical Resources

As noted in the results section, most of the plants encountered are introduced (non-native) species, many considered opportunistic weeds found in disturbed habitats. The majority of the survey area consists of an actively used pasture dominated by forage grasses (Figure 3). The forested slopes of the gulch margins are also dominated by non-native species of trees, with some scattered patches of native *uluhe* (*Dicranopteris linearis*) fern. Native *hala* (*Pandanus tectorius*) are scattered along the slopes. Several other native trees (and a tree fern) occur on the margin of the shorter, eastern ridge. Because of the steepness of these gulch margin areas, lot development is unlikely to impact on the forested slopes of the project area.

The occurrence of what appear to be several *koai‘a* trees is an unusual aspect of the flora. This plant is closely related to *koa*, but is rare in the Hawaiian Islands and not generally known from Kaua‘i. However, Brenan (discussed in Wagner, Herbst, and Summer, 1990) discovered, on the northern coast of Kaua‘i, trees generally resembling *A. koa* but having seedpods of typical *A. koaia*. The trees on the project site appear to be part of this unusual population. Within the property, as shown on maps provided to us, only a single, large *koai‘a* tree was seen and this one

at the very end of the shorter pastured ridge just over the lip of the ridge on its northwest face. This tree may actually be just off the project parcel. It is a large tree with multiple trunks and appears to be in poor health although was flowering and bearing numerous seed pods. Several more trees occur to the east, along the forested slope of the same ridge, back towards the highway. These are also large, old trees; no seedlings, juvenile, or young trees were noted in the area.

Figure 3. View from the upper, graded end of the project area looking down the length of the pasture along the ridgeline.

Avian Resources

The findings of the avian survey are consistent with the location of the property, and the habitat present on the site. Additionally, the findings are consistent with at least one other avian surveys conducted on the same parcel of land in 1995 (David 1995).

Two of the 19 avian species detected during the course of this survey, Hawaiian Goose, or *Nēnē*, and Pacific Golden-Plover are native species. *Nēnē* are listed as an endangered species under both the state and federal endangered species statutes. We recorded a total of nine separate *Nēnē*, on the site. One group of five birds consisted of two banded adults, (b80), and (rNL) and three un-banded fledglings. These birds are from the Kīlauea Point National Wildlife Refuge, which is located approximately five kilometers east of the petition area. We recorded an additional four birds flying over the site, which landed to the west of the biologist. The *Nēnē* population on Kaua‘i is increasing at a fairly rapid pace, and is likely that if this increase continues that human - *Nēnē* interactions will continue to rise on the Island over time. We recorded two Pacific Golden-Plover during station counts, this species is an indigenous migratory shorebird species that nests

in the high Arctic during the late spring and summer months, returning to Hawaii and the Tropical Pacific to spend the fall and winter months each year. They usually leave Hawai'i for their trip back to the Arctic in late April or the very early part of May each year. The remaining 17 avian species detected during this survey are all considered to be alien to the Hawaiian Islands (Table 2).

Although not detected during this survey, it is probable that the Hawaiian endemic sub-species of the Short-eared Owl, or *Pueo* (*Asio flammeus sandwichensis*) use resources in the general project area, as they are regularly seen foraging over open fields in the low-to–mid elevation areas on the Island (David 2009).

Two other species not detected during this survey, Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*) have been recorded over-flying the project site between April and the end of November each year (David 1995, Morgan et al., 2003, 2004, Verschuyl and Dennis 2007, David and Planning Solutions 2008). Additionally, the Save Our Shearwaters Program has recovered both species from the general project area on an annual basis over the past three decades (Morgan et al., 2003, 2004, David and Planning Solutions 2008, Save our Shearwater Program 2009).

The petrel is listed as endangered, and the shearwater as threatened under both Federal and State of Hawaii endangered species statutes. 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 1994, Podolsky et al., 1998, Ainley et al., 2001).

There are no nesting colonies nor appropriate nesting habitat for either of these listed seabird species within or close to the proposed petition area. The closest historically known Newell's Shearwater colony is located in the Anahola Mountains, which are located approximately 13-kilometers south east of the site (David et al., 2002). The closest known Hawaiian Petrel nesting colonies are located at the back of Limahuli, Wainiha, Lumaha'i, and probably Hanalei Valleys (David et al., 2002, DOFAW 2009).

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the property and the habitat currently present on the site. Although no Hawaiian hoary bats were detected during the course of this survey, bats have been recorded foraging for insects over the site in the past (David 1995), and within the general project area, on a regular basis (David 2009). Hawaiian hoary bats are widely distributed in the lowland areas on the Island of Kaua'i, and have been documented in and around almost all areas that still have some dense vegetation (Tomich 1986, David 1999, 2000, 2008, USFWS 1998).

Although no rodents were detected during the course of this survey, it is likely that the four established alien *muridae* fund on Kaua'i, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the general project area. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependant on them.

Potential Impacts to Protected Species

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. Therefore it is not expected that the modification of the habitat present on the site, or the development of residential lots along the ridgeline here will result in deleterious impacts to any plant species currently listed as endangered, threatened, or that are currently proposed for listing under either federal or State of Hawai'i endangered species statutes (DLNR 1998, Federal Register 2005, USFWS 2005, 2008).

Nēnē

The principal potential impacts that the development of the site poses to *Nēnē* is during the construction phase of the project, and following build-out by the increased number of humans and associated activities, such as driving, pets etc. that will occur on the subject property. Although *Nēnē* on Kaua'i tend to show a remarkable disregard of human activity, fatalities have occurred on construction sites, along roads, and numerous nests have failed due to human disturbance and as a direct result of predators taking eggs and goslings (David 2009a, 2009b).

Hawaiian Petrel and Newell's Shearwater

The principal potential impact that the development of the site poses to Hawaiian Petrels and Newell's Shearwaters is the increased threat that birds will be downed after becoming disoriented by outdoor lighting associated with possible night-time construction activity, and following build-out with exterior lighting associated with whatever structures and appurtenances that are built on the property.

Hawaiian Hoary Bat

The principal potential impact that the development of the site poses to Hawaiian hoary bats is during the clearing and grubbing phases of the project. Areas within the gulches that have dense vegetation are likely used to some degree by roosting bats, normally it is not thought that the availability of roosting habitat is a limiting factor in this species survival (Bonaccorso 2009). The principal threat that clearing potential roosting habitat poses to this species is between June and July when female bats may be carrying pups and potential may not be able to flee vegetation clearing activity quickly enough to avoid harm (Bonaccorso 2005, 2007, 2009).

