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GOVERNOR  
STATE OF HAWAII



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DEPUTY TO THE CHAIRMAN

OFFICE OF ENVIRONMENTAL  
QUALITY CONTROL

January 29, 1996

Mr. Gary Gill, Director  
State of Hawaii  
Office of Environmental  
Quality Control (OEQC)  
220 South King Street, 4th Floor  
Honolulu, Hawaii 96813

Dear Mr. Gill:

SUBJECT: Final Environmental Assessment for Kalamaula Residence  
Lots, Unit 1, Kalamaula, Island of Molokai

Enclosed are four (4) copies of the Final Environmental Assessment (Negative Declaration) for the proposed Kalamaula Residence Lots, Unit 1. Based on the analysis of the conditions and impacts presented in the Environmental Assessment, we have concluded that the proposed project will have no significant effect on the environment. Therefore, we are filing a Negative Declaration for the proposed project.

We request that this Negative Declaration be published in the next OEQC Bulletin. A completed OEQC Bulletin Publication Form is enclosed as required.

Should you have any questions, please have your staff call Mr. Patrick Young, Land Development Division, at 586-3818.

Sincerely,

  
Mike Crozier, Administrator  
Land Development Division

cc: R.M. Towill Corp.

1996-02-08-MO-PEA-Kalamaula Residence Lots, Unit 1

FEB 8 1996

**FILE COPY**

**FINAL ENVIRONMENTAL ASSESSMENT**

***KALAMAULA RESIDENCE LOTS - UNIT 1***

Kalamaula, Island of Molokai, Hawaii

January 1996

**PROJECT FOR:**

State Department of Hawaiian Home Lands  
Old Federal Building  
335 Merchant Street  
Honolulu, Hawaii 96813

**PREPARED BY:**

RMTC  
R. M. Towill Corporation  
420 Waiakamilo Road, Suite 411  
Honolulu, Hawaii 96817-4941

**Final Environmental Assessment**

**KALAMAULA RESIDENCE LOTS - UNIT 1  
Kalamaula, Island of Molokai, Hawaii**

**January 1996**

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## PROJECT SUMMARY

**Project:** Kalamaula Residence Lots - Unit 1

**Applicant:** State of Hawaii  
Department of Hawaiian Home Lands  
Old Federal Building  
335 Merchant Street  
Honolulu, Hawaii 96813

**Accepting Authority:** Department of Hawaiian Home Lands

**Tax Map Keys<sup>1</sup>:** Second Division, 5-2-08: Portion  
39, 53, 91, 92, 93, 94, Portion 95, Portion 114;  
5-2-09: Portion 01, 15,  
Portions 23 and 28; 5-2-10:  
Portion 1

**Location:** Kalamaula, Island of Molokai,  
County of Maui, State of Hawaii

**Project Area:** Approximately 133 acres

**Owner:** State of Hawaii  
Department of Hawaiian Home Lands

**Agent:** R. M. Towill Corporation  
420 Waiakamilo Road, Suite 411  
Honolulu, Hawaii 96817  
Phone (voice): 808-842-1133  
(Facsimile): 808-842-1937

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<sup>1</sup> TAX MAP KEYS FOR THE PROJECT SITE ARE BASED ON PARCEL NUMBERS ASSIGNED PRIOR TO A 1985 SUBDIVISION WHICH PRESENTLY CONSISTS OF 184 LOTS.

Existing Land Uses: Homesteads, subsistence  
agriculture, pasture and open space

State Land Use District: Rural, Agricultural and  
Conservation

County of Maui  
Molokai Community Plan: Rural, Agriculture, Conservation,  
Historic Site

County of Maui  
Zoning Designation: Agricultural and Rural



Section 1  
INTRODUCTION

**1.1 INTRODUCTION**

The Department of Hawaiian Home Lands (DHHL) proposes to develop approximately 133 acres in Kalamaula, Molokai, for homestead lots. The project is an integral part of a development plan for the entire District of Kalamaula. The residential component of the Kalamaula Development Plan will consist of 124 homestead lots each averaging one-acre in size. Upon completion of required infrastructure, homestead lots will be distributed to qualified beneficiaries of native Hawaiian ancestry.

The DHHL proposes to complete its awards program that began in 1985, by developing the 124 one-acre lots adjacent to the eastern boundary of an existing 44-lot subdivision. The project involves construction of new and improve existing infrastructure to meet County standards. Lots will be awarded based on a phased development schedule.

Pursuant to Chapter 200, Title 11, Hawaii Administrative Rules, as amended, this project is subject to Chapter 343, Hawaii Revised Statutes, due to the use of State of Hawaii funds for development. This Environmental Assessment is being prepared to address the environmental impacts anticipated for this project.

**1.2 PURPOSE AND OBJECTIVES**

The purpose of this project is to offer opportunities to native Hawaiian beneficiaries to develop lands for homesteading. It is consistent with the Hawaiian Homes Commission Act, 1920, as amended, which provides for the development and settlement of native Hawaiians on lands owned by the Department of Hawaiian Home Lands. This proposal represents DHHL's ongoing efforts to expedite the development and distribution of its lands to qualified beneficiaries.

DHHL will improve existing facilities and provide new roadways, drainage facilities, potable water storage and transmission systems. Sewage disposal will consist of a combination of a transmission system and cesspools as may be permitted by the State Department of Health. The development of basic support infrastructure will be integrated, to the greatest practical extent, with the agricultural and commercial/industrial components proposed for Kalamaula.

### 1.3 PROJECT LOCATION

The proposed project is located in Central Molokai (Figure 1). The project site is a part of DHHL's Kalamaula Development Plan which proposes the long range development of the entire 6,023-acre District of Kalamaula. Under the development plan, lands of Kalamaula are proposed for a range of uses including commercial/industrial lots and community uses makai of the project site and pasture and game management mauka of the project site.

The project is located at the makai portion of Kalamaula, within and around the existing Kalaniana'ole Colony. It is generally bounded by the District of Kaunakakai to the east, Naiwa to the west, Hoawa Road to the south, and the 150-foot elevation to the north (Figure 2). All land proposed for this project is owned by the State of Hawaii, and under jurisdiction of the Department of Hawaiian Home Lands.

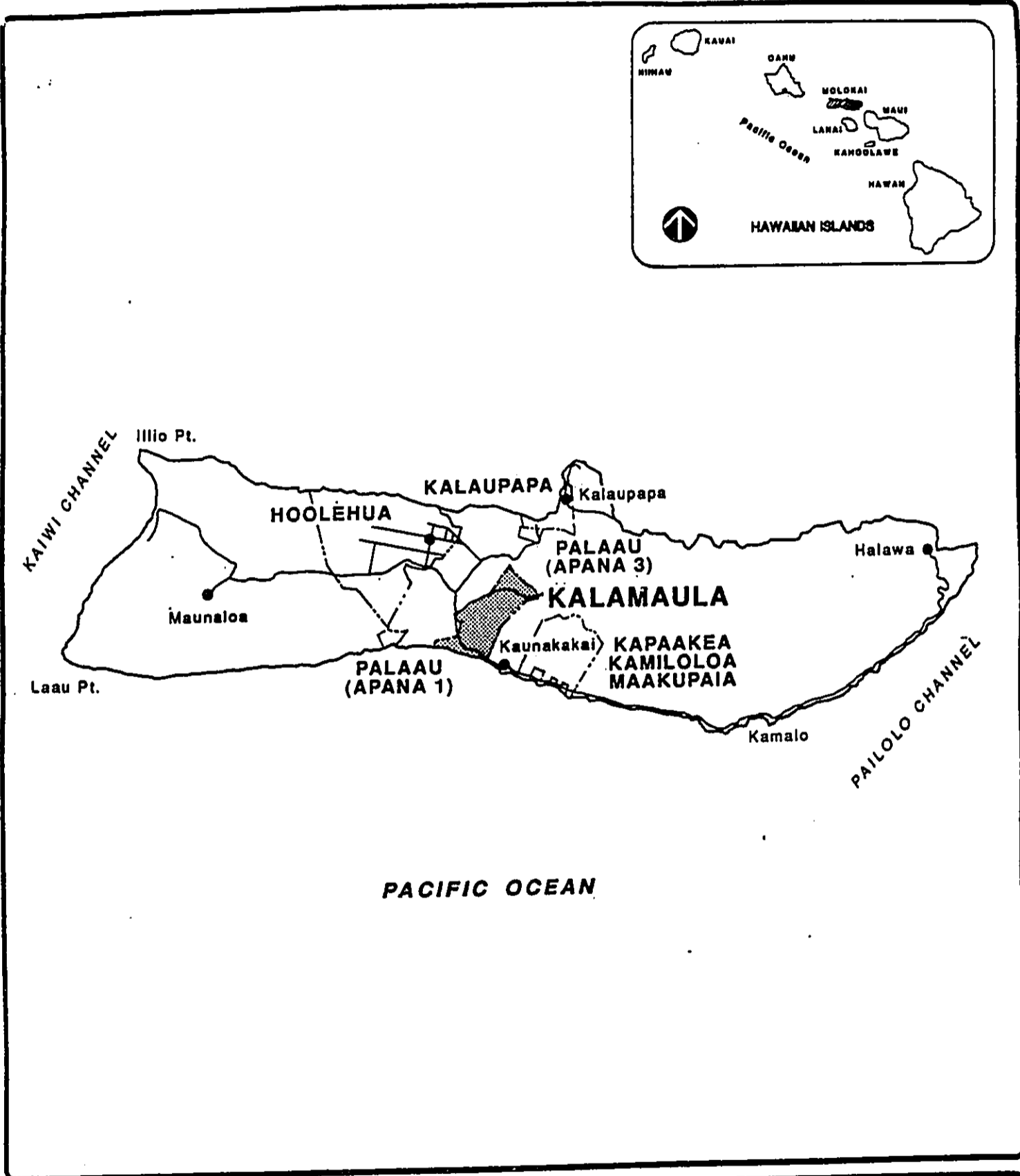


Figure 1  
**Location Map**  
 Hawaiian Home Lands



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1995

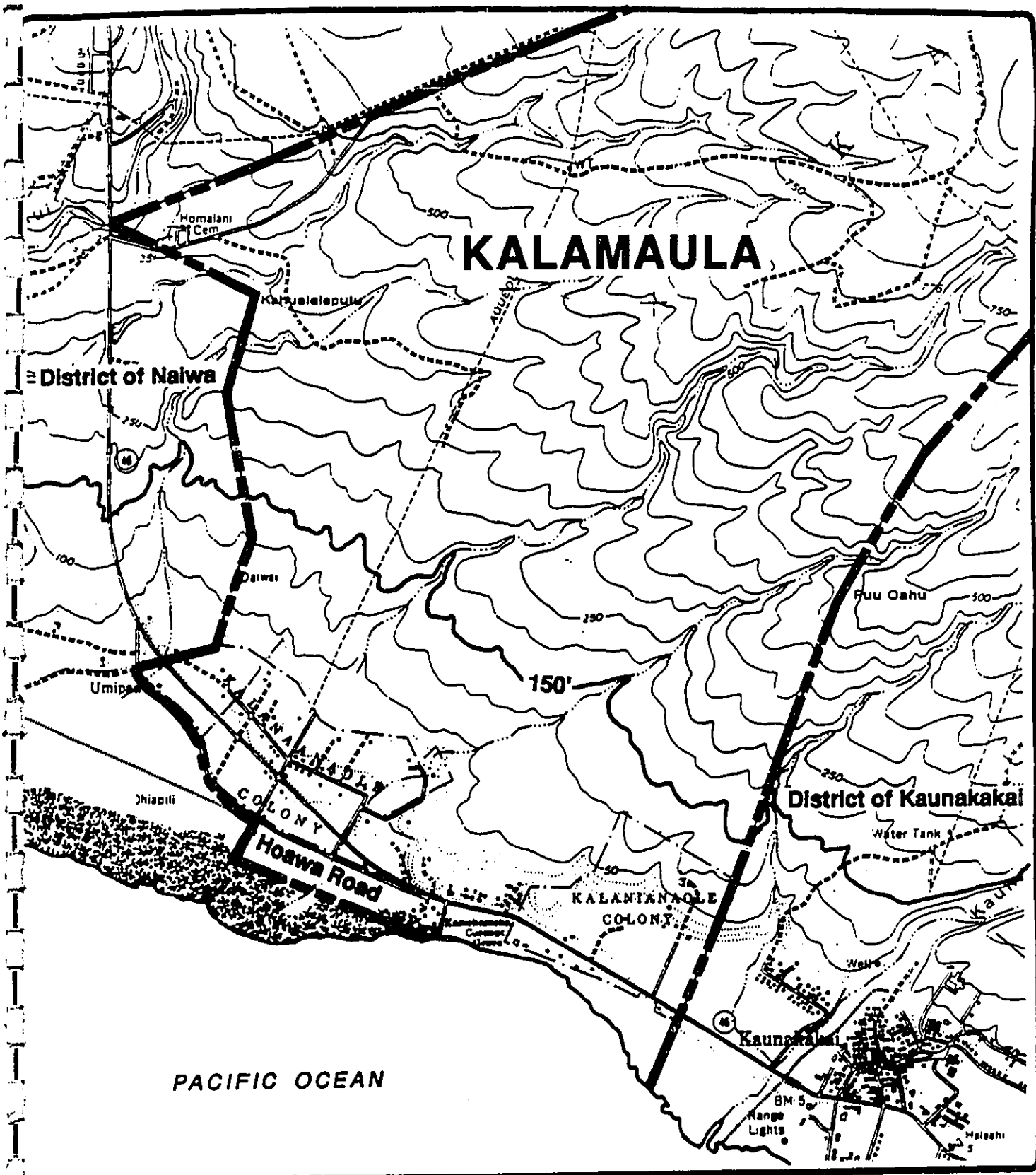


Figure 2  
**Location Map**  
**KALAMAULA**  
 (makai portion)



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 April 1995

Section 2  
PROJECT DESCRIPTION AND BACKGROUND

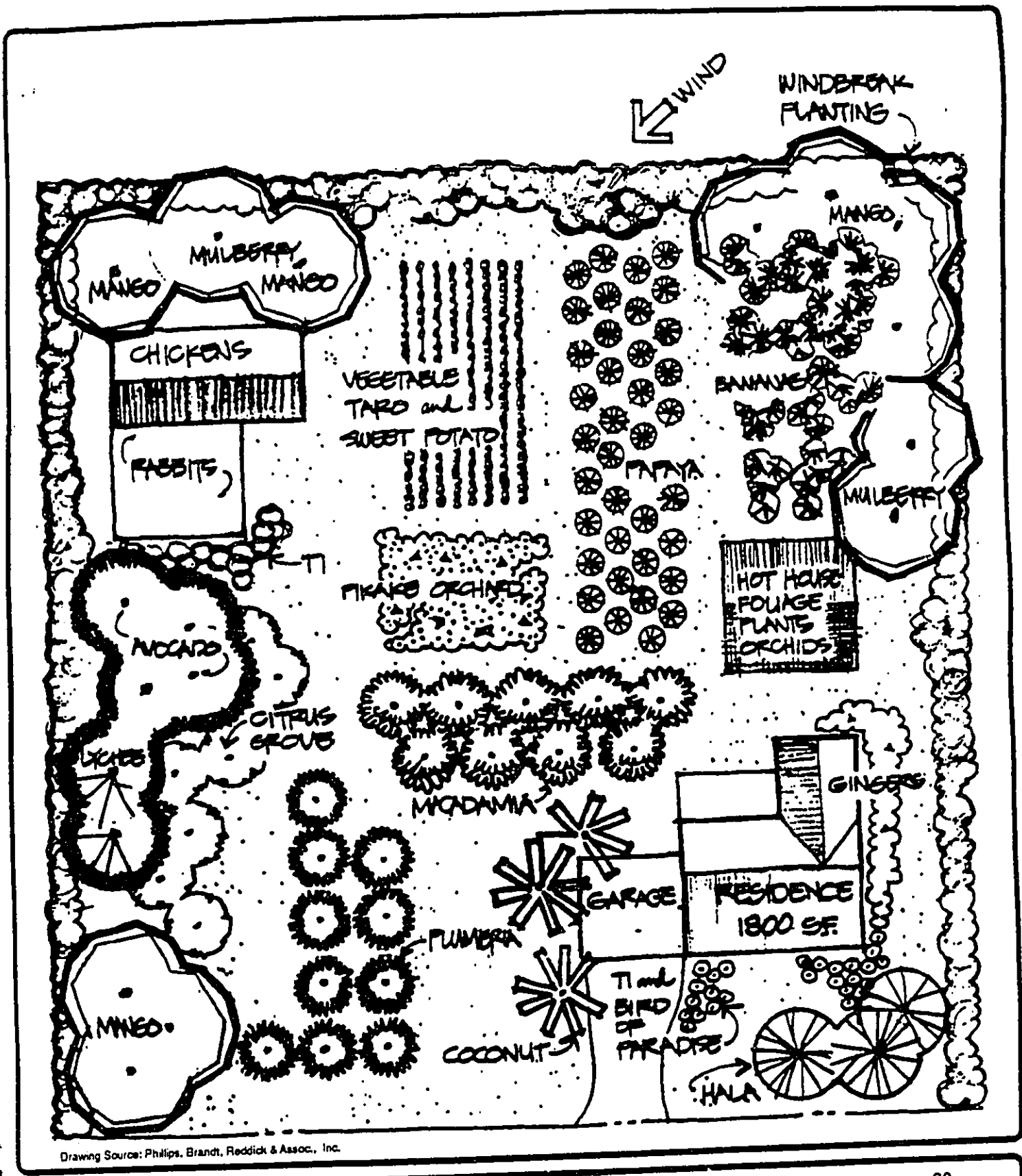
**2.1 DEVELOPMENT CONCEPT**

Development of the residential component of the project will be based on the conceptual theme of "residential subsistence". The concept places emphasis on residential use and encourages agriculture as an auxiliary use of the homestead lot. It permits beneficiaries and their families the opportunities for subsistence gardening and animal husbandry without committing to agriculture as the primary source of income. DHHL's proposal involves lots that will average one-acre in size. This range of lot sizes is consistent with the existing surrounding rural land use character of the Kalaniana'ole Colony. Figure 3 illustrates one scenario for the subsistence development of a one acre lot and involves a variety of crops and animals and a single-family dwelling of modest size. Ohana dwelling units will not be permitted.

Development of the residential portion of Kalamaula is intended to be integrated with the agricultural and commercial/industrial portions of the Kalamaula District Development Plan. All components of the development plan are envisioned to work together as a small scale agricultural community. This residential/agricultural community would be supported by basic infrastructure and contain opportunities for providing commercial and industrial services from within as well as providing services to the surrounding community. Figure 4 shows the land use plan for the entire District of Kalamaula as proposed under DHHL's Development Plan prepared in June 1983.



The development plan for Kalamaula was prepared with substantial community involvement. As a result of community input, the following guidelines were established for the development of Kalamaula:

- 0 Due to its favorable location between the agricultural lands of Hoolehua and Kaunakakai Town, Kalamaula is a reasonable location for siting residential

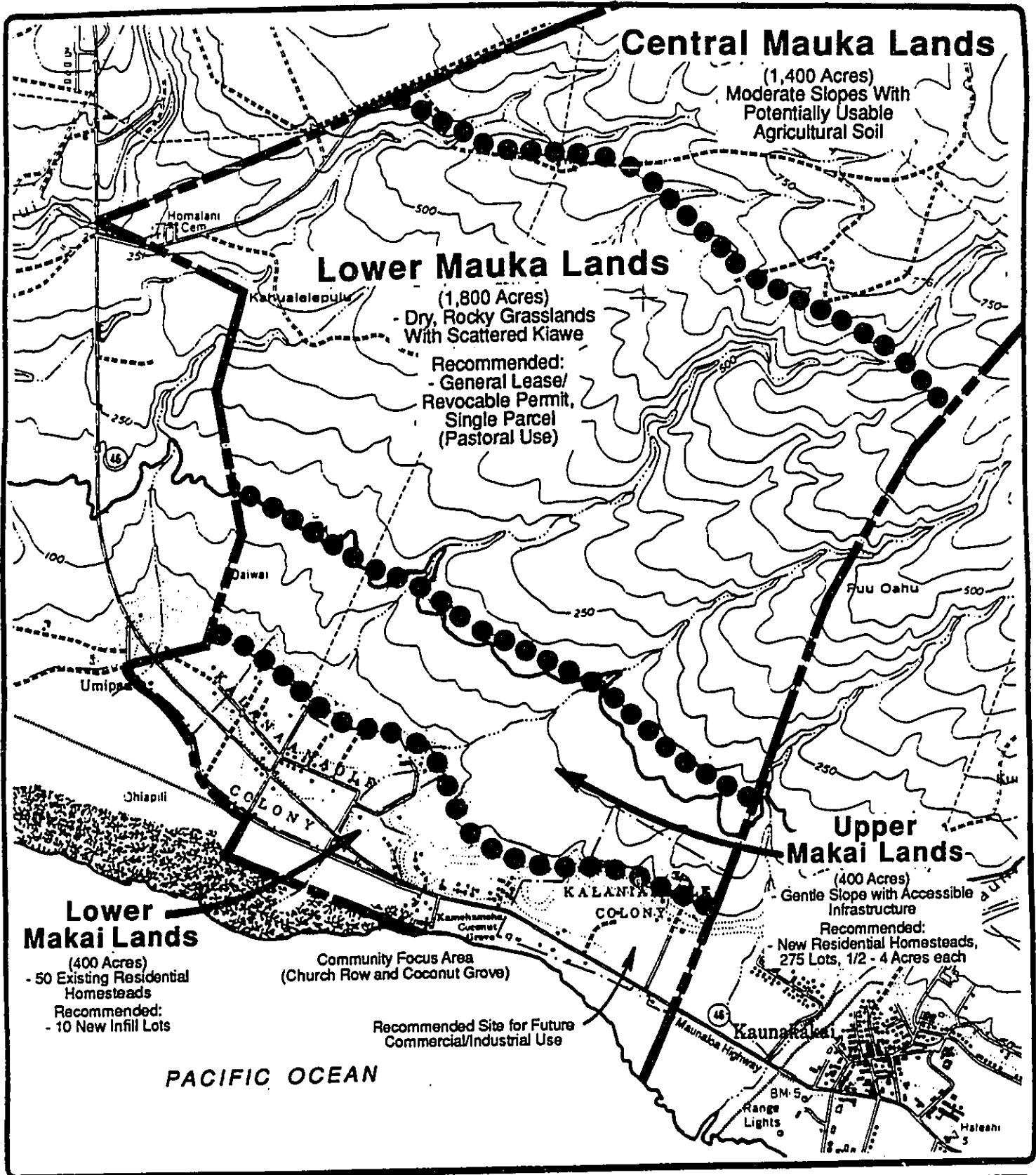


Drawing Source: Phillips, Brandt, Reddick & Assoc., Inc.

Figure 3  
**One Acre Residential  
 Homestead, Residential  
 Subsistence Lot**

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 April 1995



**Figure 4**  
**Land Use,**  
**General Recommendations**

Drawing Source: Phillips, Brandt, Reddick & Assoc., Inc.



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homesteads and commercial/industrial uses that support agricultural activities and businesses located at Kaunakakai.

- o Development of Kalamaula is envisioned to be an integrated project in which residential, agriculture and economic development work together to provide employment to beneficiaries and opportunities for them to pursue self-sufficiency.
- o Development of Kalamaula should be consistent with the existing rural lifestyle.
- o Limited opportunities for economic growth on Molokai suggests that a limited number of new homestead families could be absorbed into the already tenuous job market. Thus, the phasing of new development must be in context with the availability of island-wide employment opportunities. Implementing relatively small increments of the project over a pre-determined schedule would be one means of addressing this concern.

