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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

ENGINEERING DIVISION
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RECEIVED

Herman Tuiolosega, Acting Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Tuiolosega,

Draft Environmental Assessment
for DLNR Pukulani Tank Site Exploratory
Water Well, TMK (2nd) 2-3-007:030 and 035; ROW of Kula Highway
Island of Maui

With this letter, the Department of Land and Natural Resources hereby transmits the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the subject project for publication in the next available edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, one copy of the DEA-AFONSI, a CD with an Adobe Acrobat PDF file of the same and an electronic copy of the publication form in MS Word. If you have any questions, please contact Gayson Ching of my staff at 587-0232.

Sincerely,

CARTY S. CHANG
Chief Engineer

GC
Enclosure
c: Ron Terry, Ph.D., Project Environmental Consultant (w/o enclosure)

Project Name DLNR Pukalani Tank Site Exploratory Water Well
Island: Maui
District: Makawao
TMK: (2nd) 2-3-007:030 and 035; ROW of Kula Highway
Permits: State of Hawai'i DLNR Commission on Water Resource Management (CWRM) Well Construction / Pump Installation Permit.County of Maui Dept. of Public Works (DPW) Grading Permit: State of Hawai'i Dept. of Health (DOH) National Pollutant Discharge Elimination System (NPDES) Permit. State of Hawai'i DOH Noise Variance.

Proposing/Determination Agency:

Dept. of Land & Natural Resources
Gayson Ching
Engineering Division - Project Planning Section
1151 Punchbowl Street, Room 221
Honolulu, HI 96813
Ph. (808) 587-0232/Fax (808) 587-0283

Consultant:

Geometrician Associates
PO Box 396
Hilo HI 96721
Ron Terry Ph. (808) 969-7090 rterry@hawaii.rr.com

Status (check one only):

_x_DEA-AFNSI — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day comment period ensues upon publication in the periodic bulletin.

__FEA-FONSI — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.

__FEA-EISPN — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day consultation period ensues upon publication in the periodic bulletin.

__Act 172-12 EISPN — Submit the proposing agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov). NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.

__DEIS — The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.

__FEIS — The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.

__ Section 11-200-23 Determination — The accepting authority simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the proposing agency. No comment period ensues upon publication in the periodic bulletin.

__Section 11-200-27

Determination

The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.

__Withdrawal (explain)

Summary (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page):

The Hawai'i State Department of Land and Natural Resources, Engineering Division (DLNR) proposes to develop an exploratory potable water well at the Maui Department of Water Supply (MDWS) Pukalani Tank Site on Kula Highway. The well is intended primarily to provide potable water for future State of Hawai'i projects, including school projects for the Department of Education and residential developments of the Department of Hawaiian Home Lands. DLNR intends to enter into an agreement with MDWS to integrate this new source into the existing MDWS water system and transfer ownership to the County of Maui. This arrangement would also provide some portion of the water for other uses that are needed in the MDWS Upcountry water systems.

No adverse impact upon the sustainable yield of the aquifer will occur. As the site has been completely converted to water utility uses, no sensitive native flora or fauna or historic sites are present. Noise, traffic and visual impacts will be negligible. If testing of the exploratory well indicates an adequate quantity of water of acceptable water quality, another EA will be prepared to discuss the impacts related to conversion to a production well and subsequent use.

DLNR Pukalani Tank Site
Exploratory Water Well

DRAFT ENVIRONMENTAL ASSESSMENT

TMK (2nd) 2-3-007:030 and 035; ROW of Kula Highway
Island of Maui, State of Hawai‘i

Submitted Pursuant to Chapter 343, Hawai‘i Revised Statutes (HRS)

State of Hawai‘i
Department of Land and Natural Resources

January 2014

DLNR Pukalani Tank Site
Exploratory Water Well

DRAFT ENVIRONMENTAL ASSESSMENT

TMK (2nd) 2-3-007:030 and 035; ROW of Kula Highway,
Island of Maui, State of Hawai'i

PROPOSING
AGENCY:

State of Hawai'i
Department of Land and Natural Resources
Engineering Division
1151 Punchbowl Street, Room 221
Honolulu, HI 96813

CONSULTANT:

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PO Box 396
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and

Akinaka and Associates
3375 Koapaka Street, Suite B-206
Honolulu, HI 96819

CLASS OF ACTION:

Use of State Funds
Use of County Land

This document is prepared pursuant to:
the Hawai'i Environmental Protection Act,
Chapter 343, Hawai`i Revised Statutes (HRS), and
Title 11, Chapter 200, Hawai'i Department of Health Administrative Rules (HAR).

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SUMMARY

The Hawai‘i State Department of Land and Natural Resources, Engineering Division (DLNR) proposes to develop an exploratory potable water well at the Maui Department of Water Supply (MDWS) Pukalani Tank Site on Kula Highway, TMK (2nd.) 2-3-007:030. The well is intended primarily to provide potable water for future State of Hawai‘i projects, including school projects for the Department of Education and residential developments of the Department of Hawaiian Home Lands. DLNR intends to enter into an agreement with MDWS to integrate this new source into the existing MDWS water system and transfer ownership to the County of Maui. This arrangement would also provide some portion of the water for other uses that are needed in the MDWS Upcountry water systems.

No adverse impact upon the sustainable yield of the aquifer will occur. As the site has been completely converted to water utility uses, no sensitive native flora or fauna or historic sites are present. Noise, traffic and visual impacts will be negligible. If testing of the exploratory well indicates an adequate quantity of water of acceptable water quality, another EA will be prepared to discuss the impacts related to conversion to a production well and subsequent use.

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LIST OF ABBREVIATIONS

ALISH	Agricultural Lands of Importance to the State of Hawai‘i
AWUDP	Agricultural Water Use and Development Plan
BMP	Best Management Practice
CWRM	Hawai‘i State DLNR Commission on Water Resource Management
DHHL	Hawai‘i State Department of Hawaiian Home Lands
DLNR	Hawai‘i State Department of Land and Natural Resources
DOFAW	Hawai‘i Division of Forestry and Wildlife
DPW	Maui County Department of Public Works
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
gpm	Gallons per minute
GWPP	Groundwater Protection Program
HC&S	Hawaiian Commercial and Sugar
HEER	Hawai‘i State DOH Hazard Evaluation and Emergency Response
HDOA	Hawai‘i Department of Agriculture
HDOH	Hawai‘i State Department of Health
HAR	Hawai‘i Administrative Rules
HEPA	Hawai‘i Environmental Policy Act
HRS	Hawai‘i Revised Statutes
MCGP	Maui County General Plan
MCL	Maximum Contaminant Level
MDWS	Maui Department of Water Supply
MECO	Maui Electric Light Company
mgd	Million gallons per day
mg/L	Milligrams per liter
MLP	Maui Land & Pineapple Company
OEQC	Hawai‘i State Office of Environmental Quality Control
SFHA	Special Flood Hazard Area
SHPD/O	State Historic Preservation Division/Officer
SMA	Special Management Area
SWAP	Source Water Assessment Program
SWPP	State Water Projects Plan
UH	University of Hawai‘i
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNRCS	U.S. Natural Resources Conservation Service
WRPP	Water Resources Protection Plan
WQP	Water Quality Plan
WUDP	Water Use and Development Plan
WTP	Water Treatment Plant

1 PROJECT LOCATION, DESCRIPTION, PURPOSE AND NEED

1.1 Project Location

The Hawai‘i State Department of Land and Natural Resources, Engineering Division (hereafter referred to as DLNR) proposes to develop an exploratory potable water well at the Maui Department of Water Supply (MDWS) Pukalani Tank Site on Kula Highway, TMK (2nd.) 2-3-007:030 (Figures 1-1 to 1-3). The well is intended primarily to provide potable water for future State of Hawai‘i projects, including school projects for the Department of Education and residential developments of the Department of Hawaiian Home Lands. DLNR intends to enter into an agreement with MDWS to integrate this new source into the existing MDWS water system and transfer ownership to the County of Maui. This arrangement would also provide some portion of the water for other uses that are needed in the MDWS Upcountry water systems.

This Environmental Assessment (EA) concerns development of an exploratory well only. The viability of producing water on this site is not yet known. If testing of the exploratory well indicates an adequate quantity of water of acceptable water quality, another EA will be prepared to discuss the impacts related to conversion to a production well and subsequent use. The proportion that would be allocated for State projects versus that available to increase supply in the MDWS system would be subject to future negotiations based on the results of the well tests and system conditions at the time of negotiations. Therefore, discussion of future uses of the water will occur during the follow-on EA for a production well, should the exploratory effort prove successful.

After systematically evaluating six potential sites in the Makawao to Pukalani area, DLNR selected a site at the existing MDWS Pukalani Tank, as it offered the optimal characteristics for development of a water well. The 1.0 million gallon Pukalani Tank is located on a lot with almost an acre of space, providing ample room for well infrastructure (see Figure 1-3). The site is owned by MDWS and presents few administrative issues, assuming the DLNR and MDWS reach an agreement to transfer ownership. Hydrologists anticipate that a well at this site would produce between 0.7 and 1.0 million gallons per day (mgd). The site already has the required infrastructure to support well drilling operations. Aside from new power transmission, minimal water system improvements are required to connect the new source into the existing MDWS system. The location also integrates well into the Upcountry District water systems from an operational perspective.

The reservoir lot’s surface has already been extensively modified, but some new grading will be required to accommodate construction of the exploratory well and future appurtenant facilities, including a control building, valves, water transmission piping, access driveway, electrical facilities, storm drains, and fencing. In the future, offsite work within a linear corridor in the right-of-way of Kula Highway (State Highway 37) and/ or on adjacent TMK 2-3-007:035 (see Figure 1-3) will also be required for water transmission and electrical lines.

Figure 1-1a. General Location Map

Figure 1-1b. USGS Location Map

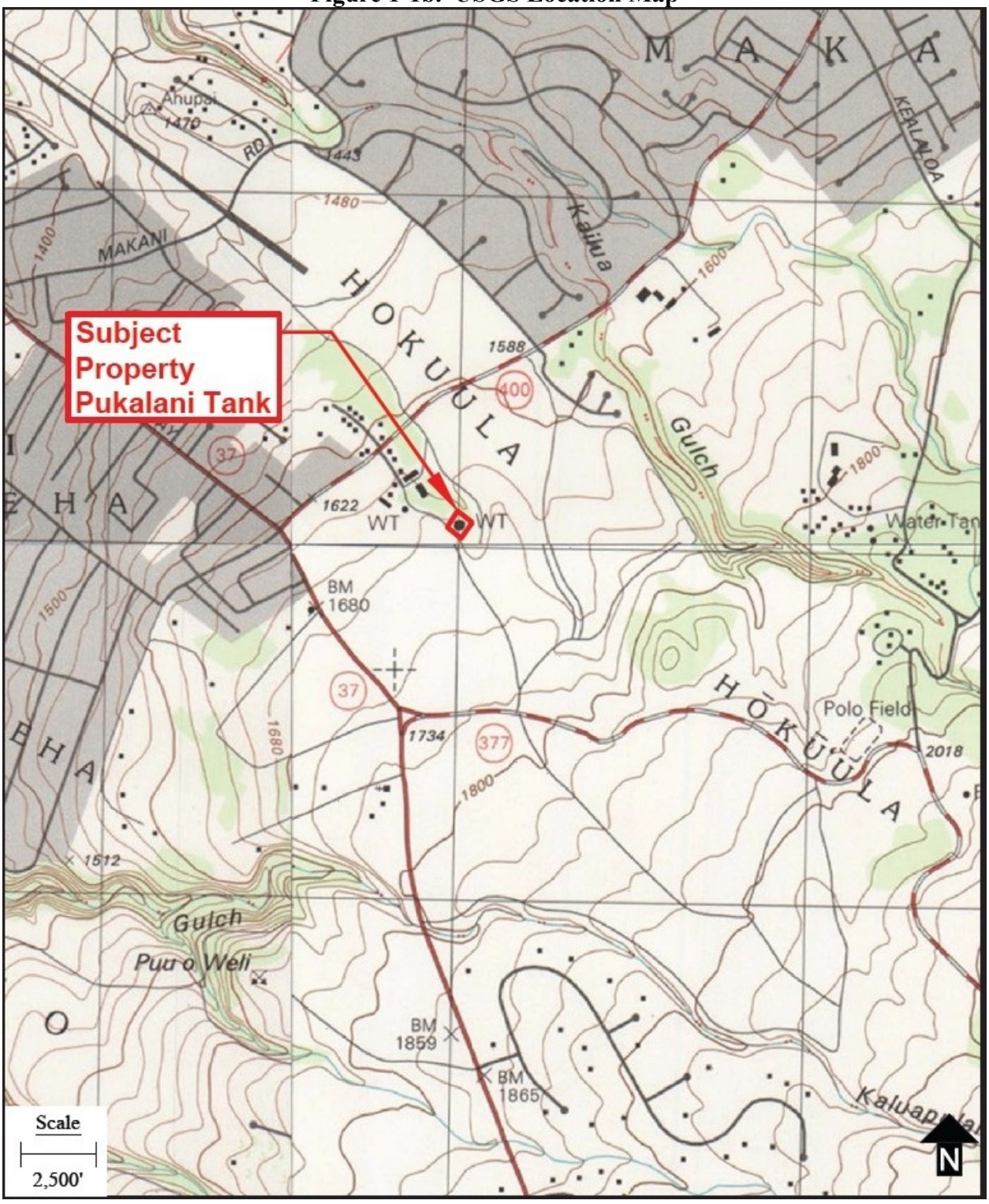
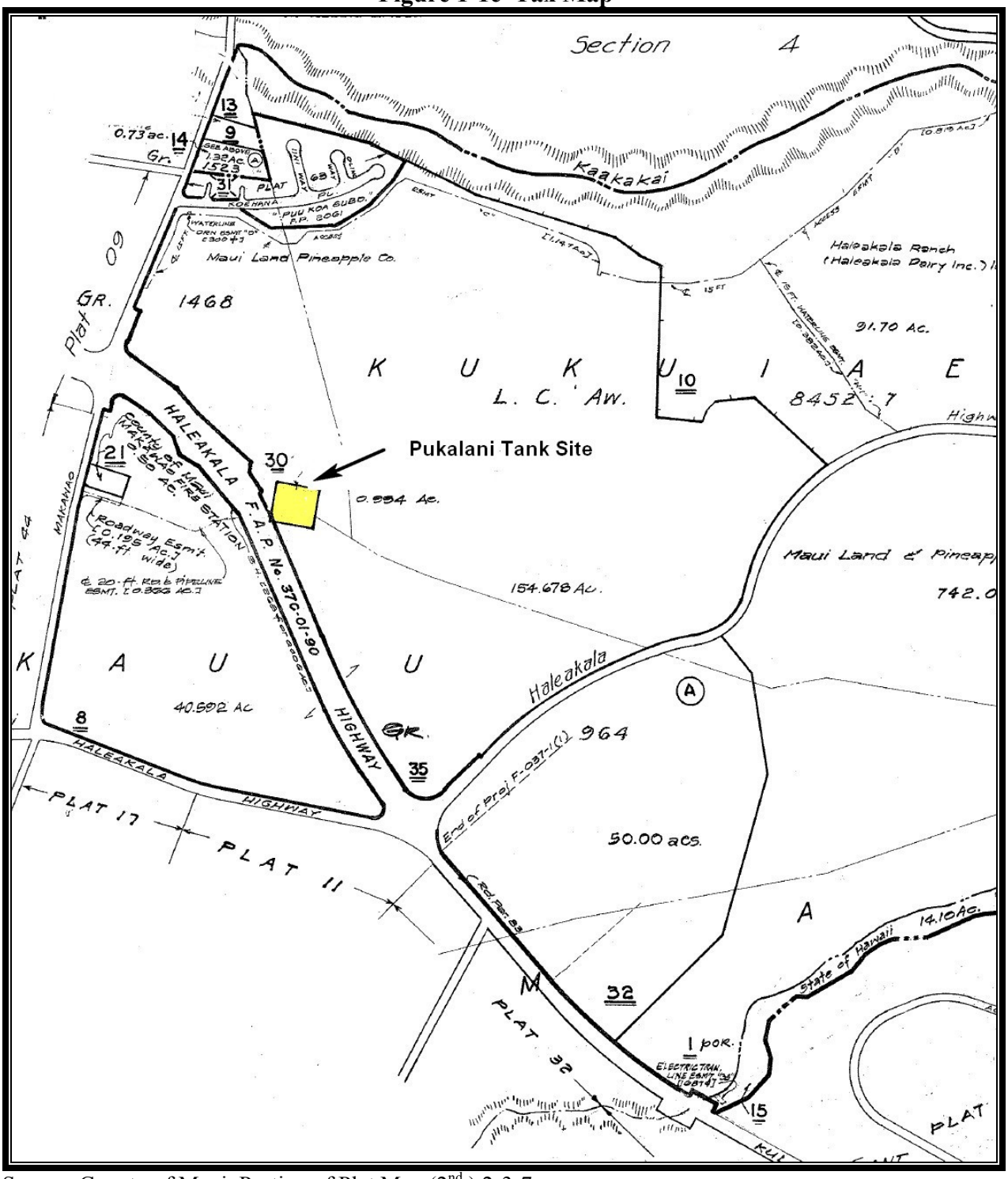


Figure 1-1c Tax Map



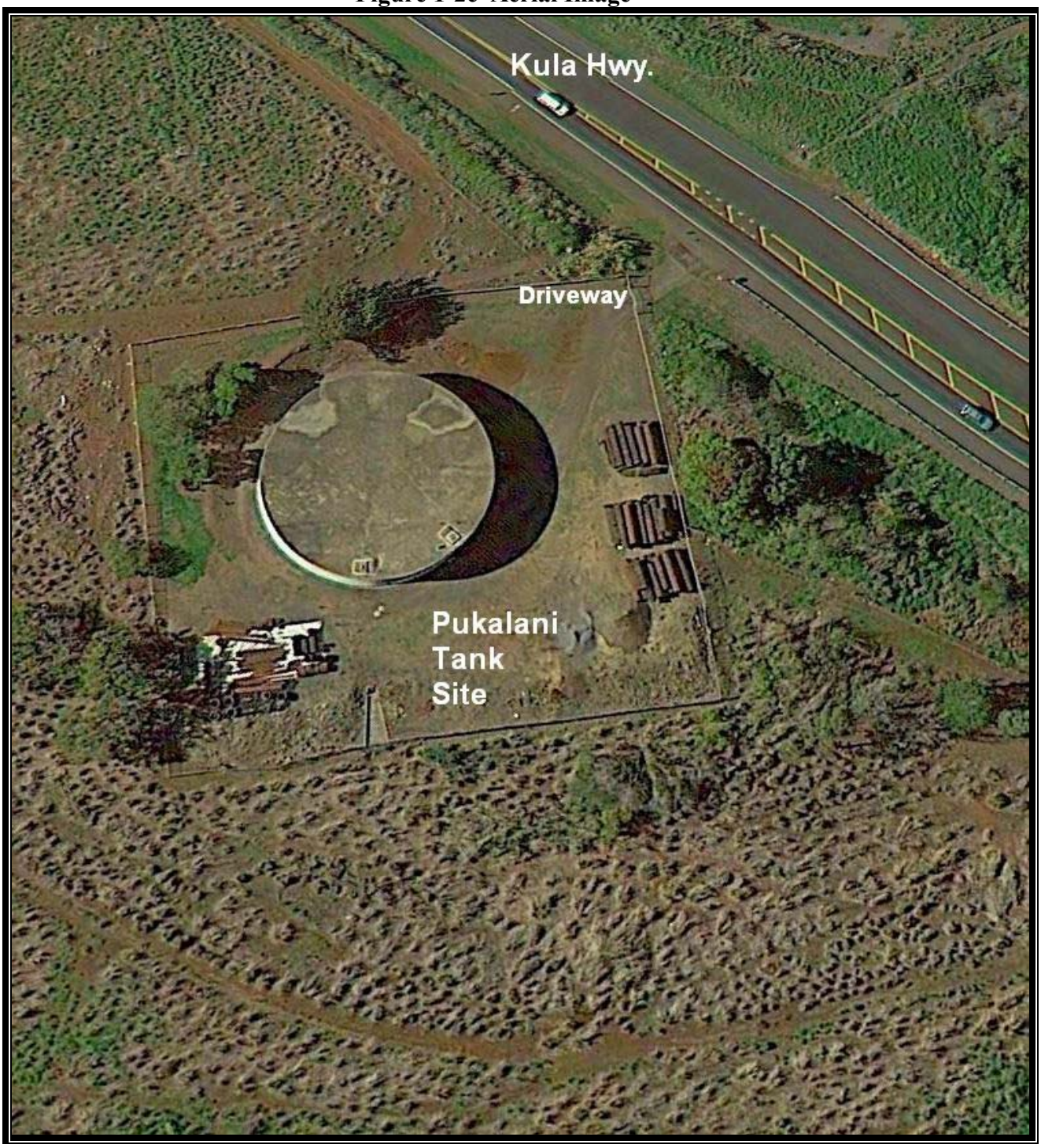
Source: County of Maui. Portion of Plat Map (2nd.) 2-3-7

Figure 1-2 Project Site Photos

1-2a Interior of Pukalani Tank Lot ▲

▼ 1-2b Right-of-way for Future Utility Corridor

Figure 1-2c Aerial Image



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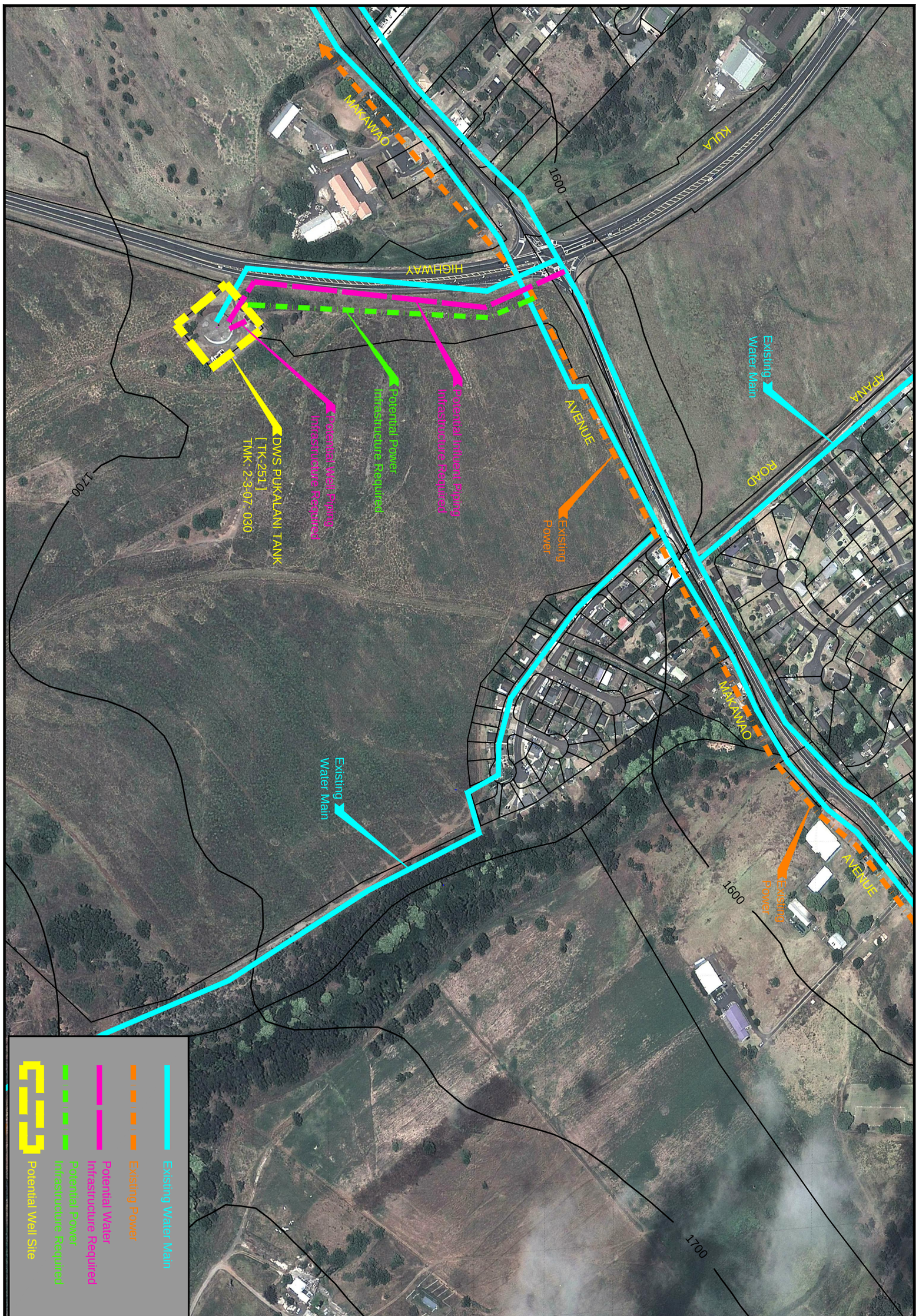


FIGURE 1-3

SITE ASSESSMENT STUDY
Upcountry Maui Exploratory Potable Water Well
Potential Well Site #1
DWS Pukalani Tank Site

CREATED: 06/22/2012
CREATED BY: SHU
REVISED:

SOURCES:
Aerial - Google Earth Dated 06/24/2011

SITE ASSESSMENT STUDY
UPCOUNTRY MAUI EXPLORATORY POTABLE WATER WELL
SCHEMATIC EXIST. WATER SYSTEM MAP

Prepared For: DLNR

CREATED: 06/26/2012
CREATED BY: KHAA
REVISED:

SOURCES:
- Distribution Maps dated 2010
- Maui DWS Correspondence

0' 800' 1600'

AKINAKA & ASSOCIATES, LTD.
CONSULTING CIVIL ENGINEERS

FIGURE
1-4

FILE: G:\DLNR11-02 Upcountry Maui Ground Water Exploratory Well\700 RSP\700 Reports\702 EA\04 Civil Exhibits\Figure 1-4 Upcountry Water System.dwg

LEGEND:
- WATER MAINS
- WATER FORCE MAINS
- SERVICE AREA
- WATER TANK
- [TK300] WATER TANK NO.
- WELL
- [4621-01] WELL NO.
- POTENTIAL WELL SITE
- FUTURE STATE WATER DEMAND

WAIKAMOI GULCH TH [4815-01]
WAIKAMOI TUNNEL [4814-01]
POLIPOLI TUNNEL [4019-01]
WAIKAUKANE TUNNEL [4020-01]
CORNWALL TUNNEL [4020-02]
MORTON TUNNEL [4020-03]
WAIKAAHI TUNNEL [4021-01]
KEAWALAPU [4152-01]
KAMAOLE [TK393]
PRESSURE BREAKER
KULA HIGHWAY
KEALAKAPU [TK407]
KEOKEA-WAIOHULI DEV. PH. 1 [TK416]
WAIOHULI [4422-01]
DHHL KULA RESIDENCE
WATER TANK #3 [TK413]
MAALAE [TK348]
NAALAE FARM LOTS [TK403]
KEALAHOU #3 [TK385]
PULEHUIHI #3 [TK366]
KULA GLEN [TK400]
PULEHU FARMS [4719-01]
KEALAHOU #4 [TK386]
KULA 1800 NO. 1 [4621-01]
KULA 1800 NO. 2 [4621-02]
OMAOPIO VACUUM PLANT [TK377]
PRESSURE BREAKER
OMAOPIO #2 [TK378]
SIELE [4720-01]
OMAOPIO-ESTE [4821-01]
KULA MEADOWS [4822-01]
PUKALANI GOLF [5021-01]
PUKALANI
PUKALANI TERRACE [TK266]
PUKALANI SITE
KING KEKAULIKE HIGH SCHOOL
HALEAKALA RANCH
KALAMA INTER. SCHOOL
MAKAWAO SYSTEM
MAKAWAO
COUNTY PARK
MAKAWAO AVENUE
MAKAWAO ELEM. SCHOOL
COUNTY BASEYARD
HARDEY
ALLENCASTRE
UPPER KAUPAKALUA [TK416] 0.5 MG TOP EL.=1519' BOT. EL. =1400'
KAUPAKALUA [5317-01]
KAUPAKALUA ROAD
OPAEPAU [TK265]
HAIKU SYSTEM
KAUHIKOA [TK277]
KAUHIKOA ROAD
PAUWELA FARMS 1 [5319-01]
SILVENO SPRING [5315-01]
FROM KAMOLE WEIR
SIMPSON MONITOR [5316-01]
KAMOLE [TK270] 0.3 MG TOP EL.=1126' BOT. EL. =1114'
BALDWIN AVENUE
HALIIMAILE [TK257]
HALIIMAILE [5220-01]
HALIIMAILE
HALEAKALA HIGHWAY
POOKELA [TK280] 2.0 MG TOP EL.=1830' BOT. EL. =1810'
PIIHOLO [5118-03]
PIIHOLO SOUTH [5118-04]
POOKELA MDWS [5118-02]
MALUHIA [5018-01]
POOKELA [TK256]
KOKOMO (abandoned) [TK258]
OLINDA ROAD
MALUHIA [TK255] 0.2 MG TOP EL.=2074' BOT. EL. =2050'
KEALALOA [TK287] 1.0 MG TOP EL.=2012' BOT. EL. =1992'
WEST OLINDA [TK254] 0.05 MG BOT. EL. =2464'
KULA 200 #1 [TK390]
KULA KOA [4818-01]
KULA 200 #2 [TK391]
EAST OLINDA [TK274]
WEST OLINDA [TK273]
WEST OLINDA, PRISON [TK272]
AWALAAG TUNNEL [5116-05]
FROM PIIHOLO WTP
OLINDA [TK253] 3.0 MG BOT. EL. =4136'
OLINDA SEDIMENTATION [TK252]
FROM UPPER KULA
COUNTRY ESTATES [TK276]
WAIHOU TUNNEL [4817-02]
LOWER KULA [TK285] 2.0 MG BOT. EL. =2778'
LOWER KULA SYSTEM
HALEAKALA HIGHWAY
KULA KAI [TK378]
LOWER KIMO #2 [TK373]
MIDDLE KIMO [TK282]
KULAMANU [TK414]
UPPER KIMO TANK [TK410]
UPPER KIMO #2 [TK370]
UPPER KIMO #1 [TK361]
OMAOPIO [TK392]
HALEAKALA ACRES [TK367]
UPPER KULA SYSTEM
HAPAPA [TK380]
KULA ORCHARDS [TK375]
PULEHUIHI [TK381]
KEALAHOU #1 [TK364]
KEALAHOU #2 [TK365]
WAIAKOA FARM LOTS [TK387]
MAUKA ESTATES II (FERNANDEZ) [TK404]
ALAE [TK362]
POLIPOLI [TK361] 0.012 MG BOT. EL. =3245' PRESSURE BREAKER
WAIOHULI [TK408] 0.5 MG TOP EL.=3592' BOT. EL. =3574'
WATER TANK #1 [TK411] 0.2 MG TOP EL.=3020' BOT. EL. =3000'
MIDDLE ROAD TANK [TK357]
WATER TANK #2 [TK412] 0.5 MG TOP EL.=2770' BOT. EL. =2750'
KEOKEA-WAIOHULI DEV. PH. 1 [TK416]

1.2 Purpose and Need for Project

The Hawai‘i DLNR is responsible for managing State-owned lands in ways that will promote the social, environmental and economic well-being of Hawai‘i’s people and for insuring that these lands are used in accordance with the goals, policies and plans of the State. The purpose of development of an exploratory well and conversion to a production well is to supply future State projects in the Maui Upcountry area with required water demand.

Sufficient potable water is a critical element for Department of Education facilities and Department of Hawaiian Home Lands (DHHL). Table 1-1 lists State projects in the Upcountry area and associated water demand (see Figure 1-4 for project locations).

Table 1-1. State Projects in Upcountry Service Area

PROJECT	WATER DEMAND (mgd)	YEAR DEMAND REQUIRED
Department of Education (DOE)		
Kalama Intermediate School, Renovate Existing		
Administrative Building	0.00050	2015
King Kekaulike High School, Balance of Increments	0.01800	2015
King Kekaulike High School, New 6-Classroom Bldg.	0.01080	2020
Makawao Elementary School, New 8-Classroom Bldg.	0.01440	2015
DOE SUBTOTAL	0.06530	
Department of Hawaiian Home Lands (DHHL)		
Kula Residence	1.50000	2015
DHHL SUBTOTAL	1.50000	
UPCOUNTRY MAUI TOTAL:	**1.56530**	

The DLNR does not operate a water system in Upcountry Maui, and instead proposes augmentation of the supply within the MDWS system. There is currently, and for the foreseeable future, a shortage of water in the Upcountry District. Water supply still relies on surface water intakes and treatment plants, including Olinda Water Treatment Plant (WTP), Piiholo WTP and Kamole WTP. Well sources include Haiku Well, Kaupakalua Well, and the largest supplier, Pookela Well, which can produce 1.3 mgd. Even with all these sources, the reliable production capacity accounting for extended dry periods of about 2.0 mgd, leaving a shortfall. Requests for water service have far exceeded the existing supply. The MDWS maintains an “Upcountry Water Service Priority List for Building Permit Applications, Subdivision & Water Service Requests.” As of June 30, 2011, there were 1,450 requests pending, dating back to October 1996. According to MDWS, this priority list translates into a backlog of approximately 1.5 mgd.

There are no additional surface sources available, and in fact the supply from existing stream sources is likely diminish due to competing agricultural and beneficial instream uses. Additional

groundwater development is vital to supplying State projects with adequate water supply and assisting MDWS is supplying its customers.

1.3 Project Background and Water System Details

The Maui County Department of Water Supply (DWS) is responsible for planning and operating water sources and systems that implement the County's General Plan. Island-wide, MDWS operates systems in four basic districts on the Island of Maui, with about 35,700 services. MDWS currently relies on groundwater for about 70 percent of its supply and stream water for about 30 percent. Each source has its advantages and disadvantages. The use of streams for potable water requires treatment, competes with agriculture, and may harm beneficial instream uses, while groundwater development faces high pumping costs, agricultural pollutants in many areas, and expensive new infrastructure.

According to the *Maui General Plan 2030*, the water systems of the Upcountry area serve the community plan region of Makawao-Pukalani-Kula and the Haiku portion of the Paia-Haiku community plan region (Figure 1-4). As discussed in the previous section, the Upcountry District has been supplied primarily by surface water sources; however, groundwater sources, particularly the Pookela Well, are available to supplement service the Upcountry system during periods of drought. The Upcountry District is one of the more complex MDWS areas, with its separate systems, range of source and service area elevations, and heavy reliance on surface water, making it vulnerable to drought conditions. The Upcountry District consists of the inter-connected Upper Kula System, the Lower Kula System and the Makawao System. The service area for the Makawao System is Haiku, Haliimaile, Makawao and Pukalani.

The Pookela Tank is the major hub for the water system. The MDWS has the ability to move water from the Haliimaile region to the Lower Kula System. The typical operation of the system consists of the Kamole WTP pumping water up to the Pookela Tank. The Pookela Tank then services the Makawao region, and supplies water to the Pukalani Tank and Haliimaile Tank. The Pookela Tank is also connected to the Upper Kaupakalua Tank. However, there are pressure breaks that prevent Pookela water from reaching the Upper Kaupakalua Tank. The Pookela Tank and Upper Kaupakalua Tank service the Haiku area, with the Upper Kaupakalua Tank being the primary source and the Pookela Tank as a backup. The source for the Upper Kaupakalua Tank is the Kaupakalua Well. The Pukalani Tank (which is also the proposed host site for the well) services the Pukalani region, and the Haliimaile Tank services the Haliimaile region. The Pookela Tank also pumps to the Maluhia Tank, which services the upper Makawao region and supplies the Kealaloa Tank. The Maluhia Tank pumps to the West Olinda Tank, then to the Lower Kula Tank, which services the Olinda and Lower Kula regions. The Upper Kula system is serviced by the Olinda Tank, whose source is the Olinda WTP, and services Olinda and Upper Kula. The system is also interconnected by gravity mains from the Olinda Tank, down to the Lower Kula Tank, then to the West Olinda Tank, the Maluhia Tank and finally back down to the Pookela Tank. In instances where upper elevation stream flows are good, the system can be operated from higher elevation to lower without requiring pumping.

The future DOE Projects listed in Table 1 are located within the Makawao System, and the future DHHL Kula Residence is serviced by the Upper and Lower Kula systems. Each site's respective water service tank is listed below (see Figure 1-4):

- Kalama Intermediate School – Pookela Tank
- Makawao Elementary School – Pookela Tank
- King Kekaulike High School - Kealaloa Tank
- DHHL Kula Residence - Polipoli Tank, Water Tank #1 and Water Tank #2

A new well at the Pukalani Tank site would present minimal problems of integration into the existing MDWS system, since the Pukalani Tank is already on this site. As explained above, although the Pukalani Tank services only the Pukalani region, the source of its water is the Pookela Tank. Development of a new source which feeds the Pukalani Tank would relieve the Pookela Tank, allowing it to provide more water to the remainder of the Upcountry District. Metered consumption data from MDWS for Pukalani for calendar years 2007 to 2011 indicate that the highest monthly usage ranged from 1.01 to 1.23 mgd, with yearly averages ranging from 0.91 to 1.05 mgd. Given an expected yield of 0.72 to 1.0 mgd for the proposed new well, this amount of Pukalani consumption could be relieved from other Upcountry District sources.

1.4 Project Components and Budget

The project consists of an exploratory water well drilled with a 600 HP motor that would have a 26-inch diameter to about 50 feet below mean sea level (msl), with a 40-inch diameter to 100 feet below msl. The annular space between the 20-inch ASTM A-53 well casing and the bore would be properly grouted and sealed to prevent contamination.

If exploratory well testing indicates an adequate quantity of water of acceptable quality, it will be converted to a production well with an expected yield of between 500 to 700 gallons per minute, with a daily yield of approximately 0.72 to 1.0 mgd. Appurtenant facilities will include a control building, valves, water transmission piping, access driveway, electrical facilities, storm drains, and fencing. Some new on-site grading would be required to accommodate the construction of the appurtenant facilities.

The budget for the exploratory well project, which is funded by the Hawai‘i State DLNR, is $1.5 million. Design would be finished and construction would begin within six months of completion of the EA process. Drilling and testing of the well would take approximately one year or less.

1.5 Alternatives Considered

1.5.1 Exploratory Well Alternative

This refers to the proposed project, which is described in Section 1.4, above.

1.5.2 Alternative Water Well Sites

The feasibility of alternative well sites was considered during the planning process for the exploratory well. Akinaka & Associates, Ltd. was retained by DLNR in May 2012 to prepare a Site Assessment Study for six potential exploratory well sites in the Upcountry region based on several criteria (see Figure 1-4)[1]. Four of the sites were identified by DLNR and two by MDWS. The purpose of this study was to evaluate the attributes of the six sites and to provide a recommendation based on a comparative analysis of political boundaries, anticipated hydrogeological conditions, well drilling operations, infrastructure and integration, and environmental considerations. Factors were weighted based on their importance. Table 1-2 identifies and compares the sites on these measures.

Table 1-2. Alternative Well Site Comparison Matrix

Attribute Characteristic / Rank	SITE 1 Pukalani Tank	SITE 2 Haleakala Ranch	SITE 3 County Park	SITE 4 County Baseyard	SITE 5 Hardey	SITE 6 Allencastre
Political Boundaries	1	2	4	2	5	5
Weighting Factor	2	2	2	2	2	2
Weighted Total	2	4	8	4	10	10
Hydrogeological Cond.	1	2	3	3	3	3
Weighting Factor	1	1	1	1	1	1
Weighted Total	1	2	3	3	3	3
Well Drilling Operations	1	2	5	5	2	2
Weighting Factor	3	3	3	3	3	3
Weighted Total	3	6	15	15	6	6
Infrastructure / Integration	1	4	3	2	3	5
Weighting Factor	1	1	1	1	1	1
Weighted Total	1	4	3	2	3	5
Environmental	3	2	3	5	1	6
Weighting Factor	2	2	2	2	2	2
Weighted Total	6	4	6	10	2	12
Total Score (sum of ranks)	13	20	35	34	24	36
Overall Rank	1	2	5	4	3	6

The conclusion was that the Pukalani Tank site represented the optimal site for development of an exploratory well. The site presents no political boundary issues, provided an agreement by DLNR and MDWS is reached. The site has the potential to produce sufficient water and the required infrastructure to support well drilling operations. The existing 1.0 MG Pukalani Tank is

1 Study is available upon request of DLNR.

present, greatly simplifying integration of the new source into the existing MDWS System, although new electricity transmission would be required. The Pukalani Tank site also integrates well into the Upcountry System from an operational perspective. No cultural or biological resources appear to be present. One concern of this, and virtually all sites in the Makawao area, is potential contaminants from former pineapple cultivation. However, hydrologists concluded that based on the context, there is only a limited chance that such contaminants pollute the basal lens in this area. The Pukalani Tank site presents the best opportunity to quickly introduce a new source into the existing strained MDWS system with minimal infrastructure costs and environmental impacts.

1.5.3 Surface Water, Catchment, Wastewater Re-Use, and Desalination

Surface water is currently the principal source for the water systems in the Upcountry District, as discussed in Section 1.3, above. Advantages of this source are low ongoing costs to acquire the water at existing stream intakes and the use of gravity to distribute the water to storage reservoirs, which minimizes energy cost. However, compliance with State and federal requirements for surface water necessitates costly water treatment plants. Furthermore, these sources are highly susceptible to drought, which reduces water supply at times when it is often most needed. Use of surface water for potable water competes with agricultural uses. Also, it is expected that diversion of stream water will need to be reduced in the future to accommodate beneficial instream uses. For all these reasons, there is little or no possibility to expand surface water collection for the Upcountry District and to supply potable water for the future State facilities that require this water.

Rainfall catchment is used in limited parts of Maui County where rainfall is sufficient and County water service is not available. Although catchment does provide a potable water source of last resort, it has many drawbacks, including high maintenance costs and susceptibility to microbiological and chemical contamination. Sources of these contaminants vary from dead animals in the storage tank to materials eroded or leached from roofs, gutters and paint. The State Department of Health (DOH) recommends using catchment water for non-consumptive needs and obtaining drinking or cooking water from regulated public water systems and/or purchased bottled drinking water. Because of the difficulties associated with treating catchment water to acceptable standards, DLNR does not consider catchment water appropriate for integrating with the MDWS system and/or utilizing for State projects.

Wastewater re-use can be an important source of water. The County of Maui enacted a mandatory recycled water use ordinance in 1995, and in 1997 became the only county in the State to establish rules for recycled water use. Soon after, the Kihei and Lahaina Wastewater Reclamation Facilities upgraded to produce R-1 quality recycled water for its customers. The original impetus behind the development of Maui County's water reuse program was concern that Maui's effluent disposal practices were causing environmental problems, but enhancing water supply has since become a driving factor. The Wastewater Reclamation Division uses recycled water from all five of its facilities. Distribution systems have been developed in South Maui and West Maui. South Maui has the most complete distribution system at this time and as a

result, the most water reuse projects. The South Maui system now provides recycled water to eighteen separate projects, with more scheduled to connect to the distribution system in the near future. Uses include landscape irrigation, agricultural irrigation, fire control, industrial cooling, composting, construction activities, and toilet and urinal flushing.

The County of Maui's Department of Environmental Management and Division of Wastewater Reclamation, assisted by the Maui Wastewater Community Working Group, has a goal of 100 percent recycling of Maui's wastewater. Reclaimed wastewater is utilized in the one Upcountry area with a wastewater treatment plant, in Pukalani. The plant, which began operation in 2011, provides water for irrigation of the Pukalani Golf Course with R-1 reclaimed wastewater, replacing the former Pukalani irrigation well source. However, it would be infeasible to utilize recycled wastewater recycling for domestic water supply for State projects in the Makawao and Kula areas, which lack a municipal wastewater treatment plant and are distant from and at a higher elevation than existing wastewater plants at Kahului, Lahaina and Kihei.

Similarly, DLNR and MDWS considers desalination, an energy-intensive and expensive process, to be unjustified for cost reasons for serving Upcountry State projects, where desalinated water would need to be pumped at least 1,200 feet uphill.

1.5.4 Optimize Distribution of Existing Potable/Non-Potable Supplies

An existing irrigation system in the Upcountry District shares much infrastructure with the potable water system. The Upcountry Maui Irrigation System links together infrastructure originally created in 1912 as a potable water system that served the water needs of upland region of Olinda and Kula that diverted stream flows from several streams. Historically, water storage to meet drought-period water demand has been necessary to meet both domestic and agricultural needs. As noted in the Maui County Water Use and Development Plan's *Upcountry District, Final Candidate Strategies Report* (Upcountry Water Advisory Committee 2009), such objectives conflict with one another, particularly during droughts, and this presents problems for future domestic water demand. Some conflicts can be remediated by additional storage. The 100-million gallon Kahakapau reservoir addition to the Upper Kula system, built with federal aid and targeting agricultural water needs, benefited both domestic and agricultural users. However, having mostly separate source, storage and transmission systems for agricultural water and domestic water would be optimal.

A modern and efficient agricultural water system is gradually under development by the Hawai‘i Department of Agriculture in conjunction with MDWS, the USDA, Natural Resources Conservation Service, and the Olinda-Kula Soil and Water Conservation District. The full cost of the system, which would benefit over 170 farmers with approximately 500 acres of unique, high value truck and ornamental crops, was estimated at $9.274 million in the State's Agricultural Water Use and Development Plan (AWUDP). It will ultimately provide Kula farmers with a source of untreated surface water by bypassing the treated municipal water supply with a parallel pipeline system, greatly reducing water rates for farmers. It will also benefit the MDWS and domestic water customers with the elimination of treatment at the Olinda Water

Treatment Facility for one million gallons per day of water that is used by agriculture. Since 2000, design and construction have resulted in the installation of three miles of main distribution pipeline and four miles of lateral pipeline. When completed, the agricultural water distribution system will include nine miles of main pipeline and 20 miles of lateral pipeline. In 2012, a $1.4 million funding appropriation was released for additional pipeline system construction.