Following build-out of the project lighting associated with the development, and landscaping vegetation will likely attract volant insects to the project area, which in turn will provide bats with additional foraging opportunities.

Recommendations

- Although the *koai'a* trees found at the eastern end of the project parcel are not protected by any statutes under state or federal law, given the unusual nature of this population (unique to Kaua'i), they should be preserved. All are located on slopes that would not be suitable for house construction. The purchaser of a lot that contains this species of tree (perhaps just one lot is involved here in the current development plans) should be informed of the unusual nature of the tree. In as much as the trees appear to be producing seeds, the Princeville Resort nursery could attempt to propagate additional trees for out-planting in the area. *Koai'a* (a type of *koa*) are beautiful landscape trees not often seen at low elevations. Reviving this unusual population would be a benefit to both the resort and botanical science.

- Since it is likely that endangered *Nēnē* will use resources on the site, and both Newell's Shearwaters and Hawaiian Petrels may fallout onto the site during the construction phase of the project, we recommend that an endangered species awareness program be developed which includes general information on the endangered species act and protected species, specific restrictions that will be in force on the job site to project endangered species, and a set of protocols on who, and how job site personnel will respond to any downed or injured endangered species that may occur on the site. All construction personnel should required to be familiar with the program, it's guidelines, restrictions and protocols that will need to be followed. Similar programs have been developed and are being used at several construction project sites, and resorts on the Island of Kaua'i.

- If construction activity is planned to occur during the *Nēnē* nesting season, which typically runs from October through March on Kaua'i, the project site should be surveyed by a qualified biologist before the onset of nesting, to determine if there is any active *Nēnē* nesting activity occurring on the site.

- If active Nene nesting does occur while construction is ongoing it may be advisable to have a *Nēnē* monitor on site during such activity to ensure that no harm befalls the birds.

- If nighttime work will be required in conjunction with the development of the project, 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).

- It is also recommended that all exterior lighting associated with the operation of the proposed facility be shielded so as 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).

- It is recommended that if heavy vegetation within the gulches needs to be cleared, that clearing not occur during the months of June and July, when bats may be carrying young and potentially could be placed at risk but such clearing.

Glossary:

Alien – Non-native, introduced to Hawai'i by humans.
Commensal – In this case animals that share humans' food and lodgings, such as rats and mice.
Crepuscular – Twilight hours.
Diurnal – Daytime.
Endangered – Listed and protected under the ESA as an endangered species.
Endemic – Native and unique to the Hawaiian Islands.
Endangered – Listed and protected under the ESA as an endangered species.
Indigenous - Native to Hawai'i, but also found elsewhere naturally.
Mauka – Upslope, towards the mountains.
Makai – Down-slope, towards the ocean.
Muridae – Rodents, including rats, mice and voles, one of the most diverse families of mammals.
Naturalized – Botanical term used for non-native or alien plants that propagate in the wild without human care or attention.
Nēnē – Hawiian Goose (*Branta sandvicensis*)
Nocturnal – Night-time, after dark.
'Ōpe'ape'a - Hawaiian hoary bat (*Lasiurus cinereus semotus*).
Pelagic – An animal that spends it's life at sea – in the case of seabirds only returning to land to nest.
Phylogenetic – The evolutionary order that organisms are arranged by taxonomists.
Pueo – The Hawaiian endemic sub-species of the Short-eared Owl (*Asio flammeus sandwichensis*)
Ruderal – Disturbed, rocky, rubbishy areas, such as old agricultural fields and rock piles.
Threatened - Listed and protected under the ESA as a threatened species.

ESA – Federal Endangered Species Act of 1973, as amended.
DLNR – Hawaii State Department of Land & Natural resources.
USFWS – U.S. Fish & Wildlife Service.

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APPENDIX E. SURVEY OF INVERTEBRATE RESOURCES AT ʻANINI, NEAR PRINCEVILLE, HANALEI DISTRICT, KAUAʻI ISLAND

Survey of Invertebrate Resources

at Anini, near Princeville,

Hanalei District, Kaua‘i Island

Prepared by:
Steven Lee Montgomery, Ph. D.,

Submitted to:
Princeville Prince Golf Course, LLC

May 23, 2009

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SUMMARY
The Princeville Prince Golf Course project site sampled in this biological survey yielded only a very few native species of arthropods. No invertebrate listed under either federal or state endangered species statutes was located within the survey area.

INTRODUCTION
This report summarizes the findings of an invertebrate[1] survey requested by Princeville Prince Golf Course. We understand this report will be used by Group 70 International, Inc., as part of a Planning Report in support of Princeville's State Land Use Commission Motion to revert from Urban to Agriculture.

Invertebrates are often the dominant fauna in natural Hawaiian environments. The primary emphasis of this survey was on invertebrates that are endemic, indigenous, or threatened species, especially those having legal status under either, or both federal and state endangered species statutes (DLNR 1996, Fed Reg 2008b, USFWS 2005a, 2009).

Native Hawaiian plant, vertebrate, and invertebrate populations are often interdependent. Certain insects are obligatorily attached to specific host plants and are able to use only that plant as their food. Those insect - host relationships are ancient and intertwined. The health of native Hawaiian invertebrate populations depends upon habitat quality and absence or low levels of predators introduced from the continents. Sufficient food sources, host plant availability, and the absence or low levels of introduced, continental predators and parasites comprise a classic native, healthy ecosystem. Consequently, where appropriate in the survey discussion, host plants and some introduced arthropods are also noted.

GENERAL SITE DESCRIPTION
The area surveyed was approximately 120 acres, within a portion of Tax Map Key (4) 5-3-006:014. The area lies north of Kuhio Highway and the Princeville Airport, in the Hanalei District of the island of Kaua'i. (Figure 1 and 2)

The parcel includes grazed grassland of primarily alien species introduced since 1790 and ravines with remnant native plant species. The land has a long history of agriculture and cattle, resulting in a limited list of native plants in isolated pockets. Archaeological reports show a history of kalo (taro), coffee, rice, and sugar growing in the larger areas (Yucha and Hammatt 2008). Currently a large part of the flat land serves as grazing for cattle and is dominated by grasses and

[1] Animals without backbones: insects, spiders, snails, shrimp, etc.

non-native trees that often invade abandoned fields. Consequently, Native Hawaiian plants of interest as hosts or shelter for native invertebrates were limited or confined to ravines in comparison to less altered island locations at similar elevations and with parallel rainfall.

