Draft Environmental Impact Statement

PROPOSED MA`ALAEA MAUKA RESIDENTIAL SUBDIVISION AND RELATED IMPROVEMENTS

(TMK (2) 3-6-001:018/
TMK (2) 3-6-004:003(por.))

VOLUME II OF II (APPENDICES)

Prepared for:

Ma`alaea Properties LLC

Accepting Authority:

State of Hawai`i,
Land Use Commission

November 2007

MUNEKIYO & HIRAGA, INC.

LIST OF APPENDICES

APPENDIX A.

Market Study Report

PREPARED FOR: **MAALAEA PROPERTIES, LLC**
355 West Waiko Road
Wailuku, Hawaii 96793

EFFECTIVE DATE: **July 21, 2006**

A MARKET STUDY AND ANALYSIS FOR MA'ALAEA MAUKA PROJECT DISTRICT, WAILUKU, ISLAND OF MAUI, HAWAII

ACM CONSULTANTS, INC.

ACM CONSULTANTS, INC. A Real Estate Appraisal, Research & Advisory Group

July 31, 2006 05-9001

MAALAEA PROPERTIES, LLC
355 West Waiko Road
Wailuku, Hawaii 96793

Re: Market Analysis and Economic Impact Report for the proposed Ma`alaea Mauka Project District in Wailuku, Island and County of Maui

Dear Mr. Kikuchi:

In accordance with your request, we have inspected the above-referenced property in order to provide a defined scope market study of the proposed Ma`alaea Mauka Project District in Ma`alaea, District of Wailuku, Island and County of Maui. This *counseling report*, and the conclusions herein, are based on the on-site inspection of the property, a study of current political and economic conditions, and a historical review of the real estate market in the Central Maui region and on Maui overall.

The subject consists of approximately 257 acres of land and is currently zoned Agricultural District. The project, which is still in its preliminary planning stage, is identified as the Ma`alaea Mauka Project District and will be located mauka of the Honoapiilani Highway. It will possess views of the ocean and off-shore islands.

The focus of this assignment essentially has three parts: (1) to define and delineate the market area; (2) to identify and analyze the current supply and demand conditions specific to the subject's market; and (3) identify, measure and forecast the effect of anticipated developments or other factors on future supply.

The following report presents a narrative review of the market study and our analysis of data along with other pertinent materials on which this report is predicated. It contains data and exhibits gathered in our investigations, and will include a description of the analytical process and our conclusions, as of July 21, 2006.

2073 Wells Street, Suite 100 ◆ Wailuku, Maui, HI 96793 ◆ Telephone: (808) 242-6481 ◆ Fax: (808) 242-1852

Thank you for allowing us the opportunity to work on this interesting assignment.

Respectfully submitted,
ACM Consultants, Inc.

Glenn K. Kunihisa, MAI
Certified General Appraiser,
State of Hawaii, CGA-039
Expiration: December 31, 2007

Shane S. Nishimoto
Certified General Appraiser
State of Hawaii, CGA-696
Expiration: December 31, 2007

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PART I – INTRODUCTION

A. EXECUTIVE SUMMARY

Background

The proposed Ma`alaea Mauka project district is located on the mauka side of Honoapiilani Highway in Ma`alaea, District of Wailuku, Island and County of Maui. The subject is currently zoned Agricultural District. The Appraiser notes that the land use breakdown below totals 260 acres; however a subsequent survey of the subject property revealed a total land area of approximately 257 acres. While this was confirmed by a representative of the developer, an updated land use breakdown was not provided. The project, which is still in its preliminary planning stage, will consist of 949 units which will be located at the base of the West Maui Mountains and will possess views of the ocean and off-shore islands. The Consultant has not been provided with any detailed site plans and has relied on information from a recent Environmental Impact Statement Preparation Notice for information regarding the subject project district. According to this source, the land use allocations are:

Land Use	Acreage	Unit Count
Single Family	118 Acres	499 Units
Multi-Family	30.5 Acres	264 Units
Apartments	11.5 Acres	126 Units
Senior Care Housing	6 Acres	60 Units
Total		949 Units
Major Roads	36 Acres	Not Applicable
Park	15 Acres	Not Applicable
Community Center & Open Space	37 Acres	Not Applicable
Wastewater Treatment Center	2 Acres	Not Applicable
Fire Station	1 Acre	Not Applicable

Preliminary indications from the developer indicate that 30 percent of the units will be allocated for affordable housing, distributed amongst the single-family units, low-rise condominium buildings, senior care housing and apartment rentals.

Study Objectives

ACM Consultants, Inc. has been retained by Mr. Steve Kikuchi of Maalaea Properties, LLC, to analyze the residential real estate market as it relates to this proposed project. In particular, we studied economic trends and demographics, and supply and demand factors for residential property which includes single family house lots, and residences, as well as condominium units. In the process, we have

gathered as much information as possible on real estate sales on Maui while focusing on the Central Maui market.

The objectives of the market analysis were as follows: (1) to define and delineate the market area; (2) to identify and analyze the current supply and demand conditions specific to the subject's market; and (3) identify, measure and forecast the effect of anticipated developments or other factors on future supply.

Conclusion

Maui in general has seen growth in its population, tourism and economy over the past two decades. Similar to many real estate markets on the mainland, Maui's real estate market has seen significant increases in the last few years. Median prices as well as sales volume are at record highs and affordable housing is in very short supply. As a result, the county administration placed the affordable housing issue among its top priorities since 2004.

There are several ongoing residential projects that will provide the immediate supply in the market. Of all the ongoing projects on Maui, there are approximately 2,073 units that are available. In addition to the projects currently under construction or in their financing phase, there are more projects on Maui that may add inventory to the market in coming years but are still in the process of gaining governmental approvals. Besides the subject, the Consultant has identified twelve (12) large developments that are expected to bring between 14,500 and 16,300 units to the Maui real estate market. In Central Maui, these include the Pu`unani Subdivision in Wailuku, and A&B Properties' Waiale Project. However, some of these twelve potential projects have been met with governmental or community resistance, leading to long delays; meanwhile, others may never be completed for various reasons. In this light, it is difficult to determine which future projects will actually be brought to the market.

A survey of projects developed on Maui within the past 10 years indicated that a total of 4,633 new units have been absorbed within this period. This includes single family residences, condominium units, residential house lots as well as agricultural lots. The average number of units sold was approximately 463 units per year over the past 10 years. It should be noted that this period also included years in which the real estate market was weak. Based on this historical absorption rate, the current short term supply of 2,073 new units (**Page 25**) will last approximately 4.5 years. However, when the demand for housing is instead based on the anticipated increase of population on the Island of Maui in the next five years, this supply is forecasted to only 2.6 years (See **Page 61**).

In this light, the short-term supply of residential supply in Maui appears to be insufficient for the next 5 or so years. If economic conditions remain the same, it is probable that prices will continue to rise in the near-term, albeit at a slower pace than years past.

Meanwhile, demand for real estate in Maui has intensified over the past five years. These increases are being fueled by the population increases on the island, the high employment rate, and the lowest 30-year mortgage interest rates in decades. The strong demand has resulted in rapidly rising prices in all communities of Maui.

With additional inventory on the market, and assuming positive growth over the next decade, it is our opinion that bringing the subject's 949 units to the market would help to alleviate the supply problem being experienced today; and, it is anticipated that the products to be offered by the Ma`alaea Mauka Project District will be well accepted by the public, based on the market's rapid absorption of recent subdivisions and condominium projects. The existing Ma`alaea neighborhood consists mostly of oceanfront, multi-family projects and a few single family residences. Although there have not been any residential developments in recent years, the central location of Ma`alaea will make it a convenient population center. In addition, the subject will provide affordable housing to 285 families on Maui. During the time that the subject is approved and construction begins, much, if not all of the existing supply in existing ongoing projects will most likely be depleted.

Although the exact product mix and pricing of the project have not been determined, this development will give market participants additional choices in single-family and multi-family living. In recent years, demand has far outpaced supply in the real estate market, leading to dramatic increases in real estate prices across the board. The increased supply will give the consumer a broader variety of choices, provide a better balance in the supply and demand equation, and should lead to more affordability in Maui's housing market.

B. PURPOSE OF THE REPORT

The purpose of this report, as of July 21, 2006, is to generate a market analysis with respect to the proposed Ma`alaea Mauka Project District.

C. INTENDED USE OF THE REPORT

The intended use or function of this report is to provide real property information and real estate market data upon which internal decision making by our client may be based.

D. SCOPE OF THE REPORT

The Consultant has agreed to provide a current market analysis of this project by (1) defining and delineating the market area; (2) identifying and analyzing the current supply and demand conditions that make up the specific real estate market; and (3) identifying, measuring and forecasting the effect of anticipated developments or other changes on future supply. The market analysis will be developed and prepared in conformity with, and subject to, the requirements of the Code of Professional Ethics and the Standards of Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice.

E. STATEMENT OF COMPETENCY

ACM Consultants, Inc. (formerly ACM Real Estate Appraisers, Inc.) has been actively involved in the real estate appraisal and consulting business since 1982. Our business emphasis has focused mainly on the research, consultation and valuation of residential and commercial properties located within the State of Hawaii. The company considers itself competent to conduct a market analysis for a proposed project district in Wailuku, Island and County of Maui.

F. EXTRAORDINARY ASSUMPTIONS AND HYPOTHETICAL CONDITIONS

As of July 2006, the subject was still in the preliminary stages of planning. A Preliminary Subdivision Plan from Ma`alaea Properties, LLC provided a visual indication of the proposed layout of the development. The consultant is not liable for any changes in the project plan past this date, nor for information that has not been released or communicated to the Consultant.

The Consultant has no control over economic conditions and other international events that could have an affect upon Hawaii's economy and the Maui real estate market. As a result, this report has not made any assumptions regarding potential conflicts with other nations, or external factors affecting economic conditions here.

The counseling report is also subject to standard "Limiting and Contingent Conditions" located in the pages following.

G. CONFIDENTIALITY PROVISION

The contents of this market study are confidential. Release of this counseling report by ACM Consultants, Inc. is limited to you and for your preparation and submission of an Environmental Impact Statement for the proposed Ma`alaea Mauka Project District. The intended users of this report include AKF Development, Munekiyo and Hiraga, Inc. and the appropriate government agencies to which this report will be submitted. Any further release of this report, or portions herein, is strictly prohibited and you shall accept the risk and liability for any such release without the previous written consent of ACM Consultants, Inc. Further, you shall indemnify and defend ACM Consultants, Inc., and its individual consultants/appraisers, from any claims arising out of any such unauthorized disclosure.

H. CERTIFICATION

The undersigned does hereby certify that except as other-wise noted in this appraisal report:

1. The Consultant's compensation is not contingent upon the reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value estimate, the attainment of a stipulated result, or the occurrence of a subsequent event.

2. The Consultant has no present or prospective interest in the property that is the subject of this report, and no personal interest or bias with respect to the parties involved. Any "Estimate(s) of Market Value" in the consulting report is not based in whole or in part upon the race, color, or national origin of the prospective owners or occupants of the properties in the vicinity of the property appraised.

3. The Consultant has personally inspected the property, and is a signatory of this Certification.

4. To the best of the Consultants' knowledge and belief, all statements of fact and information in this report are true and correct, and the Consultant(s) have not knowingly withheld any significant information.

5. Shane Fukuda provided significant professional assistance to the person(s) signing this report.

6. The reported analyses, opinions and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal unbiased professional analyses, opinions and conclusions.

7. All analyses, opinions and conclusions were developed, and this report has been prepared, in conformity with the Uniform Standards of Appraisal Practice.

8. This counseling report is subject to and in conformance with the Code of Professional Ethics and Standards of Professional Conduct of the Appraisal Institute. The analyses, opinions and conclusions of this counseling report have been made in conformity with, and is subject to, the requirements of Title XI of the Federal Financial Institutions Reform, Recovery, and Enforcement Act of 1989.

9. This counseling report is to be used only in its entirety and no part is to be used without the whole report. All conclusions and opinions concerning the real estate are set forth in the counseling report were prepared by the Consultant(s) whose signature(s) appears on the counseling report. No change of any item in the counseling report shall be made by anyone other than the Consultant, and the Consultant shall have no responsibility for any such unauthorized change.

10. The Appraisal Institute, of which this Consultant is a member, has a legal right to review this report.

11. The qualifications of this Consultant, including completed educational requirements of his/her candidacy are located in the Addendum to this report. Any member signing the report has completed the requirements of the Appraisal Institute's continuing education program.

ACM Consultants, Inc.

Glenn K. Kunihisa, MAI
Certified General Appraiser,
State of Hawaii, CGA-039
Expiration: December 31, 2007

Shane S. Nishimoto
Certified General Appraiser,
State of Hawaii, CGA-696
Expiration: December 31, 2007

I. LIMITING AND CONTINGENT CONDITIONS

1) This is a Counseling Report which is intended to comply with the reporting requirements set forth under Standards Rule 5 of the Uniform Standards of Professional Appraisal Practice for a Counseling Report. The information contained in this report is specific to the needs of the client and for the intended use stated in this report. The Consultant is not responsible for unauthorized use of this report.

   This report has not been prepared for federally-related mortgage financing purposes, and has not been prepared in compliance with the requirements of Title XI of the Federal Financial Institutions Reform, Recovery, and Enforcement Act of 1989.

2) No responsibility is assumed for legal or title considerations. Title to the property is assumed to be good and marketable unless otherwise stated in this report.

3) The property analyzed is free and clear of any or all lines and encumbrances unless otherwise stated in this report.

4) Responsible ownership and competent property management are assumed unless otherwise stated in this report.

5) The information furnished by others is believed to be reliable. However, no warranty is given for its accuracy.

6) All engineering is assumed to be correct. Any plot plans and illustrative material in this report are included only to assist the reader in visualizing the property.

7) It is assumed that there are no hidden or unapparent conditions of the property, subsoil, or structures that render it more or less valuable. No responsibility is assumed for such conditions or for arranging for engineering studies that may be required to discover them.

8) It is assumed that there is full compliance with all applicable federal, state, and local environmental regulations and laws unless otherwise stated in this report.

9) It is assumed that all applicable zoning and use regulations and restrictions have been complied with, unless a nonconformity has been stated, defined, and considered in this counseling report.

10) It is assumed that all required licenses, certificates of occupancy or other legislative or administrative authority from any local, state, or national governmental or private entity or organization have been or can be obtained or renewed for any use on which the value estimates contained in this report are based.

11) Any sketch in this report may show approximate dimensions and is included to assist the reader in visualizing the property. Maps and exhibits found in this report are provided for reader reference purposes only. No guarantee as to accuracy is expressed or implied unless otherwise stated in this report. No survey has been made for the purpose of this report.

12) It is assumed that the utilization of the land and improvements is within the boundaries or property lines of the property described and that there is no encroachment or trespass unless otherwise stated in this report.

13) The Consultant is not qualified to detect hazardous waste and/or toxic materials. Any comment by the Consultant that might suggest the possibility of the presence of such substances should not be taken as confirmation of the presence of hazardous waste and/or toxic materials. Such determination would require investigation by a qualified expert in the field of environmental assessment. The presence of substances such as asbestos, urea-formaldehyde foam insulation, or other potentially hazardous materials may affect the value of the property. The Consultant's value estimate is predicated on the assumption that there is no such material on or in the property that would cause a loss in value unless otherwise stated in this report. No responsibility is assumed for any environmental conditions, or for any expertise or engineering knowledge required to discover them. The Consultant's descriptions and resulting comments are the result of the routine observations made during the analysis process.

14) Unless otherwise stated in this report, the subject property is evaluated without a specific compliance survey having been conducted to determine if the property is or is not in conformance with the requirements of the Americans with Disabilities Act. The presence of architectural and communications barriers that are structural in nature that would restrict access by disabled individuals may adversely affect the property's value, marketability, or utility.

15) Any proposed improvements are assumed to be completed in a good workmanlike manner in accordance with the submitted plans and specification.

16) The distribution, if any, of the total valuation in this report between land and improvements applies only under the stated program of utilization. The separate allocations for land and buildings must not be used in conjunction with any other appraisal and are invalid if so used.

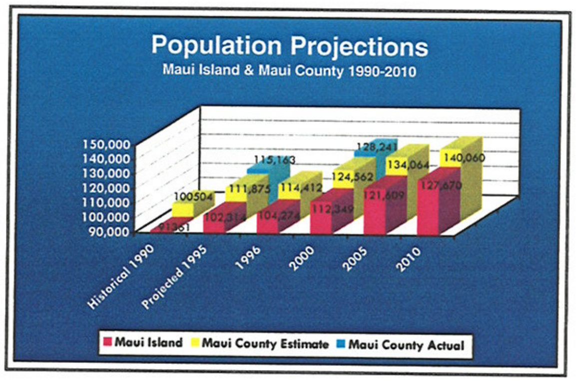
17) Possession of this report, or a copy thereof, does not carry with it the right of publication. It may not be used for any purpose by any person other than the party to whom it is addressed without the written consent of the consultant, and in any event, only with property written qualification and only in its entirety.

18) Neither all nor any part of the contents of this report (especially any conclusions as to value, the identity of the Consultant, or the firm with which the Consultant is connected) shall be disseminated to the public through advertising, public relations, news sales, or other media without prior written consent and approval of the Consultant.

PART II – FACTUAL DATA

A. REGIONAL DATA - MAUI COUNTY

Maui County is the third most populous of the four counties of Hawaii, with a total resident population of 128,241 (2000 Census) and a change of 27.6 percent since 1990. Maui County consists of the islands of Maui, Molokai, Lanai, and Kahoolawe. Ninety percent (90%) of County residents live on Maui; the 2000 U.S. Census of Population reported 7,404 residents on Molokai and 3,193 on Lanai. The Island of Maui consists of a total of 734.5 square miles, or 470,080 acres. Population Projections for Maui County and the Island Maui are illustrated on the table below.



Like all the Hawaiian Islands, Maui, Molokai and Lanai are blessed by warm air temperatures year-round, and ocean waters that range from 72-77° F in winter to 77-81° in summer. The islands' distance from other continents, the moderating effects of the surrounding water and the tropical location combine to create this pleasant climate. Hawaii's topography, particularly the mountains and valleys and location of each island, contributes to the great variety of microclimates within very small areas. On Maui, the West Maui Mountains and Haleakala are the primary geological features affecting the weather.

Due in part to the above geographical factors, Maui has, for twelve years, been selected "Best Island in the World" by readers of Conde Nast Traveler magazine. Maui has clearly dominated the tourism competition between the neighbor islands (excluding Oahu), drawing more tourists than the other Neighbor Islands of Hawaii and Kauai combined, and has consistently had the highest occupancy rates of all

combined, and has consistently had the highest occupancy rates of all island (Oahu included). Furthermore, Maui also has preserved more

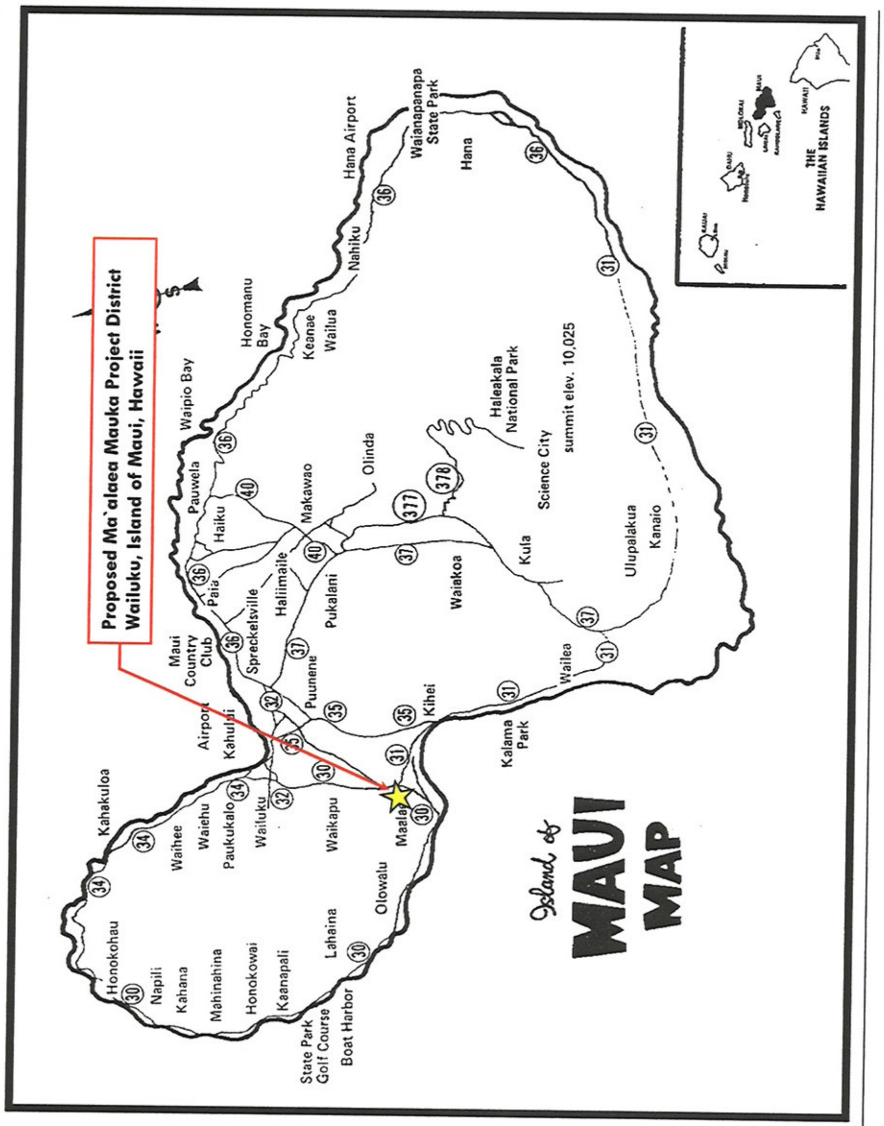
of its original plantation economy than the rest of the state. More than half Hawaii's plantation economy comes from Hawaii Commercial & Sugar Co., a 37,000-acre plantation on Maui, and the nation's last canner of pineapple, Maui Pineapple Co.

Overall, Maui's performance has exceeded other counties during the state's ongoing string of job losses that began in late 1992. In 1999, Maui led the state's four counties in job creation, up almost 3% for the year. A falling Maui County unemployment rate corroborates the tightening labor market; since the mid 1990's, Maui's unemployment rate has steadily declined and is currently the lowest in the state.

Visitor Industry

Lately, Maui hotel occupancies exceeded any area in the state with the exception of Waikiki. Its high rating is due to a number of factors. First, Maui receives the good fortune of location and climate. Second, Maui has the infrastructure in place to move tourists to a diverse variety of activities with a minimum of inconvenience and down time. The accommodations on Maui are another reason. Maui resort hotels have consistently ranked above other Hawaii resort destinations. In the same Conde Nast Traveler magazine, 9 of the "Top 30 Pacific Rim Resorts" were Maui County resorts. The Four Seasons Resort Maui at Wailea ranked highest, placing 3rd in the survey. Other Maui resorts garnering honors included: Ritz-Carlton Kapalua, Fairmont Kea Lani in Wailea, Kapalua Bay Hotel & Ocean Villas, Grand Wailea Resort, Renaissance Wailea Beach Resort, and Hotel Hana-Maui.

With the possible exception of Kauai, Maui is more dependent on tourism than any of Hawaii's four counties. That sector is treating Maui very well nowadays, but it is no accident. For years, Maui has worked very hard at cultivating a worldwide image as a premier, upscale tropical island destination. In fact, it is the only county government in Hawaii that spends money to support tourism. Its consistency in creating that image over the years has been the key its success today. The now affluent U.S. economy and that upscale image have dovetailed now, to award Maui with its own measure of affluence in today's world.



The leading edge of Maui expansion is tourism, which continues to be very healthy, despite the September 11 terrorist acts. From 1994 through 2000, visitor arrivals have consistently been between 2,300,000 and 2,350,000. The effects of the September 11, 2001 terrorist attacks had a drastic impact on the tourism industry. The final Maui visitor count for 2001 was 2,048,768. In 2002, the visitor count rebounded slightly to 2,139,427 as the visitors slowly returned during the mid to latter part of the year. Visitor totals for 2003 indicate an increase of 2.7 percent over 2002, 2004 total visitor arrivals increased by 5.7 percent over 2003, while 2005 visitor totals showed a slight decrease of 0.3 percent, to 2,314,782. Maui's mainstay is visitors from California, and the county continues to benefit from the state's robust economy. Visitors from California alone account for about 38% of Maui's westbound visitor arrivals.

Source: Department of Business and Economic Development

Added airline seats from elsewhere on the U.S. Mainland are expected to bring even more tourists to Maui. Other factors are better airline equipment and frequent-flyer program benefits. The better equipment allows more, longer distance planes to come to Maui without the much debated Kahului runway extension. Even though plans to extend the runway have been shelved, there is a push for strengthening the existing runway to support heavier planes, such as Boeing's 777.

Further evidence of Maui's booming tourism is found in occupancy statistics, even though visitor arrivals do not translate directly to occupancy levels because time-share stays and day-trippers are not included in occupancy rates. Still, Maui Islands had the second highest occupancy rate of all the islands in 2005 at 79.6 percent. Oahu led the state with an average occupancy of 85.6 percent. However, Maui had the highest average daily room rate for 2005 at $214.41.

Historically, occupancies in Wailea, Kihei, and Kapalua have run about 8% to 10% below the established resort area of Kaanapali. That gap is closing, however, as Kaanapali approaches its capacity.

Visitor shopping opportunities have increased in recent years with the opening of The Maui Marketplace, a 275,000 square foot shopping complex, modeled after Oahu's successful Waikele Center. The Maui Marketplace is now home to such retail superstores like Lowe's Hardware, Pier One Imports, Borders Books and Music, Sports Authority, Starbucks Coffee, and Office Max, as well as many small local retailers and restaurants. Also opening in the same Kahului area were Home Depot, Wal-Mart, K-Mart and Costco. In addition, the Shops at Wailea opened in December 2000 and added approximately 150,000 square feet of high-end retail space in the Wailea Resort. At about the same time, the 150,000 square foot Piilani Shopping Center opened in Kihei with Safeway as its anchor tenant.

Maui offers more than any other Neighbor Island in the way of proven vacation experiences. It has a larger tourism activities industry relative to the size of its economy than any other county. Such activities include ocean recreation, helicopter tours, biking down Haleakala, and golfing, among numerous other activities. Maui's well-developed ocean recreation industry ranges from windsurfing to snorkeling, scuba diving and sailing cruises which leave regularly from Lahaina and Maalaea Harbors.

Maui also has theme destinations, such as the Maui Tropical Plantation. But the premier theme destination, likely to be the foremost in the entire state, is the Maui Ocean Center. This center, featuring the marine environment of the Hawaiian Islands, is modeled after five other aquarium parks developed elsewhere in the world by Coral World International. This ocean center is located just behind the Maalaea Boat Harbor, and is easily accessible from Kahului/Wailuku, and the resort areas of Lahaina/Kaanapali and Kihei/Wailea. The Maui Ocean Center anchors the 18-acre Maalaea Harbor Village, which also includes a retail strip shopping center, restaurants and other services.

It appears that Maui will continue to be a strongly favored destination for Mainland tourists, with its large share of condominiums available for families and groups on a budget. The California recovery has

begun to fuel higher demand for condominium rentals in the last three to five years.

Despite the improving visitor industry on Maui, hotels have not been adding much in the way of jobs. Tourism still dominates the labor force; however, the profitability problems the large resorts have experienced led managers to refine their operations. Tourism numbers are growing steadily, but job creation in the visitor industry is not matching that growth.

Real Estate

Residential real estate can be divided into three broad categories (single-family homes, condominiums and residential lots) and four important geographic regions. As a result, there are eight subsections of the market that have proven capable of moving up and down with relatively little correlation with the others. Upcountry has virtually no condominium properties; and two other subsections, South Maui and Central Maui, have few leasehold condominiums. Only West Maui has all three types.

Of all the neighborhoods, several have virtually all luxury housing, such as Kapalua, Kaanapali, and Wailea. Kahului has no luxury housing and Wailuku only a little. All other areas have a mix.

Owner-occupied housing on Maui runs about 57.6 percent of all occupied housing units. The total housing stock has been growing at a rate of about 1,000 units a year in the 1980's. The total accelerated to 1,500-2,000 new units in the late 1980's, well short of demand. The Maui population has expanded tremendously for the past 10 to 12 years, but housing was not being built at the same pace as the 1980s. As a result, demand for housing has outpaced supply and homes prices and rents have risen dramatically. The median single-family home price on Maui in 2005 was $627,123. Meanwhile, interest rates have fallen to historical lows and have helped to make these higher prices achievable. At the same time, these low rates have stimulated new construction, new home buying and refinancing.

The following summarizes a sales volume history for Maui County from 1990 to 2005.

Year	Vacant Land	Single Family	Condominium
1990	298	560	1459
1991	116	430	593
1992	120	382	496
1993	121	361	461
1994	148	404	592
1995	118	331	495
1996	125	445	572

1997	171	491	786
1998	227	602	964
1999	397	950	1338
2000	359	951	1456
2001	318	964	1275
2002	393	978	1551
2003	429	1411	1414
2004	479	1221	1933
2005	429	1317	2000

The real estate market remained strong, after increasing significantly over the previous six years in all categories. Single-family re-sales saw significant increases in 1999 and have been stable up to 2002. In 2003, however, the number of single-family sales increased significantly by 44 percent. There was a slight 13 percent dip in 2004, followed by a rebound of almost 8 percent in 2005. Similarly, condominium re-sales have experienced significant increases since 1999 in terms of units sold, achieving a new high in 2002 and a slight decrease in 2003. In 1999, 1,338 condominium units were sold, registering a 38.8 percent increase from the prior year. In 2001, the number of sales fell slightly, but rebounded significantly in 2002. Sales in 2003 amounted to 1,414 units. In 2004, however, the total condominium sales skyrocketed to 1,933, which jumped to 2000 units in 2005.

Meanwhile, median prices rose significantly in 2005 for all categories of real estate. The monthly median prices in 2005, averaged over 12 months, for land parcels, single-family homes and condominium units, increased 22 percent, 13 percent and 17 percent, respectively.

Construction and Development

The construction industry, since 2000, has enjoyed a robust economy and building climate. Three new commercial centers were built in 2000. The Wailea Shopping Village had been demolished and was replaced with The Shops at Wailea, which includes 150,000 square feet of upscale retail and restaurant space. Also, the 150,000 square foot Piilani Village shopping center was built at the same time and is anchored by a 55,000 square foot Safeway store, considered to be the largest Safeway in the state. The Maalaea Harbor Village shopping complex, where the premier Maui Ocean Center presently stands, was also built during the same period.

Recently, Phase I of the Wailea Town Center was completed and sales of all he individual commercial condominium units closed escrow. The center will contain neighborhood services including retail and office owner-occupants such as Coldwell Banker and the Wailea

branch of First Hawaiian Bank. The second phase is currently under construction with more commercial condominium units along with residential units on the second floor. This phase was also met with high demand as all of the units are reserved and under contract; and, the developer expects to have the second phase sold as soon as it is completed.

Residential properties continue to be built, primarily in new subdivisions throughout Maui. This sector of the market had been negatively affected by the poor Hawaii economy during the 1990s; however, properties today are appreciating rapidly and new projects are enjoying a large degree of success. In Central Maui, the Maui Lani and Kehalani project districts are being developed with several new subdivisions and condominium projects.

Kihei has also experienced an upswing in residential development brought upon by new single-family subdivisions between 2000 and 2005. All of these subdivisions were highly successful, receiving immediate reservations and contracts on all units prior to completion of construction. Construction of more residential subdivisions is still strong in Kihei, including Kamali'i Alayna, Moana Estates and Hokulani Estates to name a few.

Retailing

In retail, the most significant addition is the 275,000 square foot Maui Marketplace, which opened on Dairy Road. This site contains the likes of Lowe's Hardware, Office Max, Sports Authority, Borders Books & Music, Pier One Imports, Burger King and Starbucks Coffee.

Wal-Mart and Home Depot also completed their stores on Dairy Road, immediately west of the Maui Marketplace. These outlets joined earlier arrivals Costco and Kmart, as well as Alexander & Baldwin's neighboring Triangle Square, in carving up the Maui retail pie. However, the local malls are answering the challenge with more food and entertainment, and retailers that can compete in their niche. Maui's largest mall, Maui Land & Pine's Queen Kaahumanu Center in Kahului, has been challenged by the presence of these large box retailers and vacancies are very noticeable. The most recent and highly publicized closure was that of JC Penney in January 2003.

In Kaanapali, Whalers Village has taken a turn toward the luxury market popular with the Japanese. Recently completing a $3 million renovation and a change in its tenant mix, this oceanfront center now aims for both westbound and eastbound visitors. Japanese visitors are targeted with Duty Free Shoppers, Louis Vuitton, Prada, Loewe and other high-end shops.

The 150,000-square foot Shops at Wailea opened in 2000, offering upscale shopping in its high-end retail shops. Tenants include Louis Vuitton, Coach, Bally, Fendi, Tiffany & Co., Banana Republic, and Georgiou. Restaurants in this mall include Ruth Chris Steak House, Tommy Bahama Café and Emporium, and Longhi's. Other retailers include Crazy Shirts, Hot Topix, Gap, Wolf Camera, and Whalers General Store.

The newest addition to the retail market will be the Lahaina Gateway Center situated along Honoapiilani Highway across from the Lahaina Cannery Mall. It is being dubbed as a "lifestyle center" with specialty retail shops, services and restaurants. Expected to open in 2007, this 145,000 square foot center will include tenants such as Barnes and Noble Booksellers, Central Pacific Bank, Ohana Farms, and Cost Plus World Market.

Agriculture

Agriculture on Maui is dominated by larger operations like Maui Land and Pine and Alexander & Baldwin's Hawaii Commercial and Sugar (HC&S).

Pineapple now confronts more foreign competition from places like Thailand, but Maui Land and Pine has weathered the recent drought relatively well, with adequate irrigation systems. However, there have been some recent changes in top management of Maui Land and Pine as the company seeks profitability.

HC&S survives as one of Hawaii's few remaining sugar operations because of its economies of scale, its shape (a compact area in the isthmus of the Valley isle rather than being strung out along some coastline, which facilitates cane hauling), and its decisions over the years to reinvest and upgrade plant and equipment.

HC&S continues to upgrade. A completed $6 million modernization of Puunene Mill, consists of a $2.5 million production facility to manufacture food grade sugar, and installation of an $8.5 million generator that will produce and additional 16 megawatts of power above 1998 and 1999 levels. The operation is also diversifying. A $10+ million fiberboard plant was recently completed at the end of 2000, and an ethanol plant is also being evaluated.

Maui's most recent casualty among sugar operations, Pioneer Mill in West Maui, is missed visibly. For years, proponents of maintaining and sustaining Hawaii's sugar industry argued that growing sugarcane imported to this economy an important, if underestimated, non-pecuniary benefit; sugar kept the land green and attractive, for tourists and locals alike, even if it lost money. Economists call this

situation an "externality," an activity that affects others for better or worse, without those others paying or being compensated for activity.

Anyone who doubts that logic now has only to drive the West Maui coast from Olowalu to Kaanapali and look mauka, at an entire mountain side of dry brush and unused fields. As with many cases where sugar plantations have shut down, most diversified agriculture crops are just not land intensive enough to utilize all the vacant land. Coffee and seed corn operations are possibilities, but they make only a small dent.

In addition to sugar and pineapple cultivation, Maui also offers rich opportunities for agricultural diversification by small farmers and large agribusinesses. Top among new agricultural products are: papaya, cut flowers, coffee, Kula onions and strawberries, and Chinese cabbage from Kula. Molokai offers its sweet potatoes, Molokai lettuce and alfalfa, as well as taro.

High-Tech

Maui's contribution to Hawaii's fledgling high-tech industry remains pre-eminent in the state. It also represents genuine diversification of the economy. The Maui Research and Technology Park in Kihei has all of it's infrastructure in place, and has completed three major building projects. Most important, it houses one of the country's most powerful supercomputers. The park now hosts over 30 companies and over 300 employees on 415 acres.

With access to one of the most powerful supercomputers in the world, funded by the U.S. Air Force, the Maui Research and Technology Park is continuing its efforts to diversify the Maui economy into something fundamentally different from what exists in the county or anywhere else in the state.

Construction of a new project is nearly underway in Maui Research & Technology Park. This office building is being developed by the Maui Economic Development Board and will contain approximately 31,500 square feet of rentable area on a 2.8-acre site.

The park is sticking to its long-run strategic plan to capitalize on its location at the center of the Pacific Basin. Its extensive fiber-optic lines to the U.S. Mainland make it one of the most fiber-rich environments in the world, greater than many facilities actually located on the Mainland.

County Government

Maui County is unique in having several inhabited islands in its jurisdiction: Maui, Molokai, as well as Lanai, and the uninhabited island of Kahoolawe.

Maui County has an elected Mayor and County Council, and the Board of Water Supply and Liquor Control Commission are semi-autonomous with appointed directors. Although all courts are conducted by the State, the County is responsible for prosecution and the Mayor appoints the prosecutor. The council has nine members, each residing in one of nine districts; however, voters cast ballots for all nine seats.

Unlike other states, Hawaii has only two layers of government: State and County. The State is responsible for many functions that elsewhere come under the jurisdiction of municipalities, such as schools, hospitals, airports. Also, unlike other states, Hawaii has statewide zoning carried out by the State Land Use Commission. The County has zoning authority within the boundaries established by the commission.

The County of Maui is encountering a lack of affordable housing. Maui is the most expensive county for single-family home buyers, with an average monthly median sales price of $552,833 in 2004; and a record high median price of $780,000 in May 2005 for a single-family home. According to the latest State of Hawaii Data Book, 11.0 percent of the houses are overcrowded on Maui and 47.4 percent of the households pay more than the recommended limit of 30 percent of their income on housing. In fact, 16.6 percent pay more than 40 percent on housing. The County administration has made the creation of affordable housing its priority and several new projects are either underway or in-process.

B. NEIGHBORHOOD DESCRIPTION

Since real estate is fixed in location, its marketability and rentability are strongly influenced by economic and social trends in its immediate environment. The continuing attractiveness of this neighborhood environment to potential users and tenants, and its competitive relation to those of substitute properties, must therefore be evaluated and forecast by the appraiser. In particular, perceived neighborhood trends affect both the quality and quantity of the revenues the subject property can reasonably be expected to generate.

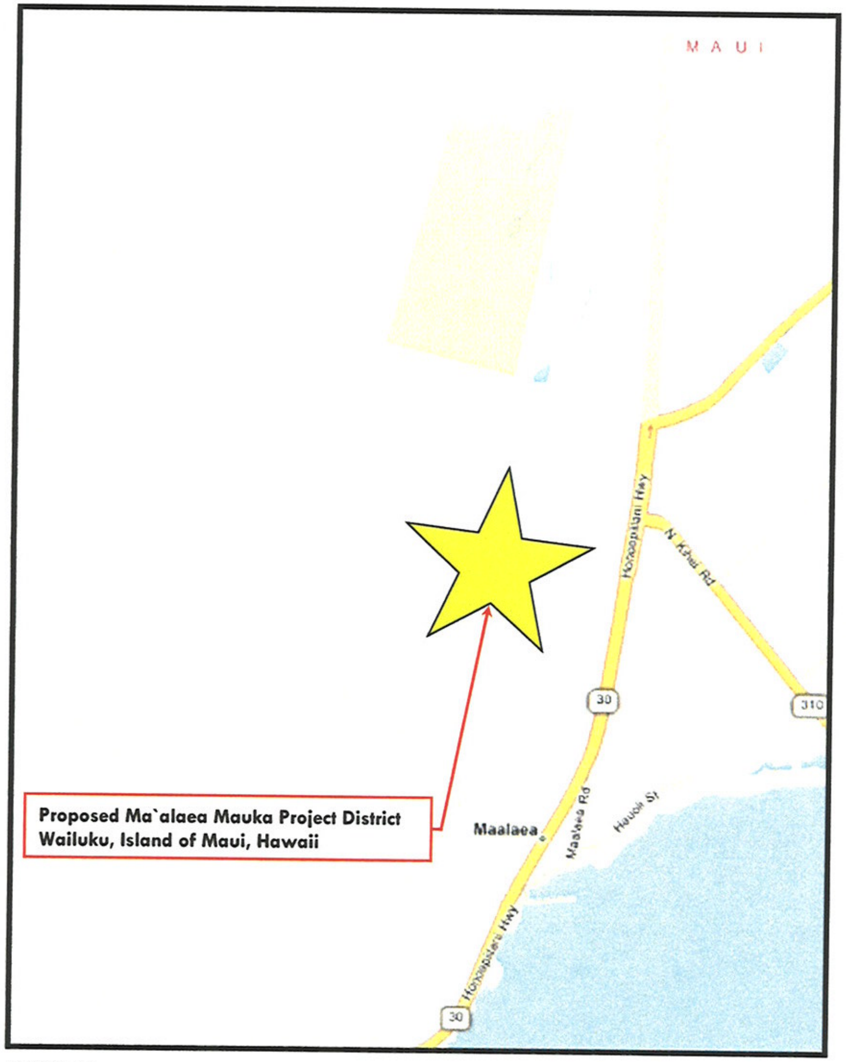
A neighborhood of income-producing properties is a geographic area characterized by similarity of uses and/or users, within which any change has a direct and immediate effect on the subject property and its value.