Planners for MDWS are working under the presumption that as non-potable water becomes available, it will displace the use of potable water that is now used for agricultural purposes. Factors such as pricing and policies on drought-period availability of water from the non-potable line will greatly affect the balance of domestic and agricultural water use.

Rather than an alternative for domestic water supply for State projects, the ultimate construction of a mostly independent agricultural water system is a parallel strategy that is being vigorously pursued by a number of cooperating parties.

1.5.5 Conservation/Demand Side Strategies

Demand-side management (DSM) encompasses actions taken by a utility to promote conservation by the utility's customers. This is now a critical strategy in resource planning for water utilities. Although such actions often have substantial costs, they provide net savings relative to the costs the utility and its customers would otherwise incur to develop and operate new supply resources. This is particularly apt for the Upcountry District, where new supplies involving pumped groundwater are inherently costly. The State's Water Resources Protection Plan outlines the following State actions:

- Establish strategies for increasing system efficiency and for managing higher water demand associated with land use and planned development.
- Compare the total water demand projection associated with land use plans and zoning, to assess the need to evaluate/revise of land use policies (e.g., a total build-out scenario).
- Seek the optimization of infrastructure to minimize local stress on aquifers and increase confidence in groundwater modeling of sustainable yields.
- Increase drought preparedness and awareness, and implement Hawaii Drought Plan recommendations for county actions.
- Implement economic incentives for resource stewardship, conservation, and reuse.
- Use alternative sources where possible, monitor agricultural demand for potable water and encourage the development and use of alternate non-potable agricultural water supply.
- Gather information on community values and expectations for water use.
- Encourage local stakeholder partnerships to implement County WUDP recommendations.

DLNR has worked with State agencies requiring water to plan the location, scope and facilities in their projects to meet these goals. Each State agency has strategies to conserve water. Recent

DHHL developments at La‘i‘ōpua on the Big Island, for example have implemented a suite of measures, including planting xerophytic native landscaping, installing low-flow toilets and showerheads, dual-flush toilets and providing information to new residents concerning the importance of water conservation. In some areas, DHHL will also be considering grey-water re-use systems for indoor water conservation, and rain-barrels for outdoor water conservation.

According to MDWS, current conservation activities on the County level include the following:

- 100 percent customer metering. All customer accounts are metered.
- Meter repair/replacement programs. Testing, repair and replacement of water meters are done on a systematic basis.
- Water analysis/reports. The difference between metered source production and metered sales to consumers is monitored to determine whether to conduct leak detection.
- Leak detection programs. MDWS examines its system for leaks in transmission and distribution pipes using special equipment designed for this purpose. In addition to MDWS leak detection procedures, contractors are available to provide services to MDWS to conduct specialized leak detection surveys using several techniques.
- Tank overflow controls/alarms. These facilities prevent system losses from unnecessary overflows.
- Voluntary water restriction notices. MDWS requests voluntary water conservation during dry periods and emergency water outages.
- Free water conservation devices and tests. MDWS provides certain free items available to the public, including shower heads, faucet aerators, and leak detection dye tablets (to check toilets for leaks).
- Public education outreach/education programs. Information on its website, exhibits in trade shows, the County fair, and public schools, among other venues, allow MDWS to share information about the potable water system and water conservation.
- Landscape education. The 2011 County of Maui Landscape and Gardening Handbook was developed by MDWS as a resource to help customers save water in the yard and learn about what and how to plant in certain areas. It provides information on xeriscaping, lists of native plants appropriate for each plant zone, and other useful resources.
- Education on water efficient appliances. MDWS encourages its customers to replace their old, inefficient fixtures and appliances such as washing machine, dishwasher and toilets with water efficient models.
- Free pre-rinse nozzles. Replacement of high water use pre-rinse spray nozzles with 1.15 gpm spray nozzles are also encouraged. These are available to restaurants and food establishments free of charge.

Existing and future water conservation programs are expected to reduce the growth of future water demand. Rather than an alternative to developing new sources, water conservation is seen by MDWS as an integral and ever-increasing part of its strategy to provide safe, affordable and reliable water service to the island of Maui in a sustainable and financially secure manner.

1.5.6 Interconnection of Upcountry and Central Water Systems Alternative

As a general rule, interconnection of systems can provide potential mutual benefits in terms of cost and reliability. The Maui County Water Use and Development Plan's *Upcountry District, Final Candidate Strategies Report* (Upcountry Water Advisory Committee 2009) discussed the potential to implement this alternative as a method to increase the supply and improve the reliability of the Upcountry District.

> "As originally conceived, interconnection of these systems could provide backup capacity for each system and possible economic benefits. Proponents posited that the groundwater sources of the Central system could provide water to the Upcountry system in times of drought and the surface water sources of the Upcountry system could provide an economical source of water for the Central system when water is plentiful. Investigation of this strategy, however, showed that interconnection, by itself, would not eliminate the need to provide new sources of water for both systems. Central resources are already too constrained to provide water to the Upcountry system for any extended periods of drought. The opportunities available to use surface water sources to provide economical water supply to the Central system are limited. The costs of interconnection are high due to the high costs of extensive transmission line construction. Interconnection could provide incremental value to both systems to the extent that this is possible without major transmission line construction. One opportunity would be limited interconnection along Baldwin Avenue where distribution lines from the two systems are in fairly close proximity. Another option would be possible if there would be transmission extensions from the Central District system to develop sources in the Haiku aquifer."

Although study of the issue of interconnection is warranted for optimizing Upcountry District water service in certain locations, it does not provide a feasible alternative to development of a well to supply domestic water for the subject State projects.

1.5.7 Selection of Project Alternative

DLNR has determined that the most rational and efficient strategy for dealing with the need for reliable supply for State Projects in the Upcountry District is to construct and exploratory well at the Pukalani Tank site, and if the well provides water of sufficient quantity and acceptable quality, to convert the exploratory well to production. The decision to advance this alternative was based on satisfaction of the following criteria:

- Based on its location in the aquifer, the well is expected to water of a quality that meets MDWS requirements at a rate of between 0.7 and 1.0 million gallons per day.
- No substantial adverse biological, cultural, historical, socioeconomic or environmental effects are expected.
- No alternative sources or strategies separate from those already being

implemented would provide a practical or economical source of potable water in this service area.

1.6 Consistency with Government Plans and Policies

The project is highly consistent with government plans and policies, which in general call for water systems that meet the needs of residents, support planned growth, and minimize environmental degradation. The following sections discuss consistency with key plans.

1.6.1 Hawai‘i State Plan

The Hawai‘i State Plan was adopted in 1978. It was revised in 1986 and again in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended). The Plan establishes a set of goals, objectives and policies that are meant to guide the State's long-term growth and development activities. The proposed project is consistent with State goals and objectives that call for increases in employment, income and job choices, and a growing, diversified economic base extending to the neighbor islands.

The sections of the Hawai‘i State Plan most relevant to the proposed project are centered on the theme of facility systems. The following objectives and policies are taken from the section dealing with water development.

- Objective a): Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational and other needs within resource capacities.
- Objective b: To achieve the facility systems water objective, it shall be the policy of this State to:
    (1) Coordinate development of land use activities with existing and potential water supply.
    (2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.
    (3) Reclaim and encourage the productive use of runoff water and wastewater discharges.
    (4) Assist in improving the quality, efficiency, service and storage capabilities of water systems for domestic and agricultural use.
    (5) Support water supply services to areas experiencing critical water problems.
    (6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.

The proposed project supports all relevant objectives and policies of the Hawai‘i State Plan.

1.6.2 Hawai‘i State Water Plan

The State Water Code, Chapter 174C, HRS, recognizes the need for a program of comprehensive water resources planning to address the problems of supply and conservation of water and establishes the Hawaii Water Plan as the guide for implementing this policy. The Hawai‘i Water Plan consists of five constituent parts: 1) a Water Resource Protection Plan (2008) which is prepared by the Commission on Water Resource Management (CWRM); 2) a Water Quality Plan (1990) which is prepared by the Department of Health; 3) a State Water Projects Plan (2003), which is prepared by the Engineering Division of the Department of Land and Natural Resources; 4) an Agricultural Water Use and Development Plan, which is prepared by the Department of Agriculture (2004); and 5) Water Use and Development Plans prepared by each separate county, which, for Maui, was developed in 1990 and is in the process of being updated (see Section 1.6.3, below).

The Water Resource Protection Plan and the Water Quality Plan provide the overall legal and policy framework that guide the development, conservation, and use of water resources. The State Water Projects Plan and Agricultural Water Use and Development Plan provide information on State and agricultural water needs and development plans. All this information is then integrated into the County Water Use and Development Plans (WUDP), which set forth the broad allocation of land to water use within each county.

Water Resource Protection Plan (WRPP)

The objective of the Water Resource Protection Plan (WRPP) is to protect and sustain ground and surface water resources, watersheds, and natural stream environments statewide. Such protection requires a comprehensive study of occurrence, sustainability, conservation, augmentation and other resource management measures.

Specifically, the State Water Code provides that the WRPP shall include, but not be limited to:

- Nature and occurrence of water resources in the State;
- Hydrologic units and their characteristics, including the quantity and quality of available resource, requirements for beneficial instream uses and environmental protection, desirable uses worthy of preservation by permit, and undesirable uses for which permits may be denied;
- Existing and contemplated uses of water, as identified in the water use and development plans of the State and the counties, their impact on the resources, and their consistency with objectives and policies established in the water resource protection quality plan; and
- Programs to conserve, augment, and protect the water resource.

The 556-page plan presents an abundance of background information, data, policies and recommendations. Of most relevance for the proposed action are the following goals:

- Foster the collaborative development, implementation, and update of short- and long-range plans for conserving and augmenting water supplies.
- Promote coordination and cooperation among agencies and private entities.
- Provide guidance, assistance, and oversight in the establishment, development, and implementation of statewide water conservation and augmentation programs.
- Encourage coordination between conservation activities and augmentation planning.
- Promote the utilization of the best available information and technology in planning and implementing conservation and augmentation projects.
- Provide the regulatory and planning framework for integrating resource conservation and augmentation into a comprehensive water management program.
- Support county and community-based conservation efforts by providing information resources and advisory assistance.
- Encourage water conservation and use of alternative water sources, whenever possible, through comments provided during land use planning and permitting review.

In relation to the proposed project, these goals are being met through development of a groundwater resource in a sustainable manner by an agency for use in necessary public projects that will incorporate water conservation measures in the form of low-use fixtures, xeric landscaping, etc.

Water Quality Plan (WQP)

The Department of Health (DOH) is responsible for the preparation of the Water Quality Plan (WQP). The WQP outlines the regulations, standards, and resource management policies that define the quality to be maintained in ground- and surface-water resources, such as:

- Federal/state/county goals, objectives, and policies related to water quality.
- Water quality criteria for designation of water management areas.
- Water quality standards, monitoring requirements and enforcement provisions.
- The identification of any substances which DOH reasonably believes may present a danger to the water quality of the State.

The DOH is currently undertaking numerous program efforts that will contribute to the update of the WQP. Such programs include the Source Water Assessment Program (SWAP), and various other water quality efforts, including the surface water studies regarding total maximum daily loads and identification of impaired water bodies. Results of these ongoing program efforts, such as SWAP, will be outlined in an updated WQP.

The proposed Pukalani Tank Site exploratory well project is consistent with the WQP in that it is expected to provide a source of high-quality groundwater for potable use that substitutes for surface water of lesser quality that may have more beneficial instream or agricultural uses that do not require treatment.

State Water Projects Plan (SWPP)

The Engineering Division of the DLNR has accountability for State projects and is responsible for the preparation of the State Water Projects Plan (SWPP) in conjunction with CWRM and other State agencies. The purpose of the SWPP is to provide a framework for planning and implementation of water development programs to meet projected demands for State projects over a 20-year planning horizon. The objective of the SWPP is to review current and future state water projects to insure orderly authorization and development of the State's water resources. The SWPP includes:

- An inventory of existing State wells, stream diversions and water systems;
- Identification of proposed States projects/developments;
- Assessment of future water demand projections;
- A water development strategy, strategy implementation and recommendations; and
- Incorporation of State agricultural water needs as outlined in the Agricultural Water Use and Development Plan.

Each State department is surveyed to inventory existing and proposed State sponsored projects, associated water requirements by island and hydrologic unit, and proposed sources to meet the demand. Agency plans for future source development should be coordinated with DLNR and integrated within the County Water Use and Development Plans.

As shown in Table 1 in Section 1.2, above, State Projects in Upcountry Service Area, DLNR has identified in coordination with the Department of Education and the Department of Hawaiian Homes Lands projects over the next two to seven years that have a combined water demand of 1.5653 mgd. The project to build a well at Pukalani Tank is highly consistent with fulfilling the objectives of the SWPP.

Agricultural Water Use and Development Plan (AWUDP)

The Hawai‘i Department of Agriculture (HDOA) is responsible for the preparation of the Agricultural Water Use and Development Plan (AWUDP), which originated as a response of the State Legislature to the closing of large sugarcane plantations in the 1990s. Agricultural lands are extensive and can require significant quantities of water to maintain productivity.

The AWUDP (current plan dates from 2003) is intended to promote the agricultural self-sufficiency of the State and protect this important State resource. The major objective of the AWUDP is to develop a long-range management plan that assesses State and private agricultural water use, supply and irrigation water systems. The plan is intended to be a master irrigation inventory plan which identifies demand and system rehabilitation needs and prioritizes system repair. It includes identifying options for development of additional and alternative irrigation water sources and for conserving irrigation water and/or managing the uses to reduce the total

irrigation water demand. It also develops strategies encompassing both demand management and resource development options.

As discussed in Section 1.5.4, the one vital project of concern in the subject area is the Upcountry Maui Irrigation System. A number of agencies have cooperated to gradually fund the $9.274 million project, which requires over 29 miles of main or lateral pipeline. It will benefit over 170 farmers with approximately 500 acres of unique, high value truck and ornamental crops. Bypassing the treated municipal water supply with a parallel pipeline system will greatly reduce water rates for farmers and also benefit the MDWS and domestic water customers with the elimination of treatment at the Olinda Water Treatment Facility for one million gallons per day of agricultural water.

The proposed exploratory well project is consistent with the AWUDP because it decouples the supply of water for needed State projects in the area from sources that are also required for agricultural use.

1.6.3 Maui Water Use and Development Plan

State law requires each county to prepare, periodically update, and adopt by ordinance a Water Use and Development Plan (WUDP) to serve as the long-range planning blueprint for all uses of water in each county. Each plan must be approved by the CWRM. Each county in Hawai‘i prepared and approved a WUDP for the year 1990. The 1990 Maui County WUDP is the latest plan that has been completely adopted.

The WUDP is meant to aid CWRM in granting permits for water use and designating water management areas, as well as serving as a reference document of current and future water resource conditions. It includes an inventory of existing water uses and developments by hydrologic units, addresses future land uses and related water needs, and is consistent with State and County land and water policies. This plan also guides DWS in future operations and to identify the improvements and facilities required to continue to provide safe, affordable and reliable water service to the island of Maui in a sustainable and financially secure manner.

The need for additional water supply in the Makawao area was discussed in detail in the 1990 Plan. Source, storage and transmission improvements including upgrades to the Kamole and Olinda Treatment Plant, a possible well field at Haiku, new reservoirs at Waiakamoi and other locations, and a new 36-inch transmission pipeline were discussed. However, there was no specific reference to State projects in the Makawao area and the source of required water. Some of these improvements were conducted, but the context of water supply in the Upcountry area has changed substantially since that time.

The MDWS is in the process of updating its WUDP. Maui County requires a WUDP update each time the County General Plan is amended or revised. The new Maui County WUDP is being prepared in six sections according to geographic district. The *Upcountry District Final Candidate Strategies Report* (current draft dated July 27, 2009) is expected to be the final

document draft addressing the Upcountry Department of Water Supply District until a complete Water Use and Development Plan that includes all six districts is compiled.

According to the report:

> "The WUDP process for the Upcountry district began with identification of planning objectives. These objectives include a broad range of considerations including water service availability, reliability, quality, cost and broader considerations including protection of streams, water resources, cultural resources, sustainability, equity, viability, and conformance with general and community plans. Strategies to meet future water needs were evaluated with respect to each of the planning objectives. Several programs and 'resources' were incorporated into the strategies to address particular objectives as necessary."

Water consumption for the MDWS Upcountry District system was expected to grow from 7.2 million gallons per day (mgd) in 2005 to 8.8 mgd in 2030. It was noted that the major sources of the inexpensive water for the region, the Upper Kula and Lower Kula surface water systems, are finite. In the drier summer months and during droughts, they are already at their limits. Additional reservoir capacity can assist but not solve the problem, and any new growth would require substantially more expensive resources, even with more emphasis on conservation.

Complicating the issue is the fact that surface water, which is derived from stream diversion, must be allocated between municipal uses, agricultural uses and the need for restoration of water to East Maui streams. It is very likely that in the future, less water will be available for both municipal and agricultural purposes, as amendments are made to the streams' Instream Flow Standards.

To accommodate the need for potable water, a series of strategies that were narrowed into "final candidate strategies" were characterized and analyzed:

A. Incremental Basal Well Development
B. Expansion of Raw Water Storage Capacity
C. "Drought-Proof" Full Basal Well Backup
D. Improved Kamole Water Treatment Plant Capacity
E. Limited Growth With Extensive Conservation Measures

After analysis, the report went on to provide a plan that included recommendations for short-term resources, long-term resources, regulatory mechanisms, resource protection and restoration, energy efficiency and energy production, and water allocation policies. The integration of all of these strategies can help achieve a balance between the objectives of minimizing cost, providing reliable water service and enhancing the sustainability of the system operations. Although the scope of the recommendations are too wide-ranging to discuss in this EA, the plan to provide a well at the Pukalani Tank Site for the additional demand that will be placed on the system by

new or expanded State of Hawai‘i facilities and developments would seem to be highly consistent.

In particular, it fulfills one of the short-term resource augmentation recommendations to acquire new wells installed by non-DWS developers as appropriate. Such wells must comply with MDWS standards and would provide resources that will be of long term value to the MDWS Upcountry District, which is the case for the proposed well. DLNR intends to integrate this new source into the existing MDWS water system and through an agreement, transfer ownership to the County of Maui.

The report notes that the sustainable yield of the Upcountry District area is sufficient to accommodate new basal groundwater well development. However, as basal wells are much more expensive to operate than surface water production, it was expected that new basal wells would not operate at capacity except in the drier summer months and for more extended periods in drought years. It was also noted that the well yield and water quality of new wells in the Upcountry District would be difficult to predict prior to drilling and testing, because of the complex hydrology and historical use of agricultural fertilizers and pesticides. As discussed in Section 3.1.2, below, hydrologists for the project concluded after evaluation that a well at Pukalani Tank will likely provide sufficient high quality water. Furthermore, the proposed location avoids disturbance to cultural and natural resources. A basal well avoids diversion of water from streams and impacts to instream values, while also obviating the need for extensive water treatment, provided there are no or minimal contaminants. The energy required to pump water from a depth of more than 1,300 feet is considerable, and needs to be a factor that is weighed, particularly given uncertainty in energy costs. However, it is also possible that in the future, locally produced energy from small wind turbines or photovoltaic solar can offset pumping costs.

1.6.4 Maui County General Plan and Community Plans

The Maui County General Plan is a long-term, comprehensive blueprint for the physical, economic, environmental development and cultural identity of the County. The Countywide Policy Plan, adopted on March 24, 2010, provides broad goals, objectives, policies, and implementing actions that portray the desired direction of the County’s future. Furthermore, this Countywide Policy Plan provides the policy framework for the development of the Maui Island Plan and the nine Community Plans. The Countywide Policy Plan is the outgrowth of, and includes the elements of the earlier General Plans of 1980 and 1990. The Maui Island Plan was adopted on December 28, 2012, and establishes urban and rural growth areas that indicate where development is intended and will be supported. Growth areas will provide for less costly services, reduced commuting, protection of community character and the preservation of agriculture, open space and cultural and natural resources.

Each of the nine community plans is meant to provide recommendations concerning land use, density and design, transportation, community facilities, infrastructure, visitor accommodations, commercial and residential areas and other matters related to development that are specific to the

region of the plan. Although the latest Makawao-Pukalani-Kula Community Plan dates from 1996 and contains recommendations that may be superseded by the General Plan, it is included here for reference.

This section is organized to list all Goals and Objectives, and where directly relevant to the proposed action, the Policies and Implementing Actions, contained in the General Plan and Community Plan, by subject area. Discussions of consistency are provided after each subject area.

Population

> Goal 1.1 Maui's people, values, and lifestyles thrive through strong, healthy, and vibrant island communities.
> Objective 1.1.1 Greater retention and return of island residents by providing viable work, education, and lifestyle options.
>
> *Discussion*: Provision of a potable water source supports strong communities that are able to retain residents and support lifestyle values.

Heritage Resources

> Goal: 2.1 Our community respects and protects archaeological and cultural resources while perpetuating diverse cultural identities and traditions.
> Objective 2.1.1 An island culture and lifestyle that is healthy and vibrant as measured by the ability of residents to live on Maui, access and enjoy the natural environment, and practice Hawaiian customs and traditions in accordance with Article XII, Section 7, Hawai'i State Constitution, and Section 7-1, Hawai'i Revised Statutes (HRS).
> Policy 2.1.1.c Ensure traditional public access routes, including native Hawaiian trails, are maintained for public use.
> Objective 2.2 A more effective and efficient planning and review process that incorporates the best available cultural resources inventory, protection techniques, and preservation strategies.
> Policy 2.1.3.c Support regulations to require developers, when appropriate, to prepare an Archaeological Inventory Survey, Cultural Impact Assessment, and Ethnographic Inventories that are reviewed and commented upon by the Office of Hawaiian Affairs, Native Hawaiian advisory bodies, the State Historic Preservation Division (SHPD), and the Office of Environmental Quality Control, and systematically comply with the steps listed in SHPD's administrative rules, including consultation and monitoring during construction phases of projects.
> Policy 2.1.3.f Support opportunities for public involvement with the intent to facilitate the protection and restoration of historic and archeological sites, including consultation with stakeholders.

Discussion: The project has included systematic, professional archaeological survey, which determined that no historic properties were present or would be affected.

Shoreline, Reefs, and Nearshore Waters and Watersheds, Streams, and Wetlands

Goal 2.2 An intact, ecologically functional system of reef, shoreline, and nearshore waters that are protected in perpetuity.
Objective 2.2.1 A more comprehensive and community-based ICZM program.
Objective 2.2.2 Improved reef health, coastal water quality, and marine life.
Objective 2.2.3 Water quality that meets or exceeds State Clean Water Act standards.
Policy 2.2.3.a Reduce the amount of impervious surface and devise site plan standards that aim to minimize storm runoff and NPS pollution.
Goal 2.3 Healthy watersheds, streams, and riparian environments.
Objective 2.3.1 Greater protection and enhancement of watersheds, streams, and riparian environments.
Objective 2.3.2 Decreased NPS and point source pollution.
Objective 2.3.4 Greater preservation of native flora and fauna biodiversity to protect native species.
Objective 2.3.5 Limited development in critical watershed areas.
Objective 2.3.6 Enhance the vitality and functioning of streams, while balancing the multiple needs of the community.

Discussion: The project avoids creation of additional impermeable surface by siting the well infrastructure on an already developed MDWS lot, and will include BMPs during construction to minimize erosion and sedimentation.

Wildlife and Natural Areas

Goal 2.4 Maui's natural areas and indigenous flora and fauna will be protected.
Objective 2.4.1 A comprehensive management strategy that includes further identification, protection, and restoration of indigenous wildlife habitats.
Policies 2.4.1.b Require flora and fauna assessment and protection plans for development in areas with concentrations of indigenous flora and fauna; development shall comply with the assessment and protection plan and shall use the avoidance, minimization, and mitigation approach respectively, with an emphasis on avoidance.
Objective 2.5.2 Reduce impacts of development projects and public-utility improvements on scenic resources.
Policy 2.5.2.f Ensure little or no effect on scenic resources from utility improvements, primarily power poles.
Objective 2.5.3 Greater protection of and access to scenic vistas, access points, and scenic lookout points.

Discussion: The project included coordination with wildlife resource and regulatory agencies as well as a systematic flora and fauna assessment that determined that no rare, threatened or endangered species would be adversely affected by the action.

Natural Hazards

Goal 3.1 Maui will be disaster resilient.
Objective 3.1.1 Increased inter-agency coordination.
Objective 3.1.2 Greater protection of life and property.
Policy:3.1.2.d Encourage the use of construction techniques that reduce the potential for damage from natural hazards.
Policy 3.1.2.e Increase the County's resilience to drought.
Objective 3.1.3 A more coordinated emergency response system that includes clearly defined and mapped evacuation routes.
Objective 3.1.4 A more educated and involved public that is aware of and prepared for natural hazards.

Discussion: The project will be designed to current seismic standards and will increase the County's resilience to drought.

Economic Development

Goal 4.1 Maui will have a balanced economy composed of a variety of industries that offer employment opportunities and well-paying jobs and a business environment that is sensitive to resident needs and the island's unique natural and cultural resources.
Objective 4.1.1 A more diversified economy.
Objective 4.1.2 Increase activities that support principles of sustainability.

Discussion: Provision of potable water for the Upcountry District will positively affect the economy .

Tourism

Goal 4.2 A healthy visitor industry that provides economic well-being with stable and diverse employment opportunities.
Objective 4.2.1 Increase the economic contribution of the visitor industry to the island's environmental well-being for the island's residents' quality of life.
Objective 4.2.2 Comprehensively manage future visitor-unit expansion.
Objective: 4.2.3 Maximize residents' benefits from the visitor industry

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to tourism.

Agriculture

Goal 4.3 Maui will have a diversified agricultural industry contributing to greater economic, food, and energy security and prosperity.
Objective 4.3.1 Strive for at least 85 percent of locally-consumed fruits and vegetables and 30 percent of all other locally-consumed foods to be grown in-State.
Objective 4.3.2 Maintain or increase agriculture's share of the total island economy.
Objective 4.3.3 Expand diversified agriculture production at an average annual rate of 4 percent.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to agriculture. Providing additional sources of potable water helps free us surface water for use on agricultural lands. Siting the well in an already utilized lot avoids use of agricultural land for well infrastructure.

Employment

Goal 4.4 A diverse array of emerging economic sectors.
Objective 4.4.1 Support increased investment and expanded activity in emerging industries.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to employment.

Small Business Development

Goal 4.5 Small businesses will play a key role in Maui's economy.
Objective 4.5.1 Increase the number of and revenue generated by small businesses and decrease the percentage of small business failures.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to small business development.

Health Care Sector

Goal 4.6 Maui will have a health care industry and options that broaden career opportunities that are reliable, efficient, and provide social well-being.
Objective 4.6.1 Expand the economic benefits of the health care sector.
Objective 4.6.2 Be more efficient in the delivery of health care services and in minimizing health care costs.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to the health care sector.

Education

Goal 4.7 Maui will have effective education and workforce development programs and initiatives that are aligned with economic development goals.
Objective 4.7.1 Improve preschool and K-12 education to allow our youth to develop the skills needed to successfully navigate the 21st century.
Objective 4.7.2 Encourage an increase in the number of certificate recipients and associate, bachelors, and graduate degrees conferred.
Objective 4.7.3 Strive to ensure that more of Maui's jobs are developed in STEM-related sectors by 2030.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to education.

Housing

Goal 5.1 Maui will have safe, decent, appropriate, and affordable housing for all residents developed in a way that contributes to strong neighborhoods and a thriving island community.
Objective 5.1.1 More livable communities that provide for a mix of housing types, land uses, income levels, and age.
Objective 5.1.2 Better monitoring, evaluation, and refinement of affordable housing policy in conjunction with the economic cycle.
Objective 5.1.3 Provide affordable housing, rental or in fee, to the broad spectrum of our island community.
Objective 5.1.4 Provide infrastructure in a more timely manner to support the development of affordable housing.
Objective 5.1.5 A wider range of affordable housing options and programs for those with special needs.
Objective 5.1.6 Reduce the cost to developers of providing housing that is affordable to families with household incomes 160 percent and below of annual median income.
Objective 5.1.7 Increased preservation and promotion of indigenous Hawaiian housing and architecture.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to housing.

Solid Waste

Goal 6.1 Maui will have implemented the ISWMP thereby diverting waste from its landfills, extending their capacities.
Objective 6.1.1 Meet our future solid waste needs with a more comprehensive planning and management strategy.
Objective 6.1.2 Divert at least 60 percent of solid waste from the island's landfills

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to solid waste.

Wastewater

Goal 6.2 Maui will have wastewater systems that comply with or exceed State and Federal regulations; meet levels-of-service needs; provide adequate capacity to accommodate projected demand; ensure efficient, effective, and environmentally sensitive operation; and maximize wastewater reuse where feasible.
Objective 6.2.1 A wastewater planning program capable of efficiently providing timely and adequate capacity to service projected demand where economically feasible and practicable.
Objective 6.2.2 Adequate levels of wastewater service with minimal environmental impacts
Objective 6.2.3 Increase the reuse of wastewater.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to wastewater. The reuse of wastewater was examined as a potential alternative to increase supply but was found not feasible to accomplish the project's purpose and need.

Water Systems

Goal 6.3 Maui will have an environmentally sustainable, reliable, safe, and efficient water system.
Objective 6.3.1 More comprehensive approach to water resources planning to effectively protect, recharge, and manage water resources including watersheds, groundwater, streams, and aquifers.
Policy 6.3.1.a Ensure that DWS actions reflect its public trust responsibilities toward water.
Policy 6.3.1.b Ensure the WUDP implements the State Water Code and MIP's goals, objectives, and policies.
Policy 6.3.1.f Encourage and improve data exchange and coordination among Federal, State, County, and private land use planning and water resource management agencies.
Objective 6.3.2 Increase the efficiency and capacity of the water systems in striving to meet the needs and balance the island's water needs.

Policy 6.3.2.a Ensure the efficiency of all water system elements including well and stream intakes, water catchment, transmission lines, reservoirs, and all other system infrastructure.
Policy 6.3.2.d Work with appropriate State and County agencies to achieve a balance in resolving the needs of water users in keeping with the water allocation priorities of the MIP.
Policy 6.3.2.e Ensure water conservation through education, incentives, and regulations.
Policy 6.3.2.f Acquire and develop additional sources of potable water.
Objective 6.3.3 Improve water quality and the monitoring of public and private water systems.
Policy 6.3.3.a Protect and maintain water delivery systems

Discussion: Provision of potable water through development of groundwater is expected to promote an environmentally sustainable, reliable, safe, and efficient water system that supplies needed potable water and helps replace diversion of stream water that may have more beneficial instream value and/or agricultural uses.

Transportation

Goal 6.4 An interconnected, efficient, and well-maintained, multimodal transportation system.
Objective 6.4.1 Provide for a more integrated island-wide transportation and land use planning program that reduces congestion and promotes more efficient (transit-friendly) land use patterns.
Objective 6.4.2 Safe, interconnected transit, roadway, bicycle, equestrian, and pedestrian network.
Objective 6.4.3 An island-wide, multimodal transportation system that respects and enhances the natural environment, scenic views, and each community's character.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to transportation.

Transit

Goal 6.5 An island-wide transit system that addresses the needs of residents and visitors and contributes to healthy and livable communities.
Objective 6.5.1 An integrated transit system that better serves all mobility needs of Maui's residents and visitors.
Objective 6.5.2 Plan for a more diversified and stable funding base to support transportation goals.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to transit.

Parks

Goal 6.6 Maui will have a diverse range of active and passive recreational parks, wilderness areas, and other natural-resource areas linked, where feasible, by a network of greenways, bikeways, pathways, and roads that are accessible to all.
Objective 6.6.1 More effective, long-range planning of parks and recreation programs able to meet community needs.
Objective 6.6.2 Achieve parks and recreation opportunities to meet the diverse needs of our community.
Objective 6.6.3 An expanded network of greenways, trails, pathways, and bikeways.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to parks.

Schools and Libraries

Goal 6.8 Maui will have school and library facilities that meet residents' needs and goals.
Objective 6.8.1 Assist in providing appropriate school and library facilities in a timely manner and in strategic locations.
Objective 6.8.2 Provide a more expansive network of safe and convenient pedestrian-friendly streets, trails, pathways, and bikeways between neighborhoods and schools where appropriate.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to schools and libraries.

Health Care Public Facilities

Goal 6.9 All of Maui residents will have the best possible health care to include healthy living, disease prevention, as well as acute and long-term care.
Objective 6.9.1 Greater autonomy to the Maui region in their efforts to improve medical care on the island.
Objective 6.9.2 An expansion of long-term care facilities and long-term care alternatives to meet the needs of our aging population.
Objective 6.9.3 More support to home-care and community-based programs so they become alternatives to traditional nursing homes.
Objective 6.9.4 Improved preventative medicine and primary health care.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to health care facilities.

Energy

Goal 6.10 Maui will meet its energy needs through local sources of clean, renewable energy, and through conservation.
Objective 6.10.1 Reduce fossil fuel consumption. Using the 2005 electricity consumption as a baseline, reduce by 15 percent in 2015; 20 percent by 2020; and 30 percent by 2030.
Policy 6.10.1.a Support energy efficient systems, processes, and methods in public and private operations, buildings, and facilities.
Objective 6.10.2 Increase the minimum percentage of electricity obtained from clean, renewable energy sources. By 2015, more than 15 percent of Maui's electricity will be produced from locally-produced, clean, renewable energy sources, 25 percent by 2020, and 40 percent by 2030.
Objective 6.10.3 Increased use of clean, renewable energy.

Discussion: Although groundwater development in the Upcountry area has many environmental benefits relative to stream diversion, it is relatively energy intensive. It is also possible that in the future, locally produced energy from small wind turbines or photovoltaic solar can offset pumping costs.

Harbors and Airports

Goal 6.11 Maui will have harbors and airports that will efficiently, dependably, and safely facilitate the movement of passengers and cargo.
Objective 6.11.1 Upgraded harbor facilities to handle larger volumes of freight and passengers and additional small boat harbors.
Objective 6.11.2 Establish more economically thriving and environmentally sensitive small boat harbors accommodating resident and business activity, including fishing, recreation, and tour boats.
Objective 6.11.3 Upgraded airport facilities and navigation aids to serve the needs of passengers, freight movements, and general aviation.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to harbors and airports.

Land Use: Agricultural Lands

Goal 7.1 Maui will have a prosperous agricultural industry and will protect agricultural lands.
Objective 7.1.1 Significantly reduce the loss of productive agricultural lands.
Policy 7.1.1.f Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding factors are present.

Objective 7.1.2 Reduction of the island's dependence on off-island agricultural products and expansion of export capacity.
Objective 7.1.3 Support and facilitate connectivity between communities.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to agricultural lands. Providing additional sources of potable water helps free us surface water for use on agricultural lands. Siting the well in an already utilized lot avoids use of agricultural land for well infrastructure.

Land Use: Rural Areas

Goal 7.2 Maui will have a rural landscape and lifestyle where natural systems, cultural resources and farm lands are protected and development enhances and complements the viability and character of rural communities.
Objective 7.2.1 Reduce the proliferation and impact of residential development outside of urban, small town, and rural growth boundaries.
Policy 7.2.1.a Focus development to areas inside urban, small town, and rural growth boundaries to preserve natural, cultural, and agricultural resources.
Objective 7.2.2 More appropriate service/infrastructure standards to enhance and protect the island's rural character and natural systems.
Policy 7.2.2.a Minimize impermeable surfaces within rural areas.
Policy 7.2.2.c Use infrastructure, public service, and design standards that are appropriate to rural areas.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to rural areas. Siting the well in an already utilized lot avoids creating additional impermeable surface and the use of undeveloped land on the rural/agricultural interface for well infrastructure.

Land Use: Urban Areas

Goal 7.3 Maui will have livable human-scale urban communities, an efficient and sustainable land use pattern, and sufficient housing and services for Maui residents.
Objective 7.3.1 Facilitate and support a more compact, efficient, human-scale urban development pattern.
Objective 7.3.2 Facilitate more self-sufficient and sustainable communities.
Objective 7.3.3 Strengthen the island's sense of place.
Objective 7.3.4 Strengthen planning and management for the visitor industry to protect resident quality of life and enhance the visitor experience.
Objective 7.3.5 Ensure that Maui's planning and development review process becomes more transparent, efficient, and innovative.

Discussion: No aspect of the proposed action is inconsistent with goals, objectives or policies related to urban areas. Provision of potable water supports approved urban land uses.

Directed Growth Plan

Goal: 8.1 Maui will have well-serviced, complete, and vibrant urban communities and traditional small towns through sound planning and clearly defined development expectations.
Goal: 8.2 Maui will maintain opportunities for agriculture and rural communities through sound planning and clearly defined development expectations.

The following four themes provide a broad island-wide framework for the identification of areas that are appropriate for future growth, the identification of areas that should be preserved, and the implementation of the directed growth plan.

Theme One: Limit Development in Northwest and East Maui.
Theme Two: Protect Maui's agricultural resource lands, especially prime and productive agricultural lands.
Theme Three: Direct growth to areas proximate to existing employment centers, where infrastructure and public facility capacity can be cost-effectively provided, and where housing can be affordably constructed.
Theme Four: Within the Urban Growth Boundaries, promote livable, mixed-use communities, defined by a high quality of life.

Nine planned growth areas have been identified for the Makawao-Pukalani-Kula community plan region: Makawao Makai, Makawao Town Expansion, Makawao Affordable Residential, Seabury Hall, Pukalani Expansion, Pukalani Makai, Hāliʻimaile, Anuhea Place, and Ulupalakua Ranch. Planned growth areas are depicted in Figure 8-8 and on Directed Growth Maps of the General Plan. New water source and development and water storage are recommended.

Discussion: The project supports the directed growth identified for the Makawao-Pukalani-Kula community plan region, for which water source development is specifically called for.

2 ENVIRONMENTAL ASSESSMENT PROCESS

The project involves the use of State of Hawai‘i funds and County of Maui lands, and therefore requires compliance with Chapter 343, Hawai‘i Revised Statutes (HRS), the Hawai‘i Environmental Policy Act (HEPA). The State of Hawai`i, Department of Land and Natural Resources, Engineering, (DLNR) is the proposing agency for this Environmental Assessment (EA).

HEPA was enacted by the Hawai‘i State Legislature to require State and County agencies to consider the environmental impacts of various actions as part of the decision-making process. Agencies are required to conduct an investigation and evaluation of alternatives as part of the environmental impact analysis process, prior to making decisions that may impact the environment. The implementing regulations for HEPA are contained in Title 11, Chapter 200, Hawai‘i Administrative Rules (HAR).

This Environmental Assessment (EA) process was conducted in accordance with HEPA. According to HEPA and its implementing regulations, a Draft EA is prepared to document environmental conditions and impacts, to develop mitigation measures that avoid, minimize or compensate for adverse environmental impacts, and determine whether or not an action has significant impacts upon the environment. Impacts are evaluated for significance according to thirteen specific criteria as presented in HAR 11-200-12. If no significant impacts are expected, then a Final EA with a Finding of No Significant Impact (FONSI) may be issued. When the Draft EA determines that significant impacts are present, then a Notice of Intent is prepared and the Final EA facilitates preparation of an Environmental Impact Statement (EIS).

The environmental assessment process for this project includes early consultation with agencies and organizations. Letters from these agencies are contained in Appendix 1a.

As discussed in Section 1.1., this EA concerns development of the exploratory well only. If testing of the exploratory well indicates an adequate quantity of water of acceptable water quality, another EA will be prepared to discuss the impacts related to conversion to a production well and subsequent use.

3 ENVIRONMENTAL SETTING AND IMPACTS

This section describes the existing social, economic, cultural, and environmental conditions surrounding the proposed project along with the probable impacts of the proposed action and mitigation measures designed to reduce or eliminate adverse environmental impacts. For many categories, the No Action Alternative would result in no impacts. Therefore, unless explicitly mentioned, discussion of impacts and mitigation relates to the Action Alternative only.

3.1 Physical Environment

3.1.1 Surface Geology, Soils and Hazards

Existing Environment, Impacts and Mitigation Measures

The project site is located on the western slope of Haleakala Volcano, which can be described as a broad upland slope. The Kula Volcanic series covers the entire northwest flank of Haleakala Volcano and was erupted .98 – 1.5 million years ago during the Pleistocene epoch. The risk of lava flows in the foreseeable future is minimal.

The U.S. Department of Agriculture, Natural Resources Conservation Service classifies the soil at the subject property as Haliimaile silty clay loam, 3-15 percent slopes. Typically, this soil is well-drained and composed of silty clay loam from 0 to 15 inches, silty clay from 15 to 41 inches, and clay from 41 to 65 inches (USDA-NRCS).

Seismic hazards are those related to ground shaking. Engineers, seismologists, architects, and planners have evaluated seismic hazards related to building construction and devised a system of classifying seismic hazards on the basis of the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The results are included in the Uniform Building Code (UBC) seismic provisions. The UBC seismic provisions contain six seismic zones, ranging from 0 (no chance of severe ground shaking) to 4 (40% chance of severe shaking in a 50-year interval). The entire Island of Maui is classified with Zone 2B, with a 20% chance of severe ground shaking.

In general, geologic conditions impose no constraints on the project, and no mitigation measures are expected to be required. The design for the well and accessory structures will be appropriate to the seismic setting and in conformance with the latest UBC.

3.1.2 Hydrogeology

Existing Environment

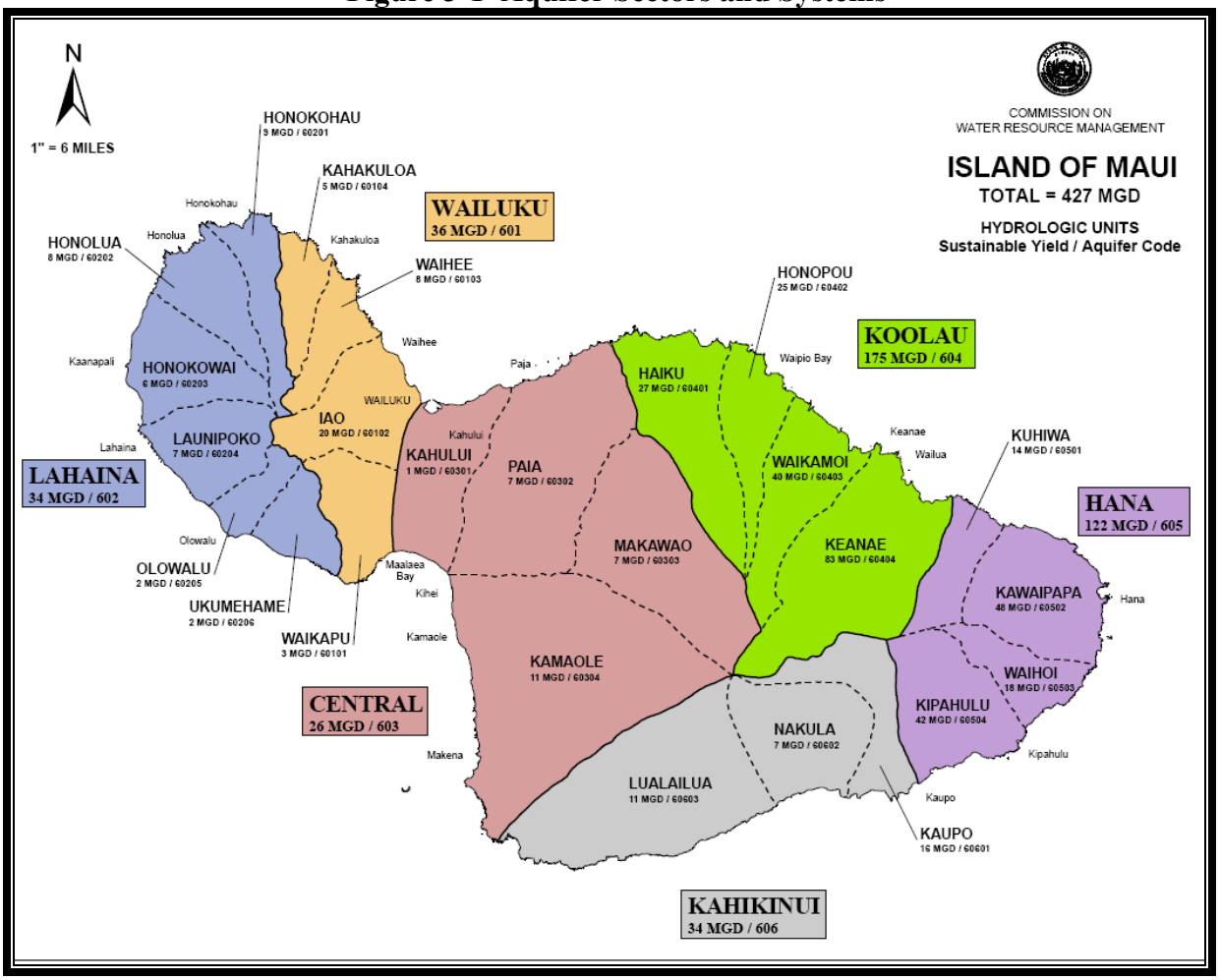
Hydrogeological Setting, Hydrologic Budget and Sustainable Yield

In the Hawaiian Islands, precipitation that is not lost through evapotranspiration or conducted through streams into the ocean percolates into the ground to collect in the aquifers under the island before slowly making its way to the sea. As streams in Hawai‘i are generally flashy or even ephemeral, underground water is the most reliable source of water supply, because there is less daily or seasonal change in water tables. Water may be trapped between vertical confining layers such as dikes or perched above horizontal confining layers such as volcanic ash soil, forming high level aquifers. This water may overflow, creating natural streams or springs. Such aquifers may be within a few feet of the surface and are susceptible to contamination by nitrates, phosphates, pesticides and permeate from septic tanks, leach fields and cesspools. Though their use is fairly common in other areas, shallow aquifers are not generally used for domestic water on Maui.