## 2.2 LAND USE PLAN

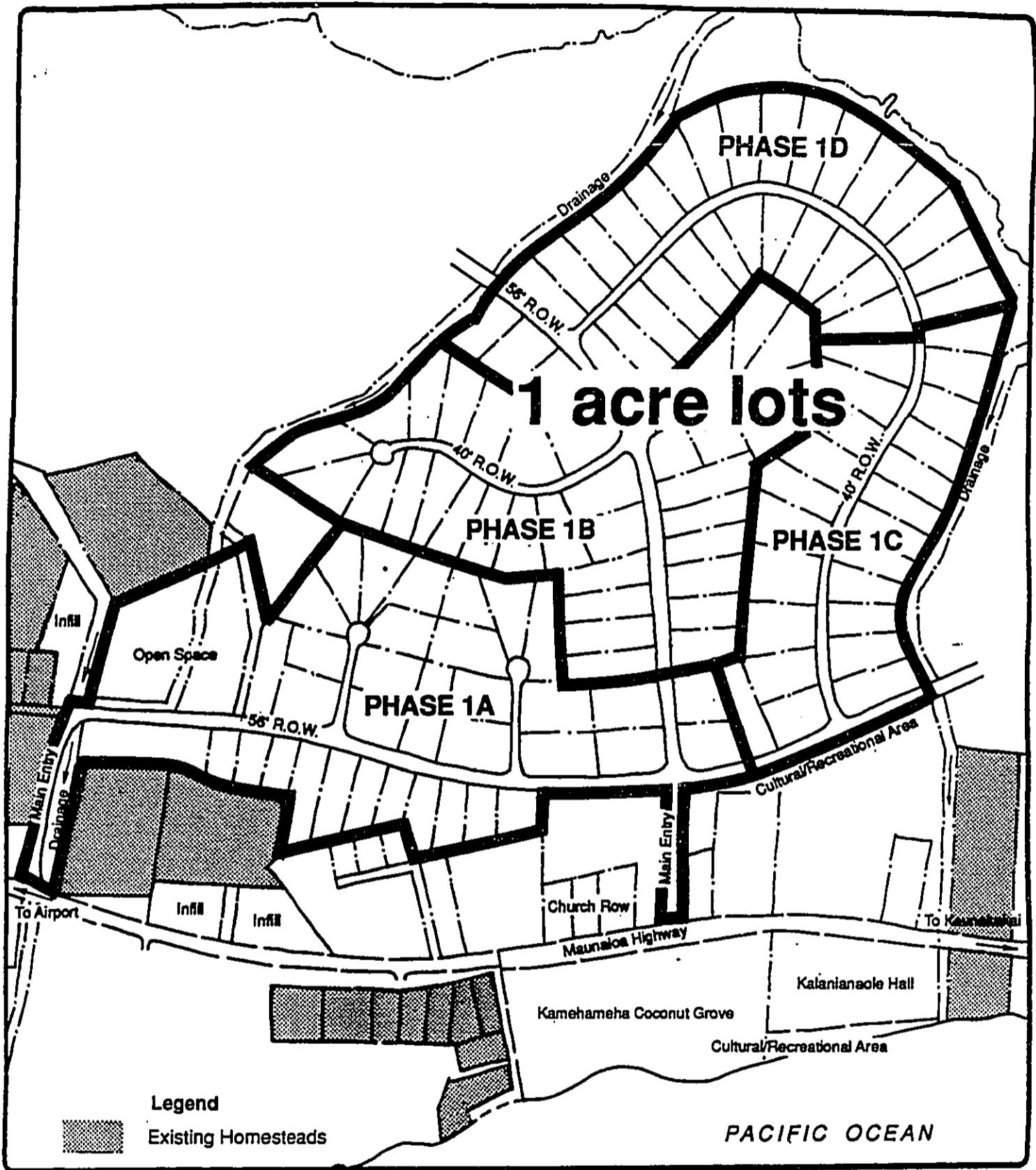
The proposed land use plan involves subdivision and the development of support infrastructure. DHHL proposes to develop the project site into one-acre lot sizes and attendant infrastructure support as follows:

TABLE 1

LAND USE (ACRES)	QUANTITY	TOTAL ACRES
Residential (1-ac. lots)	124	124
Roadways	--	9
Totals	--	133

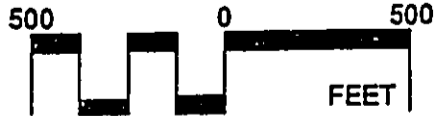
Figure 5 illustrates the implementation plan.





**Figure 5**  
**Implementation Plan**

Drawing Source: Philips, Brandt, Reddick & Assoc., Inc.



**R. M. TOWILL CORPORATION**

April 1995

Unit I will consist of 124 single family lots in four increments located mauka of "Church Row". Each phase will consist of approximately 30 lots. Lots and new 40- and 56-foot wide access road right-of-ways will be built to County of Maui rural standards. Cesspools will be used on an interim basis until there is sufficient flows to warrant the operation of a new sewage transmission system. Existing drainageways along Haka Street will be improved to alleviate flooding in the area. Other existing natural drainageways will be maintained during the development of lots and access roads. New 22- and 24-foot wide paved roadways without curbs will be constructed to serve the project. Existing drainageways will be maintained wherever possible. A tree planting program will be implemented for the larger lots for windbreaks.

Ten existing lots within the Kalaniana'ole Colony and primarily along Maunaloa Highway are presently unoccupied and will be awarded with minimal costs to the applicant.

### **2.3 PROJECT SCHEDULE AND ESTIMATED COST**

The estimated cost of this project is \$ 16,150,000 including Phase I which is estimated at \$9,430,000, Phase II estimated at \$ 3,400,000, and Phase III estimated at \$ 3,320,000. Development scheduling for each phase will depend on the availability of capitol improvement funds.

Section 3  
PHYSICAL ENVIRONMENT

**3.1 CLIMATE**

The climate in Kalamaula is characterized as dry and hot. Annual rainfall is approximately 10 to 25 inches. Wind speeds in the area are generally calm in the mornings and increases in mid-day due to trade winds. Daily on- and off-shore wind patterns also influence wind conditions at the site.

**3.2 TOPOGRAPHY, GEOLOGY, SOILS**

Topography. The site generally slopes from northeast to southwest. It is characterized as flat along the coastal area to moderate slopes ranging from 3 to 9% at the mauka boundary. The site contains four natural ephemeral drainage features that collect runoff from large storms for discharge into the coastal area. Project phasing generally follows existing drainage channels. The project site is bounded by two drainage channels. Elevation of the site ranges from a few feet above sea level at the makai boundary to about 150 feet above sea level at the project's mauka boundary.

The coastal area of Kalamaula is overgrown by mangrove on flood-prone lowlands. Mauka of this flat area is the Kalaniana'ole Colony consisting of approximately 56 residential homesteads on lots ranging from about 1/2 acre to 4 acres in size.

Mauka of the existing homesteads and the project site, the lands of Kalamaula slopes upwards at a constant rate. These lands are generally stony and are overgrown with kiawe and dry land grasses and were formerly used for pasture. Puu Lahine, a prominent cinder cone, is located at the 1,000-foot elevation and is presently being quarried by the applicant for cinder.

Geology. Molokai was formed by three shield volcanoes via successive lava flows. These volcanoes are known as East Molokai, West Molokai, and Kalaupaka. This type of volcanic activity is the fundamental process that created the Hawaiian Islands. The project site is located along the western leeward slopes of the East Molokai Volcano.

#### Soils

The site's surface soils primarily consists of severely eroded soils with about 50 to 75% of the surface covered with stones and boulders. These soils are generally found mauka of the existing Kalaniana'ole Colony. Shallow gullies and a few deep gullies are commonly found on these soils. In most places the soil is less than 24 inches deep to bedrock, but is deeper in a few low-lying areas. Dominant vegetation on these soils include kiawe, ilima, piligrass, and fingergrass. According to the U. S. Soil Conservation Survey (SCS) for the Island of Molokai, these soils are used for pasture and wildlife habitat. Improvement of pasture is difficult "because of the many stones and gullies, and in unimproved areas the carrying capacity is low. The habitat is excellent for axis deer and with a little improvement, an excellent habitat for game birds can be established".

The remaining portion of the project site located within the area of the existing drainage channel that separates Phase 1 and Phase 3, consists of soils that are well drained. The U.S. Soil Conservation Service designate these soils as Mala silty clay, 3 to 7% slopes (MmB). Runoff is slow and the erosion hazard is slight to moderate. In many places the soil is slightly to moderately eroded. There are a few gullies formed by intermittent streams and in a few places there are a few stones on the surface. This soil is used for pasture. The SCS classifies this soil type as Pasture Group 1.

Although the site appears to be poor for cultivation, there are pockets of useable agricultural land within areas classified as severely eroded. Substantial land clearing would be necessary before this land could be used to support any intensive agricultural use.

Drainage and Flooding. There are no recorded stream flooding incidents due to hurricane or unusual storm events in the Kalamaula project area (County of Maui Civil Defense and State of Hawaii Division of Water and Land Development, April 1995). However, the area below the project site is subjected to both localized and stream flooding. Situated at an

elevation of 5± feet msl with minimal slope, this area has an undefined drainage pattern and ponding frequently occurs along the Maunaloa Highway after heavy rains. Existing 24-inch culverts under the highway appear to be filled with sediment deposits, thus reducing the capacity of the existing drainage systems. Because of the low lying elevation, the existing ground appears to be saturated even during dry conditions, and sump conditions are visibly apparent.

### 3.3 FLORA AND FAUNA

A botanical resource assessment was conducted for the project site by Char & Associates in April 1995. The primary objectives of the survey were to provide a description of the vegetation and to search for threatened and endangered species protected by Federal and State laws. For the proposed grassed channel area, a search was also made for the presence of wetlands. The findings are summarized below while the report in its entirety can be found as Appendix A in this document.

The vegetation throughout the majority of the property consists of open, low grassland with scattered koa-haole shrubs and kiawe trees. A dense stand of taller kiawe trees is found along the lower boundary.

Kalamaula Houselots project site is moderately sloping and supports an open, low grassland composed primarily of buffelgrass (*Cenchrus ciliaris*) and feather fingergrass (*Chloris virgata*), which is locally abundant in places. Woody components of the mixed grassland consist of scattered koa-haole shrubs, 3 to 7 feet tall, and a few kiawe trees (*Prosopis pallida*). The charred remnants of kiawe trees, evidence of recent fires, are also occasionally encountered. One such brush fire occurred in 1992 and destroyed much of the area's vegetation.

Along the lower boundary on the western half, grassland is replaced by a band of somewhat dense kiawe forest, 18 to 30 feet tall. The grass and herbaceous cover become less dense under the trees.

This wooded section of the property as well as the small gully areas is actively used by a

number of bird species which include both the Zebra or Barred Dove (*Geopelia striata*) and the larger Spotted or Mountain Dove (*Streptopelia chinensis*), House Finch or Papayabird (*Carpodacus mexicanus*), Common Myna (*Acridotheres tristis*), Japanese White-eye (*Zosterops japonicus*), Northern Cardinal (*Cardinalis cardinalis*), and Red-crested Cardinal (*Paroaria coronata*). Only the Gray Francolin (*Francolinus pondicerianus*) preferred the open grassland areas. One Cattle Egret (*Bubulcus ibis*) was observed flying over the project site, but did not make use of the site.

As part of the scope of work, an area makai of the project site was also studied because the preliminary off-site drainage plan was to include a new drainage channel. This site is located between the Kamehameha Coconut Grove and Kalaniana'ole Hall. A portion of the site serves as an informal parking area and red cinder has been spread over the ground. Scattered, thin grassy patches and small pockets of bare soil cover the rest of the site. Bermuda grass or manienie (*Cynodon dactylon*) is the most common lawn grass along with smaller clumps of pitted beardgrass (*Bothriochloa pertusa*). Along the fence line by the coconut grove are a few small shrubs of Indian pluchea (*Pluchea indica*), koa-haole, and 'uhaloa.

No low-lying wet areas were observed and the substrate is well-drained; it appears to be fill land in places. Wetland indicator species (Reed 1988) are not a dominant component of the vegetation on the site. No indications of the presence of hydric soils or wetland hydrology were observed. Such indicators include poorly drained anaerobic soils, mineral crusts on the soil surface, watermarks and sediment deposits, etc.

Conclusions/Recommendations. Introduced or alien species such as buffelgrass, feather fingergrass, koa-haole, and kiawe are the dominant components of the vegetation on the Kalamaula houselots site. The handful of native species found on the site are indigenous, that is, they are native to the Hawaiian Islands but are also found elsewhere throughout the Pacific and other tropical areas. These plants are 'ilima (*Sida fallax*), 'uhaloa (*Waltheria indica*), and alena (*Boerhavia glabrata*). None of the plants found on the site are listed, proposed, or candidate threatened and endangered species (U.S. Fish and Wildlife Service 1992, 1994a, 1994b); nor is any plant considered rare or vulnerable (Wagner et al. 1990).

Given the findings above, there is very little of botanical concern on theouselots site and the proposed drainage channel area. The proposed uses are not expected to have a significant negative impact on the botanical resources. There are no botanical reasons to impose any restrictions, conditions, or impediments to the development of the two sites.

There are no rare or endangered wildlife known to inhabit the project site. Other than deer, pigs, and game birds that inhabit the uplands of Kalamaula, there no other significant animal populations in the vicinity of the project.

#### 3.4 SCENIC AND VISUAL RESOURCES

Located on the leeward slopes of east Molokai, the site affords unobstructed views towards Kaunakakai and the Pacific Ocean to the south and southeast, and the top of the East Molokai Range on cloud-free periods. The most prominent feature of the landscape in the area is Puu Luahine, a cinder cone that gently rises approximately 200 feet above the surrounding land.

The property and the surrounding area to the northeast appears dry and arid with rocky soils due to lava flows of the East Molokai Volcano. The lack of rainfall results in low lying shrubs and barren soils and is typical of the site's general appearance.

The proposed low intensity of development and uses such as pasture, self-sufficiency homesteads, horticulture, re-vegetation and cultural sites preservation, will not significantly affect the area's visual resources. Subsistence shelters would be few due to the lack of support infrastructure. It is anticipated that these shelters would be low-rise one-story structures, constructed of materials such as wood or stone and would not appear out of character with the surrounding landscape.

Until such time that plans for more intense uses of the property are formalized, the proposed passive uses of the site would not adversely affect the area's visual resources.

### 3.5 HISTORIC/ARCHAEOLOGICAL RESOURCES

Historic. Prior to western contact, lands of Kalamaula like the rest of southern Molokai were intensely settled in the coastal areas. Subsistence farming was carried out on the dry inland slopes with habitations located along the coast. Approximately six fishponds were located along the southern shores but are presently silted and overgrown with mangrove. There were also several small brackish water springs along the Kalamaula coast that were used for drinking or bathing where ponds occurred. During the 18th century, Molokai was a target during inter-island wars of conquest and used a staging for armies as they moved among the larger islands. Little mention is made of Kalamaula during the historic period. In the 1800s, a coconut grove was planted in the coastal area for King Kamehameha IV or by Kamehameha V.

The most significant event in the history of the land was the development of the Kalaniana'ole Homestead, named after the prime promoter of the Hawaiian Homes Commission Act, Prince Jonah Kuhio Kalaniana'ole. The first homestead was developed in 1921 and the colony was used as a test case to prove the Act's feasibility. Water for the colony was transmitted through a redwood flume from an old spring near Kaunakakai. Homesteaders raised alfalfa, tomatoes, bananas, sweet potatoes, and other garden crops. Crops were sold to Honolulu markets and traded among homesteaders. Cattle, pig, chickens and other domestic animals were also raised with fishing supplementing farming efforts. By 1930, increasing salinity in the irrigation system led to exchanges of the leases for lands in Hoolehua which became available in 1924. Presently, the colony consists of residential uses.

Archaeological Resources. International Archaeological Research Institute, Inc. (IARI) conducted an archaeological inventory survey of approximately 300 acres of the 371-acre project site for the applicant in the fall of 1989. The survey called for 100% coverage of the survey area, sketches and photographs of significant sites, and limited subsurface testing. Historical research and limited oral history interviews were also conducted. The project area covered under the inventory is bounded on the south by the Kalaniana'ole Colony, on the east by a major ephemeral drainage channel, on the west by the Kalamaula/Naiwa ahupuaa boundary, and on the north by the 150-foot elevation contour.



A total of 54 sites and survey complexes were identified including two previously identified sites. The sites fell within 75 of the 184 existing lots surveyed. Thirteen of the 75 lots contained clusters of sites or large site complexes. The remaining 62 lots contain isolated sites or smaller site complexes. Eleven of the sites are located near proposed and presently graded roadways and would be impacted by proposed roadway improvements. Almost one-half of all the sites were found within the western portion of the survey area. Figure 6 shows the approximate locations of these sites.

The nature of archaeological sites found in the survey area indicates a low intensity and possibly sporadic or short-term occupation of the area. There are relatively few sites within the survey area given the close proximity to the coast and its extent across much of the ahupuaa. Site complexes surveyed contained features that tended to be small and crudely constructed. Testing results also showed that most of the sites tested were single-event occupations.

Distribution of the sites toward the western portion of the project site is probably due to the proximity of three to five historic fishponds located along the widest portion of the ahupuaa's coastal flats. The area's topography is also highly dissected suggesting a propensity for higher surface water run-off that may have been used by ancient Hawaiian farmers. Dominant cultural features found were irregularly shaped, large enclosure complexes and occurred above the 70-foot elevation contour in the western area. The enclosures had substantial walls enclosing a bluff outcrop and other rocky terrain. Only one large enclosure contained midden.

All of the sites surveyed are considered significant. Several sites are considered important for information related to the 1921 settlement of the Kalaniana'ole Colony. In the context of the present proposal, the importance of the Colony as the first homestead establishment under the Hawaiian Homes Commission Act, can help create a sense of place for new homesteaders, many of whom are or will be from off-island. Other features have potential significance to important Hawaiians of past and cultural significance such as Site 1742 which appears to be a heiau.

The archaeological consultant recommended two sites and features for preservation and 44

sites, including Site 802, for data recovery. Sufficient information has been collected for eight sites and no further work is recommended. Sites 1731 and 1742 are recommended for preservation. These sites are identified and briefly described in the following table (Also see Figure 6):

**TABLE 2**

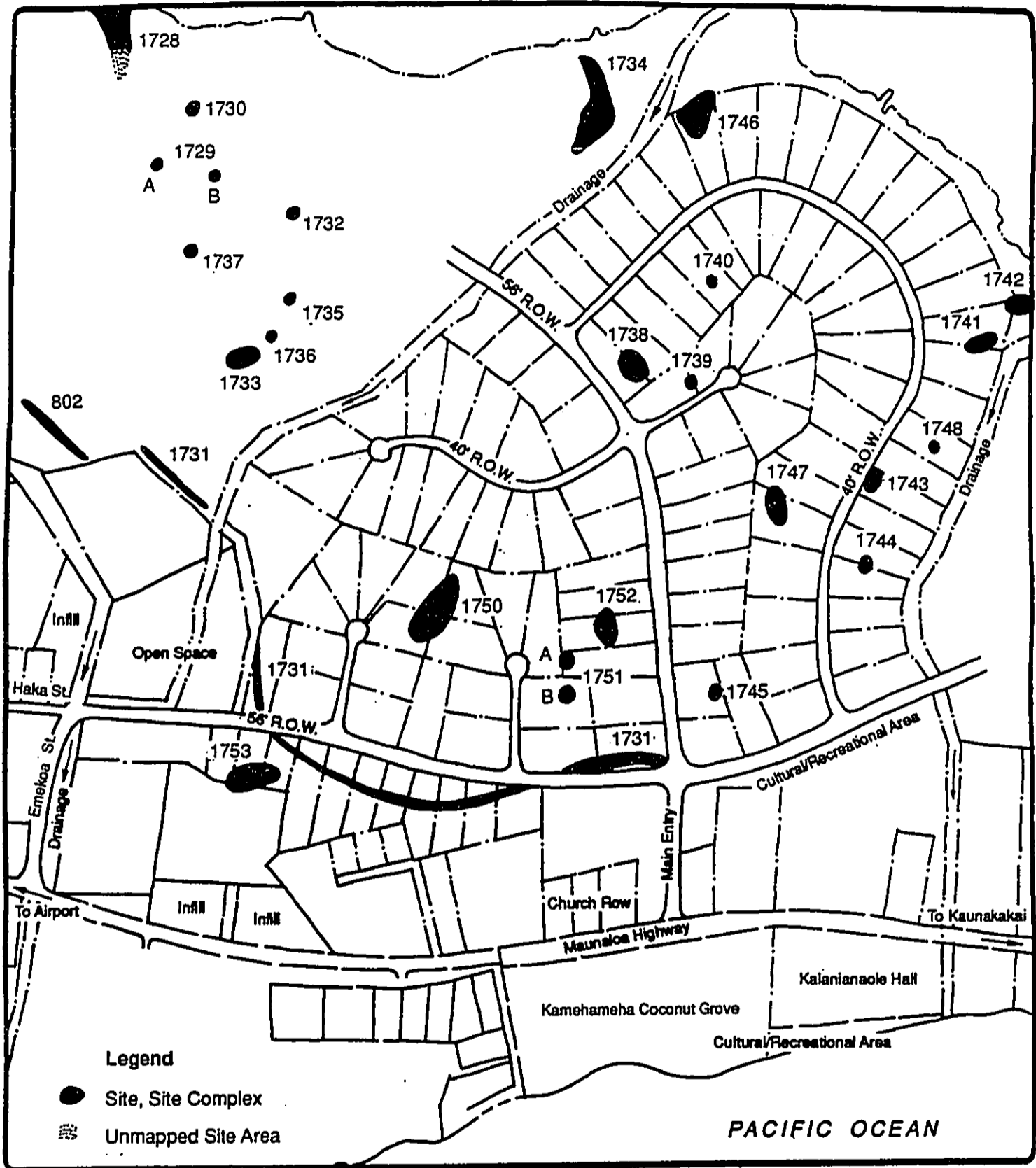
SITE NO.	SITE TYPE	DIMENSIONS	BRIEF DESCRIPTION/ RECOMMENDATION
1731	Ditch	Variable	Possible irrigation flume; significant due to relationship to Kalaniana'ole Colony/ incorporate into site design.
1742	Terrace/enclosure complex	27m X 20m	Heiau consisting of two features/ preservation with limited testing to verify ceremonial function

N/A - Not available.

Should the above sites be accepted for preservation, a preservation plan would be required. Such a plan would identify the nature of preservation for each site, define buffer zones, provide short-term protection measures, allow for relevant citizen participation, and detail specific tasks for preservation for each site. To protect sites designated for preservation, DHHL will encourage avoidance by creating buffers around each site slated for preservation. Buffers could consist of setbacks, fencing and/or appropriate signage. Buffer areas will be mapped in future parceling of the project area for retention under DHHL control.

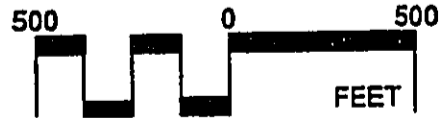
Development of the site would be in accord with any mitigation measures required by the Historic Preservation Division of the Department of Land and Natural Resources.

Since much of the lots of the project have been awarded, and these lots contains significant cultural remains, the archaeologist recommends that the community participate and be encouraged to join in the preservation process. This could be achieved by incorporating significant sites into individual lot development plans. Participation would be encouraged through various educational and cultural promotion programs.



**Figure 6**  
**Archaeological Site Locations**

Drawing Source: International Archaeological Research Institute, Inc.



**R. M. TOWILL CORPORATION**  
 April 1995

Should cultural deposits or evidence of archaeological remains be uncovered during construction, work will be halted and the State Historic Preservation Division of the Department of Land and Natural Resources will be notified to determine the appropriate course of action.

### **3.6 NOISE**

The subject site has low noise levels associated with a rural residential and agricultural lifestyle. The area is characterized as a low density residential development with some subsistence agriculture for supplemental income. The nearest urbanization and associated noises occurs at Kaunakakai, a small town consisting of a population of approximately 2,658. Other than construction noise generated by building and paving existing roadways, subsistence shelters and limited land preparation for pasture use, adverse noise impacts from the development of Kalamaula for homestead and subsistence agricultural use is not expected.

Short-term construction noise from road building would be in accordance with noise regulations of the Department of Health.

No significant short- or long-term noise impacts are anticipated from the project.

### **3.7 AIR QUALITY**

Existing air quality at the site generally has very low levels of urban generated pollutants due to the site's low residential density and distance from air emission sources. Other than localized short-term impacts from road, drainage improvement, and individual lot improvement activities, development of the site for homestead and pastoral use is not anticipated to have a significant adverse impact on the area's air quality.

With respect to impacts from short-term road and drainage building activities, existing air quality regulations would be adequate to control adverse air quality impacts from construction activities. These regulations would require frequent watering of exposed

surfaces. In addition, the project would be developed in small increments, thereby limiting the amount of land that would be graded and exposed to wind erosion.

Due to the need to improve the existing roadway system prior to additional distribution and settlement by beneficiaries, any impacts on the area's air quality would have dispersed long before new settlers arrive.

Thus, no significant impacts on the area's long-term air quality are anticipated.

Section 4  
SOCIOECONOMIC ENVIRONMENT

**4.1 POPULATION AND EMPLOYMENT**

**Population.** The site and the surrounding area is sparsely populated. The nearest population center is at Kaunakakai located approximately 2,000 feet to the southeast.

DHHL's proposes to award approximately 124 parcels averaging one acre in size. Beneficiaries would be allowed to have one dwelling per parcel consistent with Maui County zoning regulations. Land uses on these parcels would be encouraged to be consistent with County and State land use controls. Beneficiaries are required to develop homes on the one-half acre lots within one year after receiving the lot. There are no time limits to build on lots larger than one-half acre.

Based on the average beneficiary's household size of four members per family and Molokai's economic conditions, DHHL estimates that the site could be populated by an upper range of 800 to 1,000 persons distributed over the 371-acre site. However, due to the depressed economic conditions on Molokai, it is likely that this project will not be fully occupied until some period beyond five years after the date of initial lot distribution. Accordingly, DHHL will be developing lots in phases as economic conditions permit and according to available State funding. In fact, most beneficiaries would be from off-island and would not immediately relocate to lots on the project site until suitable financial resources or commitments have been established in order to fund the start-up period for subsistence farming. Much of the lots under this project have poor qualities for crop production and will require substantial resources from individual beneficiaries in order to prepare the lots for a variety of crops and animals. Under the more practical scenario, the population density would be well below suggested levels during the first five years after the initial distribution of project lots.