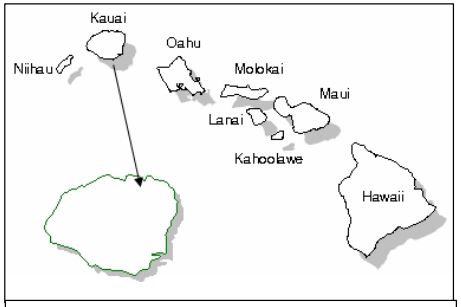


Figure 1: General location of project on island of Kaua'i.

INVERTEBRATE SURVEY METHODS

Previous Surveys and Literature Search
Prior to the field survey, a search was made for publications relating to invertebrates associated with the Princeville area. The review shows no previous native invertebrate surveys in the project area. Searches were made in the electronic catalogs of the Hawaii Public and University of Hawai'i libraries, and electronic and manual catalogs of Bishop Museum Library. The online data bases of AgEcon Search, ARGIS, Google Scholar, Hawaii's Office of Environmental Quality Control, and the NBII Pacific Basic Information Node[2] were searched. The University of Hawaii's Hawaii Pacific Journal Index which includes listings for the *Proceedings of the Hawaiian Entomological Society*.

The only previous Environmental Impact Statement located provided a survey of the larger property (Belt Collins 1983), but did not survey for land invertebrates. A recent archaeological survey of the area shows no evidence of lava tubes (Yucha and Hammatt 2008).

[2] Searches the cataloged specimens of Bishop Museum.

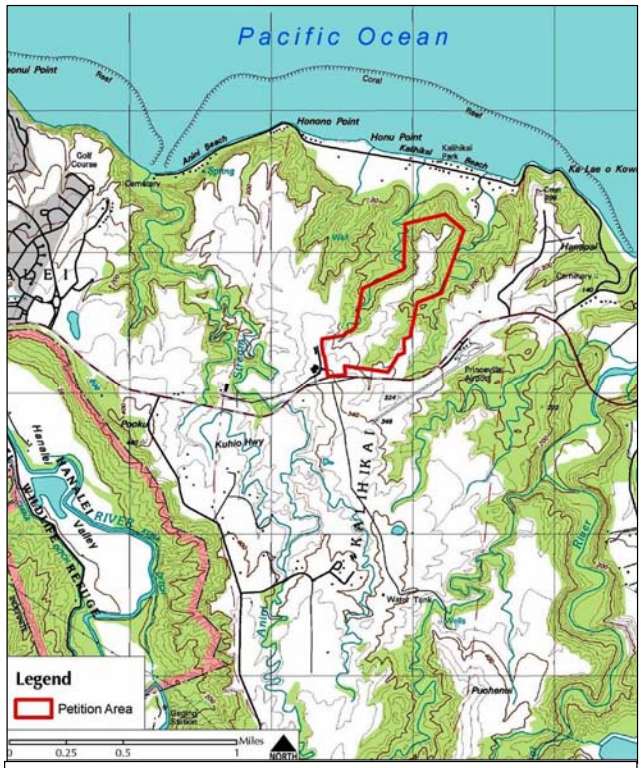


Figure 2: Map showing area of project at Princeville, Kaua'i. (map by Group 70)

Fieldwork

A field survey was conducted by Steven Lee Montgomery, Ph. D. at the site in April 2009. A general assessment of terrain and habitats was conducted at the start of the survey. Transects were walked through the property, and sampling sites selected to represent differences in elevation, vegetation, substrate, and other ecological factors. Known host plants for native invertebrate species were examined. Special attention was given to steep ravine walls which could shelter remnant native invertebrate populations. Surveying efforts were conducted at various times of day and night, a technique which is vital for a thorough survey.

Fieldwork schedule:

April 7, 2009	Site examination and general orientation
	Light assisted survey using UV bulb
April 8, 2009	General daylight survey

Survey Methods

Since 1969, I have taken part in field projects at other locations in similar locations on Kaua'i and throughout the island chain. Those experiences and the results of those surveys provided the basis for my study design and my analysis of results. The following survey methods for terrestrial invertebrates were used as appropriate to the terrain, botanical resources, and target species.

Host plant searches: Potential host plants, both native and introduced, were searched for arthropods that feed or rest on plants.

Light survey: A survey of insects active at night is vital to a complete record of the fauna. Many insects are only active at night to evade birds, avoid desiccation and high temperatures, or to use night food sources, such as night opening flowers. Light sampling uses a bright light source in front of a white cloth sheet. Night active insects seem to mistake the collecting light for the light of the moon, which they use to orient themselves. In attempting to navigate by the scientist's light, confused insects are drawn toward the light and land on the cloth in confusion. Vegetation usually blocks light from being seen over long distances, and most moths and other night fliers are not capable of very distant flight. Consequently, light surveying does not call in many insects from outside the survey area.

Light surveying began at sunset (6:55 p.m.) April 7, 2009, and continued until 4:00 a.m. April 8, 2009 (USNO). The light source was an ultra violet (UV) or black light bulb known to be attractive to night active insects. The sheet was monitored and visiting species noted. The location was chosen based on experience, host plant proximity, and terrain. The light survey location is marked on Figure 3.

Sweep nets: This method assists in surveying many flying and perching insects. A fine mesh net was swept across plants, leaf litter, rocks, etc. to census any flying, perching, or crawling insects.

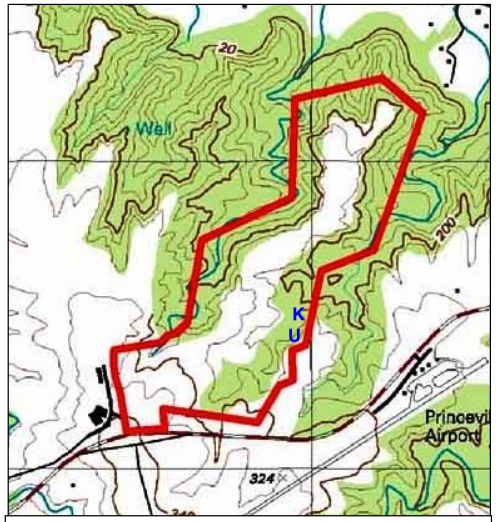


Figure 3: Map of project area showing light census location.
U = Ultraviolet light April 7, 2009 K= *Acacia koaia*

Visual observation: At all times, I was vigilant for any visual evidence of arthropod presence or activity. Visual observations provide valuable evidence and are a cross check that extends the reach of survey techniques. Visual observation also included turning over rocks, dead wood, and other debris.