If water continues to diffuse through the layers of rock, sand, soil and gravel, it will reach sea level. Fresh water has a lower density than seawater and will float on the salt water. Most of the fresh water lies below sea level, shaped much like a lens. This fresh water is the source of much of the groundwater available in the State, and much water is maintained in the basal freshwater lens which “floats” on the salt-water permeated rock below. Due to the difference in densities, for every foot the lens extends above sea level it extends 40 feet below sea level, although the lower areas contain a zone of mixing. Basal water tables have inland gradients that can rise as much as four feet per mile in high rainfall areas.

Overlaid on the geographical subdivisions used by DWS in producing and distributing water are groundwater regulatory areas. The State Commission on Water Resources Management (CWRM) classification of aquifers locates this part of Maui within the Makawao Aquifer System, Code 60303 (Fig. 3-1). This coding refers to Maui Island (6), Central Aquifer Sector (03), and Makawao Aquifer System (03). The surface boundaries of the aquifer encompass the towns of Makawao, Pukalani and Kula, as well as the drainage basins of a number of mostly intermittent streams. The surface drainage network has been extensively modified through a series of ditches constructed to supply water for sugar cane agriculture. Previous studies have estimated the sustainable yield of this hydrologic unit as approximately 7 mgd, although it is recognized that CWRM sustainable yield estimates for this and other aquifers in the State of Hawai‘i are usually very rough estimates.

Figure 3-1 Aquifer Sectors and Systems



Source: Hawai‘i State Commission on Water Resources Management

The basic characteristics of the Makawao Aquifer System are determined by the regional geology. The Kula Volcanic Series lava flows that underlie the project area can generally be characterized as thicker, narrower, and far less permeable than the deeper, underlying Honomanu basalts. The thickness of the Kula flows is a function of the chemical composition, which generally contains a higher percentage of silica than the Honomanu series flows. This increase in silica content causes the Kula series flows to be more massive with smaller fractures. The flows can average about 20 feet in thickness in the higher summit elevations to 50 feet near the edges; flows 200 feet thick can also be found. The large number of erosional unconformities and interstratified soil beds suggests that the upper Kula series lavas accumulated in the waning phase of Haleakala Volcano, when the time between flows became progressively longer. This allowed the lavas the necessary time to weather into deep soils.

This assemblage of interstratified soils, vitric tuff beds, weathered clinker zones, and wide bands of dense rock that make up the Kula series greatly affects the flow of groundwater. Most of the individual lava beds are permeable and unable to perch water. When the formation is considered as a unit, it contains enough impermeable layers, even though discontinuous, to greatly retard the downward percolation of water.

The Makawao aquifer unit covers about 37,523 acres and has limited groundwater development opportunities because of elevations more than 1,500 feet above sea level. Groundwater has, however, been developed by several deep wells, most of which are small capacity units used by private owners. Groundwater sources to date have only produced water from the basal lens, where fresh water is floating in equilibrium with underlying salt water. To date, no well drilling has discovered in developable water from a high level dike or fault confined aquifer. One well, Piiholo South, appears to terminate in a poorly permeable formation which had limited yield and may actually lie in the northeast volcanic rift zone of Haleakala. In contrast to the normal water level response to pumping, this well exhibited behavior similar to that found in dike confined aquifers, but this may be a very local condition.

Because of the lack of developed groundwater, the MDWS presently relies largely on the surface water diversions which are treated and distributed via the primary transmission system depicted in Figure 1-4. Rather than groundwater, the major MDWS water supplies to the project area consist of three stream diversions that capture primarily direct runoff from stream flow at Piiholo, Olinda and Kamole. The two upper diversions, Olinda and Piiholo, enter the MDWS system by gravity and are routed throughout the upper Kula system. The Kamole treatment plant obtains its water from the Hawaiian Commercial and Sugar (HC&S) system and is pumped up to a major distribution hub located at the Pookela Well. After use in households, these imported waters ultimately add to the local groundwater recharge entering the Makawao Hydrologic System.

As detailed in Appendix 2, the project hydrologists conducted a groundwater hydrologic budget analysis for the 37,523-acre Makawao Aquifer System. This was prepared to better understand the impacts of the imported waters on the recharge or infiltration component of the aquifer, and to study the sensitivity to recharge and pumping. It should be noted that there are no perennial streams in the Makawao project area and direct runoff from rainfall rarely discharges outside of the area.

Input consists of local rainfall, fog-drip and irrigation water flows into the weathered andesitic lavas of the Kula volcanic series. The Makawao Aquifer System area is located within a transitional climatic regime, between the windward and leeward sides of Haleakala. Within the Makawao area the maximum annual rainfall, 165 inches, occurs at the higher elevations on the windward side and the minimum annual rainfall, 16 inches, occurs over the southwestern section on the leeward side. Data for the rainfall component of the water-budget model was derived from the *Rainfall Atlas of Hawai'i* (Giambelluca et al 2013). These data are for the most current 30-

year period of record, 1978 to 2007, which includes both strong El Niño events and all years of the current Kilauea eruption on Hawai‘i. These data are thought to be most representative of recent rainfall distributions in the project area.

Upslope fog in Hawai‘i occurs predominantly by the cooling to the saturation point of warm moist marine air as it moves upslope. The water yield of fog is a function of droplet size that tends to be large in marine air masses (McKnight and Juvik, 1975). Studies have found that the most productive fog occurs in non-raining cloud decks formed in degenerating marine air masses (Grunow, 1960, and McKnight and Juvik 1975), a situation that occurs frequently in the Makawao area between approximately 3,950 and 5,900 feet elevation. The analysis calculated fog-drip as 10 percent of rainfall in the aquifer recharge area.

Irrigation is a locally significant input into the Makawao water-budget model. An estimated 3.5 mgd of imported surface water is applied over agricultural fields and an estimated 0.5 mgd of recycled water from a sewage treatment plant irrigates the Pukalani Golf Course.

Much of the water that enters the surface of the Makawao Aquifer System area through rainfall, fog drip or irrigation exits via evapotranspiration, which was accounted for in the model. Infiltrated water tends to migrate horizontally as groundwater perched on dense lava or weathered soil formations. In the high rainfall areas, these perched aquifers appear as surface springs or will sustain perennial flow in streams. These percolating waters can be intersected during the drilling of wells in some areas but are otherwise not visible. The hydrologists' estimate of groundwater recharge to the aquifer within the Makawao Aquifer System when calculated in the budget averages about 67.84 mgd, including the infiltration of fog drip and the imported 6.44 mgd from surface water sources. Previous studies by the State Commission on Water Resources Management (1990) and the U.S. Geological Survey (Shade 1999; Engott and Vana 2007), which used different methods and did not account for fog drip and irrigation, estimated total recharge at 15.12 mgd and 46.51 mgd, respectively. Based on the higher estimates of recharge derived from recent studies, it would appear that sustainable yield could be considerably higher than the official estimate of 7 mgd.

Current Installed Capacity and Water Use

CWRM maintains a database of wells that provides information on, among other categories, the aquifer identity, user identity, installed capacity, chloride content, and function. The database does not provide information on current pumpage, which instead is kept in a separate database and is derived from reports from individual well operators. Because not all well operators report their use in a timely manner, pumpage data are often not complete or up to date. Because of security concerns after September 11, 2001, these databases are no longer accessible to the public and data must be requested from CWRM.

The Makawao Aquifer System has a total of 12 wells with a total installed capacity about 6.49 mgd (see Appendix 2 for details). Present pumpage in the Makawao Aquifer System is much less, about 1.36 mgd, primarily from the Pookela Well and the Pukalani irrigation well, which is now supplemented with R-1 reclaimed wastewater. In addition, there are a number of small domestic or stack water wells, owned by Haleakala Ranch, Piiholo Investments LLC, Maui Land and Pine, and others, which together produce less than 100,000 gpd.

Existing Water Quality

The MDWS regularly conducts microbiological analysis and contracts for extensive chemical testing in order to comply with U.S. Environmental Protection Agency (EPA) and State of Hawai‘i standards. In conformance with the federal Consumer Confidence Report rule, MDWS produces an annual report on the quality of drinking water and provides it to all customers. The Water Quality Report describes the sources and measures the quality of drinking water. The MDWS tests for more than 100 substances in the water, including bacteria, pesticides and herbicides, asbestos, lead, copper, petroleum products, and by-products of industrial and water treatment processes.

The latest report reviews testing conducted and compiled in 2012 for reporting by July 2013, and is included as Appendix 5. The Upper Kula System, which serves Kula, Waiakoa, Keokea, Ulupalakua, Kanaio, derives its water from the Kaipuaena Intake, and is fully surface water. Although several contaminants were present, including total trihalomethanes, haloacetic acid, lead, and copper, the tests showed that they were well below EPA allowable limits and action levels, and the water is deemed safe and the system compliant. The Makawao System, which serves Haiku, Haliimaile, Makawao and Pukalani, derives its water from the Wailoa Ditch and the Haiku, Kaupakalua and Pookela Wells. A larger range of contaminants was present, many of them resulting from the natural geology, while others were derived from man-made chemicals and their breakdown products. The tests showed that they were well below EPA allowable limits and action levels, and the water is deemed safe and the system compliant. There are a number of unregulated contaminants that are also tested for. EPA uses the Unregulated Contaminant Monitoring Rule to collect data for contaminants suspected to be present in drinking water but do not have health-based standards set under the Safe Drinking Water Act. The purpose of monitoring for these contaminants is to help EPA decide whether the contaminants should be regulated. In summary, no violations were recorded for radioactive, inorganic, organic or lead and copper contaminants, with all contaminants far below EPA allowable limits and action levels.

The State Department of Health publishes *Hawaii's Groundwater Contamination Maps* (http://healthuser.hawaii.gov/health/environmental/water/sdwb/conmaps/conmaps.html) as an integral part of Hawai‘i's Groundwater Protection Program (GWPP). The GWPP's goal is to protect human health and sensitive ecosystems by fostering protection of groundwater resources and emphasizing water quality assessment, pollution prevention and protection measures.

These maps identify the location and amount of organic and other contaminants detected and confirmed present in public drinking water wells and select non-potable wells. The latest maps available, which date from 2006, illustrate that various contaminants are known to have been present in Maui wells, particularly near current or former agricultural operations. Although most contaminants were measured at levels below the applicable drinking water standard, any contamination is of concern. Some wells have been removed from use, and others have required treatment to reduce contaminants to below levels that are recognized by the EPA as acceptable, which has generated controversy on Maui among many residents (see discussion concerning Hamakuapoko Well at:http://maui-tomorrow.org/category/wai/hamakuapoko-wells/ - Maui Tomorrow website).

Of particular concern for new wells in the Makawao Aquifer System is the potential for widespread surface contamination associated with former pineapple. Two soil fumigants previously used by pineapple growers, 1,2-dibromo-3-chloropropane (DBCP) and 1,2-dibromoethane or ethylene dibromide (EDB), have been detected in several wells on the lower part of Makawao Aquifer System, at Maunaolu, Puunene and Kaheka (some of which are irrigation wells). An impurity of the soil fumigant DD, 1,2,3-trichloropropane (TCP), has also has been detected in a number of wells. DBCP, EDB, and TCP are of particular concern to State public health officials due to known and possible unknown health effects associated with these compounds.

Other toxic chemicals have also been used in agriculture in this area. A Limited Phase II Surface Investigation of the Former Corn Mill Camp in Pukalani, several hundred feet downslope of the proposed well site, was conducted in in 2001 (see Appendix 4 for discussion). This area was used for mixing and storing of agricultural chemicals, including pentachlorophenol phenate, DDT, and disodium methanearsenate. Due to practices at the property over the decades, there was a high potential for these chemicals to have spilled. Soil samples found organochlorine pesticides (4,4-DDE and 4,4-DDT) were detected above the State of Hawai‘i DOH Tier I Soil Action Level (“SAL”) in ten of the eleven samples analyzed. Phenols analysis revealed concentrations of pentachlorophenol above the Preliminary Remediation Goals in one sample. Arsenic was detected in soil samples at concentrations ranging from 6.0 to 150 milligrams per kilogram (mg/kg). The horizontal and vertical extent of pesticide contamination could not be delineated by the limited investigation.

Clearly, there is a high potential for agricultural contaminants to be present at the surface at various areas within the Makawao Aquifer System and to have migrated into the soil to unknown depths and horizontal extents.

Impacts and Mitigation Measures

Hydrologic Impacts to the Makawao Aquifer System

The exploratory water well would be drilled with a 12-inch pilot hole to a predetermined depth, and then test pump would be installed in order to perform a 4 to 8-hour test to check drawdown and measure chlorides. The results would determine whether the process would continue or the well would be abandoned and sealed per CWRM standards to ensure that no aquifer contamination occurs.

If the process continues, the well might be deepened and it would be reamed to its final 26-inch diameter to about 50 feet below mean sea level, with a 40-inch diameter to 100 feet below mean sea level. A 20-inch ASTM A-53 casing would be installed, and the annular space between the well casing and the bore would be properly grouted and sealed to prevent contamination. A test pump with a 600 HP motor would be installed and the drillers would perform a constant rate test and specific capacity test according to CWRM standards. The tests measure the response of the aquifer to being pumped. The goals is to determine when drawdown of the water tables stabilizes, indicating that the rate of recharge to the well equals the rate of discharge. This generally involves about 100 to 120 hours of pumping for both tests.

Water quality samples would be taken by a certified third party contractor during the pump tests and sent to a certified laboratory for testing. Water will be analyzed for chloride content, temperature, and field pH and contaminants to ensure that it meets standards. Based on these tests, hydrologists will be able to determine if the well is capable of producing potable water of acceptable quality at a particular rate. When tests were complete, the drillers would pour a cement slab around the casing on surface and obtain an official Bench Mark for future reference. The driller would demobilize from the site and DLNR would determine whether it wished to proceed with a production well.

Taking into account the expected well production of 0.7 to 1.0 mgd, the installed capacity of 6.49 mgd, pumpage of 1.36 mgd, and the recharge rate of at least 15.12 mgd (but likely closer to 67.84 mgd, see above discussion), DLNR currently reckons that there would be no risk of this well causing an exceedance of the sustainable yield of the aquifer, which is currently listed at 7 mgd. This will be systematically examined if and when the results of the exploratory well testing are successful and DLNR decides to proceed with an EA for a production well.

As any additional new wells are brought on line in the future, however, there would need to be additional analysis of the installed capacity, pumpage rates and sustainable yield of the aquifer. The long-term records of salinity, pumpage and water levels that will be maintained by DLNR and MDWS will assist in protecting the long-term sustainability of the aquifer.

Effects to Other Wells, Stream Flow Springs

A concern in well site selection is placing a well such that it affects other existing wells. Historically, there is clear evidence from plantation water sources that wells placed up-gradient of the water table can cause salinity increase in the lower wells if excessively pumped. Selecting a well site immediately down-gradient from a pumping well in general should be avoided. In the case of the Pukalani site, there is also little potential to affect other wells, as none are located in the vicinity or directly down-gradient.

The water source will be basal, which means that the only streams and wells that could be affected would have to be in reasonable proximity to the well and at sea level. No such springs or streams are present, with elevations in even the deepest nearby gulches (Kailua, Maliko and Kalialinui Streams) perched more than 700 feet above sea level at distances of three miles from the proposed well. Thus there will be no streams or springs in the area that would be affected by the well drawdown.

Water Quality

As discussed above, there is always the potential for well water to contain microbial, metal, chemical or other contaminants that require treatment or are so severe as to be too costly to remediate.

DLNR reviewed a number of sources from the Department of Health and MDWS, including maps of groundwater contamination discussed above in Chapter 1. This led DLNR to exclude several other potential well sites in the Makawao to Pukalani area, in order to minimize potential for groundwater contamination from Underground Storage Tanks (USTs), Aboveground Storage Tanks (ASTs), cesspools and septic tanks, machinery repair maintenance sites, gas stations, confined animal feeding facilities, 55-gallon drum storage, parking lots, automotive repair sites, stores of abandoned vehicles, etc. While nearly all of the land within a ¼-mile radius surrounding the Pukalani Tank Site was formerly used for pineapple cultivation, there is no record in the DWS map of having the fumigant DBCP applied.

The Underground Injection Control (UIC) line in the Upcountry area is located well *makai* of Pukalani and the proposed well site. The well site and its recharge area are thus *mauka* of the UIC line, where underlying aquifers are considered drinking water sources and injection wells may be prohibited and are subject to stringent permit requirements. Nevertheless, the entire Upcountry area contains a number of unsewered homes that rely on septic tanks and even cesspools. However, the area directly *mauka* of the proposed well site is rural, with relatively few homes. The 1,500 feet of significantly weathered lava (sapprolite) between the surface and the water table would very likely prevent any noticeable effects from human wastewater.

In terms of agricultural chemicals, the hydrologists determined that the potential to reach the basal lens is greatest in areas of high rainfall and in old wells not constructed to modern standards. If the annular space between the well casing and the bore is not properly grouted and sealed, the migrating water may find its way downward into the production well bore, as has been evidenced in certain wells in the lower Kula and Haiku regions. This can be completely avoided in properly constructed wells. The hydrologists reviewed well records and determined that none of the high elevation wells (more than 1,500 feet in depth) have exhibited any evidence of organic contamination. Although DBCP and EDB can be removed from groundwater through granular activated carbon filtration, if required, it is unlikely that the well would be utilized if substantial contamination from these sources were present.

To summarize, although there are certainly sources of potential groundwater contamination in the area, DLNR believes there is a strong likelihood of uncontaminated basal water underneath the site that can successfully be used in the potable water system, with minimal or no treatment for contaminants. This can only be determined through drilling and testing an exploratory well.

The following measures will be implemented to prevent or mitigate for chemical contaminants:

- The well will be constructed in conformance with best practices to have the annular space between casing and bore hole grouted to within 5 feet of mean sea level as a precaution against shallow, perched water reaching the basal water table.
- The well water will undergo standard periodic testing for a suite of contaminants, and if found, DLNR and MDWS will determine the proper course of action.

3.1.3 Floodplains and Surface Water Quality

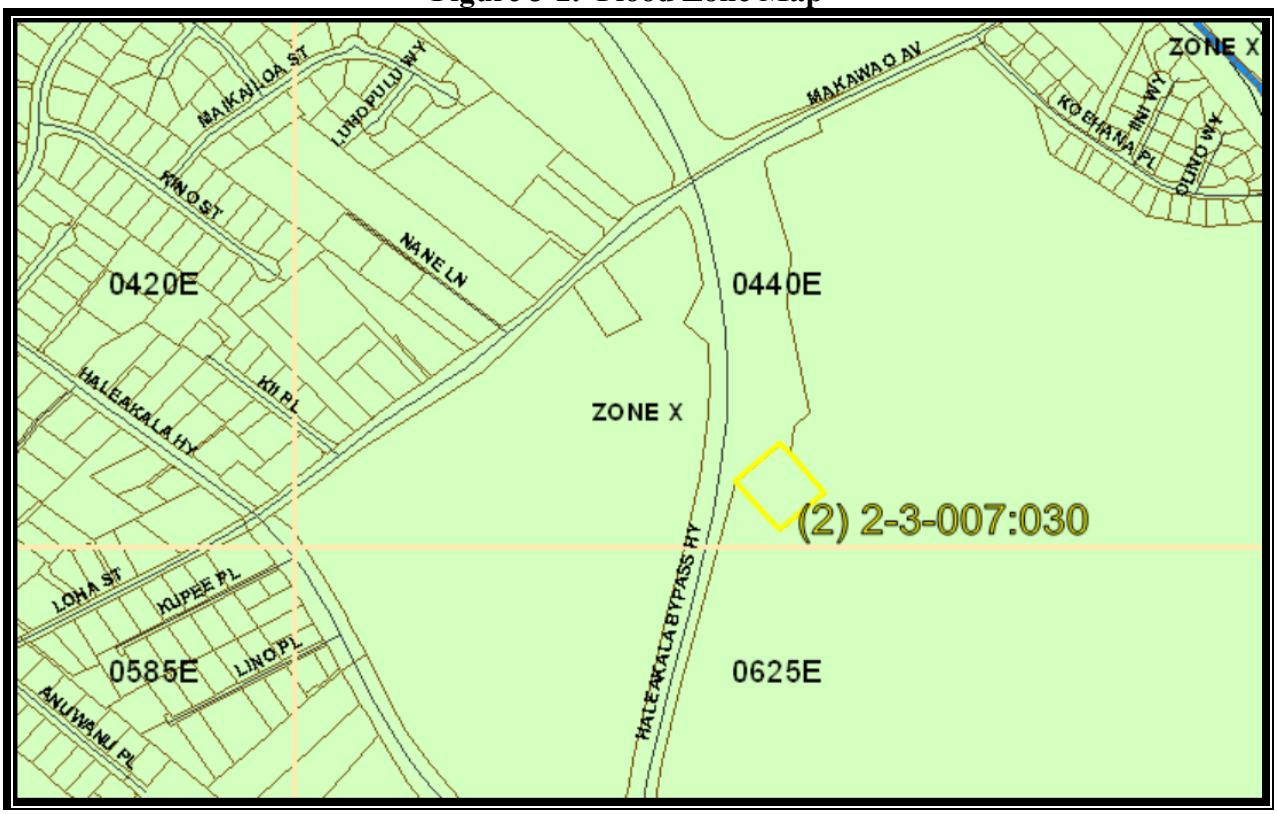
Existing Environment

Floodplain status for the area near the Pukalani Tank Site has been determined by FEMA, the Federal Emergency Management Agency (Fig. 3-2). The entire Tank Site and all land nearby, including areas along Kula Highway proposed for utility work, are classified as Zone X, or Special Flood Hazard areas identified in the community flood insurance study as areas of moderate or minimal hazard from the principal source of flood in the area.

Impacts and Mitigation Measures

No impact to flooding or flood zones would occur with development of the project. The project will add very minimally to the area of impermeable surface and will not adversely affect drainage. In any project, uncontrolled excess sediment from soil erosion during and after excavation and construction has the potential to impact natural watercourses, water quality and flooding potential. Contaminants associated with heavy equipment and other sources during construction may also impact receiving stream, ocean and ground water.

Figure 3-2. Flood Zone Map



Source: DLNR: Hawai'i National Flood Insurance Program Flood Hazard Assessment Tool
http://gis.hawaiinfip.org/fhat/

Provisions will be made during the construction grading and earthwork to minimize the potential for soil erosion and off-site sediment transport. A Pollution Control Plan and a Stormwater Pollution Prevention Plan will be implemented as part of a County of Maui Grading Permit and, if required, a National Pollutant Discharge Elimination System (NPDES) permit, to ensure that the proposed improvements do not cause drainage or water quality impacts. Best Management Practices (BMPs) such as standard soil erosion and sediment control shall be implemented. These may include measures such as the following:

- Limiting the amount of surface area graded at any given time to reduce the area subject to potential erosion;
- Utilizing soil erosion protective materials such as mulch or geotextiles on areas where soils have a high potential for erosion until permanent provisions such as lawns and grasses can be developed;
- Planting vegetation as soon as grading operations permit to minimize the amount of time soils are exposed to possible erosion; and
- Building sedimentation basins to collect sediment which enters runoff waters.

The project will be regulated through review, revision and approval by the Maui County Department of Public Works (DPW) to ensure compliance with standards related to storm runoff containment.

3.1.4 Climate and Air Quality

Existing Environment

The climate of the Pukalani area can be described as mild and semi-moist due to its location in the lowlands on the windward side of the island. Average annual rainfall in the area is about 40 inches (Giambelluca et al 2013), with a moderate winter maximum. Winds are generally trades from the east-northeast, which are occasionally replaced by light and variable southerly "kona" winds, most often in winter (UH-Manoa, Dept. of Geography 1998).

Air quality in the project area, despite being near a highway and between two towns, is generally good. There are occasional impacts from agricultural dust, smoke during sugar cane burning (although the dominant winds general blow this away from this site) and sulfur particulates from volcanic emissions from Kilauea Volcano on the Big Island, called vog.

Impacts and Mitigation Measures

The proposed project will not produce any permanent substantial air quality impacts. Construction has the potential to produce very localized and temporary fugitive dust emissions. No homes are present within 900 feet. A dust control plan will be implemented for construction activities with potential to generate substantial dust. The elements of the plan may include some or all of the following:

- Watering of active work areas;
- Cleaning adjacent paved roads affected by construction;
- Covering of open-bodied trucks carrying soil or rock;
- Limiting area to be disturbed at any given time;
- Mulching or stabilizing disturbed inactive areas with geotextile; and
- Paving and landscaping of project areas as soon as practical in the construction schedule.

3.1.5 Noise and Scenic Value

Existing Environment

Noise levels on the site are moderate and derived from Kula Highway and the reservoir pump. No sensitive noise receptors such as churches, residences or schools are present within 900 feet of the existing Tank Site (see Figure 1-3). Residential subdivisions located just over 1,000 feet away in Pukalani are separated from the Tank Site by Kula Highway and industrial yards. Another subdivision is present about 1,400 feet away to the northeast, separated only by fields.

The proposed well site is on an industrial-looking property adjacent to the existing reservoir and near agricultural fields formerly used for pineapple and now being grazed. Topography and vegetation block the reservoir from view from Kula Highway, and the site lacks scenic value.

Impacts and Mitigation Measures

Construction will elevate noise levels during short periods over the course of several months. Rules of the Department of Health (DOH), at Title 11, Chapter 46, HAR (Community Noise Control), specify the maximum permissible sound levels based on zoning district. The rules apply to any excessive noise source emanating within the property to any point at or beyond the property line. The Pukalani Tank site (as well as all adjacent land) is within the State Land Use Agricultural District, where daytime and nighttime maximum permissible levels are both 70 decibels, which is about the volume of a typical vacuum cleaner.

Noise levels are not allowed to exceed the maximum permissible sound levels for more than ten percent of the time within any twenty minute period, except by permit or variance. The maximum permissible sound level for impulsive noise (i.e., sudden increases in sound levels) shall be ten decibels above the maximum permissible sound levels. A noise variance may be required for the 96-hour pump test of the exploratory well. Noise levels will vary based on construction equipment used, and if louder equipment is used, noise attenuation techniques can be employed. DOH will be consulted, and if appropriate, the contractor will be required to obtain a permit per prior to construction. DOH would review the proposed activity, location, equipment, project purpose, and timetable in order to decide upon conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers.

Operational impacts would be systematically analyzed in the production well EA, if the results of the exploratory well testing are successful and DLNR decides to proceed. In general, such wells utilize a submersible pump located deep within the well, which here would be some 1,600 feet below the ground surface and barely audible on the site. A fan located within the control building would also generate small amounts of noise, and the control building would also have an audible alarm that would be triggered only during emergencies.

The General Plan identified the rural and serene environment as one of the primary attributes that defines Upcountry Maui's character. Loss of this rural ambience is of significant concern to the region's residents. Consequently the preservation of this rural setting and open space, through comprehensive planning, public participation, and orderly plan implementation is viewed as an important goal for the region. The construction and operation of the well would not result in adverse impacts to scenery or ambience. All construction on the well site and supporting facilities will be in keeping with the existing water supply-oriented use of the site. The maximum height of structures will be approximately 14 feet, much lower (as well as less bulky) than the reservoir itself (see photos in Figure 1-2), and structures will not protrude into views of the coast or nearby roads.

3.1.6 Hazardous Substances

Existing Environment

A Phase I Environmental Site Assessment (ESA) was conducted for the project site by Myounghee Noh and Associates (MNA). The Phase I ESA is reproduced as Appendix 4. A Phase I ESA aims to identify *recognized environmental conditions* that exist on the project site and existing recognized environmental conditions in the project area that have the potential to impact the project site. The term recognized environmental conditions means the presence or likely presence of any hazardous substances or petroleum products on the site that indicates an existing release, a past release, or a material threat of a release into structures on the site or into the ground, groundwater, or surface water of the site.

MNA performed at site reconnaissance on June 5, 2013, which located rusted vehicle parts and a car battery in an area of dense vegetation within the Kula Highway right-of-way (ROW). Metals and petroleum products were assumed to have been present in the surface soil where these car parts were observed. Petroleum products and metals from these car parts were suspected to have impacted the surface soil in parts of the ROW; however, prolonged exposures to the sun and the wind, the petroleum products were likely be attenuated by dilution, dispersion, and disintegration. Therefore, the abandoned car parts are not considered a recognized environmental condition. No other areas of potential contamination were observed on the site.

Database research identified one leaking underground storage tank (LUST) facility within ½ mile of the subject property. The facility, at the Makawao Fire Station, was located 739 feet northwest of the subject property at 134 Makawao Avenue. The official status for this site was site cleanup complete, and no further action was required by the Hawai‘i Department of Health (HDOH). The site was located down gradient from the subject property. The anticipated direction of groundwater flow is to the west, away from the subject property. Therefore, this is not a recognized environmental condition.

MNA also reviewed Hawai‘i State Department of Health (DOH) Hazard Evaluation and Emergency Response (HEER) records for the property 500 feet and downgradient to the west, the parcel at TMK 2-3-007:008 previously owned by the Maui Land & Pineapple Company (MLP). A Limited Phase II ESA was previously conducted for the site, which was formerly operated as the Corn Mill Camp Pesticide Mixing and Storage Site during the 1940s through 1960s. In 2004, MLP entered into a Voluntary Response Program agreement. However, the land was sold to a new owner, thereby terminating the agreement. In December 2011, the HEER Office expressed its intent to continue remedial investigation. The HEER Office also indicated that former pesticide mixing sites often have significant levels of chemicals of concern, thereby generally considered potential "high risk" sites for contamination and public health hazards. Due to the close proximity of this site to the subject property and the potential for significant levels of chemicals of concern, this site is considered a recognized environmental condition.

Impacts and Mitigation Measures

Potential impacts of these recognized conditions, as well as fumigants used in pineapple fields in the general region, are discussed above in Section 3.1.2 in the context of water quality.

Operational impacts would be systematically analyzed in the production well EA, if the results of the exploratory well testing are successful and DLNR decides to proceed. In general, operation of a water well involves some limited use of hazardous materials. Water purification involves disinfection with chlorine gas, which is usually stored in 150-pound cylinders within a fire-rated enclosure in the control building. These systems are designed with a manual switchover, and each cylinder has an automatic shutoff. A chlorine gas monitoring and alarm system is provided, which activates a fan to purge the chlorine gas from the enclosure. Chlorine is a hazardous substance that is inventoried through a Tier-2 Reporting Form, and this information is filed with State and County Civil Defense Agencies and the County Fire Department. The design is being coordinated the County of Maui Fire Department. Given the proper design and appropriate coordination with the Fire Department, as well as the extensive safety precautions for use of the chlorine, there is negligible hazard to the public or the natural environment.

3.2 Biological Environment

Biological Consultation

In order to gain information concerning the potential presence of and impacts to important biota, early consultation included informing the U.S. Fish and Wildlife Service (UWFWS) and the DLNR Division of Forestry and Wildlife (DOFAW) about the action. In an email of August 8, 2013 (see copy in Appendix 1a), Ian Bordenave of USFWS provided the following information:

"Based on information you provided as well as information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program, the Service has determined that there is no designated critical habitat within the proposed project footprint. However, four species protected by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), may occur in or transit through the proposed action area:

The endangered Hawaiian petrel (*Pterodroma sandwichensis*) and threatened Newell's shearwater (*Puffinus auricularis newelli*), collectively referred to as seabirds, may transit through the proposed action area while flying between the ocean and nesting sites in the mountains during their breeding season (March through December). Seabird fatalities resulting from collisions with artificial structures that extend above the surrounding vegetation have been documented in Hawaii where high densities of transiting seabirds occur. Additionally, artificial lighting, such as flood lighting for construction work and site security, can adversely impact seabirds by causing disorientation which may result in collision with utility lines, buildings, fences, and vehicles. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as dogs, cats, and mongoose. Therefore, the Service recommends that project-related lighting should be minimized. All outdoor lights should be shielded so the bulb is not visible at or above bulb-height. Moreover, motion sensors and timers should be installed on any necessary outdoor lighting to minimize periods of illumination.

Additionally, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) is known to occur throughout the island of Maui. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the hoary bat breeding season (June 1 to September 15), there is a risk that young bats could inadvertently be harmed or killed. As a result, the Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season. Additionally, Hawaiian hoary bats forage for insects from as low as three feet to higher than 500 feet above the ground. When barbed wire is used in fencing, Hawaiian hoary bats can become entangled. The Service therefore recommends that barbed wire not be used for fencing as part of this proposed action.

Lastly, the Blackburn's sphinx moth (*Manduca blackburni*) may presently breed and feed within the proposed action area. Adult moths feed on nectar from native plants, including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*); larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and native aiea (*Nothocestrum latifolium*). Blackburn's sphinx moth pupae may occupy the soil within 250 feet of larval host plants for up to a year. The Service recommends that a qualified biologist survey the project area, and areas adjacent to the project

footprint, for the presence of native and non-native Blackburn's sphinx moth larval host plants. It is also recommended that these surveys be conducted during the wettest portion of the year (usually November-April) and approximately four to eight weeks following a significant rainfall event. Surveys should include looking for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If presence of the Blackburn's sphinx moth is confirmed, the Service should be contacted for further guidance."

Biological Reconnaissance Surveys

As shown in the photos in Figure 1-2, the Pukalani Tank Site was previously graded and is either bare or landscaped with grass and trees. No trace of the original vegetation of the remains. Table 3-1 provides a full list of plants observed during a June 2013 site visit by Dr. Ron Terry of the site, including the right-of-way area proposed for utility work,

No plants listed, or proposed for listing, as threatened or endangered by the U.S. Fish and Wildlife Service, were found within or near the site of the well or supporting facilities.

Table 3-1. Plant Species on Project Site

Scientific Name	Family	Common Name	Life Form	Status
Acacia confusa	Fabaceae	Formosan koa	Tree	A
Asclepias physocarpus	Apocynaceae	Balloon plant	Herb	A
Amaranthus viridis	Amaranthaceae	Slender amaranth	Herb	A
Argemone mexicana	Papaveraceae	Mexican poppy	Herb	A
Bidens pilosa	Asteraceae	Beggar's tick	Herb	A
Boerhavia coccinea	Nyctaginaceae	Boerhavia	Herb	A
Cenchrus ciliaris	Poaceae	Buffel grass	Grass	A
Chamaecrista nictitans	Fabaceae	Partridge pea	Herb	A
Chamaesyce hirta	Euphorbiaceae	Garden spurge	Herb	A
Chloris barbata	Poaceae	Swollen fingergrass	Grass	A
Cirsium vulgare	Asteraceae	Bull thistle	Herb	A
Cleome gynandra	Brassicaceae	Spider flower	Herb	A
Commelina benghalensis	Commelinaceae	Hairy honohono	Herb	A
Conyza bonariensis	Asteraceae	Hairy horseweed	Tree	A
Crassocephalum crepidioides	Asteraceae	Crassocephalum	Herb	A
Desmodium incanum	Fabaceae	Desmodium	Vine	A
Emilia fosbergii	Asteraceae	Flora's paintbrush	Herb	A
Eragrostis amabilis	Poaceae	Lovegrass	Grass	A
Euphorbia heterophylla	Euphorbiaceae	Kaliko	Shrub	A
Grevillea robusta	Proteaceae	Silver oak	Tree	A

Indigofera suffruticosa	Fabaceae	Indigo	Shrub	A
Ipomoea indica	Convolvulaceae	Morning glory	Vine	I?
Table 3-1, continued				
Lepidium bonariensis	Brassicaceae	Pepperwort	Herb	A
Leucaena leucocephala	Fabaceae	Koa haole	Tree	A
Macadamia integrifolia	Proteaceae	Macadamia	Tree	A
Malva parviflora	Malvaceae	Cheeseweed	Herb	A
Mangifera indica	Anacardiaceae	Mango	Tree	A
Megathyrsus maximus	Poaceae	Guinea grass	Grass	A
Melinis repens	Poaceae	Natal red top	Grass	A
Neonotonia wightii	Fabaceae	Glycine	Herb	A
Parthenium hysterophorus	Asteraceae	False ragweed	Herb	A
Pennisetum purpureum	Poaceae	Napier grass	Grass	A
Pluchea symphytifolia	Asteraceae	Sourbush	Shrub	A
Pandanus tectorius	Pandanaceae	Hala	Tree	I
Phyllostachys nigra	Poaceae	Black bamboo	Grass	A
Plantago lanceolata	Plantaginaceae	Narrow-leaved plantain	Herb	A
Psidium guajava	Myrtaceae	Common guava	Tree	A
Ricinus communis	Euphorbiaceae	Castor bean	Shrub	A
Salsola tragus	Chenopodacieae	Tumbleweed	Shrub	A
Schinus terebinthifolius	Anacardiaceae	Christmas berry	Shrub	A
Senecio madagascariensis	Asteraceae	Fireweed	Vine	A
Trifolium repens	Fabaceae	White clover	Herb	A
Verbena litoralis	Verbenaceae	Verbena	Herb	A
Verbesina encelioides	Asteraceae	Golden crown beard	Herb	A
Waltheria indica	Malvaceae	Uhaloa	Herb	I

* A = alien; I = indigenous; E= endemic

The alien vegetation on the project site and agricultural fields on surrounding properties appears to provide habitat for non-native bird species such as Japanese White-eyes (*Zosterops japonica*), Common Mynas (*Acroditheres tristis*) and Cardinals (*Cardinalis cardinalis*). No endangered or otherwise rare forest bird species were observed or would be expected in this lowland area. One individual of the highly invasive species axis deer (*Axis axis*) was observed after being disturbed during the biological survey of the project site. Mongooses (*Herpestes auropunctatus*), feral cats (*Felis catus*), rats (*Rattus* spp.) and mice (*Mus musculus domesticus*) may also inhabit or use the area.

No host plants for any stage of Blackburn's Sphinx Moth were present. It is important to note that the entire area consists of vegetation that is managed through herbicides and cutting to some degree by MDWS and the State Department of Transportation.
Although no Hawaiian hoary bats or seabirds were observed in the surveys, these species often require specialized detection methods and their possible presence in the region was noted by the U.S. Fish and Wildlife Service. There is no habitat suitable for nesting by Hawaiian seabirds, but several trees potentially tall enough to be utilized by Hawaiian hoary bats are present.

No aquatic environment is present in or near the proposed well. The nearest streams are intermittent gulches located approximately 2,000 feet to the east and west. Pumping of the basal aquifer in the Pukalani area, which is near sea level and more than six miles from the coastline, will not affect streams or springs. Despite the large flux of fresh groundwater into the coastal waters off Maui, steep bathymetry and rough seas induce almost instantaneous mixing of fresh and salt water. No effects on aquatic biology of coastal waters would be expected from the absence in this net flux of the relatively minor quantity of water that would be withdrawn by the well and not returned to the aquifer through use.

Impacts and Mitigation Measures

In order to avoid or minimize to negligible levels impacts to listed threatened or endangered species, the following actions, which conform to the recommendations of the U.S. Fish and Wildlife Service, will be required to be implemented as part of the project.

- Project-related lighting will be minimized, and all outdoor lights will be shielded so the bulb is not visible at or above bulb-height. Motion sensors and timers will be installed on any necessary outdoor lighting to minimize periods of illumination.
- It is not currently known if there will be a need to trim or remove trees, but if there is, woody plants greater than 15 feet tall will not be removed or trimmed during the Hawaiian hoary bat breeding season (June 1 to September 15). Additionally, no barbed wire will be utilized for fencing.

3.3 Socioeconomic

3.3.1 Social Factors and Community Identity

Existing Environment

This Upcountry region of Maui is characterized by abundant open space, agricultural lands, and rural towns. Because of its cool climate, spectacular views, and country lifestyle, it is a popular area to live. Makawao is one of the region's two main settlement areas. As noted in the General Plan, Makawao has a strong historic connection to cattle ranching and is traditionally known as

the last *paniolo* town on Maui. Commercial and institutional land uses in town are concentrated near the Baldwin Avenue and Makawao Avenue intersection. Residential areas are composed of suburban and rural subdivisions, and the town is surrounded by ranch land and farm fields. Pukalani is the second main town in the area, with a shopping center, a community center, several schools and suburban and rural subdivisions. The Kula area has a mixture of rural residential and agricultural uses, with diversified agriculture very important to the economy. Small rural service centers are sprinkled throughout the Kula region, including Waiakoa and Kēōkea.

Like most of the State of Hawai‘i, Upcountry is diverse in its social makeup (Table 3-2). Compared to the State as a whole, it has a generally greater proportion of whites and those reporting two or more races; a smaller proportion of Asians; fewer immigrants; more persons recently relocated to their current home; and more persons likely to live in single-family rather than multi-family homes.

This area saw significant increases in population in the 1980s, but less growth subsequently. One reason for the decrease in the pace of development was water supply problems. Job growth occurred at a much faster rate, but the Maui General Plan forecast calls for economic growth to continue at a slower pace. With only one job located in this area for every 2.5 households, most of the area's residents commute outside the area for work. This will continue to be the case; by 2030, the forecast shows only 2.1 local jobs per household.

As shown in Table 3-3, the General Plan 2030 forecast that the total population of Maui would not increase equally throughout the island, but overall would grow from 144,444 in 2010 to 194,630 in 2030, an increase of 35 percent. The Makawao-Pukalani area was forecast to grow during the same period from 23,919 to 29,635, an increase of 15 percent.

Some important socioeconomic trends were noted in the General Plan:

- The population is aging; the median age increased from 34.1 to 36.2 years between 1990 and 2000.
- Households are becoming smaller over time; Maui's household size is projected to decline from 2.94 persons per household in 2000 to 2.66 persons per household in 2030.
- Wage and salary jobs are expected to increase by about 1.1 percent annually.
- Per capita income will increase very little (in constant dollars).
- Visitor counts will increase by about 1 percent annually.
- Because of high occupancy rates, construction of new units is expected to resume, and the supply of visitor units is expected to grow at 1 percent annually.
- The past rate of growth in resident population, housing, and jobs is higher than the rate of visitor growth. This indicates that Maui's economy has diversified and is less driven by tourism than in the past.

Table 3-2: Selected Socioeconomic Characteristics

CHARACTERISTIC/AREA	Makawao CDP	Pukalani CDP	State of Hawai'i
POPULATION			
Population, 2010	7,184	7,574	1,360,301
Persons under 5 years, percent, 2010	7.1%	5.5%	6.4%
Persons under 18 years, percent, 2010	24.2%	24.0%	22.3%
Persons 65 years and over, percent, 2010	10.8%	12.4%	14.3%
Female persons, percent, 2010	50.9%	49.7%	49.9%
RACE			
White alone, percent, 2010 (a)	38.2%	33.2%	24.7%
Black or African American alone, percent, 2010 (a)	0.4%	0.4%	1.6%
American Indian and Alaska Native alone, percent, 2010 (a)	0.6%	0.3%	0.3%
Asian alone, percent, 2010 (a)	15.9%	23.9%	38.6%
Native Hawaiian and Other Pacific Islander alone, percent, 2010 (a)	8.4%	9.5%	10.0%
Two or More Races, percent, 2010	35.5%	30.9%	23.6%
Hispanic or Latino, percent, 2010 (b)	15.1%	12.0%	8.9%
White alone, not Hispanic or Latino, percent, 2010	33.9%	30.5%	22.7%
SOCIAL CHARACTERISTICS (2007-2001)			
Living in same house 1 year & over, percent	78.5%	90.7%	84.9%
Foreign born persons, percent	8.6%	7.4%	17.8%
Language other than English spoken at home, percent age 5+	12.1%	9.7%	25.6%
High school graduate or higher, percent of persons age 25+	92.5%	90.8%	90.1%
Bachelor's degree or higher, percent of persons age 25+	25.3%	23.4%	29.5%
Veterans, 2007-2011	429	788	114,109
Mean travel time to work (minutes), workers age 16+	23.8	28.0	25.9
HOUSING CHARACTERISTICS			
Housing units, 2010	2,702	2,900	519,508
Homeownership rate, 2007-2011	53.2%	62.4%	58.7%
Housing units in multi-unit structures, percent, 2007-2011	7.5%	13.9%	38.9%
Median value of owner-occupied housing units, 2007-2011	$595,800	$638,500	$529,500
Households, 2007-2011	2,650	2,619	445,513
Persons per household, 2007-2011	2.87	3.09	2.93
INCOME (2007-2011)			
Per capita money income in the past 12 months (2011 dollars)	$24,825	$34,891	$29,203
Median household income	$59,145	$79,481	$67,116
Persons below poverty level, percent	14.4%	3.2%	10.2%

Notes: (a) Includes persons reporting only one race. (b) Hispanics may be of any race, so also are included in applicable race categories

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, American Community Survey, Census of Population and Housing, County Business Patterns, Economic Census, Survey of Business Owners, Building Permits, Census of Governments

Table 3-3. Community Plan Area Population 2000 – 2030

Community Plan Area	2000	2005	2010	2015	2020	2025	2030
West Maui	17,967	19,852	22,156	29,103	31,410	33,743	36,058
Kīhei-Mākena	22,870	25,609	27,244	37,850	40,850	43,885	46,896
Wailuku-Kahului	41,503	46,626	54,433	52,343	56,492	60,689	64,853
Makawao-Pukalani-Kula	***21,571***	***23,176***	***25,198***	***23,919***	***25,815***	***27,732***	***29,635***
Pā`ia-Ha`ikū	11,866	12,210	13,122	11,332	12,230	13,139	14,040
Hāna	1,867	1,998	2,291	2,541	2,743	2,947	3,149
Total Maui Island	117,644	129,471	144,444	157,087	169,540	182,135	194,630

Source: Maui County General Plan 2030

Impacts and Mitigation Measures

No relocation of residences, businesses, community facilities, farms or other activities would occur because of the project. In the long-term, all direct impacts to the social environment may be regarded as beneficial, because it improves the quality, quantity, and reliability of potable water for schools, Hawaiian Home Lands residents, and Maui residents and businesses as a whole.