**Employment.** Employment for Molokai's approximately 3,000 labor force is mainly in the resort and service industries. Up until recently, agricultural employment opportunities were limited. This was due in part by the closing of Del Monte's pineapple operations on Molokai in 1983. In recent years, favorable economic conditions and the development of agricultural lots in Hoolehua have supported more construction and agricultural jobs which have assisted in increasing the civilian workforce to a 13-year high of 3,100 in 1992.

The main job center is located in West Molokai at Kalua Koi, the site of the island's only resort destination. Moderate growth in agricultural job opportunities have occurred in Hoolehua and is due primarily to the development of the Hoolehua agricultural subdivision.

The proposed project is intended to meet Native Hawaiian beneficiary requirements for developable land for farming, pasturage, and self-sufficiency. The site, therefore, will probably offer only limited employment opportunities. For some beneficiaries, agricultural and pasturage uses may increase as infrastructure is developed and income sources (from farming) developed. It is anticipated, however, that the majority of beneficiaries would derive income from jobs located elsewhere, around the Island. Thus, the project would have little, if any, impacts on employment opportunities.

#### 4.2 SURROUNDING LAND USES

Lands above the 50-foot elevation and up to the 150-foot elevation are dry and rocky with pockets of usable agricultural land and are being proposed for the 124-lot subdivision. Beyond the 150-foot elevation and up to the 700-foot elevation, lands continues to be dry and rocky and overgrown by grass and kiawe. These lands are presently used for hunting. From the 700-foot level to the top of Kalamaula are lands used for game management. Lands makai of the Highway and along the coastline are overgrown with mangrove and a coconut grove.

Beyond Kalamaula towards the west are lands owned by Molokai Ranch and used for cattle ranching. Lands towards the east are also owned by Molokai Ranch and used for

cattle pasture. Kaunakakai Town is approximately 2,000 feet east of the project's eastern boundary.

The proposed development of homesteads with agricultural uses such as pasture and potential crop production will not have a significant adverse impact on surrounding land uses and property.



Section 5  
PUBLIC FACILITIES AND SERVICES

**5.1 TRANSPORTATION FACILITIES**

Maunaloa Highway, a State owned two-lane improved roadway, provides access to the District of Kalamaula and is the "backbone" roadway in East Molokai. Maunaloa Highway consists of a twelve-foot lane and a paved shoulder averaging four feet wide in each direction; the highway is located generally in the center of an 80-foot wide highway right-of-way. To the west of the proposed roadway connection, mangrove and other plants are present within the right-of-way; the clear distance between the outside edge of shoulder and the plant material averages about ten feet. Several churches and the Queen Liliuokalani Children's Center are located adjacent to the highway on the north (mauka) side, while the south (makai) side is a historic coconut grove and Kalaniana'ole Hall. The highway has a speed limit of 45 miles per hour; however, in the vicinity of the proposed roadway connection, a speed zone for 20 miles per hour "When Children are Present" is posted.

Existing unpaved roadways off Maunaloa Highway provides access to the project site. Existing traffic on Maunaloa Highway is minimal due to the area's minimal development.

DHHL proposes to provide two access roads from Maunaloa Highway to serve as the "backbone" with local connector roads leading to individual parcels. The roadway system would be designed to County rural standards, i.e. no curbs or gutters but paved roadways for dedication to the County. The present roadway surface has been mass graded and is unpaved, without gravel surfaces in most areas.

At present, the State Department of Transportation is preparing a "Molokai Area Transportation Plan." The objective of the study is to complement the island's long-term transportation system plans with the existing Molokai Community Plan. The State's Plan is

expected to be issued in late 1995.

The proposed development of the site for homesteads and limited agricultural activities will not adversely impact the existing highway. It is anticipated that the existing highway will accommodate the anticipated low levels of traffic that would be generated by this project.

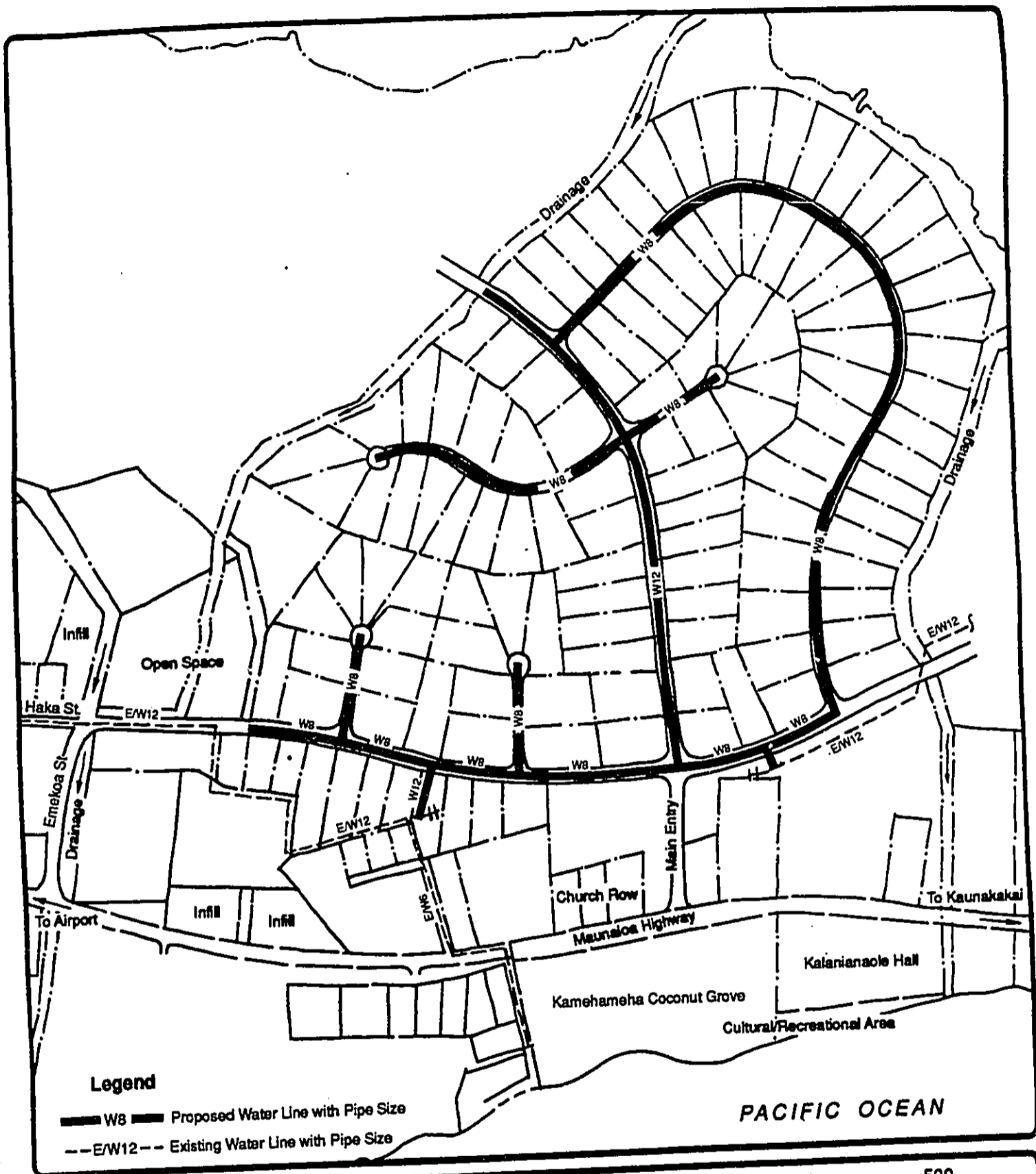
## 5.2 WATER

The Molokai Water System Phase 2-A provides storage and transmission of adequate volumes of potable water to the project site. It is a private water system. An existing 200,000 gallon reinforced concrete reservoir is located less than a mile from the eastern boundary of the project site. This will continue to function as the potable water storage system for the project. Presently, a 12-inch water main transports water to the Kalaniana'ole Colony for on-site distribution. DHHL proposes to upgrade the on-site system with 12- and 8-inch water lines (Figure 7). The proposed system would be adequate to serve anticipated demand for residential and subsistence farming needs on a limited basis. Expansions to the proposed system may be needed in the future if crop production exceeds the system's capacity.

## 5.3 WASTEWATER

Existing homesteads in the Kalaniana'ole Colony have no central sewage disposal system. Residents use individual cesspools for wastewater disposal. The nearest sewage treatment facility is located approximately 1,000 feet to the east near Kaunakakai.

DHHL proposes to obtain a variance from the State Department of Health to allow cesspools for the project which is similar to the variance granted for DHHL's Kawaihae Residence Lots - Unit 1. If the variance permit is not obtained, beneficiaries would be required to dispose of wastewater via portable wastewater systems in accordance with the regulations of the Department of Health. Thus, no impacts are anticipated to the areas' natural resources.



**Figure 7**  
**Water Master Plan**



**R. M. TOWILL CORPORATION**  
April 1995

## 5.4 DRAINAGE

The project site falls within two drainage areas labeled East and West Drainage Areas (Figure 8). The East Drainage Area consist of approximately 318 acres and two natural drainage channels which discharges runoff in the vicinity of the Kamehameha Coconut Grove and at a location approximately 800 feet east of the eastern project boundary. The West Drainage Area consists of approximately 619 acres and contains three drainage features which discharge runoff makai of Maunaloa Highway via existing bridges. Other than the five natural drainage features, there are no drainage structures on the site.

To accommodate relatively low volumes of increased runoff due to the development of roadways and house pads, the applicant proposes to construct a drainage system consisting of surface and underground drainage facilities. These facilities will consist of swales, underground drain lines and grassed open drainage channels. Portions of the drainage channels located closer to the coastal area may need to be upgraded to accommodate the additional storm run-off associated with this project. On-site, DHHL proposes to install a drainage system consisting of 24-, 36-, 48- and 54-inch drain lines (Figure 8).

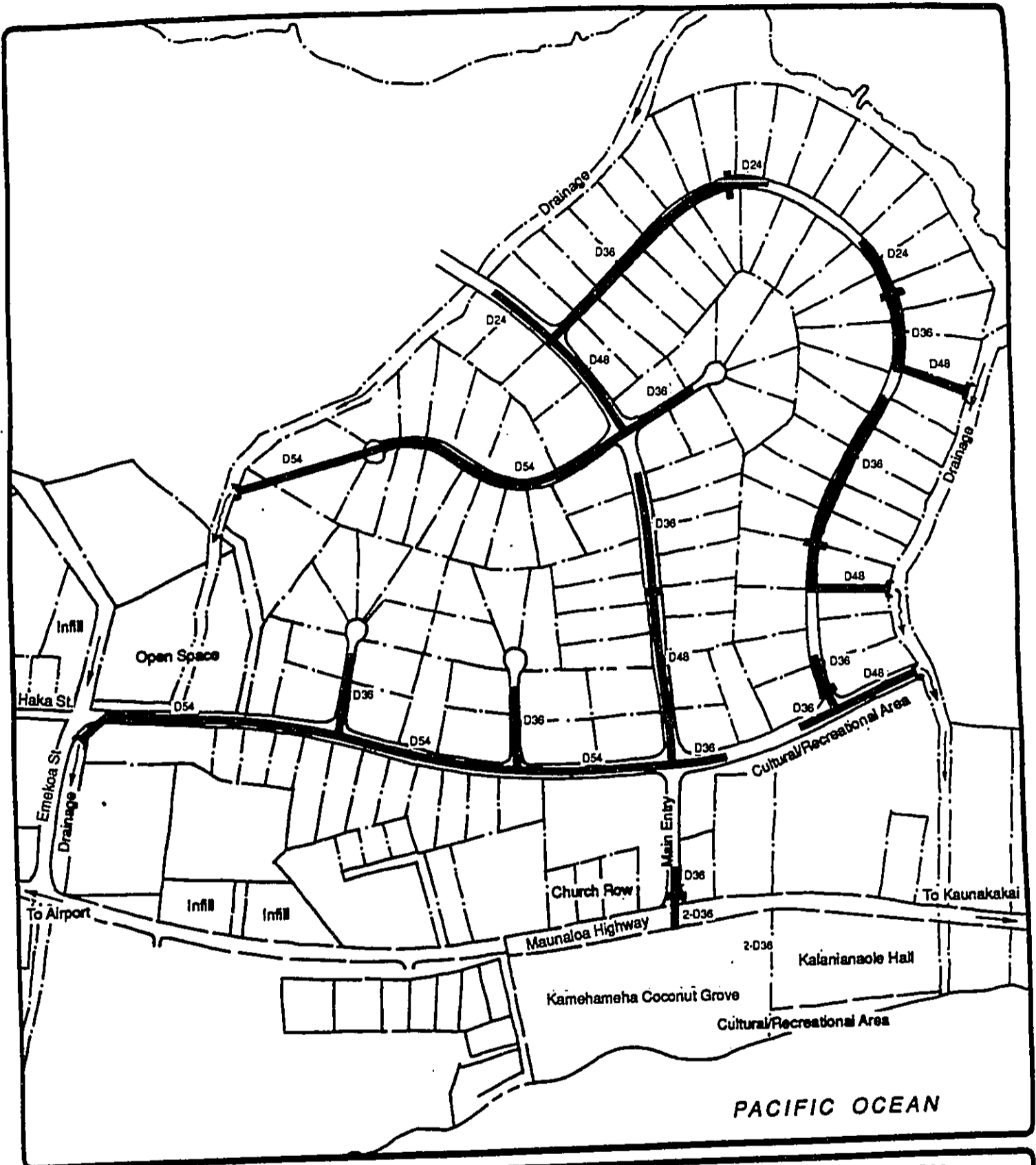
All drainage infrastructure will be designed and constructed to meet state and county standards for the 50-Year Storm.

## 5.5 FIRE AND POLICE PROTECTION

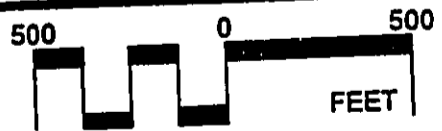
### 5.5.1 Fire Protection

The Kalamaula area is serviced by two fire stations and one substation on Molokai. The Kaunakakai Fire Station is located about one-half mile from the project site. The station is staffed by a five-man crew; i.e., four men and one captain, and the service is available 24 hours a day. The Hoolehua Fire Station is located seven miles away from the project site. Similarly, the station is staffed by a five man crew and open 24 hours daily. The East End Substation is located 15 to 16 miles away from the project site, and has a crew of two men.

The current level of fire facility services is more than adequate to handle the current



**Figure 8**  
**Drainage Master Plan**



**R. M. TOWILL CORPORATION**  
April 1995

demand. The proposed project is not expected to place enough of a demand to result in the need to increase the level of fire fighting facilities or staffing. However, the DHHL plans to add 22 fire hydrants to the project area.

The DHHL has been in discussions with the Homesteaders Livestock Association in Kalamaula regarding the Association's plans to conduct cattle grazing mauka of the project site through a lease agreement. The intent is to utilize this activity as a means to control the spread of fires in the area (Telecon with President Richard Nagrillo, Homesteaders Livestock Assoc., April 1995).

#### 5.5.2 Police Protection

The Police Department is located adjacent to the fire stations on Molokai. The police station in Kaunakakai services the Kalamaula project site (telecon with Assistant Chief Charles Hall, April 1995). A total of two officers are assigned to the island of Molokai while one patrolman is assigned to the project area. At present the County of Maui does not plan to increase police department staffing or facilities on Molokai. However, according to Assistant Chief Hall, the area's long term police protection requirements may be re-evaluated as the population increases due to the Kalamaula Houselots project.

#### 5.6 ENERGY

Kalamaula is served by Molokai Electric Company. A new generating plant is located adjacent to the Naiwa industrial park near the western boundary of Kalamaula. Electrical service to the project site will require extending the existing lines to service new residential lots into the area. Electricity would be provided by other means such as generators and solar energy collectors.

Section 6  
RELATIONSHIP TO LAND USE,  
POLICIES, AND CONTROLS OF THE AFFECTED AREA

**6.1 HAWAII STATE PLAN**

The Hawaii State Plan, Chapter 226, Hawaii Revised Statutes, serves as a written guide for the future long range development of the State. The Plan identifies goals, objectives, policies, and priorities for the State.

The proposed project would be in conformance to the State Plan's objectives and policies for socio-cultural advancement of the Hawaiian people. By allowing the beneficiaries who are Hawaiian in ethnicity the opportunity to use the property as subsistence homesteads without major supporting infrastructure, beneficiaries would revive past techniques used in living off the land. Hunting, fishing and gathering, which would be expected of beneficiaries, would foster increased knowledge and understanding of the Hawaiian culture and lifestyle.

The project would also conform to the State Plan's policy to promote housing for the Hawaiian lifestyle. It is the long term goal of the project to foster such a lifestyle with subsistence homesteads traditional to Hawaiians of the recent past. The neighborhood that would result from this project would reflect the culture and values of past Hawaiian communities.

**6.2 STATE LAND USE LAW**

The property is designated primarily within the State Rural District. Lands generally above the 150-foot elevation contour are designated within the Agricultural District. Uses proposed under the development would be consistent with objectives and policies of the State Land Use Law, Chapter 205, Hawaii Revised Statutes.

The State Rural District permits lots as small as one-half acre. The Rural District is intended to provide areas for a mix of farming and residential uses. The project's minimum lot size of one-half acre meets the State Rural District standard. In addition, pastoral and homestead uses, including subsistence farming, gathering, hunting and fishing, would be consistent with rules governing use in the State Rural District.

### **6.3 COUNTY OF MAUI GENERAL PLAN AND COMMUNITY PLANS**

The County of Maui's General Plan and Molokai Community Plan for the area covers desired population, land uses, public infrastructure, environmental concerns, and cultural resources. Under the Molokai Community Plan, the area is planned for continued use as open space and agricultural uses. Thus, the project will be consistent with the area's Community Plan.

### **6.4 COUNTY OF MAUI ZONING**

The County of Maui has not zoned the property. Uses and future standards for development are based on regulations governing the State Rural District, and dedication requirements of the County.

### **6.5 SPECIAL MANAGEMENT AREA**

The County of Maui has designated the shoreline and certain inland areas of Molokai as being within the Special Management Area (SMA). SMA areas are felt to have a sensitive environment and should be protected in accordance with the State's coastal zone management policies. Intersection improvements will be constructed at the Maunaloa Highway entrance to accommodate project traffic. Work will be conducted within the SMA Boundary as defined by the County of Maui (Figure 9). The DHHL will be exercising its exemption power in accordance with a Legal Memorandum dated October



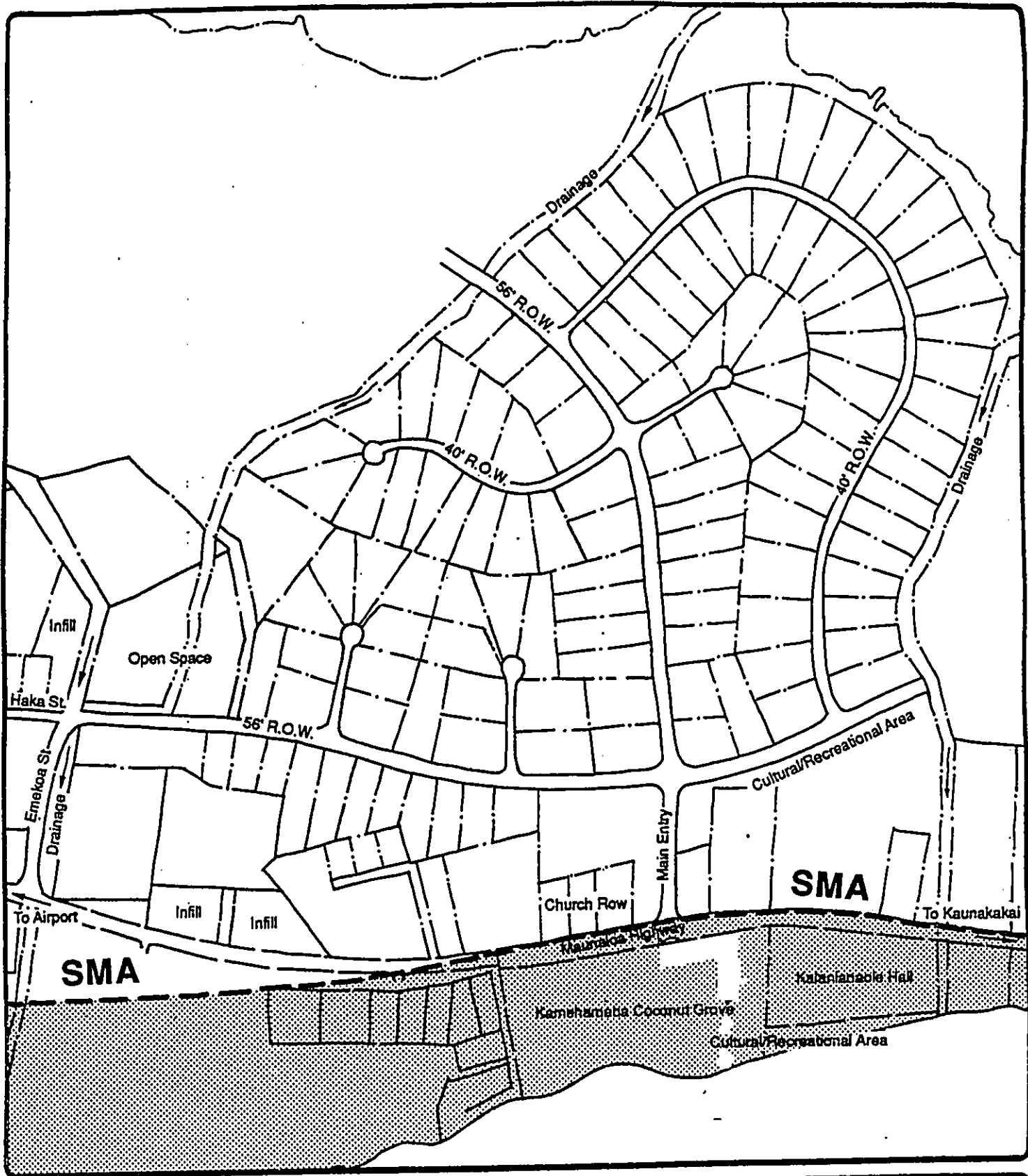
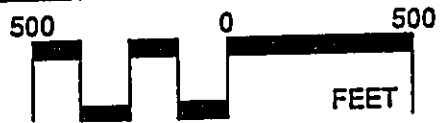


Figure 9  
**Maui County**  
**Special Management Area**  
 Kaunakakai, Molokai



R. M. TOWILL CORPORATION  
 April 1995

23, 1987 from the State Attorney General's Office, to not apply to the County of Maui for an SMA permit. However, the DHHL intends to submit project design drawings and the Chapter 343, HRS Environmental Assessment for review and comment.

The estimated storm runoff for the East Drainage Channel under existing conditions is approximately 97 cubic feet per second (cfs). The development of the project within this area will increase the drainage rate by 45 cfs or approximately one-third more runoff for the 50-Year Storm. This projected increase in the volume of runoff will be directed to the ocean via one new drainage facility, and two existing gullies that border the eastern and western ends of the project site. Since stormwater quality must meet State Department of Health and County health standards, the DHHL will implement drainage features to reduce sediments and other pollutants, and the rate of discharge before being released into the ocean. These features may include detention basins designed to let sediments drop out before discharging stormwaters into the ocean. Thus no significant adverse impacts to coastal resources are anticipated for off-shore waters fronting the East Drainage Area.

The estimated storm runoff for the West Drainage Area under existing conditions is approximately 148 cubic feet per second. Development of the project will increase the current estimated rate by 93 cfs. Proposed improvements for this area include underground drain lines which will direct stormwater to two natural drainage patterns.

Section 7  
ALTERNATIVES TO THE PROPOSED ACTION

**7.1 NO ACTION**

The no action alternative will contribute to a further backlog and wait period for qualified Hawaiian beneficiaries waiting to receive their awards. Some applicants have been waiting as long as 30 years to receive a lot. Others have since passed on before given the opportunity to receive a land award. Thus, a no-action position would further aggravate the situation and would not meet the objectives of the Hawaiian Homes Act.

**7.2 ALTERNATIVE SITES**

No alternative sites were considered since DHHL's resources are limited and cannot be used to acquire other private property. Resources that are available are directed towards the planning and development of support infrastructure for residential agricultural subdivisions.

Section 8  
RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF  
MAN'S ENVIRONMENT AND THE MAINTENANCE AND  
ENHANCEMENT OF LONG-TERM PRODUCTIVITY

No short-term exploitation of resources resulting from development of the project site for agricultural and residential uses will have long-term adverse consequences. The character of the land of the existing area will not be altered. In fact, development of farm dwellings and farming uses will be consistent with the rural lifestyle of the surrounding Kalaniana'ole Colony and will blend into the surrounding environment.

Once construction activities for support infrastructure are completed there will be no affect on air and noise quality, wildlife, and residents of the area.

Long-term gains resulting from development of the proposed project include provision of more house and farm lots for Hawaiian beneficiaries.