Survey Limitations / Conditions

My ability to form advisory opinions is limited / influenced in the following ways:

Common alien species: No attempt was made to completely document the many common alien arthropod species present in the area.

Physical limitations: The size of the project area allowed a fairly comprehensive survey of the area. The resulting survey was representative and targeted in favor of locating and examining host plants which might be utilized by native invertebrates. Special attention was paid to ravines as potential refuges for remnant native host plants.

Survey conditions: Monitoring at a different time of the year, or for a longer period of time, might produce a longer or different invertebrate list. Weather and seasonal vegetation plays an especially important role in any survey of invertebrates. Many arthropods time their emergence and breeding to overlap or follow seasonal weather or to coincide with growth spurts or fruiting of

an important plant food. Host plant presence/absence, and seasonal changes, especially plant growth after heavy rains, affect the invertebrate species noted.

Weather was favorable for surveying during each day of fieldwork. A slight rain fell occasionally during April 7, but this did not impede fieldwork and would not deter arthropod activity. This study was conducted at the end of the winter season, and vegetation on the few native plants was in a stage adequate for surveying.

On April 7, 2009, the moon did present some competition to light survey efforts being nearly full (USNO). This may have affected the number of insects attracted to the light. There were no competing streetlights or other distractions, however, and passing clouds reduced interference from time to time. The light was at a high point projecting over a large portion of the property. The absence of native invertebrate host plants was a much greater factor in survey findings.

INVERTEBRATE SURVEY RESULTS:

Table 1 records the results of day and night invertebrate surveys. In addition to the invertebrate results noted in Table 1, I note that evidence of feral pig (*Sus scrofa*) rooting in soil was widespread. The resulting soil disturbance in addition to causing reduced survival of native host plants creates erosion and reduced water quality - both potential financial losses to the ranching operation.

DISCUSSION OF INVERTEBRATE RESOURCES

Native species observed on the property are discussed below. Information is provided on several alien species frequently observed by the public that may be misidentified or confused with native species. Alien species that affect the survival of native species and species that impact human health also are discussed.

NATIVE SPECIES

ARTHROPODS: INSECTA

COLEOPTERA (Beetles)

Cerambycidae: *Plagithmysus obscurus* (Sharp) 1900 ?

Plagithmysus is a large group of beetles with over 20 endemic species on Kaua'i. *P. obscurus* was first collected on the island in 1894 by R. C. L. Perkins (NBII). The larvae of this native beetle make distinctive feeding galleries. It feeds only on dead, dying, or injured parts of the tree and is not considered a 'pest' (Swezey 1954). Empty galleries which may have been made by this species or an introduced species were seen in *Acacia koaia* (see Figure 3). Only rearing larvae to adult will resolve this identity question.

LEPIDOPTERA: Cosmopterigidae: *Hyposmocoma*

Figure 4: *Hyposmocoma* sp. A cases disguised to blend with rock surface.

Four species of native *Hyposmocoma*, as caterpillars, were found on the rocky outcroppings in pasture grasses, on *Pandanus* (hala) trees - on support roots, and lichens on trunks. No adult moths came to light, but one adult escaped capture in daylight. Properly called "case bearers," the caterpillars are sometimes misleadingly called "bagworms." Very young caterpillars of case bearers find safety in a hiding place like a leaf curl. When growth forces them out of that protection, they intricately weave a portable shell of their own silk from a lip spinneret. For camouflage, they add bits of their surroundings to the case using their silk: snips of dry grass or leaves, flakes of bark, maybe a little dirt. The case is then easily mistaken by a predator as another part of the landscape. These bunkers are fitted with a hinged lid (operculum), pulled shut by mini-mandibles to defend them from enemies like beetles and ants. Their relationship to the case is similar to that of a hermit crab to his shell. Although not physically connected to the case as a snail or turtle, they are dependent on it, and die if removed – even if protected from predators and given food. They don't move far, but feed while partly emerged from the case, dragging along their protective

Figure 5: *Hyposmocoma* sp. C (top on left, ventral on right) displaying stealth appearance on dried *Pandanus* (Hala) leaf.

LEPIDOPTERA (continued)

Figure 6: This *Hyposmocoma* sp. D was found on tree trunks and blends in by covering itself in bits of *Pandanus* . (placed on contrasting surface for photography).

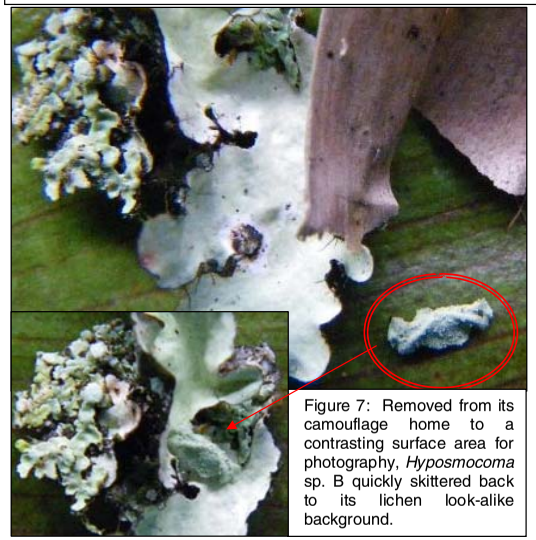


Figure 7: Removed from its camouflage home to a contrasting surface area for photography, *Hyposmocoma* sp. B quickly skittered back to its lichen look-alike background.

LEPIDOPTERA (continued)

armor by their six true legs. (Manning/Montgomery in Liittschwager & Middleton 2001) With over 500 kinds, *Hyposmocoma* micromoths are the greatest assemblage of Hawaiian Island moths, showing astonishing diversity. After writing 630 pages on them, Dr. Elwood Zimmerman lamented the inadequacy of his study. He noted an enormous cluster of species with explosive speciation and diverging radiation (Zimmerman 1978). Much remains to be learned about the life ways of this interesting group of insects now under study by University of Hawaii's Dr. Daniel Rubinoff and colleagues (Rubinoff et al. 2008).

Crambidae: *Eudonia* sp.

Figure 8: An adult *Eudonia* with a half-inch resting wingspan.

Eudonia (Figure 8) is an endemic narrow winged, speckled moth which is represented by 20 species known from Kaua'i of the 60 species in the island chain. Typically *Eudonia* larvae feed on mosses.