This EA concerns development of an exploratory well, which would not it itself produce or involve a commitment that would generate secondary impacts, such as population growth and consequent traffic, infrastructure, social services and lifestyle impacts. Section 3.4 discusses the impact analysis that would be required to be conducted if the exploratory well results are successful and DLNR decides to move forward with an EA for a production well.

3.3.2 Public Services, Facilities and Utilities

Utilities

Drilling the well will likely involve a portable, trailer-mounted drill rig utilizing a gasoline engine that requires approximately 500 gallons of fuel per 24 hours of drilling. Operating the well and supporting facilities will require electrical power, which is already available at the site. As discussed previously, considerable energy is required to pump water, and the MDWS is the largest consumer of power from MECO (Maui Electric Company) on the island of Maui. The well pump would use 345 to 770kW of power during operation, which could occur 8 to 20+ hours per day. Although this involves a substantial load, sufficient power is available through, and there will be no adverse effect to MECO or its customers. It is also possible that in the future, locally produced energy from small wind turbines or photovoltaic solar can offset pumping costs.

Roadways

As shown in Figure 1-3, access to the site for construction and maintenance will be via the MDWS Pukalani Tank driveway to Kula Highway, State Highway 37. No adverse impacts to public roads will occur.

If the exploratory well is successful, and DLNR moves forward with a production well, the need to place electric and water utilities inside the right-of-way of Kula Highway will require coordination and permitting with the State Department of Transportation.

Police, Fire, Emergency Medical, Recreation, Schools, and other Public Facilities and Services

All such facilities and services are present in the Upcountry area. No such facilities or services would be affected in any adverse way.

3.3.3 Cultural Resources

Chapter 343, HRS, requires consideration of cultural impacts for projects subject to an Environmental Assessment. The purpose of this is to ensure that significant cultural features and uses are identified, and to provide information to address the constitutional duty of agencies of the State of Hawai'i to protect the reasonable exercise of customarily and traditionally exercised rights of native Hawaiians, to the extent feasible, in connection with activities requiring State or County permits.

Existing Environment

Archaeological settlement data indicates that initial colonization and occupation of the Hawaiian Islands first occurred on the windward sides of the main islands, with populations eventually settling into drier leeward areas at later periods (Kirch 1985). Kirch (2011), in a review of 150 years of literature regarding settlement of the Hawaiian Islands, suggests earliest occupation of the islands occurred between A.D. 900 and 1000. The earliest populations purportedly used local resources and seldom ventured into upland valleys. Greater population expansion to inland areas, including upland *kula* zones, appears to have begun in the 12th century A.D., continuing through the 16th century AD.

Around the 14th century, the various *mōʻi* (kings/monarchs) of the Hawaiian Islands decided to formalize land tenure, mainly in order to better manage disputes between neighboring *aliʻi* (chiefs). Land was surveyed and land boundaries were marked. Hawaiian lands were divided into *moku* (districts), *ahupuaʻa,* and numerous smaller divisions, called *ʻokana*, *ʻili,* etc. These land divisions generally encompassed land from the mountain to the sea, thereby allowing access to both marine and mountain resources. Rather than denoting ownership of the lands by *aliʻi,* the

ahupuʻa boundaries signified a trusteeship between the caretakers of the land (*konohiki*), designated by the *aliʻi,* and the nature gods worshipped by Hawaiians (Handy and Handy 1972).

The project area is located in what is now called Pukalani, which translates to the "heavenly gates" (Pukui, et al. 1974). The original name may have been "Puʻu ka lani", or hill of the heavens (Ibid), alluding to the upland nature of the town and afternoon cloud formations over the area. Traditionally, the project site appears to have belonged to Hōkūʻula Ahupuaʻa, or "red star" *ahupuaʻa*; legendary and mythological references to Hōkūʻula are scarce. The project site is also near Makaʻeha and Makawao Ahupuaʻa, which are referenced more commonly in oral accounts. Hōkūʻula Ahupuaʻa is unique in that it does not run all the way from the mountain to the ocean, but rather is entirely composed of high agricultural lands (*kula*). Wailuku Moku marks the northwestern *makai* border of the *ahupuaʻa*, cutting off access to marine resources in this particular land division. The project site traditionally belonged to the *moku* of Kula but since 1848 has belonged to the larger Makawao District, as described in the Introduction

Upland areas of Maui such as the Kēōkea-Waiohuli area contained large garden enclosures, ceremonial structures, and permanent habitation sites by about A.D. 1600. Of Kula District, Handy (1940: 161) wrote:

> "On the coast, where fishing was good, and the lower westward slopes of Haleakala, a considerable population existed, fishing and raising occasional crops of potatoes along the coast, and cultivating large crops of potatoes inland, especially in the central and northeastern section including Keokea, Waiohuli, Koheo, Kaonoulu, and Waiakoa, where rainfall drawn round the northwest slopes of Haleakala increases toward Makawao."

Handy and Handy (1972) described the aridness of Kula, and the dependence of its people on receiving *poi* from the wetter valleys of Waikapu and Wailuku to supplement their diet. Yet Kula was "…wildly famous for its sweet potato plantations. ʻUala [the sweet potato] was the staple of life here" (Handy and Handy 1972: 510-511).

Makawao Ahupuaʻa, on the other hand, was once a vast area containing both wet and dry forests (Sterling 1998); its name literally means "forest beginning" (Pukui et al., 1976: 142). There are many references to the rains of Makawao, and it is likely that hunting and gathering took place in its diverse native forests (Sterling 1998; Pukui 1983). Tree species included *koa* (*Acacia koa*), sandalwood and *ʻōhiʻa lehua*; *maile* and ferns including *palapalai* and *palaʻa* thrived in these forests (Sterling 1998: 98). In the drier regions of Makawao, sweet potato was cultivated extensively, as it was in Kula. From Pukalani to historic Poʻokela Church, there are many oral accounts of sweet potato patches.

However, no sites in the project area have firmly identified permanent habitation sites such as those found in the Kēōkea-Waiohuli area of Kula. Rather, evidence of occupation includes petroglyphs, such as the canoe petroglyphs of Kaluapulani gulch in Makaʻeha Ahupuaʻa

(Sterling 1998). Numerous *heiau* (large religious structures) have also been recorded in Hōkūʻula and surrounding *ahupuaʻa*. Oral evidence of a large sweet potato patch is recorded by Manu in Sterling (1998) for the *ahupuaʻa* of Makaʻeha. These petroglyphs, religious structures and agricultural accounts attest to human activity in the project area, but do not provide evidence of permanent habitation. Rather, the area was most likely significant in terms of gathering of upland forest resources and dryland agricultural endeavors, primarily the cultivation of sweet potato.

By the early historic period in Hawaiʻi, significant natural and cultural changes had taken place throughout the islands, not only due to contact with Westerners, but also because of internal social and environmental restructuring and external social and environmental factors (e.g., foreign species being introduced as well as foreign ideologies). These combined to have a severe impact on Hawaiian environments, land-tenure, and social structures.

By the 1800s, agriculture in the *moku* of Kula had transitioned from a subsistence activity to a commercial one (Kuykendall 1965 in Pantaleo 2004b). Demand from new populations such as whalers encouraged the cultivation of vegetables, meat and fruit in Upcountry Maui. In the mid-19th century, demand for Irish potatoes by California gold rush workers caused a boom on Maui; Irish potato farms thrived in Kula, and soon Kula was known as the "potato district" (Kuykendall 1965: 313 in Pantaleo 2004b).

On the other side of Hōkūʻula Ahupuaʻa, in Makawao, cattle ranching became a prominent means of employment and adopted lifestyle. Livestock was introduced to the Hawaiian Islands in 1793 when Captain Vancouver transported cattle and sheep aboard his ship the Discovery, with the intention of giving the four cows, two bulls, four ewes, and two rams to Kamehameha I as a gift of goodwill. The rough seas and intense heat of the journey took its toll on the health of the cattle and several of the animals died. In order to ensure that the cattle population would increase, a ten-year *kapu* (ban) was placed on slaughtering them. Eventually the cattle did increase in number to the point of becoming a dangerous nuisance. As they were allowed to roam wild, gardens were destroyed and the Native Hawaiians were terrified of being attacked. Managing and controlling the unruly animals became a necessity. In order to solve this problem Kamehameha I employed "a varied crew with unsavory reputations who had immigrated to the islands to escape their pasts" as bullock hunters to capture the animals.

The stage was set for the first cowboys in what is now the U.S., when in 1803, Captain Richard Cleveland and his partner Captain William Shaler introduced horses to the Islands. These men brought aboard their ship, the HMS Lelia Byrd, several horses including a stallion and a mare with foal, which they presented as gifts to Kamehameha. Soon the horses, like the cattle, were roaming freely across the Islands. The horses adapted rapidly to the rough terrain where the cattle grazed and "their ability to work the livestock [did not] go unnoticed." Around 1830, Kamehameha III brought Mexican *vaqueros* from Vera Cruz to the Big Island to teach the local men how to rope and handle the animals. As the cattle and horse populations proliferated, the

animals were transferred to the various Hawaiian Islands and the *vaqueros*, which now included local cowboys, were needed on the outer islands. In addition to cattle ranching, agricultural activities were pursued. Despite claims that "the soil in this area of Maui grows rocks" (Fredericksen et al 1991:5) due to the many areas of exposed bedrock and scattered boulders and gravels in the surrounding fields, oral accounts of historic agricultural endeavors listed crops such as sweet potato, potatoes, corn, beans, and wheat, plantings of which had expanded exponentially in the first half of the nineteenth century (Sterling 1998: 99; Bartholomew 1994: 120).

During the historic period, extreme modification to traditional land tenure occurred throughout all of the Hawaiian Islands. The transition from traditional Hawaiian communal land use to private ownership and division was commonly referred to as the Māhele (Division). The Māhele of 1848 set the stage for vast changes to land holdings within the islands as it introduced the foreign (western) concept of land ownership to the Islands. Although it remains a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian economy to that of a market economy (Kuykendall Vol. I, 1938:145 footnote 47, 152, 165–166, 170; Daws 1968:111; Kelly 1983:45; Kameʻeleihiwa 1992:169–170, 176). Kameʻeleihiwa (1992: 209) stated that Makawao District was the first area in Hawaiʻi to experiment with land sales. In January 1846, land was made available for eventual ownership to the commoners (*makaʻāinana*).

For native Hawaiians who had been cultivating and living on the lands, lengthy and costly procedures enabled them to possibly claim some of the plots. These claims could not include any previously cultivated or presently fallow land, stream fisheries or many other resources necessary for traditional survival (Kelly 1983; Kameʻeleihiwa 1992:2; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed Land Commission Award (LCA), issued a Royal Patent number (RP), and could then take possession of the property (Chinen 1961: 16).

According to Chinen (1961), in Makawao District land was sold for $1.00 per acre; this would mark the beginning of land grants. Experimental lots purchased by Hawaiians ranged from five to ten acres, with a total land area of approximately 900 acres of grant lands purchased in Makawao. If applicants met all of the requirements (and were notified of the procedures), they eventually received the title to their land. Much of the granted lands in Makawao not purchased by native Hawaiian homesteaders was leased to foreign ranchers (Pantaleo 2004b). During the mid-nineteenth century a large population of Chinese immigrants began leasing lands from native Hawaiians and ranchers and developing a thriving agricultural community in Kula (ibid). Grants 1468 and 964 and LCA Award 8452: 7 are all in the immediate vicinity of the project site. Waihona ʻAina (date) lists Grant 1468 as a 115.85-acre property sold to Daniel P. Conde in Kailua Ahupuaʻa, Kula/Makawao District, for $11.00 per acre in 1854. Grant 964 was a 150-acre parcel sold to Kekaha in Kauau Ahupuaʻa, Kula/Makawao District, for $11.00 per acre in 1852.

Finally, LCA Award 8452-7 is part of a series of LCAs awarded to Keohokalole in 1848 in the *ahupua'a* of Kukuiaeo and Aapueo (among others) in Kula District.

The change in land tenure coupled with a growing world market for Hawai'i crops and political entanglement with the United States eventually set up a dramatic change in agriculture. Throughout Makawao District, sugar and pineapple production grew rapidly. The area which had once been "developed as an agricultural and stock-raising area" later expanded "into pineapple upon the formation of the Pukalani Dairy and Pineapple Company in 1907" (Bartholomew 1994: 121). By the end of the nineteenth century, sugarcane and pineapple proved profitable crops; patches of the crops still exist in the Upcountry areas today.

Impacts and Mitigation Measures

In the case of the proposed exploratory well project, it is important to reiterate that all ground disturbance will occur on a small portion of a roughly one-acre plot of land that has been completely graded and utilized for water supply functions for several decades, along with disturbed highway right-of-way adjacent to the tank site. The fenced site is hidden from public view and the project does not involve visual impacts. No streams, springs, wetlands or anchialine pools are fed or affected by the area of the aquifer that would be pumped by the project, and hydrological impacts upon these or any marine resources would be expected. No biological resources (e.g., valuable native or Polynesian gathering plants) are found on the Pukalani Tank site or would be expected to be impacted by project activities.

Nevertheless, the archaeological inventory survey (Appendix 3), the Phase I Environmental Site Assessment (Appendix 4) and the early consultation process for the EA itself (Appendix 1a) involved consultation of agencies, groups and individuals who might have knowledge of cultural resources or practices that be affected. No information relative to such practices or resources was received. It is reasonable to conclude, based upon the limited range of resources, that the exercise of native Hawaiian rights related to gathering, access or other customary activities will not be affected, and there will be no adverse effect upon cultural sites, practices or beliefs. The Draft EA was distributed to agencies and groups who might have knowledge in order to confirm this finding, including the Office of Hawaiian Affairs and the State Historic Preservation Division.

3.3.4 Historic Sites/Archaeological Resources

An archaeological inventory survey of the property was conducted by Scientific Consultant Services, Inc. (SCS). The study is attached as Appendix 3 and summarized below, with historical and cultural information summarized above.

Existing Environment

A cultural and historical review of the literature as well as previous archaeology indicates that Hōkūʻula Ahupuaʻa in Kula District, at the edge of Makawao Ahupuaʻa, was primarily a source of forest resources and agricultural land. There is a lack of evidence, both in oral accounts and archaeological remains, for permanent settlement in this particular area of upcountry Maui. Southeast of the project area, on the leeward slopes of Haleakalā in Kula Moku, where sweet potatoes were more extensively cultivated, there is evidence for permanent settlement. However, activities in this somewhat wetter and lower elevation area centered on hunting, gathering and more limited dryland cultivation. Many petroglyphs and ceremonial structures attest to the significance of this area, and it is clear that humans have utilized Hōkūʻula Ahupuaʻa from pre-Contact through the entire historic period.

Fieldwork was conducted on June 5, 2013 by SCS personnel David Perzinski B.A. and Michael Dega, Ph.D (Principal Investigator). The inventory survey included a 100 percent pedestrian survey of the project area in transects spaced 15 feet or less apart. As discussed above, the project area consisted of a one-acre fenced parcel that currently houses a one million gallon water tank, as well as an approximately 1,100-foot long pipeline corridor that parallels the eastern side of Kula Highway. The site has undergone extensive cutting and filling for the tank and includes a 12-foot cut on the southern portion of the reservoir lot, and up to 15 feet of fill on the north and east sides of the tank site. No sites or cultural deposits were encountered during the survey of the well site or the corridor. If sites did exist formerly, they were likely destroyed by the extensive disturbance associated with intensive agriculture, highway construction, and water tank uses, which have completely changed the surface of the project site.

Impacts and Mitigation Measures

The inventory survey resulted in an archaeological assessment report concluding that no sites were present and there would be no effects to significant historic properties. This was officially transmitted to the State Historic Preservation Division (SHPD) for review, comment and concurrence in August 2013. In a letter of November 7, 2013, SHPD approved the report, pending some revisions, and concurred with its findings (see end of Appendix 3 for letter).

In the unlikely event that archaeological resources or human remains are encountered during future development activities within the project site, contract specifications will require that work in the immediate area of the discovery shall be halted and DLNR-SHPD contacted as outlined in Hawaiʻi Administrative Rules 13§13-275-12.

3.3.5 Agricultural Land

Existing Farming Operations and Value of Agricultural Land

Consultation of maps of important farmland from the U.S. Natural Resources Conservation Service (USNRCS) (as displayed in the Hawai‘i State Geographic Information System) determined that the reservoir property, where the well is located, is land classified as Other Important Agricultural Land in the *Agricultural Lands of Importance to the State of Hawaii* (ALISH) map series. Although the Pukalani Tank site has been completely converted to water utility use, farming is occurring on adjacent land.

Impacts and Mitigation Measures

No adverse impacts to farmland or farming would occur, because the well site has been converted for use by the water utility and no farming is taking place or could take place. If results of testing the exploratory well are favorable and DLNR decides to proceed with a production well, the EA will examine direct and secondary effects to farming and farmland. As discussed in Section 3.1.2, Best Management Practices will be employed during grading of the well site and access driveway and during construction of all improvements, in order to minimize erosion or sedimentation and any adverse effects on adjacent land.

3.4 Growth-Inducing, Cumulative and Secondary Impacts

Growth-Inducing Impacts

Analysis of growth-inducing impacts examines the potential for a project to induce unplanned development, substantially accelerate planned development, encourage shifts in growth from other areas in the region, or intensify growth beyond the levels anticipated and planned for without the project. Provision of needed infrastructure such as roads, water supply, sewer facilities, etc., is often seen as growth-inducing. Of key importance is whether infrastructure fulfills existing demands/needs of planned growth, or whether it instead enables unplanned growth and/or diverts growth away from planned areas.

An analysis of these factors will be conducted if and when there are favorable results from testing the exploratory well data and DLNR decides to move forward with an EA for a production well. At that time, it will be possible to determine whether, and at what quantities, water of acceptable quality can be produced from the well. The outcome of subsequent negotiation between DLNR and MDWS will allow determination of what amount of water can be utilized for State projects and what can be used for other needs of MDWS.

Cumulative Impacts

Cumulative impacts result when implementation of several projects that individually have minor impacts combine to produce more severe impacts or conflicts among mitigation measures.

All adverse impacts of the exploratory well project related to hydrology, native species/habitat, wetlands, water quality, erosion, historic sites, and other areas of concern, are either non-existent or extremely restricted in geographic scale, negligible, and capable of mitigation through proper enforcement of permit conditions. There are no known appreciable adverse impacts that might accumulate with those of other past, present and future actions to produce more severe impacts.
Secondary Impacts

Construction projects sometimes have the potential to induce secondary physical and social impacts that are only indirectly related to project. For example, construction of a new recreation facility can lead to changes in traffic patterns that produce impacts to noise and air quality for a previously unimpacted neighborhood. In this case, the project's impacts are limited to direct impacts at the site itself, and there does not appear to be any potential for secondary impacts.

3.5 Required Permits and Approvals

Several permits and approvals will or may be required to implement this exploratory well project. The need for some of these permits will be determined in later stages of design.

- *State of Hawai'i DLNR Commission on Water Resource Management (CWRM) Well Construction / Pump Installation Permit*.
- *County of Maui Dept. of Public Works (DPW) Grading Permit*: Required for grading that exceeds 100 cubic yards or for feet in vertical height. A Minor Grading Permit applies when the graded area is under one acre and the maximum height/depth of excavation or fill less than 15 feet. A Major Grading Permit applies when the graded area exceeds one acre or the maximum height/depth of excavation or fill is over 15 feet.
- *State of Hawai'i Dept. of Health (DOH) National Pollutant Discharge Elimination System (NPDES) Permit*. An NPDES General Permit covers discharges composed entirely of storm water runoff associated with construction activities, including clearing, grading, and excavation that results in the disturbance of one acre or more of total land area.
- *State of Hawai'i DOH Noise Variance*. If construction may exceed maximum permissible sound levels based on the Agricultural zoning district, the permit may be required.

4 COMMENTS AND COORDINATION

4.1 Agencies and Organizations Contacted

The following agencies and organizations received a letter inviting their participation in the preparation of the Environmental Assessment.

County of Maui

- Department of Planning
- Department of Environmental Management
- Department of Fire/Public Safety
- Police Department
- County Council
- Department of Water Supply
- Department of Public Works

State of Hawai'i

- Department of Land and Natural Resources, Land Division
- Department of Land and Natural Resources, Historic Preservation Division
- Department of Land and Natural Resources, Commission on Water Resource Management
- Department of Health
- Office of Hawaiian Affairs
- Hawaiian Homes Commission
- Department of Transportation

Federal

- Haleakala National Park
- U.S. Fish and Wildlife Service

Organizations

- Sierra Club
- Maui Tomorrow
- Makawao Community Association

Copies of correspondence from agencies with substantive comments during the preparation of the EA are included in Appendix 1A and are cited in appropriate sections of the text of this EA.

5 LIST OF DOCUMENT PREPARERS

This Environmental Assessment was prepared for the State of Hawai‘i, Department of Land and Natural Resources by Ron Terry, Ph.D., of Geometrician Associates, with assistance from Akinaka & Associates, the engineering contractor for the well project.

6 STATE OF HAWAIʻI ENVIRONMENTAL ASSESSMENT FINDINGS

Section 11-200-12 of the State Administrative Rules sets forth the criteria by which the significance of environmental impacts shall be evaluated. The following discussion paraphrases these criteria individually and evaluates the project's relation to each.

1. *The project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources*. No natural resources will be irrevocably committed or lost. The biota on the site consists of landscaped or weedy species, and no sensitive water bodies or other natural resources are present. The State Historic Preservation Division has concurred that the project would have no effect to historic sites.

2. *The project will not curtail the range of beneficial uses of the environment*. No future beneficial use of the environment will be affected in any way by the proposed project. Sufficient water will remain, well within the sustainable yield of the aquifer, to promote other beneficial uses of groundwater in the Makawao region. The existing use of the site for a reservoir will not be affected.

3. *The project will not conflict with the State's long-term environmental policies*. The State's long term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. A number of specific guidelines support these goals. No aspect of the proposed project conflicts with these guidelines. The project's goals of providing potable water to support schools and Hawaiian Home Lands projects as well as adequate supply and orderly development of planned growth, while conserving natural resources satisfies the State's environmental policies.

4. *The project will not substantially affect the economic or social welfare of the community or State*. The improvements will benefit the social and economic welfare of Hawaiʻi by improving the potable water supply for schools and Hawaiian Home Lands.

5. *The project does not substantially affect public health in any detrimental way*. No adverse effects to public health are anticipated. Public health will be benefitted by improving the potable water supply system for schools and Hawaiian Home Lands.

6. *The project will not involve substantial secondary impacts, such as population changes or effects on public facilities*. No adverse secondary effects are expected. The project will not enable development, but will instead assure adequate supply to existing customers and serve planned growth.

7. *The project will not involve a substantial degradation of environmental quality*. The implementation of best management practices for all construction will ensure that the project will not degrade environmental quality in any substantial way.

8. *The project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat*. No endangered species of flora or fauna are known to exist on the project site or would be affected in any way by the project.

9. *The project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions*. Cumulative impacts result when implementation of several projects that individually have minor impacts combine to produce more severe impacts or conflicts among mitigation measures. All adverse impacts will either not occur or will be reduced to negligible levels through mitigation measures, and will therefore not tend to accumulate in relation to this or other projects.

10. *The project will not detrimentally affect air or water quality or ambient noise levels.* The project will have negligible effects in terms of water quality, air quality and noise.

11. *The project will not affect or will likely be damaged as a result of being located within an environmentally sensitive area such as flood plains, tsunami zones, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters or coastal waters*. No floodplains, tsunami zones, geologically hazardous areas, or other such sensitive land is involved in the area planned for development.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No protected viewplanes will be impacted by the project, which will have no adverse scenic effects.

13. *The project will not require substantial energy consumption*. Some, but not substantial, input of energy is required for the construction of the facilities and the operation of the pump for the exploratory well. Further studies and planning that would be discussed in the EA for the production will be necessary to determine the energy implications.

Based on the above, the State of Hawai‘i, Department of Land and Natural Resources, expects at this time to determine that the proposed project will not have any significant effect in the context of Chapter 343, Hawai‘i Revised Statues and section 11-200-12 of the State Administrative Rules, and thus expects to issue a Finding of No Significant Impact. This finding will be carefully evaluated and made final upon consideration of comments on the Draft EA.

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DLNR Pukalani Tank Site
Exploratory Water Well

ENVIRONMENTAL ASSESSMENT

Appendix 1a
Comments Received in Response to Early Consultation

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NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

13-134
Pukalani Reservoir

July 15, 2013

Mr. Ron Terry
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawaii 96721

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment
Proposed DLNR Pukalani Reservoir Well Site, TMK: 2-3-007: 030

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter dated July 5, 2013. Thank you for allowing us to review and comment on the subject document. The document was routed to the Department of Health's Safe Drinking Water Branch. They will provide specific comments to you if necessary. EPO recommends that you review the Standard Comments found on our website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/. You are required to adhere to all Standard Comments specifically applicable to this application.

EPO suggests that you examine the many sources available on strategies to support the sustainable design of communities, including the:

- U.S. Environmental Protection Agency's report, "Creating Equitable, Health and Sustainable Communities: Strategies for Advancing Smart Grants, Environmental Justice, and Equitable Development" (Feb. 2013), http://www.epa.gov/smartgrowth/pdf/equitable-dev/equitable-development-report-508-011713b.pdf;
- U.S. Environmental Protection Agency's sustainability programs: www.epa.gov/sustainability;
- U.S. Green Building Council's LEED program: www.new.usgbc.org/leed; and
- World Health Organization, www.who.int/hia.

The DOH encourages everyone to apply these sustainability strategies and principles early in the planning and review of projects. We also request that for future projects you consider conducting a Health Impact Assessment (HIA). More information is available at www.cdc.gov/healthyplaces/hia.htm. We request you share all of this information with others to increase community awareness on sustainable, innovative, inspirational, and healthy community design.

We wish to receive notice of the environmental assessment's availability when it is completed. We request a written response confirming receipt of this letter and any other letters you receive from DOH in regards to this submission. You may mail your response to: 919 Ala Moana Blvd., Ste. 312, Honolulu, Hawaii 96814. However, we would prefer an email submission to epo@doh.hawaii.gov. We anticipate that our letter(s) and your response(s) will be included in the final document. If you have any questions, please contact me at (808) 586-4337.

Mahalo,

Laura Leialoha Phillips McIntyre, AICP
Manager, Environmental Planning Office

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS

200 SOUTH HIGH STREET, ROOM NO. 434, WAILUKU, MAUI, HAWAII 96793
Telephone: (808) 270-7845 • Fax: (808) 270-7955

July 24, 2013

Ron Terry, Ph.D., Project Environmental Consultant
GEOMETRICIAN ASSOCIATES, LLC
P. O. Box 396
Hilo, Hawaii 96721

Dear Dr. Terry:

SUBJECT: EARLY CONSULTATION FOR ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED DEPARTMENT OF LAND AND NATURAL RESOURCES (DLNR) PUKALANI RESERVOIR WELL SITE; TMK: (2) 2-3-007:030

We reviewed the subject early consultation request and have the following comment:

1. When a project is financed with State or County funds, the requirements of Hawaii Revised Statutes, Section 103-50 will apply.

Please call Rowena M. Dagdag-Andaya at (808) 270-7845 if you have any questions regarding this letter.

Sincerely,

for DAVID C. GOODE
Director of Public Works

DCG:RMDA:ls
xc: Highways Division
Engineering Division
S:\LUCA\CZM\prop_dlnr_pukalani_reservoir_well_site_ec_23007030_ls.wpd

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 29, 2013

Geometrician Associates, LLC
Attention: Mr. Ron Terry
P.O. Box 396
Hilo, Hawaii 96721

via email: rterry@hawaii.rr.com

State of Hawaii
Department of Land and Natural Resources
Engineering Division
Attention: Mr. Gayson Ching
1151 Punchbowl Street, Room 221
Honolulu, Hawaii 96813

via email: gayson.y.ching@hawaii.gov

Dear Mr. Terry and Mr. Ching:

SUBJECT: Early Consultation for Environmental Assessment, Proposed DLNR Pukalani Reservoir Well Site

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, the DLNR has no comments to offer on the subject matter. If you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

cc: Central Files

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
STP 8.1263

July 22, 2013

Mr. Ron Terry, Ph.D.
Project Environmental Consultant
Geometrician
P. O. Box 396
Hilo, Hawaii 96721

Dear Mr. Terry:

Subject: Pukalani Reservoir Well Site
Early Consultation for Environmental Assessment
TMK: (2) 2-3-007:030

Thank you for requesting the State Department of Transportation's (DOT) review of the subject project. DOT understands the Department of Land and Natural Resources (DLNR) has identified the need to develop an exploratory potable water well at the Maui Department of Water Supply (MDWS) Pukalani Reservoir Site on Kula Highway.

DOT does not anticipate any significant adverse impacts to the State transportation facilities (Kula Highway) at this time. We do ask that the DLNR consult with the DOT Highways Division, Maui District Office, throughout the planning and design phase of the project to identify the appropriate access requirements, permits and approval for construction traffic and construction of the reservoir access road as they prepare the Draft Environmental Assessment.

DOT appreciates the opportunity to provide comments. If there are any questions, including the need to meet with DOT staff, please contact Mr. Garrett Smith of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

In Reply Refer To:
2013-TA-0357

Mr. Ron Terry, Ph.D
Project Environmental Consultant
Geometrician Associates, LLC
PO Box 396
Hilo, Hawaii 96721

Subject: Technical Assistance for the Proposed Pukalani Reservoir Well Site, Maui

The U.S. Fish and Wildlife Service (Service) received your letter on July 9, 2013, requesting comment in preparation of a Draft Environmental Assessment for the proposed development of an exploratory potable water well at the Maui Department of Water Supply Pukalani Reservoir Site on the Kula Highway near Pukalani, Hawaii [TMK: (2) 2-3-007:030]. Although the site is fully developed, some new grading will be required to accommodate the construction activity and appurtenant facilities.

Based on information you provided as well as information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program, the Service has determined that there is no designated critical habitat within the proposed project footprint. However, four species protected by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), may occur in or transit through the proposed action area:

The endangered Hawaiian petrel (*Pterodroma sandwichensis*) and threatened Newell's shearwater (*Puffinus auricularis newelli*), collectively referred to as seabirds, may transit through the proposed action area while flying between the ocean and nesting sites in the mountains during their breeding season (March through December). Seabird fatalities resulting from collisions with artificial structures that extend above the surrounding vegetation have been documented in Hawaii where high densities of transiting seabirds occur. Additionally, artificial lighting, such as flood lighting for construction work and site security, can adversely impact seabirds by causing disorientation which may result in collision with utility lines, buildings, fences, and vehicles. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as dogs, cats, and mongoose. Therefore, the Service recommends that project-related lighting should be minimized. All outdoor lights should be shielded so the bulb is not visible at or above bulb-height. Moreover, motion sensors and timers should be installed on any necessary outdoor lighting to minimize periods of illumination.

Additionally, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) is known to occur throughout the island of Maui. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the hoary bat breeding season (June 1 to September 15), there is a risk that young bats could inadvertently be harmed or killed. As a result, the Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season. Additionally, Hawaiian hoary bats forage for insects from as low as three feet to higher than 500 feet above the ground. When barbed wire is used in fencing, Hawaiian hoary bats can become entangled. The Service therefore recommends that barbed wire not be used for fencing as part of this proposed action.

Lastly, the Blackburn's sphinx moth (*Manduca blackburni*) may presently breed and feed within the proposed action area. Adult moths feed on nectar from native plants, including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*); larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and native aiea (*Nothocestrum latifolium*). Blackburn's sphinx moth pupae may occupy the soil within 250 feet of larval host plants for up to a year. The Service recommends that a qualified biologist survey the project area, and areas adjacent to the project footprint, for the presence of native and non-native Blackburn's sphinx moth larval host plants. It is also recommended that these surveys be conducted during the wettest portion of the year (usually November-April) and approximately four to eight weeks following a significant rainfall event. Surveys should include looking for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If presence of the Blackburn's sphinx moth is confirmed, the Service should be contacted for further guidance.

If you have any questions or concerns regarding this technical assistance, please feel free to contact me using the information provided below.

Aloha,

Ian Bordenave
Biologist
U.S. Fish and Wildlife Service
Pacific Islands Field Office
300 Ala Moana Blvd., Suite 3-122
Honolulu, HI. 96850
Phone: (808) 792-9453
E-Mail: ian_bordenave@fws.gov

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 27, 2013

Geometrician Associates, LLC
Attention: Mr. Ron Terry
P.O. Box 396
Hilo, Hawaii 96721

via email: rterry@hawaii.rr.com

State of Hawaii
Department of Land and Natural Resources
Engineering Division
Attention: Mr. Gayson Ching
1151 Punchbowl Street, Room 221
Honolulu, Hawaii 96813

via email: gayson.y.ching@hawaii.gov

Dear Mr. Terry and Mr. Ching:

SUBJECT: Early Consultation for Environmental Assessment, Proposed DLNR Pukalani Reservoir Well Site

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments previously sent you on July 29, 2013, enclosed are comments from the Commission on Water Resources Management on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc: Central Files

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

August 23, 2013

TO: Russell Tsuji, Administrator
Land Division

FROM: William M. Tam, Deputy Director
Commission on Water Resource Management

SUBJECT: Exploratory Well At Pukalani Reservoir Early Consult

FILE NO.: N/A
TMK NO.: (2) 2-3-007:030

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://www.hawaii.gov/dlnr/cwrm.

Our comments related to water resources are checked off below.

☒ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☒ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EPA as having high water efficiency can be found at http://www.epa.gov/watersense/.

☒ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

☒ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/programs/achieving-efficiency/green-business-program

☐ 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://landscapehawaii.org/_library/documents/lich_irrigation_conservation_bmps.pdf

☐ 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:
Additional information and forms are available at http://hawaii.gov/dlnr/cwrm/info_permits.htm.

☐ 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☒ 11. A Well Construction Permit(s) is (are) required before any well construction work begins.

☒ 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 14. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.

☐ 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.

☐ 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☐ OTHER:

If there are any questions, please contact Charley Ice at 587-0218.

ALAN M. ARAKAWA
Mayor
KYLE K. GINOZA, P.E.
Director
MICHAEL M. MIYAMOTO
Deputy Director

TRACY TAKAMINE, P.E.
Solid Waste Division
ERIC NAKAGAWA, P.E.
Wastewater Reclamation Division

COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2200 MAIN STREET, SUITE 100
WAILUKU, MAUI, HAWAII 96793

October 10, 2013

Mr. Ron Terry
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawaii 96721

Dear Mr. Terry:

SUBJECT: DLNR PUKALANI RESERVOIR WELL SITE EARLY CONSULTATION FOR ENVIRONMENTAL ASSESSMENT TMK (2) 2-3-007:030, PUKALANI, MAUI

We reviewed the subject application and have the following comments:

1. Solid Waste Division comments:

   a. None.

2. Wastewater Reclamation Division (WWRD) comments:

   a. None.

If you have any questions regarding this memorandum, please contact Michael Miyamoto at 270-8230.

Sincerely,

KYLE K. GINOZA, P.E.
Director of Environmental Management

DLNR Pukalani Tank Site
Exploratory Water Well

ENVIRONMENTAL ASSESSMENT

Appendix 2
Hydrology Report

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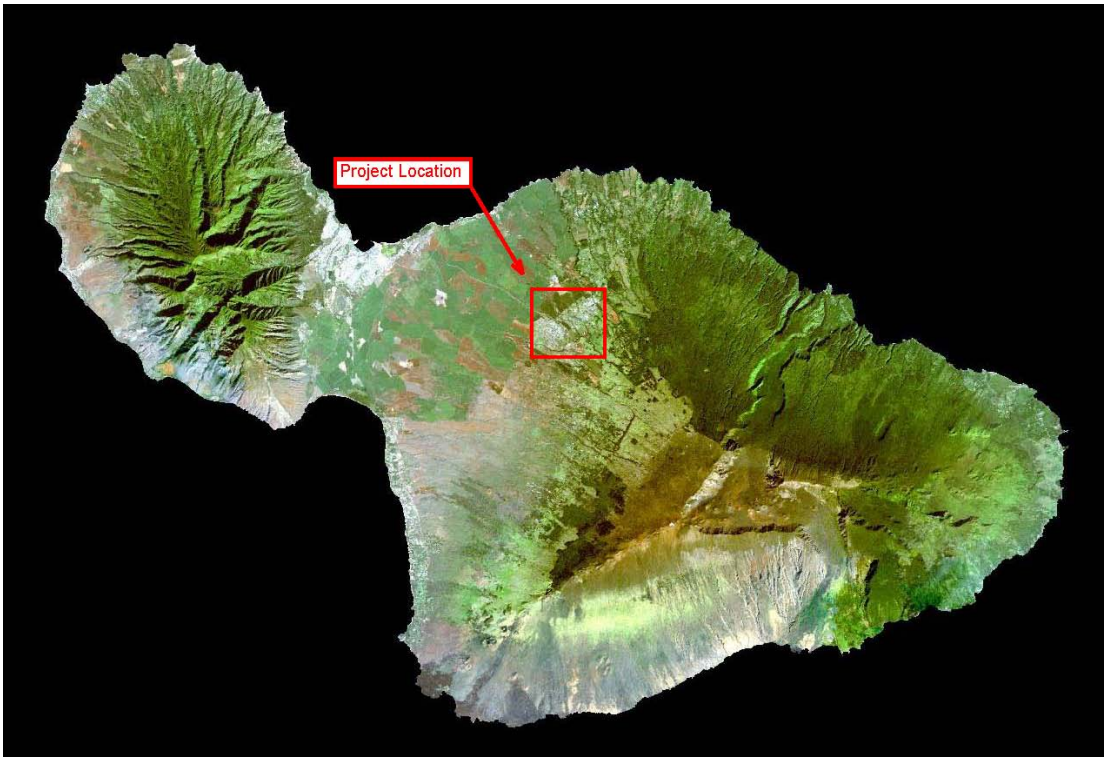
waimea water services

Office (808) 885-5941
Fax (808) 885-7851

Upcountry Maui Exploratory Well
Makawao, Maui



August 8th, 2012

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Background

The State of Hawaii is interested in exploring potential water sources in the Makawao area of the Island of Maui as a way to support the development of future state projects. Akinaka and Associates Inc. are contracted as the engineers and Waimea Water Services, LLC is subcontracted to act as consultants in determining the best potential site for developing a water source.

In considering the locality for a new well in support of State of Hawaii projects, the hydrogeology of the potential site is the prime consideration. Given suitable aquifer information, the site must consider the location to storage, transmission and power as well as proximity to the project locations. All of these factors must be considered in the risk of success. The desired production sought from the exploration well is proposed to be 1 million gallons per day (700 gpm). With this as the objective the following discussion presents the risk considerations.

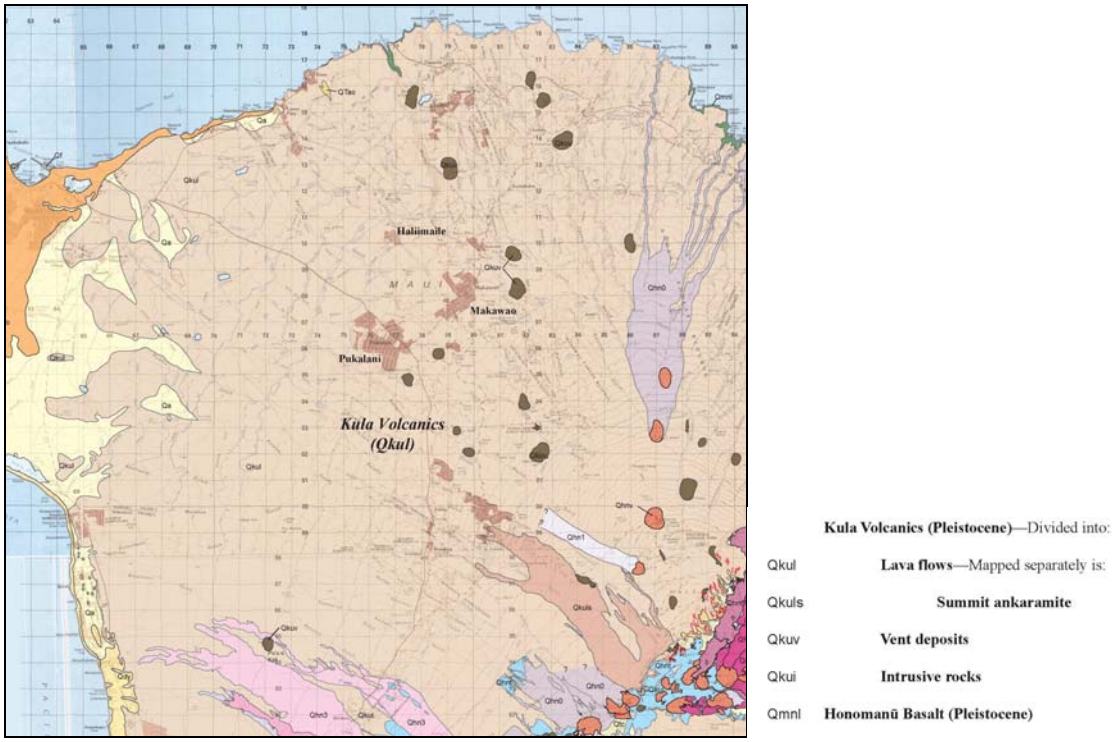
Geology

The project area is located on the western slope of Haleakala Volcano which can be described as a broad, flat, upland slope. The Kula Volcanic series (Okul) covers the entire northwest flank of Haleakala Volcano and was erupted .98 – 1.5 million years ago during the Pleistocene epoch.

The flows can generally be characterized as thicker, narrower, and far less permeable than the underlying Honomanu basalts. The thickness of the flows is a function of the chemical composition which generally contains a higher percentage of silica. This increase in silica content causes the flows to be more massive with smaller fractures and the flows can average about 20 feet in thickness in the higher summit elevations to 50 feet near the edges, but flows 200 feet thick can also be found.

The number of erosional unconformities and interstratified soil beds suggests that the upper Kula lavas accumulated in the waning phase of Haleakala Volcano when the time between flows became progressively longer. This allowed the lavas the necessary time to weather into deep soils. This assemblage of interstratified soils, vitric tuff beds, weathered clinker zones, and wide bands of dense rock that make up the Kula series greatly affect the flow of groundwater.

Most of the individual lava beds are permeable and unable to perch water. When the whole formation is considered as a unit, it contains enough impermeable layers, even through discontinuous, to greatly retard the downward percolation of water.



Geology of Central Maui (USGS)

Hydrology

The major water supplies to the study consist of three primary stream diversions; Piiholo, Olinda and Kamaole (see A&A Exhibit 2). These diversions deliver primarily direct runoff from stream flow in Maui. The two upper diversions, Olinda and Piiholo enter the Maui Department of Water Supply system by gravity and are routed throughout the upper Kula system. The Kamaole treatment plant obtains its water from the HC & S and is pumped up to a major distribution hub located at the Pookela well. These imported waters ultimately add to the local ground water recharge entering the Makawao hydrologic unit. A hydrologic budget was prepared to better understand the impacts of the imported waters on the recharge or infiltration component (Appendix A).

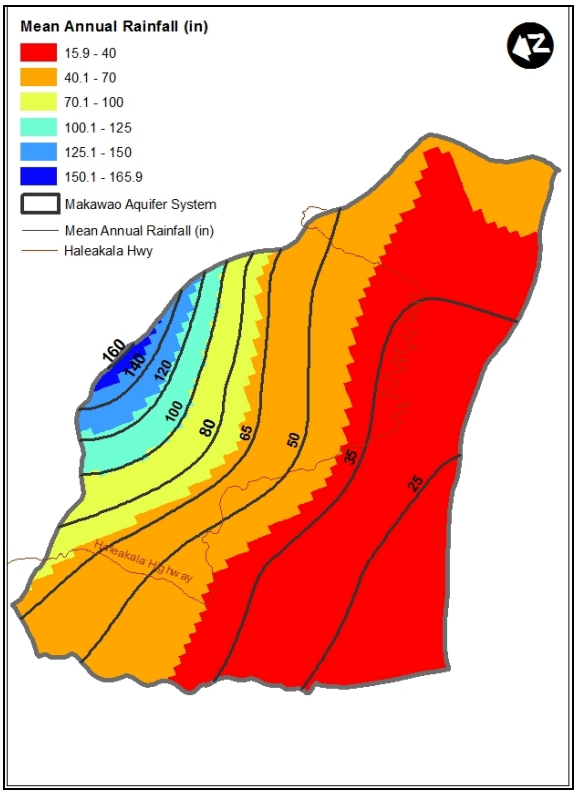
The local rainfall and irrigation water flows into the weathered andesitic lavas of the Kula volcanic series. Infiltrated water tends to migrate horizontally as groundwater perched on dense lava or weathered soil formations. In the high rainfall areas, these perched aquifers appear as surface springs or will sustain perennial flow in streams. West of Maliko gulch, these percolating waters can be intersected during the drilling of wells but are otherwise not visible. If the annular space between the well casing and the bore is not properly grouted and sealed, the migrating water may find its way downward into the production well bore as has been evidenced in certain well in the lower Kula and Haiku regions.