The geographic area surrounding the subject property is defined by physical and man-made boundaries, and encompasses an area known as Wailuku-Kahului. This region is located on the north shore of the Island of Maui and encompasses the civic and business centers of Wailuku and Kahului. The island's major seaport and primary airport are also contained within the boundaries of this region. The surrounding agricultural land of Central Maui, and the eastern half of the West Maui Mountains are also within the Wailuku-Kahului neighborhood.

The boundaries of the Wailuku-Kahului region are the northern shoreline from Poelua Bay to Baldwin Park on the north, Kailua Gulch and Lowrie Ditch on the east, Spanish Road to Waikapu Road to Honoapiilani Highway to Pohakea Gulch on the south, and the Wailuku Judicial District boundary on the west.

Population is concentrated in the urban centers of the region. Wailuku has maintained its role as the civic-financial-cultural center while Kahului has strengthened its role in recent years as the business and industrial center.

In addition to the urban centers of Wailuku-Kahului, the region also includes the more rural settlements of Waihee to the north and Waikapu and Puunene to the southeast. Agricultural lands are adjacent on the lower slopes of the West Maui Mountains and in the central plain south and east of Kahului. This green border is a significant part of the settlement pattern because of its open space and economic value. Kahului Harbor and Airport are major land users along the Kahului shoreline. As major ports of entry for people and



Not To Scale!

NEIGHBORHOOD MAP

goods, they serve as an important center of jobs and economic activity.

The major thoroughfares through Kahului and Wailuku are Kaahumanu Avenue which begins in Kahului and provides primary access to Wailuku as well as Lahaina and Kihei; Hana Highway, which is actually a continuation of Kaahumanu Avenue, leads from Kahului to the eastern or "upcountry" portions of the island; and Puunene Avenue which provides access to all major areas in Kahului and ultimately leads to the new Kuihelani Highway which provides by-pass access to Lahaina and Kihei. The Kaahumanu Avenue also runs into Main Street, and via secondary access, runs into Waiehu Beach Road and Lower Main Street.

Kahului, adjacent to Wailuku, is situated on the northwest portion of the island of Maui, and is the central commercial, industrial and residential area of Maui. Kahului Town contains Maui's major shopping centers, centralized industrial areas, financial institutions, medical office facilities and business offices. Additionally, the Kahului Airport and Kahului Harbor are located in Kahului proper and centrally provides the majority of firms providing various goods and services throughout the island, as well as to Lanai and Molokai. Consistent with its central location, post office facilities, community library, parks, schools (elementary, intermediate, high school and a community college), churches of various denominations, entertainment facilities, food outlets and a fire station are located in Kahului.

Wailuku, at one time, was the heart of Maui's business activities. Decentralization of business to nearby Kahului and lack of maintenance and modernization of buildings to keep up with the new shopping habits brought about a gradual decline. However, since the creation of the municipal parking area in Wailuku, several new buildings have been built or renovated and a rejuvenation of the Wailuku Town is being experienced. The recently passed Community Plan envisions Wailuku as the "governmental, cultural and professional center of Maui". Located in Wailuku are the various government agencies, courts, hospital, major recreational facilities and police station.

Wailuku's Fire Station sits in the heart of Wailuku Town, and until the opening of the Kahului Fire Station, was the only one in Central Maui. Kahului's Fire Station is a 21,300 square foot facility that includes two main buildings and is situated on Dairy Road.

The Maui Memorial Hospital, which is Maui's primary facility of medical and emergency service, is located between the connecting boundaries of Kahului and Wailuku. Work is nearly complete on the addition of a new wing for the hospital. The Police Station is also conveniently located nearby.

Numerous pre-schools, elementary, grade and high schools are located throughout Kahului and Wailuku, with the Maui Community College located on Kaahumanu Avenue.

In order to fully understand and appreciate Kahului and Wailuku's potential for expansion, as well as factors that could limit the growth of this region, a brief summary of recent or proposed developments in central Maui, along with a few important issues facing future development are in order.

RESIDENTIAL

The residential districts surrounding these two centers are significantly different in character. Kahului residential areas are newer, with wide curvilinear streets. Wailuku Town, however, is comprised of older residential areas, intermixed with business uses, varying lot sizes, and a more haphazard street pattern representative of older subdivision practices. Only within the past three years has development at the Kehalani Project District really picked up.

Kahului

Currently in Kahului, the major residential area is represented by Alexander & Baldwin, Inc.'s Kahului Town Development. This subdivision consists of 14 increments that were built between 1951 and 1981. There are a total of 3,400 lots within the 14 increments. Kahului Town is distinguished as the first planned "new town" in Hawaii to provide quality housing at affordable prices.

Today, Kahului Town is a bustling residential community, and the on going Maui Lani project is generating a great deal of interest. This development will include up to 3,000 new residential units, ranging from executive golf homes to affordable units and will span 1,000 acres on the south side of Kahului and Wailuku. The Maui Lani development includes a golf course, churches, schools and a recreational center. Already, several phases have been sold over the past several years.

Wailuku

In Wailuku, the older residential homes are mixed with small businesses throughout central Wailuku. There are three primary residential subdivisions on the outskirts of the town including Wailuku Heights, Waiehu Terrace and Leisure Estates.

The older Wailuku Heights area was extended by two exclusive and prestigious phases. The first extension offers 270 lots while the second

phase offers an additional 130 lots to the subdivision. Once verdant pastureland, Wailuku Heights is nestled in the West Maui Mountains and offers underground utilities, scenic views and a landscaped park.

The newest residential developments in Wailuku include the Ohia and Maunaleo subdivisions. These projects, by Towne Development and Stanford Carr Development, were sold strictly as house-and-lot packages. Kehalani Gardens and Iliahi at Kehalani, both condominium projects, were also built by the same developers and were completed in 2005. Another unique subdivision that was recently completed is the Wailuku Country Estates Subdivision which consisted of 184 agriculture lots located near the Pu`uohala Camp neighborhood.

Two other projects ready to proceed in Kehalani are The Cottages at Kehalani (14-lot single-family subdivision) being developed by Stanford Carr Development; and Akolea at Kehalani (97-lot single family subdivision) being developed by Towne Development on the north side of Kuikahi Drive. Another notable project underway is Waikapu Gardens, Jesse Spencer's 410-unit affordable housing project in nearby Waikapu, a small community in Wailuku proper.

COMMERCIAL

Commercial development in Kahului is concentrated along the major thoroughfares in strip fashion, while Wailuku's main commercial activity is concentrated in the central core of the town. Due to the central location of these communities, demand for commercial space is strong at this time, and vacancies within established projects in this region are very low.

Kahului

There are four major shopping centers in Kahului. Maui Mall, opened in late 1971 contains a gross leasable area of 181,500 square feet on a 25-acre site. It is anchored by tenants such as Longs Drug Store, Star Supermarket and the new Maui Mall Megaplex, by Wallace Theater Corporation. The largest center, Queen Kaahumanu Center, opened in 1973 and had 300,000 square feet of gross leasable area. Extensive renovations were completed in 1995, which includes a new two-level shopping wing, a six-screen movie theater, expanding the major stores, renovating the existing mall and adding a parking structure and access road. The project expanded the center to 500,000 square feet. It is currently anchored by Macy's and Sears. The Maui Marketplace on Dairy Road is home to a number of big-box retailers including Lowe's Hardware, Borders Books and Music, Sports Authority, Office Max, Pier One Imports, Starbucks Coffee, Jamba Juice, Bank of Hawaii and Burger King. Finally, Kahului Shopping Center, the oldest major shopping center which opened in 1951, was partially destroyed by fire in 2005 and plans are underway to redevelop the entire block into Kahului Town Center. This development will consist of retail, office and condominium living.

In addition to these centers, Kahului is home to other large retailers including Costco, Home Depot and Kmart. All of the major financial institutions and the large automobile dealerships are also located in Kahului. The Maui Arts and Cultural Center was built here in 1993 and includes a 1,150-seat theater, a 200-to 300-seat theater, an art gallery, administrative offices and a restaurant/gift shop on 12-acres at Maui Central Park, which is located between the Maui Community College and the Maui Zoo.

Wailuku

The hub of commercial activity in Wailuku is concentrated in an area along Market Street and Main Streets. Known as Old Wailuku Town, this neighborhood is characterized by older, low-rise buildings consisting of small, individual shops and offices. Civic uses surrounding this area of Wailuku include the State Office Building, the County office buildings, and the judicial building.

Wailuku's office market has rebounded in recent years and now experiences high occupancy rates and increasing rents. The town is home to numerous professionals in the fields of architecture, engineering, financial management real estate and banking. All of the major financial institutions have branches in Wailuku Town. Notable office buildings in Wailuku include One Main Plaza, Wailuku Executive Center, Maui Realty Suites, the Trask Building and Wells Professional Plaza.

INDUSTRIAL

Industrial space in Central Maui is very scarce with vacancy rates of three percent or less in most projects. In addition, vacant industrial land is also difficult to acquire due to the lack of inventory in the market. These factors have led to strong increases in warehouse rents and land prices.

Kahului

There are several industrial parks in Kahului, but the largest and most established of them all is the Maui (Kahului) Industrial Park, which is bordered by Hana Highway, Puunene Avenue, Dairy Road and Kamehameha Avenue. It includes low-rise warehouse and commercial uses and is occupied with a mixture of industrial, retail and office tenants.

Maui Business Park, Phase I-A and I-B is also establishing themselves to be active commercial and industrial subdivisions. Their developer,

Alexander & Baldwin, Inc. plans to add on another 179 acres of light industrial land surrounding the first phase. However, delays in the entitlement process means that finished lots will probably not be available for building until about 2009.

Other industrial subdivisions include the Airport Triangle on about 13 acres, the 36-lot Kamehameha Parkway No. 2, and the Central Maui Baseyard on Mokulele Highway.

Wailuku

Existing industrial subdivisions in Wailuku include Wailuku Industrial Park, The Millyard, and Waiko Baseyard. Wailuku Industrial Park is an improved light industrial subdivision with 74 fee simple lots off of Lower Main Street in Wailuku. Lots range from 10,106 square feet to a parcel 3.089 acres in size. This subdivision is approximately 95 percent developed and includes the Wailuku Town Center, anchored by Sack 'n Save.

The Millyard was developed in 1985 as an improved light industrial subdivision located at the old Wailuku Sugar Mill site. This industrial subdivision contains 57 lots, and is home to the Wailuku Post Office which opened there during the late-1990s. Approximately 60 percent of this subdivision has been developed with a mixture of commercial and light industrial uses.

The Millyard Plaza is one of the largest additions to this subdivision. Also, several dentists have seen fit to build their own free-standing facilities in The Millyard, which has been developed into more of an office park than an industrial center.

Completed in 2006, the Waiko Baseyard in Waikapu consists of 18 lots on approximately 15 acres of land. This subdivision was immediately sold prior to subdivision completion and will be home to relocating local businesses. Meanwhile, construction on Consolidated Baseyard is slated to begin in late-summer of 2006 and will consist of 35 lots on about 23 acres of land. Reports indicate a very strong interest in these lots and sales are expected to be brisk.

CONCLUSION

All public utilities including electricity, water, telephone, and sewer service are available in Kahului and Wailuku, as is police, fire and ambulance services. Propane gas is not a public utility, however, is available. All charges for public services are standardized for Kahului as well as for the Island of Maui.

Although no public transportation exists on Maui, Kahului and Wailuku is easily accessible from most parts of the island. This and the fact that it is central to airport and harbor facilities, commercial and industrial establishments, properties located in this area are ideal.

Due to this region being the center of County, State and Federal offices, as well as community services, properties in these areas are anticipated to be in greater demand in the years ahead. Based on the desirability of this area and forecasted demand here, property values are expected to continue their appreciation in the foreseeable future.

C. PROJECT DATA

Environs

The subject is located on the mauka (mountain) side of Honoapiilani Highway in Ma`alaea, Island and County of Maui. Honoapiilani Highway runs in a general north-south direction, in the vicinity of the subject, and connects Wailuku and Waikapu to the Ma`alaea neighborhood. It then continues westward to the communities lying within the West Maui region.

The community of Ma`alaea is situated along Maui's southern coastline. Central to this neighborhood is the small boat harbor which is home to a number of fishing and sightseeing charter boats, as well as private recreational vessels. The U.S. Coast Guard also has a small office and a dock for its ships. Included within this community are a small number of older oceanfront residences, and 10 oceanfront condominium projects. The condominium developments account for approximately 560 residential apartment units, the majority of which are rented on a short-term hotel basis. The Ma`alaea Triangle Subdivision is home to the Ma`alaea Harbor Shops, a small amusement park, and the Maui Ocean Center aquarium. The area does not have any schools, public recreational facilities (other than the harbor), or residential subdivisions. The nearest employment centers, shopping centers and schools are located in Kihei and Wailuku, both a 10-minute drive from Ma`alaea. Access to Ma`alaea is provided by one major thoroughfare, the Honoapiilani Highway, which also provides the only access to West Maui, the island's premier visitor destination.

Besides the subject, two other major projects are currently being planned in the Ma`alaea community. Landowner A&B Properties is also planning a residential and multi-family subdivision in Ma`alaea, northeast of the subject. Additionally, the U.S. Army Corps of Engineers, in cooperation with the State Harbors Division, has proposed expanding the harbor at Ma`alaea. The environmental impact statement includes 5 proposed designs which will expand the slip count in the harbor to approximately 220. This proposal has been in the process for a number of years as the various community groups voice their opinions.

Description of the Proposed Project

The proposed Ma`alaea Mauka Project District is a 949-unit community located west of, and bordering, Honoapiilani Highway in Ma`alaea. The subject consists of approximately 257 acres of land and is currently zoned Agricultural District but is designated as Project District 12 within the Kihei-Makena Community Plan. The project, which is still in its preliminary planning stage, will possess views of Mt.

Haleakala, the West Maui Mountains, the ocean and the islands offshore. The Consultant has gleaned information from the recently submitted Environmental Impact Statement Preparation Notice as well as conversations with the developer. Additionally, information from the Project District 12 description within the Kihei-Wailea Community Plan was also utilized to further understand the proposed project. A breakdown of the proposed land uses and allocated areas is listed below as gleaned from the Environmental Impact Statement-Preparation Notice (EISPN).

Land Use	Land Area
Single Family	118 Acres
Multi-Family	30.5 Acres
Senior Care Housing	6 Acres
Apartment	11.5 Acres
Community Center & Open Space	37 Acres
Park	15 Acres
Fire Station	1 Acre
Wastewater Treatment Facility	2 Acres
Collector Roadways	36 Acres

Early indications from the developer suggest that the single-family component will consist of 7,500 to 10,000 square foot "production" house lots, in addition to 10,000 to 12,000-plus square foot custom house lots. Ohanas, or additional dwelling units, will not be allowed on any of the lots.

According to the developer, approximately thirty (30) percent of the project will be developed as affordable housing. It is expected that all of the apartment (126 units) and senior housing components (60 units) will be set aside as affordable housing. 64 of the multi-family town homes and patio homes, as well as 35 units of the single-family component will be set aside for affordable housing. Based solely on unit count, the 30 percent affordable component of the 949 total units will calculate to approximately 285 affordable housing units for the County of Maui. As mentioned earlier, the project is still in its initial development stages and details regarding affordable pricing have not been determined yet.

PART III – ANALYSIS AND CONCLUSIONS

A. MARKET ANALYSIS

For the purpose of estimating the market response to this project, a market study was conducted to determine how current supply and demand for residential homes might be affected by the development of the subject's 949 units. The extent of our survey encompassed new, ongoing and proposed residential developments on Maui to give the reader the best perspective of the overall market.

OVERVIEW

One of the more difficult factors in determining the success of a proposed project is estimating future absorption rates. There are two components to this: First, is the design and pricing of the proposed project. This, of course, is well within the developer's control but has not yet been determined for the subject. Second, is the overall market environment at the time of pre-sale and project completion. This is, obviously, more difficult to define because it involves forecasting such variables as interest rates, overall market conditions, and general and specific sector real estate market conditions.

The added complication with most projects is the time frames and time lags involved. Since most subdivisions or condominium projects take several years between conception and completion, market and interest rate conditions can change significantly. Thus, a project may commence in a favorable environment and be completed in an unfavorable one (or vice versa). Furthermore, real estate is a cyclical industry and sales activity tends to move in spurts. It is not unusual for a new project to sell half its units in the first year of marketing and require 2 to 3 years (or longer) to sell the remaining half. Of course, these time periods could expand or contract depending upon market conditions. Thus, the notion of a linear sales rate may be deemed unrealistic for practical purposes, but is a useful and convenient tool for planning.

RESIDENTIAL SUPPLY CHARACTERISTICS

The Ma'alaea Mauka Project District is centrally located and has relatively uniform travel times to each of the major population centers on Maui. It follows that the subject's primary market area is the Central Maui region, while South Maui and West Maui are expected to be secondary markets. Central Maui is home to the County and State government offices and is the industrial center of the island with convenient access to the major transportation facilities. South Maui has become a visitor destination with its expansive beaches and retail establishments targeted towards the tourist industry. West Maui is also a major tourist destination and is home to the famous Front Street retail corridor which allows for pedestrian access to numerous retail establishments within Old Lahaina Town. Further north of Lahaina are the Kaanapali and Kapalua master planned resorts. Clearly, the subject's Ma`alaea location is highly convenient with respect to all of the major population centers.

Due to robust economic conditions and a strong real estate market, there are numerous housing projects under construction or in various entitlement phases.

Available Residential Supply In New Maui Projects

Research was conducted in order to determine the number of housing units in new developments that are currently available in the market. According to this survey, there are 2,073 housing units which are currently for sale on the Maui market within, on-going projects and those developments which will be constructed in the near future. It is noted that two large projects, Hale Mua and Spencer Home's Waikapu Gardens subdivision will consist of approximately 37 percent of this total. Based solely on historical annual absorption rates of other new projects (463 units per year), the short-term market supply would be expected to last approximately 4.5 years. Of course, a multitude of other factors can influence the capture rate. For instance, the larger percentage of affordable units in the future supply almost guarantees a faster-than-normal absorption. Also, the number of buyers from the U.S. mainland and from foreign countries can fluctuate from year to year, and their presence in the market is not as predictable as the demand from local residents.

Shown in the table on **Page 25** is the list of projects representing the short-term housing supply for the Island of Maui. Many of these projects are currently under construction but have not actually closed on their units. Those that have not begun construction are undergoing their financing processes and are expected to commence construction within the next year. Included in this list are both single-family and condominium units from the island's four major population centers: Central Maui (Wailuku-Kahului); South Maui (Kihei-Wailea); Upcountry (Pukalani-Makawao-Kula) and West Maui (Lahaina to Kapalua). Some of the recently completed projects named in the following table, such as Koa at Kehalani, Sand Hills, Maluhia at Wailea, Lanikeha and Mahanalua Nui Phase IV have already begun closing sales of their units.

Of the ongoing projects, those most similar to the subject are the Koa at Kehalani and Sand Hills Estates at Maui Lani. This was based on the types of product that these projects offer as well as their location in Central Maui. It is also expected that their price ranges should be comparable to the subject's market lots. Koa contains a total of 72 house lots with lot sizes ranging from 7,900 to 21,675 square feet of land area. As of the effective date of this report, 48 lots have been sold under contract while a total of 24 remain available for sale. Thirty (30) house lots have closed while another 5 house and lot packages were closed. Lots began closing in October of 2005 while house and lot packages began closing in the first quarter of 2006. Most of the Sand Hills Estates subdivision has been sold and there are 11 lots remaining for sale ranging in price from $400,000 to $575,000.

Other project in Central Maui include A&B Properties' Aina `O Kane, a multi-family development in the midst of Kahului which will contain a total of 103 units. Also in Kahului is the Legends at Maui Lani, Phase II, which consists of house and lot packages developed by D.R. Horton's Schuler Homes division. In the Waikapu neighborhood, there is the Waiolani Mauka and Waiolani Pikake projects which will consist of single family house lots. As mentioned before, Spencer Homes is bringing 410 homes to the market on the eastern side of Honoapiilani Highway in Waikapu. In addition to the ongoing Koa at Kehalani project, The Cottages at Kehalani and Akolea are two single family projects that will offer house and lots. In Waiehu, Hale Mua is expected to bring approximately 466 units to the market with about one-half of them being designated for affordable housing. Nineteen (19) of the lots in this subdivision will be larger than 2 acres in size. Na Mala O Waihee is an agriculture lot subdivision in Waihee.

The number of units indicated in the table below reflects the number of remaining units that are not under contract and are available for sale.

Table 1 - Available Supply in Ongoing Projects on Maui

Name	Location	# Units remaining	Type of Development
CENTRAL MAUI			
Koa at Kehalani	Kehalani Proj Dist	24	Residential House Lots & SF Homes
Ohio at Kehalani Phase II	Kehalani Proj Dist	1	SF Homes
Sand Hills @ Maui Lani	Maui Lani Proj Dist	11	Residential House Lots
Fairways at Maui Lani	Maui Lani Proj Dist	50	Residential House Lots
Legends Phase II	Maui Lani Proj Dist	71	SF Homes
Waikapu Gardens	Waikapu	300	Affordable Homes
Cottages at Kehalani	Kehalani Proj Dist	114	SF Homes
Akolea	Kehalani Proj Dist	97	SF Homes
Waiolani Mauka	Waikapu	105	Residential House Lots
Na Mala O Waihee	Waihee	1	Agriculture Lots
Waiolani Pikake	Waikapu	11	Residential House Lots & SF Homes
Aina O Kane	Kahului	103	Lowrise Condominium
Hale Mua	Waiehu	466	Mixed Lots & Affordable Homes
SOUTH MAUI			
Maluhia at Wailea	Wailea	2	Luxury Condominiums
Kilohana Waena	South Kihei	31	Residential House Lots
Konani Wailea	Wailea	2	Luxury Condominiums
Moana Estates	South Kihei	34	SF Homes
Ke Alii Ocean Villas	South Kihei	101	Lowrise Condominiums
Liloa Village	South Kihei	65	SF Homes
Hokulani	Central Kihei	120	SF Homes
Hoolei	Wailea	16	Luxury Condominiums
Papali	Wailea	10	Luxury Condominiums
Komalii Alayna	North Kihei	90	SF Homes
UPCOUNTRY/EAST MAUI			
Kualono	Pukalani	49	Residential House Lots
Keaweamahi	Kula	11	1/2 to 1-acre Residential Lots
E Paepae Ka Puko'a	Spreckelsville	16	1/2 to 1-acre Residential Lots
WEST MAUI			
Lanikeha	Kaanapali	60	Residential House Lots
Mahanalua Nui Phase IV	Launiupoko	4	Agriculture Lots
Kaanapali 10-H	Kaanapali	18	Residential House Lots
Kahekili Grove Condominiums	Honokowai	90	MF Condos
	Total units	2,073	

Maui's Potential Residential Projects

It is also important to discuss the potential developments on Maui that could be brought to the market in the future. As mentioned earlier, many external factors, such as economic or social factors, could affect the supply and demand for real estate in the future. These factors cannot be controlled by developers who must constantly assess market conditions for their prospective construction and sales periods. Many of these projects are still in the planning phases and must still complete governmental requirements before bringing their products to the market. Combine these factors with "internal" events that could affect a developer and predicting which developments will actually make it to market becomes more difficult. This list also includes long term projects that are under way such as the Kehalani and Maui Lani Project Districts.

Nevertheless, the paragraphs below detail the projects that are in their preliminary stages of development, but are considered to be potential sources of additional supply for Maui's housing market.

Maui Lani consists of approximately 1,012 acres of land in the Central Maui plains that has approximately 800 units completed. Completed phases include the Greens, Grand Fairways North, Grand Fairways, The Island and The Bluffs. Presently, there are two projects under construction, the Legends, Phase II and the Fairways. An upcoming project called Village/Mixed Use will consist of a mixed use product that will allow both residential and small scale commercial uses. This phase will consist of approximately 650 units. In addition to the phases already completed and the upcoming Village/Mixed Use phase, approximately 2,200 units remain to be developed within Maui Lani.

Kehalani is situated at the base of the West Maui mountain range in Wailuku and consists of approximately 550 acres of developable land area. Currently, there are numerous ongoing residential developments such as Koa at Kehalani, The Cottages at Kehalani and Akolea. There are approximately 1,100 units remaining within this project district.

Kapalua Mauka has announced plans to expand into the pineapple fields on the slopes above the existing West Maui destination. Their plan calls for development of about 690 units on more than 925 acres. Kapalua Mauka would be built around the Village Course, one of three championship courses there. It would also be expanded from 18 holes to 27 holes and given another clubhouse. Although the resort is zoned for an additional hotel, there are no plans to add one at this point in time. As part of the project, Kapalua will develop a 35-acre park, and pineapple cultivation north of Napili is expected to end.

Kaanapali 2020, on about 4,300 acres in Kaanapali, is currently in the planning stage. In 2002, the planning had already taken three years and the permit process is expected to take another four years. Construction is expected to being around 2008 and will include a mix of products needed by both the community and Amfac. It was reported that the developer is dedicating approximately 60 to 70 percent to open space. This project will also include cluster housing, single-family residential, multi-family residential, commercial, schools, churches, medical facilities, a cultural center, golf course and transportation center. Preliminary plans call for a total of 2,810 housing units to be built out over the next 20 to 30 years.

Pu`ukoli`i Village is part of Kaanapali 2020 and it is expected to be the first section of the plan to be developed. It contains 260 acres of what was formerly a plantation camp and 940 of the 2,810 housing units in Kaanapali 2020 is proposed for Pu`ukoli`i Village. The developer, Kaanapali Development Corp., is in the process of revising the original Pu`ukoli`i approvals to allow for development before the construction of the by-pass road. A revision to the affordable housing requirements is also in the works.

Waine`e will be located on the mauka side of Honoapiilani Highway. Situated along the eastern boundary of the Lahaina Aquatic Center and Recreation Center, this development will consist of approximately 240 acres of land once a plantation camp. It is currently undergoing the planning and entitlement process and is expected to begin construction in 2008. The development will contain approximately 1,100 housing units with approximately half being set aside as affordable housing for the residents of West Maui.

Pulelehua will be developed by Maui Land and Pineapple Company and will be situated between Honoapiilani Highway and the Kapalua Airport, on approximately 300 acres of land. This community will consist of single family and multi-family residential units, churches, schools, and other civic services. There will be a total of 882 residential units, with approximately 50 percent being marked as affordable units. The targeted buyers will be those earning between 80 and 140 percent of the county's median income level. Preliminary designs of the community show that it will have a small town feel to it. Narrow roadways are expected to keep the development pedestrian oriented and naturally reduce traffic speeds within the neighborhood.

Hawaiian Homelands The Department of Hawaiian Home Lands (DHHL) has approximately 700+ acres of land under its stewardship located between the proposed Pulelehua and Kaanapali 2020 projects mentioned above. Plans for this project are so preliminary that the owners do not know to what use, or to what extent, the proposed development will favor.

Villages of Leiali`i The delay of this planned development is probably the most significant factor affecting the housing market in West Maui. This 1,120-acre, 4,813-unit community proposed by the State of Hawaii's Housing Finance and Development Corporation, was planned over a 15-year period. This project, however, was indefinitely shelved due to a legal dispute over whether the State of Hawaii can sell ceded lands now held in trust for Native Hawaiians. The sale of the land from the State to the developer has not been completed due to litigation on behalf of native Hawaiian interests asserting claims and seeking to recover damages from the State. Conceptually, this project will develop 14 residential villages within 15 years. C. Brewer Homes, Inc. was marketing the housing in Village 1 known as Halelani in 1992 when the work was halted. Currently, only plans for Village 1A is in the works, which will consist of 304 units.

Wailea 670 (Honua`ula) This project first surfaced in the late-1980s and, in 1982 it received a Maui Planning Commission recommendation for approval of the developer's request to rezone the land from an agricultural district to residential and commercial districts. The land use measure, however, has yet to be heard by the Maui County Council. Initially, the developers planned to build approximately 2,600 units of housing and resort lodging, along with two golf courses. Today, renamed Honua`ula, the new scaled-down version features 1,400 single-family homes and multi-family units, which amounts to only 2.1 units per acre. There will be only one golf course and approximately 80,000 square feet of commercial space. The developers of Honua`ula say they will address their own infrastructure needs with the construction of a water well on site, a sewage system, roads, pedestrian paths and bikeways. These new changes were announced in March 2005, which arose in part from changes in market conditions and public comments on the project made more than a decade ago. The developer has indicated that about 20 percent of the units will be dedicated to affordable housing. At this point in time, the estimated price range of the affordable units is from $225,000 to $340,000. At least two-thirds of the units are planned for construction on the Honua`ula site, with the remaining one-third of the units built elsewhere.

Haliimaile has begun community meetings to discuss development and expansion of the existing town. The current land owners, A&B Properties and Maui Land and Pineapple, are in the preliminary planning stages and it was rumored that 2,700 units are looking to be developed in this expansion.

Kualono will consist of 49 half-acre rural lots in Pukalani at the intersection of Kula Highway and Old Pukalani Highway. As of June 2006, the developer has not begun formal marketing of the lots or started a formal reservation list. However, when the project was first introduced to the public in 2005, there was significant interest in it, due to its low density product of ½-acre lots. Based on this initial response, the developer feels the project will be sold immediately upon going to market.

A&B Waiale Project is a proposed 826 acre development that will be located off of Kuihelani Highway and Honoapiilani Highway, just south of the existing Maui Lani Project District. It will also surround the existing industrial lands along East Waiko Road, which was recently developed with the Waiko Baseyard Subdivision. The Consolidated Baseyard Subdivision has been granted County approvals and is expected to begin construction soon. Community meetings have been held to seek input into designing this area to best serve the island population. This proposed project district is expected to have approximately 1,900 to 3,700 housing units.

Pu`unani Subdivision is still in the planning and approval phase and may potentially bring a total of 550 housing units to the "gap" area between Wailuku and Waikapu, just south of the Kehalani project district. This proposed development consists of approximately 210 acres of land and is currently zoned Agricultural District by the County of Maui. Pu`unani will be located mauka of the Honoapiilani Highway and will possess views of the ocean as well as the West Maui Mountains and Haleakala. According to a Conceptual Land Use Plan, the subject will contain Rural District zoned lots, multi-family units, and R-0 Residential lots.

Central Maui's Residential Active Listings

Besides the properties available in the projects, the number of resale listings on Maui is a good indication of real estate market conditions. This market evidence is generally viewed as a "counter-cyclical" indicator, which means that it is typically lower in strong markets and higher in weak ones.

The Consultant utilized the Realtors Association of Maui-Multiple Listing Service to research active listings of residential house lots,

condominium and residential homes in Central Maui and found that there are currently 348 active listings (See **Exhibit B** at the end of this report). More detailed analysis of the finding revealed the following.

Single-Family

There were a total of 169 resale listings of residential properties in the Multiple Listing Service. This total was broken down as follows:

Range of Prices	No. of Listings	Average DOM
Below $400,000	1	90
$400,000 to $649,000	53	105
$650,000 to $899,000	67	105
$900,000 to $1,499,000	38	116
$1,500,000 and over	10	209

Clearly, the residential resale market supply of single-family homes is very low in the affordable bracket of "Below $400,000" where there is only one listing. The lowest priced property, at $350,000, was for a 59-year old, 780 square foot dwelling. The MLS information has indicated that the structure is in "tear down" condition which suggests that the value of the property may lie solely in the land. This listing is in the Waiale neighborhood in Wailuku.

According to the Affordable Sales Guidelines published by the Housing & Community Development Corporation of Hawaii the highest sales price of an affordable home in Maui is approximately $450,000, which is based on 140 percent of the 2006 median income as determined by HUD. According to this survey, there are only six (6) single family properties that are listed for sale at or below this price level.

The greatest supply was reflected in the $650,000 to $899,000 category. This segment is seen as the average market prices in Maui. It is noted that the median price for a single family property in Maui has ranged from approximately $600,000 to $780,000 in the past two years. Therefore, it is not surprising that this segment has the most abundant number of active listings on the market. Neighborhoods with prices in this range include the Kehalani and Maui Lani developments, Sand Hills in Wailuku, Waiehu Heights, and Kahului Town. The average DOM in this category was noticeably higher at 105 days. At the $900,000 level, the prices border the "high-end" or "luxury" segment of the real estate market.

The survey of active listings for single-family homes found a total of forty eight (48) properties listed at $900,000 or higher with the highest price being $12,000,000 for a property in Kahakuloa. In Central Maui, there are very few new developments which will solely offer high-end properties over $900,000. The Fairways at Maui Lani will consist of 50 house lots along the Dunes at Maui Lani Golf Course. With prices expected to be in the mid-$400,000 range for a lot, the finished homes are expected to be priced at about $850,000. Hale Mua will have nineteen (19) lots with areas greater than 2.00 acres. Once complete these, homes will probably be priced over $900,000. Developments or subdivisions with listings in the $900,000-and-above range include, Wailuku Heights, The Island and Bluffs, Grand Fairways North, Maluhia Country Ranches, and the recently completed Maunaleo at Kehalani.

Vacant House Lots

The number of vacant house lots on the market at this time appears to be plentiful, with 73 listings in Central Maui; however, their market prices are prohibitive to developing an affordable product. For instance, the lowest priced house lot is $100,000, for a 2,085 square foot property on Vineyard Street. Based on a construction cost of about $200 per square foot, a buyer could afford to build a 1,750 square foot home if he/she could only afford a total housing cost of $450,000. This scenario is based on 140 percent of the median household income as defined by HUD which is the upper limit of the affordable housing guidelines. Of course, this $100,000 listing is an exception in the marketplace, as the next lowest listing is offered at $300,000.

The majority of the lots offered for sale in Central Maui are located in the Sand Hills Estates Subdivision in Maui Lani. These listings range from $350,000 to $600,000. Other notable developments with active listings include the Wailuku Country Estates, a recently completed 184-lot agriculture subdivision just outside of Wailuku Town.

Condominiums

This category typically dominates the number of sales in Maui. Condominium listings in Central Maui total eighty four (84), or over half the amount of single family listings. The listings of condominium units in Central Maui range from $164,000 for a fee simple studio unit at Harbor Lights, to $1,095,000 for a leasehold 2 bedroom, 2.0 bath oceanfront unit at Milowai in Ma'alaea. However, these two examples are at the extremes of the range, with most of the listings clustering in the $200,000 to $300,000 range. The most units available are located in the Harbor Lights project which has a total of

28 active listings. Other notable projects with numerous units listed include Iao Parkside and Kahului Ikena.

Condominiums have been in great demand as an alternative to single-family living, as home prices have been on the rise during the past few years.

New Construction

According to the Maui County Data Book 2005, new single-family construction fell from its high in 1988 to its lowest point during the latter half of the 1990's. Since 2000 however, the number of new home starts has rebounded.

Table 2 - New Construction Island of Maui

Year	Number of New Single-Family Units	Five-Year Average
1980	803	
1981	398	
1982	530	
1983	547	
1984	638	
Subtotal	2,916	583
1985	984	
1986	911	
1987	1,119	
1988	1,453	
1989	1,136	
Subtotal	5,603	1,121
1990	1,068	
1991	694	
1992	810	
1993	660	
1994	673	
Subtotal	3,905	781
1995	473	
1996	601	
1997	532	
1998	574	
1999	647	
Subtotal	2,827	565

Year	Number of New Single-Family Units	Five-Year Average
2000	904	
2001	778	
2002	787	
2003	877	
2004	1,104	
Subtotal	4,450	890

Source: Maui County Data Book 2002, 2003, 2004 & 2005

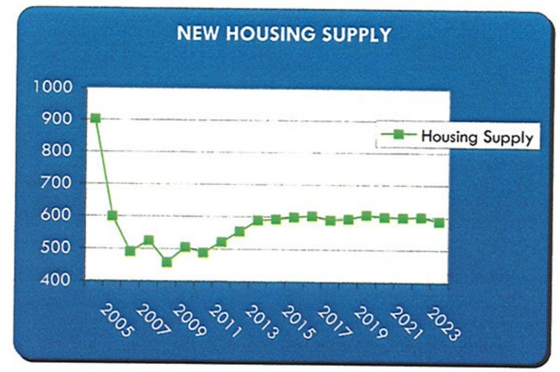
New single-family construction averaged 583 units during the five years between 1980 and 1984. During the next five years, 1985 to 1989, single-family housing starts increased significantly to an average of 1,121 per year. During 1990, house construction was also relatively active at 1,068 units, but declined significantly following the Persian Gulf War and the economic slowdowns on the U.S. mainland and in Japan. Consequently, between 1990 and 1994, there was an average of 781 new single-family units built per year. From 1995 to 1999, construction of these units declined even more, with an average of only 565 units per year. In 2000, the number increased significantly to 904 units and then declined in 2001, to 778 units. The number of units remained nearly identical in 2002, with 787 units. In 2003 this number increased again to 877 units. Single family building permits in 2004 reached a total of 1,104, which is its highest level since the late 1980's. The average for the past 5 years is 890 units per year. (Refer to **Table 2** on the preceding page).

Without an adequate supply of new construction projects, the shortage of housing typically causes prices in general to move up. As a result, those at the bottom end of the income scale usually find it most difficult to purchase real estate. Due to the low number of housing starts during the 1990's, today's supply is lagging behind demand and is a significant limiting factor in the affordability of real estate in the Maui market.

Hawaii Housing Policy Study

In comparison to the supply survey conducted by the Consultant, the Hawaii Housing Policy Study 2003 indicated that approximately 2,573 housing units will be built over the next five years, from 2006 to 2010, an average of 514.6 units per year. This was calculated from the projected total housing units as indicted by the Hawaii Housing Inventory Report. It is also similar to the average number of units absorbed by the market over the past 10 years. This count will be explained later in this report. This inventory report is based on the standing inventory of housing units in 2002 and forward projections of

housing units. Over the next 19 years to 2024, the total resident housing supply will total 10,692 units.



RESIDENTIAL DEMAND CHARACTERISTICS

Demand is analyzed from two perspectives: The first is "demographic" demand, the number of units needed for a given market or employment base. Second is "effective" demand, the financial demand equation which involves looking at the number of buyers who would be qualified and interested in purchasing residential real estate.

Population

Population growth on Maui between 1980 and 1990 had been exceptionally high, and had outpaced the County's ability to provide adequate infrastructure and housing for this added number of people. Overall, population growth for the County of Maui during 1980 to 1990 was 41.67 percent. With this growth in population came a surge in real estate prices in the late-1980s. This increase, driven primarily by foreign and domestic investment and speculation, put the price of homes in Maui County well above the reach of many local residents, and affordable housing became a major concern to everyone.

The downturn in the economy between 1991 and 1997 led to the development of lower-priced housing as large land parcels became more affordable to developers. Zero-lot-line zoning was adopted by the County of Maui and the Meadowlands project in Kihei was among the first to be built. Three smaller zero-lot-line subdivisions were developed in West Maui between 1996 and 1998 and were highly successful. The only Zero Lot Line subdivisions in Central Maui were the Kaimana Subdivision in the Kehalani Project District and Luana Gardens in Kahului.

Meanwhile, the population of Maui County continued to grow during the 1990s. Between the 1990 and 2000 censuses, Maui's population increased by 28.5 percent, making it the fastest growing county in the State of Hawaii. According to Claritas Market Comparison Report (See **Exhibit A** at the end of this report), leading the growth on Maui was the South Maui region of Kihei which reflected a 51.3 percent increase over the 10-year period. The subject's Central Maui region of Kahului and Wailuku registered growth of 26.0 percent; while the West Maui region indicated a growth factor of 23.3 percent over the same 10-year period. The growth trend has continued since the end of 2000. The 2006 population estimates have indicated growth rates for South and West Maui in the 13 percent range, while growth in Central Maui has increased by approximately 11 percent over the respective population indicated in the 2000 census.

The growth in the number of households in these regions paralleled the population pattern. Household numbers grew in the south, west and central regions at the respective rates of 53.5, 23.9 and 26.4 percent.