Pyralidae: *Mestolobes miniscula* (Butler 1881)
This native moth came to light. The adults also are often seen flying in daylight to flowers. The larvae are unknown except for one reared by Timberlake from tree moss (Zimmerman 1958).

ODONATA (Dragonflies and Damselflies)
Coenagrionidae: *Megalagrion* sp. Damselfly

Figure 9: *Megalagrion* sp.

There are 13 native *Megalagrion* species known on Kaua'i and of those several have red and black markings. An identification from a female alone is problematic. This female (Figure 9) displays some characters of several known species. Identification is pending collection of a male specimen from this or another nearby location at a later time. It is not expected, however, to be a new species or an alien introduction (Howarth 2009) (Maciolek & Howarth 1979; Polhemus & Asquith1996; Zimmerman 1948).

Dragonfly
Libellulidae: *Pantala flavescens* Globe skimmer
This indigenous dragonfly (Figure 10) was observed in open grassy areas of the property. Among the most easily observed native insects, they are large, fearless around people, and graceful in flight. A small amount of fresh water is attractive and they often colonize human maintained water sources such as the cattle troughs. Adults lay eggs in the water where predatory young called naiads develop and eat mosquito larvae, for example. The native dragonflies are widely distributed throughout the Hawaiian Islands, from Kure to Hawai'i Island (HBS 2002; Nishida 2002).

© Figure 10: Globe skimmers often use human created water sources (file photo)

ALIEN SPECIES

No attempt was made in this survey to document the many alien species common throughout the lowlands of the Hawaiian Islands. Those mentioned here are important to the health of native invertebrates or humans.

ARTHROPODS
INSECTA
HYMENOPTERA (Wasps, Bees, Ants)
Formicidae:

The crustacean eating ant (*Leptogenys falcigera*) (Figure 11) is known for preying on invertebrates such as sow bugs. The big-headed ant (*Pheidole megacephala*) is common in the Hawaiian Island lowlands and preys on most small invertebrates. Big-headed ants swarm larger insects, dismember them, and carry pieces back to nest (Figure 12).

©Figure 11: Crustacean eating ant (*Leptogenys falcigera*).

©Figure 12: *Pheidole megacephala* or big-headed ant soldiers display large jaws for defense of nest mates.

MEDICALLY IMPORTANT SPECIES

Invertebrate species which negatively impact human health are discussed below.

Although **large centipedes** and **scorpions** were not seen in this survey, they can be encountered anywhere in the Hawaiian Islands. Centipedes and scorpions are often disturbed when dead brush, large rocks, or trash are moved. Workers should be alert for these species when working on the property.

HYMENOPTERA

The **ants** noted in the survey (page 12), the crustacean eating ant (*Leptogenys falcigera*), and the big-headed ant (*Pheidole megacephala*), are not known to bite or sting humans. Caution should be used, however, anywhere nests or large numbers of ants are found.

©Figure 13: Honey bee stings cause severe allergic reactions in sensitive individuals.

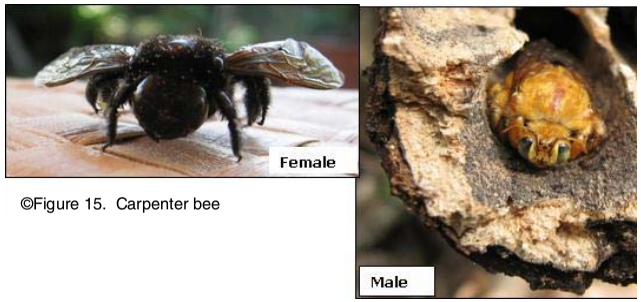
Honey bees (*Apis mellifera*) Figure 13) and **paper wasps** (*Polistes exclamans*) (Figure 14) were seen in this survey and can be encountered at any time of day. Their sting is known to cause **severe allergic reaction** in sensitive individuals.

Unlike honey bees, paper wasps can sting repeatedly, making them more dangerous in some ways. **Mud wasps** were not seen, but they can be encountered anywhere in the islands. Not seeing them during the short term of this survey does not mean they are not on the property.

©Figure 14. Paper wasps can sting repeatedly.

Medically important species: continued

The Sonoran **carpenter bee** (*Xylocopa sonorina*) (Figure 15), a large, introduced bee was seen in several areas. Their name derives from their activity of chewing distinctive round, shallow tunnels for a home in soft, dry, dead wood. Males are golden and limited in number; females more numerous and black. Although relatively large, and noisy in flight, they are usually harmless. When workers begin to clear dry wood where carpenter bees might live, the bees will fly out to protest and come quite close to people, but do not sting unless handled.



©Figure 15. Carpenter bee

Recommendations:

Employees and others using the area should be alert for all these species when on the property as they may pose a serious risk to some individuals. Supervisors should be aware of any special allergy by employees. Some individuals can experience anaphylactic reactions to venom (e.g., bee stings). When moving trash, stones, or piled brush, use of gloves and long sleeves in addition to covered shoes and long pants will greatly reduce the risk of accidental contact and bites or stings. Pulling socks up over pant cuffs (socks on outside) reduces the chance of a stinging invertebrate crawling up a pant leg. Please see *What Bit Me?* for photos and discussion of Hawaii's long-standing invertebrate health hazards (Nishida and Tenorio 1993).

Table 1: List of Invertebrates[3]: Princeville, Kaua'i

Species	Common name	Status	Abundance	Notes
INSECTA				
COLEOPTERA	beetles			
Cerambycidae				
Plagithmysus obscurus (Sharp) 1900 ?		End	U	larvae galleries seen in *Acacia koaia*
DIPTERA	flies and mosquitoes			
Drosophilidae	Pomace flies			
Drosophila mercatorum Patterson & Wheeler, 1942		Adv	C	in rotting *Pandanus*
Sciaridae	fungus gnats			
Sciara sp.		Adv	C	in rotting *Pandanus*
Ceratopogonidae				
Forcipomyia hardyi Wirth & Howarth 1982		End	O	
Tipulidae				
Limonia sp.	crane fly	End	U	
HOMOPTERA				
Pseudococcidae				
Pseudococcus giffardi (Ehrhorn)	hala mealybug	End	A	on *Pandanus*
HYMENOPTERA	wasps, bees, ants			
Anthophoridae				
Xylocopa sonorina F. Smith, 1874	Sonoran carpenter bee	Adv	O	dead wood
Apidae				
Apis mellifera Linnaeus, 1758	honey bee	Pur	C	on *Metrosideros* sp.
Formicidae	ants			
Leptogenys falcigera Roger, 1861	crustacean eating ant	Adv	U	in wood cavities
Pheidole megacephala	big-headed ant	Adv	C	on soil
Vespidae	wasps			
Polistes exclamans Viereck, 1906	common paper wasp	Adv	C	bushes