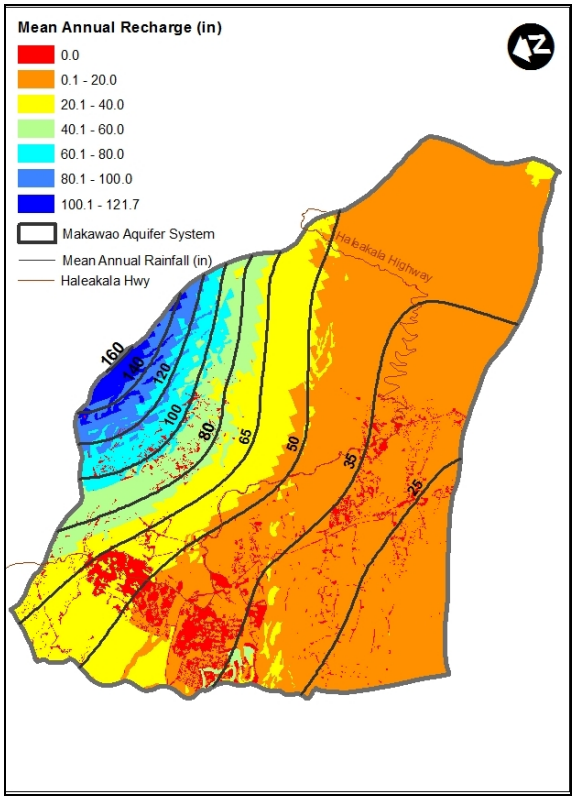
There is also a geologic unconformity between the upper Kula formations and the Honomanu basalt (which constitute the high yielding basal aquifer). In most wells, the soil over laying the Honomanu basalt is readily identified during drilling.

The hydrologic budget was prepared to study the sensitivity of the aquifer to recharge and pumping. Previous studies have estimated the sustainable yield of the hydrologic unit as approximately 7mgd. Present pumpage is about 1.36 mgd, and is primarily from the Pookela Well according to DWS data and the Pukalani irrigation well which is now supplemented with R-1 reclaimed wastewater. In addition, there are a number of small domestic or stack water wells which produce less than 100,000 gpd total. The total developed groundwater is about 6.49 mgd.

The best estimate of groundwater recharge to the aquifer within the Makawao hydrologic unit when calculated in the budget averages about 67.84 mgd. This includes the infiltration of the imported 6.44 mgd from the surface water sources.

The distribution of the annual average rainfall and recharge are shown in the maps below.

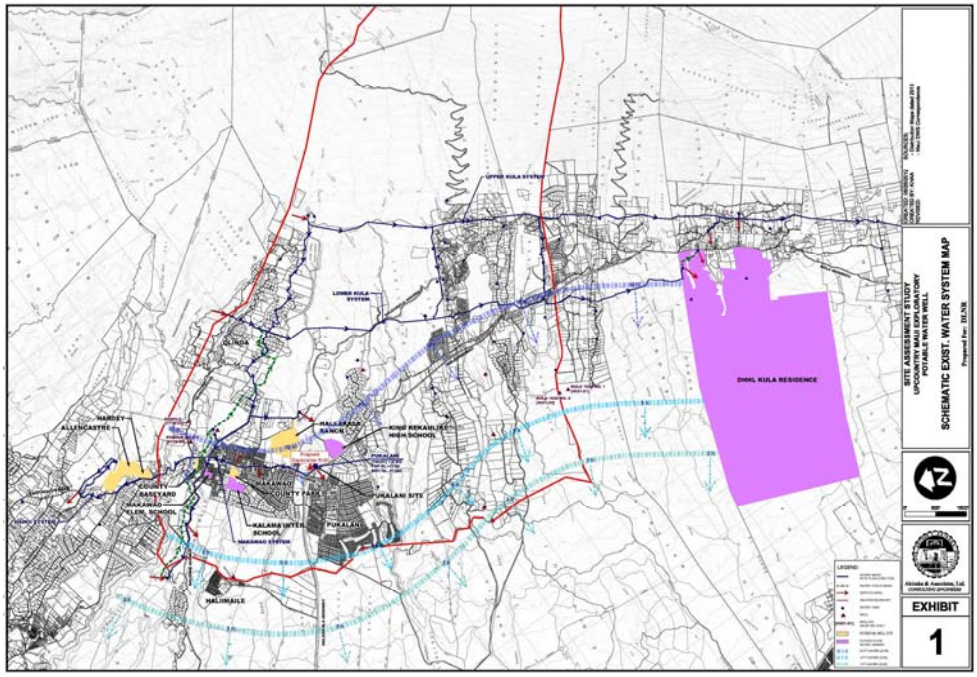




Existing Water System

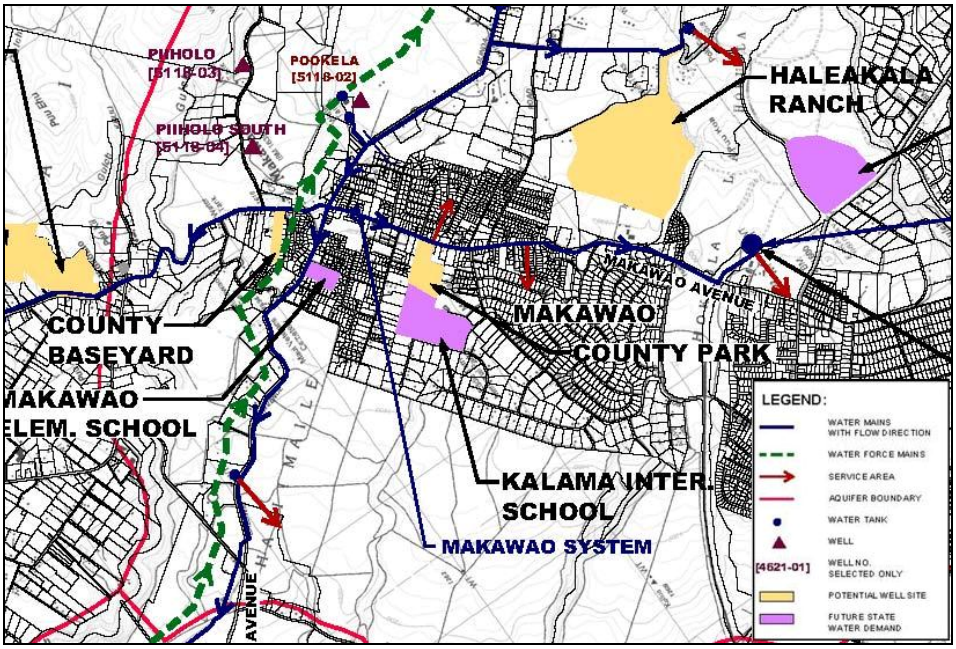
The Makawao aquifer unit covers about 37,523 acres and has limited groundwater opportunities because of the land elevation. The preceding hydrologic budget spells out the likely recharge quantities which might be tapped. Groundwater has been developed by a number of deep wells, most of which are small capacity units used by private owners. The MDWS presently relies largely on the surface water diversions which are treated and distributed via the primary transmission system shown in map below.

In order to properly locate a well site for exploration, this study reviewed all of the previous investigations available, reviewed well data and selected quality information. From this information, a water level contour map was prepared, based on selected wells.



See Appendix

The Pookela well (as seen below) and storage are the hub of reliable supply. The upper and lower Kula transmission lines and the water pumped from the Kamaole Weir to the Pookela site can all be delivered to that location. The main groundwater source to serve the communities west of Makawao village is the Pookela well. This study has investigated ground water development potential specifically to serve the State of Hawaii projects west of Makawao.



Ground water sources to date have only produced water from the basal lens, where fresh water is floating in equilibrium with underlying salt water. One well, Piiholo South appears to terminate in a poorly permeable formation which had limited yield and may actually lie in the northeast volcanic rift zone of Haleakala. In contrast to the normal water level response to pumping, this well exhibited behavior similar to that found in dike confined aquifers. This may be a very local condition. There has been no well yet confirmed to develop water from a high level aquifer (dike or fault confined), although fresh water in the basal lens has been found.

The primary water supply for the Makawao-Kula-Ulupalakua region is the surface water diversions. Requests for water service have far exceeded the existing supply, particularly during dry periods. The Pookela well has become a critical source in such periods and more ground water development is needed to meet the demand during these dry periods.

Potential Pollution

A concern in well site selection is placing a well such that they might compete with other existing wells. Historically, there is clear evidence from the plantation water sources, up gradient (water table) wells do cause salinity increase in the lower wells if excessively pumped. Ground water flow direction is normal (90 degrees) to the water level contours of equal head. Selecting a well site immediately down gradient from a pumping well should be avoided.

Many of the potential sites are located in the general vicinity of un-sewered homes, such sites will be located above an elevation of 1500', and there is no evidence to indicate any pollution from normal human waste ever reaching the aquifer as it is a rural home density and underlain by significantly weathered lava (sapprolite).

Where pineapples were once grown, there is a potential for fumigates such as EDB to have been used. The limited evidence of such pollutants reaching the basal lens has been where rainfall is high and in old wells. None of the high elevation (above 1500') wells have exhibited any evidence of organic contamination. It is very important that a well located in these upper slopes would have the annular space between casing and bore hole be grouted to within 5' of mean sea level as a precaution against shallow, perched water reaching the basal water table.

Exploration Site Options

Six potential well sites of interest were reviewed as recommended of the DLNR project staff. DWS suggested sites of Allencastre, Hardey, County base yard were visited. They were ruled out for this project as their location and service areas were small and remote for consideration for this project.

The Makawao County Park lies in the heart of the urban subdivision and noise during construction could be a limiting factor for construction and the potential of urban type pollution is greater but not necessarily a restricting factor. The State of Hawaii projects of the Makawao Elementary school and Kalama Intermediate School are located near these sites and have low demand potential. Also, wells developed at these sites would compete for water that is currently being produced at the Pookela well site directly up slope.

All of the above sites are located in what might be called the Makawao –Pukalani transmission service area. On Map Exhibit 1, the site labeled Haleakala Ranch is a strong candidate because it is likely to have a high yield and quality resource, but water developed on the site will require property acquisition and significant system and power improvements.

The recommended site for exploration is at the Pukalani Tank (elevation 1684'). It would be located in or adjacent to the tank site. This site presents little or no property issues, minimal piping improvements but does require some power transmission investment. An alternative exploration site to serve the Pukalani Tank might be from King Kekaulike High School. Importantly, it is probable that a well with a capacity of 500 to 700 gpm could be found at this site as there is no significant ground-water development nearby and it can free up a significant surface water component being supplied from either the Kamaole or Piiholo diversions for use in the Lower Kula transmission which serve the State of Hawaii DHHL lands. In addition, this will improve the dry weather deliveries.

Pukalani Tank

In the long term, more groundwater must be developed to serve the upper and lower Kula systems. It is recommended that the appropriate agency consider the acquisition of the Kula 1800 wells 1 and 2 as a way to provide additional support to the DHHL land which are served by the both the Upper and Lower Kula systems.

Well and Pump Considerations

The absence of evidence to indicate high level ground-water occurrence means that any well has a depth below sea level consideration to prevent salt water intrusion. This in turn limits the size of pump diameters and lengths since the probable pump for high lift pumping will be the submersible type. As the elevation of the well head is increased above say 1500 feet, a longer pump will be required, the motor speed must be increased or the capacity must be reduced to decrease the required horsepower.

For example, if a well is located at elevation 2000 feet and the desired yield is 700 gpm, the motor horsepower will be about 475 horsepower. This will require a very large diameter well if a 1760 rpm motor or a slim, long motor with high voltage, high rpm. The well diameter for the low rpm pump might be 20" where the high rpm motor might require a 12 inch diameter well but will penetrate deeper below sea level.

Most of the wells presently located west of Pukalani are in the 50 to 100 gpm category and the most significant wells are the Kula 1800 wells which have been tested at 500 gpm and would be in the 300 horsepower class. This means the wells must extend to at least elevation -50 feet to accommodate the pumps. If the water level stands at +5 feet, the depth to pure salt water will be close to -200 feet and the top of brackish is likely to be at -75 feet to -100 feet. The selection of the exploration well sites must recognize these factors which will dictate the diameter and cost for exploration.

Other well sites above elevation 1700 feet could be considered but will require major water transmission considerations as well as other off site and property issues.

Selected References

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Appendix A

Water Budget for the Makawao Aquifer Unit

Water Budget of the Makawao Aquifer

Water Budget

The Makawao aquifer system area encompasses a total of 37,523 acres or 58.63 square miles. Agricultural land was digitized and categorized by crop using 2010 World View 2 satellite imagery. Forest, range land, golf course, rural, and developed areas were digitized using the same imagery and an edited impervious surface layer from NOAA.

Previous Studies

Several water-budgets have been calculated for areas that encompass the Makawao project area. The three most pertinent studies were conducted by the State of Hawaii (1990) and by the U.S. Geological Survey (Shade, 1999 and Engott and Vana, 2007). The State of Hawaii report includes ground-water recharge and sustainable yield estimates by aquifer system areas, including Makawao. The 1999 USGS study area includes the entire eastern part of Maui extending east from the isthmus bounded on the north and south by Kahului and Maalaea Bays, respectively. Several monthly water-budgets were calculated in the 1999 USGS report, and much of the methodology was replicated in the current study. However, no irrigation volumes or land-use were considered in either the State or 1999 USGS water budgets.

The 2007 USGS study area includes central and west Maui, and focuses primarily on the Iao aquifer system. The water-budget accounting method uses a daily interval, rather than the monthly interval used in this and the 1999 USGS study. In the 2007 USGS study, fog-drip was not a water-budget component in the Makawao area and irrigation volumes are not tabulated in the report. Therefore, it is not clear if irrigation was a water-budget component in the Makawao area.

Water-Budget Model

Ground water is replenished by the infiltration of rainfall that percolates through the root zone in the soil to bedrock. Ground-water recharge can be estimated by a water-budget model similar to that developed by Thornthwaite (1948) and Thornthwaite and Mather (1955) that balances the input components of rainfall, fog-drip, and irrigation with the output components of runoff, evapotranspiration, ground-water recharge, and the change in soil-moisture storage expressed by:

Eq 1. $G = P + F + I - R - ET - \Delta SS$

Where: G = ground-water recharge,
P = rainfall,
F = fog-drip,
I = irrigation,
R = direct runoff,
ET = evapotranspiration, and
ΔSS = change in soil-moisture storage.

In the water-budget model, fog-drip and direct runoff are calculated separately as a percentage of rainfall. Irrigation and fog-drip volumes are approximately 3 and 2 percent, respectively of rainfall over the entire study area. One irrigation source is outside of the study area thus reflecting an important estimated import of 3.5 Mgal/d to the water budget. An additional 0.5 Mgal/d of recycled water from a sewage treatment plant irrigates a golf course within the study area. The model calculates ground-water recharge, evapotranspiration and the change in soil-moisture storage.

Daily, hourly or smaller time-intervals of climatologic and soil-water data collected from a dense network of gages over a small areal extent can more accurately determine volumes of water in each water-budget component. However, these data are not available in the project area and therefore, a monthly budget was calculated. A monthly water budget is a coarse representation of the allocation of water in the hydrologic cycle. The extremes of nature are not simulated by this model. For example, the influence on the water budget of a slug of ground-water recharge generated from an intense 2-day storm will be moderated by the monthly accounting. By using mean monthly data, the budget calculates average component volumes useful for regional assessments of resource availability.

Rainfall

The rainfall distribution in the project area is predominantly influenced by the effect of Haleakala Volcano that reaches a height of 10,023 ft and shelters the southwestern part of the Makawao area from the predominant northeast tradewinds. The Makawao project area is located within a transitional climatic regime, between the windward and leeward sides of

Haleakala. Within the Makawao area the maximum annual rainfall, 165 inches, occurs at the higher elevations on the windward side and the minimum annual rainfall, 16 inches occurs over the southwestern section on the leeward side (fig 1).

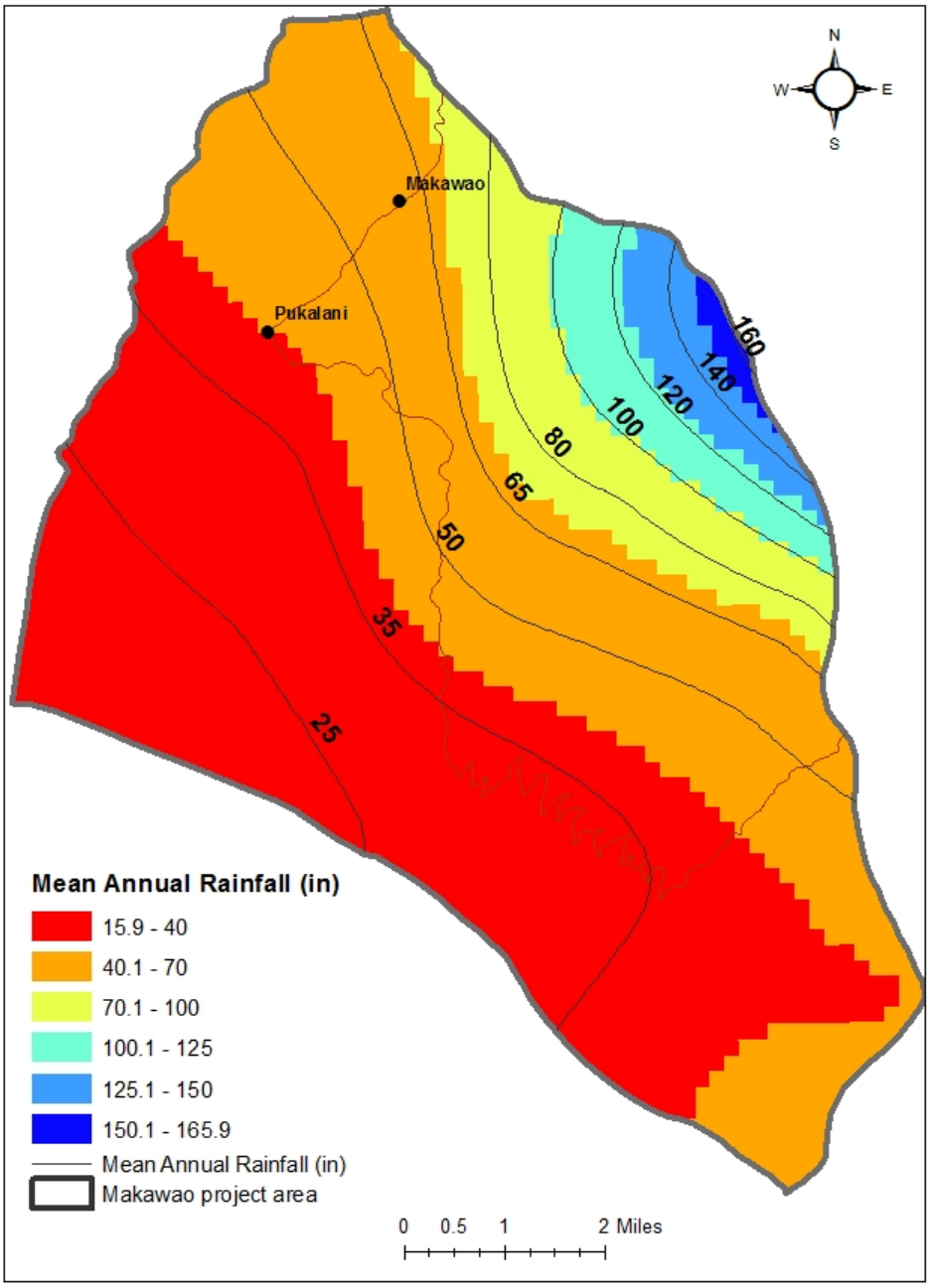


Figure 1. Mean Annual Rainfall (Giambelluca, T.W. and others, 2011)

Data for the rainfall component of the water-budget model was derived from the Rainfall Atlas of Hawaii (Giambelluca, T.W. and others, 2011). These data are for the most current 30-year period of record, 1978 to 2007 that includes both strong El Nino events and all years of the current Kilauea eruption on Hawaii. These data are thought to be most representative of recent rainfall distributions in the project area.

Fog-Drip

Upslope fog in Hawaii occurs predominantly by the cooling to the saturation point of warm moist marine air as it moves upslope. The water yield of fog is a function of droplet size that tends to be large in marine air masses (McKnight and Juvik, 1975). Different studies have found that the most productive fog occurs in nonraining cloud decks formed in degenerating marine air masses (Grunow, 1960 and McKnight and Juvik, 1975), a situation that occurs frequently in the Makawao area between approximately 3,950 and 5,900 ft. The depth of the inland cloud structure on the upper slopes at 1800 meters (5905 feet) is decreased from that at sea level due to the compression of ascending air between the mountain and the trade wind inversion. This shallow cloud formation limits the growth of droplets to a size optimal for forest interception (McKnight and Juvik, 1975). Giambelluca and Nullet (1991) describe the mean cloud base at about 3940 ft on the leeward Haleakala slope. The fog zone extends from this level to the lower limit of the most frequent inversion base height range at about 5900 ft (fig 2).

Ekern’s work at Lanaihale on Lanai found fog interception equal to 2/3 of rainfall measured in the area (1964). However, in a 2-year study by Scholl and others (2004), fog drip was estimated by measuring forest canopy throughfall as a percentage of rainfall at 2 sites. The leeward Haleakala site is south of the Makawao project area at Auwahi at 4000 feet. Throughfall was measured as 65 percent of the rainfall at this site, and therefore it was concluded that fog-drip contributed no additional moisture. The windward Haleakala site, Waikamoi at 6400 feet, is east of the Makawao area windward boundary. Throughfall was measured as 119 percent of rainfall at this site, and therefore fog-drip contributed additional moisture equal to 20 percent of rainfall. Because Makawao is a transitional area between windward and leeward Haleakala, fog-drip was calculated as 10 percent of rainfall in this study. The total fog area is 6,746 acres and the calculated fog-drip is 970 Mgal/year, or 5.3 inches/year if distributed evenly over the area.

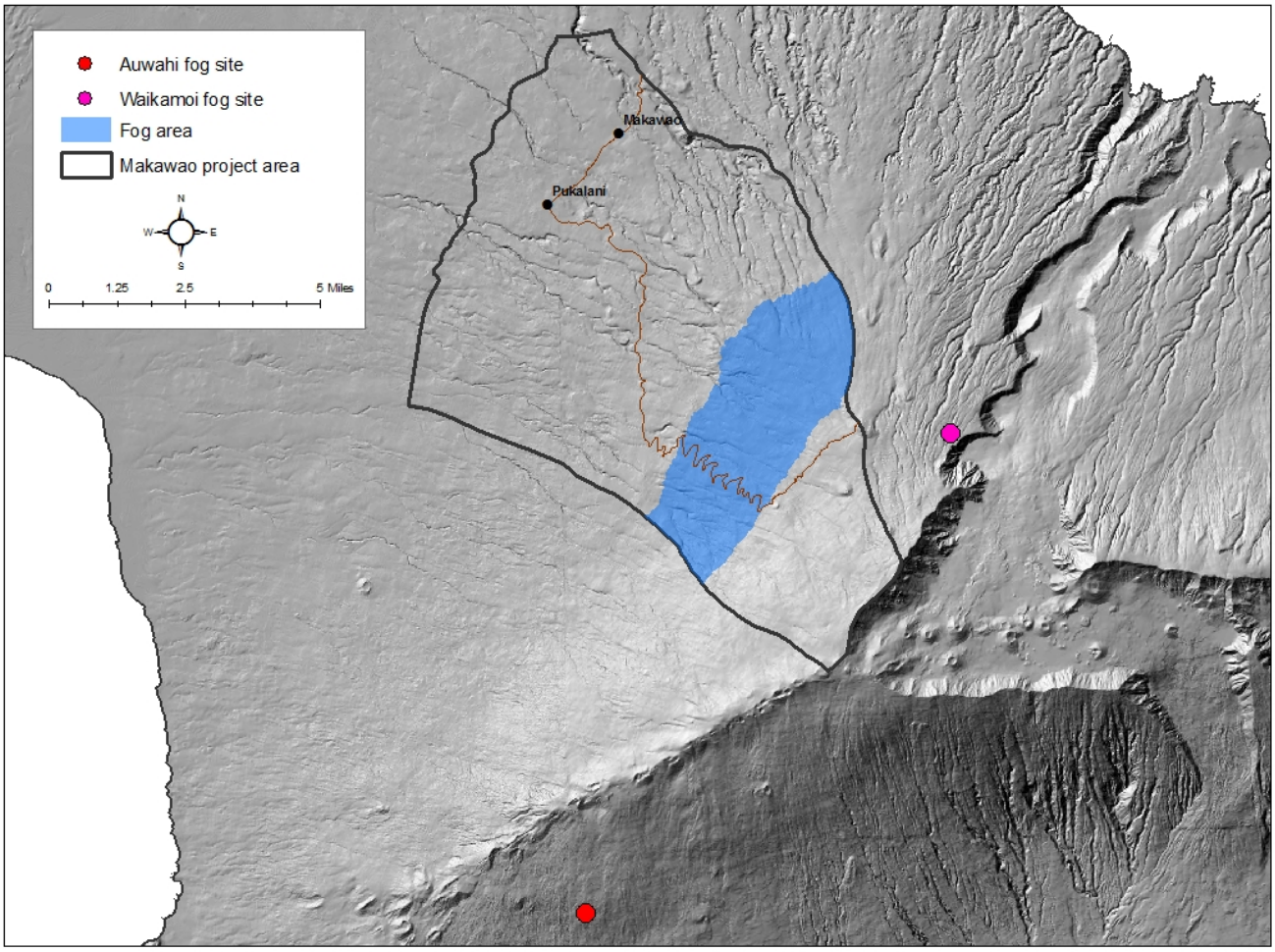


Fig. 2. Fog area.

Irrigation

Irrigation is a locally significant input into the Makawao water-budget model. An estimated 3.5 Mgal/d of imported surface water is applied over agricultural fields and an estimated 0.5 Mgal/d of recycled water from a sewage treatment plant irrigates the Pukalani golf course (fig. 3). Sugarcane and pineapple irrigation were calculated following the same method used by USGS (2007).

Eq. 2 Sugarcane irrigation for month = [(pan evaporation for month – rainfall for month + runoff for month) / irrigation efficiency] x 0.8. Irrigation efficiency was estimated as 80 percent, and fields in this area are also only irrigated at 80 percent of sugarcane demand. There are only 3.3 acres of sugarcane in the Makawao project area.

Eq. 3 Pineapple irrigation for month = (4.3 inches – rainfall for month + runoff for month). There are 1,811 acres of pineapple in the Makawao project area.

The diversified agriculture irrigation amounts from USGS (2007) were applied to nursery, orchards and row crops in the Makawao project area (table 1). The total irrigated acreage is 2,933 acres. The total irrigation volume is 1,483 Mgal/year, or 18.6 inches/year if distributed evenly over the irrigated area.

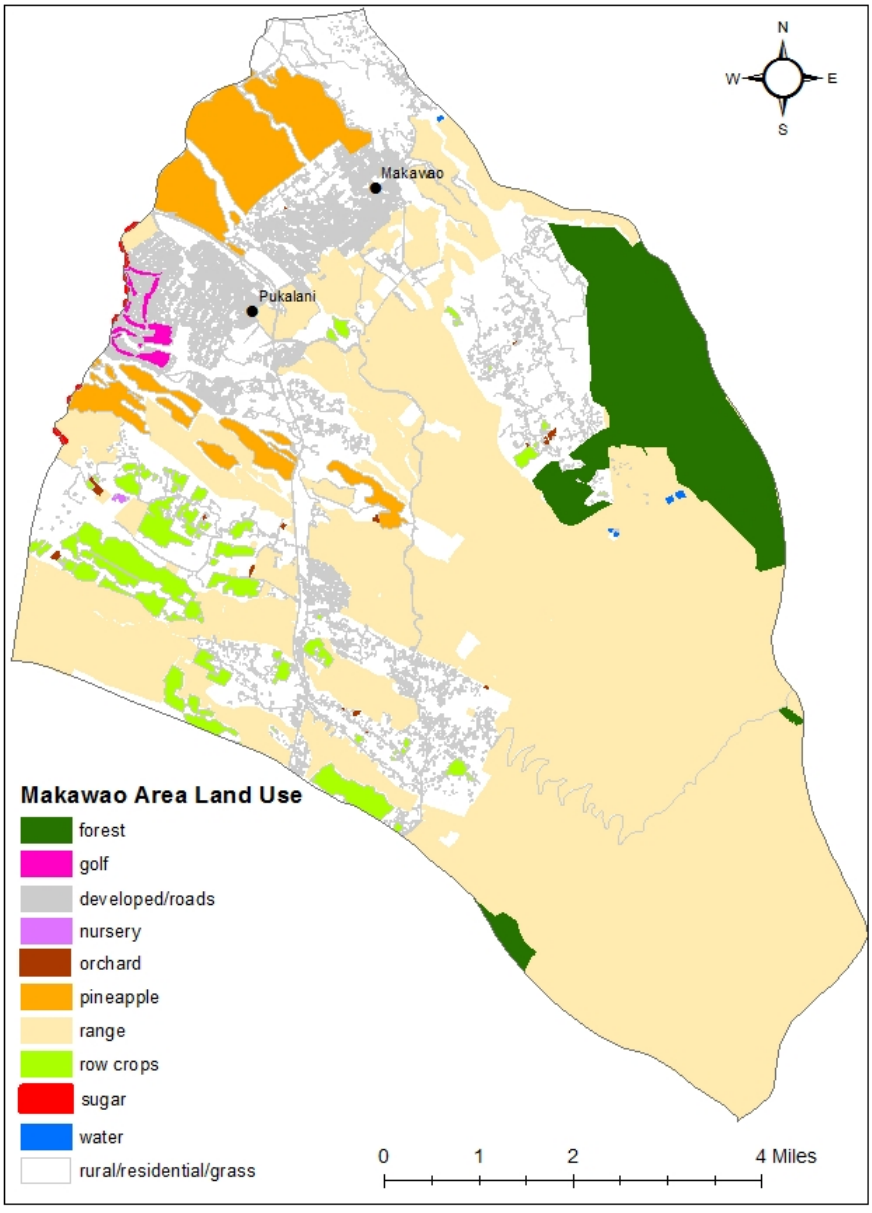


Fig. 3 Land use and irrigated areas.

Table 1. Diversified agriculture irrigation (inches)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.27	1.47	1.93	1.59	1.78	1.86	2.05	2.32	2.07	2.08	1.51	1.38

Direct Runoff

There are no perennial streams in the Makawao project area and direct runoff from rainfall rarely discharges outside of the area. Thus, the same monthly runoff/rainfall ratios were applied as used in the USGS East Maui water-budget report (Shade, 1999) for zone A which includes the Makawao project area. These ratios were determined for a single drainage basin gaged at USGS station 16660000 Kulanihakoi Gulch (Table 2).

Table 2. Direct runoff/Rainfall monthly ratios (percent)

Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	**1**	**5**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**2**	**1**

Evapotranspiration

Evapotranspiration (ET) is the quantity of water evaporated from water and soil surfaces and transpired by plants. ET can be measured by evaporimeters or lysimeters, or calculated mathematically from various climatic data, none of which are available throughout the project area. However, ET can be estimated from soil and pan evaporation data.

Soil Characteristics

Soils in the study area have been mapped and digitized by the Natural Resources Conservation Service (Foote and others, 1972). Available water is a measure of the quantity of water in the soil between field capacity and the wilting point; the amount of water available for uptake by plant roots. The available water value for each soil type varies by root depth as determined by the Soil Data Viewer program provided by the Natural Resources Conservation Service. The root depth values (table 3) for each crop and land use are the same as reported

by USGS (2007). The maximum soil-moisture storage value (table 4) is the product of the root depth and the available water capacity for each soil type (fig 4). Because the root depth is poorly known, the values for maximum soil-moisture storage are similarly coarse estimates. The maximum soil-moisture storage values are critical in the water-budget accounting, because they establish the limit for each soil type, above which ground-water recharge can occur. This is a weak element in the model, and frequently is the reason for what may appear to be anomalous areas on the recharge distribution maps.

Table 3. Land use and root depth

Land use	Root depth (inches)
Forest	25
Pineapple, rangeland, developed, golf	12
Orchard, nursery	30
Sugarcane	24
Row crops	22

Table 4. Soil characteristics

Soil type	Available-water capacity (inch per inch of soil)	Root depth (inches)	Maximum soil-moisture storage (inches)	Permeability (inches/hour)
HbB	0.12	12-24	1.44-2.88	6.00 – 20.00
HbC	0.12	12	1.44	0.63
HgB	0.10	12-22	1.2-2.22	20
HgC	0.10	12	1.2	0.63 – 2.0
HhB	0.10	12-24	1.2-2.4	0.63
HhC	0.10	12-24	1.2-2.4	0.63
HkC2	0.09	12-24	1.08-2.16	>20.0
HIB	0.13	12	1.56	2.00 –- 6.30
HIC	0.13	12	1.56	2.00 – 6.30
HIC2	0.13	12	1.56	0.63 – 2.00
KBID	0.13	12-25	1.56-3.25	0.63 – 2.00
KDIE	0.14	12-25	1.68-3.5	2.00 – 6.30
KDVE	0.14	12	1.68	0.63 – 2.00
KGKC	0.09-0.10	12-22	1.08-2.2	0.63 – 2.00
KGLC	0.09	12	1.08	0.63 – 2.00
KnB	0.09-0.10	12-24	1.08-2.4	0.63 – 2.00
KnC	0.09-0.10	12-24	1.08-2.4	0.63 – 2.00
KnaB	0.08	12-24	0.96-1.92	2.00 – 6.30
KnaC	0.08	12-30	0.96-2.4	2.00 – 6.30
KnaD	0.08	12-30	0.96-2.4	2.00 – 6.30
KnbD	0.06-.07	12-22	0.72-1.54	2.00 – 6.30
KncC	0.08	12-30	0.96-2.4	0.06 – 6.30
KnhC	0.08-.09	12-30	0.96-2.7	0.06 – 6.30
KnsC	0.07-.08	12-22	0.84-1.76	2.00 – 6.30
KxC	0.15	12-22	1.8-3.3	2.00 – 6.30
KxD	0.15	12-22	1.8-3.3	2.00 – 6.30
KxaD	0.10-.13	12-30	1.2-3.9	>0.06 – 20.00
KxbE	0.15	12	1.8	0.63 – 2.00
LME	0.15	12-25	1.8-3.75	0.63 – 2.00
LMF	0.15	12	1.8	2.00 – 6.30
LNE	0.09	12	1.08	>20.00
MfB	0.10	12	1.2	>20.00
MfC	0.09-.10	12-25	1.08-2.5	0.63 – 2.00
ONC	0.14	12-30	1.68-4.2	0.63 – 2.00
OND	0.14	12-30	1.68-4.2	0.63 – 2.00
ONE	0.14	12-25	1.68-3.5	0.63 – 2.00
PXD	0.15	12-30	1.8-4.5	0.63 – 2.00
PcB	0.14	12	1.68	6.00 – 20.00
PcC	0.14	12	1.68	20.00
rCI	0.03	12	0.36	0.06 – 2.00
rHR	0.17	12-25	2.04-4.25	6.00 – 20.00
rRK	0.05-.09	12-30	0.6-2.7	0.06 – 2.00
rRO	0.0	12	0.0	0.00
rRR	0.15	12-25	1.8-3.75	0.6 – 2.0
rRS	0.11	12	1.32	0.6 – 2.0
rVS	0.13	12	1.56	6.00 – 20.00

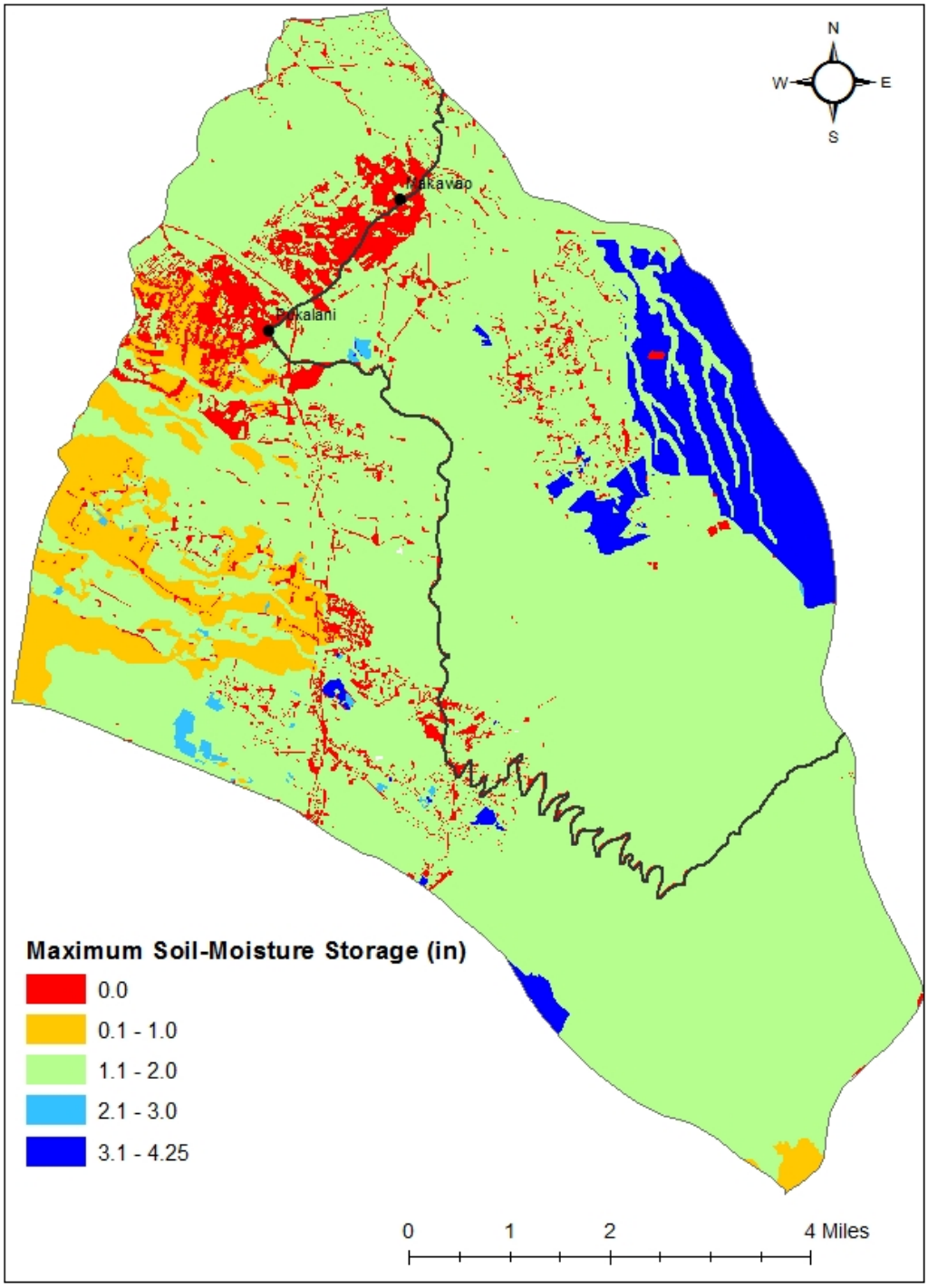


Figure 4. Maximum Soil-Moisture Storage

Pan Evaporation and Potential Evapotranspiration

Ekern and Chang (1985) created a map of the mean annual pan evaporation for the island of Maui that was digitized for the GIS water-budget model. The value assigned for the area between the lines of equal pan evaporation is the average value of the two bounding lines (fig 5). This map does not provide pan evaporation values for much of the Makawao project area. Therefore, the method to estimate pan evaporation as a function of rainfall as described in Shade (1999) was followed. A transect was drawn roughly from the top of Mauna Loa to South Point on the island of Hawaii. Mean annual rainfall and pan evaporation values were tabulated where those isolines intersected along the transect. The following equation was derived from these data and applied to the mean annual values of rainfall in the Makawao project area outside of Ekern and Chang's mapped area.

Eq 4 $E = 235.16 \times P^{-0.32}$

Where: E = Annual pan evaporation, in inches

P = Mean annual rainfall, in inches

Within the area that is above the temperature inversion equation 4 was used.

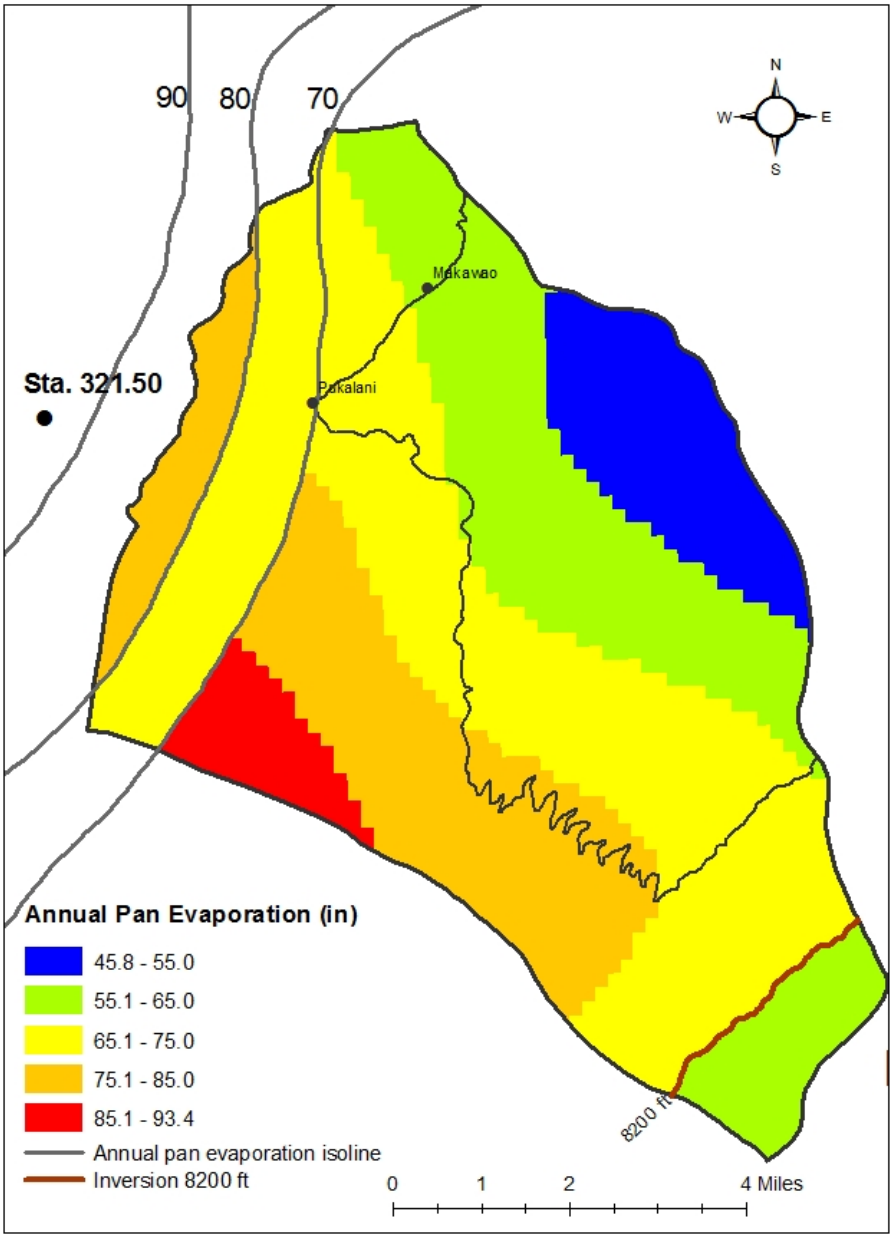
Eq. 5 $E = 295.96 \times P^{-0.44}$

The monthly pan values at station 321.50 were used to apportion annual pan evaporation to monthly values for the entire Makawao project area (table 5).

Table 5. Monthly pan evaporation to annual pan evaporation ratios

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
.058	.062	.076	.081	.092	.098	.11	.109	.096	.084	.069	.061

Fig. 5 Annual pan evaporation isolines (from Ekern and Chang, 1985).



Evapotranspiration and Soil-Moisture Accounting

On a monthly interval, the water-budget model calculates evapotranspiration on the basis of potential evapotranspiration estimated by the pan evaporation values, the current value of soil-moisture storage and the maximum soil-moisture storage value. In any month and for any soil type, the amount of water in soil storage cannot exceed the maximum soil-moisture storage value listed in table 4. Evapotranspiration is also limited by the quantity of water in soil-moisture storage and cannot exceed the potential evapotranspiration value. In any month, the potential evapotranspiration value may exceed the quantity of water held in soil-moisture storage to meet that demand. Thus, evapotranspiration would occur at less than the potential evapotranspiration rate. It is also possible, in some locations and in some months, that the potential evapotranspiration value is greater than the maximum soil-moisture storage value, and therefore evapotranspiration could not occur at the maximum rate. Thus, the maximum soil-moisture storage value is also an important limiting factor in the model calculation of evapotranspiration.

Because the volume of water in soil-moisture storage changes from month to month, the values for beginning soil-moisture storage in January were established objectively by running the water-budget model three times. Starting in January with maximum soil-moisture storage volumes, half of the maximum soil-moisture storage volumes, and with zero soil-moisture storage, all yielded identical ending soil-moisture storage volumes in December. These ending volumes in December were input for beginning soil-moisture storage volumes in January for the final water-budget model calculation.

Water-Budget Model Accounting

Two accounting methods were used in the water-budget model. Method I allocates excess soil-moisture to evapotranspiration first, and Method II allocates excess soil-moisture to ground-water recharge first. Method I is the standard sequence in monthly water budgeting. However, this sequence is not supported by soil infiltration rates, represented by permeability values in table 4, evapotranspiration and rainfall rates in the project area. That is, in dry areas, the majority of rainfall occurs in intense events, and infiltration rates are such that water passes beyond the root zone during the period when evapotranspiration is suppressed, thus recharging ground-water. Averaging the results of the two methods attempts to mitigate the errors associated with each method as was done by USGS in (Shade, 1997, 1999).

Method I

This method maximizes evapotranspiration and is shown in equations 6 through 8. The sum of the previous month's soil-moisture storage, the month's rainfall, fog and irrigation minus runoff is calculated. This volume is the first interim soil-moisture storage value (eq. 6). If this volume exceeds potential (maximum) evapotranspiration, estimated by the pan evaporation value, then evapotranspiration occurs at the maximum rate, and the second interim soil-moisture storage volume is calculated by subtracting the potential evapotranspiration volume from the first interim soil-moisture storage volume (eq. 7). If the second interim soil-moisture storage volume exceeds the maximum soil storage volume, SS_{max}, then the excess recharges ground water (eq. 7). Any water remaining in soil-moisture storage is carried over to the next month.