According to the Population and Economic Projections for the State of Hawaii to 2030, the projected population of Maui County is expected to be 199,550 by the year 2030. This represents a 54.7 percent increase over the 2000 census numbers.

Employment and Household Income

The unemployment rate on Maui has been on a decline since 1992, when unemployment was at 8.0 percent. In 1998, the unemployment rate was 6.2 percent, while most recently in 2004 this rate was at 3.1 percent. (Maui County Data Book 2005, Page 173).

Household income figures have also been increasing. The estimated median annual household income for Maui in 2006 is $56,370 (Source: Claritas), a rise of approximately 14 percent over the 1999 median annual household income of $49,489 (Source: US Census 2000) and a 45 percent increase over the 1989 figure of $38,771 (Source: US Census 1990). During the seven year period from 2000 to 2006, this represented an average increase of approximately 2 percent per year.

In comparison, and further described below, re-sales in the Wailuku Parkside Subdivision have indicated prices appreciating at a rate of approximately 24 to 40 percent per year during the similar time frame. With home prices increasing at a faster rate than household incomes, many potential buyers are quickly priced out of the market.

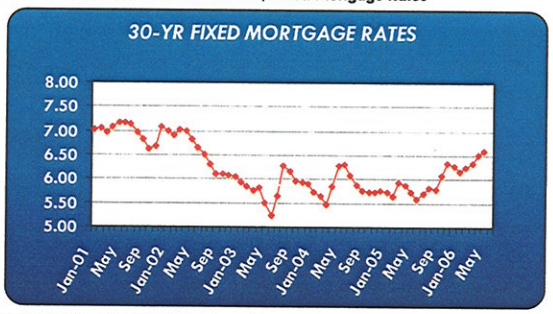
Mortgage Interest Rates

Mortgage rates were steadily decreasing for the past six years and momentarily dipped to around 5.00 percent in 2003. Recently, rates have been rebounding, and as of June 20, 2006, the average interest rate on 30-year, fixed-rate mortgages was at 6.26 percent, according to Bankrate.com.

The recent bounce in mortgage rates was spurred by rising yields in the long term Treasury bond market. In addition, short term interest rates have been rising due to concerns of inflation by the Federal Reserve Board. A constraint on oil production in the Middle East has led to a rise in fuel prices, as well as prices for consumer goods. This has a considerable effect on Hawaii due to the increased cost of shipping.

Housing markets throughout the nation have risen in the past five years, but have recently showed signs of stabilization due to the rising interest rate environment. The current mortgage rates are still at historically low levels which are still very conducive to home buying (See **Table 3** below).

Table 3 - Historical Trend of 30 Year, Fixed Mortgage Rates



Source: Freddie Mac-Primary Mortgage Survey

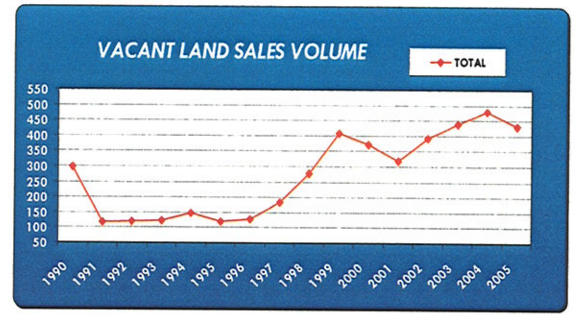
General Residential Sales Activity – Island of Maui

The number of units sold is the most basic indicator of market activity and is useful in helping estimate the number of new units which a specific market segment may be capable of absorbing. The downturn in the economy between 1991 and 1998 led to development of low-priced housing on Maui. Zero-lot-line housing projects were popularized during this period as developers strived to make housing affordable to Maui residents. Since 1998, however, real estate began a strong recovery. As evidenced in the following section, prices and number of sales increased while marketing times decreased. The tables on the following pages illustrate the general market trends over the past 16 years on Maui, as well as the year-to-date 2006 sales activity.

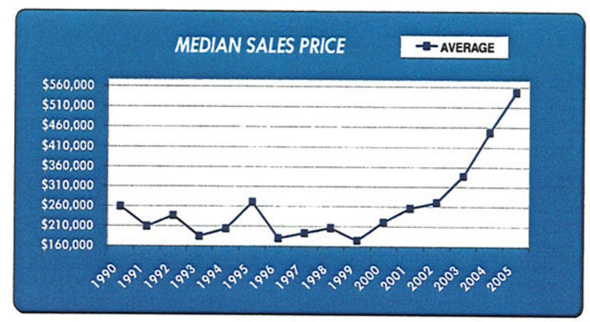
<u>Vacant Land</u>

Sales of vacant land fell sharply after 1990 (298) to a level wavering around 100 to 150 sales for the next 6 years. Weakest sales, in terms of units sold, occurred in 1991 when only 116 properties were sold. In 1998, the number of land sales increased to 276 and in 1999, increased again to 408, reflecting a gain of 48 percent. Sales had fallen slightly since 1999 with 372 sales in the

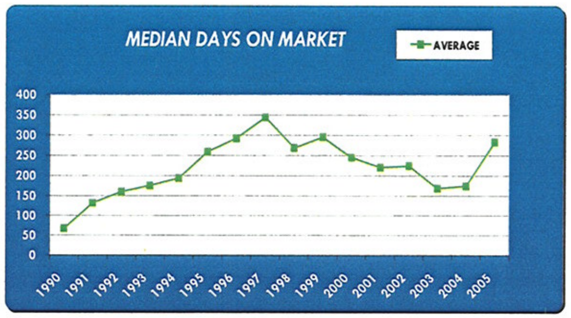
year 2000 and 318 sales in 2001; however, these figures rebounded in 2002, 2003 and 2004 to 393, 439 and 479, respectively. Vacant land sales for 2005 showed a slight decrease at 429 transactions.



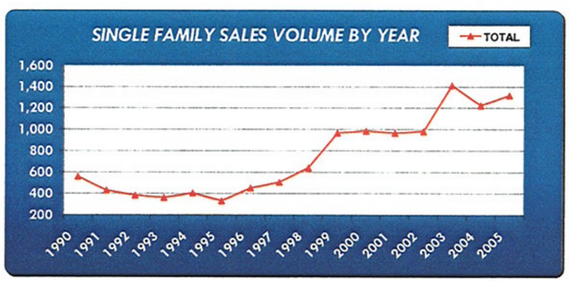
Meanwhile, median prices slowly regained ground from a low of $173,458 in 1999 to $269,691 in 2002, and then sharply increased to $336,690 in 2003, $446,563 in 2004, and $546,081 in 2005.



Median monthly days-on-market figures increased steadily from 67 in 1990 to 352 in 1997, but had fallen to 225 in 2002, to 168 days in 2003, increasing slightly to 174 days in 2004. This average escalated in 2005 to 283 days.

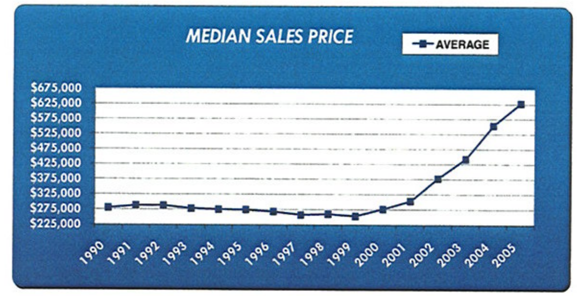


Single-Family
Sales of single-family properties exhibited a decrease after 1990 (560) to a level wavering around 350 to 450 sales for the next 6 years. Weakest sales, in terms of units sold, occurred in 1995 when only 331 properties were sold. In 1997, the number of single-family sales increased to 507 and in 1998, exceeded 1990 results with a figure of 641. The number of sales in 1999 (965 units) was 51 percent more than the number of sales in 1998 (641). Sales were slightly higher in 2000 at 981 units sold, but leveled off in 2001 at 964 units and 978 units in 2002. Sales sharply increased in 2003 to 1,411 transactions, and then decreased slightly in 2004 to 1,221, before climbing to 1,317 transactions in 2005.

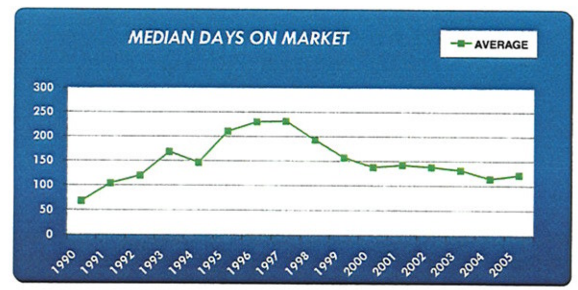


Median prices in 2001 showed a 9.5 percent increase from $275,620 in the year 2000, and reached a high for the past decade with a median of $302,022. In 2002, the median price increased even more to a level of $377,361, an enormous increase of 25 percent over

2001. Median prices for 2003 indicated an increase of about 17 percent to $441,921; then another large 25 percent increase to $552,833 in 2004. This trend continued in 2005, with a median sales price of $627,123, translating into a 13 percent increase.

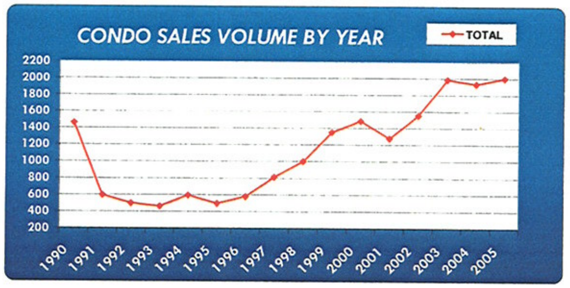


Average monthly days-on-market figures increased steadily from 67 in 1990 to 231 in 1997, but steadily fell to 137 in 2000. It has remained relatively level since that time, except in 2004 when that figure fell to 114 days, before rebounding to 121 days in 2005.

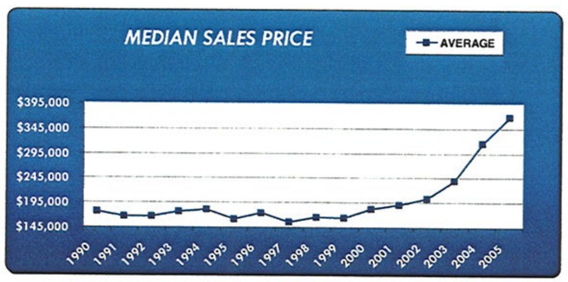


Condominiums
Sales of condominium units fell sharply after 1990 (1,459) to a level wavering between 400 to 600 sales for the next 6 years. Weakest sales, in terms of units sold, occurred in 1993 when only 461 properties were sold. In 1997, however, the number of sales increased to 812 and up to a record number of 1,986 units in 2003.

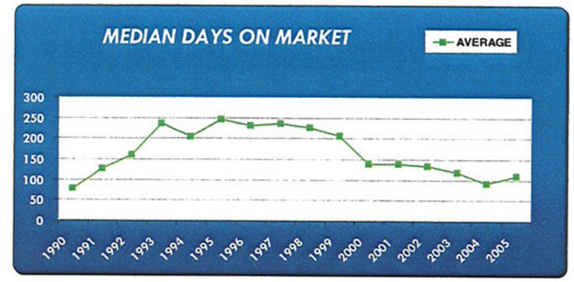
2004 showed a drop in sales, to 1,933 units. This was followed by another high volume year in 2005, with 2,000 units sold.



Median prices remained in a range from $154,296 to $180,892 between 1990 and 2000. However, since then, the average monthly median price increased 5 percent to $190,321 in 2001, 6 percent to $201,623 in 2002, and 19 percent in 2003 to $239,217. 2004 indicated a sharp increase of 31 percent, with an average median price of $314,052, followed by a 17 percent gain in 2005, to $367,656.



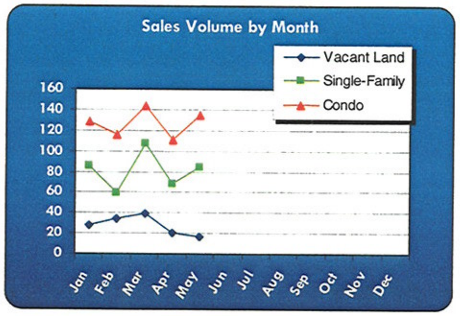
Average monthly days-on-market figures increased steadily from 77 days in 1990 to 230 days in 1996, but had decreased considerably to 134 days by the end of 2002. This figure fell to 118 days in 2003, then to 92 days in 2004, before rebounding to 109 days in 2005.



The year-to-date 2006 Maui sales figures for vacant land, single-family and condominium units are shown on the next page. While the median sales price for condominium unit continue their upward trend, prices for single family properties and vacant land have stabilized since reaching their peaks in mid-2005. Sales volume for all types of property has been on a decline since mid-2005, or around the same time that mortgage rate started their latest upward push. Despite the short term volatility, the long term trends for median prices and sales volume should still show increases over a year-to-year basis. The average days on market had been on a steady decline since 2000, before increasing in late 2004 to early 2005, primarily for vacant land. It is noted that marketing times for vacant land have shown great volatility over the past 9 months, which may show its sensitivity to speculation. However, the stability of marketing times in 2005 for single-family and condominiums, still indicates a strong demand for owner occupant and rental properties.

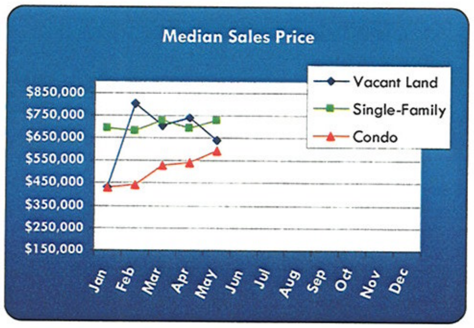
SALES VOLUME BY MONTH

2006	Vacant Land	Single-Family	Condo
Jan	28	86	129
Feb	34	59	116
Mar	39	107	143
Apr	20	68	111
May	17	84	135
Jun			
Jul			
Aug			
Sep			
Oct			
Nov			
Dec			



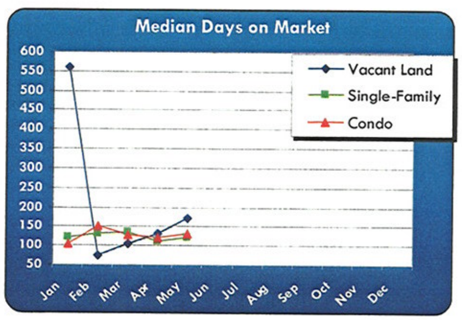
MEDIAN SALES PRICE

2006	Vacant Land	Single-Family	Condo
Jan	$430,000	$690,500	$430,000
Feb	$800,000	$680,000	$438,325
Mar	$701,000	$725,000	$530,250
Apr	$735,800	$690,000	$539,000
May	$640,000	$727,000	$590,000
Jun			
Jul			
Aug			
Sep			
Oct			
Nov			
Dec			



MEDIAN DAYS ON MARKET

2006	Vacant Land	Single-Family	Condo
Jan	558	121	103
Feb	75	132	152
Mar	104	134	127
Apr	131	110	121
May	173	122	132
Jun			
Jul			
Aug			
Sep			
Oct			
Nov			
Dec			



Historical Project Absorption

In addition to the absorption rates of the individual projects, research was also conducted to give a historical look at the total residential inventory absorbed on a year to year basis. This survey included large projects that are typically put on the open market. These projects included single family residential homes, residential house lots, condominium projects, as well as agricultural subdivisions. It is also known that individual property owners occasionally subdivide tracts of land and sell off the lots to relatives or to a private list of purchasers. These types of projects are difficult to track and have not been included in the survey. The intent of this survey was to provide an indication of the real estate market's ability to absorb new inventory on an annual basis.

Within the past 5 years, the real estate market has been steadily increasing in terms of sales volume as well as sales prices. In 1999 668 new units were purchased. This number dropped to 283 in 2000 and has been on a steady climb up to 2003. In year 2003, the real estate market absorbed a total of 845 new housing units. In 2004, this number dropped again to 395 units. However, this drop proved to be temporary as numerous projects in Central and South Maui were completed and a total of 819 units closed in 2005. These projects included Ohia, Maunaleo, Iliahi, and Kehalani Gardens within the Kehalani Project District as well as the Sand Hills Estates and Legends in the Maui Lani Project District. In addition, Hale Kanani and Wailea Beach Villas were completed in South Maui. There were a few projects in West Maui that were completed in 2005 and included Mahanalua Nui Phase IV, Honolua Ridge and the Villas at Kahana Ridge. Lanikeha in Kaanapali closed a third of their lots in 2005 and has continued into 2006. This survey only included the original sales of units within new projects.

During the six year period between 2000 and 2005, there has been an average of approximately 626 units sold each year. By dividing the supply available in the market by this average, an estimate of the remaining years of current supply can be determined. This demand is expected to continue in the near future as the release of supply in the market has been met with great interest. However, due to the recent stabilization of the real estate market, it should be expected that sales may not be as brisk as in the past. The Cottages at Kehalani has approximately 470 interested parties for their 114 homes while Akolea at Kehalani has 120 names for their 97 homes. Both of these projects have just begun their marketing within the past two months. The Legends at Maui Lani, Phase II are selling their all of their homes as they are released for sale.

Table 4 - Units Absorbed Per Year (Central Maui)

	Type	Units	Year 1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Closed
KAIMANA	S	177	50	55	11	1	2	1					120
GREENS	L	217	38	67	104	8							217
IAO PARKSIDE IV-B	C	52	11	14	14	5	6	1	1				52
IAO PARKSIDE IV-C	C	52		2	1	3	5	41					52
NANEA	S	90		20	70								90
GRAND FAIRWAYS	L	36			31	5							36
IAO PARKSIDE IV-A	C	13			4	7	2						13
GRAND FAIRWAYS NORTH	L	79				57	22						79
WAILUKU PARKSIDE	S	119				31	87	1					119
THE ISLAND SCHULER PHASE I	S	55				1	24	30					55
THE ISLANDMAUI LANI PHASE I	L	44				10	23	10	1				44
OLENA	S	31					7	24					31
THE ISLAND MAUI LANI PH II	L	35						35					35
THE ISLAND SCHULER PH II	S	53						9	44				53
WAILUKU COUNTRY EST	L	184							175	6			181
WAIOLANI ELUA	L	25							20	3			23
BLUFFS													
MAUI LANI	L	15							6	9			15
SCHULER	S	21								7	14		21
OLENA II	S	32								32			32
LEGEND	S	139								47	90		137
OHIA AT KEHALANI	S	140									131		131
MAUNALEO AT KEHALANI	S	82									49	15	64
ILIAHI AT KEHALANI	C	92									57	24	81
KEHALANI GARDENS	C	132									83	37	120
KOA AT KEHALANI	L	72									14	21	35
NEW SAND HILLS	L	108									84	13	97
OHIA AT KEHALANI PH II	S	44										0	0

Table 5 - Units Absorbed Per Year (West Maui)

	Type	Units	Year 1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Closed
KAHANA RIDGE	L	228		32	195			1					228
KAUHALE MAHINAHINA	S	19			19								19
MAHANALUA NUI (I to III)	L	104			33	10	19		41	1			104
VINTAGE	C	73				3	70						73
KE ALII SUB'D III	L	12				7	1	4					12
PINEAPPLE HILL II	L	30				12	8	9	1				30
MAKILA I	L	19						19					19
OLOWALU MAKAI	L	5					1	4					5
OLOWALU MAUKA	L	14						8	6				14
COCONUT GROVE AT KAPALUA	C	36					36						36
PUUNOA SUBDIVISION	L	14					14						14
KAHANA NUI SUB'D (HUA NUI)	L	17					16	1					17
PINNACLE	C	33					5	8	8	12			33
SUMMIT													0
Phase I	C	18					5	11	2				18
Phase II (Pulled off Market)	C	17								17			17
Phase III	C	19							19				19
NAPILI VILLAS PH I	C	100						100					100
NAPILI VILLAS PH II	C	44						44					44
KE ALII SUB'D I	L	15						12	3				15
KAPUA VILLAGE	L	45						10	35				45
NAPILI VILLAS PHIII	C	40							40				40
MAKILA II	L	24								24			24
HONOLUA RIDGE	L	25								17	8		25
VILLAS AT KAHANA RIDGE	MF	117									87	27	114
MAHANALUA NUI IV	L	36									30	1	31
LANIKEHA	L	139									47	32	79

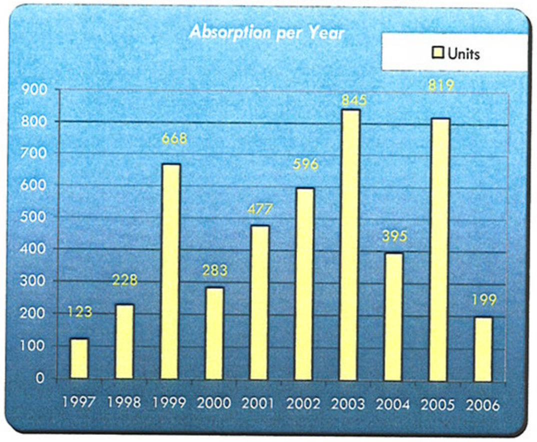
Table 6 - Units Absorbed Per Year (South Maui)

	Type	Units	Year 1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Closed
WAILEA PUALANI	L	92	2	10	19	29	5	1					66
WAILEA FAIRWAY ESTATES	L	50	2	2	2	2			1	26			35
MEADOWLANDS	L	32	20	5									25
MAKENA PLACE	C	10		1	2	2	2	2	1				10
KAMAOLE HEIGHTS	L	40			40								40
MEADOWLANDS II	L	88			63	25							88
WAILEA FAIRWAY VILLAS	C	118			56	62							118
PIILANI VILL II	S	114					112	2					114
MALUHIA AT WAILEA	C	14					5		1	3	2	1	12
KE ALII KAI	S	96						61	35				96
KENOLIO (KAONOULU) ESTATES	S	51						45	6				51
NA HALE O MAKENA	C	40						13	24	3			40
KEAHOU AT MAKENA	L	7						6		1			7
PIILANI VILL III	S	117							117				117
HONU ALAHELE	L	64							64				64
KILOHANA RIDGE	S	73							69	4			73
KILOHANA HEMA	L	29							28	1			29
VILLAS AT KENOLIO	C	140							61	77			138
ONE PALAUEA	L	17							1	8	8		17
ALII VILLAGE	L	27								27			27
KENOLIO MAUKA		12								12			12
HALE KANANI	C	72									70	2	72
WAILEA BEACH VILLAS	C	98									34	26	60

Table 7 - Units Absorbed Per Year (Upcountry/East Maui)

	Type	Units	Year 1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Closed
HAIKU MAKAI	L	27		20	4	3							27
MAUNAOLU PLANTATIONS	L	39						27	12				39
RESIDENCES AT KULAMALU	L	57						56	1				57
NORTH SHORE VILLAGE	S	23							22	1			23
RIDGE AT KULAMANU	L	57								57			57
KULAMALU HILLTOP (DOWLING)		11									11		11

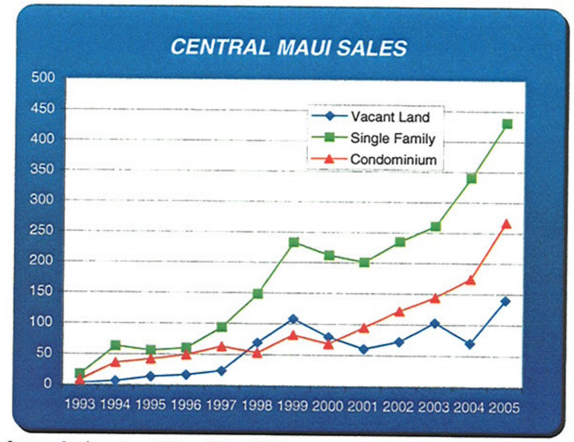
Table 8 - Total New Project Absorption 1997 to YTD 2006



Historical Resale Activity In Central Maui (Past 6 Years)

According to the Realtors Association of Maui, Multiple Listing Service, there has been an average of 512 sales of condominium, residential and vacant land properties in Central Maui (Wailuku and Kahului) over the past six years. During this period, the number of vacant land sales ranged from 60 in 2001 to 140 in 2005, with an average of approximately 87 sales each year. Condominium units ranged from a low of 68 in 2000 to 267 units in 2005, showing a steady increase each year. Single family properties ranged from 201 in 2001 to 431 in 2005. Each of the last two years saw increases of 30 percent over the previous year.

	2000	2001	2002	2003	2004	2005	Total
Vacant Land	79	60	72	103	70	140	524
Condo	68	95	122	144	174	267	870
Single Family	212	201	235	261	340	431	1,680
Total	359	356	429	508	584	838	3,074



Source: Realtors Association of Maui MLS

Judging from the number of sales from previous years, it appears that the real estate market has the capacity to absorb the subject's 949 units fairly easily. When compared to the sales volume for the entire Island of Maui, volume for Central Maui properties have been continually increasing while sales for the entire island (Central Maui included) have stabilized. This is a good testament to the desirability of the Central Maui location.

Historical Resale Activity Central Maui (Past 12 Months)

Condominiums Units

Since the subject development will contain Multi Family units, analysis of the market for condominium units in Central Maui was conducted. The sales included all condominium units that were sold within the past year. This time frame was determined to be appropriate since it gives a current look at the market. There were a total of 291 sales of condominium units with prices ranging from $109,500 for a one bedroom/one bath unit at 341 North Market Street to $800,000 for a leasehold oceanfront unit at Milowai. The median sales price was $285,000 while the average bedroom and count was approximately 2 bedrooms and 2 baths. The average living area for the units was 865 square feet, not including lanai and porch areas. Of all the property types, condominium units had the lowest marketing time with an average of 172 days on market.

Analysis of the results of this research indicated that 123 of these sales were original developer sales in the Kehalani Gardens project. Of the remaining sales the most abundant occurred in the Harbor Lights project in Kahului, located across of Kahului Harbor. There were 50 sales in this project with an average price of $190,830. In 2001, the average price of a unit in Harbor lights was approximately $45,000. Another active project was the Iao Parkside Condominiums, which had a total of 40 sales over the past year. The average price in this project was approximately $330,250.

Vacant Land

Early indications from the developer suggest that the single-family component will consist of 7,500 to 10,000 square foot "production" house lots, in addition to 10,000 to 12,000-plus square foot custom house lots. Ohanas will not be allowed on any of the lots.

Over the past year there were 138 sales of vacant land with a median price of $375,875. The average land area was 27,250 square feet. There are numerous single family subdivisions with lots in the 10,000 square foot range as well as agriculture subdivisions with lots containing 2.00 acres or more of land area.

Research on the MLS indicated that of these 138 sales of vacant land, 96 were from the Sand Hills Estates Subdivision and all of these appear to be original developer sales. This subdivision is located along the Dunes at Maui Lani Golf Course, off of Maui Lani Parkway. These sales ranged in price from $294,000 to $495,000 and ranged in size from 7,561 to 16,999 square feet in size. However, the 16,999 square foot parcel, which sold for $352,000, is not representative of the typical lot size for the project. Most of the lots within Sand Hills Estates are between 8,000 to 12,000 square feet, which is similar to what will be offered by the subject.

The research also showed that there were a total of 24 agriculture lot sales within the Wailuku Country Estates Subdivision and another 3 sales in the Maluhia Country Ranches Subdivision. Wailuku Country Estates is a 184 lot agricultural subdivision overlooking Happy Valley and was completed in 2003. This subdivision was highly successful and sold out almost immediately, closing the majority of their lots in 2003. Over the past year, sales in this subdivision ranged from $545,000 to $750,000, with most occurring in the $625,000 to $650,000 range. The sales in the Maluhia Country Ranches

Subdivision consist of lots from 3.5 to 5.68 acres in size, but are usually afforded good ocean views despite their usually irregular terrains. The subdivision is located approximately 7 miles north of Wailuku Town and access is somewhat difficult, as the narrow roadway winds along steep cliffs. Recent sales prices range from $600,000 to $825,000.

Single Family

Since the subject will also offer house and lot packages, the Consultant found it important to look at sales of single family homes in the market. A total of 353 transactions in Central Maui were shown during the past year. The sales prices ranged from $225,000 for a 616 square foot house on Momi Lane in Wailuku to $1,450,000 for a 2,948 square foot house with an ohana unit in the Maluhia Country Ranches subdivision in Kahakuloa. The median sales price was $600,000, with an average living area of approximately 1,615 square feet. The room count was about 3.4 bedrooms with an average of 2.3 baths.

Further review of the data indicated that 30 of the original closings for the Legends at Maui Lani were included in this list, in addition to 72 of the original closings for the Maunaleo at Kehalani Subdivision.

Notable subdivisions with re-sale activity include Leisure Estates, Wailuku Parkside, Kaimana, Greens, Grand Fairways North, Island and Bluffs at Maui Lani, Waiehu Terrace, Waiehu Heights, Wailuku Heights, and Kahului PUD.

Project Sales in Central Maui

The success of projects in Central Maui can be attributed to their location with respect to governmental agencies, transportation facilities, and commercial and professional services. New developments like the proposed subject often create excitement in the market, especially when the product is perceived to offer a particular value to the buyer. Project sales in Central Maui, at all price levels, have met good demand from the market in recent years. As shown in **Table 9** on the following page, absorption rates have been rapid in recent years. In many subdivisions, especially the lower-priced homes, the residences are immediately reserved and waiting lists are as long as the reservation list. The long waits in line to secure a spot on the reservation list and lottery systems are well-documented for recent Maui housing projects.

Ohia at Kehalani and Maunaleo each had waiting list of approximately 300 names and closing rates were 9.42 and 6.69 homes per month, respectively.

Another example that stands out is Spencer Homes' affordable single-family subdivision in Waikapu. This project, named Waikapu Gardens, is planned for approximately 410 single-family homes, of which 50 percent will be affordably priced to those households earning up to 120 percent of the median household income. Prior to the start of construction, the developer had approximately 3,500 families on his waiting list.

Developers have been pressed to speed up the construction process due to the heavy demand. It goes without saying that supply is the limiting factor in the current real estate market. Release of more supply into the market such as those that are proposed by the subject's 949 units should be well received, based on historical information. Additionally, the added competition in the market may have a secondary effect of stabilization or even lowering of prices in the region. This in turn will help make housing more affordable to Maui's residents.

Table 9 - Central Maui Projects

No.	Project Name Location	No. of Units	Project Type	Lot Size	Living Area of Dwellings	Price Range	Closing Time in Months	Units Sold	Units Sold Per Month
1	Ohia at Kehalani Wailuku, Maui, Hawaii Towne Dev of Hawaii	140 House and Lot Packages	Single Family	3,759 to 12,534 SF	1,308 to 1,860 sf	$350,000 to $775,000 (2/05 to 4/06)	13.91	131	9.42
2	Maunaleo at Kehalani Wailuku, Maui, Hawaii Stanford Carr Dev	83 House and Lot Packages	Single Family	6,301 to 16,082 SF	1,408 to 2,152 sf	$435,900 to $839,000 (6/05 to 4/06)	9.57	64	6.69
3	Iliahi at Kehalani Wailuku, Maui, Hawaii Towne Dev of Hawaii	92 Condominiums	Lowrise Condos	N/A	1,242 to 1,258 sf	$292,200 to $433,795 (8/05 to 2/06)	5.82	81	13.92
4	Kehalani Gardens Wailuku, Maui, Hawaii Stanford Carr Dev	132 Condominiums	Lowrise Condos	N/A	935 to 1,133 sf	$190,600 to $470,000 (5/05 to 5/06)	11.28	120	10.64
5	Koa at Kehalani Wailuku, Maui, Hawaii Towne Dev of Hawaii	72 House Lots	Single Family	7,900 to 21,675 sf	N/A	$390,000 to $486,000 (10/05 to 6/06)	8	35	4.38
6	Olena at Kehalani Ph II Wailuku, Maui, Hawaii Stanford Carr Dev	32 House and Lot Packages	Single Family	6,040 to 8,516 sf	1,328 to 1,681 sf	$320,410 to $505,000 (7/04 to 11/04)	3.45	32	9.28
7	Maui Lani The Legend Schuler Homes	House and Lot Packages 139	Single Family	3,072 to 6,767 SF	1,286 to 1,930 SF	$321,000 to $633,000	11.94	137	11.47
8	Maui Lani The Bluffs	36 Lots and House and Lot Packages	Single Family	8,190 to 12,538 sf	N/A	$250,000 to $972,000	15.68	36	2.30
9	Iao Parkside IV-C Wailuku, Maui, Hawaii Schuler Hawaii	40 Condominiums	Lowrise Condos	N/A	543 to 1,111 sf	$100,000 to $165,000 (3/02 to 6/02)	3	40	13.23
10	Waiolani Elua Waikapu, Maui, Hawaii Waiolani Elua, Inc.	25 House Lots	Single Family	7,500 to 10,831 sf	N/A	$134,000 to $169,000	7 6/2003 to 1/2004	23	3.29
11	Olena at Kehalani Wailuku, Maui SCD Development	31 Lots	Single Family	6,000 to 8,000	1,302 to 1,681 sf	$245,000 to $318,000	7	31	4.43
12	Nanea at Kehalani Wailuku Spencer Homes	80 House and Lot Packages	Single Family	6,030 to 8,050 sf	1,144 to 1,717 sf	$179,900 to $255,793	8 11/98-7/98	78	9.75
13	Maui Lani (Maui Lani Dev.) Phase IV Maui Lani Development	75 House Lots	Single Family	5,647 to 12,522 sf	N/A	$79,000 to $92,800	12	75	6.25
14	Maui Lani (Schuler Hawaii) The Island Phase I Phase II	House and Lot Packages 56 53	Single Family			$339,500 to $410,500	19 7	56 36	2.95 5.14
15	Wailuku Parkside Wailuku SCD International	119 House and Lot Packages	Single Family	6000 to 11,502 sf	1,267 to 1,694 sf	$179,900 to $285,000	17 12/99-5/01	119	7.00

Price Appreciation

The Consultant analyzed recently completed subdivision sales in Maui to illustrate the rate of price appreciation. We specifically focused on single family subdivisions, condominium projects, and residential house lot subdivisions in the Central Maui neighborhood to give an indication of the demand for housing and its affect on prices within these projects. These developments were selected knowing that these products represent moderately priced market developments.

In Central Maui, our focus on single family and condominium projects included re-sales in the Olena and Wailuku Parkside subdivisions, as well as re-sales in the Iao Parkside Phase IV-C. These are among the most recently completed projects in Central Maui and the price appreciation of re-sales in these projects provides a good representation of the demand for residential units.

Wailuku Parkside – Original closings ranged from $183,585 to $313,019 between September 2000 and February 2002. Since then there have been many re-sales with the most recent reaching $699,000. Analysis of the individual sales indicates that the prices are about 70 to 185 percent greater than original sales prices. On average, the increase was about **125 percent** more than the original sales prices. On a monthly basis, these sales indicated price increases of **1.96 to 3.35 percent per month**, or **24 to 40 percent per year.**

Olena Phase I – Further comparisons were made between the average sales price at Olena Subdivision Phase I, within the Kehalani Project District. The original prices at Phase I averaged about $287,267 and all of the lots closed between October of 2001 and April 2002. In 2004, the most recent sales within this subdivision have seen gross increases ranging from **40 to 111 percent** higher than original prices. Calculated on a monthly basis from the original sale to the most recent sale, the price increase ranged from **1.62 to 3.37 percent** per month.

Iao Parkside Phase IV-C – This is the most recently completed condominium project in Central Maui and original sales prices ranged from $100,000 to $165,500. According to public records there have been numerous re-sales beginning in May of 2004. These re-sales indicated increases of approximately **77 to 169 percent** over the original prices. On a monthly basis, these resulted in increases of **2.42 to 3.59 percent** per month.

In addition to these well established projects, re-sales in recently completed Kehalani projects are showing even higher appreciation rates when looked at on a per month basis.

A resale at the Iliahi at Kehalani condominium project in April of 2006 showed a gross increase of **33 percent** over a three month period. This calculated to be an increase of **11 percent** per month.

Another resale of a condominium unit in the Kehalani Gardens project showed multiple sales of a unit over a 3.5 month period. The first resale occurred **less than a month** after the original close and indicated a sales price that was **50 percent** higher. The next sale occurred approximately 2.5 months later and indicated a price only **5.6 percent higher** than the previous sale. Despite the slower appreciation rate, the price of the last sale in February 2006 indicated a 57 percent increase over the original sales price, which calculated to an appreciation rate of **16 percent** per month.

Further evidence of the demand for Central Maui homes can be seen in the appreciation of properties at the Maunaleo project. Since the first closing in April of 2005, there have been 14 re-sales within this project. More significant is the appreciation of the prices. Although two properties were sold for modest gains of 6 percent each, 11 sold with gross increases of **26 to 68 percent.** Three of these sales closed almost immediately after the original closing for gains of 26, 30 and 52 percent. The other re-sales indicated monthly appreciation rates of **6.7 to 34.2 percent per month.** The Consultant notes there was also one conveyance which re-sold for 3 percent less than the original sale; however this was more than likely not an arms length transaction.

Re-sales could have been researched for many older projects in Central Maui, but the emphasis of this analysis is the demand by purchasers of new homes and the nearly immediate increases in prices in these projects.

Re-sale prices in recently completed projects in the Kehalani Project district are increasing at a rapid pace despite original closings less than one year ago. Gross increases range from 6 to 68 percent with most clustering around the 30 to 40 percent range. On a per month basis, these increases are among the highest experienced at 2.0 to 34.2 percent per month, with some immediate resales showing increases of 26 to 68 percent.

Typical monthly increases in this strong market are 2 to 3 percent per month. Re-sales in established single family subdivisions and condominium projects in Wailuku supported these increases and revealed annual appreciation rates of 40 to 140 percent between 2000 and 2005.

Market Demand for One Bedroom Units And Multiple Bedroom Units

Ma`alaea Mauka is projected to have an assortment of attached multi-family housing options, including apartments and townhouses. In an effort to illustrate how the market has historically received these different unit types, the Consultant conducted a study of sales of one-bedroom and two/three-bedroom condominium units. Conveyances from 2000 to 2005 were analyzed, with primary focus being Central Maui.

<u>One Bedroom Units</u>– From 2000 to 2002, sales ranged from approximately 30 to 35 units per year. This doubled between 2003 and 2005, when annual sales escalated to approximately 60 to 65 units. The average sales price showed annual increases, from $87,966 in 2000, to $268,067 in 2005. Conversely, the average days on market dropped each year, with the exception of a slight increase, less than 10 percent, in 2005.

<u>Two/Three Bedroom Units</u> – Sales of these types of units also increased yearly, from approximately 70 in 2000 to a high of 265 in 2005. Average sales prices also exhibited annual gains, going from $126,079 in 2000, to $292,235 in 2005.

Days on market dropped from 264 days in 2000 to 116 days in 2004, but showed an almost 20 percent increase to 138 days in 2005. At first glance, this could have indicated a stabilization of the market. However, further research revealed that the higher days on market was caused by developer sales from the Kehalani Gardens project, in Wailuku. For new project units, the recorded days on market often reflects the time from when the contract was signed, until the day the sale closed. If construction is still underway, as was the case with Kehalani Gardens, an inflated number of days on market could be represented. After extracting the Kehalani Gardens sales, the average days on market for 2005 was actually only 88 days.

<u>Comparison of Unit Types</u> – When comparing the two different unit categories, the Consultant observed that while the average price of a one-bedroom unit was 43 percent lower than a two/three bedroom unit in 2000, it was only 11 percent less in 2005. During this period, the average price for a one-bedroom unit in Central Maui increased by 205 percent while the average price for two- and three-bedroom units increased by 132 percent. On the entire island of Maui the increase in prices between one-bedroom units and two- and three-bedroom units showed similar results with one bedroom units increasing by 130 percent while two- and three-bedroom units

increasing by only 69 percent. By looking at price increases over the past 6 years, it appears that the relative demand for one-bedroom units outpaced demand for two- and three-bedroom units.

Furthermore, although the average sales price of a one-bedroom unit had continued to climb through 2005, the number of transactions and days on market remained stable since 2003 posting only modest gains in sales volume in Central Maui while actually showing decreasing sales on the entire island. This could not be said for two/three-bedroom units, which had showed yearly increases in sales numbers and average sales price through 2005, while at the same time exhibiting a continuous annual drop in days on market. In Central Maui, the increase in sales volume far outpaced sales of one-bedroom units with an increase of 290 percent during the past six years compared to an increase of only 106 percent for one-bedroom units. On the entire island of Maui, two- and three-bedroom units showed an increase of 51 percent in 2005 over 2000 sales levels.

Based on these observations, it appears that while the one-bedroom product is still being purchased, the units have possibly reached the high side of the price range that the market is willing to bear. Furthermore, since the price difference between the smaller and larger units is so much less today than it was in 2000, it would make sense for a potential buyer to consider the larger unit, if it is within their purchasing ability.