[3] Names authority: Hawaii Biological Survey 2002; Nishida 2002; Zimmerman 1948-80; Zimmerman 2001

Species	Common name	Status	Abundance	Notes
INSECTA (continued)				
LEPIDOPTERA				
Cosmopterigidae	case bearers			
Hyposmocoma sp. A	tube case	End	O	on stones
Hyposmocoma sp. B	pale 'lichen' case	End	O	on lichens on *Pandanus* trunk
Hyposmocoma sp. C	tooth edged 'crab' case	End	O	on dead *Pandanus* prop root
Hyposmocoma sp. D	slender case	End	O	on dead *Pandanus* prop root
Crambidae	micro-moths			
Eudonia demodes (Meyrick) 1899	moss moth	End	O	at light
Eudonia struthias Meyrick 1899	moss moth	End	C	at light
Pyralidae				
Mestolobes miniscula (Butler 1881)		End	O	at light
ODONATA	dragonflies and damselflies			
Coenagrionidae	damselflies			
Megalagrion sp.		End	U	by ravine seep
Libellulidae	skimmers			
Pantala flavescens (Fabricius, 1798)	globe skimmer	Ind	A	in flight over pastures

Status:
End endemic to Hawaiian Islands
Ind indigenous to Hawaiian Islands
Adv adventive
Pur purposefully introduced
? unknown

Abundance = occurrence ratings:
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 survey
A Abundant: found in large numbers
AA Very abundant: abundant and dominant

INVERTEBRATES NOT PRESENT

Plant and land invertebrate populations are interdependent. Consequently, host plant presence is one way to review invertebrate health. The absence of many native host plants on much of the property due to years of agriculture and grazing (Yucha & Hammatt 2008) contributes to the paucity of Hawaiian arthropods at this site.

Alien predatory ants are another major cause for the scarcity of native arthropods. The big-headed ant (*Pheidole megacephala*), which is especially noted as a "very aggressive and efficient" predator on other insects (Tenorio & Nishida 1995; Williams 1931), is present in vast colonies on the property. These ants are well documented as a primary cause of low levels of native arthropods at elevations up to 2000 ft. (Perkins 1913). Ant species populations often do not overlap, but have separate territories, effectively apportioning the hunting grounds among themselves, offering few ant-free zones to native arthropods.

Figure 16. *Pandanus* did not yield native species.

INSECTA

Larvae of several Diptera were found in decaying *Pandanus* (hala) axils and recovered for rearing to determine species (Figure 16). *Pandanus* has been present in the area since the pre-human era, and was noted in a recent survey of the history of the area (Yucha &Hammatt 2008).

> William T. Brigham[4] visited Kaua'i in 1865 and also commented on the extensive pandanus, "Vast numbers of pandanus cover the hillsides and grow so luxuriantly as to furnish an admirable shelter from the rain" (Lydgate 1991).

The long presence of *Pandanus* in the area, together with the use of *Pandanus* by several native species led me to expect these to be native. After rearing and identification, they all proved to be alien species. (see also Protected Species Not Seen: Diptera).

[4] Later first Director of Bernice P. Bishop Museum.

PROTECTED SPECIES NOT SEEN

MOLLUSCA: Gastropoda (Snails)

No indigenous or endemic mollusca were noted during this survey.

Basommatophora

Lymnaeidae: *Erinna newcombi* Adams & Adams, 1855 *or* Newcomb's Snail

This threatened species was not found by my survey or by a 1983 survey of Anini Stream (Timbol in Belt, Collins 1983). The habitat (stream flow and moisture levels) makes the survey area unsuitable for this snail. (USFWS 2006)

ARTHROPODA

ARANEAE (Spiders)

Kaua'i cave wolf spider (*Adelocosa anops*)

My own survey showed no evidence of lava tubes or caves which would support the endangered Kaua'i cave wolf spider or other cave species. An archaeological survey of the area (Yucha and Hammatt 2008) found no evidence of lava tubes. None of the areas designated as critical habitat for the recovery of this species are in the project area (Federal Register 2003).

DIPTERA (Flies)

Drosophilidae*: Drosophila musaphilia*

No native *Drosophila* were observed in the project area during this survey. The project location does not provide appropriate habitat for the one native *Drosophila* species recently listed as endangered. *Drosophila musaphilia* requires koa forests at elevations much higher than this property provides. (Federal Register 2006). The only critical habitat designated for this species is at Kokee, Kaua'i. (Federal Register 2008a).

LEPIDOPTERA

Sphingidae: *Manduca blackburni*

© Figure 17: Blackburn's sphinx moth is distinguished from other hawk moths by orange markings.

Blackburn's sphinx moth (*Manduca blackburni*) (Figure 16), an endangered species (Fed Reg 2000) was not found in this survey. The *Recovery Plan* for this large sphinx moth proposes only one Kaua'i Management Unit at Kokee. (USFWS 2005b)

The moth's solanaceous host plants, native 'aiea (*Nothocestrum* sp.), the alien hosts, tree tobacco (*Nicotiana glauca*), and *Solanum mauritianum* were not observed on the property.

POTENTIAL IMPACTS

Potential Impacts on Native, Rare, Federally or State Listed Species

No federally or state listed endangered or threatened species were noted in this survey (USFWS 2006). There is no federally designated Critical Habitat for any invertebrate species on or adjacent to the subject property. No anticipated actions related to the proposed project activity in the surveyed locations are expected to threaten entire species or entire populations.

Recommendations

Preservation of the existing native flora environments, including on steep slopes, and in ravines should provide habitats for the few native invertebrate species.

Cerambycidae: *Plagithmysus obscurus* (Sharp) 1900 ?

If any terrain alterations or vegetation clearing is planned in the area of the *Acacia koaia* plants (see Figure 3), it would be advisable to obtain beetle larvae for rearing. This would allow determination to species, answering the question of native vs. alien.

If any new decorative plantings are planned in connection with the proposed activity, the use of native plants appropriate to the area would enhance habitat for native species. Native insects and birds will find this refuge over time.