Section 9  
IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF  
RESOURCES BY THE PROPOSED ACTION

Development of the proposed project will involve the irretrievable loss of certain environmental and fiscal resources. However, the costs associated with the use of these resources should be evaluated in light of the benefits to the Hawaiian beneficiaries of the State of Hawaii and the County of Maui.

It is anticipated that the development of additional lots and improved support infrastructure will commit the necessary construction materials and human resources (in the form of planning, designing, engineering, construction labor, landscaping, and personnel for management and maintenance functions). Reuse for much of these materials and resources is not practicable. Although labor is compensated during the various stages of development, labor expended for project development is non-retrievable.

Section 10  
NECESSARY PERMITS AND APPROVALS

10.1 STATE

Office of State Planning  
Coastal Zone Management Consistency Review

Department of Health  
Section 401, Water Quality Certification  
National Pollutant Discharge Elimination System (NPDES) for  
Stormwater Discharge

Department of Transportation  
State Highway Rights-Of-Way

10.2 COUNTY

Planning Department  
Subdivision

10.3 FEDERAL

U.S. Army COE  
Corps of Engineers Section 404/Section 10

Section 11  
CONSULTED AGENCIES AND PARTICIPANTS  
IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

**11.1 FEDERAL AGENCIES**

*U.S. Army Corps of Engineers*

**11.2 STATE AGENCIES**

Department of Land and Natural Resources  
    Aquatic Division  
    Land Management Division  
    Office of Conservation and Environmental Affairs  
    Division of Land & Water Development  
Department of Transportation  
Department of Health  
Department of Business, Economic Development & Tourism

**11.3 COUNTY OF MAUI**

Civil Defense  
Planning Department  
Department of Parks & Recreation  
Department of Public Works  
Mayors Office  
Fire Department  
Police Department

**11.4 INDIVIDUALS AND GROUPS**

Kalamaula Advisory Committee  
Homesteaders Livestock Association (Mr. Richard Nagrillo, Pres.)  
Kalamaula Homesteaders Association (Ms. Wilma Grambusch, Pres.)

**11.5 COMMENTS & RESPONSES ON THE DRAFT EA (ATTACHED)**

Section 12  
REFERENCES

"Kalamaula Development Plan," June 1983

"Archaeological Resource Inventory Survey of a Portion of Kalamaula, Island of Molokai,"  
International Archaeological Research Institute, Inc., July 1990.

"Botanical Assessment Study Kalamaula Houselots and Drainage Channel, Kalamaula,  
Island of Molokai," Char & Associates, April 1995.

"Water Quality and Biological Assessments, Kalamaula Drainage Improvement Project,  
Molokai, Hawaii," Aecos, Inc., April 1995.

State of Hawaii 1993 Data Book, Department of Business, Economic Development and  
Tourism

Hawaii Atlas, University of Hawaii Department of Geography, 1987

"Traffic Assessment Report", Julian Ng Incorporated, July 1995

"Geotechnical Engineering Exploration", CW Associates Inc., dba Geolabs-Hawaii, August  
1995



APPENDICES

A: Botanical Resource Assessment by Char & Associates, April 1995

B: Water Quality and Biological Assessments, Aecos, Inc., April 1995

C: Traffic Assessment Report, Julian Ng, Incorporated, July 1995

D: Geotechnical Engineering Exploration, C.W. Associates, Inc., dba Geolabs-Hawaii,  
August 1995

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**COMMENTS & RESPONSES**

ON

**DRAFT ENVIRONMENTAL ASSESSMENT**



**BOARD OF WATER SUPPLY**  
 COUNTY OF MAUI  
 P.O. BOX 1108  
 WAILUKU, MAUI, HAWAII 96793-7108

June 29, 1995

R.N. Towill Corporation  
 420 Waiakamilo Boulevard, Suite 411  
 Honolulu, Hawaii 96817-4941  
 Attention: Ms. Colette Sakoda

Aloha Sirs and Madames,

Subject: Proposed residential subsistence subdivision, Unit 1, 124 lots, 1-acre each, at Kalamaula, Molokai, TMK:5-2-8:por. 39, 53, 91-94, por. 114; 5-2-9:por. 01, 15, por. 23, 28; 5-2-10:por. 01; Draft Environmental Assessment by R.N. Towill Corp. on behalf of State Department of Hawaiian Home Lands

Mahalo for providing the Board of Water Supply with opportunity and the materials to review the above-mentioned draft environmental assessment. The Board provides suggested topics for additions to the document as follows:

- A. Water Source of System Serving the Proposed Project
  - 1. Aquifer
    - a. Description
    - b. Status
    - c. Summary of Users
    - d. Impacts
- B. Project Water Consumption
  - 1. Expected project water consumption in average gallons-per-day, or other standard expression
  - 2. Accounting of proposed project water use within source's total water use as permitted by DLNR Commission on Water Resources Management
- C. Project Water Conservation
  - 1. Description of any proposed water-saving actions

June 29, 1995 to R.N. Towill Corporation  
 Proposed 124-lot subdivision, Unit 1, Kalamaula, Molokai  
 TMK:5-2-8:por. 39, 53, 91-94, por. 114; 5-2-9:por. 01, 15,  
 por. 23, 28; 5-2-10:por. 01  
 Draft EA by R.N. Towill Corp. on behalf of DHHL  
 page 2 of 2

We have attached some reference materials that may be useful. You can reach the Board's Water Resources Planning Division at ph(808)243-7835 or fax(808)243-7833, if you have questions.

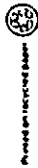
Sincerely,

MAUI COUNTY BOARD OF WATER SUPPLY

*Ellen R. Craddock*  
 for David R. Craddock, Director

DDS  
 c w/atch: Applicant - DHHL, 335 Merchant St, Honolulu, HI 96813

"By Water All Things Find Life"



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

KAHUNA KAHIKI  
STATE OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF HAWAIIAN HOME LANDS  
FOUNDED 1919  
HOOMAHUANAUNAUNA

KALI WATSON  
CHAIRMAN  
HAWAIIAN HOMES COMMISSION  
JURIE M. M. YAMAMOTO  
SECRETARY

December 6, 1995

Mr. David R. Craddock, Director  
Board of Water Supply  
County of Maui  
P.O. Box 1109  
Wailuku, Maui, Hawaii 96793-7109

Dear Mr. Craddock:

SUBJECT: Kalamaula Residence Lots, Unit 1 Draft Environmental Assessment (DEA)  
Tax Map Key nos. 5-2-10; por. 39, 53, 91 - 94, por. 95, por. 114; 5-2-9;  
por. 01, 15, por. 23, 28; 5-2-10; por. 01; Kalamaula, Island of Molokai

We have received your letter of June 29, 1995 regarding the subject project. The Final Environmental Assessment will be amended to reflect your recommended topics for discussion.

Your participation in this project is appreciated.

Warmest aloha,

*Kali Watson*  
Kali Watson, Chairman  
Hawaiian Homes Commission

cc: RMT/C

REPLACEMENT COPY  
OF ORIGINAL



STATE OF HAWAII  
DEPARTMENT OF HEALTH

P. O. BOX 3378  
HONOLULU, HAWAII 96811

July 11, 1995

LUMINOUS IMAGE  
DIRECTOR OF HEALTH

IN REPLY, PLEASE REFER TO:

95-074/epo

Ms. Colette Sakoda  
R. M. Towill Corporation  
420 Waiakamilo Boulevard, #411  
Honolulu, Hawaii 96817-4941

Dear Ms. Sakoda:

Subject: Draft Environmental Assessment (DEA)

Kalamaula Residence Lots - Unit 1  
Molokai, Hawaii

TMK: 5-2-8: Por. 39, 53, 91-94, Por. 95, Por. 114  
5-2-9: Por. 1, 15, Por. 23 & 28  
5-2-10: Por. 1

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

Water Pollution

A National Pollutant Discharge Elimination System (NPDES) permit is required for any discharge to waters of the State including the following:

1. Storm water discharges relating to construction activities for project equal to or greater than five acres;
2. Storm water discharges from industrial activities;
3. Construction dewatering activities;
4. Cooling water discharges less than one million gallons;
5. Ground water remediation activities; and
6. Hydrotreating water.

Any person wishing to be covered by the NPDES general permit for any of the above activities should file a Notice of Intent with the Department's Clean Water Branch at least 90 days prior to commencement of any discharge to waters of the State.

Ms. Colette Sakoda  
July 11, 1995  
Page 2

Any questions regarding this matter should be directed to Mr. Denis Lau of the Clean Water Branch at 586-4309.

Wastewater

The subject project is located in the critical wastewater disposal area (CWDA) as determined by the Maui County Wastewater Advisory Committee. Our rules state that no new cesspools will be allowed in a CWDA. As such, a variance will have to be obtained from the Department of Health (DOH) for the use of cesspools.

Also, our rules say that a project of greater than 50 lots, can not utilize individual wastewater systems (IWS) for sewage disposal. Because this project will have 124 homestead lots, a wastewater treatment plant must be constructed for the entire project, or a variance will have to be obtained from the DOH for utilizing IWS for such a large project.

All wastewater plans must conform to applicable provisions of the DOH's Administrative Rules, Chapter 11-62, "Wastewater Systems", and we reserve the right to review these plans.

If you have any questions on this matter, please contact Ms. Lori Kajiwara of the Wastewater Branch at 586-4294 or Mr. Herbert Matsubayashi, Chief Sanitarian, Maui District Health Office at 243-5255.

Drinking Water

1. Federal and state regulations define a public water system as a system that serves 25 or more individuals at least 60 days per year or has at least 15 service connections. All public water system owners and operators are required to comply with Hawaii Administrative Rules, Title 11, Chapter 20, Rules Relating to Potable Water System.
2. The draft EA indicates that the potable water systems may be expanded in the future. Section 11-20-30 requires that new or substantially modified distribution systems for public water systems be approved by the Director. However, if the water system is under the jurisdiction of the County of Maui, the Department of Water Supply will be responsible for the review and approval of the plans.
3. Section 11-20-29 of Chapter 20 requires that all new sources of potable water serving a public water system be approved by the Director of Health prior to its use. Such an approval is based primarily upon the submission of a

Ms. Colette Sakoda  
July 11, 1995  
Page 3

satisfactory engineering report which addresses the requirements set in Section 11-20-29.

4. The engineering report must identify all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate the potential for contamination, including treatment of the water source. In addition, water quality analyses performed by a laboratory certified in the State of Hawaii, must be submitted as part of the report to demonstrate compliance with all drinking water standards. Additional test may be required by the Director upon his review of the information submitted.

#### Underground Injection Control

1. The UIC line crosses the Kalamaula district about 0.6 mile from the coastline.
2. If the project plans to use drainage injection wells (drywells), it will be necessary to obtain a UIC permit to authorize the construction and operation of these wells.
3. The UIC rules prohibit sewage or industrial disposal wells in areas above the UIC line.
4. Injection wells cannot be sited within 1/4 mile of any drinking water source.

If you should have any questions concerning drinking water, or Underground Injection Control (UIC), please contact the Engineering Section or the Underground Injection Control (UIC) Section respectively of the Safe Drinking Water Branch at 586-4258.

#### Nonpoint Source Pollution

The proposed drainage improvement project is located on the island of Molokai above the South Molokai coastline, one of sixteen Water Quality Limited Segments identified by the Hawaii State Department of Health. Currently, state monitoring of coastal waters show significant violations of water quality standards for suspended solids and nutrients. Proper planning, design and use of erosion control measures, and best management practices will substantially reduce the total volume of runoff, erosion, and potential for nonpoint source pollution.

For the proposed project, we recommend the following measures to reduce sediment and improve coastal water quality of South Molokai.

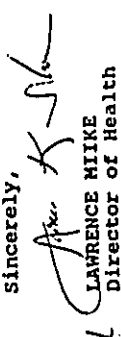
Ms. Colette Sakoda  
July 11, 1995  
Page 4

1. Grub areas sequentially so that only a small portion of the total area is bare at any one time.
2. Replant or cover bare areas from construction activities as soon as grading or grubbing work is completed. New planting will require soil amendments, fertilizers, and temporary irrigation to become established. Use high planting and/or seeding rates to ensure rapid stand establishment.
3. Plant and maintain a vegetative windbreak around the perimeter of the property to reduce wind erosion.
4. Proper installation, operation, and maintenance of all structural erosion control measures are critical. Surface and underground drainage facilities require frequent maintenance to sustain their runoff capacity and to remain effective.

All homesteaders should contact and work with the United States Department of Agriculture's Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, for advice about the area to be farmed. The NRCS can assist the owners in preparing and implementing a conservation plan to minimize erosion from site preparation and agricultural operations. The NRCS office on Molokai can be reached at 587-6868.

If you should have any questions on this matter, please contact Ms. Shirley Nakamura of the Environmental Planning Office at 586-4245.

Sincerely,

  
LAWRENCE MIIKE  
Director of Health

c: MDHO  
HMB  
CMB  
SDWB  
EPO

BENJAMIN J. CASTLEMAN  
DIRECTOR OF HEALTH



STATE OF HAWAII  
DEPARTMENT OF HAWAIIAN HOME LANDS  
PU MOELIPI  
HEMOKU, HAWAII

KALI WATSON  
CHAIRMAN  
HAWAIIAN HOMES COMMISSION  
KUMIHALA K. AL. YAMALICHIO  
IN TRUST FOR THE COMMISSION

Mr. Lawrence Milke  
Page 2

Your comments and recommendations regarding this important project are appreciated.

Warmest aloha,

*Kali Watson*  
Kali Watson, Chairman  
Hawaiian Homes Commission

Mr. Lawrence Milke  
Director of Health  
State Department of Health  
P.O. Box 3376  
Honolulu, Hawaii 96801

December 6, 1995

Dear Doctor Milke:

**SUBJECT:** Kalamaua Residence Lots, Unit 1 Draft Environmental Assessment (DEA)  
Tax Map Key nos. 5-2-8; por. 39, 53, 91 - 94, por. 95, por. 114; 5-2-9;  
por. 01, 15, por. 23, 28; 5-2-10; por. 01; Kalamaua, Island of Molokai

We have received your letter of July 11, 1995. The following has been prepared in response to your comments and concerns.

Water Pollution

A Notice of Intent for a National Pollutant Discharge Elimination System (NPDES) permit for storm water discharges relating to construction activities for a project equal to or greater than five acres was filed with the Department of Health earlier this summer. Subsequently, a Notice of General Permit Coverage was issued on August 2, 1995.

Wastewater

We are aware of the DOH rules regarding wastewater systems and DHHL will submit to the DOH a variance request to utilize individual wastewater systems.

Drinking Water

All applicable federal and state regulations regarding potable water systems will be adhered to for the subject project.

Underground Injection Control

Injection wells will not be sited within 1/4 of a mile of any drinking water source. Drainage injection wells (drywells) are not proposed for the project.

Nonpoint Source Pollution

Proper planning, design and requirement of the contractor to use erosion control measures as well as best management practices will be stressed to substantially reduce the total volume of runoff, erosion and potential for nonpoint source pollution. Measures to reduce sedimentation as recommended in your letter will be evaluated for implementation.

BENJAMIN J. CAYETANO  
Governor of Hawaii



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. Box 621  
Honolulu, Hawaii 96809

REF: OCEA: KRM

Chairperson  
MICHAEL D. WILSON  
Board of Land and Natural Resources

Deputy Director  
GILBERT COLONIA-AGARAN

Aquatic Resources  
Public Services  
Planning and Ocean Recreation  
Bioscience Services  
Conservation and Environmental Affairs  
Forestry and Wildlife  
Historic Preservation  
Land Management  
State Parks  
Water and Land Development

FILE NO.: 95-566

Ms. Colette Sakoda  
R.M. Towill Corporation  
420 Waiakamilo Blvd., #411  
Honolulu, Hawaii 96817-4941

Dear Ms. Sakoda:

SUBJECT: Draft Environmental Assessment (DEA): Kalamaula  
Residence Lots-Unit 1, Kalamaula, Molokai,  
TKMS: 5-2-08: por. 39, 53, 91-94, por. 95 & 114;  
3-2-09: por. 1, 15, por. 23 & 28: 5-2-10: por. 1.

We have reviewed the DEA information for the subject project transmitted by your letter dated May 19, 1995, and have the following comments:

Division of Aquatic Resources

Our Division of Aquatic Resources (DAR) comments that although significant long-term impacts adverse to aquatic resource values are not expected from the development activities proposed, additional or undescribed construction or landscape modifications near the shoreline should be submitted to the Department for additional review.

DAR suggests that construction activities be restricted to periods of minimal rainfall and that areas denuded of vegetation which could be susceptible to erosion, be appropriately stabilized to prevent or limit additional sedimentation of the shoreline. Further, precautions should be taken during construction to prevent debris, landscaping chemicals, eroded soil, petroleum products and other potential contaminants from flowing, blowing or leaching into coastal waters.

We have no other comments to offer at this time. Thank you for the opportunity to comment on this matter.

Ms. C. Sakoda

File No.: 95-566

Please feel free to contact Steve Tagawa at our Office of Conservation and Environmental Affairs at 587-0377, should you have any questions.

Aloha,

~~Steve Tagawa~~  
MICHAEL D. WILSON

ST:krm

JUL 13 1995



BRUCE A. CAVIARO  
GOVERNOR OF HAWAII

SEARCHED	INDEXED
SERIALIZED	FILED
JUL 14 1995	
HONOLULU, HAWAII	



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
STATE HISTORIC PRESERVATION DIVISION  
34 SOUTH KING STREET, 8TH FLOOR  
HONOLULU, HAWAII 96813

HOWARD D. WELCH, CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
DEPUTY  
SARAH F. COLEMAN, HAWAIIAN  
PROGRAM  
ACQUACULTURE DEVELOPMENT  
PROGRAM  
AQUATIC RESOURCES  
CONSERVATION AND  
ENVIRONMENTAL AFFAIRS  
CONSERVATION AND  
RESOURCES IMPROVEMENT  
COMMITTEES  
FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
LAND MANAGEMENT  
STATE PARKS  
WATER AND LAND DEVELOPMENT

Ms. Colette Sakoda  
Page 2

(2) Tomonari-Tuggle recommends that archaeological data recovery work be conducted at the specified sites. Data mapping of sites; test excavations; extensive/intensive excavations at selected sites; preparation of a burial treatment plan (if needed); additional oral history work.

Therefore, we recommend that the draft EA be revised so as to include a detailed mitigation plan, with provisions for site preservation and data recovery work, where warranted. In particular, we recommend that the two possible shrines identified during the survey (Sites 1707-C and 1714-E) be added to the list of historic sites to be preserved. With this inclusion, the mitigation commitments will ensure "no adverse effect" to the significant sites. The next steps would then be preparation of the detailed mitigation plan (scopes of work), their approval by our office, and then their successful execution.

Should you have any questions, please feel free to call Sara Collins at 587-0013.

Aloha.

*Sara Collins*  
DON HIBBARD, Administrator  
State Historic Preservation Division

SC:jen

c: Planning Office, Department of Hawaiian Home Lands

July 14, 1995

R.M. Towill Corporation  
Attention: Ms. Colette Sakoda  
420 Waikamilo Road, #411  
Honolulu, Hawaii 96817-4941

Dear Ms. Sakoda:

SUBJECT: Historic Preservation Review of the Draft Environmental Assessment for the Kalamaula Residence Lots - Unit 1, Kalamaula, Moloka'i  
TWLs: 5-2-08; Por. 39, 53, 91 - 94, Por. 95, Por. 114;  
5-2-09; Por. 01, 15, Por. 23 and 28; 5-2-10; Por. 01

Thank you for the opportunity to comment on the draft Environmental Assessment (EA) for the proposed Kalamaula Residence Lots - Unit 1, to be built on Department of Hawaiian Homelands (DHHL) property at Kalamaula, Moloka'i. Our review is based on historic reports, maps, and aerial photographs maintained at the State Historic Preservation Division; no field inspection was made of the subject parcels. Our review is late, and we apologize.

In general, the draft Environmental Assessment (EA) adequately summarizes previous archaeological work and findings made at the subject parcels. We note, however, that the report on the archaeological inventory survey, from which the data in the draft EA are drawn, makes further recommendations which do not appear in the draft EA (Archaeological Inventory Survey of a Portion of Kalamaula, Island of Moloka'i, 1990. M. Tomonari-Tuggle.). These recommendations are as follows:

- (1) Two additional sites were recommended for preservation. These features are Sites 1707, Feature C, and Site 1714, Feature E; both structures are thought to be shrines. As such, they are significant under criteria D and E: Criterion D (information content) and Criterion E (traditional cultural significance).







**OFFICE OF STATE PLANNING**  
Office of the Governor

MAILING ADDRESS: P.O. BOX 3408, HONOLULU, HAWAII 96811-3408  
STREET ADDRESS: 200 SOUTH ROYALE STREET, 8TH FLOOR  
HONOLULU, HAWAII 96813-2008  
TELEPHONE: (808) 521-3000, 521-3000

Ref. No. C-1292

June 30, 1995

Ms. Collette Sakoda  
R.M. Towill Corporation  
420 Waiakamilo Road, #411  
Honolulu, Hawaii 96817-4941

Dear Ms. Sakoda:

Subject: Draft Environmental Assessment for the Kalamaula  
Residence Lots - Unit 1, Kalamaula, Molokai, Hawaii.

We have reviewed the Draft Environmental Assessment (DEA) and have the following comments to offer.

Archaeological and historical sites of significance, nonpoint source pollution, and ground water contamination are important Coastal Zone Management program (CZM) concerns.

The large number of historic sites in the project area is a concern. The protection, preservation, and restoration of historic resources of significance to Hawaiian and American history are important objectives of our CZM program. Since there is the potential for them to be destroyed or altered, mitigation measures should be developed and discussed in the Environmental Impact Statement.

The use of cesspools contributes to ground water contamination and is a source of water quality degradation. Cesspools typically need deep soil to filter through and remove the bacteria and nutrients from waste water. Since the DEA indicates that in most places the soil is less than 24 inches deep before it hits bedrock, there are questions about the suitability of the area for cesspools. This matter should also be thoroughly discussed in the Environmental Impact Statement.

If there are any questions, please contact our Coastal Zone Management Program at 587-2876.

Sincerely,

Gregory G.Y. Pai, Ph.D.  
Director



**STATE OF HAWAII**  
DEPARTMENT OF HAWAIIAN HOME LANDS

100 SOUTH ROYALE STREET  
HONOLULU, HAWAII 96813-2008

December 6, 1995

Dr. Gregory G.Y. Pai, Ph.D.  
Director  
Office of State Planning  
P.O. Box 3540  
Honolulu, Hawaii 96811-3540

Dear Dr. Pai:

SUBJECT: Kalamaula Residence Lots, Unit 1 Draft Environmental Assessment (DEA)  
Tax Map Key nos. 5-2-8; por. 39, 53, 91 - 94, por. 95, por. 114; 5-2-9; por.  
01, 15, por. 23, 28; 5-2-10; por. 01, Kalamaula, Island of Molokai

We have received your letter of June 30, 1995 regarding the subject project. The following has been prepared in response to your comments and concerns regarding Coastal Zone Management program (CZM) criteria.

Historic Sites

The DEA not only identified the archaeological resources in and around the project site, but also discussed proper mitigation measures for the sites as recommended by the archaeologist.

Use of Cesspool

A soils and percolation study has been conducted by a soils engineer for the project's engineering design phase and on the suitability of utilizing individual wastewater systems for sewage effluent disposal. The report is being finalized, and will be included in the Final Environmental Assessment.

Your comments are appreciated in the planning phase of this project.

Warmest aloha,

Kail Watson, Chairman  
Hawaiian Homes Commission

cc: RMTC



REINVESTING IN HAWAII  
STATE OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF HAWAIIAN HOME LANDS

PO BOX 57  
HONOLULU, HAWAII 96833

KALI WATSON  
CHAIRMAN  
HAWAIIAN HOMES COMMISSION

KURE M. M. YAMAGUCHI  
DEPUTY TO THE CHAIRMAN

December 6, 1995

Mr. Charles Jencks, Director  
Department of Public Works & Waste Management  
Land Use and Codes Administration  
250 South High Street  
Wailuku, Maui, Hawaii 96793

Dear Mr. Jencks:

**SUBJECT:** Kalamaula Residence Lots, Unit 1 Draft Environmental Assessment (DEA)  
Tax Map Key nos. 5-2-8; por. 39, 53, 91 - 94, por. 95, 114; 5-2-9; por.  
01, 15, por 23, 28; 5-2-10; por. 01; Kalamaula, Island of Molokai

We have received your letter of June 28, 1995 regarding the subject project. The following has been prepared in response to your comments.

1. Engineering Division comments:  
A Traffic Impact Analysis report (TIAR) has been recently completed for the project. The report findings will be summarized in the final environmental assessment, and the report in its entirety will be included as an appendix in the document. The report will also include a conceptual layout of the highway improvements needed at the connection of the project access road to Maunaloa Highway.
2. Your comments and recommendation will be discussed in the Final Environmental Assessment.
3. Land Use and Codes Administration Comments:  
Information and maps regarding Special Flood Hazard Areas (SFHA), and 100-year storm flow rate are also noted. Any development within the SFHA will be made to conform to Chapter 19.62 of the Maui County Code.