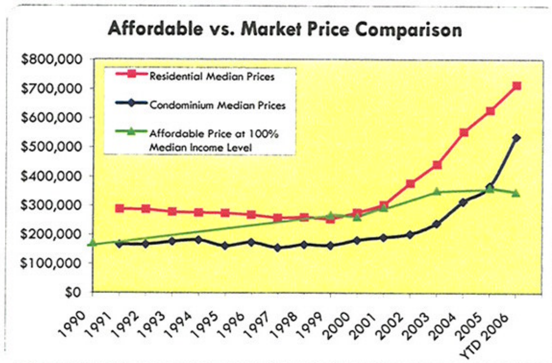
The one-bedroom apartments planned for Ma`alaea Mauka should be well received by the market. If pricing has indeed reached the high end of its range, an infusion of new supply would surely create a more attractive purchasing environment. In recent years, there have been no condominium projects offering one-bedroom units. As for potential buyers and/or occupants for this type of product, those looking to downsize, such as retiring baby boomers and "empty nest" homeowners, come to mind. In addition, singles or young couples who are not ready to start families may also have an interest in a one-bedroom unit. Currently, this market segment has to compete for the few, available one-bedroom units on the market. Otherwise they are forced into two- or three-bedroom units which may stretch their budgets or may be entirely out of their price range. Research indicates that there are only 16 listings of one-bedroom units in Central Maui versus 71 listings of two- or three-bedroom units.

The project's two and three-bedroom apartments and townhouses are also expected to appeal to buyers. When compared to one-bedroom units, the added utility and convenience of a second or third bedroom is highly desirable. Couples who are starting families or those with existing families would probably also consider this type of housing option, when shopping for a conventional house. As previously mentioned, two and three-bedroom units continue to be purchased in higher numbers and for higher prices than previous years, while having spent less days on the market. The larger number of sales of two- and three-bedroom units may be due to the fact that recently completed condominium projects consist mostly of two- and three-bedroom units. The most recent of these projects include Napili Villas, Villas at Kahana Ridge, Iliahi at Kehalani, Villas at Kenolio and Hale Kanani. This suggests that pricing for two and three-bedroom units has not yet reached the high end of the range, and the market is still able to efficiently absorb this type of product.

Comparison of Affordable And Market Prices

An analysis was done to compare the increase in affordable prices to the increase in the median prices for residential and condominium units. The affordable price is based on the median income level for the County of Maui and typical mortgage interest rates and loan requirements. This calculation assumed a typical 80 percent loan to value ratio and a 35 percent debt to income level. Since 1990, interest rates have dropped from 10.13% to 6.37% as of July 2006. In addition to the steady increase in the median income level, lower interest rates allow housing to be more affordable. As shown in **Table 10**, the price which is affordable to earners of the median household income was compared to the median prices of residential and condominium prices in the market.

Table 10 – Comparison of Affordable and Market Prices



As income levels rose from 1990 to 2000, residential properties became more affordable to those earning the County's median income level, although it wasn't until 1999 that the median price for a residential property was actually lower than the price that can be afforded by a household earning the County's median income. During this period, the only option was to purchase a condominium unit, which for larger families can be less accommodating. In 2001, the nation's economy hit a recession, which was followed by the lowering of short term interest rates by the government. Consumer money flowed out of the stock market and into bonds and treasuries, which pushed long term interest rates lower. This caused a surge in demand for real estate, which sent prices skyrocketing within a few years.

By 2002, the soaring prices outpaced the County's median income level despite steadily falling interest rates. At the same time, condominium units were found to be a more feasible alternative and sales in this category started to pick up their pace.

From 2003 to today, sales prices for residential properties continue their climb to record levels, making it unaffordable for most of Maui's residents. Condominiums also began their record climb and by 2005 the median price surpassed the price that would be affordable to those earning the County's median income level.

By 2006, this situation has reached critical levels as prices for both residential and condominium units continue upwards. It does not help that mortgage rates have also been trending slightly upwards, which lowers the affordability to buyers needing to finance their purchase.

In past few years, when demand far exceeded supply, prices were driven upwards and many of Maui's residents could not afford to buy or even rent homes. To help alleviate this situation, more housing units should be brought to the market. The added supply may help to slow the rising prices, especially in categories where Maui's residents are being priced out of the housing market.

Residential Demand Model
(Survey of Short Term Supply)

An effort was made to measure the effective demand for the subject's 949 units. A model was developed that considered the increase of population and the current competitive supply in the market. This model is illustrated and discussed below.

Table 11 - Residential Demand Model

Housing Demand – *Central Maui*
Study Period 2006 – 2011

		Central Maui	*Maui Island*
1.	Population change during period (Maui Island)		11,637
2.	Population change during period (Central Maui)	3,955	
3.	Average household size (Maui Island)		2.88
4.	Average household size (Central Maui)	3.13	
5.	Total new housing units demanded (Maui Island) (#1 ÷ #3)		4,041
6.	Total new housing units demanded (Central Maui) (#2 ÷ #4)	1,264	
7.	# of subject type units demanded each year (#6 ÷ 5 (yrs))	253	808
8.	Market area supply of subject type units Market area annual supply	1,354	2,073
9.	Total market area residual demand (#6 – #8)	-90	1,968
10.	Duration of existing supply without subject (years) (#8 ÷ #7)	5.4	2.6
11.	Duration of existing supply with subject's remaining units (years) [(949 units + #8) ÷ #7]	7.5	3.2

Although the subject is situated in Ma`alaea and its primary market is Central Maui, the subject's secondary market area was determined to include the population centers of West and South Maui. Due to the island-wide demand for developable residential land on Maui, it was felt that interested buyers will come from all areas of the island. This is especially true because Central Maui is the center of employment for the island and Wailuku is home to the County seat of government. Furthermore, Kahului has the majority of the industrial lands on Maui as well as the airport and harbor facilities. In addition, the island's only full service hospital is also located in Kahului.

Island of Maui
Housing Demand Analysis
Over the next 5 years, the total population of Maui is expected to increase by 11,637 persons, while the expected average household size is projected to be approximately 2.88 persons per household. Based solely on this population increase, the total demand for housing units is projected to be 4,041 units over the next 5 years.

As mentioned earlier, the subject will have 949 units, consisting of single-family units, multi-family units, patio homes, apartments, and senior housing units. It was determined that buyers of such a wide range of product will be prospects in both the single-family and multi-family residential markets.

Based on the projected population increase of Maui, there would be a demand for 4,041 housing units over the next 5 years. It is estimated that there will be a current and near term supply of 2,107 units currently available on the market. Based on the average amount of demand for the next five years (808 units per year), this supply will last for 2.6 years. This resulted in a residual demand of 1,934 units over the next five years. This indicates that demand levels during this period will exceed the supply for homes by nearly a 2 to 1 margin.

Central Maui
Housing Demand Analysis
Central Maui is a highly convenient location with respect to its proximity to government buildings, such as the County, State and Judicial Buildings, numerous shopping centers, as well as various professional services. In addition, Kahului is the center of industrial operations due to its proximity to transportation facilities such as the Kahului Airport and Harbor.

For these reasons, Central Maui has approximately 40 percent of the total jobs on the Island of Maui, according to the U.S Census Bureau (http://censtats.census.gov/cbpnaic/cbpnaic.shtml) and residential projects in Central Maui have been met with great demand and all have sold out within a short period. Due to the highly desirable location of Central Maui, a separate Housing Demand Analysis was completed based on the supply and demand factors of Central Maui.

During the 5 year study period, the projected population increase is expected to be 3,955 people, with an average household size of 3.13 persons per household. This amounts to a demand for 1,264 housing units that will be needed during this study period. Since the subject will contain a mixture of single-family lots, house and lot packages, and multi-family units, a wide range of prices are represented by this mix. When compared to the current supply in the market of 1,354 units, a slight oversupply of 90 units is calculated. Based on the average amount of demand for the next five years (253 units per year), this oversupply will last for 5.4 years. This indicates that the supply currently available in the market is greater than the demand over the next 5 years. Despite the oversupply as indicated by our housing model, it should be noted that this oversupply could be absorbed by the market in less than one year, based on historical absorption rates. It is not considered to be an excessive or significant amount of supply to affect the market. The construction of housing units in Central Maui could be a result of the desirability of the Central Maui region four housing and employment due to its highly convenient location. Because of this, it can be expected that the 90 units may also be absorbed by the influx of residents in other regions of Maui, migrating to Central Maui.

Buyer Profile

Up to this point, the demand model that has been presented only considers the demand from the increase in population over the specified time period. It does not consider the existing local residents who are potential participants in this market.

Most significantly, this model does not consider resident buyers who are moving up, or upgrading to higher priced homes. Over the past few years, prices have doubled in some Maui neighborhoods while the island wide median prices for single family homes has increased anywhere between 20 and 25 percent per year. These increases have built equity for existing homeowners just by the appreciation of their homes. This situation allows many current home owners to sell their existing homes at a profit and move their equity into another property. The demand model presented above does not account for this segment of the market, which may comprise a significant amount of the buyers of the subject's project.

In addition to upgrade buyers, there are also local investors and partnerships that purchase units for long term investment purposes. There is also the market segment that purchases property on the island as a second home or vacation property. Once again, this model does not account for these segments.

Evidence of this additional demand can be seen when looking at the number of re-sales of existing properties in Central Maui as indicated by the MLS, as well as the number of sales that have occurred at new projects over the past year.

According to the previously described Realtors Association of Maui MLS data, there has been an average of approximately 500 sales of existing single family, condominium and vacant land properties in Central Maui over the past 7 years.

Hawaii Housing Policy

Study Update 2003

This study provides evidence of the need for additional housing on Maui (See **Exhibit C** at the end of this report). The balance between supply and demand has shifted greatly in recent years, as a result of the limited supply described herein, as well as the low interest rate environment that makes home ownership easier for the consumer. This is evidenced by the rapid increase of prices for single-family homes and rental units on Maui. Prices for condominium and vacant land properties have also been on the increase. The most recent update of the study was completed in 2003.

Single-Family Home Prices

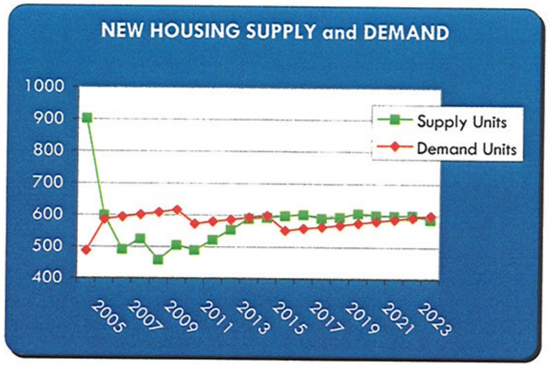
As mentioned before, it is a well known fact that single-family housing prices are increasing at a fast pace and have pushed prices for residential properties to historical highs. The Hawaii Housing Policy Study Update, 2003, revealed that 58 percent of the parties surveyed stated that the high prices are the reason why they do not want to purchase a home. *(Source: Hawaii Housing Policy Study Update 2003 - Table IV D-8).* The Kihei/Makena and Paia/Haiku residents had the lowest percentage of this response at 39.3 and 20.3 percent respectively. Among all the regions on Maui, Wailuku/Kahului residents had the highest percentage of this response at 73.5 percent.

County of Maui – Housing Demand Model

This study indicated that as of 2006, there was a current need for 3,755 resident housing units. This study also projected the effect of increasing population and the effect of decreasing household sizes on the supply and demand for residential units. The demand for housing units was calculated by comparing the increase in Maui's population to the average household size during a certain period. As population increases and household sizes remain the same or decrease, this would indicate the need for additional housing units. Conversely, if population decreases while household sizes remain the same; this would indicate a softening in demand for housing units.

According to the projections by SMS for the Housing Policy Update 2003, the supply and demand model indicates that from 2006 to 2014, demand will be higher than the available supply in the market. However, from 2015 to 2023 this balance will shift and provide a slightly higher supply of product versus demand. Theoretically, only at this point would prices begin to fall due to the oversupply in the market. However, this relief will not come for another 10 years.

The total supply that will become available between 2005 and 2024 (the end of the study period) will be 11,593 units, compared with the demand for 11,589 units.



Through this study period, the balance between supply and demand does not significantly shift to either side. However, this indicates that the original deficit of 4,170 units will not be reduced. By the end of the study period there will still be a need for 4,156 additional resident housing units.

It is also noted that resident housing units (RHU) only account for 70 percent of the total housing units in any given year. According to the Hawaii Housing Policy Study 2003, the remaining units include vacant units which is generally 5 percent of the total and non-resident housing units which account for approximately 25 percent of the total housing unit inventory. Non-resident units are defined as units that are set aside for rental pools and are targeted to transient visitors. These units are not available for County residents on an ongoing basis.

Based on these allocations, the actual number of additional housing units that need to be built in order to remove the deficit of resident housing units in 2024 is 5,937 units.

EFFECTIVE DEMAND

Effective demand considers the ability of market participants to purchase a home. The Hawaii Housing Policy Study 2003 compared the profiles of potential buyers and renters from previous studies conducted in 1997 and 1992.

"Own Now" – The 2003 study indicated that approximately 48 percent of potential owners currently own housing units. This is down from previous studies in 1992 and 1997 when the percentages were 50 and 53 percent, respectively. Similarly, only 6 percent of potential renters have indicated that they currently own a housing unit, down from 12 and 14 percent in the past studies.

"Make Over $25,000 per Year" – Despite lower ownership numbers, buyers are earning more than they were in the past. The 2003 study indicated that 55 percent of the respondents make $25,000 or more per year. Past surveys in 1992 and 1997 showed only 23 and 30 percent were making that amount. In 1997, only 7 percent of potential renters were making $25,000 or more per year. This number jumped six fold in 2003 to 43 percent.

"Have Household Incomes of $75,000 or More" – Since 1992, this percentage for potential buyers has been steadily climbing from 10 percent in 1992 and 18 percent in 1997 to 30 percent in 2003. The rate for potential renters increased slightly since 1992 but has generally held steady at 7 percent.

"Currently Employed" – The employment rates for potential buyers has steadily increased from 93 percent in 1992 to 97 percent in 2003. However, employment rates for renters have fallen below 1992 levels. Most recently this rate was estimated at only 85 percent. Previous studies indicted employment rates of 87 percent in 1992 and 92 percent in 1997.

"Have More than $40,000 for Down Payment" – Despite, strong indicators of increasing effective demand by potential buyers, this category has slipped since the initial study in 1992, when 32 percent of respondents said that have more than $40,000 for a down payment. These numbers dropped to 22 percent in 1997 and to 18 percent in 2003. This number has remained level for potential renters, at 8 percent.

The survey conducted in 2003, has indicated that the effective demand by potential buyers has increased since earlier surveys conducted in 1992 and 1997. With the exception of down payment, potential buyers seem to have increased their ability to purchase a home, as employment and income levels have made steady increases. Potential renters offer a mixed indication of effective demand, as income has increased, while employment rates have dropped.

CONCLUSION

Over the past decade, Maui has seen significant growth in virtually all aspects (e.g., population, visitor arrivals, economy) of the community. One of the most important issues facing Maui has been the need for affordable housing. Increasing population and the low interest rate environment has increased the demand for homes. This demand has led to record prices and sales volume for real estate. Many single family subdivisions and condominium projects have been sold out prior to the completion of construction. In recent years a strong emphasis has been placed on the construction of affordable homes as housing prices have outpaced increases in household incomes. The current County administration has set its sights on providing relief for island residents in this strong real estate market.

The following points summarize the supply of real estate in Maui at this time.

- As of July 2006, there are currently 2,108 active listings in the Realtors Association of Maui Multiple Listing Service for all types of residential properties on Maui.
- There are approximately 2,073 new housing units (single family residential, condominium and residential house lots) currently available in the market. This was determined to be the short term supply of new housing units or vacant lots available for purchase in the market. Of this total, approximately 1,354 units are located in Central Maui. 471 units are located in South Maui. West Maui has only 172 of the total short term supply.
- Based on historical annual absorption rates of the real estate markets, the current short term supply of units is expected to last approximately 4.5 years (2,073 units of supply ÷ 463 units of average absorption over 10 years). Equating the increase of households over the next five years with the required number of housing units, an average annual demand of 808 units per year is expected. Without additional inventory, the current supply will last 2.6 years. (2,073 ÷ 808)
- In addition to the existing supply, other projects are expected to add 14,500 to 16,300 units to the market. These units include remaining units in existing, entitled projects that have not been built or brought to the market yet. This count also includes projects that are in the planning phases and may be

developed in the future. Although there is a chance that some of this potential supply may be built soon, it is difficult to gauge the timing of these projects until construction actually begins.

Economic changes, community intervention, market conditions or internal issues with the developers may affect the feasibility of many of these projects. In reality, some of these projects may never be approved and some of the larger ones are expected to take 20 to 30 years to be built out. For this reason, the number of units of potential supply that will actually be developed is expected to be much lower than the 14,500 to 16,300 units on the list.

For example, in Central Maui, the Pu`unani subdivision with its 550 units and A&B Properties' Waiale project, which may bring between 1,900 and 3,700 units, are two potential projects but both are still in their planning and entitlement stages and there is an uncertainty as to their timing or even whether they will actually be brought to the market.

- According to the Hawaii Housing Policy Study 2003, there will be a total of 10,692 resident housing units (RHU) available from 2006 to 2024. This does not include vacant units as well as units set aside for non-resident occupancy.

The following points summarize the demand for real estate in Maui at this time.

- Population on Maui between 1990 and 2000 grew by 27.6 percent. Population is expected to increase by 44 percent from 2000 to 2025.
- Mortgage rates remain very reasonable despite rising slightly since hitting a historic low in mid-2003. As of June 2006, the average interest rate on a 30-year, fixed-rate mortgage was approximately 6.5 percent. These lower rates typically mean that real estate becomes more affordable to a larger segment of the population. At the same time, however, prices tend to rise faster and at rates higher than increases in household incomes. This factor has quickly decreased the affordability of home ownership to many potential buyers.
- Real estate sales activity for land, single-family and condominium properties has stabilized in terms of number of sales and median sales price since their peaks in mid-2005.

However, the median sales price for single family homes is only 7 percent off its high, while the median price of a condominium unit continues its climb to record levels. The median sales price of vacant land, which is the most speculative type of property, has seen some volatility in recent months. At the same time, marketing times or days-on-market for single family and condominium units remain at record lows while days on market for vacant land has been showing the same volatility as its median price.

- There is a strong demand for real estate in the neighborhood to be occupied by Ma`alaea Mauka. Research of sales performance of the new projects in Central Maui indicated rapid absorption of the new units and re-sales demonstrating very high appreciation rates. This is a good testament to the desirability of the Central Maui properties.
- The Hawaii Housing Policy Study Update 2003 shows that there will be a demand for 11,103 new resident housing units (RHU) from 2006 to 2024.
- The Hawaii Housing Policy Study Update 2003 also indicates that demand will outweigh supply until the year 2015, when supply will be slightly higher than demand. In theory, and assuming stable market conditions, only at this point will lower prices be realized in the market due to the slight oversupply. The higher demand up to 2015 means that there is no short term relief for high sales prices. As such, many of Maui's residents will remain out priced in this market.
- The Hawaii Housing Policy Study Update 2003 also estimated a deficit of approximately 3,755 needed resident housing units, as of 2005. By the end of the study in 2024, this deficit will increase by approximately 10 percent, to 4,156 units.
- The immediate availability of 2,073 housing units in the market has not done much to ease the historically high sales prices for real estate. A significant increase in supply in the market may have that desired effect on sales prices.

There is currently an imbalance between the supply and demand for residential real estate on Maui. Prices have increased significantly during the past few years and have made home ownership extremely difficult for residents of Maui, especially for those near the median income levels. Most of the development focus, both current and past, has been on market level, upper income brackets or the luxury resort

market. There is a strong need for development to serve the general population and ultimately rebalance the supply and demand factors for residential properties.

In this light, the short-term supply of single-family homes on Maui appears to be insufficient for the next 5 or so years. If economic conditions remain the same, it is probable that prices will continue to rise in the near-term, albeit at a slower pace than years past. On a long term basis, from 5 to 20 years, it is difficult to reliably estimate the number of projects that will be actually brought to the market. As mentioned before, many projects have been delayed or have met with resistance from the community for various reasons. Some face the lengthy and uncertain tasks of rezoning and Community Plan Amendments by the county, as well as District Boundary Amendments by the State of Hawaii. This would seem to indicate that of all the potential projects that have been identified, many may never be realized. It is also possible that given the higher risk in the entitlement process, developers may seek to put their money elsewhere instead of constructing homes for Maui's residents.

Meanwhile, demand for real estate on Maui has intensified over the past five years. These increases are being fueled by the population increases in this district, the high employment rate, and the lowest 30-year mortgage interest rates in decades. The strong demand has resulted in rapidly rising prices in all communities of Maui.

With additional inventory on the market, and assuming positive growth over the next decade, it is our opinion that bringing the subject's 949 units to the market would help alleviate the supply problem being experienced today and will be well accepted by the public due to the broad spectrum of real estate product that it will offer.

The proposed development is very attractive because the local community possesses an intense desire for property in this neighborhood. In addition, the subject's apartment, single-family and multi-family units will provide affordable homes to 288 families on Maui. This total also includes 60 units to be allocated for senior care housing. As the baby boomer generation reaches retirement in greater numbers, demand for this type of product is expected to increase. Having Maui's only acute medical facility located in nearby Kahului should only boost the desirability of these units.

The additional choices that buyers will have in the real estate market will provide healthy competition and allows for a more balanced market. Social issues generally associated with overcrowded living conditions on Maui may also be indirectly addressed. Consequently, it is the Consultant's opinion that the development of the Ma'alaea Mauka Project District will be well received, based on historical absorption of developments in this high-demand neighborhood. It will also add much needed supply to the market and will help alleviate the high cost of housing on Maui.

EXHIBITS

EXHIBIT A

Claritas Demographic Data

Central Maui

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
Population		
2011 Projection	50,300	
2006 Estimate	46,345	
2000 Census	41,655	
1990 Census	33,059	
Growth 2006-2011	8.53%	
Growth 2000-2006	11.26%	
Growth 1990-2000	26.00%	
2006 Est. Population by Single Race Classification	46,345	
White Alone	7,341	15.84
Black or African American Alone	138	0.30
American Indian and Alaska Native Alone	160	0.35
Asian Alone	21,255	45.86
Native Hawaiian and Other Pacific Islander Alone	4,987	10.76
Some Other Race Alone	612	1.32
Two or More Races	11,852	25.57
2006 Est. Population Hispanic or Latino by Origin*	46,345	
Not Hispanic or Latino	42,077	90.79
Hispanic or Latino:	4,268	9.21
Mexican	859	20.13
Puerto Rican	1,753	41.07
Cuban	8	0.19
All Other Hispanic or Latino	1,648	38.61
2006 Est. Hispanic or Latino by Single Race Class.	4,268	
White Alone	755	17.69
Black or African American Alone	7	0.16
American Indian and Alaska Native Alone	51	1.19
Asian Alone	489	11.46
Native Hawaiian and Other Pacific Islander Alone	246	5.76
Some Other Race Alone	553	12.96
Two or More Races	2,167	50.77

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Pop. Asian Alone Race by Category*	21,255	
Chinese, except Taiwanese	496	2.33
Filipino	11,299	53.16
Japanese	7,581	35.67
Asian Indian	29	0.14
Korean	471	2.22
Vietnamese	136	0.64
Cambodian	2	0.01
Hmong	0	0.00
Laotian	24	0.11
Thai	24	0.11
Other Asian	125	0.59
Two or more Asian categories	1,068	5.02
2006 Est. Population by Ancestry	46,345	
Pop, Arab	56	0.12
Pop, Czech	24	0.05
Pop, Danish	6	0.01
Pop, Dutch	56	0.12
Pop, English	571	1.23
Pop, French (except Basque)	201	0.43
Pop, French Canadian	83	0.18
Pop, German	845	1.82
Pop, Greek	0	0.00
Pop, Hungarian	19	0.04
Pop, Irish	562	1.21
Pop, Italian	284	0.61
Pop, Lithuanian	7	0.02
Pop, United States or American	261	0.56
Pop, Norwegian	143	0.31
Pop, Polish	102	0.22
Pop, Portuguese	1,833	3.96
Pop, Russian	39	0.08
Pop, Scottish	113	0.24
Pop, Scotch-Irish	110	0.24
Pop, Slovak	1	0.00
Pop, Subsaharan African	23	0.05
Pop, Swedish	116	0.25
Pop, Swiss	5	0.01
Pop, Ukrainian	0	0.00
Pop, Welsh	21	0.05
Pop, West Indian (exc Hisp groups)	15	0.03

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Population by Ancestry		
Pop, Other ancestries	35,239	76.04
Pop, Ancestry Unclassified	5,610	12.10
2006 Est. Pop Age 5+ by Language Spoken At Home	42,983	
Speak Only English at Home	30,052	69.92
Speak Asian/Pacific Islander Language at Home	11,824	27.51
Speak IndoEuropean Language at Home	318	0.74
Speak Spanish at Home	741	1.72
Speak Other Language at Home	48	0.11
2006 Est. Population by Sex	46,345	
Male	23,058	49.75
Female	23,287	50.25
Male/Female Ratio	0.99	
2006 Est. Population by Age	46,345	
Age 0 - 4	3,362	7.25
Age 5 - 9	3,079	6.64
Age 10 - 14	3,229	6.97
Age 15 - 17	2,064	4.45
Age 18 - 20	1,823	3.93
Age 21 - 24	2,589	5.59
Age 25 - 34	5,746	12.40
Age 35 - 44	6,275	13.54
Age 45 - 49	3,288	7.09
Age 50 - 54	3,219	6.95
Age 55 - 59	2,833	6.11
Age 60 - 64	2,247	4.85
Age 65 - 74	3,024	6.52
Age 75 - 84	2,514	5.42
Age 85 and over	1,053	2.27
Age 16 and over	36,002	77.68
Age 18 and over	34,611	74.68
Age 21 and over	32,788	70.75
Age 65 and over	6,591	14.22
2006 Est. Median Age	37.04	
2006 Est. Average Age	37.96	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Male Population by Age	23,058	
Age 0 - 4	1,704	7.39
Age 5 - 9	1,558	6.76
Age 10 - 14	1,657	7.19
Age 15 - 17	1,042	4.52
Age 18 - 20	1,006	4.36
Age 21 - 24	1,366	5.92
Age 25 - 34	3,017	13.08
Age 35 - 44	3,247	14.08
Age 45 - 49	1,655	7.18
Age 50 - 54	1,590	6.90
Age 55 - 59	1,432	6.21
Age 60 - 64	1,066	4.62
Age 65 - 74	1,326	5.75
Age 75 - 84	1,026	4.45
Age 85 and over	366	1.59
2006 Est. Median Age, Male	35.55	
2006 Est. Average Age, Male	36.58	
2006 Est. Female Population by Age	23,287	
Age 0 - 4	1,658	7.12
Age 5 - 9	1,521	6.53
Age 10 - 14	1,572	6.75
Age 15 - 17	1,022	4.39
Age 18 - 20	817	3.51
Age 21 - 24	1,223	5.25
Age 25 - 34	2,729	11.72
Age 35 - 44	3,028	13.00
Age 45 - 49	1,633	7.01
Age 50 - 54	1,629	7.00
Age 55 - 59	1,401	6.02
Age 60 - 64	1,181	5.07
Age 65 - 74	1,698	7.29
Age 75 - 84	1,488	6.39
Age 85 and over	687	2.95
2006 Est. Median Age, Female	38.64	
2006 Est. Average Age, Female	39.32	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Population Age 15+ by Marital Status*	36,675	
Total, Never Married	11,049	30.13
Married, Spouse present	17,450	47.58
Married, Spouse absent	2,330	6.35
Widowed	2,633	7.18
Divorced	3,213	8.76
Males, Never Married	6,255	17.06
Previously Married	2,176	5.93
Females, Never Married	4,794	13.07
Previously Married	4,175	11.38
2006 Est. Pop. Age 25+ by Educational Attainment*	30,199	
Less than 9th grade	3,582	11.86
Some High School, no diploma	3,369	11.16
High School Graduate (or GED)	9,547	31.61
Some College, no degree	6,076	20.12
Associate Degree	2,279	7.55
Bachelor's Degree	3,941	13.05
Master's Degree	893	2.96
Professional School Degree	478	1.58
Doctorate Degree	34	0.11
Households		
2011 Projection	15,789	
2006 Estimate	14,524	
2000 Census	12,998	
1990 Census	10,281	
Growth 2006-2011	8.71%	
Growth 2000-2006	11.74%	
Growth 1990-2000	26.43%	
2006 Est. Households by Household Type	14,524	
Family Households	10,695	73.64
Nonfamily Households	3,829	26.36
2006 Est. Group Quarters Population	831	
2006 Households by Ethnicity, Hispanic/Latino	997	6.86

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Households by Household Income	14,524	
Income Less than $15,000	1,681	11.57
Income $15,000 - $24,999	1,371	9.44
Income $25,000 - $34,999	1,383	9.52
Income $35,000 - $49,999	2,041	14.05
Income $50,000 - $74,999	3,163	21.78
Income $75,000 - $99,999	2,018	13.89
Income $100,000 - $149,999	1,931	13.30
Income $150,000 - $249,999	703	4.84
Income $250,000 - $499,999	183	1.26
Income $500,000 and more	50	0.34
2006 Est. Average Household Income	$69,145	
2006 Est. Median Household Income	$56,214	
2006 Est. Per Capita Income	$21,924	
2006 Est. Household Type, Presence Own Children*	14,524	
Single Male Householder	1,390	9.57
Single Female Householder	1,643	11.31
Married-Couple Family, own children	3,718	25.60
Married-Couple Family, no own children	4,014	27.64
Male Householder, own children	397	2.73
Male Householder, no own children	472	3.25
Female Householder, own children	1,056	7.27
Female Householder, no own children	1,038	7.15
Nonfamily, Male Householder	454	3.13
Nonfamily, Female Householder	342	2.35
2006 Est. Households by Household Size*	14,524	
1-person household	3,033	20.88
2-person household	3,888	26.77
3-person household	2,509	17.27
4-person household	2,207	15.20
5-person household	1,333	9.18
6-person household	683	4.70
7 or more person household	871	6.00
2006 Est. Average Household Size	3.13	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Households by Presence of People*	14,524	
Households with 1 or more People under Age 18:		
Married-Couple Family	4,250	29.26
Other Family, Male Householder	508	3.50
Other Family, Female Householder	1,377	9.48
Nonfamily, Male Householder	33	0.23
Nonfamily, Female Householder	19	0.13
Households no People under Age 18:		
Married-Couple Family	3,482	23.97
Other Family, Male Householder	361	2.49
Other Family, Female Householder	717	4.94
Nonfamily, Male Householder	1,811	12.47
Nonfamily, Female Householder	1,966	13.54
2006 Est. Households by Number of Vehicles*	14,524	
No Vehicles	1,198	8.25
1 Vehicle	5,120	35.25
2 Vehicles	5,234	36.04
3 Vehicles	1,976	13.61
4 Vehicles	640	4.41
5 or more Vehicles	356	2.45
2006 Est. Average Number of Vehicles*	1.80	
Family Households		
2011 Projection	11,663	
2006 Estimate	10,695	
2000 Census	9,517	
1990 Census	7,728	
Growth 2006-2011	9.05%	
Growth 2000-2006	12.38%	
Growth 1990-2000	23.15%	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Family Households by Household Income	10,695	
Income Less than $15,000	722	6.75
Income $15,000 - $24,999	712	6.66
Income $25,000 - $34,999	858	8.02
Income $35,000 - $49,999	1,480	13.84
Income $50,000 - $74,999	2,607	24.38
Income $75,000 - $99,999	1,821	17.03
Income $100,000 - $149,999	1,696	15.86
Income $150,000 - $249,999	600	5.61
Income $250,000 - $499,999	156	1.46
Income $500,000 and more	43	0.40
2006 Est. Average Family Household Income	$77,637	
2006 Est. Median Family Household Income	$65,107	
2006 Est. Families by Poverty Status*	10,695	
Income At or Above Poverty Level:		
Married-Couple Family, own children	3,980	37.21
Married-Couple Family, no own children	3,447	32.23
Male Householder, own children	466	4.36
Male Householder, no own children	294	2.75
Female Householder, own children	825	7.71
Female Householder, no own children	751	7.02
Income Below Poverty Level:		
Married-Couple Family, own children	196	1.83
Married-Couple Family, no own children	109	1.02
Male Householder, own children	103	0.96
Male Householder, no own children	6	0.06
Female Householder, own children	449	4.20
Female Householder, no own children	69	0.65
2006 Est. Pop Age 16+ by Employment Status*	36,002	
In Armed Forces	36	0.10
Civilian - Employed	21,072	58.53
Civilian - Unemployed	1,202	3.34
Not in Labor Force	13,692	38.03

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Civ Employed Pop 16+ Class of Worker*	21,072	
For-Profit Private Workers	15,006	71.21
Non-Profit Private Workers	1,172	5.56
Local Government Workers	1,200	5.69
State Government Workers	2,198	10.43
Federal Government Workers	305	1.45
Self-Emp Workers	1,120	5.32
Unpaid Family Workers	71	0.34
2006 Est. Civ Employed Pop 16+ by Occupation*	21,072	
Management, Business, and Financial Operations	1,880	8.92
Professional and Related Occupations	2,828	13.42
Service	5,126	24.33
Sales and Office	6,282	29.81
Farming, Fishing, and Forestry	511	2.43
Construction, Extraction and Maintainance	2,032	9.64
Production, Transportation and Material Moving	2,413	11.45
2006 Est. Pop 16+ by Occupation Classification*	21,072	
Blue Collar	4,445	21.09
White Collar	10,919	51.82
Service and Farm	5,708	27.09
2006 Est. Workers Age 16+, Transportation To Work*	20,616	
Drove Alone	14,836	71.96
Car Pooled	4,169	20.22
Public Transportation	162	0.79
Walked	414	2.01
Motorcycle	63	0.31
Bicycle	103	0.50
Other Means	371	1.80
Worked at Home	498	2.42
2006 Est. Workers Age 16+ by Travel Time to Work*	20,118	
Less than 15 Minutes	8,724	43.36
15 - 29 Minutes	5,230	26.00
30 - 44 Minutes	3,383	16.82
45 - 59 Minutes	1,900	9.44
60 or more Minutes	881	4.38
2006 Est. Average Travel Time to Work in Minutes*	23.89	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Tenure of Occupied Housing Units	14,524	
Owner Occupied	8,874	61.10
Renter Occupied	5,650	38.90
2006 Occ Housing Units, Avg Length of Residence	12	
2006 Est. All Owner-Occupied Housing Values	8,874	
Value Less than $20,000	5	0.06
Value $20,000 - $39,999	92	1.04
Value $40,000 - $59,999	46	0.52
Value $60,000 - $79,999	52	0.59
Value $80,000 - $99,999	26	0.29
Value $100,000 - $149,999	249	2.81
Value $150,000 - $199,999	643	7.25
Value $200,000 - $299,999	2,230	25.13
Value $300,000 - $399,999	2,452	27.63
Value $400,000 - $499,999	1,697	19.12
Value $500,000 - $749,999	1,062	11.97
Value $750,000 - $999,999	162	1.83
Value $1,000,000 or more	158	1.78
2006 Est. Median All Owner-Occupied Housing Value	$344,619	
2006 Est. Housing Units by Units in Structure*	15,416	
1 Unit Attached	1,339	8.69
1 Unit Detached	9,886	64.13
2 Units	154	1.00
3 to 19 Units	2,536	16.45
20 to 49 Units	585	3.79
50 or More Units	863	5.60
Mobile Home or Trailer	53	0.34
Boat, RV, Van, etc.	0	0.00

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Housing Units by Year Structure Built	15,416	
Housing Units Built 1999 to 2006	2,083	13.51
Housing Unit Built 1995 to 1998	1,352	8.77
Housing Unit Built 1990 to 1994	1,604	10.40
Housing Unit Built 1980 to 1989	2,451	15.90
Housing Unit Built 1970 to 1979	3,103	20.13
Housing Unit Built 1960 to 1969	2,307	14.96
Housing Unit Built 1950 to 1959	1,341	8.70
Housing Unit Built 1940 to 1949	504	3.27
Housing Unit Built 1939 or Earlier	671	4.35
2006 Est. Median Year Structure Built **	1979	

*In contrast to Claritas Demographic Estimates, "smoothed" data items are Census 2000 tables made consistent with current year estimated and 5 year projected base counts.