Eq. 6 $X_1 = P_m + F_m + I_m - R_m + SS_m$

X_1 = first interim soil-moisture storage volume
P_m = rainfall for the month
F_m = fog for the month
I_m = irrigation for the month
R_m = direct runoff for the month
SS_m = beginning soil-moisture storage volume for the month

Eq. 7

If $X_1 \geq PE_m$	OR	If $X_1 < PE_m$
Then $ET_m = PE_m$		then $ET_m = X_1$ and
And $X_2 = X_1 - PE_m$		$X_2 = 0$

X_1 = first interim soil-moisture storage volume
PE_m = potential (pan) evapotranspiration for the month
ET_m = evapotranspiration for the month

Eq. 8

If $X_2 \geq SS_{max}$	OR	If $X_2 < SS_{max}$
Then $G_m = X_2 - SS_{max}$		$G_m = 0$
And $X_{end} = SS_{max}$		and $X_{end} = X_2$

SS_{max} = maximum soil-moisture storage

G_m = ground-water recharge for the month

X_2 = second interim soil-moisture storage in the month

X_{end} = soil-moisture storage volume at the end of the month
which becomes the beginning soil-moisture storage
volume for the next month

Method II

This method maximizes ground-water recharge and is shown in equations 9 through 11. The sum of the previous month's soil-moisture storage, the month's rainfall, fog and irrigation minus runoff is calculated. This volume is the first interim soil-moisture storage value (eq. 9). If this volume exceeds the maximum soil moisture storage, then the excess becomes ground-water recharge, and the second interim soil-moisture storage volume is calculated by subtracting the ground-water recharge volume from the first interim soil-moisture storage volume. If the second interim soil-moisture storage volume exceeds the pan evaporation, (potential ET) value (PE), then evapotranspiration occurs at the maximum rate. The ending soil-moisture storage is the second interim soil-moisture storage minus evapotranspiration. Any water remaining in soil-moisture storage is carried over to the next month.

Eq. 9 $X_1 = P_m + F_m + I_m - R_m + SS_m$

X_1 = first interim soil-moisture storage volume

P_m = rainfall for the month

F_m = fog for the month

I_m = irrigation for the month

R_m = direct runoff for the month

SS_m = beginning soil-moisture storage volume for the month

Eq. 10

If $X_1 > SS_{max}$,	OR	If $X_1 \leq SS_{max}$
then $X_1 - SS_{max} = G_m$		then $G_m = 0$ and
and $X_2 = SS_{max}$		$X_2 = X_1$

SS_{max} = maximum soil-moisture storage

G_m = ground-water recharge for the month

X_2 = second interim soil-moisture storage in the month

Eq. 11	If $X_2 \geq PE_m$	OR	If $X_2 < PE$
	then $ET_m = PE_m$		then $ET_m = X_2$
	and $X_{end} = X_2 - PE_m$		and $X_{end} = 0$

ET_m = evapotranspiration for the month

PE_m = potential (maximum) evapotranspiration for the month

X_{end} = soil-moisture storage volume at the end of the month
which becomes the beginning soil-moisture storage
volume for the next month.

The evapotranspiration and ground-water recharge distributions are shown in figures 6 and 7.

Water Budget Results

The distinct effect of irrigation can be seen in figure 6 where evapotranspiration is occurring at a rate of more than 35 inches annually in areas that receive 35 inches of annual rainfall. Similarly in figure 7, ground-water recharge averages about 40 inches in the same low-rainfall, irrigated areas. The recycled 0.5 Mgal/d from the waste-water treatment plant is clearly a significant input to the water budget. It is apparent that imported water to the Makawao area is a critical and beneficial component of the water budget.

Fig. 6 Evapotranspiration Distribution

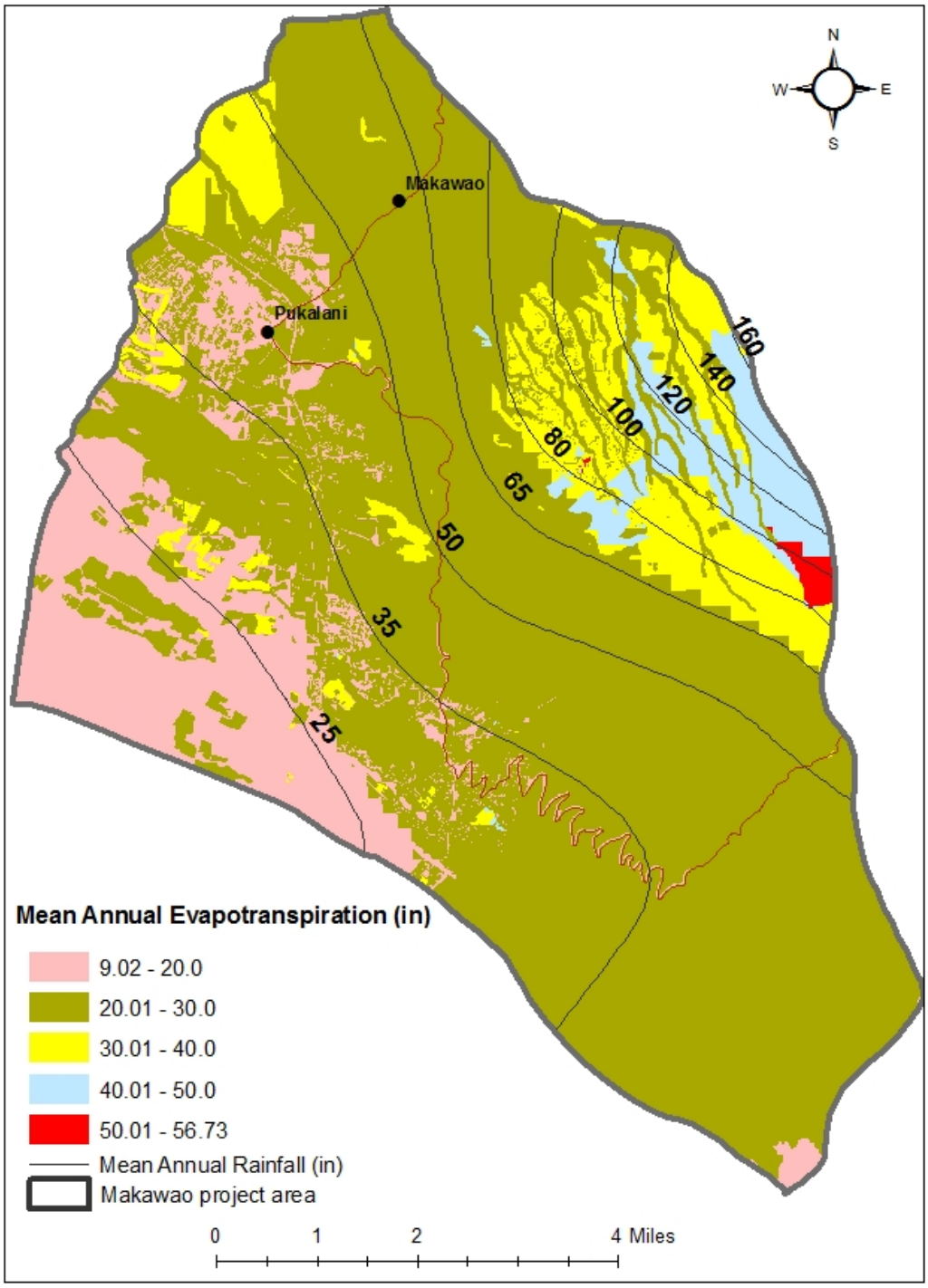
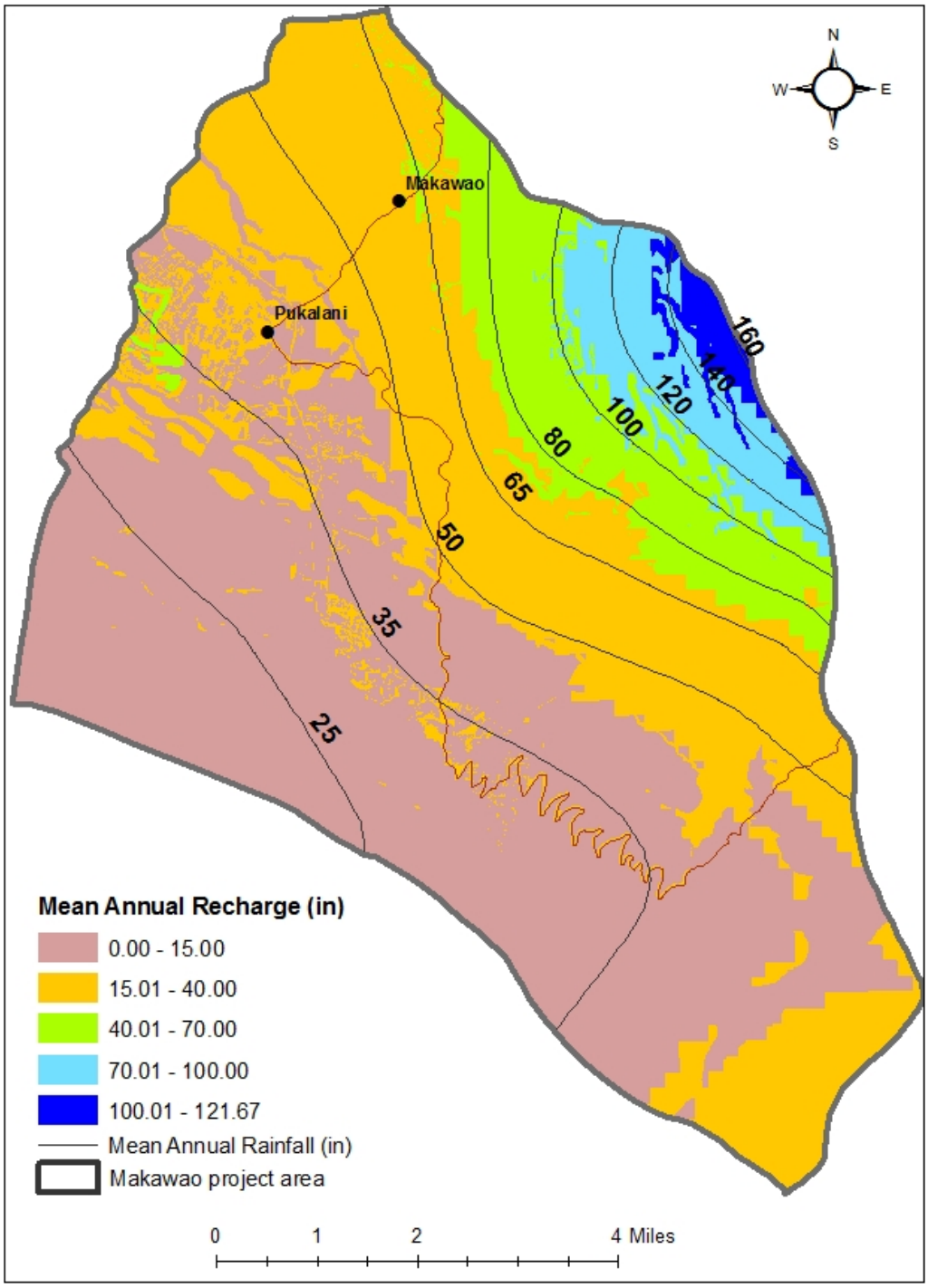


Fig. 7 Ground-Water Recharge Distribution



For the Makawao project area water-budget, the results can best be evaluated by determining the apportioning of the moisture inputs of rainfall, fog, and irrigation to evapotranspiration and ground-water recharge as well as the spatial distribution of the calculated water-budget components. In table 6 for the current Waimea Water Services (WWS) study, the irrigation value includes the input of 0.5 Mgal/d recycled discharge from the waste water treatment plant, and 3.5 Mgal/d of imported surface water. The percentages in parentheses for WWS are in relation to the sum of the rainfall, fog-drip and irrigation volumes. For the USGS and State studies the percentages are in relation to rainfall only.

Table 6. Water Budget Results (all volumes in Mgal/d)

Study	Area (sq.mi.)	Rain	Fog	Irr	Runoff	ET	PanET	Recharge
WWS	58.63	142.3	2.66	4.06	2.15 (1.4)	79.03 (53)	192.79 (41)**	67.84 (45.5)
USGS	51.47	103.86	0	*	1.34 (1)	56.01 (54)	*	46.51 (45)
State	52.93	95.74	0	*	7.56 (8)	70.55 (74)	*	15.12 (16)

*Note: * indicates no value reported.*

*** indicates the ratio of ET to PanET, an estimate of maximum ET*

Water-Budget Limitations

Without data that are recorded on a daily or shorter time interval, for all components of the water budget, the results cannot simulate the events of nature. The mean monthly rainfall data (2011) that were used in the GIS water-budget model adequately represent the average monthly rainfall conditions anywhere in the project area. However, these data do not capture the instances where a large proportion of the average monthly rainfall occurs during a period of a few days. During such an event, the thin soils would be saturated, evapotranspiration would be suppressed and water would infiltrate quickly beyond the root zone resulting in slugs of ground-water recharge.

Using a monthly budget essentially treats the hydrologic cycle as a single large event each month. In areas where rainfall is generally negligible except for an infrequent event, the monthly approach could yield satisfactory results. However, this scenario does not represent the occurrence of rainfall and fog formation in parts of the Makawao area.

Simulating a water-budget on an event- or daily-basis is a useful endeavor to improve the ground-water recharge estimates as was done by USGS (2007). Comparison of the USGS results for Makawao are difficult as the rainfall input data are substantially lower, fog-drip was not calculated for the project area and irrigation values are not reported, although that does not necessarily confirm that irrigation was not applied in the area. However, it is significant that USGS ET/rainfall and recharge/rainfall ratios are equal to the ET and recharge/rainfall+fog+irrigation ratios calculated in this study, from substantially different methodologies.

Measurements of meteorologic variables that can be used to calculate evapotranspiration and fog interception measurements in the Makawao area as forest canopy throughfall (Scholl and others, 2004) can improve the water-budget estimates of recharge.

Soil parameters, particularly available water, are coarsely estimated due to the lack of field data in the project area. These values were determined from individual soil profiles that are regionalized for the soil series, and thus the calculated maximum moisture storage of the soil at any given point is coarsely estimated. The soil-moisture storage is a critical component in the water-budget model because it directly affects the calculation of both ground-water recharge and evapotranspiration. The estimate of maximum soil-moisture storage is one of the weakest components of the water-budget calculations. The collection of any data that can more accurately determine soil-moisture storage would be a significant contribution to the improvement of ground-water recharge estimates from a water-budget method.

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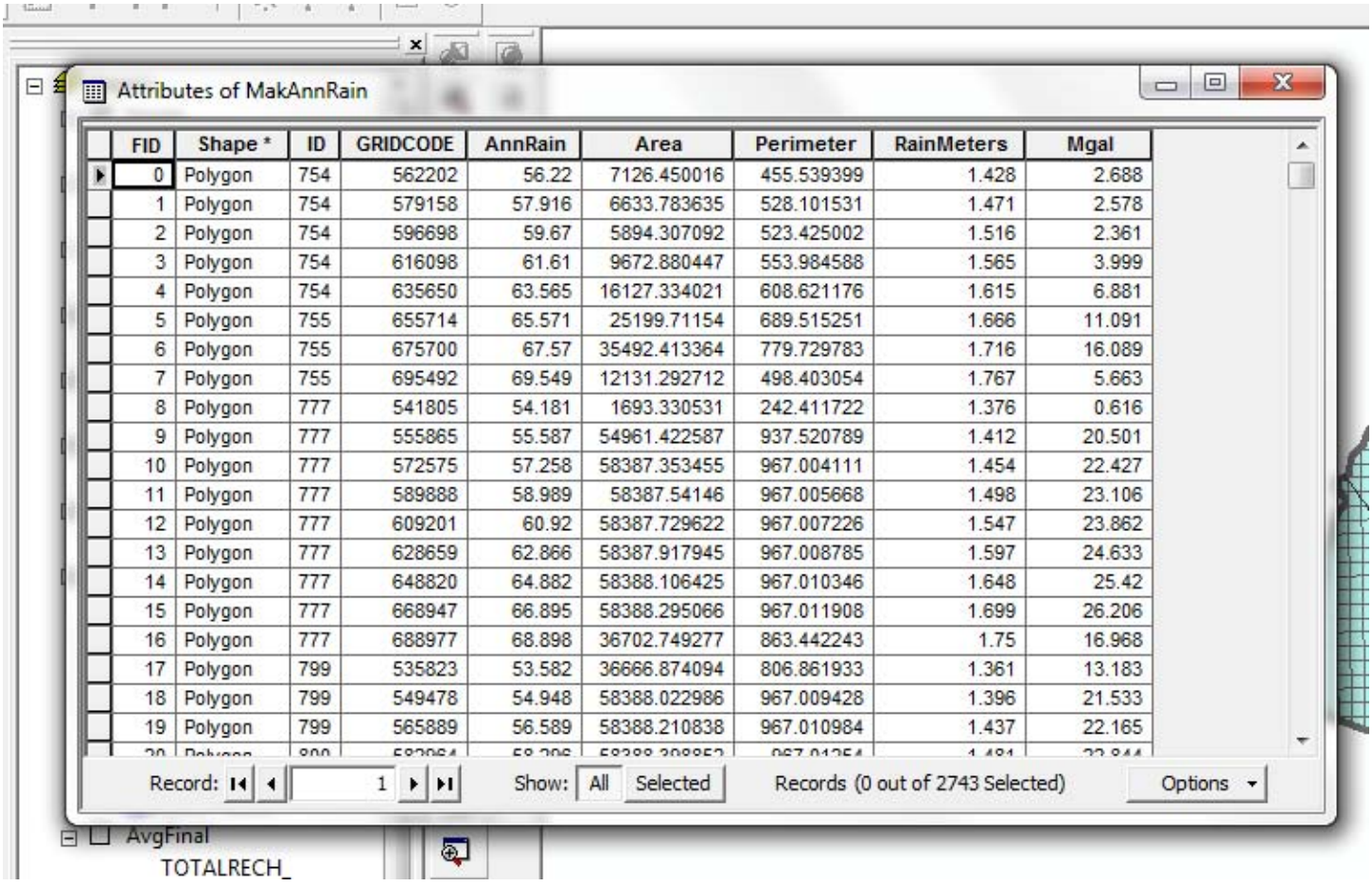
Calculating Makawao project area rainfall directly from Maui annual rainfall grid.



FID	Shape *	ID	GRIDCODE	AnnRain	Area	Perimeter	RainMeters	Mgal
0	Polygon	754	562202	56.22	7126.450016	455.539399	1.428	2.688
1	Polygon	754	579158	57.916	6633.783635	528.101531	1.471	2.578
2	Polygon	754	596698	59.67	5894.307092	523.425002	1.516	2.361
3	Polygon	754	616098	61.61	9672.880447	553.984588	1.565	3.999
4	Polygon	754	635650	63.565	16127.334021	608.621176	1.615	6.881
5	Polygon	755	655714	65.571	25199.71154	689.515251	1.666	11.091
6	Polygon	755	675700	67.57	35492.413364	779.729783	1.716	16.089
7	Polygon	755	695492	69.549	12131.292712	498.403054	1.767	5.663
8	Polygon	777	541805	54.181	1693.330531	242.411722	1.376	0.616
9	Polygon	777	555865	55.587	54961.422587	937.520789	1.412	20.501
10	Polygon	777	572575	57.258	58387.353455	967.004111	1.454	22.427
11	Polygon	777	589888	58.989	58387.54146	967.005668	1.498	23.106
12	Polygon	777	609201	60.92	58387.729622	967.007226	1.547	23.862
13	Polygon	777	628659	62.866	58387.917945	967.008785	1.597	24.633
14	Polygon	777	648820	64.882	58388.106425	967.010346	1.648	25.42
15	Polygon	777	668947	66.895	58388.295066	967.011908	1.699	26.206
16	Polygon	777	688977	68.898	36702.749277	863.442243	1.75	16.968
17	Polygon	799	535823	53.582	36666.874094	806.861933	1.361	13.183
18	Polygon	799	549478	54.948	58388.022986	967.009428	1.396	21.533
19	Polygon	799	565889	56.589	58388.210838	967.010984	1.437	22.165

NOTE:

ADDITIONAL APPENDICES TO APPENDIX 2 ARE NOT INCLUDED IN THE DRAFT EA TO REDUCE SIZE OF EA DOCUMENT

FULL STUDY AVAILABLE UPON REQUEST OF DLNR-ENGINERRING

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DLNR Pukalani Tank Site
Exploratory Water Well

ENVIRONMENTAL ASSESSMENT

Appendix 3
Archaeology Report

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SCS Project No. 1429-2 AA

AN ARCHAEOLOGICAL AS SESSMENT REPORT FOR A 0.994-ACRE WATER TANK PARCEL AND c. 550 FOOT PIPELINE IN PUKALANI, HŌKŪ`ULA AHUPUA`A, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI`I [TMK: (2) 2-3-007:030 and 2-3-007:035]

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and
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November, 2013
FINAL

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INTRODUCTION

At the request of Mr. Ron Terry, under contract by the State of Hawai‘i Department of Land and Natural Resources (DLNR), Scientific Consultant Services, Inc. (SCS) conducted an Archaeological Inventory survey on 0.994-acres of land currently housing a water tank, where a new well will be excavated, and a c. 550 foot pipeline connecting the tank with an existing tie-in along the Kula Highway right-of-way [TMK (2) 2-3-007-030 and 2-3-007:035 respectively] (Figures 1 and 2). The tank and pipeline are located on Maui in Hōkū‘ula Ahupua‘a, in the traditional district (*moku*) of Kula (Makawao District), just at the border with the traditional district of Hāmākuapoko, to the North and East (Figure 1). The parcel is located in the modern-day district of Makawao, which now encompasses the traditional *moku* of Kula, Hāmākuapoko, Honua‘ula and Hāmākualoa (Kame‘eleihiwa 1992). While Inventory-Survey-level investigations were completed, this report is being written as an Archaeological Assessment as a determination of “no findings” was made during fieldwork.

This project is being conducted for the County of Maui, Department of Water Supply (landowner) and is covered under HRS 6E-8. As this archaeological project did not lead to the identification of any historic properties, this report is being written in accordance with HAR 13-275-5, which provides guidelines for writing Archaeological Assessment reports.

Proposed Project Details

The DLNR proposes to develop an exploratory potable water well at the Maui Department of Water Supply (MDWS) Pukalani Tank Site on Kula Highway, TMK (2) 2-3-007:030. The well is intended primarily to provide potable water for future State of Hawai‘i projects, including school projects for the Department of Education and residential developments of the Department of Hawaiian Home Lands. DLNR intends to enter into an agreement with MDWS to integrate this new source into the existing MDWS water system and transfer ownership to the County of Maui. This arrangement would also provide some portion of the water for other uses that are needed in the MDWS Upcountry water systems.

After systematically evaluating six potential sites in the Makawao to Pukalani area, DLNR selected a site at the existing MDWS Pukalani Tank, as it offered the optimal characteristics for development of a water well. The 1.0 million gallon Pukalani Tank is located on a lot with almost an acre of space, providing ample room for well infrastructure. The site is owned by MDWS and presents few administrative issues, assuming the DLNR and MDWS reach an agreement to transfer ownership. Hydrologists anticipate that a well at this site would produce between 0.7 and 1.0 million gallons per day (mgd). The site already has the required infrastructure to support well drilling operations. Aside from new power transmission, minimal water system improvements are required to connect the new

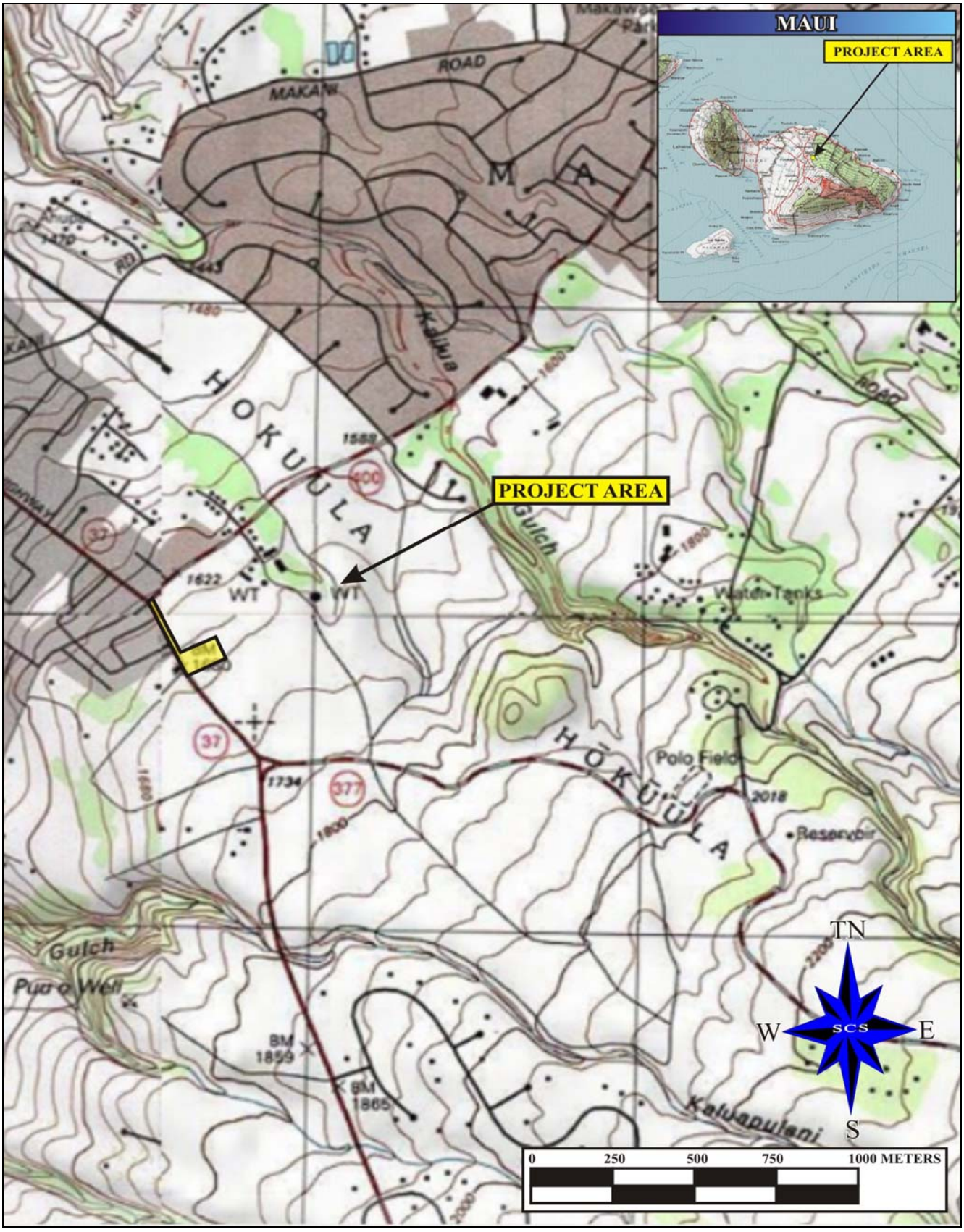

Figure 1: Portion of USGS Topographic Map Showing the Location of the Project Area

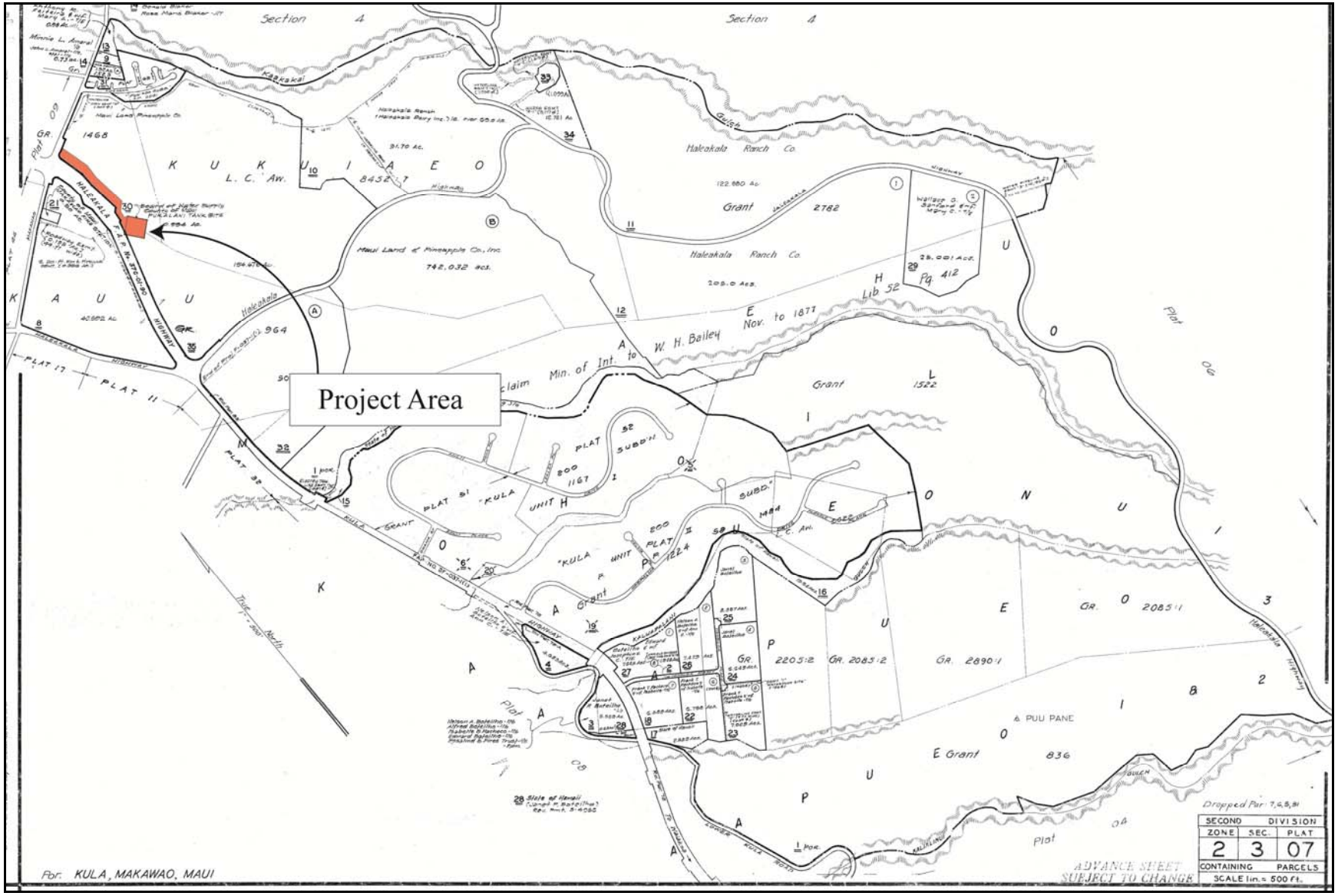

Figure 2: TMK Showing Location of Project Area

source into the existing MDWS system. The location also integrates well into the Upcountry District water systems from an operational perspective.

The reservoir lot's surface has already been extensively modified, but some new grading will be required to accommodate construction of the exploratory well and future appurtenant facilities, including a control building, valves, water transmission piping, access driveway, electrical facilities, storm drains, and fencing. In the future, offsite work within a linear corridor (pipeline corridor) in the right-of-way of Kula Highway (State Highway 37) and/ or on adjacent TMK 2-3-007:035 will also be required for water transmission and electrical lines.

The overall purpose of the project was to determine the presence or absence of architecture, midden deposits and artifact deposits on the surface of the project area, as well as assess the potential for the presence of subsurface cultural deposits. If sites/historic properties were identified, they were to be evaluated in terms of significance criteria. In sum, no sites were identified in surface or subsurface contexts. Extensive alteration by historic and modern grading and grubbing, as explained more so below, appears to have significantly altered the natural topography of the tank parcel. The proposed c. 550 foot pipeline is proposed within the Kula Highway right-of-way, a built environment.

ENVIRONMENTAL SETTING

PROJECT AREA LOCATION

The project area consists of a 0.994-acre rectangular piece of land on which curently sits a one-million gallon water tank. The parcel is bounded to the west by Kula Highway (Highway No. 37) and to the north, east and south by fallow pineapple fields owned by Maui Land and Pineapple Co., Inc. (Figure 3). To the northwest, across Kula Highway, is the Pukalani Fire Station. The parcel is situated on flat land at an elevation of ~500 m (1,640 ft) above mean sea level (amsl) at a distance of 12 km (7.5 mi) from the nearest coastline on the North Shore of Māui.

SOILS

Soils found within the project area are a part of the Haliimaile series (HgB) that consists of a silty clay loam on 3 to 7 percent slopes (Foote, *et al,* 1972). Foote notes "This soil is used for pineapple, pasture, and homesites" (*ibid:* 35). In addition to these soils, which were observed in the cut faces around the water tank at the well site, abundant fill deposits were observed on the eastern side of the tank site as well as in the road bed of Kula Highway.

RAINFALL

The project area is located on the northwestern slope of Haleakalā within East Māui. The area is subject to an average annual rainfall of 1031 mm (41 in), measured at the MAUI PINE rain gauge located on the project area parcel (Giambelluca, *et al.* 2013). The wettest months fall between November and April, when the northeast trade winds blow. During the summer months, when drier Kona winds are more common, the level of precipitation drops.

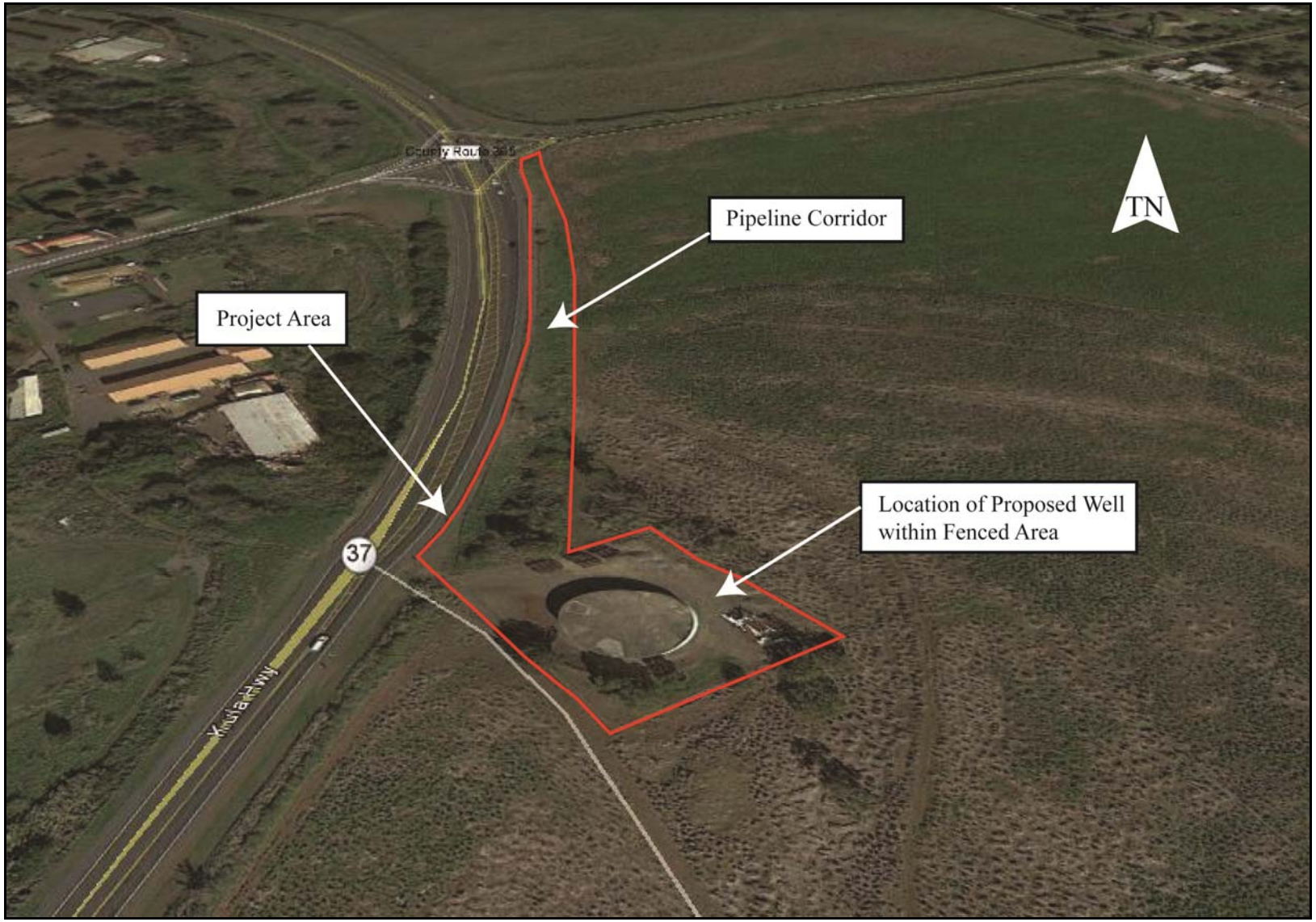

Figure 3: Satellite Photograph of the Project Area and Surroundings.

Figure 4: Fallow Pineapple Field Surrounding Project Parcel. View East to Haleakalā.

TRADITIONAL AND HISTORIC SETTING

PRE-CONTACT ERA AND MYTHOLOGICAL ACCOUNTS

Archaeological settlement data indicates that initial colonization and occupation of the Hawaiian Islands first occurred on the windward sides of the main islands, with populations eventually settling into drier leeward areas at later periods (Kirch 1985). Kirch (2011), in a review of 150 years of literature regarding settlement of the Hawaiian Islands, suggests earliest occupation of the islands occurred between A.D. 900 and 1000. The earliest populations purportedly used local resources and seldom ventured into upland valleys. Greater population expansion to inland areas, including upland *kula* zones, appears to have begun in the 12th century A.D., continuing through the 16th century AD.

Around the 14th century, the various *mōʻi* (kings/monarchs) of the Hawaiian Islands decided to formalize traditional land tenure in Hawaiʻi, mainly in order to better manage disputes between neighboring *aliʻi* (chiefs). Land was surveyed and land boundaries were marked. Hawaiian lands were divided into *moku* (districts), *ahupuaʻa,* and numerous smaller divisions, called *ʻokana*, *ʻili,* etc. These land divisions generally encompassed land from the mountain to the sea, thereby allowing access to both marine and mountain resources. Rather than denoting ownership of the lands by *aliʻi,* the *ahupuʻa* boundaries signified a trusteeship between the caretakers of the land (*konohiki*), designated by the *aliʻi,* and the nature gods worshipped by Hawaiians (Handy and Handy 1972).

The project area is located in what is now called Pukalani, which translates to the "heavenly gates" (Pukui *et al.* 1974). The original name may have been *Puʻu ka lani,* or hill of the heavens (*ibid*), alluding to the upland nature of the town and afternoon cloud formations over the area. Traditionally, the parcel appears to have belonged to Hōkūʻula Ahupuaʻa, or "red star" *ahupuaʻa*; legendary and mythological references to Hōkūʻula are scarce. The project parcel is also near to Makaʻeha and Makawao Ahupuaʻa, which are referenced more commonly in oral accounts. Hōkūʻula Ahupuaʻa is unique in that it does not run all the way from the mountain to the ocean, but rather is entirely composed of high agricultural lands (*kula*). Wailuku *moku* marks the northwestern *makai* border of the *ahupuaʻa,* cutting off access to marine resources in this particular land division. The parcel traditionally belonged to the *moku* of Kula but since 1848 has belonged to the larger Makawao District, as described in the Introduction.

Upland areas of Māui such as the Kēōkea-Waiohuli area contained large garden enclosures, ceremonial structures, and permanent habitation sites by *c*. A.D. 1600. Of Kula District, Handy (1940: 161) writes,

> On the coast, where fishing was good, and the lower westward slopes of Haleakala, a considerable population existed, fishing and raising occasional crops of potatoes along the coast, and cultivating large crops of potatoes inland, especially in the central and northeastern section including Keokea, Waiohuli, Koheo, Kaonoulu, and Waiakoa, where rainfall drawn round the northwest slopes of Haleakala increases toward Makawao.

Handy and Handy (1972) describe the aridness of Kula, and the dependence of its people on receiving *poi* from the wetter valleys of Waikapu and Wailuku to supplement their diet. Yet, Kula was "wildly famous for its sweet potato plantations. *ʻUala* was the staple of life here" (Handy and Handy 1972: 510-511).

Makawao *ahupuaʻa,* on the other hand, was once a vast area of wet and dry forest (Sterling 1998); its name literally means "forest beginning" (Pukui *et al.,* 1976: 142). There are many references to the rains of Makawao, and it is likely that hunting and gathering took place in its diverse native forests (Sterling 1998; Pukui 1983). Tree species included *koa (Acacia koa),* sandalwood and *ʻohiʻā lehua; maile* and ferns including *palapalai* and *palaʻa* thrived in these forests (Sterling 1998: 98). In the drier regions of Makawao, sweet potato was cultivated extensively, as it was in Kula; from Pukalani to historic Poʻokela Church, there are many oral accounts of sweet potato patches.

However, no sites in the project area have firmly identified permanent habitation sites such as those found in the Kēōkea-Waiohuli area of Kula. Rather, evidence of occupation includes petroglyphs, such as the canoe petroglyphs of Kaluapulani gulch in Makaʻeha *ahupuaʻa* (Sterling 1998). Numerous *heiau* have also been recorded in Hōkūʻula and surrounding *ahupuaʻa.* Oral evidence of a large sweet potato patch is recorded by Manu in Sterling (1998) for the *ahupuaʻa* of Makaʻeha. These petroglyphs, religious structures and agricultural accounts attest to human activity in the project area, but do not provide evidence of permanent habitation. Rather, the area was most likely significant in terms of gathering of upland forest resources and dryland agricultural endeavors, primarily the cultivation of sweet potato (*ʻuala*).

HISTORIC PERIOD

By the early historic period in Hawaiʻi, significant natural and cultural changes had taken place throughout the islands, not only due to contact with westerners, but also because of internal

social and environmental restructuring and external social and environmental factors (*e.g.*, foreign species being introduced as well as foreign ideologies). These combined to have a severe impact on Hawaiian environments, land-tenure, and social structures.

By the 1800s, agriculture in the *moku* of Kula had transitioned to a commercial rather than subsistence activity (Kuykendall 1965 in Pantaleo 2004b). Demand from new populations such as whalers encouraged the cultivation of vegetables, meat and fruit in upcountry Māui. In the mid-nineteenth century, demand for Irish potatoes by California gold rush workers caused a boom on Māui; Irish potato farms thrived in Kula, and soon Kula was known as the "potato district" (Kuykendall 1965: 313 in Pantaleo 2004b).

On the other side of Hōkūʻula Ahupuaʻa, in Makawao, cattle ranching became a prominent position of employment and adopted lifestyle. Livestock was introduced to the Hawaiian Islands in 1793 when Captain Vancouver transported cattle and sheep aboard his ship the *Discovery* with the intention of giving the four cows, two bulls, four ewes, and two rams to Kamehameha I as a gift of goodwill. The rough seas and intense heat of the journey took its toll on the health of the cattle and several of the animals died. In order to ensure that the cattle population would increase, a ten-year *kapu* (ban) was placed on slaughtering them. Eventually the cattle did increase in number to the point of becoming a dangerous nuisance. As they were allowed to roam wild, gardens were destroyed and the Native Hawaiians were terrified of being attacked. Managing and controlling the unruly animals became a necessity. In order to solve this problem Kamehameha I employed "a varied crew with unsavory reputations who had immigrated to the islands to escape their pasts" as *bullock hunters* to capture the animals (Cowan-Smith and Stone 1988:8).

Things were about to change in 1803 when Captain Richard Cleveland and his partner Captain William Shaler introduced horses to the Islands. These men brought aboard their ship, the HMS *Lelia Byrd*, several horses including a stallion and a mare with foal, which they presented as gifts to Kamehameha. Soon the horses, like the cattle, were roaming freely across the Islands. The horses (*lio*) adapted rapidly to the rough terrain where the cattle grazed and "their ability to work the livestock [did not] go unnoticed" (Cowan-Smith and Stone 1988:12).

Around 1830, Kamehameha III brought Mexican *vacqueros* from Vera Cruz to the Big Island to teach the local men how to rope and handle the animals. As the cattle and horse populations proliferated, the animals were transferred to the various Hawaiian Islands and the *vacqueros*, which now included local cowboys, were needed on the outer islands. In addition to

cattle ranching, agricultural activities were pursued. Despite claims that "the soil in this area of Māui grows rocks" (Fredericksen, *et al*. 1991: 05) due to the many areas of exposed bedrock and scattered boulders and gravels in the surrounding fields, oral accounts of historic agricultural endeavors listed crops such as sweet potato (*`uala; Ipomoea batatas*), potatoes, corn, beans, and wheat, which had expanded exponentially in the first half of the nineteenth century (Fredericksen *et al*. 1991: 03–05; Sterling 1998: 99; Bartholomew 1994: 120).

Finally, throughout Makawao District (encompassing Kula *moku*), sugar and pineapple production grew rapidly. The area which had once been "developed as an agricultural and stock-raising area" later expanded "into pineapple upon the formation of the Pukalani Dairy and Pineapple Company in 1907" (Bartholomew 1994: 121). By the end of the nineteenth century, sugarcane and pineapple proved profitable crops; patches of the crops still exist in the upcountry areas today.