Importantly, using native plants to landscape will mean lower long-term watering costs, following an initial establishment period. Native plants remain green and so more fire resistant through the summer. Plants chosen to fit the height and space requirements will have very low maintenance costs. Planted in a mix of ground cover, shrub, and tree heights the native plants will also help slow run off on slopes and retain moisture. Shrubs at the tops of gulches can define the edge and improve safety.

With prior arrangement, native plants can be as convenient for mass plantings as the introduced plants commonly used to revegetate after new construction. A list of suppliers of native plants (see page 2 for Kaua'i) is available at

http://hbs.bishopmuseum.org/botany/riparian/pdf/propagators.pdf

ACKNOWLEDGMENTS

Thanks are extended to Mr. George Atta, Group 70, Mr. Mike Loo, and Princeville Prince Golf Course staff for assistance with access to the site at the irregular times required for this survey. Special thanks to DLNR, Division of Forestry & Wildlife staff for speedy provision of permits necessary for this survey. Anita Manning contributed to preparation of this report. Steven Lee Montgomery conducted all surveying and is responsible for all conclusions.

ABBREVIATIONS

DLNR	Department of Land and Natural Resources, State of Hawai'i
DOFAW	Division of Forestry and Wildlife, State of Hawai'i
ft	feet
HBS	Hawai'i Biological Survey
m	meter
MV	mercury vapor
n.	new
sp.	species
spp.	more than one species
TMK	Tax Map Key
UH	University of Hawai'i
USFWS	United States Fish and Wildlife Service
UV	ultra violet

STANDARD NOMENCLATURE

Bird names follow *Hawaii's Birds* (Hawaii Audubon Society 2005).

Invertebrate names follow
Common Names of Insects & Related Organisms (HES 1990)
Hawaiian Terrestrial Arthropod Checklist (HBS2002; Nishida 2002)

Mammal names follow *Mammals in Hawaii* (Tomich 1986).

Place name spelling follows *Place Names of Hawaii* (Pukui et al. 1976).

Plant names follow
Manual of the Flowering Plants of Hawaii (Wagner et al. 1999)
A Tropical Garden Flora (Staples and Herbst 2005)

GLOSSARY[5]

Adventive: organisms introduced to an area but not purposefully.

Alien: occurring in the locality it occupies ONLY with human assistance, accidental or purposeful; not native. Both Polynesian introductions (e.g., coconut) and post-1778 introductions are aliens (e.g., guava).

Anaphylactic: hypersensitivity resulting in a sudden severe and potentially fatal allergic reaction, marked by a drop in blood pressure, difficulty in breathing, itching, and swelling

Arthropod: insects and related invertebrates (e.g., spiders) having an external skeleton and jointed legs.

Endemic: naturally occurring, without human transport, ONLY in the locality occupied. Hawaii has a high percentage of endemic plants and animals, some in very small microenvironments.

Entomology: the study of insects and other arthropods

Indigenous: naturally occurring without human assistance in the locality it occupies; may also occur elsewhere, including outside the Hawaiian Islands. (e.g., Naupaka kahakai (*Scaevola sericea*) is the same plant in Hawai'i and throughout the Pacific).

Insects: arthropods with six legs, and bodies in 3 sections

Invertebrates: animals without backbones (insects, spiders, snails / slugs, shrimp)

Larva/larval: an immature stage of development in offspring of many types of animals.

Mollusk: invertebrates in the phylum Mollusca. Common representatives are snails, slugs, mussels, clams, oysters, squids, and octopuses.

Native: organism that originated in area where it lives without human assistance. May be indigenous or endemic.

Nocturnal: active or most apparent at night.

Purposefully introduced: an organism brought into an area for a specific purpose, for example, as a biological control agent.

Rare: threatened by extinction and low numbers.

Species: all individuals and populations of a particular type of organism, maintained by biological mechanisms that result in their breeding mostly with their kind.

5 Glossary based largely on definitions in *Biological Science: An Ecological Approach*, 7th ed., Kendall/Hunt Publishing Co., Dubuque, a high school text; on the glossary in *Manual of Flowering Plants of Hawai'i*, Vol.2, Wagner, et al., 1999, Bishop Museum Press, and other sources.

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APPENDIX F. PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION PRINCEVILLE GRAND ESTATES SUBDIVISION TMK: 5-3-06:14

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION
PRINCEVILLE GRAND ESTATES SUBDIVISION
TMK: 5-3-06: 14
PRINCEVILLE, KAUAI, HAWAII

W.O. 5742-00(A) JANUARY 15, 2007

Prepared for

PRINCEVILLE PRINCE GOLF COURSE, LLC

CLAYTON S. MIMURA
LICENSED PROFESSIONAL ENGINEER
No. 4176-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

DRAFT

SIGNATURE — 4-30-08 EXPIRATION DATE OF THE LICENSE

GEOLABS, INC.
Geotechnical Engineering and Drilling Services
2006 Kalihi Street • Honolulu, HI 96819

Hawaii • California

December 15, 2007
W.O. 5742-00(A)

Mr. Michael Y.M. Loo
Princeville Prince Golf Course, LLC
P.O. Box 223040
Princeville, HI 96722-3040

Dear **Mr. Loo:**

Geolabs, Inc. is pleased to submit our report entitled "Preliminary Geotechnical Engineering Exploration, Princeville Grand Estates Subdivision, TMK: 5-3-06: 14, Princeville, Kauai, Hawaii" prepared in support of the general design for the project.

Our work was performed in general accordance with the scope of services outlined in our fee proposal dated July 19, 2006.

Please note that the soil samples recovered during our field exploration (remaining after testing) will be stored for a period of two months from the date of this report. The samples will be discarded after that date unless arrangements are made for a longer sample storage period. Please contact our office for alternative sample storage requirements, if appropriate.

Detailed discussion and specific recommendations are contained in the body of this report. If there is any point that is not clear, please contact our office.

Very truly yours,

GEOLABS, INC.

DRAFT

Clayton S. Mimura, P.E.
President

CSM:DEF/SC:mj

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DRAFT

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

PRINCEVILLE GRAND ESTATES SUBDIVISION

TMK: 5-3-06: 14

PRINCEVILLE, KAUAI, HAWAII

W.O. 5742-00(A) JANUARY 15, 2007

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DRAFT

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

PRINCEVILLE GRAND ESTATES SUBDIVISION

TMK: 5-3-06: 14

PRINCEVILLE, KAUAI, HAWAII

W.O. 5742-00(A) JANUARY 15, 2007

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The project site is situated in an upland plateau region north of the existing Princeville Airport. The project site is in a humid climate typified by relatively high rainfall and very moist soil conditions. Based on our field exploration, the upland plateau region is underlain by thick saprolitic soils generally consisting of stiff to very stiff silty clay and clayey silt with fine sand and localized zones of friable, decomposed basalt rock. We did not encounter groundwater on the upland plateau; however, we did encounter generally wet soils with frequent zones of groundwater seepage throughout the boring depths.