**1939 will appear when at least half of the Housing Units in this reports area were built in 1939 or earlier.

Appendix: Area Listing

Area Name:

Type: List - Area ZIP Codes   Reporting Detail: Aggregate   Reporting Level: Area ZIP Codes

Geography Code	Geography Name	Geography Code	Geography Name
96732	Kahului	96793	Wailuku

Pop-Facts: Demographic Snapshot Comparison Report

Prepared For:
Project Code:

Order #: 964040524
Site: 01

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
Population		
2011 Projection	153,367	
2006 Estimate	141,730	
2000 Census	128,095	
1990 Census	100,372	
Growth 2006-2011	8.21%	
Growth 2000-2006	10.64%	
Growth 1990-2000	27.62%	
2006 Est. Population by Single Race Classification	141,730	
White Alone	50,669	35.75
Black or African American Alone	748	0.53
American Indian and Alaska Native Alone	616	0.43
Asian Alone	42,033	29.66
Native Hawaiian and Other Pacific Islander Alone	14,131	9.97
Some Other Race Alone	2,097	1.48
Two or More Races	31,436	22.18
2006 Est. Population Hispanic or Latino by Origin*	141,730	
Not Hispanic or Latino	129,519	91.38
Hispanic or Latino:	12,211	8.62
Mexican	3,636	29.78
Puerto Rican	3,896	31.91
Cuban	74	0.61
All Other Hispanic or Latino	4,605	37.71
2006 Est. Hispanic or Latino by Single Race Class.	12,211	
White Alone	3,040	24.90
Black or African American Alone	34	0.28
American Indian and Alaska Native Alone	154	1.26
Asian Alone	1,124	9.20
Native Hawaiian and Other Pacific Islander Alone	678	5.55
Some Other Race Alone	1,870	15.31
Two or More Races	5,311	43.49

Maui County

Trade Area: ZIP, (see appendix for geographics), aggregate

Description	Total ZIP	%
2006 Est. Pop. Asian Alone Race by Category*	42,033	
Chinese, except Taiwanese	1,256	2.99
Filipino	23,320	55.48
Japanese	13,418	31.92
Asian Indian	114	0.27
Korean	846	2.01
Vietnamese	339	0.81
Cambodian	10	0.02
Hmong	0	0.00
Laotian	48	0.11
Thai	85	0.20
Other Asian	299	0.71
Two or more Asian categories	2,298	5.47
2006 Est. Population by Ancestry	141,730	
Pop, Arab	214	0.15
Pop, Czech	182	0.13
Pop, Danish	331	0.23
Pop, Dutch	772	0.54
Pop, English	4,792	3.38
Pop, French (except Basque)	1,526	1.08
Pop, French Canadian	350	0.25
Pop, German	6,804	4.80
Pop, Greek	227	0.16
Pop, Hungarian	184	0.13
Pop, Irish	4,533	3.20
Pop, Italian	2,482	1.75
Pop, Lithuanian	124	0.09
Pop, United States or American	1,967	1.39
Pop, Norwegian	1,043	0.74
Pop, Polish	1,066	0.75
Pop, Portuguese	5,543	3.91
Pop, Russian	592	0.42
Pop, Scottish	1,178	0.83
Pop, Scotch-Irish	942	0.66
Pop, Slovak	11	0.01
Pop, Subsaharan African	106	0.07
Pop, Swedish	899	0.63
Pop, Swiss	210	0.15
Pop, Ukrainian	206	0.15
Pop, Welsh	218	0.15
Pop, West Indian (exc Hisp groups)	69	0.05

Trade Area: ZIP, (see appendix for geographics), aggregate

Description	Total ZIP	%
2006 Est. Population by Ancestry		
Pop, Other ancestries	86,564	61.08
Pop, Ancestry Unclassified	18,595	13.12
2006 Est. Pop Age 5+ by Language Spoken At Home	132,043	
Speak Only English at Home	100,312	75.97
Speak Asian/Pacific Islander Language at Home	26,472	20.05
Speak IndoEuropean Language at Home	2,197	1.66
Speak Spanish at Home	2,868	2.17
Speak Other Language at Home	194	0.15
2006 Est. Population by Sex	141,730	
Male	71,183	50.22
Female	70,547	49.78
Male/Female Ratio	1.01	
2006 Est. Population by Age	141,730	
Age 0 - 4	9,687	6.83
Age 5 - 9	9,136	6.45
Age 10 - 14	9,493	6.70
Age 15 - 17	6,356	4.48
Age 18 - 20	5,254	3.71
Age 21 - 24	7,548	5.33
Age 25 - 34	17,237	12.16
Age 35 - 44	20,444	14.42
Age 45 - 49	11,616	8.20
Age 50 - 54	11,447	8.08
Age 55 - 59	9,659	6.82
Age 60 - 64	7,209	5.09
Age 65 - 74	8,386	5.92
Age 75 - 84	5,862	4.14
Age 85 and over	2,396	1.69
Age 16 and over	111,345	78.56
Age 18 and over	107,058	75.54
Age 21 and over	101,804	71.83
Age 65 and over	16,644	11.74
2006 Est. Median Age	38.01	
2006 Est. Average Age	37.78	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Male Population by Age	71,183	
Age 0 - 4	4,887	6.87
Age 5 - 9	4,600	6.46
Age 10 - 14	4,818	6.77
Age 15 - 17	3,216	4.52
Age 18 - 20	2,727	3.83
Age 21 - 24	3,977	5.59
Age 25 - 34	9,129	12.82
Age 35 - 44	10,408	14.62
Age 45 - 49	5,795	8.14
Age 50 - 54	5,794	8.14
Age 55 - 59	4,937	6.94
Age 60 - 64	3,614	5.08
Age 65 - 74	3,942	5.54
Age 75 - 84	2,455	3.45
Age 85 and over	884	1.24
2006 Est. Median Age, Male	37.15	
2006 Est. Average Age, Male	37.00	
2006 Est. Female Population by Age	70,547	
Age 0 - 4	4,800	6.80
Age 5 - 9	4,536	6.43
Age 10 - 14	4,675	6.63
Age 15 - 17	3,140	4.45
Age 18 - 20	2,527	3.58
Age 21 - 24	3,571	5.06
Age 25 - 34	8,108	11.49
Age 35 - 44	10,036	14.23
Age 45 - 49	5,821	8.25
Age 50 - 54	5,653	8.01
Age 55 - 59	4,722	6.69
Age 60 - 64	3,595	5.10
Age 65 - 74	4,444	6.30
Age 75 - 84	3,407	4.83
Age 85 and over	1,512	2.14
2006 Est. Median Age, Female	38.90	
2006 Est. Average Age, Female	38.57	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Population Age 15+ by Marital Status*	113,414	
Total, Never Married	33,711	29.72
Married, Spouse present	54,857	48.37
Married, Spouse absent	6,007	5.30
Widowed	6,439	5.68
Divorced	12,400	10.93
Males, Never Married	19,224	16.95
Previously Married	7,643	6.74
Females, Never Married	14,487	12.77
Previously Married	12,665	11.17
2006 Est. Pop. Age 25+ by Educational Attainment*	94,256	
Less than 9th grade	7,036	7.46
Some High School, no diploma	8,500	9.02
High School Graduate (or GED)	27,721	29.41
Some College, no degree	22,452	23.82
Associate Degree	7,358	7.81
Bachelor's Degree	14,828	15.73
Master's Degree	3,917	4.16
Professional School Degree	1,927	2.04
Doctorate Degree	517	0.55
Households		
2011 Projection	53,006	
2006 Estimate	48,684	
2000 Census	43,508	
1990 Census	33,145	
Growth 2006-2011	8.88%	
Growth 2000-2006	11.90%	
Growth 1990-2000	31.27%	
2006 Est. Households by Household Type	48,684	
Family Households	33,458	68.72
Nonfamily Households	15,226	31.28
2006 Est. Group Quarters Population	1,425	
2006 Households by Ethnicity, Hispanic/Latino	2,997	6.16

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Households by Household Income	48,684	
Income Less than $15,000	5,193	10.67
Income $15,000 - $24,999	4,538	9.32
Income $25,000 - $34,999	4,835	9.93
Income $35,000 - $49,999	7,153	14.69
Income $50,000 - $74,999	10,295	21.15
Income $75,000 - $99,999	6,611	13.58
Income $100,000 - $149,999	6,326	12.99
Income $150,000 - $249,999	2,633	5.41
Income $250,000 - $499,999	788	1.62
Income $500,000 and more	312	0.64
2006 Est. Average Household Income	$72,554	
2006 Est. Median Household Income	$56,370	
2006 Est. Per Capita Income	$25,144	
2006 Est. Household Type, Presence Own Children*	48,684	
Single Male Householder	5,475	11.25
Single Female Householder	5,473	11.24
Married-Couple Family, own children	11,454	23.53
Married-Couple Family, no own children	13,363	27.45
Male Householder, own children	1,474	3.03
Male Householder, no own children	1,358	2.79
Female Householder, own children	3,230	6.63
Female Householder, no own children	2,579	5.30
Nonfamily, Male Householder	2,616	5.37
Nonfamily, Female Householder	1,662	3.41
2006 Est. Households by Household Size*	48,684	
1-person household	10,948	22.49
2-person household	15,102	31.02
3-person household	8,325	17.10
4-person household	6,720	13.80
5-person household	3,666	7.53
6-person household	1,906	3.92
7 or more person household	2,017	4.14
2006 Est. Average Household Size	2.88	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Households by Presence of People*	48,684	
Households with 1 or more People under Age 18:		
Married-Couple Family	12,866	26.43
Other Family, Male Householder	1,802	3.70
Other Family, Female Householder	4,017	8.25
Nonfamily, Male Householder	181	0.37
Nonfamily, Female Householder	74	0.15
Households no People under Age 18:		
Married-Couple Family	11,951	24.55
Other Family, Male Householder	1,030	2.12
Other Family, Female Householder	1,792	3.68
Nonfamily, Male Householder	7,910	16.25
Nonfamily, Female Householder	7,061	14.50
2006 Est. Households by Number of Vehicles*	48,684	
No Vehicles	3,030	6.22
1 Vehicle	17,507	35.96
2 Vehicles	18,954	38.93
3 Vehicles	6,194	12.72
4 Vehicles	1,927	3.96
5 or more Vehicles	1,072	2.20
2006 Est. Average Number of Vehicles*	1.81	
Family Households		
2011 Projection	36,426	
2006 Estimate	33,458	
2000 Census	29,899	
1990 Census	23,537	
Growth 2006-2011	8.87%	
Growth 2000-2006	11.90%	
Growth 1990-2000	27.03%	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Family Households by Household Income	33,458	
Income Less than $15,000	2,167	6.48
Income $15,000 - $24,999	2,336	6.98
Income $25,000 - $34,999	2,769	8.28
Income $35,000 - $49,999	4,563	13.64
Income $50,000 - $74,999	7,684	22.97
Income $75,000 - $99,999	5,672	16.95
Income $100,000 - $149,999	5,202	15.55
Income $150,000 - $249,999	2,205	6.59
Income $250,000 - $499,999	614	1.84
Income $500,000 and more	246	0.74
2006 Est. Average Family Household Income	$81,538	
2006 Est. Median Family Household Income	$65,922	
2006 Est. Families by Poverty Status*	33,458	
Income At or Above Poverty Level:		
Married-Couple Family, own children	12,039	35.98
Married-Couple Family, no own children	11,646	34.81
Male Householder, own children	1,540	4.60
Male Householder, no own children	826	2.47
Female Householder, own children	2,812	8.40
Female Householder, no own children	1,838	5.49
Income Below Poverty Level:		
Married-Couple Family, own children	710	2.12
Married-Couple Family, no own children	422	1.26
Male Householder, own children	362	1.08
Male Householder, no own children	104	0.31
Female Householder, own children	1,031	3.08
Female Householder, no own children	128	0.38
2006 Est. Pop Age 16+ by Employment Status*	111,345	
In Armed Forces	104	0.09
Civilian - Employed	70,655	63.46
Civilian - Unemployed	3,709	3.33
Not in Labor Force	36,877	33.12

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Civ Employed Pop 16+ Class of Worker*	70,655	
For-Profit Private Workers	49,038	69.40
Non-Profit Private Workers	3,780	5.35
Local Government Workers	2,828	4.00
State Government Workers	6,357	9.00
Federal Government Workers	1,058	1.50
Self-Emp Workers	7,311	10.35
Unpaid Family Workers	283	0.40
2006 Est. Civ Employed Pop 16+ by Occupation*	70,655	
Management, Business, and Financial Operations	7,798	11.04
Professional and Related Occupations	10,897	15.42
Service	18,626	26.36
Sales and Office	18,496	26.18
Farming, Fishing, and Forestry	1,451	2.05
Construction, Extraction and Maintainance	6,772	9.58
Production, Transportation and Material Moving	6,615	9.36
2006 Est. Pop 16+ by Occupation Classification*	70,655	
Blue Collar	13,387	18.95
White Collar	36,480	51.63
Service and Farm	20,788	29.42
2006 Est. Workers Age 16+, Transportation To Work*	68,791	
Drove Alone	49,005	71.24
Car Pooled	11,779	17.12
Public Transportation	545	0.79
Walked	1,917	2.79
Motorcycle	432	0.63
Bicycle	818	1.19
Other Means	938	1.36
Worked at Home	3,357	4.88
2006 Est. Workers Age 16+ by Travel Time to Work*	65,434	
Less than 15 Minutes	24,954	38.14
15 - 29 Minutes	20,966	32.04
30 - 44 Minutes	11,273	17.23
45 - 59 Minutes	5,050	7.72
60 or more Minutes	3,191	4.88
2006 Est. Average Travel Time to Work in Minutes*	24.24	

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Tenure of Occupied Housing Units	48,684	
Owner Occupied	28,077	57.67
Renter Occupied	20,607	42.33
2006 Occ Housing Units, Avg Length of Residence	10	
2006 Est. All Owner-Occupied Housing Values	28,077	
Value Less than $20,000	80	0.28
Value $20,000 - $39,999	154	0.55
Value $40,000 - $59,999	88	0.31
Value $60,000 - $79,999	124	0.44
Value $80,000 - $99,999	170	0.61
Value $100,000 - $149,999	984	3.50
Value $150,000 - $199,999	1,999	7.12
Value $200,000 - $299,999	5,407	19.26
Value $300,000 - $399,999	6,259	22.29
Value $400,000 - $499,999	4,789	17.06
Value $500,000 - $749,999	4,702	16.75
Value $750,000 - $999,999	1,329	4.73
Value $1,000,000 or more	1,992	7.09
2006 Est. Median All Owner-Occupied Housing Value	$380,399	
2006 Est. Housing Units by Units in Structure*	62,493	
1 Unit Attached	3,841	6.15
1 Unit Detached	35,070	56.12
2 Units	1,134	1.81
3 to 19 Units	10,233	16.37
20 to 49 Units	3,115	4.98
50 or More Units	8,933	14.29
Mobile Home or Trailer	121	0.19
Boat, RV, Van, etc.	46	0.07

Trade Area: ZIP, (see appendix for geographies), aggregate

Description	Total ZIP	%
2006 Est. Housing Units by Year Structure Built	62,493	
Housing Units Built 1999 to 2006	8,183	13.09
Housing Unit Built 1995 to 1998	4,264	6.82
Housing Unit Built 1990 to 1994	7,873	12.60
Housing Unit Built 1980 to 1989	13,941	22.31
Housing Unit Built 1970 to 1979	16,262	26.02
Housing Unit Built 1960 to 1969	5,459	8.74
Housing Unit Built 1950 to 1959	2,678	4.29
Housing Unit Built 1940 to 1949	1,591	2.55
Housing Unit Built 1939 or Earlier	2,242	3.59
2006 Est. Median Year Structure Built **	1982	

*In contrast to Claritas Demographic Estimates, "smoothed" data items are Census 2000 tables made consistent with current year estimated and 5 year projected base counts.

**1939 will appear when at least half of the Housing Units in this reports area were built in 1939 or earlier.

Pop-Facts: Demographic Snapshot Comparison Report

Prepared For:
Project Code:

Order #: 964040524
Site: 01

Appendix: Area Listing

Area Name:

Type: List - Area ZIP Codes   Reporting Detail: Aggregate   Reporting Level: Area ZIP Codes

Geography Code	Geography Name	Geography Code	Geography Name
96708	Haiku	96713	Hana
96729	Hoolehua	96732	Kahului
96748	Kaunakakai	96753	Kihei
96757	Kualapuu	96761	Lahaina
96763	Lanai City	96768	Makawao
96770	Maunaloa	96779	Paia
96790	Kula	96793	Wailuku

 Claritas Tech Support: 1 800 866 6511

CLARITAS MARKETPLACE

EXHIBIT B

Active Listings in the Central Maui Region
Single-Family, Vacant Land and Condominiums

MLS #	Class	District	LT	Address	Land SQFT	Baths	Beds	Liv A SF	List Price	DOM	Status Date	Original Price
318115	CO	Wailuku	FS	1885 Main Street	35,719	3.0	3	1,881	$ 660,000	43	5/8/2006	$ 660,000
317553	CO	Wailuku	FS	2158 Main Street	23,938	1.5	2	730	$ 350,000	77	4/3/2006	$ 350,000
318362	CO	Wailuku	FS	2180 Vineyard St.	35,284	1.0	1	511	$ 225,000	35	5/22/2006	$ 225,000
316324	CO	Wailuku	FS	2180 Vineyard St.	35,284	2.0	2	839	$ 259,500	140	6/2/2006	$ 285,000
316198	CO	Wailuku	FS	2180 Vineyard Street	35,284	2.0	2	839	$ 295,000	146	2/17/2006	$ 295,000
314549	CO	Wailuku	FS	2180 Vineyard Street	43,560	2.0	2	839	$ 370,000	230	11/1/2005	$ 395,000
315766	CO	Wailuku	FS	31 Kopi Ln.	396,396	1.0	1	543	$ 285,000	166	1/5/2006	$ 300,000
317564	CO	Wailuku	FS	940 Eha Street	396,570	1.0	2	657	$ 319,000	77	4/4/2006	$ 329,000
318576	CO	Wailuku	FS	55 Waiaka Lane	396,570	1.0	2	655	$ 320,000	14	6/5/2006	$ 320,000
318481	CO	Wailuku	FS	1060 Eha Street	396,570	2.0	2	843	$ 349,000	20	5/30/2006	$ 349,000
317990	CO	Wailuku	FS	1110 Eha Street	396,396	2.0	2	807	$ 349,000	52	4/28/2006	$ 360,000
312365	CO	Wailuku	FS	1050 EHA ST. Apt 24-104	396,570	2.0	2	754	$ 355,000	359	6/26/2005	$ 380,000
318478	CO	Wailuku	FS	1140 Eha Street	396,570	2.0	2	807	$ 359,000	20	5/30/2006	$ 359,000
318643	CO	Wailuku	FS	91 Kopi Lane	396,570	2.0	2	754	$ 369,000	13	6/9/2006	$ 369,000
316884	CO	Wailuku	FS	1110 Eha Street	396,570	2.0	2	843	$ 379,000	110	3/1/2006	$ 379,000
313871	CO	Wailuku	FS	31 Kopi Lane	396,570	2.0	3	960	$ 379,000	265	9/27/2005	$ 425,000
317202	CO	Wailuku	FS	51 Kopi Lane	396,570	2.0	3	960	$ 399,000	96	3/15/2006	$ 429,000
316474	CO	Wailuku	FS	70 Waiaka Lane	396,570	2.0	3	960	$ 415,000	132	2/7/2006	$ 429,000
318787	CO	Wailuku	FS	1080 Eha St.	396,396	2.0	3	960	$ 415,000	3	6/17/2006	$ 415,000
316733	CO	Wailuku	FS	25 Waipaa Lane	396,396	2.0	3	934	$ 415,000	118	2/21/2006	$ 430,000
317418	CO	Wailuku	FS	349 N Market	16,117	1.0	1	392	$ 199,900	84	3/27/2006	$ 189,900
315617	CO	Wailuku	FS	341 N Market Stgreet	16,117	1.0	2	567	$ 225,500	174	3/4/2006	$ 225,500
315620	CO	Wailuku	FS	341 N Market Street	16,117	1.0	2	567	$ 225,500	174	4/27/2006	$ 225,500
315626	CO	Wailuku	FS	341 N Market Street	16,117	1.0	2	567	$ 235,500	174	12/30/2005	$ 235,500
315628	CO	Wailuku	FS	341 N Market Street	16,117	1.0	2	567	$ 235,500	174	12/30/2005	$ 235,500
315634	CO	Wailuku	FS	341 N Market Street	16,117	1.0	2	710	$ 369,500	174	12/30/2005	$ 469,500
315632	CO	Wailuku	FS	341 N Market Street	16,117	1.0	2	815	$ 399,500	174	12/30/2005	$ 499,500
316932	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.0	1	610	$ 164,000	109	3/3/2006	$ 175,000
317019	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.0	1	610	$ 175,500	102	3/9/2006	$ 175,500
316648	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 185,000	124	2/16/2006	$ 215,000
318397	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 185,000	26	5/24/2006	$ 199,000
316464	CO	Kahului	FS	111 Kahului Beach Rd	328,050	1.5	2	787	$ 198,900	135	2/7/2006	$ 245,000
317776	CO	Kahului	FS	111 Kahului Beach Rd	327,136	1.5	2	787	$ 199,000	63	4/17/2006	$ 225,000
317329	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 200,000	89	3/22/2006	$ 219,000
316707	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 209,000	123	2/20/2006	$ 219,000
318093	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 215,000	45	5/5/2006	$ 237,500
317605	CO	Kahului	FS	111 Kahului Beach Rd	326,700	1.5	2	787	$ 218,000	77	4/5/2006	$ 255,000
317609	CO	Kahului	FS	111 Kahului Beach Rd. Apt. C-207	327,266	1.5	2	787	$ 218,500	75	4/6/2006	$ 228,500
317020	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 219,500	102	3/9/2006	$ 219,500
316475	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 220,000	132	2/7/2006	$ 229,000
316359	CO	Kahului	FS	111 Kahului Beach Road	327,136	1.5	2	787	$ 220,000	139	2/1/2006	$ 220,000
315392	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 225,000	186	5/25/2006	$ 247,000
317619	CO	Kahului	FS	111 Kahului Beach Road	327,136	1.5	2	787	$ 230,000	74	4/6/2006	$ 230,000
317604	CO	Kahului	FS	111 Kahului Beach Road #A-202	327,266	1.5	2	787	$ 230,000	75	4/5/2006	$ 225,000
317285	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 232,750	92	3/20/2006	$ 240,000
317164	CO	Kahului	FS	111 KAHULUI BEACH ROAD	327,266	1.5	2	787	$ 235,000	96	3/15/2006	$ 235,000
315343	CO	Kahului	FS	111 Kahului Beach Rd	43,560	1.5	2	787	$ 239,900	189	12/13/2005	$ 239,900
316776	CO	Kahului	FS	111 Kahului Beach Road	174,240	1.5	2	787	$ 245,000	115	2/24/2006	$ 275,000
316760	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 245,000	117	2/23/2006	$ 250,000
314565	CO	Kahului	FS	111 Kahului Beach Rd #D428	327,266	1.5	2	787	$ 250,000	229	11/2/2005	$ 250,000
318271	CO	Kahului	FS	111 Kahului Beach Road	326,700	1.5	2	787	$ 252,000	35	5/17/2006	$ 252,000
315341	CO	Kahului	FS	111 Kahului Beach Road	327,266	1.5	2	787	$ 265,000	189	12/13/2005	$ 265,000
317104	CO	Kahului	FS	111 Kahului Beach Road	327,266,280	1.5	2	784	$ 275,000	101	3/13/2006	$ 275,000
317296	CO	Kahului	FS	111 Kahului Beach Road	327,266,280	1.5	2	784	$ 275,000	91	3/21/2006	$ 275,000
318340	CO	Kahului	FS	111 Kahului Beach Road A 405	326,700	1.5	2	787	$ 275,000	32	5/20/2006	$ 275,000
318380	CO	Maalaea	LH	20 Hauoli Road	30,840	1	1.0	668	$ 340,000	59	5/23/2006	$ 340,000
314594	CO	Maalaea	LH	20 Hauoli Road	30,840	1	1.5	894	$ 365,000	259	11/4/2005	$ 379,500
318114	CO	Maalaea	LH	30 Hauoli Road	55,234	1	1.0	586	$ 369,000	74	5/8/2006	$ 369,000
313560	CO	Maalaea	LH	50 HAUOLI RD.	54,014	1	1.0	557	$ 450,000	316	9/8/2005	$ 450,000
313559	CO	Maalaea	LH	50 HAUOLI ST.	54,014	1	1.0	579	$ 450,000	316	9/8/2005	$ 450,000
313966	CO	Maalaea	FS	20 HAUOLI	30,840	1	1.0	648	$ 450,000	294	9/30/2005	$ 370,000
318642	CO	Maalaea	FS	20 HAUOLI ROAD	30,840	1	1.0	648	$ 490,000	42	6/9/2006	$ 490,000
318406	CO	Maalaea	FS	20 Hauoli Road	30,840	1	1.0	648	$ 490,000	58	5/24/2006	$ 490,000
319072	CO	Maalaea	FS	150 Hauoli Road	76,317	1	1.0	559	$ 499,000	18	7/3/2006	$ 499,000
316396	CO	Maalaea	LH	250 Hauoli Street	112,908	2	2.0	952	$ 499,500	170	2/1/2006	$ 550,000
315663	CO	Maalaea	LH	250 Hauoli St.	112,908	2	2.0	950	$ 569,000	202	12/31/2005	$ 579,000
317859	CO	Maalaea	LH	100 Hauoli Rd.	78,190	2	2.0	950	$ 599,900	94	4/18/2006	$ 599,900
314667	CO	Maalaea	LH	100 Hauoli Rd.	78,408	2	2.0	950	$ 619,000	254	11/9/2005	$ 665,000
315556	CO	Maalaea	LH	250 Hauoli Rd.	112,820	2	2.0	952	$ 629,000	210	12/23/2005	$ 712,000
318675	CO	Maalaea	FS	150 Hauoli Road	76,317	2	2.0	802	$ 649,000	39	6/12/2006	$ 649,000
316906	CO	Maalaea	LH	100 Hauoli Road	78,190	2	2.0	950	$ 649,000	141	3/2/2006	$ 663,000
318150	CO	Maalaea	LH	100 Hauoli Road	78,408	2	2.0	950	$ 669,500	73	5/9/2006	$ 669,500
315885	CO	Maalaea	FS	300 Hauoli Road	41,295	2	2.0	909	$ 675,000	192	1/10/2006	$ 699,000
316752	CO	Maalaea	LH	250 HAOULI STREET	112,908	2	2.0	952	$ 675,000	149	2/22/2006	$ 675,000
318297	CO	Maalaea	LH	250 Hauoli Street	112,908	2	2.0	952	$ 679,000	67	5/15/2006	$ 679,000
317056	CO	Maalaea	LH	250 HAUOLI STREET	112,908	2	2.0	952	$ 695,000	135	3/8/2006	$ 695,000
318043	CO	Maalaea	FS	70 Hauoli Road	41,295	2	2.0	878	$ 699,000	81	5/1/2006	$ 779,000
317598	CO	Maalaea	FS	70 Hauoli Road	99,665	2	2.0	878	$ 745,000	109	4/3/2006	$ 755,000
318303	CO	Maalaea	LH	100 Hauoli St	78,190	1	1.0	950	$ 825,000	67	5/15/2006	$ 825,000
318160	CO	Maalaea	FS	1709 Hauoli Road	99,665	2	2.0	878	$ 885,000	76	5/6/2006	$ 885,000
317215	CO	Maalaea	LH	50 Hauoli Road	54,014	2	2.0	1,268	$ 1,095,000	127	3/16/2006	$ 1,095,000
315018	CO	Wailuku	FS	493 Pio Drive	46,174	1.0	1	586	$ 198,900	201	5/31/2006	$ 228,000
317262	CO	Wailuku	FS	493 Pio Drive	46,130	1.0	1	586	$ 199,000	91	3/20/2006	$ 210,000
312942	CO	Wailuku	FS	493 Pio Drive	46,115	1.0	1	586	$ 209,000	319	11/16/2005	$ 219,500

316173	CO	Wailuku	FS	493 Pio Drive	46,130	1.0	1	586	$ 212,000	147	1/23/2006	$ 220,000
314561	CO	Wailuku	FS	493 Pio Drive	46,115	1.0	1	586	$ 220,000	230	4/3/2006	$ 220,000
315083	CO	Wailuku	FS	1063 Lower Main Street	130,680	1.5	2	757	$ 274,000	200	3/23/2006	$ 299,000
315057	CO	Wailuku	FS	1063 Lower Main Street	130,680	1.5	2	757	$ 280,000	201	6/12/2006	$ 280,000
317730	CO	Wailuku	FS	1063 Lower Main St.	130,680	1.5	2	757	$ 285,000	68	4/12/2006	$ 285,000
315980	CO	Wailuku	FS	1063 Lower Main Street	130,680	1.5	2	757	$ 289,000	158	1/13/2006	$ 305,000
314327	CO	Wailuku	FS	1063 Lower Main	130,680	1.5	2	757	$ 295,000	242	10/20/2005	$ 295,000
318350	CO	Wailuku	FS	495 Liholiho Street	27,521	1.5	2	724	$ 297,000	31	5/22/2006	$ 297,000
318351	CO	Wailuku	FS	495 Liholiho Street	27,526	1.5	2	724	$ 297,000	31	5/22/2006	$ 297,000
318778	CO	Wailuku	FS	1063 Lower Main Street	130,680	2.0	3	1,156	$ 460,000	3	6/16/2006	$ 460,000
318607	CO	Kahului	FS	7 Koiula Lane	213,444	1.0	1	589	$ 259,000	12	6/7/2006	$ 259,000
317341	CO	Kahului	FS	11 Koiula	213,444	2.0	2	772	$ 330,000	90	3/23/2006	$ 360,000
318468	CO	Wailuku	FS	7 Koiula Ln.	43,560	2.0	2	749	$ 360,000	24	5/30/2006	$ 360,000
317439	CO	Kahului	FS	40 Kunihi Lane	213,444	2.0	2	749	$ 369,000	83	3/28/2006	$ 369,000
316764	CO	Kahului	FS	60 Kunihi Street	213,444	2.0	2	749	$ 380,000	116	2/23/2006	$ 400,000
318561	CO	Kahului	FS	44 Kunihi Lane	24,829	2.0	2	772	$ 380,000	14	6/5/2006	$ 380,000
318792	CO	Kahului	FS	11 KOIULA LN	213,444	2.0	3	900	$ 495,000	1	6/18/2006	$ 495,000
318797	CO	Wailuku	FS	1063 Lower Main Street	130,680	1.5	2	757	$ 295,000	3	6/18/2006	$ 295,000
316353	CO	Wailuku	FS	1063 Lower Main Street	130,680	1.5	2	757	$ 296,000	139	2/1/2006	$ 296,000

318180	LD	Wailuku	FS	2265 Vineyard Street	2,085	$ 100,000	40	5/11/2006	$ 100,000
318168	LD	Wailuku	FS	000 Waihee Valley Rd.	58,501	$ 300,000	40	5/10/2006	$ 300,000
316331	LD	Wailuku	FS	Lot #61 Sandhills Estates	8,033	$ 350,000	139	1/31/2006	$ 350,000
314725	LD	Wailuku	FS	8 River Road	21,780	$ 380,000	221	3/9/2006	$ 400,000
318663	LD	Wailuku	FS	23 Papakapu Pl	9,583	$ 395,000	8	6/11/2006	$ 395,000
316737	LD	Kahului	FS	380 Kuualoha Street	6,307	$ 395,000	118	3/8/2006	$ 395,000
317594	LD	Wailuku	FS	1367 Kakae Place	7,405	$ 399,000	76	4/5/2006	$ 410,000
317443	LD	Wailuku	FS	Lot #6 Sandhills Estates	8,189	$ 399,000	83	3/28/2006	$ 399,000
314220	LD	Wailuku	FS	0 KOWALI PLACE (317 AINAHOU)	5,227	$ 400,000	251	10/14/2005	$ 320,000
314743	LD	Wailuku	FS	Lot 28 Sandhills Estates	10,019	$ 405,000	222	4/3/2006	$ 549,000
317991	LD	Wailuku	FS	1357 Owaka St.	6,055	$ 410,000	52	4/28/2006	$ 410,000
316332	LD	Wailuku	FS	Lot #63 Sandhills Estats	9,228	$ 410,000	139	1/31/2006	$ 410,000
314371	LD	Wailuku	FS	Lot #41 Sandhills Estates	9,901	$ 425,000	238	10/24/2005	$ 460,000
317854	LD	Wailuku	FS	Lot 22 Sandhills Estates	10,454	$ 435,000	59	4/21/2006	$ 435,000
318025	LD	Kahului	FS	0 Sand Hills Estates	9,245	$ 435,000	48	5/2/2006	$ 435,000
314703	LD	Wailuku	FS	#36 Sandhills Estate Lot #36	8,712	$ 445,000	221	11/10/2005	$ 490,000
313962	LD	Kahului	FS	LOT 93 SANDHILL ESTATE	11,565	$ 450,000	266	9/30/2005	$ 530,000
310788	LD	Wailuku	FS	0 Malaihi Road	21,780	$ 459,000	475	6/13/2006	$ 469,000
316227	LD	Wailuku	FS	0 Sandhills Estate Lot 88	10,842	$ 463,000	145	1/26/2006	$ 528,000
317110	LD	Wailuku	FS	Lot 3 Sandhills Estates	8,058	$ 475,000	99	3/14/2006	$ 505,000
317106	LD	Wailuku	FS	#42 Sandhill Estates	10,884	$ 475,000	98	3/13/2006	$ 475,000
316224	LD	Wailuku	FS	LOT #34 SANDHILLS ESTATE	9,337	$ 485,000	147	1/25/2006	$ 485,000

317892	LD	Kahului	FS	115 kamalei circle	10,454	$ 487,000	56	4/24/2006	$ 499,000
313465	LD	Wailuku	FS	Lot #9 Sandhills Estates	10,658	$ 488,000	290	9/2/2005	$ 528,880
318349	LD	Wailuku	FS	85 Wilikona Place	6,359	$ 495,000	31	5/22/2006	$ 495,000
315649	LD	Wailuku	FS	0 Sandhills Estates at Maui Lani 106	10,019	$ 495,000	171	12/30/2005	$ 520,000
314578	LD	Wailuku	FS	31 W Kapueone Place	8,889	$ 495,000	230	4/27/2006	$ 539,000
317515	LD	Wailuku	FS	LOT 40 Sandhills	8,756	$ 495,000	81	3/31/2006	$ 495,000
316355	LD	Wailuku	FS	Lot 49 Sandhills Estates	9,978	$ 519,000	139	2/1/2006	$ 519,000
314691	LD	Wailuku	FS	54 Sandhills Estates	9,533	$ 519,000	222	11/9/2005	$ 519,000
314891	LD	Kahului	FS	Lot 19 Kamaiki Circle	10,019	$ 520,000	210	11/21/2005	$ 520,000
316107	LD	Wailuku	FS	0 Sandhills Estate Lot 108	13,068	$ 524,000	151	1/20/2006	$ 545,000
314392	LD	Wailuku	FS	Lot 12 Sandhill Estates at Maui Lani	8,754	$ 525,000	240	10/24/2005	$ 600,000
318774	LD	Wailuku	FS	Lot #82 Sandhills Estates	12,632	$ 529,000	3	6/16/2006	$ 529,000
313116	LD	Wailuku	FS	Lot # 75 New Sandhills	10,301	$ 535,000	306	8/17/2005	$ 550,000
317109	LD	Wailuku	FS	Lot 74 Sandhills Estates	10,301	$ 535,000	99	3/14/2006	$ 549,000
317686	LD	Wailuku	FS	Lot 99 Sandhills Estates	10,125	$ 545,000	70	4/10/2006	$ 545,000
318692	LD	Wailuku	FS	10 Papuhau Place	12,116	$ 548,000	7	6/13/2006	$ 548,000
317043	LD	Wailuku	FS	Lot 8 Sandhill Estates at Maui Lani	7,867	$ 549,000	106	3/10/2006	$ 549,000
315013	LD	Wailuku	FS	Lot #30 Sandhills Estate	10,019	$ 549,000	202	11/30/2005	$ 549,000
314250	LD	Kahului	FS	Lot 16 Sandhills Estate	9,517	$ 550,000	248	10/15/2005	$ 550,000
316523	LD	Wailuku	FS	00 E Kapueone Pl.	8,276	$ 550,000	129	2/10/2006	$ 600,000
317622	LD	Wailuku	FS	Lot 46 Sandhills Estates	15,682	$ 575,000	74	4/6/2006	$ 575,000
315368	LD	Wailuku	FS	Lot 47 Sandhills Estate	10,019	$ 575,000	187	12/14/2005	$ 575,000
318413	LD	Wailuku	FS	46 Papuhau Place	10,890	$ 579,000	26	5/24/2006	$ 579,000
314990	LD	Wailuku	FS	0 Hiahia Place	13,504	$ 585,000	203	11/28/2005	$ 619,000
315385	LD	Wailuku	FS	8 Nohoana Place Lot 26	19,936	$ 595,000	188	12/15/2005	$ 650,000
316970	LD	Wailuku	FS	Lot #89 Sanhills Estates	10,759	$ 595,000	105	3/6/2006	$ 595,000
313380	LD	Kahakuloa	FS	Maluhia Country Estates	128,676	$ 599,000	293	3/3/2006	$ 635,000
316629	LD	Kahului	FS	Lot 103 Sandhill Estates	8,712	$ 600,000	124	2/15/2006	$ 600,000
317257	LD	Wailuku	FS	Lot 4 Wailuku Country Estates	99,840	$ 629,000	91	3/20/2006	$ 650,000
316758	LD	Wailuku	FS	28 Papakapu Place	9,148	$ 650,000	117	2/23/2006	$ 650,000
318747	LD	Wailuku	FS	2011 Puuohala Road	147,538	$ 675,000	13	6/16/2006	$ 675,000
317938	LD	Wailuku	FS	Lot 108 Wailuku Country Estates	88,862	$ 685,000	54	4/26/2006	$ 685,000
313068	LD	Kahakuloa	FS	51 Lahaole Place	271,379	$ 695,000	312	8/14/2005	$ 795,000
317975	LD	Wailuku	FS	2347 Kamaile Street (Lot 180)	100,188	$ 740,000	53	4/28/2006	$ 750,000
316049	LD	Kahakuloa	FS	#39B Maluhia Country Estates	163,786	$ 750,000	157	1/17/2006	$ 750,000
317923	LD	Wailuku	FS	0 Wailuku Country Estates	101,930	$ 750,000	55	4/25/2006	$ 750,000
317289	LD	Wailuku	FS	Lot 93 Mahinalani Place	98,446	$ 750,000	91	3/21/2006	$ 795,000
317945	LD	Wailuku	FS	2004 Puuohala Road	92,826	$ 750,000	54	4/26/2006	$ 750,000
317212	LD	Wailuku	FS	2850 Kamaile St.	100,362	$ 769,000	103	3/16/2006	$ 795,000
317858	LD	Wailuku	FS	2832 Kamaile Pl. (Lot #81)	99,186	$ 789,000	59	4/21/2006	$ 789,000
312983	LD	Kahakuloa	FS	00 Kaukini Loop/ Haku Hee way	191,664	$ 799,000	315	8/9/2005	$ 825,000
317701	LD	Kahakuloa	FS	Kahakalua Maluhia Country Estates	155,509	$ 799,000	69	4/11/2006	$ 799,000
312806	LD	Kahakuloa	FS	45 Hulumanu Pl.	246,550	$ 835,000	332	7/26/2005	$ 885,000