MAHELE

During the historic period, extreme modification to traditional land tenure occurred throughout all of the Hawaiian Islands. The transition from traditional Hawaiian communal land use to private ownership and division was commonly referred to as the *Māhele* (Division). The Māhele of 1848 set the stage for vast changes to land holdings within the islands as it introduced the foreign (western) concept of land ownership to the Islands. Although it remains a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian economy to that of a market economy (Kuykendall Vol. I, 1938:145 footnote 47, 152, 165–166, 170; Daws 1968:111; Kelly 1983:45; Kame`eleihiwa 1992:169–170, 176).

Kame`eleihiwa (1992: 209), states that Makawao District was the first area in Hawai`i to experiment with land sales. In January 1846, land was made available for eventual ownership to the commoners (*maka`āinana)*. For native Hawaiians that had been cultivating and living on the lands, lengthy and costly procedures enabled them to possibly claim some of the plots. These claims could not include any previously cultivated or presently fallow land, stream fisheries or many other resources necessary for traditional survival (Kelly 1983; Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed Land Commission Award (LCA), issued a Royal Patent number (RP), and could then take possession of the property (Chinen 1961: 16).

According to Chinen (1961), in Makawao District land was sold for $1.00 per acre; this would mark the beginning of land grants. Experimental lots purchased by Hawaiians ranged from five to ten acres, with a total land area of approximately 900 acres of grant lands purchased in Makawao. If applicants met all of the requirements (and were notified of the procedures), they eventually received the title to their land. Much of the granted lands in Makawao not purchased by native Hawaiian homesteaders was leased to foreign ranchers (Pantaleo 2004b). During the mid-nineteenth century a large population of Chinese immigrants began leasing lands from native Hawaiians and ranchers and developing a thriving agricultural community in Kula (*ibid*).

Grants 1468 and 964 and LCA Award 8452: 7 are all in the immediate vicinity of the project area parcel (Figure 2). Waihona ʻAina (July, 2013) lists Grant 1468 as a 115.85-acre land grant sold to Daniel P. Conde in Kailua Ahupuaʻa, Kula/Makawao District, for $11.00 per acre in 1854. Grant 964 was a 150-acre parcel sold to Kekaha in Kauau Ahupuaʻa, Kula/Makawao District, for $11.00 per acre in 1852. Finally, LCA Award 8452-7 is part of a series of LCAs awarded to Keohokalole in 1848 in the *ahupuaʻa* of Kukuiaeo and Aapueo (among others) in Kula District.

MODERN ERA

Pineapple cultivation continued into the modern era with extensive grubbing and tilling of the land. In addition, the extension of Kula Highway altered the proposed pipeline corridor with an approximate 8-20 foot lift of the land above the surrounding agricultural fields. .

PREVIOUS ARCHAEOLOGY

Several archaeological surveys have been conducted in the vicinity if the current project area. Figure 5 illustrates the overlap of surveys and identified sites located in the vicinity of the project area.

In 1973, Connolly re-identified Site 50-50-10-1062 under the direction of Bernice Pauahi Bishop Museum. The area consisted of a traditional petroglyph site containing at least 87 glyphs within the northern section of Kaluapulani Gulch, in Makaʻeha Ahupuaʻa. Site -1062 is located west of Kula Highway near the present upcountry location of Kamehameha Schools. Preservation planning for the site was completed during building of Kamehameha Schools and Kulamalu subdivision (Spear and Carson, 2003).

Donham (1992) performed an Archaeological Field Inspection and summarized findings of another Petroglyph site (State site 50-50-11-2920) further upland in the Kaluapulani Gulch, in the Kula 200 Subdivison. This 20-meter long site, identified on a vertical rock face, includes at least 32 individual glyphs, with the principal theme of canoes and paddlers.

Bordner (1980), in affiliation with the Environmental Impact Statement Corporation, conducted a Reconnaissance Survey of the proposed Makawao Subdivision. The project area, which was located between Kailua Gulch and Apana Road, was said to have been a plantation camp. However, no archaeological surface remains were located during the survey and no further work was recommended.

Donham (1990), in association with Paul H. Rosendahl, Ph.D., Inc. (PHRI), conducted an Archaeological Inventory Survey for five potential upcountry Maui High School sites in Haliʻimaile, Hokuʻula, Kailua and Makaʻeha Ahupuaʻa, Makawao District. Historic materials and traditional Hawaiian artifacts were discovered during this project: Parcel 1 contained ceramic shards; Parcel 2 contained a horseshoe and metal; Parcel 3 contained water-worn coral and marine shell; and Parcel 4 contained four lithic artifacts and a ceramic shard. Even though cultural remains were located on some of the investigated parcels, no State Site Numbers were issued for any of the findings. No further work was recommended for Parcels 1-3 and 5; however, further research was warranted for Parcel 4.

Xamanek Researches conducted an Archaeological Inventory Survey in Hoku`ula Ahupua`a, Makawao District (Fredericksen and Fredericksen 1995). A rock aggregation was

recorded and issued SIHP Site Number 50-50-05-3929. Testing resulted in the discovery of historic materials including metal, bottle glass, agricultural sheeting, cut animal bone, and ceramics. Traditional Hawaiian artifacts consisted of *kukui* nut *(Aleurites moluccana*), water-worm pebbles (*`ili`ili* stones) and marine shell. No additional archaeological work was required for the site.

Xamanek Researches conducted an Archaeological Inventory Survey for the Kulamalu water tank and water line improvements in Hoku`ula Ahupua`a, Makawao District (Fredericksen and Fredericksen 1999). Five archaeological sites were identified and each was issued a SIHP Site number. Site 50-50-10-4677 through -4681 consisted of two historic retaining walls, two shelter caves and a probable historic gravesite. The sites were not to be affected by the proposed work and no further investigations were deemed necessary.

PHRI conducted an Archaeological Inventory Survey for the proposed Pukalani Terrace Subdivision III in `A`apueo Ahupua`a, Makawao District (McPhatter and Rosendahl 1996). During this survey, additional petroglyph panels were documented in Kaluapulani Gulch. The glyphs are located on the south bank of the gulch and were issued Site 50-50-05-4179. There was also a rock wall identified (Site 50-50-05-4180) and agricultural terraces (Site 50-50-05-4181). No additional work was required for the wall and terraces; however, permanent preservation was recommended for the petroglyph panel.

Aki Sinoto Consulting completed an Archaeological Inventory Survey of the proposed Upcountry Town Center (Sinoto and Pantaleo 2002). The historic Corn Mill Camp was identified and issued Site Number 50-50-06-5169. All features associated with the historic camp were recommended for permanent preservation.

Archaeological Services Hawai`i, LLC recorded a Chinese Cemetery while monitoring the construction of Kulamalu Commercial Subdivision in `A`apueo Ahupua`a. No archaeologist was on site during the excavations; however, a construction supervisor contacted the archaeological firm upon the discovery of disturbed human bones. The site contained coffin and burial pits, burning episodes, animal burial, associated historic glass bottles and beads. The site was slated for permanent preservation (Pickett and Pantaleo 2003).

Pantaleo and Tusha (2003) completed an Archaeological Inventory Survey for the proposed Pi`iholo water well (TMK 2-4-12: portion of 6). Nothing of archaeological significance was identified.

Pantaleo (2004a) prepared an Archaeological Inventory Survey report of the Taylor-Fewell subdivision and Grove Ranch Agricultural Subdivision in Hāli`imaile [TMK: (2)-2-4-1-:004, 019). Two archaeological sites were give numbers 50-50-06-5554 and -5555. The sites consisted of a Portuguese ferno (Site -5554) and a historic cattle scale (Site -5555). Since historic remains were encountered, Archaeological Monitoring was recommended.

Pukalani Highlands Property

In March 1991, an Archaeological Inventory Survey for the proposed Pukalani Highlands Property in Hokuʻula Ahupuaʻa was completed by Archaeological Consultants of Hawaiʻi, Inc. (TMK: 2-3-44: 20) (Kennedy 1991). A total of three structures were recorded; four test units were excavated. According to Kennedy, evidence collected suggested the structures (referred to as "mounds") were pre-Contact as all historic materials (e.g., wire, nails, bovine teeth, a plastic bottle) were all collected at least 14 cm above the base of the structures and because the rock walls were stacked and faced, rather than being reinforced by concrete.

Site 50-50-05-2497 was concluded to be a *heiau* (shrine, temple) due to the structure's formal construction. Kennedy also concluded that Site -2498 was a *heiau* based upon oral accounts of the structure and its formal construction. Volcanic glass considered to be prehistoric was found below historic materials. In addition, coral found on the platform and in a test unit furthered the belief that the site was a *heiau*, "for there are ethnographic accounts of fist sized chunks of coral being brought to and used as offerings on such structures" (Kennedy 1991: 27). Site 50-50-05-2499 was not as well constructed as Site -2497, but was determined to be a burial due to its close proximity to Sites -2497 and -2498. Preservation efforts were recommended for Site -2497 due to its excellent condition and cultural value; Data Recovery was recommended for Sites -2498 and -2499 due to their potential to yield cultural data (and also an examination of a stone wall, which is absent from Kennedy's report). Sites -2497, -2498, and -2499 continued to be of interest and generated much controversy.

In June 1991, Xamanek Researchers tested Site -2499; preliminary excavations suggested the feature was the result of modern agricultural clearing activities (Fredericksen, *et al.* 1991). A trench *makai* of the bedrock at Site -2499 was excavated in order to determine if the feature covered an old lava tube which might contain a burial. Pre-Contact artifacts were recovered: a round stone, possibly a "crude or unfinished *pohaku hu*" (a rock used to snare birds, according to Brigham in Fredericksen, *et al.* 1991: 08), charcoal, several coral chunks, *kukui* (candlenut tree; *Aleurites moluccana*), shell fragments, an adze tip, two polished adze flakes, basalt flakes, and a possible hammerstone and polishing stone. Historic artifacts were also noted: metal nails, cut

bovine bone, glass sherds, rusty metal, and wire. Xamanek Researchers concluded that Site -2499 was not a lava tube and that the mix of artifacts infers activities from both pre- and post-Contact eras. A 2.0 by 3.0 m area 5.0 m north of Site -2497 was cleared and a small piece of coral, some concrete, and rusty metal pieces were recovered. Pieces of a concrete irrigation flume were found west of Site -2497. Radiocarbon dating from Site -2498 was dated at AD 1540-1680; Site -2499 returned a date of 1620 to 1750. The location may have been chosen as "repository of stones because it is an outcrop of rock which could not be utilized in other ways" (Fredericksen, *et al.* 1991: 10). Oral histories of the area confirmed agricultural cultivation and clearing occurred for many years "in recent times" (*ibid*: 10). It was recommended that further excavation on the *mauka* sides of Sites -2497 and -2498 was needed to obtain more data and that the placement and location of the two sites was "problematic" – they may be historic clearing piles, pre-Contact religious structures, or a combination of prehistoric and historic sites. Finally, a stone alignment, absent from Kennedy's 1991 report, was deemed State Site 50- 50-05-3527. The alignment was composed of "angular, quarried rocks intermixed with boulders and cobbles" (*ibid*: 07).

In January 1992, Xamanek Researchers began "dismantling work at Site 2498" (Fredericksen and Fredericksen 1992: 02). More historic articles and a charcoal layer were encountered. A bulldozer uncovered human bone, and the disarticulated remains of seven individuals were identified and disinterred. One adult coffin burial was determined to be a primary interment; all others (three adults, two infant, and one child) were secondary interments, brought from "somewhere else" (*ibid*: 14). Due to the burial style and one Hawaiian artifact found in the fill, the burials were thought to be of Hawaiian ancestry. The presence of a wooden casket and other historic remains indicated that all of the burials were interred (and reinterred in regards to the secondary burials) in historic times, possibly from bones kept by a Hawaiian family and from a family burial cave. After conferral with SHPD, the remains were moved to Lot 60, which was located on an easement that could not be developed. Monitoring and further excavation were recommended in order to explore the site and stone alignment further.

In February 1994, the SHPD and Maui/Lāna`i Island Burial Council (MLIBC) was notified of an inadvertent discovery of human skeletal remains at the Pukalani Highlands Subdivision (TMK: 2-3-44: 19). The remains (Site 50-50-05-3520) were uncovered when a section of a trench wall collapsed: "The disposition of the remains in *in situ* indicated that the elements were not articulated and that the burial had been disturbed prior to its recent exposure during construction" (Donham 1994: 01). Due to the location of the remains in an area of likely future disturbance, the decision was made to relocate the remains to a previously established

burial preserve within Pukalani Highlands Subdivision (Site 50-50-05-3725). Historic period fragments not associated with the burial were also present. Scattered charcoal was interpreted as a by-product of sugarcane burning in the vicinity of the project area.

Xamanek Researches summarize other sites in the vicinity of the project area, including Site 50-50-05-3426, an agricultural clearing pile from the historic period, as suggested by the presence of black plastic, common in cultivation pursuits (Fredericksen and Fredericksen 1994a). The Site -3527 stone alignment was interpreted as part of the historic roadway, perhaps Paku Lane. In May of 1990, Kennedy identified a stone feature, which he determined to be a *heiau*, in a pineapple field (Site 50-50-05-2701). Excavations outside of the feature included volcanic glass, basalt flakes, and *kukui* nutshells. Radiocarbon dating suggested a construction date of 1620-1770 (Fredericksen and Fredericksen 1994a).

Kennedy's previous documentation regarding Site 50-50-05-2701 required further archaeological investigation on the land parcel. Archaeological Services Hawai'i, LLC conducted an Archaeological Inventory Survey of the Kualono Residential Subdivision in Pukalani (Pantaleo 2004b). A total of 26 backhoe trenches were excavated and no culturally significant findings were encountered during subsurface testing. However, approximately 2.5 acres were set aside from the proposed development in order to preserve Site -2701. Archaeological Monitoring was recommended to protect the purported *heiau,* and in case of any subsurface cultural remains.

Finally, in December 1994, excavations occurred at Site 50-50-05-3929, a rock aggregation at TMK: 2-3-44: 31, adjacent to the Pukalani Highlands Subdivision (Fredericksen and Fredericksen 1994b). Modern trash material was noted: rusty metal, plastic, black plastic mulch associated with historic agricultural practices, and bottle glass. No significant finds were made; no further work was recommended.

In all, a survey of previous archaeological undertakings in the area suggest that this area of upcountry Māui may have been utilized from pre-Contact times into the historic period. The gathering of upland resources in traditional times seems a more likely use than more permanent habitation and agricultural practices, like those in the Kēōkea-Waiohuli areas. Although the presence of petroglyphs and ceremonial structures suggests at least temporary habitation, more evidence is needed to support this claim, especially in the Pukalani area.

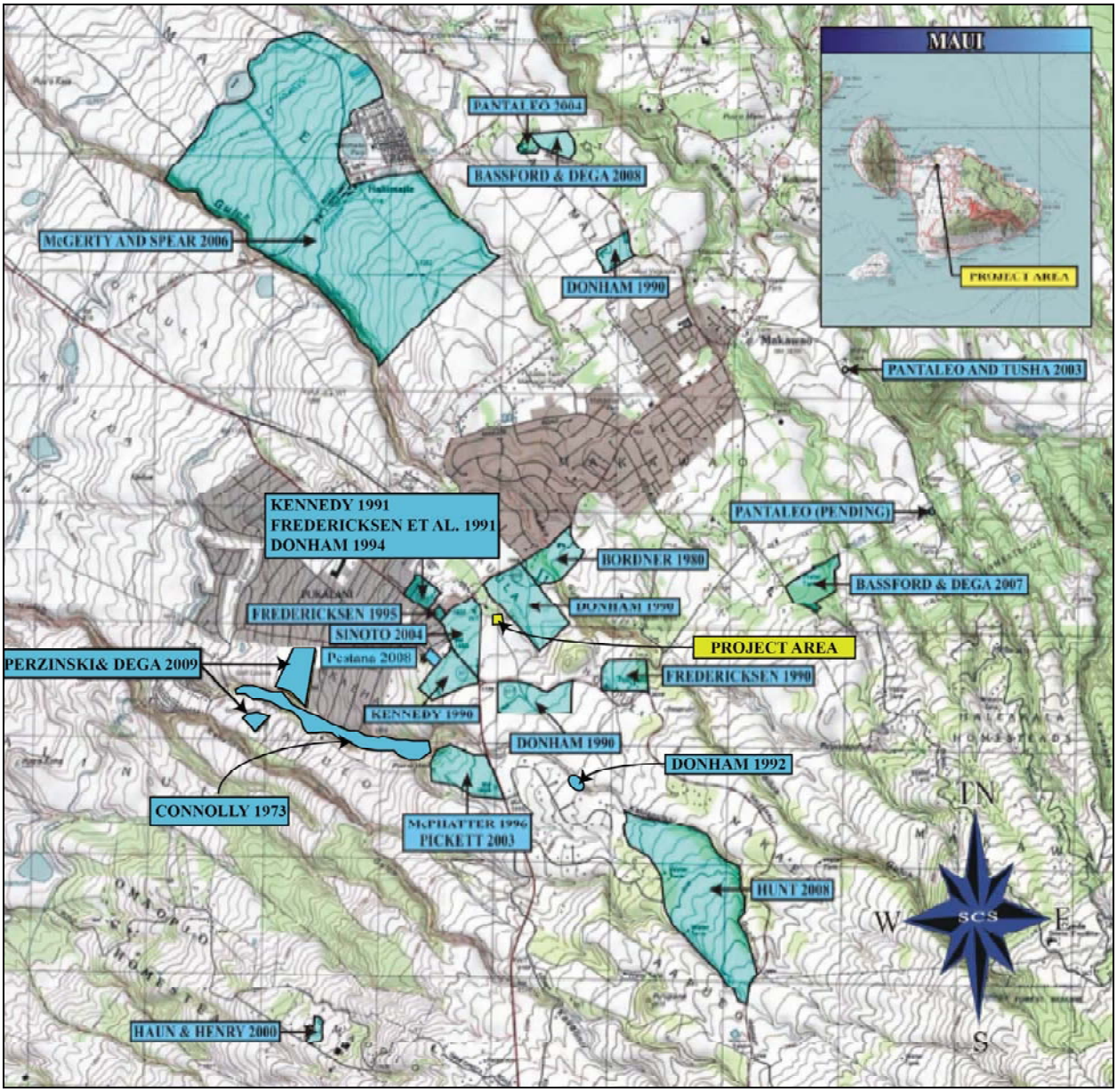

Figure 5: USGS Map Showing Location of Previous Archaeological Studies.

SETTLEMENT PATTERNS

A review of the literature as well as previous archaeology indicates that Hōkūʻula Ahupuaʻa in Kula District, at the edge of Makawao Ahupuaʻa, was primarily a source of forest resources and agricultural land. There is a lack of evidence, both in oral accounts and archaeological remains, for permanent settlement in this particular area of upcountry Māui. Southeast of the project area, on the leeward slopes of Haleakalā in Kula *moku*, where sweet potatoes (ʻ*uala*) were more extensively cultivated, there is evidence for permanent settlement. However, in this somewhat wetter and lower elevation area, hunting and gathering, with more limited dryland cultivation of ʻ*uala* appears more likely. Many petroglyphs and ceremonial structures attest to the significance of this area, and it is clear that humans have temporarily occupied Hōkūʻula Ahupuaʻa from pre-Contact through the entire historic period.

METHODS

Fieldwork was conducted on June 5, 2013 by SCS personnel David Perzinski B.A. and Michael Dega, Ph.D (Principal Investigator). The inventory survey included a 100% pedestrian survey of the project area in <5 m transects. Numerous photographs were taken of the well location and pipeline corridor in addition to written notes and descriptions of the topography and natural environment.

Archival research entailed investigating the historic and archaeological background of the general project area. This examination included a documentary search of previous archaeological research conducted in this region of Maui as well as a review of archival literature relating to Land Commission Awards and local mythology. The review of historical documents was accomplished in order to understand the impact of post-Contact events on the cultural and archaeological landscape of the region.

All laboratory work was conducted in the Maui office of SCS and included the drafting of site plan view maps and photographs. All documentary materials are currently being curated at the SCS office in Maui.

RESULTS OF FIELDWORK

The project area consisted of a one-acre fenced parcel that currently houses a 1 million gallon water tank, as well as an approximate 330 m (1100 foot) long pipeline corridor that parallels the eastern side of Kula Highway. The site has undergone extensive cutting and filling for the tank and includes a 4 m cut on the southern portion of the parcel and up to 5 m of fill on the north and eastern sides of the tank site. It is proposed that the new well be placed within the fenced-in tank site. No sites or cultural deposits were encountered during the survey of the well site.

The pipeline corridor is proposed to extend along Kula Highway between the proposed well site and the intersection of Makawao Avenue and Kula Highway with the tie-in occurring within the intersection. The pipeline will be placed within the highway right-of-way where the road has been built up approximately 3-5 m with fill material. The base of the slope levels off into former pineapple fields that are now overgrown with invasive weeds and shrubs. Along the corridor vegetation included mango, ficus, black wattle, *koa haole*, macadamia nut, guava, Christmas berry, bamboo, morning glory, *uhaloa* and thistle. No surface sites or cultural deposits were encountered along the corridor as it is believed that any previously existing sites were likely destroyed by agricultural activities and more recently, highway construction.

The archaeological assessment included a pedestrian inspection of the project area with photographic and written documentation of the proposed well site. No new sites, surface features or midden scatters were identified during the pedestrian survey. Historic and ongoing agricultural and highway construction activities within the project area has clearly impacted the project areas ground surface and likely destroyed any surface deposits and possibly any near surface cultural deposits or artifacts.

Figure 6: View Northeast Showing Proposed Location for New Well Site.

Figure 7: View North of Proposed Pipeline Corridor.

SUMMARY AND CONCLUSIONS

The current archaeological assessment did not encounter any surface cultural remains. A 100% pedestrian survey failed to lead to the identification of historic surface features, sites or layers. Historic and modern era agricultural and road construction activities in the parcel have likely disturbed any previously existing sites or surface deposits. It is our estimation, based on this archaeological assessment, that the proposed undertaking would not have an adverse impact on any archaeological sites or features.

ARCHAEOLOGICAL MONITORING

Archaeological Monitoring is not recommended during the construction activities for the proposed well site and pipeline. However, should the inadvertent discovery of significant cultural materials and/or burials occur during construction, all work in the immediate area of the find must cease and the SHPD be notified to discuss mitigation.

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

November 7, 2013

Robert Spear, Ph.D., Principal Investigator
Scientific Consultant Services, Inc.
1347 Kapiolani Boulevard, Suite 408
Honolulu, Hawai'i 96814

LOG NO: 2013.4398
DOC NO: 1309CG02
Archaeology

Dear Dr. Spear:

SUBJECT: **Chapter 6E-8 Historic Preservation Review -**
Archaeological Assessment of a 0.994 Acre Parcel for a New Well and Pipeline in Pukalani
Hōkū'ula Ahupua'a, Makawao District, Island of Maui
TMK (2) 2-3-007:030

Thank you for submitting the report titled *An Archaeological Assessment Report for a 0.994-acre Water Tank Parcel in Pukalani, Hōkū'ula Ahupua'a, Kula District, Island of Maui, Hawai'i [TMK (2) 2-3-007:030]*, R. Hodara, D. Perzinski, and M. Dega, dated June 2013 (Draft). The submittal was received in the Kapolei office on July 18, 2013; we apologize for the delay in responding.

The survey was conducted in support of the proposed excavation for a new well on a 0.994-acre parcel currently housing a 1-million gallon water tank. The subject parcel is owned by the County of Maui Department of Water Supply project area includes a pipeline corridor of approximately 330 meters along the eastern side of Kula Highway. The pedestrian survey encompassed 100% of the project area using <5 meter transects. No cultural resources were identified on the surface; no subsurface testing was conducted.

The report contains information regarding the nature of the proposed project, location maps and photographs, description of the environment, previous archaeological studies, expected findings, field results, and recommendations. The area had previously undergone extensive ground alteration from commercial agriculture, the installation of the water tank, and the construction of the highway, which includes approximately 3-5 meters of fill material. The excavation of the new well will be along the eastern side of the water tank, where up to 5 meters of fill were deposited during construction. The pipeline will also be placed within fill material along the highway. As no evidence of historic properties was found during the 100% pedestrian survey of the project area and excavations will take place in fill material, no archaeological monitoring is recommended.

The report is accepted pursuant to Hawaii Administrative Rule §13-275-5(b); however, some errors and inconsistencies were identified and they are itemized in the Attachment. We request that you address the comments and submit a final revised copy of the report. Please send one hardcopy of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention of SHPD Library. Please send a corrected hard copy of the final report to the Maui SHPD in Wailuku as well. Please contact me at (808) 933-7653 or Theresa.K.Donham@hawaii.gov if you have any questions or wish to further discuss this letter.

Aloha,

Theresa K. Donham
Archaeology Branch Chief

DLNR Pukalani Tank Site
Exploratory Water Well

ENVIRONMENTAL ASSESSMENT

Appendix 4
Phase I Environmental Site Assessment

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PHASE I
ENVIRONMENTAL SITE ASSESSMENT REPORT
FOR
PUKALANI TANK SITE
TMK (3) 2-3-007:030 AND A PORTION OF THE KULA HIGHWAY RIGHT-OF-WAY

MNA PROJECT 01378_2

OCTOBER 23, 2013

Myounghee Noh & Associates

Environmental Studies and Consulting Services

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99-1046 Iwaena Street, Suite 210A, Aiea, Hawaii, USA 96701 • 808.484.9214

This Phase I ESA report is prepared for:

Geometrician Associates, LLC
PO Box 396
Hilo, Hawaii 96721

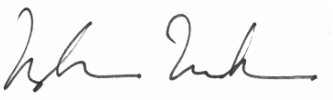
PHASE I
ENVIRONMENTAL SITE ASSESSMENT REPORT
FOR
PUKALANI TANK SITE
TMK (2) 2-3-007:030 AND A PORTION OF THE KULA HIGHWAY RIGHT-OF-WAY
PUKALANI, MAUI

MNA Job No. 01378_2

October 23, 2013

I declare that, to the best of my professional knowledge and belief, I meet the definition of *environmental professional* as defined in §312.10 of 40 CFR 312.

I have the specific qualifications based on education, training, and experience to assess a *property* of the nature, history, and setting of the subject *property*. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.



Myounghee Noh
Principal

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LIST OF ACRONYMS AND ABBREVIATIONS

AST	Aboveground Storage Tank
ASTM	American Society of Testing and Materials
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CESQG	Conditionally Exempt Small Quantity Generators
CORRACTS	RCRA Facilities that are undergoing "corrective action"
DLNR	Department of Land and Natural Resources
DWS	Department of Water Supply
ERNS	Emergency Response Notification System
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
HDOH	Hawaii Department of Health
HEER Office	Office of Hazard Evaluation and Emergency Response
LQG	Large Quantity Generator
LUST	Leaking Underground Storage Tank
MECO	Maui Electric Company
MLP	Maui Land and Pineapple Company
MNA	Myounghee Noh & Associates, L.L.C.
NFA	No Further Action
NFRAP	CERCLIS No Further Remedial Action Planned
NLR	No Longer Regulated generators
NPL	National Priorities List
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
SHWB	Solid and Hazardous Waste Branch
SQG	Small Quantity Generator
TMK	Tax Map Key
TSD	Treatment/Storage/Disposal
UIC	Underground Injection Control
UST	Underground Storage Tank
VRP	Voluntary Response Program

EXECUTIVE SUMMARY

Myounghee Noh & Associates, L.L.C. (MNA), was retained in June 2013 to conduct a Phase I Environmental Site Assessment (ESA) for the subject property located in Pukalani, Island of Maui, and identified by the Tax Map Keys (TMK) of Island 2, Zone 2, Section 3, Plat 007, and Parcel 030 (TMK [2] 2-3-007:030) and a portion of Kula Highway right-of-way adjacent to parcel :030 and parcel :035, to the intersection of Kula Highway and Makawao Avenue. The subject property at parcel :030 owned by the State of Hawaii and operated by the County of Maui, Department of Water Supply. The subject property which included the Kula Highway right-of-way was owned and operated by the State of Hawaii. This Phase I ESA was completed for Geometrician Associates, LLC, the County of Maui Department of Water Supply, and the State of Hawaii Department of Land and Natural Resources.

The purpose of this Phase I ESA is to identify *recognized environmental conditions* (REC) at the subject property, with respect to the range of contaminants within the scope of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and petroleum products. A Phase I ESA consists of four parts. Three of those parts are intended to collect information that will aid in the identification of REC at the subject property. The information generating parts of the Phase I ESA consists of a review of state, federal, and local environmental records; a site reconnaissance visit; and interviews with key site personnel and other individuals with knowledge regarding the subject property. The fourth part of a Phase I ESA is a report that documents the collection of information about the subject property and evaluation of that information towards making a determination of the presence of REC at the subject property.

The subject property at parcel :030 was located in Pukalani along the Kula Highway, approximately one quarter mile south of the Kula Highway and Makawao Avenue intersection. This parcel was located in upcountry Maui, approximately seven miles south of Maliko Bay and was improved with a gravity-fed surface water drinking water source, tank number 251, which was secured by a chain link fence. The property was approximately 0.994 acres. At the time of this Phase I ESA, this parcel was owned by the State of Hawaii and operated by the County of Maui, Department of Water Supply. The subject property included in the Kula Highway right-of-way, adjoining parcel :030 and :035, was directly adjacent to a public thoroughfare, Kula Highway, and was utilized for transportation. An approximately one quarter mile segment of the Kula Highway right-of-way, between parcel :030 and the intersection of Kula Highway and Makawao Avenue, is considered part of this subject property.

FINDINGS

During the site reconnaissance on 05 June 2013, at about mid-way of the Kula Highway right-of-way, abandoned rusted vehicle parts and a car battery were found. These car remnants were hidden by dense vegetation and located down-gradient of the maintained corridor. Metals and petroleum products were assumed to have been present in the surface soil where these car parts were observed. Petroleum products and metals from these car parts were suspected to have impacted the surface soil in the middle and north areas of the portion of Kula Highway right-of-way included in the subject property; however, prolonged exposures to the sun and the wind, the

petroleum products were likely be attenuated by dilution, dispersion, and disintegration. Therefore, the abandoned car parts are not considered a *recognized environmental condition*.

Environmental FirstSearch™ identified one leaking underground storage tank (LUST) facility within ½ mile of the subject property. The facility, Makawao Fire Station, was located 739 feet northwest of the subect property at 134 Makawao Avenue. The official status for this site was site cleanup complete, and no further action was required by the Hawaii Department of Health (HDOH). The site was located down gradient from the subject property. The anticipated direction of groundwater flow is to the west, away from the subject property. Therefore, this is not a *recognized environmental condition.*

Based on a review of the HDOH Hazard Evaluation and Emergency Response (HEER) Office records for the adjoining property to the west, the parcel at TMK (2) 2-3-007:008 was owned by the Maui Land & Pineapple Company (MLP) and located approximately 500 feet west of the subject property and 30 feet down gradient. A Limited Phase II ESA was previously conducted for the site, which was formerly operated as the Corn Mill Camp Pesticide Mixing and Storage Site during the 1940s through 1960s. In 2004, MLP entered into a Voluntary Response Program (VRP) agreement. However, the land was sold to a new owner, thereby terminating the VRP agreement. In December 2011, the HEER Office expressed its intent to continue remedial investigation. The HEER Office also indicated that former pesticide mixing sites often have significant levels of chemicals of concern, thereby generally considered potential "high risk" sites for contamination and public health hazards. Due to the close proximity of this site to the subject property and the potential for significant levels of chemicals of concern, this site is considered a *recognized environmental condition*.

RECOGNIZED ENVIRONMENTAL CONDITIONS

MNA performed a Phase I ESA in conformance with the scope and limitations of ASTM E 1527-05 of the property located at TMK (2) 2-3-007:030 and a portion of the Kula Highway right-of-way, Pukalani, Island of Maui. Any exceptions to, or deletions from, this practice are described in Section 7 of this report. This assessment has revealed evidence of a *recognized environmental condition* in connection with the *subject property*:

- Pesticide-impacted MLP site, the west adjoining property of the parcel :030, the DWS tank site (Section 4.2.2).

1.0 INTRODUCTION

This report presents the results of a Phase I Environmental Site Assessment (ESA) conducted during June and July 2013 for the subject property in Pukalani on the Island of Maui, and identified by the Tax Map Keys (TMK) of Island 2, Zone 2, Section 3, Plat 007, and Parcel 030 (TMK [2] 2-3-007:030) and and a portion of Kula Highway right-of-way, adjacent to parcel :030 and parcel :035, to the intersection of Kula Highway and Makawao Avenue. The location of the subject property is identified in Figure 1.

This Phase I ESA was conducted by Myounghee Noh & Associates, L.L.C., herein referred to as MNA, for Geometrician Associates, LLC, the County of Maui Department of Water Supply (DWS), and the State of Hawaii Department of Land and Natural Resources (DLNR). At the time of this Phase I ESA, the subject property at parcel :030 was owned by the State of Hawaii and operated by the County of Maui, Department of Water Supply. The subject property at the portion of the Kula Highway right-of-way was owned and operated by the State of Hawaii.

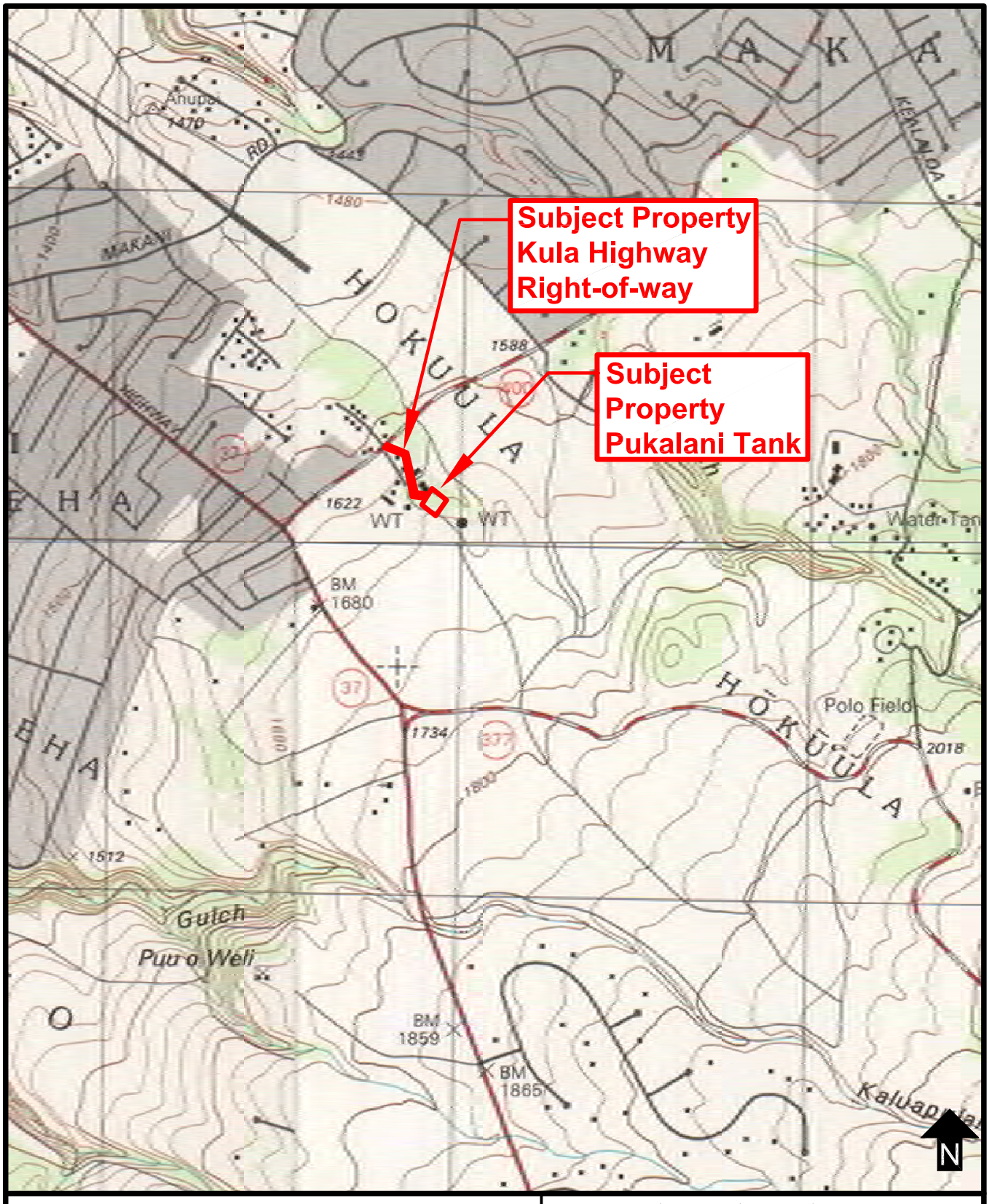
1.1 PURPOSE

The purpose of this Phase I ESA is to identify any *recognized environmental conditions* (REC) at the subject property, with respect to the range of contaminants within the scope of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and petroleum products. This practice is intended to permit a user to satisfy one of the requirements to qualify for the *innocent landowner defense* in CERCLA liability, "all appropriate inquiry into the previous ownership and uses of the site consistent with good commercial or customary practice." The term *recognized environmental condition* denotes the presence, or likely presence, of any hazardous substances or petroleum products on the property under conditions that indicate an existing release, a past release, or a material threat of a release into structures on the property or into the ground, groundwater, or surface water of the property (ASTM International, 2005).

This report is part of the Phase I ESA process which was conducted for the subject property specified above. The assessment was conducted in accordance with the practices described in *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM International, 2005).

1.2 DETAILED SCOPE OF SERVICES

A Phase I ESA has four components: records review, site reconnaissance, interview, and report. MNA conducted this ESA utilizing information sources with the potential to identify past or current releases of hazardous substances or petroleum products into the subject property. Adjoining properties were also evaluated for their potential to impact the subject property. Per the ASTM International Phase I ESA Standard, adjoining properties include parcels contiguous or partially contiguous with that of the subject property as well as those across a street, road, or other public thoroughfare (ASTM International, 2005).



Scale

2,500'

Figure 1. Site Location Map
Phase I Environmental Site Assessment
Pukalani Tank Site

October 2013

1.2.1 Site History

Where available, and as needed, MNA researched historical and current topographic maps, tax records, fire insurance maps, and aerial photographs to identify previous and current uses of the subject property, adjoining properties and surrounding areas.

1.2.2 Regulatory Records

MNA examined government records with respect to environmental conditions, citations, complaints, and permits at the subject property, at adjoining properties, and within the surrounding area. MNA utilized a records search, provided by Environmental FirstSearch™, to review records from the following federal and state programs.

- National Priorities List (NPL)
- Delisted NPL
- Resource Conservation and Recovery Act (RCRA) facilities that are undergoing "corrective action" (CORRACTS)
- RCRA-Treatment, Storage, & Disposal (TSD)
- Comprehensive Environmental Response, Compensation & Liability Information System (CERCLIS) List
- CERCLIS No Further Remedial Action Planned (NFRAP) List
- Federal and Hawaii State Brownfields
- Hawaii Solid Waste & Landfill
- Leaking Underground Storage Tank (LUST)
- RCRA – Violators/Enforcement
- Underground Storage Tank (UST)
- Emergency Response Notification System (ERNS)
- RCRA – Generators, including those No Longer Regulated (NLR)
- Hawaii Sites of Interest
- Hawaii Releases
- Federal and Hawaii State Land Use Controls
- Hawaii Voluntary Cleanup Sites
- Tribal Lands

Additionally, MNA reviewed state environmental databases and case files from the Hawaii Department of Health (HDOH), Maui Electric Company (MECO), and County of Maui Fire Department.

1.2.3 Site Reconnaissance

MNA performed a site reconnaissance to obtain information indicating the likelihood of contamination, to interview available site personnel, and to conduct a brief assessment of the adjoining properties. During the site reconnaissance, MNA looked for a variety of indicators of environmental hazards including, but not limited to, stained surface soil, dead or stressed vegetation, hazardous substances, aboveground and underground storage tanks, disposal areas,

groundwater wells, drywells, and sumps. Sampling and testing of soil and groundwater were not part of this assessment.

1.2.4 Site Geology and Hydrogeology

MNA reviewed published information, for the property and surrounding area, on surface and subsurface conditions such as topography, drainage, surface water bodies, subsurface geology, and groundwater. MNA used this information to assess the potential for migration and impact of the subject property by releases of hazardous substances or petroleum products from off-site properties.

1.2.5 Data Evaluation and Reporting

MNA evaluated the information collected and prepared this report as part of the overall assessment. Section 2 presents the site background information; Section 3 user provided information; Section 4 information collected from records review; Section 5 site reconnaissance; Section 6 interviews; Section 7 data gaps; Section 8 key findings and opinion; and Section 9 conclusion.

1.3 SIGNIFICANT ASSUMPTIONS

The conclusion presented in this report is based upon the assumption that reasonably ascertainable and relevant information pertaining to the environmental condition of the subject property was made available to MNA during the assessment. Information obtained from government agencies and other resources is presumed to be accurate and updated. Additionally, information collected in interviews was collected in "good faith" and believed to be true and accurate to the best knowledge of the interviewee.

1.4 LIMITATIONS AND EXCEPTIONS

This Phase I ESA report provides a "snapshot" of the property conditions at the time of the assessment. Findings, opinions, and conclusions apply to property conditions existing at the time of the investigation and those reasonably foreseeable. They do not apply to conditions at, or changes to, the property, of which MNA is not aware, could not reasonably be aware, and has not had the opportunity to evaluate.

This report is based upon visual observations of the property and surrounding vicinity, interpretations of the available historical and regulatory information, reviewed documents, and interviews of individuals with knowledge of the subject or surrounding property. MNA cannot ensure the accuracy of the historical or regulatory information. This report is intended exclusively for the purpose outlined and applies only to the subject property.

This Phase I ESA excludes asbestos, lead paint, and investigation of geotechnical concerns. No surface or subsurface sampling was involved.

1.5 SPECIAL TERMS AND CONDITIONS

This Phase I ESA was conducted and prepared by MNA for the exclusive use of Geometrician Associates, LLC; DWS; and DLNR. This report shall not be relied upon or transferred to any other party without written authorization from Geometrician Associates, LLC; DWS; and DLNR.

1.6 USER RELIANCE

This report is an instrument of service of MNA, which summarizes its findings and opinions with respect to REC at the subject property. Findings and opinions are predicated on information that MNA obtained from individuals, a site reconnaissance, public records reviewed, and ancillary Phase I ESA activities on the dates, stated herein.

This assessment relies upon the accuracy and completeness of the information provided. The information obtained for this assessment is used without extraordinary verification. It is possible that other information exists and may be discovered, or that environmental conditions change subsequent to the submittal of this Phase I ESA report, to which MNA shall not be held responsible for exclusion.

2.0 SITE DESCRIPTION

This section contains location and legal description information; site and vicinity general characteristics; current subject property uses; structures, roads, and other improvements; past subject property uses; and current and past uses of adjoining properties.

2.1 LOCATION AND LEGAL DESCRIPTION

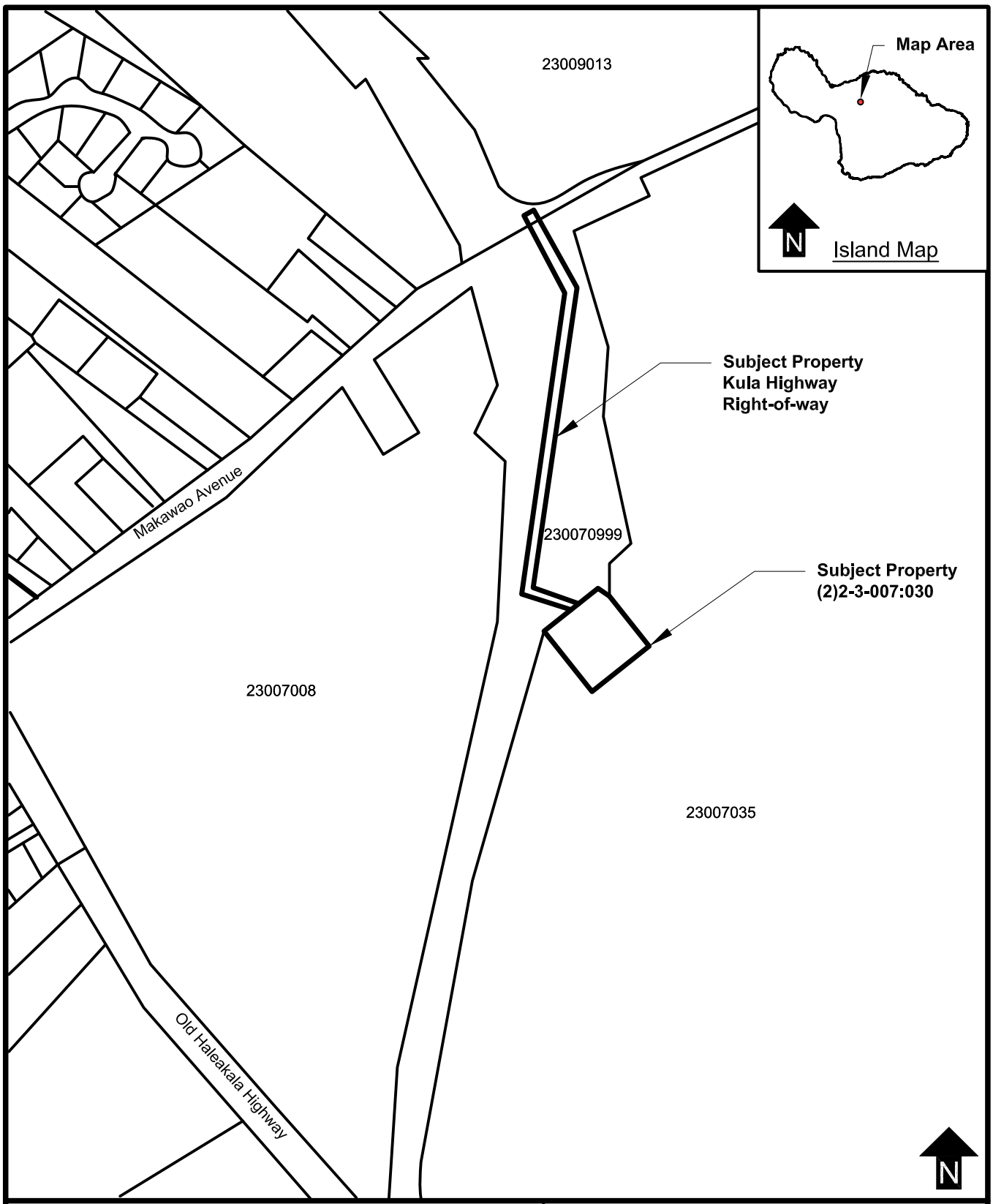
The subject property is located at TMK (2) 2-3-007:030 and a portion of the Kula Highway right-of-way in Pukalani, Island of Maui. According to the County of Maui tax records, parcel :030 was zoned as agricultural. This parcel was improved with a gravity-fed surface water drinking water source, tank number 251, which was secured by a chain link fence. The property was approximately 0.994 acres. Included in the subject property was a one quarter mile segment of the Kula Highway right-of-way, adjoining parcels :030 and :035, from parcel :030 to the intersection of Kula Highway and Makawao Avenue. A TMK map is presented in Figure 2.