Thank you for your comments regarding this important project.

Warmest aloha,

Kali Watson, Chairman  
Hawaiian Homes Commission

cc: RIMTC

Benjamin J. Cayetano  
GOVERNOR

HONOLULU, HAWAII 96813

STATE OF HAWAII  
DEPARTMENT OF EDUCATION  
HONOLULU, HAWAII 96813

REC'D JUN 23 1995

OFFICE OF THE SUPERINTENDENT

OFFICE OF THE SUPERINTENDENT

June 22, 1995

Ms. Colette Sakoda  
R. M. Towill Corporation  
420 Waiakamilo Blvd., #411  
Honolulu, Hawaii 96817-4941

Dear Ms. Sakoda:

**SUBJECT:** Kalamaula Residence Lots - Unit Draft Environmental Assessment; Kalamaula, Molokai, Hawaii  
TMK: 5-2-08: por. 39, 53, 91-94; por. 95, por. 114;  
5-2-09: por. 1, 15, 20K, 23 and 28; 5-2-10: por. 01

We have reviewed the subject assessment and have determined that the proposed 124 homestead one-acre lots would have the following enrollment impact on the area schools:

Schools	Grades	Projected Students
Kualapuu Elementary	K-6	50
Molokai Intermediate	7-8	19
Molokai High	9-12	31

Kualapuu Elementary School and Molokai High and Intermediate School are operating beyond capacity and report a shortage of classrooms. The Department of Education (DOE) cannot guarantee that classrooms would be available to accommodate the 100 students from this development.

The DOE requests that the developer make a fair-share contribution for the construction of needed school facilities in the area to accommodate the students projected from this residential development.

Page 2  
June 22, 1995

Should there be any questions, please call the Facilities Branch at 733-4862.

Sincerely,

*[Signature]*  
Herman H. Aizawa, Ph.D.  
Superintendent

HMA:jml

cc: A. Suga  
R. Murakami, Maui

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

BEJAMIN A. CALYAN  
GOVERNOR  
STATE OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF HAWAIIAN HOME LANDS

PII 001-1079  
HOMELANDS DIVISION

KALI WATSON  
CHAIRMAN  
HAWAIIAN HOMES COMMISSION

December 6, 1995

Dr. Herman M. Alzawa, Superintendent  
State of Hawaii  
Department of Education  
P.O. Box 2360  
Honolulu, Hawaii 96804

Dear Dr. Alzawa:

**SUBJECT: Kalamaula Residence Lots, Unit 1 Draft Environmental Assessment (DEA)  
Tax Map Key nos. 5-2-8; por. 39, 53, 91 - 94, por. 95, por. 114; 5-2-9; por.  
01, 15, por. 23, 28; 5-2-10; por. 01; Kalamaula, Island of Molokai**

We are in receipt of your letter dated June 22, 1995. Your data and information regarding potential project impacts on school enrollment have been noted. Also, your request that the developer make a fair share contribution for the construction of needed school facilities in the area has been taken under advisement.

Thank you for your participation in the planning stages of this important project.

Warmest aloha,

*Kali Watson*

Kali Watson, Chairman  
Hawaiian Homes Commission

cc: RIMTC



LINDA CROCKETT LINGLE  
Mayor



GWEN Y. OHASHI  
Acting Director

Ms. Colette Sakoda  
June 22, 1995  
Page 2

ENV	PLN	REC'D	JUN 23 1995
DK	DK	DK	DK
REC'D	JUN 23 1995	DK	DK
DK	DK	DK	DK

COUNTY OF MAUI  
PLANNING DEPARTMENT  
240 S. HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

June 22, 1995

R.M. Towill Corporation  
420 Waiakamilo Blvd., #411  
Honolulu, Hawaii 96817-4971

Attention: Colette Sakoda

Dear Ms. Sakoda:

Re: Draft Environmental Assessment for the Department of Hawaiian Home Lands (DHHL)'s Kalamaula Residence Lots, Unit 1 at TMK: 5-2-08: por. 39, 53, 91-94, por. 05, por. 114; 5-2-09: por. 01, 15, por. 23 and 28; 5-2-10: por. 01; Kalamaula, Molokai, Hawaii

We have reviewed the Draft Environmental Assessment (EA) dated May 1995 prepared for the Kalamaula Residence Lots Unit 1 project. The Department of Hawaiian Home Lands (DHHL) proposes to develop approximately 124 homestead lots each averaging one-acre in size on approximately 133 acres. Ohana dwelling units will not be permitted. DHHL will improve existing and provide new roadways, drainage facilities, potable water storage and transmission systems. Upon completion of required infrastructure, homestead lots will be distributed to qualified beneficiaries of native Hawaiian ancestry.

According to the draft EA, the project site is a part of DHHL's Kalamaula Development Plan of the entire 6,023-acre District of Kalamaula. Under the development plan, lands of Kalamaula are proposed for a range of uses including commercial/industrial lots and community uses makai of the project site and pasture and game management mauka of the project site. All land proposed for this project are under the jurisdiction of the Department of Hawaiian Home Lands.

Section 6.5 on p. 24 of the draft EA states that one new grassed-lined drainage channel will be developed within the SMA Boundary as defined by the County of Maui. DHHL will be exercising its exemption power in accordance with a Legal Memorandum dated October 23, 1987 from the State Attorney General's Office, to not apply to the County of Maui for an SMA Permit.

Our comments on the draft EA are as follows:

1. Since the development of 124 one-acre lots could have an effect on the nearshore waters, can you send us a letter from DHHL stating that it will be exercising its exemption power from the SMA Permit requirement and a copy of the Legal Memorandum dated October 23, 1987 from the State Attorney General's Office. Our office may receive inquiries as to why the Molokai Planning Commission was not asked to review any SMA permit for a proposed action within the SMA.
2. On p. 29 of the draft EA, Section 10.2, the subdivision approval needs to be obtained from the Department of Public Works and Waste Management and not the Planning Department.
3. A policy in the Molokai Community Plan (1984) states:  
Prepare and adopt a drainage master plan for major settlement areas, particularly Kaunakakai Town, which emphasizes land management techniques, such as the use of natural landscape swales, periodic maintenance of stream channels and avoidance of development in flood-prone areas to minimize the potential of flood damage. (Environment, e.)  
Since this development is part of the 6,023-acre Kalamaula Master Plan, we hope that a drainage master plan is developed for this master planned community.

We are also transmitting a copy of the June 13, 1995 comment letter from the Department of Transportation sent to our department.

Thank you for providing us with the opportunity to comment on the draft Environmental Assessment. Should you have any questions, please contact Clayton Yoshida of this office.

Yours truly,

*Gwen Ohashi*

GWEN OHASHI  
Acting Director of Planning

Ms. Colette Sakoda  
June 22, 1995  
Page 3

CITY  
Enclosures  
cc: OEQC  
Department of Transportation  
Department of Public Works and  
Waste Management  
Colleen Suyama  
Clayton Yoshida, AICP  
Project File

BENJAMIN J. CAYetano  
GOVERNOR  
STATE OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF HAWAIIAN HOME LANDS  
110 BERT LIPP  
HONOLULU, HAWAII 96813

MAUI WATSON  
GOVERNOR  
STATE OF HAWAII  
JULIE M. M. YAMAGUCHI III  
DEPUTY GOVERNOR

December 6, 1995

Mr. David Blane, Director  
Planning Department  
County of Maui  
250 South High Street  
Wailuku, Maui, Hawaii 96793

Dear Mr. Blane:

**SUBJECT:** Kalamaula Residence Lots, Unit 1 Draft Environmental Assessment (DEA)  
Tax Map Key nos. 5-2-8; por. 39, 53, 91 - 94, por. 95, por. 114; 5-2-9; por.  
01, 15, por. 23, 28; 5-2-10; por. 01; Kalamaula, Island of Molokai

We are in receipt of your letter of June 22 1995 regarding the subject project. The following has been prepared in response to your comments.

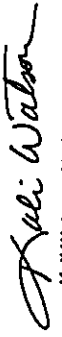
1. Exemption from SMA  
A grant of variance request dated May 26, 1995 was issued to the County of Maui. This request included our intent to exercise our exemption power regarding the SMA permit.
2. The final environmental assessment will reflect that the subdivision approval would be sought from the Department of Public Works and Waste management.
3. Molokai Community Plan policy regarding drainage  
A report, "Kalamaula Development Plan" dated June 1983 was prepared by Phillips, Brandt, Reddick (PBR), Inc. and Warren S. Unemori engineering (Civil Engineers) for the Land Management Division, Department of Hawaiian Home Lands (DHHL). This study established planning guidelines as set forth by the Hawaiian Homes Commission Act (1920) and policies by the DHHL General Plan (1975) for the planned 6,023 acres Kalamaula community (including Kalaianaoie Colony). The report also included infrastructure master plans for sewer, water and drainage improvements to the upper makai lands (including Kalamaula Residence Lots). Based upon the conceptual drainage master plan (i.e. "Kalamaula Development Plan") by PBR, implementation of the proposed drainage facilities for the Kalamaula Residence Lots, Unit 1, have been designed in compliance with Development Plan.

As part of the construction documents for the subdivision, a drainage assessment for the project site entitled "Preliminary Drainage Report for the Kalamaula Residence Lots, Unit 1 Kalamaula, Island of Molokai, Hawaii", is currently being prepared to address the onsite and offsite drainage concerns.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

Mr. David Blane, Director  
Page 2

Thank you for your participation in the planning phase of this project. Please feel free to call Colette Sakoda of R.M. Towill Corporation at 842-1133 should you have any questions regarding the enclosed information.

Warmest aloha,  
  
Kail Watson, Chairman  
Hawaiian Homes Commission



United States Department of the Interior



FISH AND WILDLIFE SERVICE  
PACIFIC ISLANDS OFFICE

300 ALA MOANA BLVD, SUITE 3-180

HONOLULU, HI 96813

tel:(808) 541-3441 fax:(808) 541-3470

In Reply Refer To: AAP

Ms. Colette Sakoda

R. M. Towill Corporation

420 Waiakaloa Blvd., #411

Honolulu, Hawaii 96817-4941

JUN 3 0 1995

Re: May 1995 Draft Environmental Assessment (DEA) for Kalamaula Residence Lots - Unit 1, Kalamaula, Molokai, Hawaii (TMR Nos. 5-2-08; por. 39, 53, 91-94, por. 95, por. 114; 5-2-09; por. 01, 15, por. 23 and 28; 5-2-10; por. 01)

Dear Ms. Sakoda:

The U.S. Fish and Wildlife Service (Service) has reviewed the May 1995 Draft Environmental Assessment (DEA) for the Kalamaula residence lots in Kalamaula, Molokai, Hawaii. The project sponsor, the State Department of Hawaiian Home Lands (DHHL), proposes to develop one hundred twenty-four (124) 0.4 ha (1 ac) residential homestead lots on 54 hectares [ha] (133 acres [ac]) of land. The project site is part of the DHHL's Kalamaula Development Plan, which proposes long range development of 2,437 ha (6,023 ac) in the Kalamaula district. Upon the completion of the required infrastructure, homestead lots will be distributed to qualified beneficiaries of native Hawaiian ancestry. The Service offers the following comments for your consideration.

The Service does not anticipate significant adverse impacts to fish and wildlife resources to result from the development of the homestead lots. No known rare, threatened, or endangered species are present on the affected site. Additionally, the proposed homestead lots will avoid wetlands and other potential aquatic habitats for the native Hawaiian orange-black damselfly (*Megalagrion xanthomelas*). This species was historically recorded in coastal freshwater areas in Kaunakakai and along the coast of Palauu. Therefore, the Service has no objections to the development of the homestead lots.

The Service appreciates the opportunity to provide these comments. If you have questions regarding these comments, please do not hesitate to contact Fish and Wildlife Biologist Artene Pangelinan at 808/541-3441.

Sincerely,

Brooks Harper  
Field Supervisor  
Ecological Services



DEPARTMENT OF BUSINESS,  
ECONOMIC DEVELOPMENT,  
AND TOURISM

ENERGY DIVISION, 333 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813 PHONE (808) 587-3800 FAX: (808) 587-3320

25 007

May 23, 1995

Ms. Colette Sakoda  
R. M. Towill Corporation  
420 Waiakamilo Blvd., #411  
Honolulu, Hawaii 96817-4941


Dear Ms. Sakoda:

**SUBJECT:** Kalamaula Residence Lots - Unit 1 Draft Environmental Assessment  
Tax Map Key Nos. 5-2-08; Por. 39, 53, 91-94, por. 114; 5-2-09; por. 01, 15,  
por. 23 and 28; 5-2-10; por. 01; Kalamaula, Molokai, Hawaii

We wish to inform you that we have no comments regarding the subject  
Kalamaula Residence Lots.

Thank you for the opportunity to submit any comments or recommendations.

Sincerely,

  
Maurice H. Kaya  
Energy Program Administrator

MHK/hk



DEPARTMENT OF  
**PARKS AND RECREATION**  
COUNTY OF MAUI

1550-C Kaabuzansu Avenue, Wailuku, Hawaii 96793

LINDA CROCKETT LINGLE  
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Director  
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June 13, 1995

R.M. Towill Corporation  
420 Waiakamilo Blvd., #411  
Honolulu, HI 96817-4941

Attention: Colette Sakoda

Subject: Kalamaula Residence Lots - Unit 1 Draft Environmental Assessment  
TMK 5-2-8; por. 39, 53, 91-94, por. 95, por. 114; TMK 5-2-9;  
por. 01, 15, por. 23 and 28; TMK 5-2-10; por. 01; Kalamaula  
Molokai, Hawaii

RMTC	WES	R
EC	WES	W
TMK	WES	W
RECD JUN 15 1995 RMTC		
ROE	WES	W
EIF	WES	W
DRM	WES	W

We have reviewed the subject project's Draft Environmental Assessment and have no comments to offer at this time. The issue of recreational opportunities for the subdivision's residents will be addressed during the County's subdivision approval process.

Thank you for allowing us to comment on the Draft Environmental Assessment.

Sincerely,

CHARMAINE TAVARES  
Director

CT/rt

APPENDIX A  
BOTANICAL RESOURCE ASSESSMENT

## **CHAR & ASSOCIATES**

Botanical/Environmental Consultants  
4471 Puu Panini Ave.  
Honolulu, Hawaii 96816  
(808) 734-7828

14 April 1995

### **BOTANICAL ASSESSMENT STUDY KALAMA'ULA HOUSELOTS AND DRAINAGE CHANNEL KALAMA'ULA, ISLAND OF MOLOKA'I**

#### **INTRODUCTION**

The Kalama'ula residential lots cover 133.819 acres of land located mauka of Maunaloa Highway and the Kamehameha Coconut Grove. Elevation ranges from about 15 feet along its lower boundary where it abuts some homes and churches, to roughly 145 feet above sea level along its upper limits. The vegetation throughout the majority of the property consists of open, low grassland with scattered koa-haole shrubs and kiawe trees. A dense stand of taller kiawe trees is found along the lower boundary. About 124 houselots are planned for the site.

The proposed drainage channel will be located between the coconut grove and Kalaniana'ole Hall, makai of the highway. The proposed grass-lined channel will be no more than 15 feet wide and roughly 1 foot deep. The site proposed for the grassed channel supports a red cinder-lined parking area and patches of Bermuda grass or manienie with a few weedy plants.

Field studies to assess the botanical resources found on the proposed ±133-acre residential site and the drainage channel were conducted on 07 April 1995. The primary objectives of the survey were to provide a description of the vegetation and to search for

threatened and endangered species protected by Federal and State laws. For the proposed grassed channel area, a search was also made for the presence of wetlands. The information from the botanical studies report will be used in preparing an Environmental Assessment (EA) document for the project.

#### **DESCRIPTION OF THE VEGETATION**

The plant names used in the discussion below follow Wagner et al. (1990), while the bird names are in accordance with the Hawai'i Audubon Society's "Hawai'i's Birds" (1989) publication.

#### **Kalama'ula Houselots Site**

The moderately sloping site supports an open, low grassland composed primarily of buffelgrass (Cenchrus ciliaris) and feather fingergrass (Chloris virgata), which is locally abundant in places. Guinea grass, a somewhat taller grass, 3 to 3.5 feet tall, occurs as scattered clumps here and there. However, in the shallow gullies which border the property, Guinea grass as well as koa-haole shrubs (Leucaena leucocephala) become very dense. Two other smaller grasses, stinkgrass (Eragrostis cilianensis) and bur grass or goatgrass (Iragus berteronianus), are abundant on the dirt roads which cross the property.

Woody components of the mixed grassland consist of scattered koa-haole shrubs, 3 to 7 feet tall, and a few kiawe trees (Prosopis pallida). The charred remnants of kiawe trees, evidence of recent fires, are also occasionally encountered. Smaller shrubs or subshrubs found include 'ilima (Sida fallax), 'uhaloa (Waltheria indica), and klu (Acacia farnesiana). Herbaceous species include apple of Peru (Nicandra physalodes), hairy merremia vine (Merremia aegyptia), wild bushbean or cow pea (Macroptilium lathyroides), golden crown-beard (Verbesina encelioides), wild zinnia (Zinnia peruviana), smooth rattlespod (Crotalaria pallida), alena



(*Boerhavia glabrata*), pigweed (*Portulaca oleracea*), and allseed (*Polycarpon tetraphyllum*). During the rainy season some of these plants may become locally abundant.

Along the lower boundary on the western half, grassland is replaced by a band of somewhat dense kiawe forest, 18 to 30 feet tall. The grass and herbaceous cover become less dense under the trees.

This wooded section of the property as well as the small gully areas is actively used by a number of bird species which include both the Zebra or Barred Dove (*Geopelia striata*) and the larger Spotted or Mountain Dove (*Streptopelia chinensis*), House Finch or Papayabird (*Carpodacus mexicanus*), Common Myna (*Acridotheres tristis*), Japanese White-eye (*Zosterops japonicus*), Northern Cardinal (*Cardinalis cardinalis*), and Red-crested Cardinal (*Paroaria coronata*). Only the Gray Francolin (*Francolinus pondicerianus*) preferred the open grassland areas. One Cattle Egret (*Bubulcus ibis*) was observed flying over the project site, but did not make use of the site.

#### Proposed Drainage Channel Site

This site, located between the Kamehameha Coconut Grove and Kalaniana'ole Hall, is periodically maintained. A portion of the site serves as an informal parking area and red cinder has been spread over the ground. Scattered, thin grassy patches and small pockets of bare soil cover the rest of the site. Bermuda grass or manienie (*Cynodon dactylon*) is the most common lawn grass along with smaller clumps of pitted beardgrass (*Bothriochloa pertusa*). Along the fence line by the coconut grove are a few small shrubs of Indian pluchea (*Pluchea indica*), koa-haole, and 'uhaloa.

No low-lying wet areas were observed and the substrate is well-drained; it appears to be fill land in places. Wetland indicator

species (Reed 1988) are not a dominant component of the vegetation on the site. No indications of the presence of hydric soils or wetland hydrology were observed. Such indicators include poorly drained anaerobic or foul-smelling organic soils, mineral crusts on the soil surface, watermarks and sediment deposits, etc. (Environmental Laboratory 1987).

#### DISCUSSION AND RECOMMENDATIONS

Introduced or alien species such as buffelgrass, feather fingergrass, koa-haole, and kiawe are the dominant components of the vegetation on the Kamala'ula houselots site. The handful of native species found on the site are indigenous, that is, they are native to the Hawaiian Islands but are also found elsewhere throughout the Pacific and other tropical areas. These plants are 'ilima (*Sida fallax*), 'uhaloa (*Malthesia indica*), and alena (*Boerhavia glabrata*). None of the plants found on the site are listed, proposed, or candidate threatened and endangered species (U.S. Fish and Wildlife Service 1992, 1994a, 1994b); nor is any plant considered rare or vulnerable (Wagner et al. 1990).

The proposed grass-lined drainage channel is likewise covered by introduced species and the site is periodically mowed and maintained. The three criteria necessary for wetlands identification, that is, hydrophytic vegetation, hydric soils, and hydrology, are not present on this site.

Given the findings above, there is very little of botanical interest or concern on the houselots site and the proposed drainage channel area. The proposed uses are not expected to have a significant negative impact on the botanical resources. There are no botanical reasons to impose any restrictions, conditions, or impediments to the development of the two sites. No recommendations are proposed at this time.

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- Reed, P.B., Jr. 1988. National list of plant species that occur in wetlands: Hawaii (Region H). U.S. Fish and Wildlife Service Biological Report 88(26.13).
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- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. 2 vols. University of Hawai'i Press and B.P. Bishop Museum Press, Honolulu. B.P. Bishop Museum Special Publication No. 83.

APPENDIX B  
WATER QUALITY STUDY

AECOS No. 822

**WATER QUALITY  
AND BIOLOGICAL ASSESSMENTS**  
for the  
Kalama'ula Drainage Improvement Project  
Moloka'i, Hawaii

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*Prepared for:*

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*Prepared by:*

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April 24, 1995

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INTRODUCTION

The State of Hawaii Department of Hawaiian Homeands is proposing to develop new homesteads in Kalama'ula on the island of Moloka'i. The proposed development would be located mauka of the highway west of Kaunakakai (Figure 1). Because of the topography in this area, a number of drainage improvements are planned to alleviate flooding problems potentially resulting from the development. Although most of the drainage for the project will be directed into various existing systems, there is a need to construct a new drainage system that will include a grassy, open channel between Kamehameha Coconut Grove and Kiowea Park. This channel would drain the lower, mauka, homestead lots toward the shoreline and empty into nearshore waters.

This report presents results of water quality and biological assessments conducted by AECOS, Inc. in the vicinity of the proposed drainage channel outlet (Figure 2). The purpose of this study was to assess baseline conditions of the channel's receiving waters prior to construction. This report was prepared to support Section 401, Section 404, and National Pollutant Discharge Elimination System (NPDES) permits that are being prepared by R.M. Towill, Inc. for the Kalama'ula Drainage Improvement project.

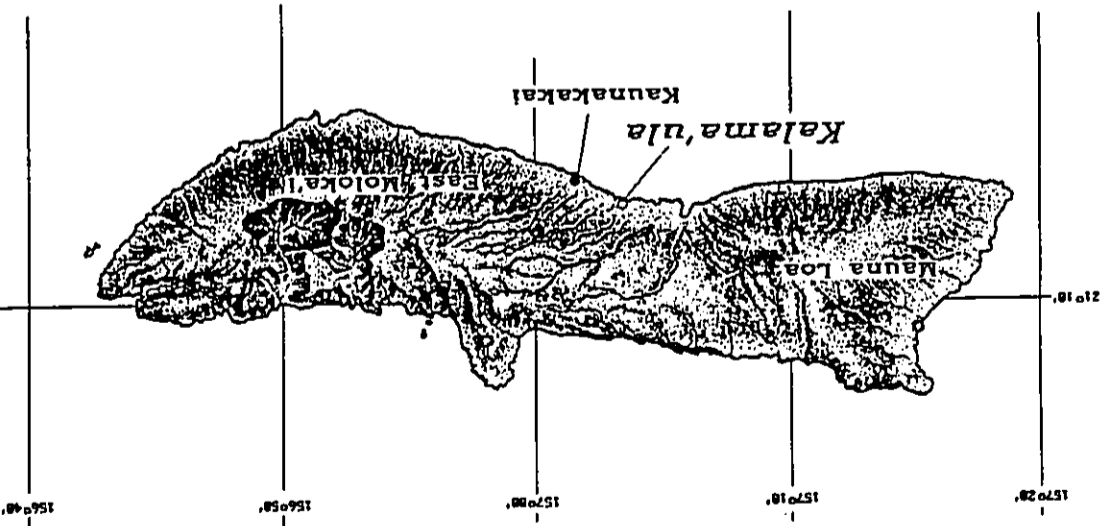


Figure 1. Shaded relief map of Molokai, showing location of Kalamau'ula.



Figure 2. Proposed drainage channel, Kalamau'ula, Molokai. Sampling locations noted.

## WATER QUALITY

Field measurements and water samples were collected at four locations at and off the shoreline in the vicinity of the proposed drainage outlet at Kalamalu (Figure 1). Station 2 was located directly off the proposed drainage culvert location. Stations 1 and 3 were located at the shore approximately 300 m east and 300 m west of Station 2, respectively. Station 3 was located close to an existing drainage outlet. Station 4 was located approximately 300 m offshore (south) of Station 2.

Samples were collected on three different dates (April 3, 4, and 5, 1995) and at widely different times of day in order to sample different tidal states. For Honolulu, predicted tide heights relative to mean lower low water (MLLW) near the water quality sampling times on Molokai were as follows:

April 3	high tide (HRW) at 1841 hrs	+1.6 ft.
April 4	high tide (LHW) at 0621 hrs	+0.7 ft.
April 5	low tide (LLW) at 1240 hrs	+0.2 ft.

The difference between the Honolulu and Kaunakakai, Molokai tides is approximately 9 minutes.