318117 LD	Wailuku	FS	Lot 22 Wailuku Country Estates	124,930				$ 875,000	45	5/8/2006	$ 875,000
318402 LD	Wailuku	FS	0 Lower Waiehu Beach Road	71,874				$ 900,000	28	5/24/2006	$ 900,000
317022 LD	Kahakuloa	FS	0 Kahekili Hwy	130,680				$ 1,200,000	103	3/9/2006	$ 1,600,000
312932 LD	Wailuku	FS	00 Piihana Road	124,582				$ 1,200,000	322	8/4/2005	$ 1,200,000
313354 LD	Wailuku	FS	949&967 Malaihi Rd	229,561				$ 2,500,000	294	8/29/2005	$ 2,500,000
318589 LD	Kahului	FS	0 Ala Makani St	20,038				$ 2,850,000	13	6/6/2006	$ 2,850,000
310679 LD	Kahului	FS	65 Kahului Beach Road	195,149				$ 5,500,000	486	6/14/2005	$ 4,500,000
307107 LD	Wailuku	FS	440 W Waiko Road	848,070				$ 8,750,000	740	6/27/2004	$ 10,000,000
314432 MD	Kahului	FS	292 MOHALU STREET	8,390				$ 995,000	236	10/26/2005	$ 995,000
318261 MD	Wailuku	FS	2114 vineyard	4,200				$ 750,000	34	5/16/2006	$ 750,000
318260 MD	Wailuku	FS	2114 vineyard	4,200				$ 750,000	34	5/16/2006	$ 750,000
317324 RS	Wailuku	FS	438 Makahala Place	7,847	1.0	3	780	$ 350,000	90	6/19/2006	$ 350,000
317947 RS	Wailuku	FS	270 North Market Street	2,831	1.0	2	665	$ 400,000	54	4/26/2006	$ 400,000
317993 RS	Wailuku	FS	2073A Wells Street	3,963	1.0	2	688	$ 400,000	52	4/28/2006	$ 445,000
314630 RS	Wailuku	FS	1835 Loke Street	4,687	1.0	2	816	$ 409,000	226	11/7/2005	$ 474,000
314296 RS	Wailuku	FS	1994 Liko Lane	4,738	1.0	2	600	$ 447,000	244	10/18/2005	$ 475,000
318722 RS	Wailuku	FS	1970 LIKO PLACE	3,875	1.0	3	864	$ 449,990	5	6/14/2006	$ 449,990
317170 RS	Wailuku	FS	440 Lauone St.	3,102	1.0	3	904	$ 464,000	104	3/15/2006	$ 474,000
313960 RS	Wailuku	FS	2265 Holowai Place	11,600	1.5	3	960	$ 485,000	262	9/30/2005	$ 650,000
318363 RS	Wailuku	FS	1816 Nani Street	3,684	1.5	4	992	$ 485,000	31	5/22/2006	$ 485,000
315702 RS	Wailuku	FS	605 Kaikoo St.	6,877	1.0	2	824	$ 485,000	167	6/10/2006	$ 569,000
313861 RS	Wailuku	FS	59 Halewaiu Rd	4,588	1.0	2	720	$ 485,000	266	9/26/2005	$ 525,000
318347 RS	Wailuku	FS	2214 Mokuhau	7,512	1.0	3	976	$ 485,000	31	5/22/2006	$ 485,000
313209 RS	Wailuku	FS	592 Kaikoo Street	6,877	1.0	3	975	$ 495,000	301	8/22/2005	$ 495,000
318780 RS	Wailuku	FS	2032 Kahawai Street	6,621	2.0	2	823	$ 495,000	3	6/16/2006	$ 495,000
317315 RS	Wailuku	FS	1727 KALAWI DRIVE	2,813	2.0	3	1,196	$ 499,000	94	3/22/2006	$ 550,000
314735 RS	Wailuku	FS	1822 Piihana Road	4,315	2.0	4	1,368	$ 499,000	224	4/3/2006	$ 499,000
317424 RS	Wailuku	FS	862 Upalu Street	3,854	2.0	3	960	$ 510,000	84	6/1/2006	$ 510,000
314384 RS	Wailuku	FS	1600 Alako Street	3,365	2.0	3	1,248	$ 520,000	238	1/26/2006	$ 589,000
318806 RS	Kahului	FS	93 Kono Place	10,509	1.0	3	760	$ 525,000	0	6/19/2006	$ 525,000
318798 RS	Wailuku	FS	917 Hoomau Street	3,585	2.0	2	836	$ 525,000	1	6/19/2006	$ 525,000
318296 RS	Wailuku	FS	808 Makaala Drive	4,512	2.0	3	1,033	$ 525,000	32	5/18/2006	$ 525,000
318762 RS	Wailuku	FS	975 Hoomau Street	4,091	2.0	3	1,104	$ 529,000	4	6/16/2006	$ 529,000
316929 RS	Wailuku	FS	865 MAKAALA DRIVE	4,128	2.0	3	980	$ 535,000	110	3/3/2006	$ 699,000
317768 RS	Wailuku	FS	2086 HELENA PLACE	6,322	1.0	3	916	$ 549,000	65	4/15/2006	$ 549,000
318430 RS	Wailuku	FS	20 Olo Place	7,479	1.0	3	1,140	$ 560,000	28	5/25/2006	$ 560,000
317163 RS	Wailuku	FS	1148 Hoalu Place	6,697	2.0	3	1,224	$ 575,000	96	4/24/2006	$ 575,000
315002 RS	Wailuku	FS	2072 KAHEKILI HWY	14,989	1.0	2	600	$ 575,000	203	11/29/2005	$ 725,000
318467 RS	Kahului	FS	382 Kea Street	7,800	1.0	3	720	$ 580,000	25	5/30/2006	$ 595,000
316700 RS	Wailuku	FS	1610 Wili Place	6,945	1.5	2	960	$ 580,000	122	2/17/2006	$ 580,000
317124 RS	Wailuku	FS	2350 Main Street	3,954	1.5	3	976	$ 589,000	108	3/14/2006	$ 589,000
315776 RS	Wailuku	FS	619 Linekona Pl.	7,364	2.0	4	1,152	$ 590,000	165	1/5/2006	$ 649,000
317839 RS	Kahului	FS	352 Ku'ualoha St.	5,755	2.0	3	1,190	$ 592,000	63	4/20/2006	$ 649,500
318758 RS	Wailuku	FS	2089 Pakahi Street	4,326	3.5	6	1,846	$ 594,900	3	6/16/2006	$ 594,900
318808 RS	Kahului	FS	401 Ano Street	8,466	1.5	3	1,288	$ 595,000	0	6/19/2006	$ 595,000
317097 RS	Kahului	FS	267 Kuualoha	6,142	2.0	3	1,122	$ 599,000	132	6/6/2006	$ 630,000
318110 RS	Wailuku	FS	923 Hoomau St	4,091	2.0	4	1,600	$ 599,000	47	5/7/2006	$ 599,000
311694 RS	Wailuku	FS	242 KONI PL	7,123	1.0	2	583	$ 599,000	415	5/30/2006	$ 650,000
318541 RS	Kahului	FS	328 Hilu Place	10,464	1.5	3	1,367	$ 615,000	17	6/2/2006	$ 615,000
318034 RS	Kahului	FS	241 Ku'ualoha Street	6,276	3.5	3	1,486	$ 620,000	48	5/2/2006	$ 650,000
316594 RS	Wailuku	FS	87 Poniu Circle	3,960	2.0	3	1,185	$ 624,900	125	2/14/2006	$ 624,900
315206 RS	Wailuku	FS	595 Linekona St.	6,838	2.0	2	912	$ 625,000	195	12/6/2005	$ 625,000
318000 RS	Kahului	FS	262 Kuualoha St.	5,705	2.0	3	1,243	$ 625,000	52	4/28/2006	$ 625,000
311690 RS	Kahului	FS	739 S KEI PLACE	7,659	1.5	3	960	$ 625,000	414	5/5/2005	$ 625,000
317699 RS	Wailuku	FS	352 NENEA ST	6,119	1.0	3	1,008	$ 625,000	71	4/11/2006	$ 625,000
318725 RS	Kahului	FS	600 Pohai St	8,176	2.0	3	1,538	$ 630,000	6	6/15/2006	$ 630,000
318496 RS	Wailuku	FS	800 Hoomau St.	8,100	2.0	3	1,124	$ 630,000	19	5/31/2006	$ 630,000
317696 RS	Wailuku	FS	757 Papua Street	7,026	2.0	3	1,404	$ 635,000	69	4/11/2006	$ 655,000
316449 RS	Wailuku	FS	388 A High Street	7,530	1.0	2	861	$ 635,000	133	2/6/2006	$ 699,000
317485 RS	Kahului	FS	360 Hilu Place	9,020	1.5	3	931	$ 638,000	81	3/30/2006	$ 638,000
318008 RS	Wailuku	FS	31 Poniu Circle	3,960	2.5	3	1,521	$ 639,000	49	5/1/2006	$ 639,000
317707 RS	Wailuku	FS	614 Akolea Street	3,960	2.0	3	1,521	$ 640,000	69	4/11/2006	$ 640,000
316930 RS	Kahului	FS	48 Hooheno Street	4,168	2.5	4	1,421	$ 647,500	109	3/3/2006	$ 680,000
317875 RS	Kahului	FS	307 Ohaa Street	7,626	1.0	2	760	$ 649,000	59	4/23/2006	$ 649,000
318405 RS	Wailuku	FS	530 Akolea Place	3,960	2.5	3	1,521	$ 649,000	26	5/24/2006	$ 649,000
317317 RS	Wailuku	FS	435 Makahala Place	14,402	1.5	3	1,514	$ 650,000	90	5/25/2006	$ 650,000
318048 RS	Kahului	FS	14 Kuuohana Way	7,653	2.0	3	1,312	$ 650,000	48	5/3/2006	$ 650,000
317088 RS	Wailuku	FS	2047 Palua Street	3,364	1.5	2	1,432	$ 650,000	99	3/12/2006	$ 650,000
314644 RS	Kahului	FS	428 KEA STREET	10,748	2.0	4	1,446	$ 650,000	224	11/7/2005	$ 675,000
315553 RS	Wailuku	FS	216 Naniloa Drive	6,307	2.0	2	1,350	$ 650,000	178	6/1/2006	$ 725,000
318332 RS	Wailuku	FS	22 Hapua Place	6,674	2.5	3	1,525	$ 657,000	31	5/19/2006	$ 677,000
318532 RS	Kahului	FS	39 Papahi Loop	4,493	2.5	4	1,421	$ 659,000	56	6/2/2006	$ 659,000
318365 RS	Kahului	FS	651 Kaulu Place	6,618	2.0	3	1,934	$ 659,000	28	5/22/2006	$ 695,000
318056 RS	Wailuku	FS	1366 Kawika Street	6,014	2.0	3	1,105	$ 661,000	47	5/3/2006	$ 661,000
318520 RS	Wailuku	FS	135 Poniu Circle	4,978	2.0	3	1,600	$ 669,000	18	6/1/2006	$ 669,000
316902 RS	Wailuku	FS	357 Lani Place	4,000	4.0	6	1,176	$ 670,000	109	3/2/2006	$ 675,000
318735 RS	Kahului	FS	61 Kaiemi Street	8,125	1.0	3	680	$ 675,000	5	6/15/2006	$ 675,000
318017 RS	Wailuku	FS	2042 KAHEKILI HIGHWAY	7,492	2.0	3	1,350	$ 675,000	49	5/1/2006	$ 675,000
317213 RS	Wailuku	FS	1292 Kawika Street	7,416	2.0	3	1,105	$ 679,000	96	5/22/2006	$ 699,000
315506 RS	Kahului	FS	67 S PAPA	7,931	1.5	5	1,465	$ 680,000	180	12/21/2005	$ 680,000
318472 RS	Wailuku	FS	1910 Koae Place	6,079	2.5	3	1,712	$ 685,000	20	5/30/2006	$ 685,000
318694 RS	Wailuku	FS	10 Malunawai Street	6,970	2.0	3	1,408	$ 689,000	6	6/13/2006	$ 689,000

318566 RS	Wailuku	FS	744 Aukai Street	6,796	2.5	3	1,648	$ 698,000	14	6/6/2006	$ 698,000
315555 RS	Kahului	FS	11 Apa'a Pl	9,834	2.0	4	1,675	$ 698,000	179	12/23/2005	$ 710,000
314851 RS	Wailuku	FS	890 Lekeona Loop	7,990	2.0	3	1,950	$ 699,000	213	11/18/2005	$ 749,000
317928 RS	Wailuku	FS	130 Waihee Valley Road	4,176	2.0	2	1,292	$ 699,000	56	4/25/2006	$ 699,000
317047 RS	Wailuku	FS	42 Kolopua Pl.	7,012	2.5	3	1,525	$ 699,000	101	6/13/2006	$ 699,000
314293 RS	Wailuku	FS	160 Hoauna Place	7,855	2.0	3	1,368	$ 699,000	244	2/24/2006	$ 815,000
316654 RS	Wailuku	FS	179 Central Ave.	7,179	2.0	4	1,616	$ 699,000	124	2/16/2006	$ 699,000
318407 RS	Wailuku	FS	2294 Vineyard St.	10,600	1.0	2	596	$ 700,000	28	5/24/2006	$ 700,000
318713 RS	Kahului	FS	507 Waikala Street	7,503	2.0	3	1,909	$ 705,000	6	6/14/2006	$ 705,000
313362 RS	Wailuku	FS	21 Hakalani Place	8,118	2.0	3	1,408	$ 707,707	297	8/29/2005	$ 1,088,044
318608 RS	Wailuku	FS	670 Kaiko'o Street	6,877	1.8	3	1,334	$ 715,000	12	6/7/2006	$ 715,000
314655 RS	Wailuku	FS	187 Ku Drive	11,167	2.0	3	1,494	$ 718,000	223	11/8/2005	$ 825,000
316156 RS	Wailuku	FS	1173 Onaha Place	7,973	3.0	3	1,938	$ 719,000	151	1/22/2006	$ 769,000
318800 RS	Wailuku	FS	480 Kamani Place	8,001	2.0	3	1,488	$ 725,000	2	6/19/2006	$ 725,000
315597 RS	Kahului	FS	12 Papahi Loop	4,978	3.0	4	1,768	$ 725,000	173	12/29/2005	$ 775,000
310917 RS	Wailuku	FS	208 Halenani Drive	11,979	2.0	3	2,238	$ 725,000	466	11/4/2005	$ 746,000
316158 RS	Wailuku	FS	1181 W Onaha Place	10,069	3.0	4	1,832	$ 734,500	151	1/22/2006	$ 769,500
317931 RS	Wailuku	FS	148 Poniu Circle	3,960	3.0	4	1,628	$ 735,000	55	4/25/2006	$ 749,900
313936 RS	Wailuku	FS	1409 Hiahia Street	6,890	3.0	3	1,361	$ 745,000	263	9/29/2005	$ 745,000
314989 RS	Wailuku	FS	670 Pio Drive	9,226	2.0	3	1,434	$ 749,000	206	11/28/2005	$ 875,000
315094 RS	Wailuku	FS	6 Malunawai St.	6,975	3.0	4	1,809	$ 750,000	200	6/17/2006	$ 849,000
314613 RS	Wailuku	FS	2092 Church Street	8,146	1.5	3	1,128	$ 750,000	226	11/6/2005	$ 850,000
317901 RS	Wailuku	FS	1757 Mill Street	14,596	1.5	4	1,592	$ 750,000	56	4/24/2006	$ 750,000
318242 RS	Wailuku	FS	1902 Pohakea Place	9,330	3.0	4	1,817	$ 750,000	35	5/15/2006	$ 750,000
317538 RS	Wailuku	FS	281 owapuhi pl.	10,896	2.0	4	1,500	$ 750,000	78	6/16/2006	$ 750,000
316356 RS	Wailuku	FS	854 Haunani Place	7,460	2.0	3	1,486	$ 759,000	138	2/1/2006	$ 759,000
318600 RS	Kahului	FS	281 W. Kamehameha Ave.	12,267	2.0	3	1,757	$ 759,500	12	6/7/2006	$ 759,500
318665 RS	Wailuku	FS	Ohia Phase 2 Lot 39	8,784	3.5	5	2,137	$ 765,000	8	6/11/2006	$ 765,000
318360 RS	Wailuku	FS	462 Palani Place	17,050	2.0	3	1,857	$ 775,000	28	5/22/2006	$ 799,000
318277 RS	Wailuku	FS	576 Akolea	3,960	3.0	4	1,656	$ 779,000	33	5/17/2006	$ 779,000
318039 RS	Wailuku	FS	1382 Kakae Place	6,106	2.0	4	1,838	$ 779,000	49	5/3/2006	$ 799,000
317900 RS	Wailuku	FS	547 Akolea Place	4,500	3.0	4	2,213	$ 779,000	56	4/24/2006	$ 779,000
317690 RS	Kahului	FS	15 Puu Ehu PL	9,871	2.0	4	1,804	$ 785,000	70	4/11/2006	$ 800,000
318248 RS	Wailuku	FS	883 Lekeona Loop	6,890	3.0	6	1,798	$ 785,000	35	5/16/2006	$ 785,000
315070 RS	Wailuku	FS	467 A Lilihua Place	22,400	2.0	4	1,674	$ 789,000	200	6/1/2006	$ 899,000
318466 RS	Wailuku	FS	952 Puuloa Street	6,369	1.5	3	1,000	$ 790,000	23	5/30/2006	$ 790,000
317755 RS	Wailuku	FS	42 Nakoa Drive	9,750	2.0	3	1,095	$ 795,000	66	4/14/2006	$ 899,000
313526 RS	Wailuku	FS	351 Waiehu Beach Road	11,250	1.0	3	1,334	$ 800,000	289	9/7/2005	$ 920,000
318287 RS	Kahului	FS	26 Inoa Po Place	8,686	3.0	4	1,773	$ 820,000	33	5/17/2006	$ 820,000
317750 RS	Kahului	FS	18 Puuaina Place	7,671	3.0	4	2,198	$ 839,000	66	4/14/2006	$ 899,000
315991 RS	Wailuku	FS	43 HAKALANI STREET	9,595	3.0	4	1,809	$ 845,000	158	1/14/2006	$ 845,000
316128 RS	Kahului	FS	11 Kuukama St.	7,519	3.5	3	1,464	$ 850,000	150	1/20/2006	$ 850,000
317977 RS	Wailuku	FS	746 OLENA	6,825	2.5	5	2,100	$ 850,000	53	4/28/2006	$ 1,100,000

318346 RS	Wailuku	FS	551 Liholiho Street	10,010	2.0	4	2,546	$ 850,000	31	5/22/2006	$ 850,000
317462 RS	Wailuku	FS	1367 Kilou St	7,163	2.0	3	1,896	$ 859,900	85	3/29/2006	$ 895,000
313125 RS	Kahului	FS	7 Loihi Place	7,560	2.5	4	1,971	$ 879,000	306	9/9/2005	$ 810,000
317886 RS	Wailuku	FS	610 Maalahi Street	8,400	3.0	3	2,084	$ 895,000	56	4/24/2006	$ 895,000
314886 RS	Wailuku	FS	2131 Kahookele St.	14,373	2.0	4	2,504	$ 895,000	210	11/21/2005	$ 895,000
318764 RS	Kahului	FS	151 Kuualoha St.	7,150	3.0	4	1,865	$ 899,000	5	6/16/2006	$ 899,000
318723 RS	Wailuku	FS	337 S Alu Road	10,313	2.0	3	1,644	$ 899,000	5	6/14/2006	$ 899,000
315756 RS	Kahului	FS	21 Puuaina Place	9,638	3.0	4	2,008	$ 916,000	165	1/5/2006	$ 916,000
317467 RS	Kahului	FS	25 Puukai Place	6,456	2.5	4	2,453	$ 925,000	82	4/18/2006	$ 925,000
317573 RS	Kahului	FS	8 Pahe'e Place	7,943	3.0	5	2,198	$ 927,000	76	4/4/2006	$ 927,000
314461 RS	Kahului	FS	29 Pahee Pl.	8,758	3.0	4	2,002	$ 929,000	235	1/13/2006	$ 899,000
317983 RS	Kahului	FS	14 Puuehu Place	7,535	2.5	4	1,632	$ 939,000	52	4/28/2006	$ 939,000
317588 RS	Kahului	FS	165 Kuualoha	7,322	2.0	3	1,598	$ 950,000	76	4/5/2006	$ 950,000
316948 RS	Kahului	FS	453 Kaulana Street	7,920	3.0	8	2,275	$ 950,000	109	3/6/2006	$ 950,000
318457 RS	Wailuku	FS	31 Pa'alae Pl	10,414	3.0	4	2,400	$ 950,000	23	5/27/2006	$ 950,000
316931 RS	Wailuku	FS	42 Maunaleo Place	7,452	3.0	4	2,152	$ 950,000	108	3/3/2006	$ 975,000
312762 RS	Wailuku	FS	656 S ALU STREET	8,560	3.0	4	2,428	$ 950,000	333	7/22/2005	$ 950,000
318488 RS	Kahului	FS	210 Puumakani St.	10,275	2.5	4	2,028	$ 960,000	20	5/31/2006	$ 960,000
315513 RS	Wailuku	FS	lot#83 Maunaleo at Kehalani	8,907	3.0	4	2,152	$ 975,000	180	12/21/2005	$ 875,000
316303 RS	Wailuku	FS	1205 Kilou Loop	7,116	5.0	4	3,241	$ 975,000	140	1/30/2006	$ 975,000
317759 RS	Wailuku	FS	355 Liholiho Street	10,000	3.5	3	2,690	$ 975,000	66	4/14/2006	$ 1,100,000
318571 RS	Wailuku	FS	504 Liholiho St.	10,344	2.0	3	1,744	$ 989,000	14	6/5/2006	$ 989,000
314431 RS	Kahului	FS	292 MOHALU STREET	8,390	4.0	10	3,464	$ 995,000	236	10/26/2005	$ 995,000
316122 RS	Kahului	FS	105 Polani St.	7,551	3.0	5	2,640	$ 1,000,000	150	1/20/2006	$ 1,100,000
318298 RS	Kahului	FS	150 Puumakani Street	10,083	3.0	4	2,328	$ 1,050,000	33	5/18/2006	$ 1,000,000
318650 RS	Wailuku	FS	970/980 Honoapiilani Highway	114,799	2.0	3	902	$ 1,050,000	11	6/9/2006	$ 1,050,000
313914 RS	Wailuku	FS	34 NANILUNA PL	14,535	2.0	4	2,332	$ 1,094,000	264	9/28/2005	$ 1,200,000
316322 RS	Kahului	FS	383 Kamalei Circle	10,112	3.0	4	1,898	$ 1,095,000	141	1/31/2006	$ 1,195,000
317828 RS	Wailuku	FS	30 Pa'alae Place	10,100	3.0	3	1,687	$ 1,098,000	60	4/20/2006	$ 979,000
316341 RS	Kahului	FS	80 Puukani Street	7,671	4.0	8	4,304	$ 1,100,000	139	1/31/2006	$ 1,100,000
316064 RS	Wailuku	FS	744 Alu Road	8,712	3.0	4	2,386	$ 1,100,000	152	1/18/2006	$ 1,200,000
318459 RS	Wailuku	FS	2222 Kamaile Street	112,733	2.0	2	974	$ 1,100,000	23	5/27/2006	$ 1,100,000
318345 RS	Kahului	FS	491 S Papa Avenue	8,656	4.5	6	4,278	$ 1,145,000	32	5/20/2006	$ 1,195,000
312811 RS	Kahului	FS	111 Kamaiki Circle	12,384	3.0	3	2,112	$ 1,149,000	329	7/27/2005	$ 1,200,000
316917 RS	Wailuku	FS	2623 W Main Street	19,040	3.0	3	1,288	$ 1,190,000	108	3/3/2006	$ 1,400,000
318531 RS	Kahului	FS	257 Kuualoha St	6,770	3.0	4	2,200	$ 1,195,000	21	6/2/2006	$ 1,195,000
314484 RS	Wailuku	FS	83 Mission Street	13,182	2.0	4	1,956	$ 1,200,000	233	10/30/2005	$ 1,200,000
318355 RS	Wailuku	FS	512 Kuikahi Drive	9,617	3.5	4	3,751	$ 1,245,000	28	5/22/2006	$ 1,295,000
317852 RS	Kahului	FS	189 Kamalei Circle	10,027	3.0	4	2,964	$ 1,250,000	59	4/21/2006	$ 1,250,000
318036 RS	Wailuku	FS	566 Kuikahi Dr.	9,974	3.5	5	2,700	$ 1,315,000	48	5/2/2006	$ 1,315,000
318645 RS	Wailuku	FS	355 Kaukini Loop	101,494	4.0	4	1,900	$ 1,339,000	10	6/9/2006	$ 1,339,000
315342 RS	Wailuku	FS	386 Naniloa Drive	27,856	3.0	4	1,600	$ 1,400,000	188	12/13/2005	$ 1,635,000
316345 RS	Kahului	FS	419 S Papa Ave	14,962	4.5	6	2,968	$ 1,400,000	139	2/1/2006	$ 1,400,000

314647 RS	Kahului	FS	252 Puumakani St.	11,130	3.5	4	2,525	$ 1,475,000	224	11/7/2005	$ 1,475,000
317069 RS	Wailuku	FS	475 Nipo Street	8,915	4.5	4	4,396	$ 1,498,000	101	3/11/2006	$ 1,498,000
316406 RS	Wailuku	FS	309 Naniloa Drive	45,738	1.5	3	1,988	$ 1,575,000	137	2/3/2006	$ 1,575,000
316129 RS	Kahakuloa	FS	425 Kaukini Loop	149,062	2.0	2	2,200	$ 1,595,000	150	1/20/2006	$ 2,000,000
318331 RS	Kahului	FS	251 Kamalei Circle	9,085	3.5	4	3,253	$ 1,675,000	31	5/19/2006	$ 1,675,000
318604 RS	Kahakuloa	FS	535 Kaukini Loop	103,673	2.5	4	2,840	$ 1,775,000	17	6/7/2006	$ 1,775,000
318286 RS	Wailuku	FS	376 W Waiko Road	36,546	2.5	3	2,510	$ 2,195,000	35	5/17/2006	$ 2,195,000
314100 RS	Kahakuloa	FS	33 Lahaole Place	279,655	2.5	3	2,800	$ 2,495,500	256	10/6/2005	$ 2,795,500
313358 RS	Wailuku	FS	949&967 Malaihi Rd.	229,561	1.0	3	768	$ 2,500,000	294	8/29/2005	$ 2,500,000
313170 RS	Kahakuloa	FS	15 Lahaole Place	135,599	6.5	9	8,000	$ 4,700,000	304	8/19/2005	$ 4,700,000
312200 RS	Wailuku	FS	440 W Waiko Road	848,070	2.0	3	1,888	$ 8,750,000	740	6/12/2005	$ 10,500,000
316716 RS	Kahakuloa	FS	4933 Kahekili Highway	2,221,560	3.0	2	5,000	$ 12,000,000	124	2/21/2006	$ 12,000,000

Chapter 19.30A

AGRICULTURAL DISTRICT

Sections:

19.30A.010 Purpose and intent.

A. Purpose. The purpose of the agricultural district is to:

1. Implement chapter 205, Hawai'i Revised Statutes, and the goals and policies of the Maui County general plan and community plans;
2. Promote agricultural development;
3. Preserve and protect agricultural resources; and
4. Support the agricultural character and components of the County's economy and lifestyle.

B. Intent. It is the intent of this chapter to:

1. Reduce the land use conflicts arising from encroachment of nonagricultural uses into agricultural areas;
2. Mitigate rising property values of farm lands to make agricultural use more economically feasible;
3. Discourage developing or subdividing lands within the agricultural district for residential uses, thereby preserving agricultural lands and allowing proper planning of land use and infrastructure development;
4. Discourage establishment of nonagricultural subdivisions;
5. Ensure that the rezoning of land from the agricultural district shall be open for public debate and in the overall public interest, as evidenced by conformance with the Maui County general plan and community plan land use designations and policies, State land use law, this chapter and good planning practices; and
6. Notify the public that lands within the agricultural district are used for agricultural purposes. Owners, residents, and other users of such property or neighboring properties may be subjected to inconvenience, discomfort, and the possibility of injury to property and health arising from normal and accepted agricultural practices and operations. Such normal and accepted agricultural practices and operations include but are not limited to noise, odors, dust, smoke, the operation of machinery of any kind, including aircraft, and the storage and disposal of manure. Owners, occupants, and users of such property or neighboring properties shall be prepared to accept such inconveniences, discomfort, and possibility of injury from normal agricultural operations. (Ord. 2749 § 3 (part),1998)

19.30A.020 District criteria.

Agricultural lands that meet at least two of the following criteria should be given the highest priority for retention in the agricultural district:

A. Agricultural Lands of Importance to the State of Hawai'i (ALISH);

B. Lands not classified by the ALISH system whose agricultural land suitability, based on soil, topographic, and climatic conditions, supports the production of agricultural commodities, including but not limited to coffee, taro, watercress, ginger, orchard and flower crops and nonirrigated pineapple. In addition, these lands shall include lands used for intensive animal husbandry, and lands in agricultural cultivation in five of the ten years immediately preceding the date of approval of this chapter; and

C. Lands which have seventy-five percent or more of their boundaries contiguous to lands within the agricultural district. (Ord. 2749 § 3 (part), 1998)

19.30A.030 District standards.

Except as otherwise provided in this chapter, the following district standards shall apply for uses, facilities and structures in the agricultural district:

A. *Minimum lot area:* two acres;

B. *Minimum lot width:* two hundred feet;

C. *Minimum yard setbacks:* front yards, twenty-five feet; side and rear yards, fifteen feet;

D. *Maximum developable area:* ten percent of the total lot area. This restriction shall apply to farm dwellings, but shall not apply to any structure or portion thereof which is used to support agriculture, including but not limited to storage facilities, barns, silos, greenhouses, farm labor dwellings, and stables, and shall not apply to utility facilities as permitted by this chapter;

E. *Maximum height limit:* Unless otherwise provided for in this chapter, the maximum height of any dwelling shall be thirty feet, except that vent pipes, fans, chimneys, antennae and solar collectors on roofs shall not exceed forty feet. Any non-dwelling structure such as a barn or silo that is over thirty-five feet in height shall be set back one additional foot for each foot in structure height;

F. *Maximum wall height:* Walls shall not exceed four feet within the yard setback area as measured from the finished or existing grade, whichever is lower, to the top of the wall as defined herein. This does not preclude constructing fences on the top of the wall for safety purposes. The director of public works and waste management may permit greater heights of walls as needed to retain earth, water or both for health and safety purposes;

G. The maximum number of lots that may be created from a lot, or portion there of, that is in the agricultural district shall be based on the gross area of the subject lot, which for the purposes of this subsection shall be the tax map key parcel as certified by the real property tax division on March 1998, as follows:

For the purposes of this subsection, any lot(s) or portions(s) thereof that is contained entirely within the subject lot, and that is owned by the same persons or related corporate entities as the subject lot, shall be considered a part of the subject lot and shall count towards the maximum number of permitted lots that may be created from the subject lot.

This subsection shall not apply to any lot which received preliminary subdivision approval prior to the effective date of the ordinance codified in this chapter and which receives final subdivision approval after the effective date of said ordinance. The subsequent lots resulting from such subdivision shall be subject to this subsection. (Ord. 2749 § 3 (part), 1998)

19.30A.040 Limitations on resubdivision.

A. Following the effective date of this the ordinance codified in this chapter:

1. At the time of subdivision, the director of public works and waste management shall determine the maximum number of lots that can be created based upon the provisions and standards set forth in section 19.30A.030;

2. The subdivider shall allocate the maximum number of lots that can be created between the original lot and any new lot created as a result of the subdivision;

3. The allocation of lots shall be recorded with the bureau of conveyances; and

4. No lot, or portion thereof, which is in the agricultural district shall be further subdivided beyond the maximum number of lots permitted pursuant to this chapter and as recorded with the bureau of conveyances, except as provided by subsection 19.30A.040.C.

B. The following subdivisions shall not reduce the gross "area of lot" nor the "maximum number of permitted lots" as provided by subsection 19.30A.030.G:

1. Any subdivision requested by a public agency or public utility company for a public purpose;

2. Any consolidation and resubdivision in which no additional developable lots, as defined by section 18.04.123, Maui County Code, are created, provided that this would not result in the potential to create any additional lots than could have been created prior to consolidation and resubdivision;

3. Any subdivision for purposes of providing an easement exclusively for the protection of sites of cultural and historic significance; greenways; protection of sensitive environmental areas such as wetlands, streams, and endangered species habitat; and easements for public access to shoreline and mountain areas; or

4. Any subdivision for purposes of providing a roadway easement or lot.

C. If the original lot has been subdivided into the maximum number of lots permitted pursuant to this chapter, additional lots may be created for family members as described in subsections 18.20.280.B.1 and 18.20.280.B.2, Maui County Code, whether or not a deferral of improvements is intended, with the approval of the council; the application for such additional lots shall be processed in the same manner as applications for conditional permits, as provided by chapter 19.40, Maui County Code.

D. No deed, lease, agreement of sale, mortgage or other instrument of conveyance shall contain any covenant or clause which restricts, directly or indirectly, the operation of agricultural activities on lands within the agricultural district. This subsection shall not apply to any covenant or clause existing prior to the effective date of the ordinance codified in this chapter. (Ord. 2749 § 3 (part), 1998)

19.30A.050 Permitted uses.

The following uses and structures shall be permitted in the agricultural district provided they also comply with all other applicable laws:

A. Principal Uses.

1. Agriculture;

2. Agricultural land conservation;

3. Agricultural parks, pursuant to chapter 171, Hawai'i Revised Statutes;

4. Animal and livestock raising, including animal feed lots and sales yards;

5. Private agricultural parks as defined herein;

6. Minor utility facilities as defined in section 19.04.040, Maui County Code; and

7. Retention, restoration, rehabilitation, or improvement of buildings, sites or cultural landscapes of historical or archaeological significance.

B. Accessory Uses. Uses which are incidental or subordinate to, or customarily used in conjunction with a permitted principal use, as follows:

1. Two farm dwellings per lot, one of which shall not exceed one thousand square feet of developable area;

2. One farm labor dwelling per five acres of lot area. On the island of Maui, the owner or lessee of the lot shall meet two of the following three criteria:

a. Provide proof of at least $35,000 of gross sales of agricultural product(s) per year, for the preceding two consecutive years, for each farm labor dwelling on the lot, as shown by State general excise tax forms and federal Schedule F forms;

b. Provide certification by the Maui board of water supply that agricultural water rates are being paid if the subject lot is served by the County water system; or

c. Provide a farm plan that demonstrates the feasibility of commercial agricultural production.

On the islands of Moloka'i and Lana'i, the owner or lessee of the lot shall meet both of the criteria provided by subsections 19.30A.050.B.2.a and 19.30A.050.B.2.b;

3. One agricultural products stand per lot, for the purpose of displaying and selling agricultural products grown and processed on the premises or grown in the County, provided that said stand shall not exceed three hundred square feet, shall be set back at least fifteen feet from roadways, shall have a wall area which is at least fifty percent open, and shall meet the off-street parking requirements for roadside stands provided by section 19.36.010, Maui County Code, except that paved parking shall not be required; stands which display or sell agricultural products which are not grown on the premises shall be required to obtain a special permit pursuant to chapter 205, Hawai'i Revised Statutes;

4. Farmer's markets, for the growers and producers of agricultural products to display and sell agricultural products grown and processed in the County; structures shall have a wall area which is at least fifty percent open; markets shall operate only during daylight hours and shall not operate on parcels less than ten acres; the director of public works and waste management may impose additional requirements if a building permit is required for any structures; markets which display or sell agricultural products which are not grown on the premises shall be required to obtain a special permit pursuant to chapter 205, Hawai'i Revised Statutes;

5. Storage, wholesale and distribution, including barns; greenhouses; storage facilities for agricultural supplies, products and irrigation water; farmer's cooperatives; and similar structures that are customarily associated with one or more of the permitted principal uses or, for the purpose of this section, are associated with agriculture in the County;

6. Processing of agricultural products, the majority of which are grown in the County; this includes the burning of bagasse as part of an agricultural operation;

7. Energy systems, small-scale;

8. Small-scale animal-keeping;

9. Animal hospitals and animal board facilities; if conducted on the island of Moloka'i, such uses shall have been approved by the Moloka'i planning commission as conforming to the intent of this chapter;
10. Riding academies; if conducted on the island of Moloka'i, such uses shall have been approved by the Moloka'i planning commission as conforming to the intent of this chapter;
11. Open land recreation as follows: hiking; noncommercial camping; fishing; hunting; equestrian activities; rodeo arenas; arboretums; greenways; botanical gardens; guided tours which are accessory to principal uses, such as farm or plantation tours, petting zoos, and garden tours; hang gliding; paragliding; mountain biking; and accessory restroom facilities. If hiking, fishing, hunting, equestrian activities, rodeo arenas, hang gliding, paragliding or mountain biking and conducted for commercial purposes on the island of Moloka'i, such uses shall have been approved by the Moloka'i planning commission as conforming to the intent of this chapter. Open land recreation uses or structures not specifically permitted by this subsection or by subsection 19.30A.060.H shall be prohibited; certain open land recreation uses or structures may also be required to obtain a special permit pursuant to chapter 205, Hawai'i Revised Statutes;
12. Parks for public use, not including golf courses and not including commercial uses except when under the supervision of a government agency in charge of parks and playgrounds; and
13. Other uses which primarily support a permitted principal use; however, such uses shall be approved by the appropriate planning commission as conforming to the intent of this chapter. (Ord. 2749 § 3 (part), 1998)

19.30A.060 Special uses.

The following uses and structures shall be permitted in the agricultural district if a special use permit, pursuant to section 19.510.070, Maui County Code, has been obtained; except that if a use described in this section also requires a special permit pursuant to chapter 205, Hawai'i Revised Statutes, and if the land area of the subject parcel is fifteen acres or less, the State special permit shall fulfill the requirements of this section:
A. Additional farm dwellings beyond those permitted by subsection 19.30A.050.B.1;
B. Farm labor dwellings that do not meet the criteria of subsection 19.30A.050.B.2;
C. Agricultural products stands that do not meet the standards of subsection 19.30A.050.B.3;
D. Farmer's markets that do not meet the standards of subsection 19.30A.050.B.4;
E. Public and quasipublic institutions which are necessary for agricultural practices;
F. Major utility facilities as defined in section 19.04.040, Maui County Code;
G. Telecommunications and broadcasting antenna;
H. Open land recreation uses, structures or facilities which do not meet the criteria of subsection 19.30A.050.B. 11, including commercial camping; gun or firing ranges; archery ranges; skeet shooting; paint ball; bungee jumping; skateboarding; roller blading; playing fields; accessory buildings and structures. Certain open land recreation uses or structures may also be required to obtain a special permit pursuant to chapter 205, Hawai'i Revised Statutes. The following uses or structures shall be prohibited: airports, heliports, drive-in theaters, country clubs, drag strips; motor sports facilities; golf courses and golf driving ranges;
I. Cemeteries, crematories, and mausoleums;
J. Churches and religious institutions;
K. Mining and resource extraction; and
L. Landfills. (Ord. 2749 § 3 (part), 1998)

19.30A.070 Private agricultural parks.

Private agricultural parks provide for appropriately sized, functionally configured, and affordable agricultural parcels to support diversified agricultural development. Lots created for the purposes of establishing or expanding a private agricultural park shall not be counted in or as part of the number of lots permitted by subsection 19.30A.030.G. Except as otherwise provided in this chapter, the following requirements and standards shall apply for uses, facilities, and structures in areas designated as private agricultural parks;
A. Individual lot leases or deeds shall provide that the lots is restricted to agricultural purposes;
B. Lots within private agricultural parks shall be made available for lease or sale;
C. No permanent or temporary dwellings or farm dwellings, including trailers and campers, shall be permitted within a private agricultural park, unless the following requirements are met:
1. A special use permit, pursuant to section 19.510.070, Maui County Code, has been obtained;
2. The lot on which the dwelling is located is used principally for agriculture, and the occupant of the dwelling provides security or caretaker services for the private agricultural park;
3. A maximum of one dwelling per lot;
4. The private agricultural park shall be subject to a maximum density of one dwelling per twenty-five acres of private agricultural park area; and
5. The dwelling shall be subject to a maximum developable area of seven hundred square feet.
D. A restrictive covenant excluding dwellings that do not meet the criteria of subsection 19.30A.070.C shall be included in the deed of the lot and run with said lot as long as said lot is within the agricultural district. This restriction shall not prohibit the construction of storage sheds, equipment sheds or other structures appropriate to the agricultural activity carried on within the lot;
E. Agricultural parks shall not be less than twenty-five acres in size;
F. Minimum lot area: five acres;
G. Subdivision requirements, as set forth in the following provisions of Title 18, Maui County Code, shall not apply to private agricultural parks and the lots therein:
1. 18.16.010 to 18.16.180;
2. 18.16.270 to 18.16.310B;
3. 18.16.320;
4. 18.20 to 18.20.090;
5. 18.20.140; and
6. 18.28; and
H. All requirements set forth herein shall terminate if an area designated as an agricultural park is rezoned to a nonagricultural zoning district. (Ord. 2749 § 3 (part), 1998)

19.30A.080 Agricultural leases.

A. Any landowner may enter into an agricultural lease provided that the following conditions are met:

1. The principal use of the leased land is agriculture; and
2. No permanent or temporary dwellings or farm dwellings, including trailers and campers, are constructed on the leased area. This restriction shall not prohibit the construction of storage sheds, equipment sheds or other structures appropriate to the agricultural activity carried on within the lot.

B. Subdivision requirements, as set forth in Title 18, Maui County Code, shall not apply to agricultural leases. (Ord. 2749 § 3 (part), 1998)

19.30A.090 Substandard agricultural lots.

Substandard agricultural lots existing prior to the enactment of the ordinance codified in this chapter shall be subject to the following standards:

A. Lots less than two acres but equal to or greater than one-half acre shall be subject to the yard and building height standards as set forth for lots of such area in section 19.29.020, Maui County Code, and shall be exempt from the maximum developable area restriction of subsection 19.30A.030.D; and

B. Lots less than one-half acre shall be subject to the yard and building height standards as set forth for lots of such area in sections 19.08.050 and 19.08.060, Maui County Code, and shall be exempt from the maximum developable area restriction of subsection 19.30A.030.D. (Ord. 2749 § 3 (part), 1998)

19.30A.100 Exemptions pursuant to state law.

A. If provided by Hawai'i Revised Statutes, for lands legally defined and recognized as kuleana or similar type of land ownership, such as land commission awards or royal patents, the district standards of section 19.30A.030, and the density restriction of subsection 19.30A.050.B.1, shall not apply.

B. Affordable housing projects as set forth in chapter 201E, Hawai'i Revised Statutes, shall be exempt from the requirements of this chapter. (Ord. 2749 § 3 (part), 1998)

19.30A.110 Permits issued prior to the enactment of this ordinance.

State or County special permits, special use permits, conditional permits and variances issued prior to the enactment of the ordinance codified in this chapter shall remain in full force and effect for their duration, and their renewal shall be subject to the provisions of this chapter. Any dwelling or structure that was constructed with a building permit that was approved prior to the enactment of said ordinance need not acquire a County special use permit, conditional permit or variance and may be reconstructed as permitted by the original building permit(s), and such dwellings or structures may be expanded or modified with a building permit, subject to the other provisions of this chapter and this title. (Ord. 2749 § 3 (part), 1998)

19.30A.120 Rule-making authority.

The planning director and the director of public works and waste management shall have the authority to adopt rules regarding the administration of this chapter. (Ord. 2749 § 3 (part), 1998)

ADDENDA

DEFINITIONS

The purpose of this Glossary is to assist the reader in understanding specific terminology used in this report.

Appraisal (noun) the act or process of estimating value; an estimate of value. (adjective) of or pertaining to appraising and related functions, e.g. appraisal practice, appraisal services.

> Complete Appraisal: The act or process of estimating value or an estimate of value performed without invoking the Departure Provision.
>
> Limited Appraisal: The act or process of estimating value or an estimate of value performed under and resulting from invoking the Departure Provision.

Binding Requirement All or part of a standards rule of the Uniform Standards of Professional Appraisal Practice (USPAP) from which departure is not permitted (See Departure Provision).

Cash Equivalent A price expressed in terms of cash, as distinguished from a price expressed totally or partly in terms of the face amounts of notes or other securities that cannot be sold at their face amounts.

Counseling Providing competent, disinterested, and unbiased advice and guidance on diverse problems in the broad field of real estate; may involve any or all aspects of the business such as merchandising, leasing, management, acquisition/disposition planning, financing, development, cost-benefit studies, feasibility analysis, and similar services. Counseling services are often associated with evaluation, but they are beyond the scope of appraisal.

Departure Provision This provision permits limited exceptions to sections of the Uniform Standards of Professional Appraisal Practice that are classified as specific guidelines rather than binding requirements. The burden of proof is on the appraiser to decide before accepting a limited assignment that the result will not confuse or mislead. The burden of disclosure is also on the appraiser to report any limitations.

Discounting The procedure used to convert periodic income and reversions into present value; based on the assumption that benefits received in the future are worth less than the same benefits received now.

Extraordinary Assumption An assumption, directly related to a specific assignment, which, if found to be false, could alter the appraiser's opinions or conclusions. Extraordinary assumptions presume as fact otherwise uncertain information about physical, legal, or economic characteristics of the subject property; or about conditions external to the property such as market conditions or trends; or about the integrity of data used in an analysis. An extraordinary assumption may be used in an assignment only if:

- It is required to properly develop credible opinions and conclusions;
- The appraiser has a reasonable basis for the extraordinary assumption;
- Use of the extraordinary assumption results in a credible analysis; and

- The appraiser complies with the disclosure requirements set forth in USPAP for extraordinary assumptions.