2.2 SITE AND VICINITY GENERAL CHARACTERISTICS

The subject property was located in Pukalani, in upcountry Maui, approximately 7.4 miles south of Maliko Bay. The subject property was located adjacent to Kula Highway on the east, one quarter of a mile south of the Makawao Avenue intersection.

2.2.1 Geology

The Island of Maui is the second youngest and second largest island in the Hawaiian Archipelago. Maui Island is the largest of Maui County, which also includes the islands of



Scale
200'

Figure 2. TMK Map
Phase I Environmental Site Assessment
Pukalani Tank Site

October 2013

Molokai, Lanai, and Kahoolawe. Maui is known as the "Valley Isle" because it was formed into a single island from two separate shield volcanoes, which overlapped and created a depression between the two. Where the lava intersected, an isthmus was formed. The low flat area known as Central Maui connects the older northwestern "West Maui Volcano," elevation of 5,778 feet, with the much larger southeastern "East Maui Volcano" (Haleakala). Haleakala's tallest peak is 10,023 feet above sea level. This is almost double the summit of the West Maui Mountains, which were formed from the now extinct volcano, Puu Kukui. The Haleakala volcano is dormant (George A.L. Yuen and Associates, Inc., 1990).

In 1990, Mink and Lau described the geology in the vicinity of the subject property as follows:

> Kula constitutes the entire surface; northwest rift zone from Haleakala as series of cones; no evidence of dikes or significant alluvium (Mink & Lau, 1990).

The United States Department of Agriculture Natural Resources Conservation Service classifies the soil at the subject property as Haliimaile silty clay loam, 3-15 percent slopes. Typically, this soil is well-drained and composed of silty clay loam from 0 to 15 inches, silty clay from 15 to 41 inches, and clay from 41 to 65 inches (United States Department of Agriculture).

2.2.2 Hydrogeology

The HDOH Safe Drinking Water Branch has established an Underground Injection Control (UIC) line to serve as a boundary between drinking water and non-drinking water portions of Hawaii's aquifers. In general, areas above (mountain side) the UIC line are within drinking water portions of the aquifer, while areas below (ocean side) the UIC line are in the non-drinking water portions of the underlying aquifer. The subject property is located above the UIC line, therefore is within a drinking water portion of the aquifer (Hawaii Department of Health Safe Drinking Water Branch, 1999).

The hydraulic gradient of the basal groundwater within basaltic formations, in general, are from mountain areas to the shoreline. According to the Mink and Lau Technical Report #191, the subject property is located above the Makawao Aquifer. Mink and Lau described the hydrogeology and aquifer as follows:

> The Makawao Aquifer System is a volcanic aquifer, consisting of unconfined basal, high-level dike, and high-level perched. Very little is known about the occurrence and distribution of groundwater in this system. The entire region is covered by Kula lava, and nowhere does the aquifer system border along a coastline. Basal groundwater in Honomanu basalt underlies about three fourths of the total area. Where high-level water occurs, it lies far below the surface in the Wailuku basalt. Minimum elevation in the system is approximately 1,000 feet (304.8 meters). Drilling of deep wells would be very costly, and operating costs expensive. Virtually no subsurface exploration has been done in the region (Mink & Lau, 1990).

Generally, groundwater flow patterns reflect topographic features. Since the topographic contours display a decreasing elevation from southeast to northwest, the groundwater flow is assumed to flow in the same direction. Aquifer classification information for the Makawao lower and upper aquifers is provided in Table 1 (Mink & Lau, 1990).

Table 1. Makawao Upper Aquifer Classification System

Aquifer Code	**60303214**
Island Code	6–Maui
Aquifer Sector	03–Central
Aquifer System	03–Makawao
Aquifer Type, hydrogeology	2–High Level
Aquifer Condition	1–Unconfined
Aquifer Type, geology	4–Perched
Status Code	**11121**
Development Stage	1–Currently Used
Utility	1–Drinking
Salinity (in mg/L Cl^-)	1–Fresh (<250)
Uniqueness	2–Replaceable
Vulnerability to Contamination	1–High

mg/L Cl^--milligrams per liter of chloride

Table 2. Makawao Lower Aquifer Classification System

Aquifer Code	**60301111**
Island Code	6–Maui
Aquifer Sector	03–Central
Aquifer System	01–Makawao
Aquifer Type, hydrogeology	1–Basal
Aquifer Condition	1–Unconfined
Aquifer Type, geology	1–Flank
Status Code	**21112**
Development Stage	2–Potential Use
Utility	1–Drinking
Salinity (in mg/L Cl^-)	1–Fresh (<250)
Uniqueness	1–Irreplaceable
Vulnerability to Contamination	2–Moderate

mg/L Cl^--milligrams per liter of chloride

2.3 CURRENT USE OF THE SUBJECT PROPERTY

The subject property at parcel :030 was owned by the County of Maui Department of Water Supply (DWS) and operated as a storage area and the location of water tank number 251. The subject property at the Kula Highway right-of-way was owned by the State of Hawaii and utilized as a transportation corridor.

2.4 STRUCTURES, ROADS, AND OTHER IMPROVEMENTS

The subject property at parcel :030 was improved with a gravity-fed surface water drinking water source, tank number 251, which was secured by a chain link fence. The property was approximately 0.994 acres. At the time of this Phase I ESA, this parcel was owned by the State of Hawaii and operated by the County of Maui DWS.

The subject property at the Kula Highway right-of-way was a transportation corridor owned and operated by the State of Hawaii. At the time of this Phase I ESA, approximately one quarter mile of the Kula Highway transportation corridor, from parcel :030 to the intersection with Makawao Avenue, was included in the subject property (Figure 3).

2.5 PAST USES OF THE SUBJECT PROPERTY

The subject property at TMK (2) 2-3-007:030 was owned by the State of Hawaii and operated by the County of Maui DWS. Tax records indicated that the State of Hawaii owned the property from 1991 to present. The subject property at the Kula Highway right-of-way was associated with Kula Highway and owned by the State of Hawaii. TT101 or Field Book tax records for this transportation corridor at the Maui County Real Property Tax office were not available. Based on the information available at the time of this writing, the subject property at parcel :030 had operated as agricultural land, and the subject property at the Kula Highway right-of-way had operated as a transportation corridor. Table 2 summarizes the available information regarding the historical uses of the subject property.

Table 3. Users and Primary Uses of Subject Property

Period (approx.)	Owner/Lessee/Sub-Lessee	Area (acres)	Primary Use
TMK (2) 2-3-007:030; 0 Haleakala Highway			
1991-present	State of Hawaii/County of Maui	0.994	Agriculture
1973-1991	County of Maui Board of Water Supply	1.000	Agriculture
Dropped from TMK (2) 2-3-007:008			

2.6 CURRENT AND PAST USES OF SURROUNDING PROPERTIES

Information regarding current and past uses of the adjoining properties was obtained from review of tax records, historic topographic maps, aerial photographs, and interviews. At the County Real Property Tax office, Field Book records were not found for TMKs (2) 2-3-007:035 and 2-3-009:063. Table 3 summarizes the property use information for the adjoining properties.

Table 4. Users and Primary Uses of Surrounding Properties

Period (approx.)	Owner/Lessee/Sub-Lessee	Area (acres)	Primary Use
TMK (2) 2-3-007:008; 0 Haleakala Highway Adjoining property to the west			
2011-2013	Pukalani Associates, LLC	40.592	Agriculture
2005-2011	Bennett Capital, LLC Pukalani Associates, LLC	40.592	Agriculture
1997-2011	Maui Land & Pineapple Co., Inc.	195.270	Pineapple cropping, cattle pasture
10.490 acres dropped into road, TMK (2) 2-3-007:011			
1987-1997	Maui Land & Pineapple Co., Inc.	205.760	Pineapple cropping, cattle pasture
1973-1987	Maui Land & Pineapple Co., Inc.	206.000	Pineapple cropping, cattle pasture

Period (approx.)	Owner/Lessee/Sub-Lessee	Area (acres)	Primary Use
		8.500	Urban
1.00 acre dropped into TMK (2) 2-3-007:030			
1970-1973	Maui Land & Pineapple Co., Inc.	215.500	Pineapple cropping, cattle pasture
TMK (2) 2-3-007:035; 0 Haleakala Highway Adjoining property to the east			
2007-2013	Maui Land & Pineapple Company, Inc. Giampaolo Paul Boschetti	149.869	Cattle pasture, waste land
TMK (3) 2-3-009:013; 0 Makani Road Adjoining property to the northeast			
2008-2013	Giampaolo Paul Boschetti	58.713	Pastureland
1976-2008	Maui Land & Pineapple Company, Inc.	84.350	Pineapple cropping and cattle pasture
TMK (3) 2-3-009:063; 3700 Haleakala Highway Adjoining property to the northwest			
1998-2013	Jesus Is Alive	15.374	Religious institution, office

TMK – Tax Map Key

3.0 USER PROVIDED INFORMATION

MNA personnel obtained user provided information by interviewing State of Hawaii DLNR engineer Gayson Ching on 15 July 2013. The following information was obtained from the interview.

3.1 ENVIRONMENTAL LIENS OR ACTIVITY AND USE LIMITATIONS

Mr. Ching was unaware of any environmental cleanup liens or activity and land use limitations for the subject property.

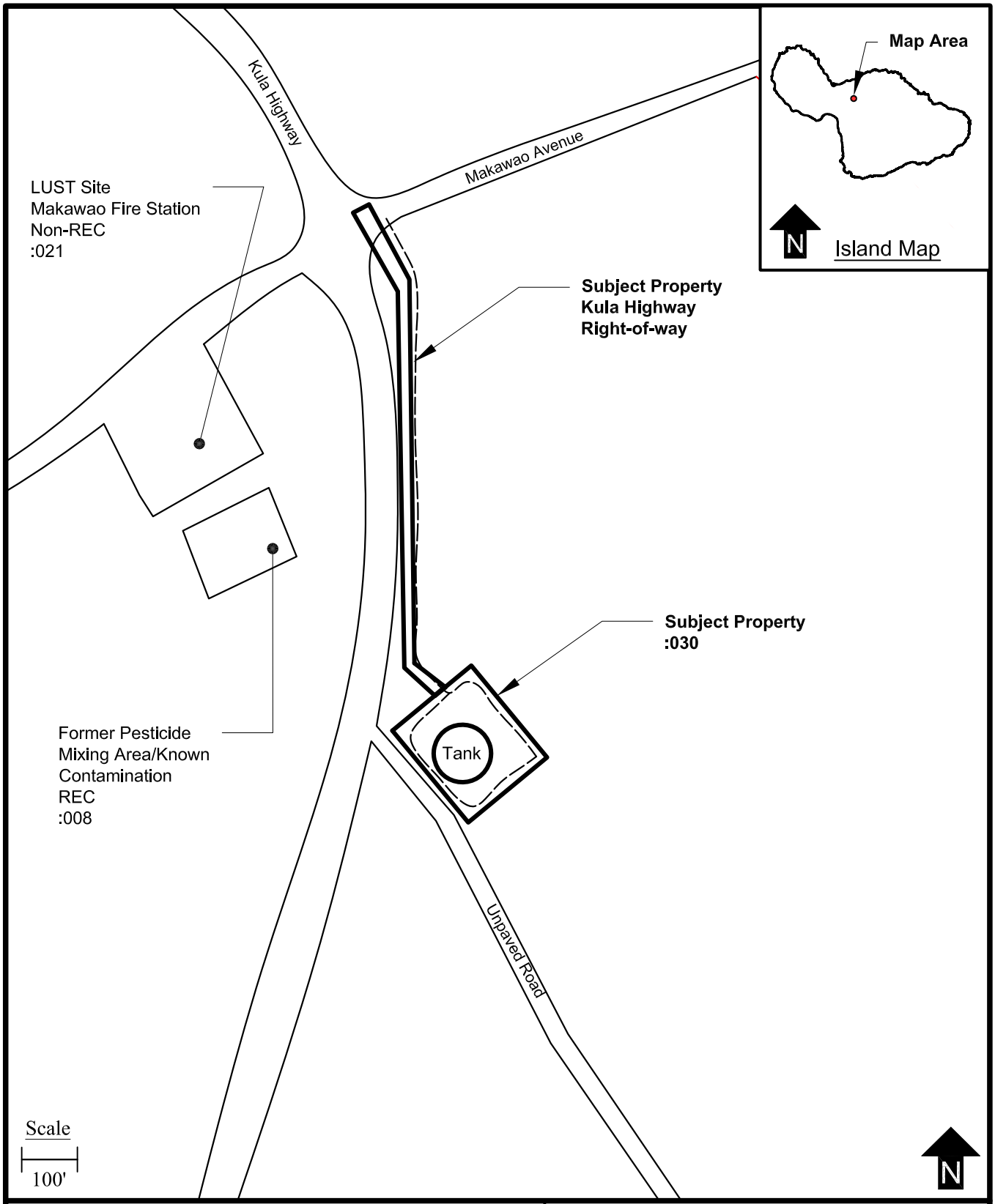
3.2 SPECIALIZED KNOWLEDGE

Mr. Ching indicated that he had no specialized knowledge or experience related to the property or nearby properties, nor did he have reasonably ascertainable information of any spills, chemical releases or environmental cleanups at the site.

When asked of the presence of specific chemicals at the subject property, Mr. Ching indicated that there may have been herbicide or pesticide related chemicals used for agriculture. Since Mr. Ching was aware that the subject property was located within former agricultural land (pineapple fields), he noted that this former land use was an obvious indicator of the presence or likely presence of contamination at the property.

3.3 VALUATION REDUCTION

The user had no information pertaining to the valuation reduction of the site.



—— Path Walked

LUST - Leaking Underground Storage Tank

REC - Recognized Environmental Condition

Figure 3. Site Map
Phase I Environmental Site Assessment
Pukalani Tank Site

October 2013

3.4 OWNER, PROPERTY MANAGER, AND OCCUPANT INFORMATION

The subject property at parcel :030 was owned by the State of Hawaii and operated by the County of Maui DWS. The subject property at the Kula Highway right-of-way was owned and operated by the State of Hawaii. No property transaction triggered this Phase I ESA.

3.5 REASON FOR PERFORMING THE PHASE I ESA

The purpose of this Phase I ESA is to identify any REC at the subject property, within the scope of ASTM Standard 1527-05, to satisfy the Environmental Assessment/Environmental Impact Statement requirements for the DLNR exploratory well project at this property.

4.0 RECORDS REVIEW

Under ASTM 1527-05, records are to be reviewed by an environmental professional who may help identify REC in connection with the subject property.

4.1 STANDARD ENVIRONMENTAL RECORD SOURCES

MNA used Environmental FirstSearch™ (FirstSearch) to search standard federal and state government databases for hazardous substance or petroleum product releases that could impact the subject property. A copy of the report is provided in Appendix A.

ASTM E 1527-05 specifies a minimum search distance for particular environmental record sources. The following sources are specified for incidents or sites within one mile of the subject property:

- Federal NPL site list
- Federal RCRA CORRACTS TSD facilities list
- State Sites of Interest

The following sources are specified for incidents or sites within ½ mile of the subject property:

- Federal Delisted NPL site list
- Federal CERCLIS list
- Federal CERCLIS NFRAP site list
- Federal RCRA non-CORRACTS TSD facilities list
- State Brownfield Sites
- State landfill and/or solid waste disposal site list
- State leaking UST list
- State voluntary cleanup program sites

The following sources are for incidents on the subject and adjoining properties:

- Federal RCRA generators list
- State registered UST list

- State IC and EC Registries
- Federal Institutional Controls (IC) and Engineering (EC) Registries

Finally, the following are for incidents for the subject property:
- Federal ERNS list
- State releases list

4.1.1 Federal National Priorities List

The NPL, maintained by the United States Environmental Protection Agency (EPA), is a list of highly contaminated sites that have been identified by Superfund. FirstSearch identified no NPL sites within one mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.2 Federal RCRA CORRACTS TSD Facilities List

The RCRA CORRACTS TSD facilities list, maintained by the EPA, contains treaters, storers, and disposers of hazardous waste that have reported violations and are subject to corrective actions. FirstSearch identified no RCRA CORRACTS TSD facilities within one mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.3 State Sites of Interest

The State Sites of Interest List, maintained by the HDOH Office of Hazard Evaluation and Emergency Response (HEER Office), contains facilities, sites, or areas in which the HEER Office has, or had an interest, or may investigate. This list includes CERCLIS sites. FirstSearch identified no State Sites of Interest within one mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.4 Delisted NPL Site List

The delisted NPL site list, maintained by the EPA, contains delisted NPL sites. FirstSearch identified no delisted NPL sites within ½ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.5 Federal CERCLIS NFRAP Site List

The CERCLIS list, maintained by the EPA, contains sites that are either proposed to be or are on the NPL list, as well as sites that are in the screening and assessment phase for possible inclusion on the NPL. FirstSearch identified no CERCLIS sites within ½ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.6 Federal CERCLIS NFRAP Site List

The CERCLIS NFRAP list, maintained by the EPA, contains designated CERCLA sites that, to the best of the EPA's knowledge, assessment has been completed and it has been determined that no further steps will be taken to list the sites on the NPL. FirstSearch identified no CERCLIS NFRAP sites within ½ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.7 Federal RCRA non-CORRACTS TSD facilities List

The RCRA non-CORRACTS TSD facilities list, maintained by the EPA, contains RCRA permitted facilities that treat, store, or dispose of hazardous waste. FirstSearch identified no RCRA TSD facilities within ½ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.8 State Brownfield Sites

The state brownfield site list, maintained by the HDOH HEER Office, is an inventory of state designated brownfield sites. Under the Small Business Liability Relief and Brownfields Revitalization Act, a brownfield is defined as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant." The EPA provides grants and loans to state and local governments for the assessment, cleanup, and redevelopment of these properties. Properties located on the state brownfield list may have received federal funding under this program or be designated a brownfield for state administration or funding purposes. FirstSearch identified no state brownfield sites within ½ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.9 State Landfill/Solid Waste Disposal Sites

The HDOH records contain an inventory of permitted landfills in the State of Hawaii. FirstSearch identified no permitted solid waste landfills, incinerators, or transfer stations within ½ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.10 State LUST List

The state LUST list, maintained by the HDOH Solid and Hazardous Waste Branch (SHWB), contains an inventory of sites with LUSTs. FirstSearch identified one LUST facility within ½ mile of the subject property (FirstSearch Technology Corporation, 2012). The facility was identifed as Makawao Fire Station, located approximately 739 feet northwest of the Pukalani Tank Site. The facility was issued a site cleanup completed status, indicating the past release was remediated to the HDOH standards.

4.1.11 State Voluntary Cleanup Sites

The state voluntary cleanup sites list, maintained by the HDOH HEER Office, contains sites participating in the state's Voluntary Response Program. FirstSearch identified no site participating in the state Voluntary Response Program within ½ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.12 Federal RCRA Generators List

The RCRA Generators list, maintained by the EPA, contains small and large quantity generators of RCRA hazardous waste. The determination of generator size is used to establish the risk that the facility poses to public health and the environment and consequently, the amount of regulation and reporting required. Large Quantity Generators (LQG) are facilities that generate

more than 1,000 kilograms per month of hazardous waste and/or more than 1 kilogram per month of acute hazardous waste. Small Quantity Generators (SQG) are facilities that generate less than 1,000 kilograms per month but more than 100 kilograms per month of hazardous waste and/or less than 1 kilogram per month of acute hazardous waste. Conditionally Exempt Small Quantity Generators (CESQG) are facilities that generate less than 100 kg/month of hazardous waste and/or less than 1 kilogram per month of acute hazardous waste. The EPA also maintains the RCRA No Longer Regulated (NLR) list. This list contains facilities that were once on the RCRA generators list but are now no longer in business entirely, no longer in business at the listed address, or are no longer generating hazardous wastes in quantities that require reporting. This list also identifies the facilities of hazardous waste transporters. FirstSearch identified no generators within ¼ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.13 Federal ICs and ECs Registries

Federal ICs and ECs sites are federally listed sites that are required to implement special institutional control or engineering controls. Because the sites may continue to be impacted by past use, future use of the property may be restricted in order to protect human health and the environment. Land use controls can be either ICs or ECs. Institutional controls are limitations on how the property may be used such as limiting use to industrial activities. Engineering controls are physical structures or devices located on the property that contain or limit exposure to contamination. Engineering controls need to be maintained or protected to be effective. FirstSearch identified no federal ICs or ECs within ¼ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.14 State ICs and ECs Registries

The State of Hawaii maintains a list of properties that have been remediated to a particular standard. Because the sites may continue to be impacted by past use, future use of the property may be restricted in order to protect human health and the environment. Land Use Controls can be either ICs or ECs. Institutional controls are limitations on how the property may be used, such as limiting use to industrial activities. Engineering controls are physical structures or devices located on the property that contain or limit exposure to contamination. Engineering controls need to be maintained or protected to be effective. FirstSearch identified no state IC or EC sites within ¼ mile of the subject property (FirstSearch Technology Corporation, 2012).

4.1.15 State Registered UST List

The HDOH SHWB maintains a database of known underground storage tanks. FirstSearch identified one UST facility within ¼ mile of the subject property (FirstSearch Technology Corporation, 2012). The facility was identified as Makawao Fire Station and is located approximately 739 feet northwest of the subject property at 134 Makawao Avenue. One 500-gallon diesel tank was taken permanently out of use in 1993.

4.1.16 Federal ERNS List

The ERNS list, maintained by the EPA, contains CERCLA hazardous substance releases or spills, as maintained at the National Response Center. FirstSearch identified no ERNS incidents on the subject property (FirstSearch Technology Corporation, 2012).

4.1.17 State Releases List

The HDOH HEER Office maintains a database of known releases to the environment of hazardous material or petroleum products. FirstSearch identified no release incidents on the subject property (FirstSearch Technology Corporation, 2012).

4.2 ADDITIONAL ENVIRONMENTAL RECORD SOURCES

MNA requested for and reviewed additional environmental record sources as needed. Additional record sources reviewed included the HDOH HEER Office, HDOH SHWB, HDOH Wastewater Branch (WWB), DNLR, and County of Maui DWS. The Maui Fire Department and MECO responded that they had no records on file pertaining to the subject or adjoining properties.

4.2.1 Subject Property

The HEER Office, SHWB, WWB, and DLNR identified no case files for the subject property.

MNA identified no USTs at the subject property from the UST database (Hawaii Department of Health, 2013).

4.2.2 Surrounding Properties

The DWS databases included a figure which indicated that within ¼ mile radius surrounding the Pukalani Tank Site there is an agricultural food production facility, two septic tanks, and two aboveground storage tanks (AST). Additionally, DWS records indicated that the area surrounding the subject property was formerly used for pineapple cultivation.

One record of a registered LUST facility was identified within ½ mile of the subject property from the HDOH UST database (Hawaii Department of Health, 2013). The Makawao Fire Station (Facility ID 9-502765) was located at 134 Makawao Avenue, approximately 739 feet northwest and topographically down-gradient from the subject property. This LUST facility was recorded as having a SCC NFA status and was last updated on 20 October 1997.

The HDOH HEER Office had record files available for the west adjoining property, located at TMK (2) 2-3-007:008, approximately 500 feet west of the subject property. This site operated as the former Corn Mill Camp Pesticide Mixing and Storage site. From the 1940s to the mid-1960s, the property structures had been used for agricultural operations, specifically for equipment and agricultural chemical storage. Since the mid-1960s, the site was used for storage purposes only. The owner, the Maui Land & Pineapple Co., Inc. (MLP), was committed to performing necessary remediation actions on the site, since it was planned to be used as part of their Maui Upcountry Town Center project, a proposed mixed-used development to include retail, office, and multi-family house.

A 2001 Limited Phase II ESA of this site detected the presence of pesticide residues (4,4-DDE and 4,4-DDT) and arsenic in the surface soils that exceeded HDOH Tier 1 Soil Action Levels and EPA Preliminary Remediation Goals. The MLP planned to achieve permanent closure and to obtain a Letter of Completion for the site.

On 27 May 2004, the MLP and HDOH entered a Voluntary Response Program Agreement to conduct further site investigation and follow-up remediation actions on the former pineapple pesticide mixing area. The site to be remediated was approximately 24,000 square feet and was located near the intersection of Makawao Avenue and Pukalani Bypass Road. The further investigation was postponed to concert with the planned site development, which was not approved.

In a letter from the HEER Office to the new property owners, dated 19 December 2011, it revealed that the property was sold by MLP and that the site contamination issues were fully disclosed during the sale. Once MLP sold the property, the VRP agreement with HDOH was terminated by default. The letter acknowledged that the HDOH would be working with the new owners to continue soil investigation activities, which was long overdue at the site. The HEER Office was concerned that the contamination at the site had yet to be fully delineated so that remediation options can be considered and pursued. The HEER Office stated that former pesticide mixing sites often have significant levels of chemicals of concern, and thereby generally considered potential "high risk" sites for contamination and public health hazards. No other documents following the 2011 letter were on file for this site during the records review.

4.3 HISTORICAL USE INFORMATION ON THE SUBJECT PROPERTY

MNA reviewed historical use information for the subject property including aerial photographs and United States Geological Survey (USGS) topographic maps.

4.3.1 Historical Aerial Photographs

Aerial photographs of the subject, adjoining, and surrounding properties were provided by FirstSearch. Photographs from the years 1976, 1978, and 2001 were reviewed (Environmental FirstSearch Report, 2012). Table 4 provides the details for those photos.

Table 5. Photograph Details

Date	Image Type	Plane Elevation (feet)	Approximate Scale
2001	C	----	1":750'
1978	B/W	----	1":750'
1976	B/W	----	1":750'

---- Information not provided B/W - Black and white photograph C – Color photograph

For the reviewed aerial photographs, the following observations were made:

1976: A circular-shaped structure (water tank) was observed on the subject property. The east and west adjoining properties were composed of farmland field strips. Structures were present northwest and west of the subject property in Pukalani. Several rectangular structures were observed approximately one-half mile northeast of the subject property. The surrounding areas predominantly consisted of vegetation.

1978: The field strips on the east and west adjoining properties were no longer distinguishable; instead, these areas were covered in vegetation with patches of light-shaded areas. The area to the north of the subject property was transfigured into field strips.

2001: The west adjoining property was transfigured into field strips. Structures were abundant in Makawao, located northeast of the subject property. More structures were built in the Pukalani area. Several structures, including a sports field, were developed south of the subject property, on the east and west sides of Kula Highway and south of Old Haleakala Highway.

4.3.2 Historical Topographic Maps

Topographic maps that cover the subject property and vicinity were reviewed. Maps were available for the years 1925, 1957, 1983 and 1992 (Environmental FirstSearch Report, 2012). A copy of the historical topographic maps provided by FirstSearch is included in Appendix A. The maps of the subject property and surrounding area depicted the following:

1925: Buildings were intermittently spread in the area north of the subject property. No structures were found on the subject property. The topography of the area generally descended in elevation from southeast to the northwest. One gulch was labeled southwest of the subject property, and one was labeled in the southeast. The road names were not called out on this map. Thoroughfares were observed to branch east of what is presently Kula Highway.

1957: Road development and the concentration density of buildings increased in the Pukalani (northwest) and Makawao (northeast) areas, which are generally down-gradient from the subject property. No structures were shown on the subject property. The north adjoining property had approximately 10 buildings, and the west adjoining property consisted of more than 20 buildings. The Corn Mill Camp, a Filipino Camp, a gulch, and two water tanks were identified east of the subject property. One reservoir and one water tank were labeled southeast of the subject property. A gulch and Puu o Weli was identified south of the subject property. Green patches representing vegetation were visible east of the subject property, between Makawao and Kaluapulani. The roads branching east of present-day Kula Road had been modified, and what is presently Haleakala Highway is visible.

1983: The Pukalani and Makawao areas were shaded in pink to indicate high building density. The north and west adjoining properties were also shaded in pink. No structures were present on the subject property. Pukalani Park and Makawao Park were identified on the map. The Corn Mill Camp and Filipino Camp were not indicated as previously shown in the 1957 map. A cinder pit was labeled west of Puu o Weli. Polo Field was located southeast of the subject property.

1992: More structures and road development were shown in the Pukalani area. No structures were depicted on the subject property. The Makawao area expanded from the 1983 map, notably in the westward direction. A cluster of structures was observed to be up-gradient and approximately three-quarters of a mile southeast of the subject property.

4.3.3 Sanborn Fire Insurance Map

No Sanborn Fire Insurance maps were available for the subject property.

5.0 SITE RECONNAISSANCE

MNA personnel conducted a site reconnaissance on 05 June 2013. The site reconnaissance focused on the identification of *RECs* that may have the ability to impact the subject property. A site map of the subject property is presented in Figure 3.

5.1 METHODOLOGY AND LIMITING CONDITIONS

The site reconnaissance was conducted by Tiana Magsanoc of MNA. MNA visually inspected the subject and adjoining properties. MNA looked for environmental hazard indicators at and around the subject property including, but are not limited to, stained surface soil, dead or stressed vegetation, hazardous substances, aboveground and underground storage tanks, disposal areas, groundwater wells, drywells, and sumps. Inspection of subsurface utility systems was not part of this assessment. Photographs of the site reconnaissance are presented in Appendix B.

5.2 GENERAL SITE SETTING

The subject property was located in Pukalani, in the central north area of the Island of Maui, approximately nine miles southeast of Kahului Bay. The subject property was adjacently situated east of Kula Highway between the Makawao Avenue intersection and Haleakala Highway intersection.

5.3 EXTERIOR OBSERVATIONS

The entrance to the subject property was accessible from Kula Highway (Photograph 1). The subject property was comprised of two parcels, :030 and a one quarter mile portion of the Kula Highway right-of-way from parcel :030 to the intersection of Kula Highway and Makawao Avenue. Parcel :030 was observed to be up-gradient from north and east adjoining properties. It was a square-shaped property bordered by a metal fence and contains one 1,000,000-gallon water tank built in 1973, which is currently in use (Photograph 2). The Kula Highway right-of-way was a transportation corridor that adjoins Kula Highway (Photograph 3). On parcel :030, MNA observed rusted concrete water pipes and metal parts, as well as fill material consisting of gravel and dirt mounds located at the north side of the property (Photographs 4-6). Water piping and parts were also stored on the east side of parcel :030 (Photographs 7-8). Pieces of metal parts were also sporadically spread on the ground of parcel :030 (Photograph 9). During the site reconnaissance, Curtis Eaton, P.E., of DWS explained that the gravel and other fill material were recently added; and that in general, fill materials and water piping parts occasionally enter and leave the site.

The Kula Highway right-of-way consisted of a narrow and maintained path, which was adjacent to Kula Highway, followed by high and dense vegetation (Photographs 10-12). Adjoining the north side of the Kula Highway right-of-way was the intersection of Kula Highway and Makawao Avenue (Photograph 13). Near this intersection and located at the north end of the included portion of the Kula Highway right-of-way was a storm drain (Photograph 14). A plastic casing and a few concrete traffic signal boxes were observed in the ground of the Kula Highway right-of-way (Photograph 16). Geometrician and archaeologist subcontractors inspected the high and densely vegetative area that paralleled the maintained corridor at the Kula Highway right-of-

way; the project team walked along a fence line that was down-gradient and approximately 40 feet east of the maintained corridor. During the inspection, the team observed remnants of a rusted vehicle along with a car battery. They also found a culvert that connected the Kula Highway right-of-way to the parcel across Kula Highway to the west, TMK (2) 2-3-007:008.

Agricultural properties were surrounding the subject property. The adjoining property at TMK (2) 2-3-007:035 borders the subject property on the east and south sides and was observed to have high and dense vegetation (Photographs 17-18). The adjoining property at TMK (2) 2-3-007:008 were observed to be highly vegetated and also include several structures (Photographs 18-19).

5.4 INTERIOR OBSERVATIONS

No structures aside from the water tank were observed on the subject property; and as a result, no interior observations were made. Aged water tanks are known to contain hazardous materials, such as asbestos-containing sealants or tank liner/membrane, and lead-containing paints. Any plans for future renovation or demolition of the water tank will warrant a hazardous materials survey. Water tank hazardous materials survey was not part of this Phase I ESA.

5.5 HAZARDOUS SUBSTANCES AND PETROLEUM PRODUCTS

No hazardous substances or petroleum products were observed on the subject property. No indication of a past release was observed on the subject property, except for what appeared to be an illegal historical dumping, described in Section 8.1.

5.6 UNDERGROUND STORAGE TANKS

Records requested from the HDOH HEER Office and the SHWB verified that no USTs were associated with the subject property. No evidence of USTs, such as dispensers, vent pipes, fill ports, or manholes were observed on the subject property.

6.0 INTERVIEW

MNA interviewed Curtis Eaton of the County of Maui DWS, owner and operator of the subject property located at (2) 2-3-007:030. The interview was conducted by Tiana Magsanoc of MNA.

6.1 CURTIS EATON, P.E.

On 05 June 2013, MNA interviewed Curtis Eaton, an engineer at DWS. Mr. Eaton was onsite during the inspection of the subject property conducted by Geometrician and the project team on 05 June 2013. He opened the gate for the inspectors to access the subject property located at parcel :030. Mr. Eaton indicated that the water tank on parcel :030 was built in 1973 and had a 1,000,000-gallon capacity. His assumption of the past uses of the subject and adjoining properties was that these lands were used for pineapple farming. He told MNA that the east adjoining property is now abandoned.

Mr. Eaton indicated that he had no knowledge of any spills, chemical releases, environmental cleanups, environmental cleanup liens, engineering controls, land use restrictions, or institutional controls at the site.

7.0 DATA GAPS AND DEVIATIONS

No deviations from the *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* were found or conducted (ASTM International, 2005). A data gap exists in this Phase I ESA. Due to tall vegetation and steep slopes, the right-of-way adjacent to the Kula Highway and within the subject property was not surveyed. While attempts were made to contact the State of Highway Department of Transportation to inquire on the status and information regarding current and historical illegal dumping in the area, phone calls were not returned. Therefore the current and historical extent of illegal dumping in this area and potential contaminants are unknown.

8.0 KEY FINDINGS & OPINION

This section evaluates the key findings of this assessment and makes a determination as to the presence of a REC.

8.1 Subject Property

During the site reconnaissance on 05 June 2013, it was noted that about mid-way of the portion of Kula Highway right-of-way included in the subject property there contained abandoned rusted vehicle parts and a car battery. These car remnants were hidden by dense vegetation and located down-gradient of the maintained corridor. Metals and petroleum products were assumed to have been present in the surface soil where these car parts were observed. Petroleum products and metals from these car parts were suspected to have impacted the surface soil in the middle and north areas of the portion of Kula Highway right-of-way included in the subject property; however, due to the prolonged exposures to the sun and the wind, the petroleum products were likely be attenuated by dilution, dispersion, and disintegration. Therefore, the abandoned car parts are not considered a *recognized environmental condition*.

Sugarcane and pineapple cultivations have been widely known to use various pesticides and fertilizers. Groundwater is monitored throughout the island, and no significant findings have been reported in the Pukalani well to date. In addition, any residual pesticides in surface soil may have been attenuated by various physical, biological, and chemical means; therefore, the historical use of crop protection chemicals in and around the subject property is not considered a *recognized environmental condition*.

8.2 Surrounding Properties

A LUST facility within ½ mile of the subject property was located at the Makawao Fire Station, 739 feet northwest of the subect property at 134 Makawao Avenue. The site was cleanup, and no further action statement was issued by the HDOH. The site was located down-gradient from the subject property; therefore, this is not a *recognized environmental condition* (Section 4.2.2).

Maui Land & Pineapple Company (MLP) was located approximately 500 feet west of the subject property and 30 feet down gradient. A Limited Phase II ESA was completed for the site, formerly operated as the Corn Mill Camp Pesticide Mixing and Storage Site during the 1940s through 1960s. In 2004, MLP entered into a VRP agreement. However, the land was sold to a new owner, thereby terminating the VRP agreement. In December 2011, the HEER Office expressed its intent to work with the new owners and continue remedial investigation. According to the HEER Office, former pesticide mixing sites often have significant levels of chemicals of concern, and thereby considered potential "high risk" sites for contamination and health hazards. Due to the close proximity of this site to the subject property and the potential for significant levels of chemicals of concern, this site is considered a *recognized environmental condition* (Section 4.2.2).

9.0 CONCLUSION

MNA performed a Phase I ESA in conformance with the scope and limitations of ASTM E 1527-05 of the property located at TMK (2) 3-3-030 and a portion of the Kula Highway right-of-way, Pukalani, Island of Maui. Any exceptions to, or deletions from, this practice are described in Section 7 of this report. This assessment has revealed evidence of a *recognized environmental condition* in connection with the *subject property*. The *recognized environmental condition* is:

- Pesticide-impacted MLP site, the west adjoining property of the parcel :030, the DWS tank site (Section 4.2.2 and Section 8.2).

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DLNR Pukalani Tank Site
Exploratory Water Well

ENVIRONMENTAL ASSESSMENT

Appendix 5
Water Quality Reports for Makawao and Kula System, July 2013

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2012 WATER QUALITY MONITORING RESULTS FOR THE: MAKAWAO SYSTEM

This water has been tested and meets all Federal and State Standards. Testing was conducted and compiled in 2012 for reporting by July 2013. The following data is about **your** drinking water. Data listed are from the most recent testing and monitoring done in accordance with the regulations of the State of Hawaii Department of Health.

This water serves: Haiku, Haliimaile, Makawao, and Pukalani

SOURCE NAME	ORIGIN	TREATMENT	SOURCE NAME	ORIGIN	TREATMENT
Wailoa Ditch	Surface	Microfiltration/Chlorination	Kaupakalua Well	Ground	Chlorination
Haiku Well	Ground	Chlorination	Pookela Well	Ground	Chlorination

If a contaminant is NOT SHOWN, IT WAS NOT DETECTED

Regulated Contaminants[1]	Unit of Measure	Highest Detected Level[2]	Range[3]	EPA's Allowable Limits MCL[4]	EPA's Allowable Limits MCLG[5]	Typical Source of Contamination[6]	Is Your Water Safe? Compliance Met?
Chromium (Total)	ppb	1.1	ND-1.1	100	100	Erosion of natural deposits	✓ Yes
Copper	ppm	0.002	ND-0.002	1.3[8]	1.3[8]	Erosion of natural deposits; corrosion of plumbing fixtures	✓ Yes
DBCP (1,2-Dibromo-3-chloropropane)	ppt	19	ND-19	200	0	Erosion of man-made chemicals	✓ Yes
Fluoride	ppm	0.14	ND – 0.14	4	4	Erosion of natural deposits	✓ Yes
Hexachloropentadiene	ppb	0.064	NA	50	50	Erosion of man-made chemicals	✓ Yes
Nitrate (as N)	ppm	1.93	ND – 1.93	10.0	10.0	Erosion of natural deposits;runoff from fertilizer use; leaching from septic systems	✓ Yes
TCP (1,2,3 trichloropropane)	ppt	260	ND-260	600*	N/A	Runoff/leaching from soil fumigant	✓ Yes
Radiologicals,Beta particles (Sample year-2011)	pCi/L	4.1[9]	ND–4.1	50[7]	0	Decay of natural & man-made deposits	✓ Yes
Xylenes	ppm	.0024	ND-.0024	10	10	Erosion of man-made chemicals	✓ Yes
Distribution System Monitoring (Disinfection By-Products)	**Unit of Measure**	**Highest Annual Average[2]**	**Range[3]**	**EPA's Allowable Limits MCL[4]**	**EPA's Allowable Limits MCLG[5]**	**Typical Source of Contamination[6]**	**Is Your Water Safe? Compliance Met?**
TTHM's (Total Trihalomethanes)	ppb	30	3-39	80	N/A	Disinfection by-product	✓ Yes
HAA's (Haloacetic Acids)	ppb	10	0-13	60	N/A	Disinfection by-product	✓ Yes

[1] Detected contaminant
[2] Highest detected level or highest average level found
[3] Range of levels found
[4] Highest Level allowed by EPA
[5] EPA's goal
[6] Possible source of contaminant
[7] EPA considers 50 pCi/L to be the level of concern for beta particles
[8] Action level
* Regulated in Hawaii but not by EPA

[9] The state allows us to monitor for some contaminants less than once per year because the concentrations of these contaminants do not change frequently. Some of our data, though representative, are more than one year old.

Unregulated Contaminants	Unit Of Measure	Sample Year	Range[3] Detected	Use or Environmental Source	
Chlorate	ppb	2012	ND - 170	Disinfection byproduct; agricultural defoliant or desiccant	*EPA uses the Unregulated Contaminant Monitoring Rule (UCMR) to collect data for contaminants suspected to be present in drinking water but do not have health-based standards set under the Safe Drinking Water Act. The purpose of monitoring for these contaminants is to help EPA decide whether the contaminants should be regulated.*
Hexavalent Chromium	ppb	2012	ND – 1.2	Naturally occurring element; used for chrome plating, dyes and pigments, and wood preservation	
Strontium	ppb	2012	ND – 110	Naturally occurring element; historically used in the faceplate glass of cathode-ray tube televisions	
Vanadium	ppb	2012	ND - 13	Naturally occurring elemental metal; used as vanadium pentoxide which is a chemical intermediate and a catalyst	
1,2,4 Trimethylbenzene	ppb	2012	ND – 0.74	Leaching of tank repair materials	
Di-n-butylphthalate	ppb	2012	ND – 1.3	Leaching of tank repair materials	

2012 WATER QUALITY MONITORING RESULTS FOR THE: MAKAWAO SYSTEM

LEAD/COPPER Rule Compliance Monitoring

Contaminant	Sample Date	Unit of Measure	90th Percentile Reading	Action Level	# of Samples Above Action Level	Is Your Water Safe? Compliance Met?
Lead	2010	ppb	< 5	15	1	✓ Yes
Copper	2010	ppm	0.02	1.3	0	✓ Yes

The next round of testing for the Makawao System is 2013.

Infants and young children are typically more vulnerable to Lead in drinking water than the general population. It is possible that Lead levels at your home may be higher than at homes in the community as a result of material used in your home's plumbing. If you are concerned about elevated Lead levels in your home's water, you may wish to have your water tested. **As a general practice, you should flush your tap for 30 seconds to 2 minutes before using the tap water, if you have not used it for 4-6 hours.** Additional information is available from the Safe Drinking water Hotline at 1-800-426-4791

State Water System ID#: 213

Date Distributed: June 2013

2012 WATER QUALITY MONITORING RESULTS FOR THE: UPPER KULA SYSTEM

This water has been tested and meets all Federal and State Standards. Testing was conducted and compiled in 2012 for reporting by July 2013. The following data is about **your** drinking water. Data listed are from the most recent testing and monitoring done in accordance with the regulations of the State of Hawaii Department of Health.

This water serves: Upper Kula, Waiakoa, Keokea, Ulupalakua, and Kanaio

SOURCE NAME	ORIGIN	TREATMENT
Haipua'ena Intake	Surface	Microfiltration/Chlorination

If a contaminant is NOT SHOWN, IT WAS NOT DETECTED

Primary Contaminants Detected in the Distribution System[1]	Unit of Measure	Highest Annual Average[2]	Range[3]	EPA's Allowable Limits MCL[4]	EPA's Allowable Limits MCLG[5]	Typical Source of Contamination[6]	Is Your Water Safe? Compliance Met?
TTHM's (Total Trihalomethanes)	ppb	34	4-11	80	N/A	Disinfection by-product	✓ Yes
HAA's (Haloacetic Acids)	ppb	29	15-32	60	N/A	Disinfection by-product	✓ Yes

[1] Detected contaminant
[2] Highest detected level or highest average level found
[3] Range of levels found
[4] Highest Level allowed by EPA
[5] EPA's goal
[6] Possible source of contaminant

Lead/Copper Rule Compliance Monitoring

Contaminant	Sample Date	Unit of Measure	90th Percentile Reading	Action Level	# of Samples Above Action Level	Is Your Water Safe? Compliance Met?
Lead	2010	ppb	0.5	15	0	✓ Yes
Copper	2010	ppm	0.22	1.3	0	✓ Yes

The next round of testing for the Upper Kula System is June-September 2013.

Infants and young children are typically more vulnerable to Lead in drinking water than the general population. It is possible that Lead levels at your home may be higher than at homes in the community as a result of material used in your home's plumbing. If you are concerned about elevated Lead levels in your home's water, you may wish to have your water tested. **As a general practice, you should flush your tap for 30 seconds to 2 minutes before using the tap water, if you have not used it for 4-6 hours.** Additional information is available from the Safe Drinking water Hotline at 1-800-426-4791

State Water System ID#: 215

Date Distributed: June 2013