Samples were collected by filling pre-cleaned bottles directly in the field and thus represent essentially surface samples (depth <0.1 m). Temperature, salinity (by refractometer), pH, and dissolved oxygen (DO) were measured in the field. Chlorophyll *a* was filtered in the field. Water samples were cooled on ice after collection, then shipped by air in a cooler to the AECOS laboratory on Oahu. The samples were then analyzed for Hawaii Administrative Rules (HAR) §11-54-06(b)(3) basic water quality criteria for coastal waters. In addition, samples were analyzed for other constituents (ammonia, total suspended solids (TSS)) that would probably be required to be monitored as part of NPDES permit conditions. All analyses and laboratory methods used in the water quality assessment are listed in Table 1.

Analytical results are presented in Table 2 and summarized in Tables 3 and 4. These summaries present mean values (arithmetic means for temperature, salinity, DO, and pH; geometric means for TSS, turbidity, nitrate + nitrite, ammonia, organic nitrogen, total nitrogen, total phosphorus, and chlorophyll *a*) calculated from the data provided in Table 2. Simple correlation coefficients, based upon linear correlations, have been calculated to assess associations or interrelationships. The correlation coefficient (*r*) is presented

Table 1. Analytical methods and instruments used in the water quality surveys at Kalamalu, Molokai.

Analysis List	Method	Reference	Instrument
pH	EPA 150.1 meter calibrated to NBS cert. thermometer	EPA (1979)	Orion SA 250 pH meter
Temperature	EPA 170.1	EPA (1979)	YSI Model 57 DO meter
Dissolved Oxygen	EPA 360.1	EPA (1979)	YSI Model 57 DO meter
Salinity (<25 ppt)	Refractive index	Grasshoff et al. (1984)	Refractometer
Salinity (25-35 ppt)	Bench salinometer	Grasshoff et al. (1984)	AGE Model 2100
Turbidity	Method 2130B (EPA 180.1)	Grasshoff et al. (1984) Standard Methods 18th Edition (1992)	Turner nephelometer
Suspended Solids	Method 2540D (EPA 160.3)	Standard Methods 18th Edition (1992)	Mettler H31 balance
Nitrate + nitrite	EPA 353.2	EPA (1979)	Technicon AutoAnalyzer II
Ammonia	alkaline phenol	Kordecki et al. (1986)	Technicon AutoAnalyzer II
Total Nitrogen	persulfate digestion /EPA 353.2	Grasshoff et al. (1984)	Technicon AutoAnalyzer II
Total Phosphorus	persulfate digestion /EPA 365.1	Kordecki et al. (1986)	Technicon AutoAnalyzer II
Chlorophyll <i>a</i>	Method 10200H	Standard Methods 18th Edition (1992)	Turner fluorometer

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along with the critical value ( $r_{\alpha, n-2}$  where  $\alpha$  is degrees of freedom), which for this data set ( $n=12$ ) would be  $r_{0.05, 10} = 0.576$ . If  $r > r_{\alpha, n-2}$ , then the correlation is deemed significant at  $\alpha=0.05$ .

The temperature range recorded considering all stations and events was 23 to 30 °C. Means for each station were generally similar, with the Station 2 mean a degree higher than the other locations. Highest temperatures were recorded at low tide on the afternoon of April 5. Reduced salinities demonstrate that nearshore waters were strongly influenced by ground water. Ocean salinity would be around 34 ppt. Lowest salinities were recorded at low tide on the afternoon of April 5. Significant negative correlations ( $r > 0.576$ ) were found between salinity and pH, turbidity, nitrate + nitrite, total N, total P, and chlorophyll *a*. For the most part, these correlations would follow from the fact the all of these particular parameters were elevated at the shore stations where salinities were lowest, and also tended to be elevated at low tide (April 5) when salinities were lowest.

Table 2. Water quality results, Kalamalu'a Drainage Improvement, Molokai

STATION 1 (Kalamalu'a shore 300 meters west of proposed culvert location)												
EVENT No.	Date	Time	Temperature °C	Salinity ppt	pH	Dissolved Oxygen mg/l	Turbidity NTU	TSS mg/l	Nitrite µg N/l	Nitrate µg N/l	Ammonia µg N/l	Chlorophyll a µg/l
001	04/03/95	1855	28.3	33.42	8.0	5.7	8.44	10	11	34	20	2.15
002	04/04/95	0545	23.1	33.42	8.0	5.7	8.44	10	11	34	20	1.93
003	04/05/95	1330	27.5	33.46	8.2	6.9	10.4	7.7	2	3	215	41
STATION 2 (Kalamalu'a shore at proposed culvert location)												
001	04/03/95	1850	28.9	33.82	8.2	6.4	14.0	46.8	10	7	171	32
002	04/04/95	0550	23.3	33.44	7.9	5.9	9.90	13	43	10	178	24
003	04/05/95	1335	28.9	33.44	8.9	8.2	63.6	72.0	291	12	278	186
STATION 3 (Kalamalu'a shore 300 meters east of proposed culvert location)												
001	04/03/95	1845	28.1	33.28	8.1	6.0	25.0	47.3	21	7	249	106
002	04/04/95	0555	23.2	25.65	7.7	6.1	6.90	196	12	12	351	60
003	04/05/95	1340	28	16	8.7	8.5	14.8	19.7	395	10	577	92
STATION 4 (300 meters offshore of proposed culvert location at Kalamalu'a)												
001	04/03/95	1835	27.9	33.50	8.2	6.5	3.28	4.5	12	5	141	16
002	04/04/95	0610	23.0	33.33	7.7	6.4	2.56	3.6	5	5	180	19
003	04/05/95	1350	28	33.33	8.8	8.2	6.10	6.5	2	4	180	0.40

Table 3. Basic water quality characteristics (means and geometric means) for Kalamalu'a nearshore waters, April 3-5, 1995 (n=3).

Station	Temperature (°C)	Salinity (ppt)	Salinity range (ppt)	DO (mg/L)	pH	Suspended Solids	
						TSS (mg/l)	Turbidity (ntu)
Station 1	26.3	25	8-33	6.6	8.37	13.5	13.5
Station 2	27.4	27	15-33	6.8	8.33	35.3	20.7
Station 3	26.4	25	16-33	6.9	8.17	17.7	13.7
Station 4	26.3	33.45	33.33-33.53	7.0	8.23	4.7	3.71

Table 4. Nutrient and chlorophyll values (means and geometric means) for Kalamalu'a nearshore waters, April 3-5, 1995 (n=3).

Station	Nitrate + Nitrite (µg N/L)			Ammonia (µg N/L)		Total Nitrogen (µg N/L)		Total Phosphorus (µg P/L)		Total Chlorophyll (µg/L)	
	Nitrate	Nitrite	Total	Ammonia	Organic N	Total	Phosphorus	Total	Chlorophyll		
Station 1	24	13	214	9	113	226	52	58	2.3		
Station 2	50	9	113	9	176	369	84	1.3			
Station 3	118	9	155	9	174	18	0.59				
Station 4	8	5	174	5	18						

DO was close to saturation on all occasions. For example, the lowest measured value of 5.7 mg/l measured on April 4 at Station 1, is about 80% of saturation at 33 ppt and 23°C. Values were lowest at most stations on April 4 (early morning) and highest on April 5 (late afternoon). pH values were generally as expected for marine waters (8.1 to 8.3). Values were highest on April 5, coincident with high DO values. Primary productivity during mid-day usually tends to increase DO and, as carbon dioxide (CO) is used up in the process, raise the pH of the water. In fact, in these data, pH correlated reasonably well with DO (r=0.847). That is, high DO was a relatively good predictor of high pH.

Turbidities ranged from 2.56 to 63.6 nephelometric turbidity units (ntu). Values offshore (Sta. 4) were clearly lower than those measured along the shore (Table 2). TSS results mirrored turbidity. The correlation coefficient comparing these two parameters was r=0.889. These measures of water clarity and particulates content are understandably correlated. A comparable correlation (r=0.890) was found between turbidity and chlorophyll. Results are not characteristic of a period of terrestrial runoff from storm conditions. Values for both TSS and turbidity tended to be slightly higher at Station 2 (off the proposed culvert) than at Station 3 (in the vicinity of an existing drainage outlet).



perhaps due to local conditions influencing resuspension of fine bottom material by waves.

Nitrate + nitrite varied substantially in these samples, ranging from a low of 2 to a high of 653  $\mu\text{g N/L}$ . As a rule, nitrate tends to be high in ground water compared with sea water, and nitrate + nitrite in these samples was substantially higher at shoreline stations as compared with the offshore station (Sta. 4). Shoreline stations showed, by the depressed salinities, to be more influenced by ground water. The correlation between nitrate + nitrate and salinity was a particularly strong one ( $r=0.974$ ). At all three shoreline stations (Sta. 1, 2, & 3), nitrate + nitrite increased from high water (April 3) to low water (April 5), commensurate with a decreasing influence of sea water as the tide retreats from the reef flat. Highest mean nitrate + nitrite was at Station 3.

Ammonia, like nitrate + nitrite, was higher along the shore than offshore, but differences between stations were not great. The trend of increasing nitrate at the shore with declining tide level was apparent in the ammonia data, suggesting a link between ammonia and ground water influence, although at most stations the highest ammonia was measured on the April 4 lower high water (LHW; lower of the two daily high tides). This result may have been caused by sampling early in the morning. Ammonia concentration did not correlate significantly with salinity ( $r=0.288$ ).

Total organic nitrogen (N) was calculated from total nitrogen by subtracting the inorganic nitrate, nitrite, and ammonia concentrations. Values ranged from 75 to 313  $\mu\text{g N/L}$ . No patterns relative to time of day, tide, or location were evident. Organic nitrogen showed a significant correlation only with total N ( $r=0.614$ ).

Total nitrogen ranged from 141 to 986  $\mu\text{g N/L}$ . Values along the shore were higher than those at the offshore station, essentially reflecting the higher inorganic nutrient concentrations found near shore in the Kalamala area. Total N and nitrate + nitrite were strongly correlated ( $r=0.974$ ), as might be expected given the proportion of each total N measurement that was nitrate. This fact would seem to be accounted for the strong correlation between salinity and total N ( $r=0.914$ ).

Total phosphorus (P) ranged from 16 to 186  $\mu\text{g P/L}$ . Values offshore (Station 4) were lowest, suggesting a terrestrial influence on total P. Total P was weakly correlated with salinity ( $r=0.787$ ) and TSS ( $r=0.795$ ), but showed a strong correlation with turbidity ( $r=0.929$ ). Patterns relative to tide level were not marked, although highest values tended to be found on the April 5 low water. Lowest values at all stations were measured on the early morning sampling of April 4 (LHW).

Chlorophyll  $a$  varied from 0.29 to 4.83  $\mu\text{g/L}$  with the lowest values found offshore (Sta. 4). Highest values at shoreline stations were found at the low tide measurements made

on April 5. Lowest values at all stations occurred on April 4. Chlorophyll  $a$  weakly correlated with TSS ( $r=0.770$ ). Correlations with turbidity ( $r=0.890$ ) and total P ( $r=0.834$ ) were stronger. OI Consultants, Inc. (1992) noted a correlation between total P and chlorophyll in water quality data collected from off Kaunakakai, Molokai.

## BIOLOGICAL ASSESSMENT

Semi-quantitative surveys were conducted on April 5, 1995 to assess the distribution and abundance (percent cover) of benthic macroalgae and the distribution of reef flat macroinvertebrates and fishes. Three transect locations were established perpendicular to the shoreline, corresponding to the three nearshore water-quality sampling stations. Each 300-m transect was laid from the top of the beach (i.e., the berm) or, where no beach existed, from the shoreline. Trained observers surveyed the length of the transects underwater using mask and snorkel.

When benthic algae became apparent along the transect line, point-quadrat counts were taken *in situ* at 5-m intervals. A 0.5 m<sup>2</sup> (0.5 by 1 m) quadrat frame was laid on the bottom tangential to the right side of the transect line. This frame supported a grid of nylon cross-wires with a spacing interval of 10 cm. The grid was used to estimate percent cover by noting what species was under each cross-wire intersection, or "point." A total of 36 points were used. Points where the wires attached to the frame were not counted.

Sessile invertebrates "captured" by the point-quadrat method were also counted. Fish and other invertebrates observed in the area during the transect surveys were qualitatively recorded. A species list for the general area was prepared from such qualitative observations.

Transect results showed that the nearshore substrate in the vicinity of the proposed drainage outlet is composed primarily of mud mixed with sand. In general, there are no benthic algae and very few invertebrates within about the first 100 to 150 m from shore. Algae and invertebrates are seen in somewhat greater abundance between about 150 to 300 m offshore, but typically with less than 25% cover. Few fish are present, most of which are juveniles occurring close to shore. The three transects were qualitatively similar with regard to substrate and species distributions. Specific site descriptions are given below.

### Station 1

Station 1, located west of the proposed drainage outlet, has no beach. The sediment here is very soft and consists mostly of mud. Floating clusters of *Acanthophora spicifera*, *Dictyota* spp., *Spyridia filamentosa*, and *Enteromorpha* sp. are common here. The sea grass *Halophila hawaiiensis* becomes common at 150 m from shore. Algal coverage remains relatively unchanged from 200 m to approximately 300 m.

Bottom sediment becomes more sandy with intermittent patches of sand that has some algae growth approximately 350 m from shore.

### Station 2

The beach at Station 2, where the proposed drainage outlet would be built, is 6 m wide. The first 160 m thereafter consist of mud flats interspersed with some sand but no observable benthic algae. Free-floating clusters of algae are found here, mostly *A. spicifera*, *Dictyota* spp., and *S. filamentosa*, which probably drift in from the reef flat. At 165 m from the beach berm, *H. hawaiiensis* becomes common and is dominant out to 300 m. Also very common here is a large, black sponge. After 300 m from the beach berm, the bottom sediment, depth, and algae remain relatively unchanged for approximately another 200 m.

### Station 3

The beach at Station 3 is 4 m wide. The dominant species of algae here are *A. spicifera* and *Hymnea*. Algal patches become progressively more common farther from shore.

Results of transects conducted at each station are given as raw data in Appendix 1 and summarized in Table 5. Point-quadrat counts provided in the appendix were converted to percent cover. As Table 5 indicates, the most common algal species observed in the vicinity of the project were *S. filamentosa* and *A. spicifera*. The sea grass *H. hawaiiensis* was also abundant. Few sessile invertebrates were found, mostly at Station 3.

A comprehensive checklist of species observed during the survey is given in Table 6. This table compares the present results with those from a qualitative biological survey of the same area conducted in 1989 by the University of Hawaii Marine Option Program (Bigelow, 1989). Approximately 22% of the species observed in 1995 had been seen during the 1989 survey.

Table 5. Average percent cover of biota at the Kalamā'ula Drainage Improvement transect locations.

ALGAE	Station:		
	1	2	3
<i>Acanthophora spicifera</i>	1.0	10.5	3.0
<i>Caulerpa racifolia</i>	-	-	0.3
<i>Cladophora</i> spp.	-	-	0.1
<i>Dicorya</i> spp.	-	0.3	-
<i>Enteromorpha</i> sp.	1.5	-	-
<i>Hymea cervicornis</i>	-	0.4	2.4
<i>Palychoa vistratus</i>	-	-	0.1
<i>Spyridia filamentosa</i>	12.4	11.8	-
<i>Symploca hydroides</i>	-	0.1	-
SEA GRASSES			
<i>Halophila hawaiiana</i>	23.7	13.7	6.9
INVERTEBRATES			
Anemone	-	-	0.1
Encrusting green sponge	-	-	0.2
Encrusting red sponge	-	-	0.1
Snapping shrimp hole	-	-	0.1
Tunicate	-	-	0.1

Table 6. Species checklist, 1989 vs. 1995  
(+ = observed; - = not observed)

Species	Common Name (Hawaiian Name)	Present Study	1989 Study <sup>1</sup>
<b>FISHES</b>			
<i>Aetobatus narinari</i>	Spotted eagle ray (huhimānu)	-	+
<i>Bathygobius</i> sp.	Goby (o'ōpu)	+	-
Boiidae or Soleidae Family	Flounder	+	-
<i>Caranx ignobilis</i>	Giant trevally (white ulua)	-	+
<i>Dendrochirus barberti</i>	Hawaiian lionfish	+	-
<i>Diodon hystrix</i>	Porcupinefish (kokala)	+	+
<i>Foa brachygrammia</i> <sup>*</sup>	Bay cardinalfish (upapahu)	+	+
<i>Kuhlia sandwicensis</i> <sup>*</sup>	Hawaiian flagtail (ahohoehole)	+	-
<i>Mugil cephalus</i>	Striped mullet (ama'ama)	-	+
<i>Psilogobius mainlandi</i>	Goby (o'ōpu)	+	-
<i>Selar crumenophthalmus</i>	Big-eyed scad (akule-halatu)	-	+
<i>Sphyræna barracuda</i>	Barracuda (kaku)	+	+
<i>Stolephorus purpurus</i>	Hawaiian anchovy (nehu)	-	+
<i>Synodus</i> sp.	Lizardfish (ulua)	+	+
<i>Thalassoma duperrey</i>	Saddle wrasse (himala)	-	+
<b>INVERTEBRATES</b>			
<b>CRUSTACEANS</b>			
Crangonidae Family	Snapping shrimp	+	+
<i>Calappa</i> sp.	Box crab	+	-
<i>Ocypode ceratophthalma</i>	Ghost crab	+	-
<i>Penaeus</i> sp.	Penaeid shrimp (opae)	-	+
<i>Podopthalmus vigil</i>	Swimming crab	-	+
<i>Portunus sanguinolentus</i>	Haole crab	+	+
Squillidae Family	Mantis shrimp	+	+
<i>Thalassidroma crenata</i>	Blue-clawed swimming crab	+	-
<b>MOLLUSKS</b>			
<i>Conus quercinus</i>	Cone shell	+	-
<i>Plakobranchus ocellatus</i>	Sea slug	+	-
<b>POLYCHAETES</b>			
<i>Sabellastarte sanctiolepti</i>	Spaghetti worm	+	-

<sup>1</sup> Bigelow, 1989  
\* juvenile(s) only

Table 6 (continued)

Species	Common Name (Hawaiian Name)	Present Study	1989 Study <sup>a</sup>
<b>ALGAE</b>			
<i>Acanthophora spicifera</i>	Red alga	+	+
<i>Caulerpa taxifolia</i>	Green alga	+	-
<i>Cladophora</i> spp.	Green alga	+	-
<i>Dictyosphaeria cavernosa</i>	Green bubble alga	-	+
<i>Dictyota</i> spp.	Brown alga	+	-
<i>Enteromorpha</i> sp.	Green alga (ele'ele)	+	-
<i>Hypnea cervicornis</i>	Red alga (huna)	+	-
<i>Lyngbya majuscula</i>	Blue-green alga	+	+
<i>Neomeris annulata</i>	Green alga	-	+
<i>Padina australis</i>	Brown alga	+	+
<i>Porolithon</i> spp.	Red alga	-	+
<i>Sargassum echinocarpum</i>	Brown alga (kala)	-	+
<i>Sargassum polyphyllum</i>	Brown alga (kala)	-	+
<i>Spyridia filamentosa</i>	Red alga	+	+
<i>Symploca hydnoïdes</i>	Blue-green alga	+	+
<i>Turbinaria ornata</i>	Brown alga	-	+
<b>OTHER</b>			
<i>Halophila hawaiiiana</i>	Sea grass	+	-
<i>Polysiphonia viaticus</i>	Soft coral	+	-

<sup>a</sup> Bigelow, 1989**CONCLUSIONS AND DISCUSSION**

The coastal environment at Kalamā'ula is part of the largest wetlands complex on the Island of Molokai (Elliott and Hall, 1977). Fishponds, mangroves, and coral reefs are the dominant ecosystems. This part of Molokai has a characteristically dry climate and lacks perennial streams. A number of dry, unnamed gulches drain towards the wetland, with continuous flow only during heavy rain storms. Typically, these gulches arise near the 1,000-foot elevation and become poorly defined as they reach the alluvial plain at Kalamā'ula, where flows tend to disperse. All of these drainage systems are capable of contributing to flooding by directing surface flow into the shallow, coastal water table. The wetland environments found in this area are further described in Bigelow (1989) and AECOS (1992). The proposed drainage basin discussed here is small, extending mauka to a low elevation in an arid area of a proposed housing development. Larger gulches exist over one mile east and about one-half mile west of the subject basin, but these are not well described.

The introduced red mangrove, *Rhizophora mangle*, dominates most of the shoreline at Kalamā'ula. The mangrove forest is younger and slightly less dense in the vicinity of Kamehameha Coconut Grove and Kiowa Park than along the shore further to the west and to the east. A mangrove shoreline tends to retain a substantial amount of sediment and could be a factor in reducing sedimentation from surface flows at the project vicinity, especially flows from the large drainage to the west.

The coral reef off Kalamā'ula is part of an extensive fringing reef system bordering the entire south shore of Molokai. This reef is very broad and shallow, with maximum depths of only about 0.5 m across its expanse. Bigelow (1989) characterized the sediments in the vicinity of the proposed drainage basin as being poorly sorted with average depth and a low percentage of organic material. The present study found the nearshore area to consist almost entirely of sandy mud flats with small amounts of algae, essentially devoid of macroinvertebrates other than an occasional crab, shrimp, or mollusk, and few (mostly juvenile) fishes. This result corroborates with previous surveys (Bigelow, 1989; OI Consultants, 1992) for the project area and off Kaunakakai (nearly one mile east), although the species found were slightly different.

It is evident from the current study's water quality results that the nearshore environment along this coast is influenced by terrestrial inputs, most likely ground water entering the ocean. The broad, shallow reef flat magnifies this influence by limiting exchange with offshore waters. For this reason, terrestrial influences are most evident at

times of low tide. Numerous small springs can be found at and behind the shore in the Kalamā'ūa area. Ground water seepage appears to be responsible for enhancing concentrations of nitrates, ammonia, and phosphates resulting in a corresponding increase in primary productivity as evidenced by chlorophyll  $\alpha$  concentrations. Elevated silica levels have also been found in the nearshore area of the Coconut Grove (Bigelow, 1989), which is also indicative of a fresh water influence.

Although baseline sampling represented a narrow range of conditions because of the limited period of time during which sampling was undertaken, mean values (Tables 3 and 4) can be compared with the State of Hawaii water quality standards applicable to open coastal waters (Table 7). This segment of coastline was designated as "perennially dry" in DOH (1977). However, all four April 1995 stations exceeded both the "dry" and "wet" coastal geometric mean criteria not to be exceeded for total N, ammonia, nitrate + nitrite, total P, chlorophyll  $\alpha$ , and turbidity based on the April 1995 water quality measurements. At the shoreline stations, salinity did vary by more than 10‰ from ocean water, but the low values measured would be regarded as "natural" changes.

An early report which included marine water quality data from the Kaunakakai area was prepared by Hawaii Planning Design and Research (1978). Water samples were collected from Kaunakakai Harbor and at four ocean stations (seaward of the reef) on four occasions (June 18, June 19, August 6, and August 7, 1977). Both nutrient and bacteriological parameters were measured, in addition to temperature, salinity, and dissolved oxygen depth profiles. One ocean station (designated "J") was located off of the Kalamā'ūa area, about 2300 m (7500 ft) seaward of the Kamehameha Coconut Grove.

The survey concluded that water quality was generally poorer within the Kaunakakai wharf area as compared with the stations seaward of the fringing reef. Nutrients were generally higher near the wharf: 23  $\mu\text{g N/l}$  (average of all harbor measurements) compared with 18  $\mu\text{g N/l}$ ; average of all offshore measurements) offshore for total N; 29  $\mu\text{g P/l}$  compared with 21  $\mu\text{g P/l}$  for total P. Nitrate and orthophosphate concentrations were not significantly different between the two areas, with average values of 4  $\mu\text{g N/l}$  and 5  $\mu\text{g P/l}$  respectively. This result was interpreted to indicate little or no ground water influence on the wharf area. However, phytoplankton levels were found to be significantly higher in the wharf basin than in the adjacent (offshore) waters: average chlorophyll  $\alpha$  in the harbor was 0.85  $\mu\text{g/l}$ , while the offshore average was 0.25  $\mu\text{g/l}$ . Since phytoplankton would remove inorganic nutrients from the water, the similarity of nutrient concentrations within and outside the harbor considering the elevated chlorophyll  $\alpha$  inside suggests that ground water influence within the harbor can not be ruled out, even during the drier months of June and August.

Measurements were made of three types of enteric bacteriological indicators: total coliforms, fecal coliforms, and fecal streptococci (includes *Enterococcus*). Results were

quite variable from day to day. Low values in June 1977 were attributed to anomalously small sample volumes. Values were highest on August 7, 1977 and higher in the vicinity of the wharf than in the waters seaward of the reef on August 6 and 7. The results provided evidence of terrestrial influences within the harbor basin and on a water mass seaward of the reef, which had presumably exited the basin and the moved eastward. Current measurements made during the study indicated reversing flows into and out of the harbor and flows off the reef front parallel to the reef (i.e., east and west).

Table 7. State of Hawaii water quality criteria for open coastal waters (after DOH, 1992).