Fair Value

The cash price that might reasonably be anticipated in a current sale under all conditions requisite to a fair sale. A fair sale means that buyer and seller are each acting prudently, knowledgeably, and under no necessity to buy or sell–, i.e., other than in a forced or liquidation sale. The appraiser should estimate the cash price that might be received upon exposure to the open market for a reasonable time, considering the property type and local market conditions. ***When a current sale is unlikely–i.e., when it is unlikely that the sale can be completed within 12 months–the appraiser must discount all cash flows generated by the property to obtain the estimate of fair value.*** These cash flows include, but are not limited to, those arising from ownership, development, operating, and sale of the property. The discount applied shall reflect the appraiser's judgment of what a prudent, knowledgeable purchase under a necessity to buy would be willing to pay to purchase the property in a current sale.

Fee Simple Estate

Absolute ownership encumbered by any other interest or restate, subject only to the limitations imposed by the governmental powers of taxation, eminent domain, police power, and escheat.

Hawaiian Terms

The Hawaiian words "mauka" and "makai" are commonly used in the islands as indicators of direction. The word "mauka" means toward the mountain, and "makai" means toward the ocean.

Highest and Best Use

The reasonably probable and legal use of vacant land or an improved property, which is physically possible, appropriately supported, financially feasible, and that results in the highest value. The four criteria the highest and best use must meet are legal permissibility, physical possibility, financial feasibility, and maximum profitability.

Highest and Best Use of Land or a Site as Though Vacant

The use of a property based on the assumption that a parcel of land is vacant or can be made vacant through demolition of any improvements.

Highest and Best Use of Property as Improved

The use that should be made of a property as it exists.

Hypothetical Condition

That which is contrary to what exists, but is supposed for the purpose of analysis. Hypothetical conditions assume conditions contrary to known facts about physical, legal, or economic characteristics of the subject property; or about conditions external to the property, such as market conditions or trends; or about the integrity of data used in an analysis. A hypothetical condition may be used in an assignment only if:

- Use of the hypothetical condition is clearly required for legal purposes, for purposes of reasonable analysis, or for purposes of comparison;
- Use of the hypothetical condition results in a credible analysis; and
- The appraiser complies with the disclosure requirements set forth in USPAP for hypothetical conditions

Leased Fee Estate

An ownership interest held by a landlord with the right of use and occupancy conveyed by lease others; the rights of lessor or the leased fee owner and leased fee are specified by contract terms contained within the lease

Leasehold Estate

The right to use and occupy real estate for a stated term and under certain conditions; conveyed by a lease.

Market Rent

The rental income that a property would most probably command in the open market.

Market Value

Market value is the major focus of most real property appraisal assignments. Both economic and legal definitions of market value have been developed and refined. Continual refinement is essential to the growth of the appraisal profession. The current economic definition of market value can be stated as follows:

"The most probable price, as of a specified date, in cash, or in terms equivalent to cash, or in other precisely revealed terms for which the specified property rights should sell after reasonable exposure in a competitive market under all conditions requisite to a fair sale, with the buyer and seller each acting prudently, knowledgeably, and for self-interest, and assuming that neither is under undue duress."

The current economic definition of "market value" as stated in the Uniform Standards of Professional Practice, published by The Appraisal Foundation in 1990, is as follows:

"The most probable price which a property should bring in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus. Implicit in this definition is the consummation of a sale as of a specified date and the passing of title from seller to buyer under conditions whereby:

1. buyer and seller are typically motivated.
2. both parties are well informed or well advised, and acting in what they consider their best interests;
3. a reasonable time is allowed for exposure in the open market;
4. payment is made in terms of cash in United States dollars or in terms of financial arrangements comparable thereto; and
5. the price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granted by anyone associated with the sale."

Prospective Market Value Upon Completion of Construction

The prospective future value of a property on the date that construction is completed, based upon market conditions forecast to exist as of the completion date.

Prospective Value Estimate

A forecast of the value expected at a specified future date. A prospective value estimate is most frequently sought in connection with real estate projects that are proposed, under construction, or under conversion to a new use, or those that have not achieved sellout or a stabilized level of long-term occupancy at the time the appraisal report is written.

Report

Any communication, written or oral, of an appraisal, review, or consulting service that is transmitted to the client upon completion of an assignment. The types of written reports listed below apply to real property appraisals:

Self-Contained Appraisal Report: A written report prepared under Standards Rule 2-2(a) of a complete or Limited Appraisal performed under Standard 1.

Summary Appraisal Report: A written report prepared under Standards Rule 2-2(b) of a Complete or Limited Appraisal performed under Standard 1.

Restricted Appraisal Report: A written report prepared under Standards Rule 2-2(c) of a Complete or Limited Appraisal performed under Standard 1.

Specific Guideline

All or part of a standards rule of the Uniform Standards of Professional Appraisal Practice (USPAP) from which departure is permitted under certain conditions (See Departure Provision).

Uniform Standards of Professional Appraisal Practice

Current standards of the appraisal profession, developed for appraisers and the users of appraisal services; the USPAP deal with the procedures to be followed in developing an appraisal, analysis, or opinion and the manner in which an appraisal, analysis, or opinion is communicated. The USPAP are endorsed by the Appraisal Institute and other professional appraisal organizations.

LIMITING AND CONTINGENT CONDITIONS
ACM Consultants, Inc.

LIMITING AND CONTINGENT CONDITIONS: The certification of the Appraiser appearing in the appraisal report is subject to the following conditions and to such other specific and limiting conditions as are set forth by the Appraiser in the report. By this notice, all persons and firms reviewing, utilizing or relying on the report in any manner bind themselves to accept these assumptions and limiting conditions. Do not use this report if you do not so accept. These conditions are a part of the appraisal report, they are a preface to any certification, definition, fact or analysis, and are intended to establish as a matter of record that the Appraiser's function is to provide a present market value indication for the subject property based upon the Appraiser's observation as to the subject property and real estate market. This appraisal report is an economic study to estimate value as defined in it. It is not an engineering, construction, legal or architectural study nor survey and expertise in these areas, among others, is not implied.

1. CONFIDENTIALITY. The contents of the appraisal are confidential. Release of this appraisal by ACM Consultants, Inc. to you is limited to and solely for your business use only. Any further release of this appraisal by you or any of your agents is strictly prohibited and you shall accept the risk and liability for any such release without the previous written consent of ACM Consultants, Inc. Further, you shall indemnify and defend ACM Consultants, Inc. from any claims arising out of any such unauthorized disclosure.

2. LIMIT OF LIABILITY. The liability of ACM Consultants, Inc. and employees and affiliated independent contractors is limited to the fee actually received by Appraiser (total per appraisal). Further, there is no accountability, obligation, or liability to any third party. If this report is placed in the hands of anyone other than client, the client shall make such party aware of all limiting conditions and assumptions of the assignment and related discussions. The Appraiser is in no way to be responsible for any costs incurred to discover or correct any deficiencies of any type present in the property; physically, financially, and/or legally. In the case of limited partnerships or syndication offerings or stock offerings in real estate, client agrees that in case of lawsuit (brought by lender, partner or part owner in any form of ownership, tenant, or any other party), any and all awards, settlements of any type in such suit, regardless of outcome, client will hold Appraiser harmless in any such action.

3. INFORMATION USED. No responsibility is assumed for accuracy of information furnished by work of or work by others, the client, his designee, or public records. We are not liable for such information or the work of possible subcontracters. The comparable date relied upon in this report has been confirmed with one or more parties familiar with the transaction or from affidavit or other source though reasonable; all are considered appropriate for inclusion to the best of our factual judgment and knowledge. An impractical and uneconomic expenditure of time would be required in attempting to furnished unimpeachable verification in all instances, particularly as to engineering and market-related information It is suggested that the client consider independent verification as a prerequisite to any transaction involving sale, lease, or other significant commitment of funds of subject property.

4. TESTIMONY, CONSULTATION, COMPLETION OF CONTRACT FOR APPRAISAL SERVICES The contract for appraisal, consultation or analytical service is fulfilled, and the total fee is payable upon completion of the report.

   The Appraiser(s) or those assisting in preparation of the report will not be asked or required to give testimony in court or hearing because of having made the appraisal, in full or in part, nor engage in post appraisal consultation with client or third parties except under separate and special arrangement and at additional fee. If testimony or deposition is required because of subpoena, the client shall be responsible for any additional time, fees, and charges regardless of issuing party.

5. LEGALITY OF USE. The appraisal is based on the premise that, there is full compliance with all applicable federal, state and local environmental regulations and laws unless otherwise stated in the report; further, that all applicable zoning, building, use regulations and restrictions of all types have been complied with unless otherwise stated in the report; further, it is assumed that all required licenses, consents, permits, or other legislative or administrative authority, local , state, federal and/or private entity or organization have been or can be obtained or renewed for any use considered in the value estimate.

6. COMPONENT VALUES. The distribution of the total valuation in this report between land and improvements applies only under the existing program of utilization. The separate valuations for land and building must not be used in conjunction with any other appraisal and are invalid if so used.

7. AUXILIARY AND RELATED STUDIES. No environmental or impact studies, special market study or analysis, highest and best use analysis or feasibility study has been requested or made unless otherwise specifically stated in an agreement for services or in the report.

8. DOLLAR VALUES, PURCHASING POWER. The market value estimated, and the costs used, are as of the date of the estimate of value. All dollar amounts are based on the purchasing power and price of the dollar as of the date of the value estimate.

9. INCLUSIONS. Furnishings and equipment or personal property or business operations except as specifically indicated and typically considered as a part of real estate, have been disregarded with only the real estate being considered in the value estimate unless otherwise stated.

10. ENVIRONMENTAL DISCLAIMER. The value estimated in this report is based on the assumption that the property is not negatively affected by the existence of hazardous substances or detrimental environmental conditions. The Appraiser is not an expert in the identification of hazardous substances or detrimental environmental conditions. The Appraiser's routine inspection of and inquiries about the subject property did not develop any information that indicated any apparent significant hazardous substances or detrimental environmental conditions which would affect the property negatively. It is possible that tests and inspections made by a qualified hazardous substance and environmental expert would reveal the existence of hazard material and environmental conditions on or around the property that would negatively affect its value.

11. LEGAL, ENGINEERING, FINANCIAL, STRUCTURAL, OR MECHANICAL NATURE, HIDDEN COMPONENTS, SOIL. The Appraiser and/or firm has no responsibility for matters legal in character or nature, nor of any architectural, structural, mechanical, or engineering nature. No opinion is rendered as to the title, which is presumed to be good and merchantable. The property is appraised as if free and clear, unless otherwise stated in particular parts of the report.

The legal description is assumed to be correct as used in this report as furnished by the client, his designee, or as derived by the Appraiser.

Note that no advice is given regarding mechanical equipment or structural integrity or adequacy, no soils and potential for settlement, drainage, and such (seek assistance from qualified architect and/or engineer) nor matters concerning liens, title status, and legal marketability (seek legal assistance), and such. The lender and owner should inspect the property before any disbursement of funds; further it is likely that the lender or owner may wish to require mechanical or structural inspections by a qualified and licensed contractor, civil or structural engineer, architect, or other expert.

The Appraiser has inspected as far as possible, by observation, the land and the improvements; however, it was not possible to personally observe conditions beneath the soil or hidden structurally or by other components. We have not critically inspected mechanical components within the improvements and no representations are made herein as to these matters unless specifically stated and considered in the report. The value estimate considers there being no such conditions that would cause a loss of value. The land or the soil of the area being appraised appears firm, however, subsidence in the area is unknown. The Appraiser(s) do not warrant against this condition or occurrence of problems arising from soil conditions.

The appraisal is based on there being no hidden, unapparent, or apparent conditions of the property site, subsoil, or structures or toxic material which would render it more or less valuable. The Appraiser and firm have no responsibility for any such conditions or for any expertise or engineering to discover them. All mechanical components are assumed to be in operable condition and status standard for properties of the subject type. Conditions of heating, cooling, ventilation, electrical and plumbing equipment is considered to be commensurate with the conditions of the balance of the improvements unless otherwise stated. No judgment may be made by us as to adequacy of insulation, type of insulation, or energy efficiency of the improvements or equipment which is assumed standard for subject and type.

If the Appraiser has not been supplied with a termite inspection, survey or occupancy permit, no responsibility or representation is assumed or made for costs associated with obtaining same or for any deficiencies discovered before or after they are obtained. No representation or warranties are made concerning obtaining the above mentioned items.
The Appraiser has no responsibility for any costs or consequences arising due to the need, or the lack of need for flood hazard insurance. An Agent for the Federal Flood Insurance Program should be contacted to determine the actual need for Flood Hazard Insurance.

12. PROPOSED IMPROVEMENTS, CONDITIONED VALUE. Improvements proposed, if any, on or off-site, as well as any repairs required are considered, for purposes of the appraisal to be completed in good and workmanlike manner according to information submitted and/or considered by the Appraiser(s). In cases of proposed construction, the appraisal is subject to change upon inspection of property after construction is completed. This estimate of market value is as of the date shown, as proposed, as if completed and operating at levels shown and projected. On all appraisals, subject to satisfactory completion, repairs, or alterations, the appraisal report and value conclusion are contingent upon completion of the improvements in a workmanlike manner.

13. VALUE CHANGE, DYNAMIC MARKET, INFLUENCES, ALTERATION OF ESTIMATE BY APPRAISER. The estimated market value, which is defined in the report, is subject to change with market changes over time; value is highly related to exposure, time, promotional effort, terms, motivation, and conditions surrounding the offering. The value estimate considers the productivity and relative attractiveness of the property physically and economically in the marketplace.

Appraisal report and value estimate subject to change if physical or legal entity or financing is different than that envisioned in this report.

14. EXHIBITS. The sketches and maps in this report are included to assist the reader in visualizing the property and are not necessarily to scale. Various photos, if any, are included for the same purpose as of the date of the photos. Site plans are not surveys unless shown from separate surveyor. All documents, materials, photographs, negatives, and other items provided to or obtained by the Appraiser becomes the property of the Appraiser unless other arrangements have been previously made therefore.

15. CHANGES, MODIFICATION. The Appraiser(s) and/or officers of ACM Consultants, Inc., reserve the right to alter statements, analysis, conclusion or any value estimate in the appraisal if there becomes known to us facts pertinent to the appraisal process which were unknown to us when the report was completed.

16. DISCLOSURE. Disclosure of the contents of the appraisal report is governed by the Bylaws and Regulations of the professional appraisal organizations with which the Appraiser is affiliated. Neither all, nor any part of the content of the report, or copy thereof (including conclusions as to the property value, the identity of the Appraiser, professional designations, reference to any professional appraisal organizations, or the firm with which the Appraiser is connected, shall be used for any purpose by anyone but the client specified in the report, without the previous written consent of the Appraiser; nor shall it be conveyed by anyone to the public through advertising, public relations, news sales, or other media, without the written consent and approval of the Appraiser. The Appraiser may not divulge the material (evaluation) contents of the report, analytical findings or conclusions, or give a copy of the report to anyone other than the client or his designee as specified in writing except as may be required by the Appraisal Institute as they may request in confidence for ethics enforcement, or by a court of law or body with the power of subpoena.

17. CONTINUING EDUCATION. The Appraisal Institute conducts a voluntary program of continuing education for its designated members. As of the date of this report, Glenn Kunihisa has completed the requirements of the continuing education program of the Appraisal Institute.

ACCEPTANCE OF, AND/OR USE OF THIS APPRAISAL REPORT BY CLIENT OR ANY THIRD PARTY CONSTITUTES ACCEPTANCE OF THE ACM CONSULTANTS, INC., CERTIFICATION, LIMITING AND CONTINGENT CONDITIONS. APPRAISER LIABILITY EXTENDS ONLY TO STATED CLIENT, NOT SUBSEQUENT PARTIES OR USERS OF ANY TYPE, and the total liability of Appraiser(s) and firm is limited to the amount of fee received by Appraiser.

APPRAISAL QUALIFICATIONS

Glenn K. Kunihisa, MAI

STATE LICENSING

State Certified General Appraiser,
State of Hawaii, License No. CGA 39, July 17, 1991
Expiration: December 31, 2007

PROFESSIONAL AFFILIATIONS

Member, Appraisal Institute, MAI Designation, Hawaii Chapter No. 67
Member, International Right of Way Association
Appraiser-Realtor, National Association of Realtors, Maui Board of Realtors

PROFESSIONAL INVOLVEMENT

Education Chairperson – Hawaii Chapter of the Appraisal Institute – 2004 and 2005
Former Island of Maui Representative – Hawaii Chapter of the Appraisal Institute
Former Multiple Listing Service (MLS) Committee Member – Realtors Association of Maui

COMMUNITY AFFILIATIONS

St. Anthony Parish School Board
Board Member 1995 to Present
Board President 1997 and 1998
Alii Community Care, Inc. – A non-profit corporation
Board Member 2004 to Present

EMPLOYMENT

President
ACM Consultants, Inc.
May, 1997 to present

Previously associated with the following:
ACM, Real Estate Appraisers, Inc. - 1986 to 1997
A&B Commercial Company; a division of Alexander & Baldwin, Inc. - 1979 to 1985
Bank of Hawaii - 1976 to 1979

GENERAL EDUCATION

University of Hawaii at Manoa
Master of Business Administration (MBA) - Executive MBA Program V, 1988
Bachelor of Business Administration (BBA), 1976
Iolani School, 1971

LEGAL

Qualified as an expert witness in the Second Circuit Court of the State of Hawaii

APPRAISAL EDUCATION

Appraisal Institute

Seminar	*California Conservation Easements* Sacramento, California – November 2005
Course 400	*7-Hour National USPAP Update Course* Honolulu, Hawaii – October 2005
Seminar	*Case Studies in Limited Partnership and Partial Interest Valuation* Honolulu, Hawaii – May 2005
Seminar	*Appraisal Consulting: A Solutions Approach for Professionals* Honolulu, Hawaii – February 2005
Seminar	*Real Estate Finance, Value and Investment Performance* Honolulu, Hawaii – February 2005
Seminar	*Fannie Mae Residential Presentation* Honolulu, Hawaii - July 2004

Seminar	*Subdivision Analysis* Chicago, Illinois - August 2003
Seminar	*Supporting Capitalization Rates* Chicago, Illinois - August 2003
Seminar	*The Technology Assisted Appraiser* Chicago, Illinois - August 2003
Seminar	*Scope of Work: Expanding Your Range of Services* Chicago, Illinois - August 2003
Course 400	*National Uniform Standards of Professional Practice* Honolulu, Hawaii - May 2003
Course 420	*Business Practices and Ethics* Honolulu, Hawaii - May 2003
Seminar	*The Private Conservation Market* Honolulu, Hawaii - July 2002
Seminar	*Finance Reporting Valuations Parts I and II* Honolulu, Hawaii - July 2002
Seminar	*Future of Appraisal Profession from a Global Perspective* Honolulu, Hawaii - July 2002
Seminar	*Appraisal Office Management* Honolulu, Hawaii - July 2002
Course 540	*Report Writing* Denver, Colorado - December 2000
Seminar	*Partial Interests: Theory and Case Law* Las Vegas, Nevada - July 2000
Seminar	*Easement Valuation* Las Vegas, Nevada - July 2000
Seminar	*Bridging the Gap: Marketability Discounts for Real Estate Interests* Las Vegas, Nevada - July 2000
Course 430	*Standards of Professional Practice, Part C* Honolulu, Hawaii - September 1999
Seminar	*Litigation Skills for the Appraiser: An Overview* Honolulu, Hawaii - May 1998
Seminar	*Special Purpose Properties* Honolulu, Hawaii - September 1997
Seminar	*Highest and Best Use Applications* Honolulu, Hawaii - September 1997
Seminar	*Detrimental Conditions* Honolulu, Hawaii - July 1997
Seminar	*The Appraiser As Expert Witness* Honolulu, Hawaii - August, 1995
Seminar	*How to Appraise FHA-Insured Property* Los Angeles, California - January, 1995
Seminar	*Understanding Limited Appraisals and Reporting Options* Honolulu, Hawaii - August, 1994
Seminar	*Valuation of Leasehold Interests* Honolulu, Hawaii - May, 1993
Seminar	*Valuation of Leased Fee Interests* Honolulu, Hawaii - May, 1993
Seminar	*Valuation Considerations: Appraising Non-Profits* Boston, Massachusetts - July, 1992
Seminar	*Americans With Disabilities Act* Boston, Massachusetts - July, 1992
Seminar	*Valuation in Today's Capital and Financing Markets* Honolulu, Hawaii - June 1992
Seminar	*Arbitration Principles, Procedures and Pitfalls* Honolulu, Hawaii - June, 1992

Seminar	*Institutional Real Estate in the 1990's* Honolulu, Hawaii - June, 1992
Seminar	*FIRREA and its Impact on Appraisers* Honolulu, Hawaii - June, 1992
Course 410/420	*Standards of Professional Practice, Parts A & B* Honolulu, Hawaii - April, 1991

<u>Society of Real Estate Appraisers</u>

Course 101	*Introduction to Appraising Real Property* Dallas, Texas - 1987
Course 102	*Applied Residential Property Valuation* Honolulu, Hawaii - July 1990
Course 201	*Principles of Income Property Appraising* Chicago, Illinois, 1987
Course 202	*Applied Income Property Valuation* San Diego, California - 1988
Seminar	*Professional Practice and the Society of Real Estate Appraisers* Honolulu, Hawaii - 1988
Seminar	*Appraisal Standards Seminar - Federal Home Loan Bank Board Guidelines, Regulations and Policies* Honolulu, Hawaii - April, 1988

<u>American Institute of Real Estate Appraisers</u>

Seminar	*Rates, Ratios and Reasonableness* Honolulu, Hawaii - 1989
Seminar	*Discounted Cash Flow Analysis* Honolulu, Hawaii - 1989
Seminar	*Highest and Best Use* Honolulu, Hawaii - 1989
Seminar	*Capitalization Overview - Part A* Honolulu, Hawaii - 1990
Seminar	*Capitalization Overview - Part B* Honolulu, Hawaii - 1990
Seminar	*Accrued Depreciation* Honolulu, Hawaii - 1990

<u>International Right of Way Association</u>

Course 101	*Appraisal* Las Vegas, Nevada - October, 1998
Course 101	*Negotiation* Las Vegas, Nevada - October 1998

<u>National Business Institute, Inc.</u>

Seminar	*Commercial Real Estate Leasing In Hawaii* Honolulu, Hawaii - 1989

<u>American Arbitration Association</u>

Seminar	*Real Estate Dispute Resolution - Mediation and Arbitration* Kahului, Maui, Hawaii - October, 1990

APPRAISAL QUALIFICATIONS

Shane S. Nishimoto

STATE LICENSING

State Certified General Appraiser,
State of Hawaii, License No. CGA-696
Expiration: December 31, 2007

PROFESSIONAL AFFILIATIONS

None

EMPLOYMENT

Staff Appraiser
ACM Consultants, Inc.
July 2000 to Present

Previously associated with the following:

Saint Francis Healthcare Systems
2000

Pflueger Acura
1993 to 1999

Successories of Hawaii
1998 to 1999

GENERAL EDUCATION

University of Hawaii at Manoa
Bachelor of Arts (BA), 2000

Punahou School, 1993

APPRAISAL EDUCATION

Appraisal Institute

Course 110 — *Appraisal Principles*
Las Vegas, Nevada – November 2001

Course 120 — *Appraisal Procedures*
Denver, Colorado – August 2002

Course 310 — *Basic Income Capitalization*
Dublin, California – May 2003

Course 320 — *General Applications*
Pasadena, California - June 2004

Course 520 — *Advanced Income Capitalization*
Sacramento, California – May 2006

Seminar — *Price Indexing Real Estate Markets*
Honolulu, Hawaii – July 2002

Seminar — *USPAP-The Changing Role of the Appraiser and USPAP*
Honolulu, Hawaii - July 2002

Seminar — *The Aftermath: Our World Post September 11*
Honolulu, Hawaii - July2002

Seminar — *The Aftermath: Our World Post September 11: A General/Commercial View*
Honolulu, Hawaii - July 2002

Seminar — *Statistical Modeling and GIS: Statistical Applications for Income Properties*
Honolulu, Hawaii – July 2002

Seminar — *National 7-Hour USPAP Update*
Honolulu, Hawaii - May 2003

Seminar — *Fannie Mae Seminar*
Honolulu, Hawaii - July 2004

Seminar — *Real Estate Finance, Value, and Investment Performance*
Honolulu, Hawaii – February 2005

Seminar — *Case studies in Limited Partnerships and Common TenancyValuation*
Honolulu, Hawaii - May 2005

Online Seminar — *Introduction to GIS Applications for Real Estate Appraisal*
Honolulu, Hawaii - December 2005

Lincoln Graduate Center

Course 527 — *Principles of Real Estate Appraisal*
Honolulu, Hawaii - February 2001

Course 672 — *Uniform Standards of Professional Appraisal Practice*
Honolulu, Hawaii - February 2001

Course 536 — *Practice of Real Estate Appraisal*
Honolulu, Hawaii - March 2001

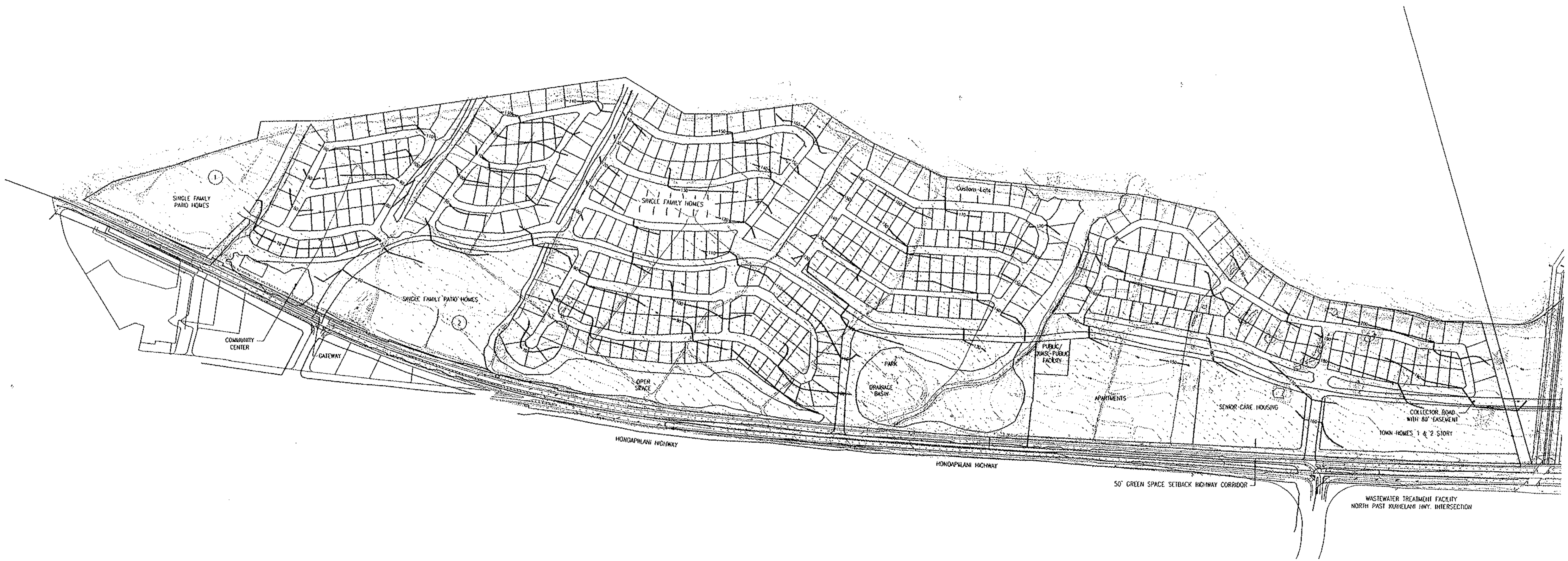
Course 512 — *Appraisal of Residential Property*
Honolulu, Hawaii - March 2001

Course 660 — *Writing the Narrative Report*
Honolulu, Hawaii - April 2001

Course 772 — *National USPAP Course*
Honolulu, Hawaii - September 2004

MISC. EDUCATION

REALM Business Solutions — Argus 10.0
Honolulu, Hawaii – February 2003



SINGLE FAMILY PATIO HOMES
COMMUNITY CENTER
GATEWAY
SINGLE FAMILY PATIO HOMES
OPEN SPACE
SINGLE FAMILY HOMES
Custom Lots
PARK
DRAINAGE BASIN
PUBLIC/ QUASI-PUBLIC FACILITY
APARTMENTS
SENIOR CARE HOUSING
COLLECTOR ROAD WITH 80' EASEMENT
TOWN HOMES 1 & 2 STORY
HONOAPIILANI HIGHWAY
HONOAPIILANI HIGHWAY
50' GREEN SPACE SETBACK HIGHWAY CORRIDOR
WASTEWATER TREATMENT FACILITY
NORTH PAST KUIHELANI HWY. INTERSECTION

0 300 600 900

1" = 300' SCALE FEET

CONCEPTUAL MASS GRADING PLAN

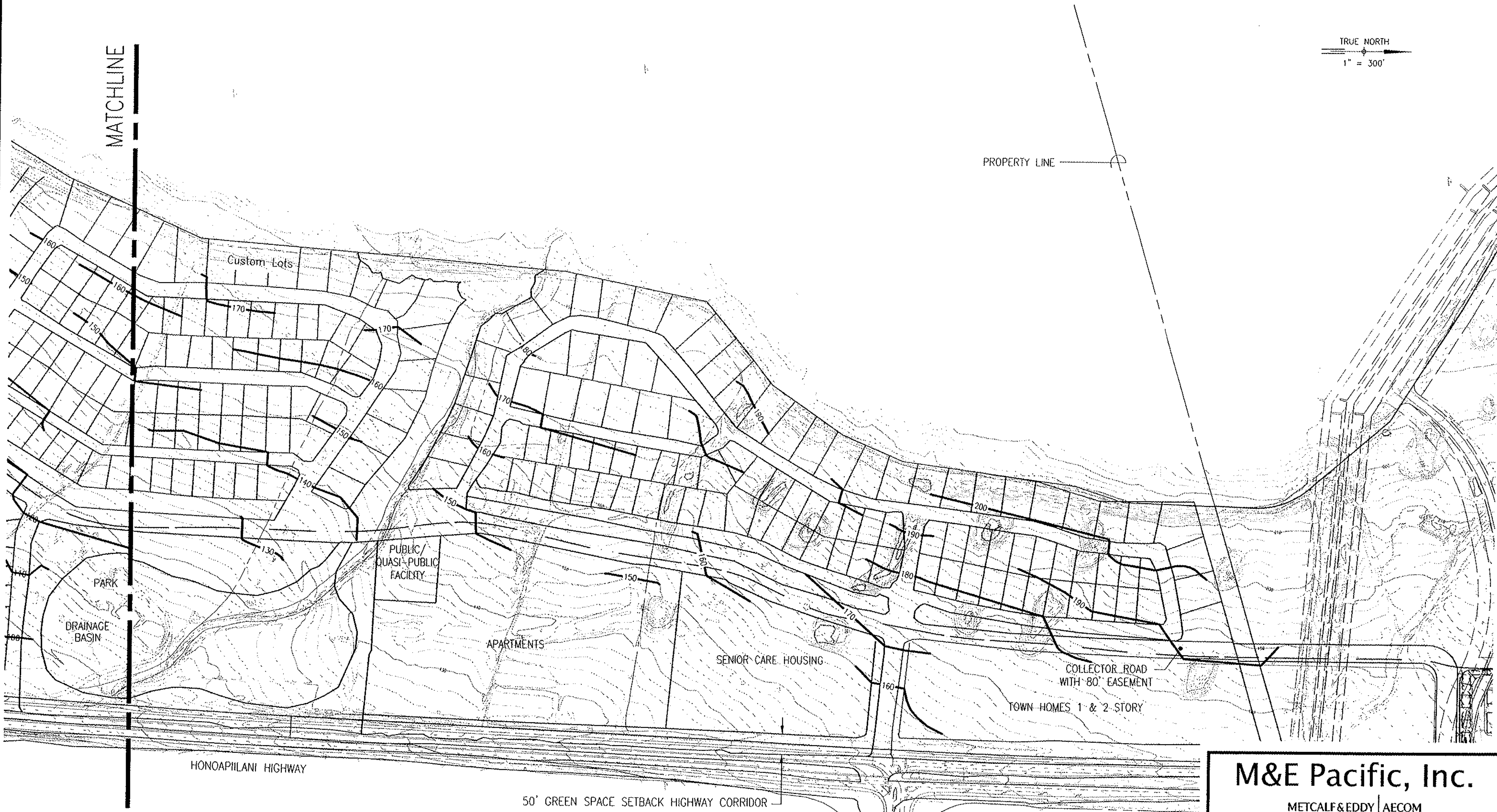
SCALE: 1"=300'

M&E Pacific, Inc.

METCALF&EDDY | AECOM

DAVIES PACIFIC CTR, STE 1900 · 841 BISHOP ST, HONOLULU, HAWAII 96813

Figure 1-A
Conceptual Mass Grading Plan
Maalea Mauka Subdivision
Environmental Impact Study
Maalea Property, LLC
November 2006



CONCEPTUAL MASS GRADING PLAN

SCALE: 1"=300'

1" = 300' — 0 — 300 — 600 — 900
SCALE — FEET

M&E Pacific, Inc.

METCALF & EDDY | AECOM

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Figure 1-B
Conceptual Mass Grading Plan
Maalea Mauka Subdivision
Environmental Impact Study
Maalea Property, LLC
November 2006

APPENDIX C.

Agricultural Impact Assessment Report

MA'ALAEA MAUKA RESIDENTIAL SUBDIVISION:
IMPACT ON AGRICULTURE

DECISION ANALYSTS HAWAI'I, INC.

MA'ALAEA MAUKA RESIDENTIAL SUBDIVISION:
IMPACT ON AGRICULTURE

PREPARED FOR:

Ma'alaea Properties, LLC

PREPARED BY:

Decision Analysts Hawai'i, Inc.

January 2007

Contents

EXECUTIVE SUMMARY

1. PROPOSED DEVELOPMENT

Ma'alaea Properties, LLC proposes to develop Ma'alaea Mauka Residential Subdivision ("the Project"), a planned residential community on a 257-acre site located in the southeast corner of Central Maui. The Project will include about 949 market and affordable homes, a community center, a park, open space and buffer zones, a quasi-public facility, and interior roads. An additional 5 acres north of the Project will be used for a wastewater treatment plant. Some or all of the treated effluent will be dispersed on a nearby 85-acre site.

The Project is within the State Agricultural District, and the County of Maui zoning for the Project site is "Agricultural." However, the *Kihei-Makena Community Plan* designates the site as a residential Project District. Development of the Project will require (1) a State Land Use Boundary Amendment to change the districting from Agricultural to Urban, (2) Project District Approval pursuant to Chapter 19.45 of the Maui County Code, and (3) changes in zoning to conform with the *Kihei-Makena Community Plan*.

2. AGRICULTURAL CONDITIONS

About 240 ± 5 acres at the Project site and the 5 acres for the off-site wastewater treatment plant have favorable agronomic conditions for crop production as indicated by good soils (although they are stony in most areas), gently sloping terrain, high solar radiation, access to irrigation water, and good road access.

3. LOCATIONAL ADVANTAGES AND DISADVANTAGES FOR CROP PRODUCTION

In terms of location, farmers in Central Maui are well-located to supply the small Maui Island market. And compared to other farmers in Hawai'i, they can also compete reasonably well in supplying mainland markets, as long as their products have long shelf-lives and so can be shipped by surface vessel.

However, compared to farmers on O'ahu, Maui farmers are at a disadvantage in supplying the Honolulu market. Furthermore, they are at a disadvantage supplying mainland markets if their products have short shelf-lives and so must be shipped by air. Also, farmers in Central Maui are at a disadvantage in competing against the low-cost producers who supply mainland markets.

4. SURROUNDING LAND USES

Honoapi'ilani Highway borders the eastern edge of the Project site, beyond which lie sugarcane fields. South and southeast of the Project site are Ma'alaea Triangle commercial complex, the Ma'alaea Small Boat Harbor, and apartment buildings. To the west are the lower slopes of the West Maui Mountains. To the north are fallow agricultural lands, followed by the King Kamehameha Golf Courses and sugarcane fields.

Maui Pineapple Co. (Maui Pine) grew pineapple on abutting fields north of the Project site until they chose to return the land to the landowner in late 2006.

5. PAST AGRICULTURAL USES

The Project lands have been used for growing sugarcane (late 1800s to about 1988), pineapple (about 1992 to 1995) and, on less than half of the acreage, diversified crops (about 1988 to 2004).

6. IMPACT ON EXISTING AGRICULTURAL OPERATIONS

a. Grazing

Maui Cattle Co. leased the Project site in 2005 to graze cattle, but cattle were not placed on the land until 2006 after fencing and other improvements were installed. The lease is for a 3-year period, with an option to extend for an additional 4 years.

Development of the Project will remove about 257 acres of grazing lands from their inventory of about 60,000 acres. The company anticipates no significant impact from this small loss of land, including no significant impact on the size of their herd, production, revenues, employment or payroll.

In view of these findings, mitigation measures for this loss of grazing land are not recommended.

b. Nearby Farm Operations and Nuisance Issues

Hawaiian Commercial & Sugar Company (HC&S) fields are located east of the Project site across Honoapi'ilani Highway. These operations are <u>not</u> likely to cause significant nuisance problems to residents of the Project because the homes will be separated from the sugarcane fields by the highway and by a buffer along the eastern boundary of the Project site. Also, residents will <u>not</u> be downwind of farm areas during prevailing tradewinds since these winds blow across the isthmus roughly parallel to Honoapi'ilani Highway.

To the north, the upwind sugarcane operations are not likely to cause significant nuisance problems because of the distance: about 4,200 feet (0.8 mile) to the nearest homes in the Project.

Farming of the adjoining fallow fields to the north, which are owned by an affiliate of the Project developer, could place agricultural operations within about 1,000 feet of some of the homes in the Project. In order to avoid potential nuisance issues, both the landowner and one or more future agricultural tenants are likely to limit activities to ones that are compatible with nearby homes. Instead of short-term crops on this land, more compatible agricultural uses could include cattle grazing on an irrigated pasture that would allow high stocking densities, or one or more orchard crops.

Before new residents purchase homes and lots, they will be informed that they will be living near farming areas. This point will be highlighted in promotional brochures and will be spelled out in the sales contracts. Under these circumstances, buyers are more likely to accept that nearby farm operations are part of the ambiance and lifestyle of the area.

In any case, Hawai'i's Right-to-Farm Act gives farmers who were operating before neighboring properties were developed the right to farm even if they cause a nuisance, provided that the farm activity does not threaten public health or safety.

In view of the above, no additional measures are needed to mitigate potential nuisance problems.

7. GROWTH OF DIVERSIFIED CROP FARMING (CUMULATIVE IMPACT)

a. Potential Acreage Requirements for Diversified Crops

<u>Crops to Replace Imports of Fruits and Vegetables</u>

For low-elevation fruits and vegetables that have a history of profitable production in Hawai'i, potential land requirements in 2010 for 100% import substitution for the state and for Maui County are estimated at 12,700 acres and 1,700 acres, respectively, plus additional acreage for fallowing land between crop plantings. When allowing for competition from imports, these estimates drop to about half.

<u>Export Crops</u>

Hawai'i farmers are exploring various export crops on lands released from plantation agriculture. Over the next 20+ years, one or more of these crops may prove to be successful and may grow into a major export crop.

However, the history of agricultural efforts in Hawai'i reveals that the successful development of major new export crops requiring large amounts of land is infrequent. For example, over the past 50 years in Hawai'i, farmers have explored numerous possibilities for export crops, but they have developed overseas markets for just one diversified crop that requires more than 10,000 acres (macadamia nuts at 18,000 acres in 2004); one additional crop that requires more than 5,000 acres (coffee at 7,700 acres); and only five additional crops or crop categories that require more than 1,000 acres each.

Feed Crops

If feed crops could be grown in Hawai'i and priced competitively against mainland imports, they could replace some of the grains and hay that is now being imported to the state. Unfortunately, a number of commercial attempts in Hawai'i to grow grains and alfalfa have been unsuccessful.

Biofuel Crops

Crops can be grown to produce biomass to fuel a boiler, or as feedstock to produce fuels. In Hawai'i, the common practice is to produce biomass as a by-product of some principal crop. However, O'ahu Ethanol Corporation plans to build an ethanol plant at Campbell Industrial Park using conventional technology but, at least initially, using imported molasses as the feedstock. For the longer term, this company is exploring the economics of growing sweet sorghum to supply feedstock to its ethanol plant. Acreage requirements for a new sorghum biofuel plantation on O'ahu would range from about 6,000 acres for viability to 15,000 if it were to replace all imported molasses.