The project site encompasses two existing landfill sites identified as Landfill Areas I and II on the upland plateau. Development surrounding the existing landfill areas should follow established building setbacks and future use of the landfill areas should be carefully considered.

An area of spread stockpiled clayey soils exists easterly of the existing Golf Clubhouse and a possible old water tunnel alignment may traverse a section of the ridgeline north of the Golf Clubhouse. The stockpile soils should be removed prior to developing the affected area. In addition, the old water tunnel site should be investigated and geotechnical recommendations for tunnel abandonment or incorporation into the development plan should be pursued, if the tunnel is found to actually exist.

Due to the existing steep slopes bordering the ridgelines on the upland plateau, general building setback guidelines for future residential structures should be established. The individual purchasers should be responsible for obtaining additional detailed geotechnical consultation and recommendations for the design of foundation systems and the site-specific assessment of building setbacks and other potential geological and geotechnical constraints and hazards.

The text of this report should be referred to for detailed discussion and specific recommendations.

END OF SUMMARY OF FINDINGS AND RECOMMENDATIONS

SECTION 1.0 – GENERAL

1.1 Introduction

This report presents the results of our preliminary geotechnical engineering exploration performed for the proposed *Princeville Grand Estates Subdivision* project in the District of Hanalei on the Island of Kauai, Hawaii. The project location and general vicinity are shown on the Project Location Map, Plate 1.

This report summarizes the findings from our field exploration and presents our preliminary geotechnical engineering recommendations derived from our analyses for the general design of foundations, retaining structures, site grading, and pavements for the project site infrastructure only. These preliminary recommendations are intended for design input and should not be utilized for construction estimation or bidding purposes. Additional geotechnical engineering field exploration and consultation should be performed to address the site-specific conditions and recommendations related to development of the individual home sites. The preliminary findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.2 Project Considerations

The project site is on the eastern and central plateau areas in Princeville on the Island of Kauai, Hawaii. The project site is on the existing gently to moderately sloping upland plateaus north of Kuhio Highway. Several drainage ravines, ranging from relatively shallow to deep, bound the upland plateau and encompass some steep natural hill slopes.

The proposed project is anticipated to consist of approximately 77 subdivision estate lots of about 5 acres. The subdivision lots will be developed on the bluffs at the central and eastern plateau areas in Princeville. We understand that it is desired to perform a preliminary geotechnical engineering exploration to address the construction of roads, utility infrastructure, and building pads, based on the available subdivision layout and concept planning. Individual house construction by the developer is not anticipated. It will be the responsibility of the future buyers to pursue detailed

geotechnical engineering exploration and consultation services for development of their individual home sites. Recommendations for the home sites may include the evaluation of potential geologic hazards and the development of site-specific design considerations for lot grading and structural foundations.

We anticipate that the new subdivision roadways may consist of flexible pavements with associated drainage structures. Portions of the proposed new roadways that traverse some steep upland slopes may require more intensive site grading or the construction of retaining structures. A project site grading plan and other detailed information for the proposed infrastructure development are currently not available for our consideration. In general, we envision that the new homes may consist of large one to two-story structures to be located in various geologic regions ranging between lowland coastal plains, interior valley hillsides, and upland plateau settings. Based on the existing relatively flat coastal and bluff top topography, cut and fill on the order of about 5 to 10 feet in height is generally anticipated. Where locally hilly terrain is encountered on the upland plateau, we anticipate that site grading may generally consist of cut and fill on the order of about 10 to 20 feet in height.

Some of the proposed home sites may be located along the top of the bluffs adjacent to tall and steep hillslopes composed of deeply weathered basalt rock (saprolitic soils). We performed a geotechnical engineering analysis of the regional slope stability to develop general guidelines for building setbacks at the top of the slopes.

In addition, the proposed development encompasses some land that was formerly used for landfill of greenwaste and construction debris. We performed a previous field exploration to evaluate the limits of the known landfills.

We performed a preliminary geotechnical engineering exploration in January 2004 for the proposed eastern plateau development. We prepared our November 22, 2004 report entitled "Preliminary Geotechnical Engineering Exploration, Princeville Eastern Plateau Agricultural Subdivision, TMK 5-3-06: 1 and 14, Princeville, Kauai, Hawaii." We understand that the current eastern plateau development layout is generally unchanged

with the exception of the realignment and exclusion of some previously planned roadways; therefore, we evaluated and included information from our earlier report in this report.

In addition, we reviewed an earlier geotechnical report that we prepared for a portion of the project site entitled, "Soil Engineering Investigation, Proposed Princeville II Golf Course, Hanalei, Kauai, Hawaii" (W.O. 1142-00) dated July 30, 1982. The report addresses some groundwater springs that were observed at the bases of several slopes below the site. These springs indicate that perched groundwater may be present under the site. This older exploration also noted the possible presence of an old water development tunnel crossing the site to the north of the existing Golf Course Clubhouse as shown on the Site Plan, Plate 2.

1.3 Purpose and Scope

The purpose of our preliminary geotechnical engineering exploration was to obtain an overview of the surface and subsurface conditions to develop a soil/rock data set to formulate geotechnical engineering recommendations for the preliminary design of the proposed Princeville Grand Estates Subdivision project. In order to accomplish this, we have conducted an exploration program consisting of the following tasks and work efforts:

1. Review of available in-house information such as reports, geologic maps, soil survey maps, and aerial photographs for the project site, including our November 22, 2004 report entitled "Preliminary Geotechnical Engineering Exploration, Princeville Eastern Plateau Agricultural Subdivision, TMK 5-3-06: 1 and 14, Princeville, Kauai, Hawaii".

2. Review of previous field exploration information pertinent to the Landfill Areas I and II and the Eastern Plateau.

3. General reconnaissance of the project site by our project geologist and principal engineer to record observations of the existing site conditions.

4. Mobilization and demobilization of a truck-mounted drill rig and two operators from Honolulu to the project site and back.

5. Drilling and sampling of 16 test borings, identified as Boring Nos. B-101 through B-116, extending to depths of about 21.5 to 91.5 feet below the existing ground surface.