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Total Nitrogen ( $\mu\text{g N/l}$ )	110.00 150.00	180.00 250.00	250.00 350.00
Ammonia Nitrogen ( $\mu\text{g NH}_4\text{-N/l}$ )	2.00 3.50	5.00 8.50	9.00 15.00
Nitrate+ Nitrite ( $\mu\text{g N/l}$ )	3.50 5.00	10.00 14.00	20.00 25.00
Total Phosphorus ( $\mu\text{g P/l}$ )	16.00 20.00	30.00 40.00	45.00 60.00
Chlorophyll $\alpha$ ( $\mu\text{g/l}$ )	0.15 0.30	0.50 0.90	1.00 1.75
Turbidity (NTU)	0.20 0.50	0.50 1.25	1.00 2.00

Two values: upper, "dry" criteria apply when the open coastal waters receive less than three million gallons per day of freshwater discharge per shoreline mile; lower, "wet" (italicized) criteria apply when the open coastal waters receive more than three million gallons per day of freshwater discharge per shoreline mile.

Other "standards":

- pit units shall not deviate more than 0.5 units from a value of 8.1.
- Dissolved oxygen shall not decrease below 75% of saturation.
- Temperature shall not vary more than 1  $^{\circ}\text{C}$  from ambient conditions.
- Salinity shall not vary more than 10‰ from natural or seasonal changes.

The degree to which ground water versus surface runoff influence nearshore waters will depend upon local geology and storm events. For smaller storms, much of the rain falling on the land will eventually reach the marine environment as ground water. Runoff can be expected to be greater for large storms than for small storms, and comprise a greater proportion of the total fresh water contribution to the shore. Man-made drainage systems shift the relative proportion towards greater runoff volumes. To do otherwise would generally defeat the purpose of constructing drainage improvements in the first place. Inclusion of detention structures can mitigate adverse runoff effects.

New drainage outlets have the potential for altering nearshore ecosystems by contributing particulates of terrestrial origin. These particulates may be deposited as sand or mud in the immediate vicinity of the outlet, and/or transported by waves and currents to other areas in the marine environment. For the proposed outlet, such an outcome is not a significant problem because the nearshore bottom is one now strongly influenced by fine terrigenous sediment transported there from sites of runoff elsewhere along the coast. The extent to which this new drainage exacerbates the problem of mud deposits here and elsewhere, will depend upon erosion controls (or lack of controls) on the drainage basin feeding into the new culvert structure.

Any potential effects of increased sedimentation from runoff due to the proposed project would be restricted to this nearshore area and probably not detrimental to the survival of the coral reef ecosystem offshore of the mud flats. In fact, this was the conclusion reached by OI Consultants (1992) in their study offshore of Kaunakakai, approximately 1.5 km east of the proposed project. Moreover, the presence of mangrove stands and associated soil-binding vegetation in the vicinity would help to bind some of the excess sedimentation.

Water quality impacts from drainage systems and new outlets also must consider the potential of introducing urban pollutants into an area not previously subjected to runoff from highways, roadways, human habitation areas, etc. The proposed drainage outlet is in sparsely populated area. However, runoff from roadways and house lots in this area presently reaches the shore at several drainage outlet points in the same general vicinity of the proposed outlet structure. Man-made or unmodified drainage channels serving small, local drainage basins are located approximately 120 m east and (appearing on aerial photographs) approximately 600 m west of the proposed drainage outlet. However, approximately 1,000 m west is an outlet through the coastal mangrove belt which drains a significant portion of the lands in Kalamā'ula to an elevation of around 300 m. Urban pollutants (primarily heavy metals) were measured in a variety of aquatic animals from the vicinity of this outlet in 1992 (AECOS, 1992), suggesting that local runoff might be contributing lead (Pb) to the nearshore ecosystem.

In an effort to describe the water quality associated with the mangrove environment, Bigelow (1989) sampled at intervals along transects extending from shore in the Kalamā'ula area. "Site 1" was located off Klowea Beach Park, corresponding closely to our Station 2. At this site, as well as at the other sites along the mangrove coast to the west, turbidity (measured as the light extinction coefficient) was shown to decrease from the shore to the offshore (800 m) stations. Measurements were made on the tidal flood, approximately three hours after the low tide (on July 26, 1988 at Site 1).

The salinity along the Site 1 transect varied from 34.90‰ at the shore to 35.02‰ at 800 m off the shore. Water temperature varied from 29.4 to 27.5 °C along this transect. Ground water intrusion would seem to have been minimal at the time. Nutrients (only dissolved forms were measured) varied considerably from site to site. Only three points (shore, 200 m, and 800 m) were sampled for nutrients along each transect, and onshore/offshore gradients were not always evident. The shore stations usually gave the highest values for nitrate + nitrite and orthophosphate, and always for silicate. Comparing the seven sites (which extended westward as far as Hikaui Fishpond), Site 1 gave the highest ammonia (11.6 µg N/l) and orthophosphate (18.8 µg/l) averages, and was somewhat intermediate for nitrate + nitrite (at 5.9 µg N/l) and silicate (at 600 µg Si/l). Such an outcome might be indicative of seepage from septic tanks behind the houses. The shoreline values (a single measurement) reported for nitrate + nitrite, ammonia, orthophosphate, and silicate at Klowea Park were 11.3 µg N/l, 18.3 µg N/l, 14.6 µg P/l, and 1326 µg Si/l, respectively (Bigelow, 1989).

OI Consultants, Inc. (1992) looked at nearshore water quality at a number of stations distributed from the shore to seaward of the reef margin (up to approximately 400 m offshore) in the Kaunakakai area. Stations were sampled twice: once during "normal dry conditions" (April 28, 1992) and once following a major rain storm (May 20, 1992). These efforts demonstrated the influence of terrestrial runoff on nearshore water quality. Salinities were only slightly depressed at the shore at several of the stations, particularly east of the pier and off Kapa'akea Colony on the "dry" sampling date, presumably indicating ground water influences. Salinity depressions were observed at all of the nearshore locations sampled between the mouth of Kaunakakai Stream and off Kapa'akea Colony to the east following the rain storm. Runoff appeared to contribute directly or indirectly to elevated turbidity, TSS, chlorophyll *a*, silicate, total N, nitrate + nitrite, total P, and orthophosphate. However, the authors suggested that ground water discharges were the main source of nutrients to the inshore waters. Unfortunately, nutrient levels were quite variable following the rain storm. Silicate levels were elevated at all nearshore stations following the storm (except one), as were most of the other parameters measured. The data appeared to only weakly support the stated contention that silicate could be used to differentiate surface runoff influences from ground water influences.

Although drainage outlets may enhance the transfer of urban pollutants (such as heavy metals, petroleum products, and pesticides) to the marine environment, it is the urbanization that is responsible for the generation of these pollutants. The proposed outlet, *per se*, would not contribute measurably to pollutant transfer to the local marine environment because the proposed location is not much different from the area receiving runoff from the drainage basin at present and the proposed outlet is to serve a very small part of a proposed urban development on the watershed. Efforts that reduce the movement of particulates in runoff will be beneficial to reducing pollutants that are frequently associated with particulates in urban settings. Programs that reduce the use of pollutants and enhance future resident's awareness of the potential for harm to the marine ecosystems from their misuse of pollutants are practical approaches to reducing the entire project's potential adverse impacts on the nearshore environment.

Studies of currents in the nearshore area directly off the proposed outlet have not been undertaken. Runoff discharged from the proposed outlet is anticipated to move generally to the west or southwest under Tradewind conditions (Hawaii Planning Design and Research, 1978). Tidal effects may produce a generally eastward flow during the ebb phase, with the nearshore water mass exiting the reef through the channel off Kaunakakai.

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APPENDIX I

Kalama'ula Drainage Improvement  
Biological Transect Data

0830hrs

The weather is sunny and clear with a slight south-westerly wind at 5 mph. Water is flat and visibility is clear.

CATEGORY	QUADRAT NUMBER			April 5, 1995		
	Q205	Q210	Q215	Q220	Q225	
<i>Halophila hawaiiana</i>	18	10	15	11	5	5
<i>Spyridia filamentosa</i>	-	-	-	1	1	1
Total Points	36	36	36	36	36	36

CATEGORY	QUADRAT NUMBER			April 5, 1995		
	Q230	Q235	Q240	Q245	Q250	
<i>Halophila hawaiiana</i>	5	8	4	5	7	7
<i>Acanthophora spicifera</i>	2	-	-	-	-	-
<i>Spyridia filamentosa</i>	6	3	6	6	3	3
<i>Hypnea cervicornis</i>	-	-	-	2	-	-
Total Points	36	36	36	36	36	36

CATEGORY	QUADRAT NUMBER			April 5, 1995		
	Q255	Q260	Q265	Q270	Q275	
<i>Halophila hawaiiana</i>	4	1	2	4	-	-
<i>Acanthophora spicifera</i>	-	2	3	-	8	-
<i>Dictyota sp.</i>	-	2	-	-	-	-
<i>Hypnea cervicornis</i>	1	-	-	-	-	-
<i>Spyridia filamentosa</i>	5	12	12	-	6	6
<i>Symploca hydnoides</i>	-	-	-	1	-	-
Total Points	36	36	36	36	36	36

CATEGORY	QUADRAT NUMBER			April 5, 1995		
	Q280	Q285	Q290	Q295	Q300	
<i>Acanthophora spicifera</i>	4	8	13	12	24	24
<i>Spyridia filamentosa</i>	12	4	4	4	-	-
Total Points	36	36	36	36	36	36

1100hrs  
Wind has turned to Easterly trades 15-25 mph.

CATEGORY	QUADRAT NUMBER			April 5, 1995		
	Q150	Q155	Q160	Q165	Q170	
<i>Halophila hawaiiana</i>	-	-	-	2	10	10
<i>Acanthophora spicifera</i>	-	1	2	-	-	-
<i>Enteromorpha spp.</i>	-	-	-	2	3	3
<i>Spyridia filamentosa</i>	-	13	4	10	4	4
Total Points	36	36	36	36	36	36

CATEGORY	QUADRAT NUMBER			April 5, 1995		
	Q175	Q180	Q185	Q190	Q195	
<i>Halophila hawaiiana</i>	13	4	22	18	14	14
<i>Acanthophora spicifera</i>	1	-	-	-	-	-
<i>Enteromorpha spp.</i>	-	-	1	-	-	-
<i>Spyridia filamentosa</i>	9	9	-	-	-	-
Total Points	36	36	36	36	36	36

CATEGORY	QUADRAT NUMBER			April 5, 1995		
	Q200					
<i>Halophila hawaiiana</i>	11					11
Total Points	36					36



1300 hrs

TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q105	QUADRAT NUMBER			Q125
		Q110	Q115	Q120	
<i>Acanthophora spicifera</i>	2	-	1	1	1
<i>Hypnea cervicornis</i>	1	-	-	1	-
Total Points	36	36	36	36	36

TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q130	QUADRAT NUMBER			Q150
		Q135	Q140	Q145	
<i>Acanthophora spicifera</i>	-	1	2	-	-
<i>Hypnea cervicornis</i>	-	-	-	2	-
Encrusting green sponge	-	-	-	1	-
Total Points	36	36	36	36	36

TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q155	QUADRAT NUMBER			Q175
		Q160	Q165	Q170	
<i>Acanthophora spicifera</i>	1	-	3	2	-
<i>Hypnea cervicornis</i>	-	-	3	-	1
Tuffate	-	-	-	-	1
Total Points	36	36	36	36	36

TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q180	QUADRAT NUMBER			Q200
		Q185	Q190	Q195	
<i>Halophila hawaiiensis</i>	9	-	-	-	0
<i>Acanthophora spicifera</i>	2	-	-	-	2
<i>Caulerpa taxifolia</i>	-	-	-	-	2
Encrusting red sponge	-	-	-	1	-
Total Points	36	36	36	36	36

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TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q205	QUADRAT NUMBER			Q225
		Q210	Q215	Q220	
<i>Halophila hawaiiensis</i>	12	14	14	12	5
<i>Acanthophora spicifera</i>	4	4	9	-	-
<i>Hypnea cervicornis</i>	4	2	4	-	-
Encrusting green sponge	-	-	-	-	2
Total Points	36	36	36	36	36

TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q230	QUADRAT NUMBER			Q250
		Q235	Q240	Q245	
<i>Halophila hawaiiensis</i>	8	-	8	17	-
<i>Acanthophora spicifera</i>	3	7	-	1	-
<i>Hypnea cervicornis</i>	4	-	7	4	-
<i>Caulerpa taxifolia</i>	-	-	-	-	1
<i>Palythoa vilitatis</i>	-	-	1	-	-
Total Points	36	36	36	36	36

TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q255	QUADRAT NUMBER			Q275
		Q260	Q265	Q270	
<i>Cladophora</i> sp.	-	-	-	1	-
Total Points	36	36	36	36	36

TRANSECT: Station 3		April 5, 1995			
CATEGORY	Q280	QUADRAT NUMBER			Q300
		Q285	Q290	Q295	
Alenosee	1	-	-	-	-
Snapping shrimp hole	-	1	-	-	-
Total Points	36	36	36	36	36

A-4

**APPENDIX C**  
**TRAFFIC ASSESSMENT REPORT**

**TRAFFIC ASSESSMENT REPORT  
KALAMAULA RESIDENCE LOTS, PHASE I  
Kalamaula, Molokai**

The Department of Hawaiian Home Lands (DHHL) has proposed to develop Phase I of the Kalamaula project. Located at Kalamaula, Molokai, west of Kaunakakai (Exhibit 1), the Kalamaula project (including later phases) will contain a total of about 280 residential lots. Phase I of the proposed project will include 124 lots with access provided by new roadways built to County of Maui rural standards; one of these roadways will be connected to Maunaloa Highway. Later phases will include additional access roadways connected to the highway. This assessment describes the existing traffic conditions along the highway near the proposed new intersection with the Phase I road, provides an estimate of future traffic volumes and conditions without the proposed project, and evaluates future conditions with traffic due to the proposed project. Evaluation of future conditions for the year 2005 with Phase I and 2020 with traffic contributed by other phases of the project are included.

The description of existing conditions is based on field observations made on Thursday, July 13. Traffic volumes on Maunaloa Highway from traffic counts taken by the State Highways Division<sup>1</sup> in 1993 and the State's estimates<sup>2</sup> of average daily traffic on the highway for odd-numbered years between 1983 and 1991 were used in this assessment. A linear regression of the estimates of daily traffic was used to factor the latest available counts (1993) to future year traffic volumes.

Traffic generated by the project was added to these future volumes. These traffic volumes were estimated using the average trip generation rates for single family dwelling units reported in *Trip Generation*<sup>3</sup>, a reference published by the Institute of Transportation Engineers. Analysis methods from the *Highway Capacity Manual*<sup>4,5</sup> were used to determine traffic conditions, with highway and intersection conditions being described by a "Level of Service" (LOS) ranging from "A" (good) to "F" (poor). An appendix to this report provides descriptions of these levels of service.

**Existing Traffic Conditions**

The site of the proposed project is Kalamaula, located adjacent to and west of Kaunakakai on the southern coast of Molokai. The site is inland from Maunaloa Highway, a two-lane highway between Maunaloa on the west side of Molokai and the town of Kaunakakai in the center of the southern coast of Molokai.

Maunaloa Highway consists of a twelve-foot lane and a paved shoulder averaging four feet wide in each direction; the highway is located generally in the center of an 80-foot wide highway right-of-way. To the west of the proposed roadway connection, mangrove and other plants are present within the right-of-way; the clear

**TRAFFIC ASSESSMENT REPORT**

**KALAMAULA PHASE I**

**Kalamaula, Molokai, Hawaii**

**DRAFT July 31, 1995**

**Prepared By:**

**Julian Ng, Inc.  
P.O. Box 816  
Kaneohe, Hawaii 96744**

Peak hour traffic conditions on Maunaloa Highway were evaluated. On a two-lane highway, levels of service are determined by evaluating potential delays due to slow moving vehicles and the effects of opposing traffic volume on the ability to pass these vehicles, considering highway characteristics and the total two-way volume. Peak hour conditions on Maunaloa Highway were determined to be LOS C for the existing peak hourly volumes.

#### Future Traffic Conditions

Traffic volumes on Maunaloa Highway have been increasing over the past several years and are expected to continue to increase. As illustrated in Exhibit 2, the increase has been gradual, averaging less than 200 vehicles per day (VPD) per year. Factors for future years 2005 and 2020 were derived using a linear regression analysis of the State estimates of Average Daily Traffic for the odd-numbered years from 1983 to 1991. Year 2005 traffic volumes have been estimated to be about 44 percent higher than the volumes counted in 1993; year 2010 volumes are estimated to be nearly double the 1993 volumes.

The portion of the daily traffic which uses the roadway during the peak hours has been assumed to be the same as the latest count (1993). The existing peak hour volumes were multiplied by the factors stated above to project future peak hour highway volumes for the without project conditions.

The future conditions on the two-lane highway were found to remain at LOS C in both peak hours for the traffic volumes projected for year 2005, with volume-to-capacity (V/C) ratio increasing from an existing (1993) 0.21 to 0.30. The volumes projected for year 2020 would be served at LOS D, with V/C ratios of 0.42 for each peak hour.

#### Project Traffic

Phase I of the proposed project is a subdivision to create 124 houselots, each approximately one acre in size. The subdivision is intended to implement a concept "which emphasizes residential use of the land and encourages agricultural as a secondary or auxiliary use to the Homestead family." The traffic impact of this subdivision has been estimated for the use of each and every lot for purely residential purposes, with members of each household commuting to jobs, school, or other activities offsite. Estimates of the traffic generated under these conditions were made using the average trip rates for single family detached dwellings that are tabulated in *Trip Generation*.

Traffic impacts were estimated for two cases: Phase I only, and for completion of the entire project. In the latter case, additional connections to the highway would

distance between the outside edge of shoulder and the plant material averages about ten feet. Several churches and the Queen Liliuokalani Children's Center are located adjacent to the highway on the north (mauka) side, while the south (makai) side is a historic coconut grove and Kalianaoale Hall. An existing horizontal curve in the highway's alignment and the plant material limit sight distance from the church driveways to about 600 feet. The highway has a speed limit of 45 miles per hour; however, in the vicinity of the proposed roadway connection, a speed zone for 20 miles per hour "WHEN CHILDREN ARE PRESENT" is posted.

Calculations were done to determine the sight distance available for drivers exiting from church driveways and other roadways located mauka of the highway, within the horizontal curve located west of the churches. For the existing baseline radius of 3,820 feet, 12-foot wide lanes and 4-foot wide shoulders on the highway, an additional 10-foot wide cleared area beyond the shoulder, the sight distance to the right was calculated to be 670 feet, appropriate for a design speed of 44 miles per hour. Sight distance to the left was calculated to be 570 feet, or a design speed of 39 miles per hour. Typical vehicular speeds on the highway through the area were observed during the site visit to be between 35 and 40 miles per hour.

The nearest State Highways Division traffic count station on Maunaloa Highway is Station C-1-A, located 0.1 mile west of Oloolo Place. While Oloolo Place could not be physically identified during the site visit, maps showing Oloolo Place indicate that it is located approximately 0.15 mile east of the proposed roadway connection. Therefore, Station C-1-A would be within a few hundred feet of the proposed connection. Counts taken at that station and approximately one mile to the east in Kaunakakai are summarized in Table 2.

Table 1

#### TRAFFIC COUNTS

	Westbound	Eastbound
Maunaloa Highway 0.1 mile west of Oloolo Place (C-1-A)		
24-hour (March 15-16, 1993)	2,917	2,926
AM Peak Hour (6:45-7:45 AM)	310	203
PM Peak Hour (4:45-5:45 PM)	210	315
Maunaloa Highway west of Kaunakakai Wharf Road (1)		
24-hour (March 15-16, 1993)	3,543	4,254
AM Peak Hour (6:45-7:45 AM)	308	360
PM Peak Hour (4:30-5:30 PM)	281	419

Source: State of Hawaii, Department of Transportation, Highways Division,  
*Traffic Survey Data (Individual Stations) - Islands of Maui, Molokai & Lanai 1993.*

accommodate most of the traffic generated by future phases; however, a review of the preliminary site plan for the entire project indicates that approximately 36 lots in Phase III may use the Phase I roadway to access the highway. Table 2 summarizes the traffic generation estimates.

Table 2  
SITE TRAFFIC GENERATION

	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
Phase I only (124 Dwellings)	24	68	80	45
Phases I and III (160 DUs)	31	87	103	59

The nearest existing significant cluster of residential units is located between the project site and Kaunakakai off of Manila Place. Volumes counted at the two count stations shown in Table 1, one located west and the other located east of Manila Place, were used to determine the trip distribution for traffic approaching and departing the proposed project. Table 3 summarizes the trip distribution used for project traffic.

Table 3

TRIP DISTRIBUTION

	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
From / to west	40%	46%	53%	33%
From / to east	60%	54%	47%	67%

The project traffic was added to the projections of future highway traffic. Exhibits 3 and 4 show the future traffic at the intersection of the highway and the proposed project road.

#### Capacity Analyses

Conditions on the two-lane Maunaloa Highway on both sides of the proposed connection were analyzed. The two-lane highway analysis considers highway characteristics and two-way volume in determining the service (maximum) volume for each level of service. The service volume for LOS E is used to compare volume to capacity ("V/C ratio"). Table 4 presents the peak hour volumes and findings of the two-lane highway analyses for existing and future cases.

Table 4  
TWO-LANE HIGHWAY ANALYSIS

Maunaloa Highway, east of project road	Volume	LOS	V/C ratio
AM Peak Hour			
Existing (1993)	513	C	0.21
Future (2005) without project	740	C	0.30
Future (2005) with project	791	C	0.33
Future (2020) without project	1,024	D	0.42
Future (2020) with project	1,090	D	0.45
PM Peak Hour			
Existing (1993)	525	C	0.21
Future (2005) without project	758	C	0.30
Future (2005) with project	826	C	0.33
Future (2020) without project	1,048	D	0.42
Future (2020) with project	1,136	D	0.45
Maunaloa Highway, west of project road			
AM Peak Hour			
Existing (1993)	513	C	0.21
Future (2005) without project	740	C	0.30
Future (2005) with project	781	C	0.32
Future (2020) without project	1,024	D	0.42
Future (2020) with project	1,076	D	0.44
PM Peak Hour			
Existing (1993)	525	C	0.21
Future (2005) without project	758	C	0.30
Future (2005) with project	815	C	0.33
Future (2020) without project	1,048	D	0.42
Future (2020) with project	1,122	D	0.45

\* V/C = ratio of volume to capacity (service volume for LOS E)

As indicated in Table 4, LOS C would describe future highway conditions with or without Phase I of the proposed project; the addition of the proposed project's traffic would not have a significant impact on highway conditions. Longer term deterioration to LOS D is due more to the other growth that was forecasted than to project-related traffic. However, highway conditions would continue to be acceptable.

The traffic assignments at the intersection (Exhibits 3 and 4) were analyzed using two Unsignalized Intersection Analysis procedures from the *Highway Capacity Manual* to determine peak hour conditions. The first procedure, from the 1985 edition of the *Highway Capacity Manual*, determines the capacity of the left turn into the side

street and the capacity of the controlled side street movement by estimating the number of adequate gaps available in the uncontrolled movements at the intersection. The volume wishing to make each of these movements is deducted from the capacity, and the difference ("reserve capacity") determines the level of service. The findings of the analyses are presented in Table 5.

Table 5  
INTERSECTION LEVELS OF SERVICE  
(1985 Highway Capacity Manual)

Project Road at Maunaloa Highway	Reserve Capacity (Level of Service)			
	Left Turn from Hwy.	Left Turn to Hwy.	Right Turn to Hwy.	Shared Lane to Hwy.
Phase I only (2005)	732 (A)	234 (C)	542 (A)	277 (C)
AM Peak Hour	802 (A)	210 (C)	670 (A)	257 (C)
PM Peak Hour				
Phases I and III (2020)				
AM Peak Hour	595 (A)	116 (D)	412 (A)	131 (D)
PM Peak Hour	677 (A)	97 (E)	566 (A)	119 (D)

Traffic engineers using this method have been concerned that the analysis is overly conservative, i.e. it shows worse conditions than could be expected for the volumes used. An updated Highway Capacity Manual (1994) modified the procedure by recalibrating the charts for determining capacities from the volumes of opposing movements. The Level of Service determination was also changed, from a reserve capacity basis to one based on average delay. The results of the analysis using the procedure from the 1994 update are shown in Table 6.

Table 6  
INTERSECTION LEVELS OF SERVICE  
(1994 update of Highway Capacity Manual)

Project Road at Maunaloa Highway	Average Delay in seconds (Level of Service)			
	Left Turn from Hwy.	Left Turn to Hwy.	Right Turn to Hwy.	Shared Lane to Hwy.
Phase I only (2005)	4 (A)	10 (C)	5 (A)	9 (B)
AM Peak Hour	3 (A)	11 (C)	4 (A)	10 (B)
PM Peak Hour				
Phases I and III (2020)				
AM Peak Hour	4 (A)	17 (C)	6 (B)	15 (C)
PM Peak Hour	4 (A)	19 (C)	4 (A)	17 (C)

The need for a separate deceleration and storage lane for left turns from the highway to the side street was determined from an analysis procedure described by M. D. Harmelink in an article published in 1967, which is referenced by the American Association of State Highways and Transportation Officials (AASHTO). This analysis is based on minimizing the probability that a through vehicle is impeded by a vehicle waiting to turn left against opposing traffic. The application consists of plotting advancing traffic volume and opposing traffic volume on one of a set of charts to determine the required storage length. Analyses of the volumes shown in Exhibits 3 and 4 indicate that a storage length of 75 feet will be needed for the year 2005 PM Peak Hour (100 feet would be needed for the year 2020 PM Peak Hour). The article includes layouts with which these storage lengths would be used, which show substantial deceleration within the through lanes.

The State Highways Design Manual (page 6-30) states that, "At unsignalized intersections the storage length, exclusive of taper, may be based on the number of turning vehicles likely to arrive in an average 2 minute period within the peak hour." For the projected left turn volumes (PM Peak Hour) of 43 and 55 vehicles per hour and an allowance of 25 feet per vehicle, the storage length would be 50 feet. In addition, the State Highways Division has a requirement that left turn lanes on two-lane highways where the speed limit is 45 miles per hour or higher be separated from the opposing traffic lane by a striped median, six feet wide. This requirement has been applied to several new rural intersections on the islands of Oahu and Hawaii where there are no driveways to the highway nearby. The existing speed limit of Maunaloa Highway in the vicinity of the proposed connection is 45 miles per hour, with a speed zone posted for 20 miles per hour "WHEN CHILDREN ARE PRESENT." A review of existing conditions, including spot observations of vehicular speeds and an evaluation of sight distances from driveways and intersections, indicates that a speed limit of 35 miles per hour would be more appropriate for this segment of highway.

In addition to storage, the turn lane desirably would include length for deceleration and taper. As stated in AASHTO (p.828), "Common practice, however, is to accept a moderate amount of deceleration within the through lanes and to consider the taper as part of the deceleration length." The required deceleration length to stop depends on the design speed; for 50 miles per hour, 435 feet is required and for 40 miles per hour, the required deceleration length is 315 feet.

The principles described in the Harmelink article were also applied to the right turn movements off of the highway. In all cases, the combinations of turning volume, advancing volume, and opposing traffic were such that there would be neither unreasonable delays nor undesirable conflicts; therefore, separate lanes for right turns would not be warranted. A layout of the recommended improvements at the intersection based on a speed limit of 35 miles per hour and a design speed of 40 miles per hour is shown in Exhibit 5.

#### Conclusions and Recommendations

The analyses show that Maunaloa Highway in the vicinity of the project is adequate for existing traffic and will be adequate for expected increases in future traffic. At the proposed connection of the project roadway to the highway, a left turn lane should be provided so that eastbound traffic is not blocked by cars waiting to turn left into the project road. Because of the low volume of opposing traffic, westbound right turns would be unimpeded and a separate lane can not be justified on the basis of potential delays to following traffic. The capacity analyses indicate that an unsignalized intersection would not cause any undue delays to stopped traffic on the project road.

The proposed project will have a minor effect on traffic conditions, as increases in traffic volumes in the area due to other growth is greater than the project impact. The project impact to traffic volumes has been estimated to be less than five percent.

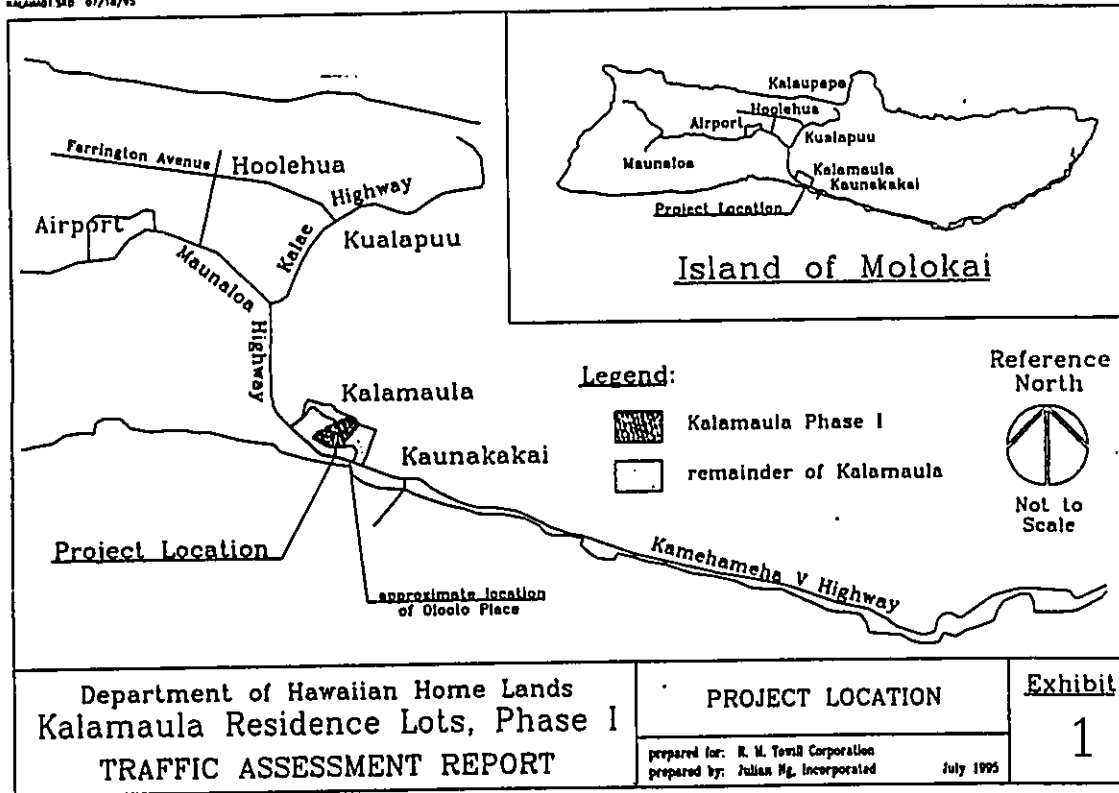
Observations of existing conditions along Maunaloa Highway indicate that the existing speed limit of 45 miles per hour should be lowered to 35 miles per hour (no change to the existing 20 mile per hour speed zoning is recommended). Existing speeds appear to be 40 miles per hour or less and may be due to two factors: 1) the uncertainty on the part of drivers as to the legal speed limit, and 2) the narrow bridges and many driveways along this segment of the highway. The level terrain that exists in this area does not contribute to higher speeds as trucks and other vehicles have little problem gaining speed where roadside conditions are better (east and west of the immediate vicinity).

If the speed limit is not reduced, improved maintenance should be provided to remove vegetation (on the inside of the horizontal curves) within the highway right-of-way so that additional clear width is available to improve sight distances for driveways and other intersecting roadways. Additionally, a waiver or exemption from the requirement for a six-foot wide median should be sought because many existing driveways are within the area where the left turn lane would be located.

Recommendations for intersection improvements assuming that the highway speed limit is reduced to 35 miles per hour are shown in Exhibit 5.

#### References

1. State of Hawaii, Department of Transportation, Highways Division, *Traffic Survey Data (Individual Stations) - Islands of Maui, Molokai & Lanai 1993*.
2. State of Hawaii, Department of Transportation, Highways Division, *Traffic Summary - Islands of Maui, Molokai & Lanai 1991*.
3. Institute of Transportation Engineers, *Trip Generation, An Informational Report, 5th Edition*, Washington, D.C., 1991.
4. Transportation Research Board, National Research Council, *Highway Capacity Manual, Special Report 209*, Washington, D.C., 1985.
5. Transportation Research Board, National Research Council, *Highway Capacity Manual (Third Edition)*, Special Report 209, Washington, D.C., updated October 1994.
6. American Association of State Highway and Transportation Officials, *A Policy on Geometric Design of Highways and Streets 1990*, Washington, D.C., 1990. Figure IX-40.
7. Department of Hawaiian Home Lands, *Kalamaula Development Plan*, June 1983.
8. M. D. Harmelink, "Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections." *Highway Research Record No. 211*, 1967.
9. State of Hawaii, Department of Transportation. *Statewide Uniform Design Manual for Streets and Highways*, October 1980.



Department of Hawaiian Home Lands  
 Kalamaula Residence Lots, Phase I  
 TRAFFIC ASSESSMENT REPORT

PROJECT LOCATION

Exhibit

1

prepared for: R. M. Towill Corporation  
 prepared by: Julian Ng, Incorporated July 1995

**APPENDIX - LEVELS OF SERVICE**

A qualitative measure used by traffic engineers to describe traffic operational conditions is the level of service (LOS). Six levels have been defined, from LOS A (best operating condition) to LOS F (worst). The *Highway Capacity Manual* describes analysis procedures for different types of facilities. For uninterrupted flow facilities such as freeways, other divided highways, and two-lane rural highways, factors such as speed and travel time, freedom to maneuver, comfort and safety, and continuity of flow are used to determine levels of service.

On multi-lane highways, levels of service are related to maneuverability within the traffic stream travelling in the same direction; directional volume and traffic density are used to determine capacities and levels of service. On two-lane highways, levels of service are affected by a driver's ability to pass slow-moving vehicles; opposing volume is also a factor. Descriptions of the levels of service for two-lane rural highways are:

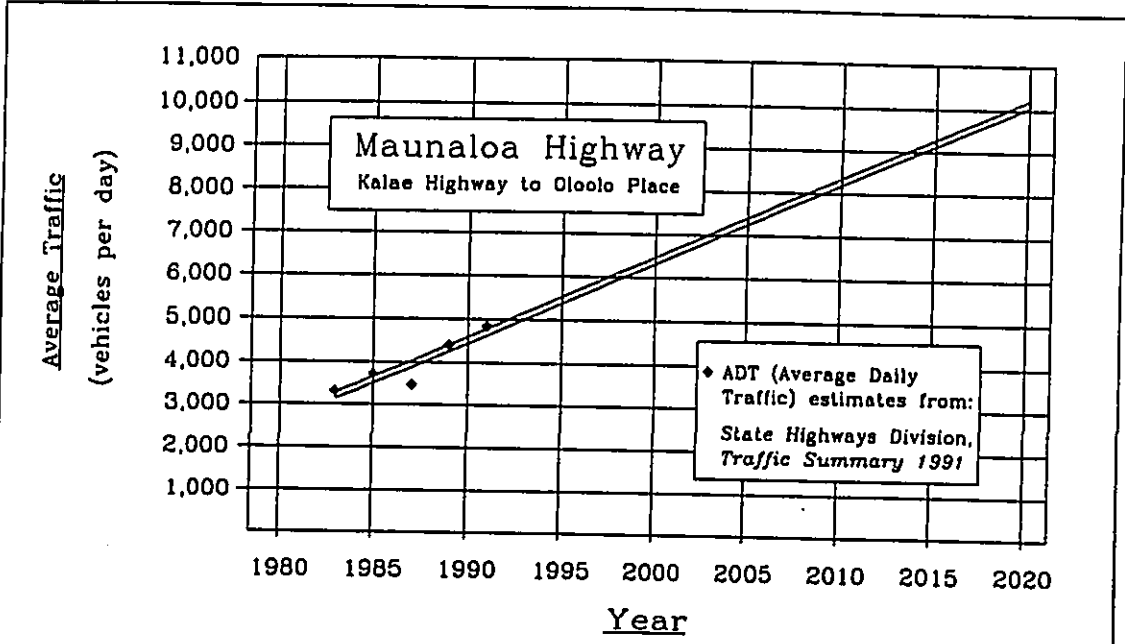
- LOS A represents free flow. Travel at desired speeds is unimpeded, as passing of any slow-moving vehicles is infrequent and can be done easily. Platoons of vehicles would be three or less.
- LOS B describes stable flow. Passing to maintain desired speed becomes significant and platooning of vehicles increases.
- LOS C also describes stable flow. Platooning and restrictions to passing become noticeable and while flow remains stable, some congestion may occur because of slow-moving vehicles or turning movements.
- LOS D is characterized by opposing traffic flows operating separately. Passing is extremely difficult as opportunities are very limited.
- LOS E describes unstable operation at or near capacity levels. There are no usable gaps in the traffic stream and any disruption to flow causes congestion. Flow is unstable as slow-moving vehicles and other interruptions cause intense platooning and congestion; passing is virtually impossible.
- LOS F represents a forced or breakdown flow caused by traffic demand volume exceeding capacity; actual volume served will drop as speed decreases and congestion increases. LOS F is used to identify bottlenecks, or points of congestion, and operations within the queue behind these bottlenecks.

Levels of service are identified for the controlled movements at unsignalized intersections. A revised procedure uses computed average delays to identify levels of service. The analysis procedure from the 1985 *Highway Capacity Manual* determines the reserve capacity (total capacity less volume) of a controlled movement such as a left turn against oncoming traffic, or traffic entering a roadway from a side street controlled by a stop sign:

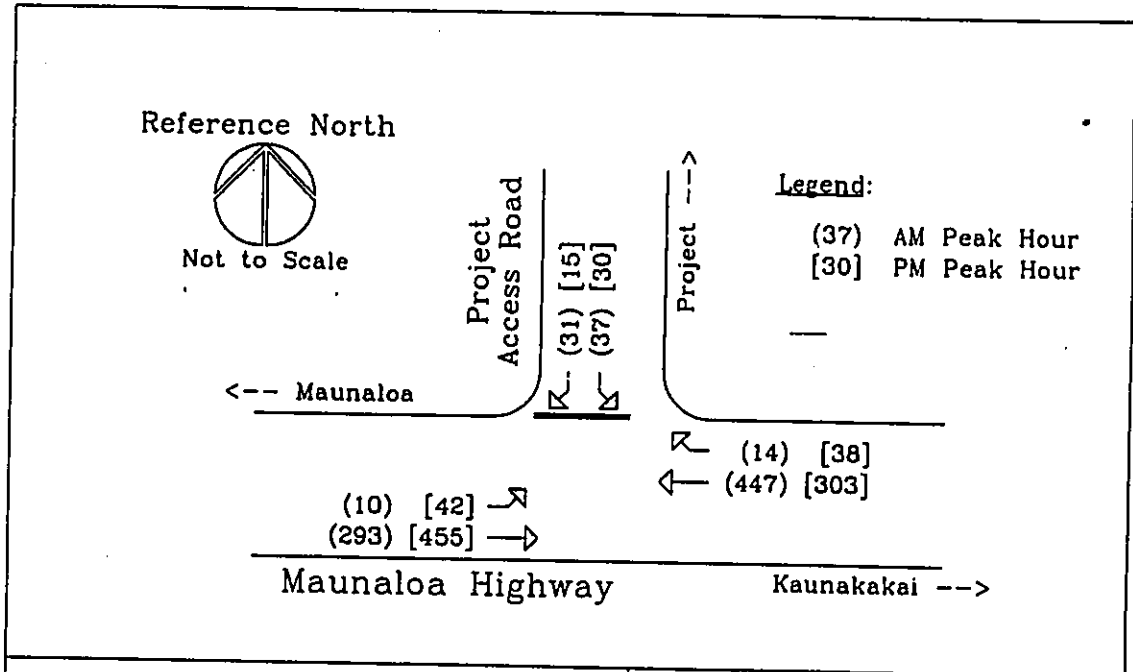
Reserve Capacity	LOS	Estimated Delay to Controlled Movement
≥ 400	A	Little or no delay (≤ 5 seconds)
300 - 399	B	Short traffic delays (> 5 and ≤ 10 seconds)
200 - 299	C	Average traffic delays (> 10 and ≤ 20 seconds)
100 - 199	D	Long traffic delays (> 20 and ≤ 30 seconds)
0 - 99	E	Very long traffic delays (> 30 and ≤ 45 seconds)
< 0	F	Very long traffic delays (> 45 seconds)

References: Transportation Research Board, National Research Council, *Highway Capacity Manual*, Special Report 209, Washington, D. C., 1983  
 Transportation Research Board, National Research Council, *Highway Capacity Manual - Third Edition*, Updated 1994, Special Report 209, Washington, D. C., 1994



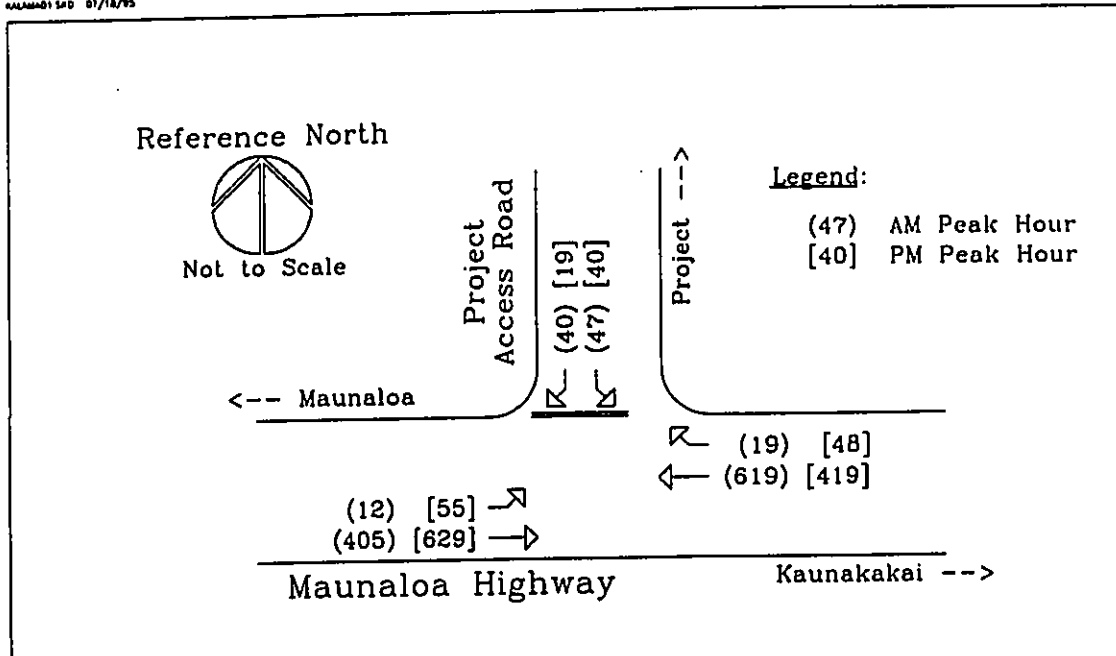


Department of Hawaiian Home Lands Kalamaula Residence Lots, Phase I TRAFFIC ASSESSMENT REPORT	HIGHWAY TRAFFIC TREND	Exhibit 2
	prepared for: R. M. Tavill Corporation prepared by: Julian Ng, Incorporated July 1995	



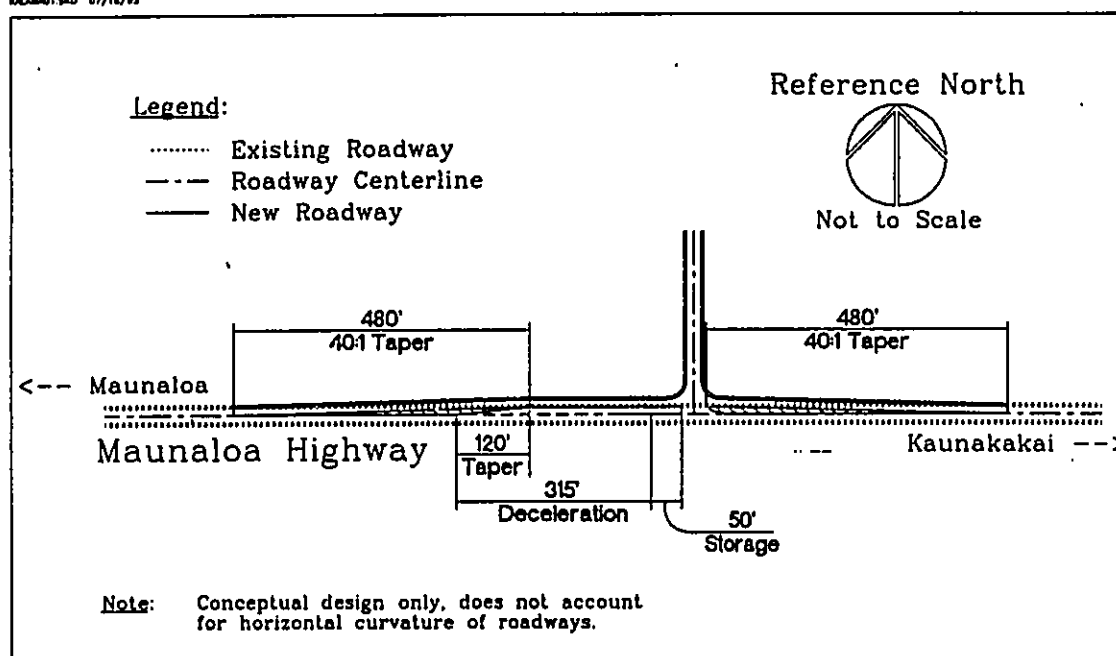
Department of Hawaiian Home Lands Kalamaula Residence Lots, Phase I TRAFFIC ASSESSMENT REPORT	2005 TRAFFIC ASSIGNMENTS	Exhibit 3
	prepared for: R. M. Tavill Corporation prepared by: Julian Ng, Incorporated July 1995	

KALAMAU1.54D 07/18/95



Department of Hawaiian Home Lands Kalamaula Residence Lots, Phase I TRAFFIC ASSESSMENT REPORT	2020 TRAFFIC ASSIGNMENTS	Exhibit 4
	prepared for: R. M. Towill Corporation prepared by: Julian Ng, Incorporated July 1995	

KALAMAU1.54D 07/18/95



Department of Hawaiian Home Lands Kalamaula Residence Lots, Phase I TRAFFIC ASSESSMENT REPORT	CONCEPTUAL DESIGN OF HIGHWAY CONNECTION	Exhibit 5
	prepared for: R. M. Towill Corporation prepared by: Julian Ng, Incorporated July 1995	

APPENDIX D  
GEOTECHNICAL ENGINEERING EXPLORATION  
SUMMARY

**DRAFT**

**GEOTECHNICAL ENGINEERING EXPLORATION  
KALAMAULA RESIDENCE LOTS - UNIT 1  
KALAMAULA, MOLOKAI, HAWAII  
TMK: 5-2-08**

**W.O. 3480-00      AUGUST 31, 1995**

**FOR**

**R.M. TOWILL CORPORATION**

# DRAFT

## GEOTECHNICAL ENGINEERING EXPLORATION

### KALAMAULA RESIDENCE LOTS - UNIT 1

#### KALAMAULA, MOLOKAI, HAWAII

TMK: 5-2-08

W.O. 3480-00      AUGUST 31, 1995

#### SUMMARY OF FINDINGS AND RECOMMENDATIONS

Our field exploration generally encountered a relatively thin (about 1 to 8 feet thick) deposit of alluvial soils, consisting of stiff clayey and sandy silts in a relatively dry and friable state. The surficial alluvial deposit was generally underlain by hard, weathered basalt rock formation extending to the maximum depth explored of approximately 11½ feet below the existing ground surface. Groundwater was not encountered in the drilled borings and excavated test pits at the time of our field exploration.

Based on our field exploration and analyses, the near-surface on-site soils may lose substantial strength when subjected to saturation. Therefore, special attention should be given to the proper surface drainage of the site.

In general, the on-site silty soils and basalt rocks generated from cut areas may be reused as a source of fill material provided that they are properly processed, moisture-conditioned, and placed on prepared subgrades as recommended in the "Site Grading" section of this report.

Because of the relatively competent subsoil conditions encountered at the project site, shallow foundations consisting of posts-and-beams and slabs-on-grade may be utilized for the future house construction. An allowable bearing pressure of up to 2,500 and 4,000 pounds per square foot (p.s.f.) may be used for the design of foundations bearing on the recompacted in-situ silty soils and basalt formation, respectively. Special attention should be given to the drainage requirements discussed in the "Drainage" section of this report.

### DISCUSSION AND RECOMMENDATIONS

Our field exploration generally encountered a relatively thin mantle of stiff alluvial soils over competent basalt rock formation across the project site. The alluvial soils generally consist of clayey and sandy silts in a relatively dry and friable state. In general, we believe that the on-site silty soils and basalt rocks generated from cut areas may be reused as a source of fill material provided that they are properly processed and placed on prepared subgrades as recommended in the "Site Grading" section of this report. Due to the relatively dry and windy conditions at the project site, proper moisture-conditioning of the fill materials and implementation of a dust control program will be of critical considerations during the grading operations of the project construction.

Because of the relatively competent subsoil conditions encountered at the project site, shallow foundations consisting of posts-and-beams and slabs-on-grade may be utilized for the future house construction. Our field exploration and laboratory testing indicated that the on-site silty soils generally exist in a dry and friable state with low moisture contents. Therefore, special attention should be given to proper moisture-conditioning of the near-surface soils during subgrade preparation for slab-on-grade foundations. In addition, our laboratory testing suggest that the on-site silty soils may lose substantial bearing strength upon saturation. Therefore, special attention should also be given to the recommendations presented in the "Drainage" section of this report.

Our laboratory California Bearing Ratio (CBR) tests indicated that the near-surface silty soils generally have poor pavement support characteristics. Therefore, we recommend that the pavement subgrade be over-excavated a minimum of 12 inches below the base course layer and be replaced with compacted select borrow in areas where silty soils are encountered.