However, a number of substantial difficulties must be overcome in order to develop a biofuel plantation that supplies feedstock for ethanol production. For example, in many areas of the state, it will be difficult to lease the large amount of land required for a biofuel plantation at low lease rents for the 30 or so years required to capitalize the substantial investment in a new plantation. Also, emerging technology in the early stages of commercialization promises a more plentiful and cheaper source of feedstock for ethanol. Instead of producing ethanol using sugars from conventional sources, the sugar would come from "cellulosic" sources. This would include green waste for which there would be no land rent and no growing costs, but there could be a disposal fee paid to the processor. In the long term, this less expensive source of feedstock could result in an unprofitable biofuel plantation.

These and other difficulties and risks suggest that the probability of successfully developing and sustaining a sorghum biofuel plantation in Hawai'i is low.

Recent Trends in Crop Acreage

For all diversified crops—i.e., all crops other than sugarcane and pineapple, including crops to replace imports and crops for export—statewide land requirements grew by an average of 240 acres per year from 1984 through 2004, or about 2,400 acres per decade.

b. Statewide Availability of Land for Diversified Crops

Statewide, a vast amount of land has been released from plantation agriculture: about 249,900 acres between 1968 and 2004—an average decrease of over 6,940 acres per year over a 36-year period (see Figure 10). The 2006 closure of Del Monte's pineapple plantation on O'ahu increased this acreage by about 5,100 acres, resulting in a total release of at least 255,000 acres from plantation agriculture between 1968 and 2007.

Over this same period, the demand for land for diversified crops increased by about 26,500 acres, or an average of about 740 acres per year. Since 1984, the growth has slowed to an average of 240 acres per year, as previously mentioned.

As the above indicates, the release of land from plantation agriculture has far outpaced the demand for land for diversified crops. The net decrease in crop land between 1968 and 2004 amounted to 223,400 acres; this figure has increased to about 228,500 acres after adding the land fallowed by Del Monte. While some of the released land has been converted or is scheduled to be converted to urban uses and tree plantations, an estimated 160,000+ acres remain available for diversified crops.

Once the Superferry begins operating in 2007, cultivating crops on the Neighbor Islands for the Honolulu market, and vice versa, will become more economically feasible. This will increase the importance of the statewide availability of agricultural land vis-a-vis the island-wide availability.

The above indicates that ample land is available in Hawai'i to accommodate the growth of diversified crops, whether demand is based on potential or recent trends. In other words, the limiting factor to the growth of diversified crops is *not* the *land supply*, but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

c. Maui Island Availability of Land for Diversified Crops

The above findings also apply to Maui. Since 1977, the contraction and eventual closure of Wailuku Sugar Co. and Pioneer Mill released about 11,200 acres from sugarcane production. In addition, the contraction of pineapple operations has released about 5,000 acres since 1993.

During the 1980s, about 4,700 acres of sugarcane land in Central Maui were made available for other uses. During the 1990s, the reduction in sugarcane acreage occurred in West Maui. Similarly, most of the recent reduction in pineapple acreage occurred in West Maui.

Some of this former plantation land was developed and some was converted to other crops, but most of it remains fallow or is used for grazing cattle.

In summary, considerable land remains available on Maui for diversified agriculture, although most of it is in West Maui.

d. Potential Loss of Agricultural Land on Maui to Development

If all of the committed, designated and proposed residential and resort projects on Maui Island were approved, built and sold, they would supply about 45,740 homes. At the projected demand of about 1,380 new homes per year, this potential supply of homes could be absorbed in about 33 years.

Development of all of these projects—including the 257-acre Ma'alaea Mauka Residential Subdivision—would result in about 11,800 acres that are now in the Agricultural District being lost to potential agricultural uses. This estimate includes prime agricultural land, low-quality land that is suitable for grazing but not farming, and gulch land. It represents less than 5% of the 244,600 acres on Maui Island that are in the State Agricultural District.

After a period in 33 years or so, this would leave about 232,800 acres on Maui Island available for agricultural uses.

e. Cumulative Impact on the Growth of Diversified Crop Farming

Including the wastewater treatment plant, the Project will commit 262 acres of agricultural land to a non-agricultural use. If this land were used to grow a typical vegetable or fruit crop, then it could support about 33 farm jobs (based on about 12.5 jobs per 100 acres).

More realistically, development on this agricultural land—combined with other developments in Hawai'i and on Maui Island—involves the loss of too little agricultural land to significantly affect (1) the availability of land to farmers in Hawai'i, (2) agricultural land rents, (3) the growth of diversified crops, or (4) potential agricultural employment. This conclusion is based on the finding that, as a result of the contraction of plantation agriculture, ample land is available for diversified crops, with the available supply far exceeding likely or potential demand.

However, in Central Maui, the Project might adversely affect the growth of diversified agriculture somewhat since the market for agricultural land is tighter there than it is in most other areas of the State.

f. Mitigating Measures

In view of the small impact of the Project on the growth of diversified agriculture, mitigation measures for the lost agricultural land are not recommended.

8. OFFSETTING BENEFITS

a. Non-agricultural Benefits

The loss of 262 acres of agricultural land will be offset by the following benefits of the Project:

- — 949 homes for Maui residents including senior care housing and affordable housing, along with a community center, parks, open space, and supporting infrastructure;
- — construction jobs and other jobs provided by the development activity;
- — at full development of the Project, jobs generated by residents of the Project who purchase goods and services on Maui;
- — tax revenues (excise taxes, personal income taxes, corporate income taxes, property taxes, etc.) generated by development activity; and
- — tax revenues generated by the families who occupy homes in the Project.

b. Agricultural Benefits

Preservation of Prime Agricultural Land Supplied with Water

In addition to the above, the Project will provide agricultural benefits—namely, it will preserve the 85-acre wastewater disposal area for future agricultural use. This is high-quality agricultural land that will be supplied with 600,000 gallons per day of wastewater that will be treated to a high standard that will allow any method of irrigation of any crop. Agricultural uses that would be compatible with the Project would include orchard crops and cattle grazing.

Support for Affiliated Agricultural Operations

The Project developer is affiliated with other Hawai'i companies that are engaged in farming, including Maui Tropical Plantation, a Coffees of Hawai'i farm on Moloka'i, and a new Coffees of Hawai'i farm on Maui.

Many agricultural operations in Hawai'i are marginally profitable, including MTP and probably most coffee farms. The association of MTP and Coffees of Hawai'i with the Project may contribute to their economic health by having profits from development (1) cover losses from farming during lean years, and (2) contribute capital to improve or further expand the farms.

9. CONSISTENCY WITH STATE AND COUNTY POLICIES

a. Availability of Lands for Agriculture

The *Hawai'i State Constitution*, the *Hawai'i State Plan*, the *State Agriculture Functional Plan*, the *County of Maui General Plan 1990*, and the County's *Kihei-Makena Community Plan* call directly or implicitly for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture. To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to plantation agriculture, the Project site is no longer part of a sugarcane or pineapple plantation.

With regard to diversified agriculture, the Project will reduce the availability of agricultural land by a relatively small amount. However, the Project will not limit the statewide growth of diversified agriculture since ample agricultural land is available. This is due to the enormous supply of agricultural land that is now available due to the contraction of plantation agriculture. However, the growth of diversified agriculture in Central Maui might be limited due to the tighter agricultural land market there.

b. Conservation of Agricultural Lands

In addition to the above, State and County policies call for conserving and protecting prime agricultural lands, including protecting agricultural lands from urban development.

However, these policies—which for the State were written before the major contraction of plantation agriculture in the 1990s—assume implicitly that profitable agricultural activities eventually will be available to utilize all available agricultural lands. This has proven to be a questionable assumption in view of the enormity of the contraction of plantation agriculture, the abundant supply of land that came available for diversified agriculture, and the slow growth in the amount of land being utilized for diversified agriculture.

Furthermore, discussions in the Agriculture portion of the *State Functional Plan* recognize that redesignation of lands from Agricultural to Urban should be allowed "... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in ...agriculture;" that is, when an "overriding public interest exists." The enormous contraction in plantation agriculture, resulting in the supply of agricultural land far exceeding demand, constitutes a major change in economic conditions. Moreover, development of the Project will provide community and agricultural benefits (about 949 homes, construction jobs, jobs generated by the purchase of goods and services by Project residents, tax revenues, preservation of 85 acres of prime agricultural land supplied with

an ample volume of high-quality agricultural water, and occasional financial support for affiliated agricultural operations) that far exceed those provided by agriculture (less than one job with the current grazing operation).

In practice, development of the Project site is expected to have no significant adverse impact on existing or potential agricultural employment. However, it could contribute new agricultural jobs on the nearby 85 acres that will be preserved, and could contribute to preserving or increasing employment for the affiliated agricultural operations.

c. State Districting

The Project site is within State Agricultural District. However, Ma'alaea Properties is filing a petition with the State Land Use Commission for a District Boundary Amendment to redesignate the Project site to the "Urban" District.

d. County of Maui General Plan

County of Maui zoning for the project site is "Agricultural." However, Ma'alaea Properties plans to file a petition with the County for a change in zoning to conform to the *Kihei-Makena Community Plan*.

e. Kihei-Makena Community Plan

The Project is consistent with the *Kihei-Makena Community Plan* which designates the site "Project District 12," thereby allowing for a residential community at Ma'alaea Mauka.

MA'ALAEA MAUKA RESIDENTIAL SUBDIVISION: IMPACT ON AGRICULTURE

1. INTRODUCTION[1]

Ma'alaea Mauka, LLC proposes to develop Ma'alaea Mauka Residential Subdivision ("the Project"), a planned residential community on a 257-acre site located in the southeast corner of Central Maui—see Figures 1 and 2 for the location of the Project, and Figure 3 for the proposed development (the figures follow the body of the report). An additional 5 acres north of the Project will be used for a wastewater treatment plant. Some or all of the treated effluent will be dispersed on a nearby 85-acre site.

The Project is within the State Agricultural District (Figure 4), and the County of Maui ("County") zoning for the Project site is "Agricultural." However, the *Kihei-Makena Community Plan* designates the site as a residential Project District referred to as "Project District 12" (Figure 5). Development of the Project will require (1) a State Land Use Boundary Amendment to change the districting from Agricultural to Urban, (2) Project District Approval pursuant to Chapter 19.45 of the Maui County Code, and (3) changes in zoning to conform with the *Kihei-Makena Community Plan*.

This report addresses the impacts on agriculture of developing the Project. The material below gives the following information: its location; a description of the Project; the agricultural conditions at the Project site, along with supporting Figures 6, 7, 8 and 9; potential crops; locational advantages and disadvantages for crop production; surrounding land uses; past and current agricultural uses of the land; the impact of the Project on existing agricultural operations in or near the Project site; the impact the Project on the growth of diversified crop farming, along with supporting Figure 10; benefits of the Project that would offset adverse agricultural impacts; and consistency of the Project with State and County agricultural policies.

Two Appendices are at the end of the report. Appendix A provides a listing of planned and proposed development projects on Maui and the amount of agricultural land that would be affected. Appendix B provides a summary of State and County goals, objectives, policies and guidelines related to agricultural lands.

2. LOCATION OF THE PROJECT [1]

Figure 1 shows the location of the Project in the Central Maui region. As indicated, the Project site is in the southwest area of Central Maui near Ma'alaea Small Boat Harbor. Figure 2 shows a closer view of the site location and its Tax Map Key: (2) 3-6-01: 018.

The wastewater treatment plant will be located on a 5-acre site that is mauka and north of the intersection of Honoapi'ilani and Kuihelani Highways, and abutting Honoapi'ilani Highway. This treatment plant will be located over 600 feet north of the Project.

Also, the 85-acre effluent dispersal site is north of the treatment plant and mauka of Honoapi'ilani Highway. The site abuts both the treatment plant and the highway.

3. PROJECT DESCRIPTION[1,2]

Ma'alaea Mauka is a 257-acre master-planned residential development that will provide about 949 market and affordable residential units on about 165 acres (see Table 1 and Figure 3). Table 1 lists the types of single-family and multi-family homes that will be provided and, for each type, the approximate acreage involved and the number of homes. The remainder of the parcel will include a community center, a park, open space and buffer zones, a quasi-public facility, and interior roads.

As mentioned above, about 5 acres north of the Project site will be used for a wastewater treatment plant. This plant will discharge about 600,000 gallons per day of effluent that will be treated to the R-1 standard, which is the highest quality effluent designated by the Hawaii State Department of Health.[4] Because R-1 effluent undergoes a high level of treatment, State restrictions for reuse are minimal. In particular, R-1 effluent is sufficiently safe for any method of irrigation (drip, furrow, sprinkler, etc.) for any crop (fruit, vegetable, surface crop or below surface, processed or unprocessed, etc.). Some or all of the treated effluent from the Project will be used to irrigate about 85 acres lying north of the Project. The effluent can also be used to irrigate landscaping at the Project site.

4. AGRICULTURAL CONDITIONS

a. Soil Types[3]

As shown in Figures 6 and 7 respectively, the Project site has soils belonging to the Pulehu-Ewa-Jaucus association and consists of four specific soil types. Table 2 shows the acreages of the various soil types and their ratings by the Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service. The soil ratings are discussed in the next subsection.

Table 1. Ma'alaea Mauka Residential Subdivision: Summary of Preliminary Subdivision Plan[1]

Land Use	Acres	Homes
On-site		
Homes		
Custom lots (single-family homes)	38.0	144
Single-family homes	80.0	355
Patio homes (multi-family homes)	23.5	164
Town homes (multi-family homes)	7.0	100
Senior care housing	6.0	60
Apartments	11.5	126
Community Center and Open Space	37.0	
Park	15.0	
Quasi-public Facility	3.0	
Roads (including R-O-W)	36.0	
Total, On-site	257.0	949
Off-site: Wastewater Treatment Plant	5.0	

Table 2. Ma'alaea Mauka Residential Subdivision: Soil Types and NRCS Ratings[3]

Soil Types	Acres	%	NRCS Ratings
On-site			
High-Quality Soils			
EsB	65	25%	IIe
EtB	135	53%	IIe
PtB	35	14%	IIe
Low-Quality Soils			
rSM	22	8%	VIIs
Total	**257**	**100%**	
Off-site: High-quality PtB soil	5		IIe

For each of the four soil types, the complete name, range of slopes, and soil descriptions are:

— EsB: Ewa silty clay, 3 - 7% slopes

In a representative profile the surface layer is about 18 inches thick, and the subsoil is about 42 inches thick with a subangular blocky structure. The substratum is coral limestone, sand, or gravelly alluvium. In places, roots penetrate to a depth of 5 feet or more.

The soil is neutral in the surface layer and subsoil. Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot in the surface layer and 1.4 inches per foot in the subsoil. This soil is more than 60 inches deep.

— EtB: Ewa cobbly silty clay, 3 - 7% slopes

This soil has a profile like that of EsB, except for the texture of the surface layer. Cobblestones in the surface layer interfere with tillage but do not make intertilled crops impracticable.

— PtB: Pulehu cobbly clay loam, 3 - 7% slopes

In a representative profile the surface layer is about 21 inches thick, and the subsoil is about 39 inches thick with massive and single grain, stratified loam, loamy sand, fine sandy loam, and silty loam. Below this is coarse, gravelly or sandy alluvium. Small areas that have thin, stratified layers of sand and gravel at a depth of 20 to 36 inches. In places, roots penetrate to a depth of 5 feet or more.

The soil is neutral in the surface layer and neutral to mildly alkaline below the surface layer. Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.4 inches per foot in the surface layer and subsoil. Low areas are subject to flooding.

— rSM: Stony alluvial land, 3 - 15% slopes

This soil consists of stones, boulders, and soil deposited by streams along the bottoms of gulches and on alluvial fans. Improvement of this land is difficult because of the stones and boulders.

b. Soil Ratings

Three classification systems are commonly used to rate soils in Hawai'i: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawai'i, and (3) Overall Productivity Rating.

Land Capability Grouping (NRCS Rating)[5]

The 1972 Land Capability Grouping by the NRCS rates soils according to eight levels, ranging from the highest classification level "I" to the lowest "VIII."

As shown in Table 2, about 235 acres (92%) of the Project site and the 5 acres for the off-site wastewater treatment plant have soils that are rated IIe. Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices. The subclassification "e" indicates that the limitation is due to erosion.

About 22 acres (8%) have soils rated VIIs. Class VII soils have very severe limitations that make them unsuitable for cultivation and restrict their use largely to pasture. The subclassification "s" indicates that the soils are rocky or stony.

Agricultural Lands of Importance in the State of Hawai'i (ALISH)[6]

ALISH ratings were developed in 1977 by the NRCS, the UH College of Tropical Agriculture and Human Resources, and the State Department of Agriculture. This system classifies land into three broad categories: (a) Prime agricultural land which is land that is best suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment; (b) Unique agricultural land which is non-Prime agricultural land used for the production of specific high-value crops; and (c) Other agricultural land which is non-Prime and non-Unique agricultural land that is important to the production of crops.

About 245 acres (95%) of the Project site and the 5 acres for the off-site wastewater treatment plant have soils that are rated Prime; about 5 acres (2%) are rated Other; and about 7 acres (3%) are unclassified (Figure 8).

Overall Productivity Rating (LSB Rating)[5]

In 1972, the University of Hawai'i (UH) Land Study Bureau (LSB) developed the Overall Productivity Rating, which classifies soils according to five levels, with "A" representing the class of highest productivity and "E" the lowest.

All or nearly all of the soils at the Project site are rated "B" (see Figure 9). However, the 5 acres for the off-site wastewater treatment plant have soils that are rated "A."

Summary Evaluation of Soil Quality

These soil-rating systems suggest that about 240 ± 5 acres at the Project site and the 5 acres for the off-site wastewater treatment plant are comprised of higher-quality soils (II for the NRCS ratings, Prime for ALISH, and A or B for the LSB rating).

c. Soil Characteristics[3,7,8]

Consistent with the above soil ratings, the higher quality lands exhibit the following soil characteristics: deep (over 30 inches), well-drained, stony, and moderately suited for machine tillability. However, a plantation manager for the former landowner and the current agricultural tenant both report that the soils are shallow and rocky.

d. Elevation and Slopes[1,3]

The Project site ranges in elevation from about the 22 feet at the southern end to about 207 feet at the northern end. Slopes range from 3% to 7% over most of the property.

e. Climatic Conditions

Like other areas in Hawai'i, Central Maui has a mild *semi*tropical climate that is due primarily to three factors: (1) Hawai'i's mid-Pacific location near the Tropic of Cancer, (2) the surrounding warm ocean waters that vary little in temperature between the winter and summer seasons, and (3) the prevailing northeasterly tradewinds that bring air having temperatures that are close to those of the surrounding waters.

Solar Radiation[9]

The Project site receives considerable sunshine, with average daily insolation of nearly 480 calories per square centimeter.

Rainfall[10]

Rainfall at the Project site is low, averaging about 20 to 30 inches per year. Most of this rainfall occurs during the winter rainy season (October through April), while the summer months (May through September) are hot and dry.

Temperatures[10]

Along the coast at Ma'alaea, the average temperature ranges from about 58°F in the winter to about 83°F in the summer.

Winds[10,11]

The prevailing tradewinds blow from north to south across the isthmus and out to sea at a mean speed of about 20 miles per hour.

f. Irrigation Water[1,7]

Historically, the sugarcane fields in the Project site were irrigated with surface water from Waihee Ditch which runs along and occasionally passes through the western edge of the property, roughly paralleling Honoapi'ilani Highway (see Figure 8). Additional water came from a groundwater well located near the arrowhead pointing to the the Project Site in Figure 4.

A plantation manager of the former landowner reports that water requirements are high at the Project site because of the typically dry and windy conditions.

g. Road Access

Plantation roads provide access to the property from Honoapi'ilani Highway (see Figures 2 and 4).

h. Summary

About 240 ± 5 acres at the Project site and the 5 acres for the off-site wastewater treatment plant have favorable agronomic conditions for crop production as indicated by good soils (although they are stony in most areas), gently sloping terrain, high solar radiation, access to irrigation water, and good road access.

5. POTENTIAL CROPS[12]

Based on the above agronomic conditions, the Project site is suitable for low-elevation crops that are grown commercially in Hawai'i, including but not limited to: asparagus, beans (green, bush and snap), bell peppers, bittermelon, cantaloupe, Chinese peas, cucumbers, daikon, dry onions, eggplant, flowers/nursery products, ginger root, green onions, green peppers, head and semi-head lettuces, herbs, honeydew melons, limes, lotus root, lychee, Manoa lettuce, mango, mustard cabbage, Oriental squash, parsley, pineapple, pumpkins, seed crops, surgarcane, sweet corn, sweet potatoes, tangerines, and watermelons.

6. LOCATIONAL ADVANTAGES AND DISADVANTAGES FOR CROP PRODUCTION

a. Maui Island Market

Farmers in Central Maui are well-located for supplying the Maui Island market because of the short trucking distance to Kahului, which is the island's commercial, industrial, distribution and transportation center. While the Maui Island market is significant, it is comparatively small: in 2000, Maui had a *de facto* population of about 156,170 residents and visitors.[13]

b. Honolulu Market

All farmers on Maui are at a disadvantage in competing against farmers on O'ahu for supplying the Honolulu market due to the interisland shipping costs, delays and extra handling. In comparing barge and air-cargo services, shipping by barge is less expensive and larger loads can be shipped, but the shipments are slow and infrequent. Air service is faster and frequent, but it is far more expensive and capacities are limited. A planned new ferry system, if successful, will increase the speed and frequency of surface shipments, and costs will be lower than air freight. In turn, this will allow Maui farmers to be more competitive in O'ahu produce markets, and vice versa.

In 2000, O'ahu had a *de facto* population of about 927,170 residents and visitors.[13] Thus, the Honolulu market is nearly six-times larger than the Maui market.

c. Mainland Market

Compared to Hawai'i, the mainland market is enormous: in 2000, the U.S. population totaled 281.4 million.[14] In supplying this market with products that can be carried by container ship because they have long shelf-lives (e.g., canned fruit), farmers on Maui are competitive with farmers on O'ahu and other islands. Even though freight from Maui must first be barged to Honolulu then transferred onto a container ship, Matson's overseas shipping service includes interisland barge service at no additional fee; except for some minor port charges, Matson charges a common fare for all islands.[15]

In the case of fresh products that must be shipped by air to the mainland because of their short shelf-lives, farmers on Maui are at a disadvantage compared to farmers on O'ahu because most mainland air cargo is shipped via the Honolulu International Airport. Compared to farmers on O'ahu, Maui farmers encounter additional costs, delays and handling for interisland air-cargo service and for transferring the fresh products from small interisland aircraft to large overseas aircraft.

However, overseas air-cargo service from Maui has improved somewhat because the current generation of aircraft can depart from the short runway at Kahului with a full load of passengers and a full load of cargo in the hold. This direct service allows farmers on Maui to be more competitive in mainland markets. However, the lift capacity from Maui is limited by the number of direct flights.

In the U.S. mainland market, farmers in Hawai'i must also compete against farmers on the mainland and in Mexico, Central and South America, the Caribbean, Australia, New Zealand, Southeast Asia, etc. Most of the competing farm areas have lower production and delivery costs than Hawai'i does. Competing against Mexico is particularly difficult given the North America Free Trade Agreement (NAFTA) and Mexico's proximity to major U.S. markets.

d. Summary

In terms of location, farmers in Central Maui are well-located to supply the small Maui Island market. And compared to other farmers in Hawai'i, they can also compete reasonably well in supplying mainland markets, as long as their products have long shelf-lives and so can be shipped by surface vessel.

However, compared to farmers on O'ahu, they are at a disadvantage in supplying the Honolulu market. Furthermore, they are at a disadvantage supplying mainland markets if their products have short shelf-lives and so must be shipped by air. Also, farmers in Central Maui are at a disadvantage in competing against the low-cost producers who supply mainland markets.

7. Surrounding Land Uses

As shown in Figures 1 to 3, Honoapi'ilani Highway borders the eastern edge of the Project site, beyond which lie sugarcane fields. South and southeast of the Project site are Ma'alaea Triangle commercial complex, the Ma'alaea Small Boat Harbor, and apartment buildings. To the west of the Project site are the lower slopes of the West Maui Mountains. To the north are fallow agricultural lands, followed by the King Kamehameha Golf Courses and sugarcane fields.

Maui Pineapple Co. (Maui Pine) grew pineapple on abutting fields north of the Project site until they chose to return the land to the landowner in late 2006. Before 1988, sugarcane was grown on these fields.

8. Past and Current Agricultural Land Uses[1,7,8,16,17]

a. Sugarcane (late 1800s to about 1988)

The Project lands and adjoining lands to the north were used to grow sugarcane for over 100 years, ending in about 1988 when Wailuku Agribusiness Co. Inc., a subsidiary of C. Brewer and Co., Ltd., ceased all sugarcane production due to unprofitable operations. Following sugar, the land was fallow for about 3 to 4 years.

b. Pineapple (about 1992 to 1995 and 2006 for adjoining lands)

Beginning in about 1992, Wailuku Agribusiness used the land at the Project site to grow pineapple to supply fruit to Maui Pine. The operation lasted 3 or 4 years until 1995 when production was discontinued due to low yields, rocky soils, high water requirements, and the availability of higher-quality agricultural lands in the region. After pineapple, the land laid fallow for about 3 years.

The 5-acre site for the wastewater treatment plant is on land to the north of the Project site that was leased to Maui Pine for continued pineapple operations. As mentioned in the previous section, Maui Pine chose to return this land to the landowner in late 2006, and it is now fallow.

c. Diversified Crops (about 1998 to 2004)

Beginning in about 1998, about 24 farmers were licensed to cultivate a little less than half the acreage at the Project site. The terms were month-to-month, and rents were about $360 per acre per year. Most of the tenants farmed for the lifestyle (that is, they were "hobby farmers"), with only about one, two or possibly three of them deriving most of their income from farming. Their crops included but were not limited to asparagus, bananas, cucumbers, papaya, squash, string beans, and tomatoes. Some of the tenants also raised fighting cocks on their land. Following a notice of over 7 months, the licenses were discontinued in August 2004 when the land was sold. Following the sale, the land laid fallow for about 2 years.

d. Cattle Grazing (since 2006)

Since 2006, the Project site has been used for grazing cattle (see next section for details).

9. Impact on Existing Agricultural Operations

a. Maui Cattle Company, LLC[8,12]

Overview of Maui Cattle Co.

Maui Cattle Co. is a partnership of seven ranches on Maui that was formed in 2002. These ranches graze about 5,500 mother cows on about 60,000 acres. About 40% of the calves remain on Maui where they are grass-fed to heavier weights, then sold locally; the remaining calves are shipped to the mainland. The long-term goal is to keep all of the calves on Maui for the Hawai'i market. The operation employs about 60 ranch hands who earn about $10 to $20 per hour.

Ma'alaea Mauka Grazing Operations

Maui Cattle Co. leased the Project site in 2005 to graze cattle, but cattle were not placed on the land until 2006 after fencing and other improvements were installed. The lease is for a 3-year period, with an option to extend for an additional 4 years. No lease rent is paid for the land; instead, Maui Cattle provides land stewardship. Also, the landowner pays the property tax and paid for about 80% of the perimeter fencing.

Depending on rainfall, the land is used seasonally to grow out about 300 weaned calves to heavier weights. The original plan to irrigate the pasture for year-round operations proved uneconomical. The Ma'alaea Mauka operation requires the part-time effort of a single land manager who makes sure that the cattle have water, fences have not been breached, etc.

Impact on Maui Cattle Company

Development of the Project will remove about 257 acres of Maui Cattle Company grazing lands. However, the company anticipates no significant impact from this small loss of land, including no significant impact on the size of their herd, production, revenues, employment or payroll.

Statewide Availability of Grazing Land[12,13]

The total supply of grazing land in Hawaii is very large—about 1.15 million acres in 2004, most of which is located on the Big Island. For comparison, this is about three times the entire land area of O'ahu (381,632 acres). Thus, the Project will have a relatively small impact on the supply of grazing land in the state—a decrease of about 0.02%.

Furthermore, the supply of grazing land has increased statewide and on Maui due to the contraction of plantation agriculture (see Section 10.b and Figure 10). In contrast, from 1980 (or even earlier) until 2005, the number of beef cows in Hawaii has remained at about 80,600 ± about 3,340 beef cows.

This large and increasing supply of grazing land, combination with no growth in the number of beef cows, indicates that land is not the limiting factor to the growth of Hawai'i's cattle industry. It further suggests that other ranches in the state could increase their herd sizes to compensate for the loss in beef production that will result from the loss of grazing land at the Project site.

Mitigating Measures

As discussed above, the Project will result in a relatively insignificant loss of grazing land. Moreover, this loss will have an insignificant impact on (1) Maui Cattle Co. and (2) Hawai'i's cattle industry. In view of these findings, mitigation measures for this loss of grazing land are not recommended.

b. Nearby Farm Operations and Nuisance Issues

Historically, nuisances arising from some farm operations can become an issue for both residents and farmers. Residents who live close to and downwind from farming operations may complain about occasional noise, dust, chemical spraying, smoke, etc. In turn, farmers may have to change their operations in order to address these complaints. The potential for nuisance problems between future residents of the Project and nearby farm operations is addressed below.

Nearby Farm Operations

Nearby sugarcane operations located to the east of the Project are not likely to cause significant nuisance problems to Project residents because the homes will be separated from the sugarcane fields by Honoapi'ilani Highway and by a

buffer along the eastern boundary of the Project site. Also, residents will not be downwind of farm areas during prevailing tradewinds since these winds blow across the isthmus roughly parallel to Honoapi'ilani Highway.

To the north, the upwind sugarcane operations are not likely to cause significant nuisance problems because of the distance: about 4,200 feet (0.8 mile) to the nearest homes in the Project. For comparison, the condominiums near the Ma'alaea Small Boat Harbor are about 100 feet to 1,000 feet downwind from sugarcane fields.

Farming of the adjoining fallow fields to the north, which are owned by an affiliate of the Project developer, could place agricultural operations within about 1,000 feet of some of the homes in the Project. The distance is based on the minimum separation between some homes in the Project and the proposed effluent disposal area where crops could be grown to take advantage of good soils and high-quality agricultural water. In order to avoid potential nuisance issues, both the landowner and one or more future agricultural tenants are likely to limit activities to ones that are compatible with nearby homes. Instead of short-term crops on this land, more compatible agricultural uses could include cattle grazing on an irrigated pasture that would allow high stocking densities, or one or more orchard crops.

Mitigating Measures

Before new residents purchase homes and lots, they will be informed that they will be living near farming areas. This point will be highlighted in promotional brochures and will be spelled out in the sales contracts. Under these circumstances, buyers are more likely to accept that nearby farm operations are part of the ambiance and lifestyle of the area.

In any case, Hawai'i's Right-to-Farm Act gives farmers who were operating before neighboring properties were developed the right to farm even if they cause a nuisance, provided that the farm activity does not threaten public health or safety.[18]

In view of the above, no additional measures are needed to mitigate potential nuisance problems.

10. IMPACT ON THE GROWTH OF DIVERSIFIED CROP FARMING

The Project will commit agricultural land to a non-agricultural use. The impact of this commitment on the growth of diversified crop farming is addressed below. The material covers the (1) amount of land required for the future growth of diversified crops, (2) availability of land for diversified crops, (3) potential loss of agricultural land on Maui to development, (4) cumulative impact of the Project and other projects on the growth of diversified crop farming, and (5) mitigating measures.

a. **Potential Acreage Requirements for Diversified Crops**

Crops to Replace Imports of Fruits and Vegetables[19]

For low-elevation fruits and vegetables that have a history of profitable production in Hawai'i, potential land requirements in 2010 for 100% import substitution for the state and for Maui County are estimated at 12,700 acres and 1,700 acres, respectively, plus additional acreage for fallowing land between crop plantings. When allowing for competition from imports, these estimates drop to about half. These estimates take into account estimated consumption, production trends, seasonal and annual market shares, yields, and the number of crops per year. Also, these figures reflect acreage in crop—not harvested acreage as is typically reported in government publications.

Market shares for Hawai'i growers are limited by the following factors: (1) local varieties are not perfect substitutes for all imports (e.g., premium-priced sweet Maui onions versus inexpensive storage onions); (2) some crops cannot be produced profitably in the summer due to competition from low-cost imports of fruits and vegetables from California, other states, and Mexico; and (3) overproduction must be avoided in order to maintain profitable price levels.

Since Hawai'i farmers already supply a portion of the Hawai'i market, land requirements for increased import substitution are a fraction of the above estimates.

Export Crops[12,13,14]

The potential market for export crops is far larger than the Hawai'i market. In 2005, the U.S. population was 296.41 million, compared to Hawai'i's resident-plus-visitor population of 1.45 million. To take advantage of this large potential, Hawai'i farmers are exploring various export crops on lands released from plantation agriculture. Over the next 20+ years, one or more of these crops may prove to be successful and may grow into a major export crop.

However, the history of agricultural efforts in Hawai'i reveals that the successful development of major new export crops requiring large amounts of land is infrequent. For example, over the past 50 years in Hawai'i, farmers have explored numerous possibilities for export crops, but they have developed overseas markets for just one diversified crop that requires more than 10,000 acres (macadamia nuts at 18,000 acres in 2004); one additional crop that requires more than 5,000 acres (coffee at 7,700 acres); and only five additional crops or crop categories that require more than 1,000 acres each (papaya at 2,105 acres, bananas at 1,360 acres, tropical specialty fruits at 1,260 acres, flowers/nursery products at 3,874 acres, and seed crops at 3,870 acres). Tropical specialty fruits include longan, lychee, mango, rambutan, star-fruit, etc.

Feed Crops[20]

If feed crops could be grown in Hawai'i and priced competitively against mainland imports, they could replace some of the grains and hay that is now being imported to the state. Unfortunately, a number of commercial attempts in Hawai'i to grow grains and alfalfa have been unsuccessful. The major problems have been (1) pests, particularly birds that eat the grains before they are harvested; (2) humidity that is too high for drying alfalfa properly; and (3) high production costs compared to those of mainland farms.

Biofuel Crops[21-27]

Crops can be grown to produce biomass to fuel a boiler, or as feedstock to produce fuels. Examples of the latter include sugarcane, corn or sorghum used to produce ethanol. In turn, the ethanol is used to produce E-10 gasohol (90% gasoline and 10% ethanol).

In Hawai'i, the common practice is to produce biomass as a by-product of some principal crop. For example, at HC&S on Maui and at Gay & Robinson on Kaua'i, the sugarcane by-product bagasse is burned to help fuel their respective power plants. In addition, the biofuel company Maui Ethanol plans to use the sugarcane by-product, molasses, from the two sugarcane plantations as a feedstock to produce ethanol. Using conventional technology, the sugar in the molasses will be fermented to produce ethanol, followed by distillation to extract the alcohol.

However, O'ahu Ethanol Corporation plans to build an ethanol plant at Campbell Industrial Park using conventional technology but, at least initially, using imported molasses as the feedstock. The rated capacity will be 15 million gallons of ethanol per year. For the longer term, this company is exploring the economics of growing sweet sorghum to supply feedstock to its ethanol plant. The sorghum would have to be grown on O'ahu because it would be too expensive to ship the sorghum juice from a Neighbor Island to O'ahu. Sorghum juice is mostly water having a low concentration of sugar compared to molasses.

Acreage requirements for a new sorghum biofuel plantation on O'ahu would range from about 6,000 acres for viability to 15,000 if it were to replace all imported molasses. This acreage comprises a substantial share, if not all, of the estimated 14,700 acres of crop land that is available on O'ahu at year-end 2006. But it is a small share of the 160,000+ acres of crop land that will be available statewide (see Section 11.b).

A number of substantial difficulties must be overcome in order to develop a biofuel plantation that supplies feedstock for ethanol production, including:

— Long-term Leases

In many areas of the state, it will be difficult to lease the large amount of land required for a biofuel plantation at low lease rents for the 30 or so years required to capitalize the investment in a new plantation. Over time, other farmers and other users of land are likely to make higher offers for lease rents or land purchases. In view of this potential, the current market value of available agricultural lands is likely to be higher if the lands are not committed long-term at rents that would be low enough to be affordable for a biofuel plantation.

— Capital

Substantial investment capital will be required to cover the cost of a mill to extract the juice from a biofuel crop, a generating plant to provide power, improvements and upgrades to irrigation systems that are in disrepair, trucks and equipment to harvest and haul the sorghum to the mill and haul the sorghum juice to the ethanol plant, etc.

— Short-term Profitability

Annual revenues from selling the ethanol plus direct subsidies are estimated by the consultant at about $2,250 per acre (based on an estimated 900 gallons per acre per year of ethanol at about $2.50 per gallon). Even with subsidies, this is low compared to revenues from other crops in Hawai'i.

Furthermore, the cost of importing molasses for feedstock or importing ethanol may prove to be less expensive than growing a biofuel crop in Hawai'i. For similar crops (such as feed crops), importing has proven to be less expensive than growing and processing crops locally. Also, the U.S. Department of Agriculture has found sorghum to be an expensive feedstock for producing ethanol—about 3.7 times more expensive than corn and 63% more expensive than molasses.

As ethanol production increases on the mainland and in Hawai'i, there is a risk that the combined Federal and State subsidies for ethanol (nearly $1 per gallon) could be reduced, thereby compromising the profitability of a biofuel crop.

— Long-term Profitability

Over the long-term, emerging technology promises a cheaper source of feedstock for ethanol than does growing a biofuel crop on a plantation. Instead of producing ethanol using sugars from conventional sources (e.g., molasses, sugarcane, grains, fruits, etc.), the sugar would come from "cellulosic" sources. Using new technology that is in the early stages of commercialization, sugar that is locked in complex carbohydrates of plants is separated into fermentable sugars. Feedstock would include agricultural wastes,

yard clippings, discarded paper, wood waste, etc.—i.e., the green waste that is now used for composting. This new technology promises (1) much higher ethanol yields per ton of biomass because the entire plant can be used as feedstock, and (2) lower costs—particularly if there are no growing costs when waste product is used, and if the operator is paid a fee to dispose of municipal and agricultural waste. Eventually, this less expensive source of feedstock could result in unprofitable biofuel plantations. In Hawai'i, this new technology is being explored by Clear-Fuels Technology Inc.

O'ahu's municipal waste could produce an estimated 160 million gallons of ethanol compared to the current annual consumption of about 400 million gallons of gasoline. Assuming a similar ratio for Maui, about 40% of the island's fuel could be supplied by ethanol, which is four times as much ethanol than is needed for E-10.

The above difficulties and risks suggest that the probability of successfully developing and sustaining a biofuel plantation in Hawai'i is low. The more likely scenario is that ethanol will be produced as a by-product of sugar and, over the long-term, it will be produced from green waste.

Recent Trends in Crop Acreage

For all diversified crops—i.e., all crops other than sugarcane and pineapple, including crops to replace imports and crops for export—statewide land requirements grew by an average of 240 acres per year from 1984 through 2004, or about 2,400 acres per decade (see Figure 10).[1]

From 1999 to 2004, crop acreage increased for just three of the major export crop categories: tropical specialty fruits up 350 acres, flowers/nursery products up 1,162 acres, and seed crops up 1,420 acres. During this same period, acreage declined for three of the major export crops: macadamia nuts down 1,900 acres, papaya down 1,395 acres, and bananas down 400 acres. Coffee remained unchanged. The net change was a decrease of 763 acres.

Factors Limiting the Growth of Diversified Crops[19]

A great many crops can be grown in Hawai'i's year-round subtropical climate, and a number of them can be grown profitably in volumes requiring a few hundred acres. However, the modest growth in land requirements for

1. In Figure 10, the temporary bump in diversified-crop acreage that occurred in the late 1990s reflects the fact that some former sugarcane fields were newly planted with grasses for future cattle grazing. After cattle grazing began in 2000, much of this acreage was recategorized from crop land to grazing land.

diversified crops reflects the fact that few crops can be grown profitably on a large scale. The primary factors that have limited the growth of diversified agriculture in Hawai'i are given below.

- Hawai'i's subtropical climate is not well-suited to the commercial production of major crops that grow better in the temperate mainland climates.
- For certain crops, special hybrids adapted to Hawai'i's subtropical climate are yet to be developed.
- Crop pests are more prevalent and more expensive to control in Hawai'i than they are on the mainland where the cold winters kill many pests.
- Fruit-fly infestations prevent exports of many crops, or require expensive treatment.
- Most soils in Hawai'i have low nutrient levels and therefore require high expenditures for fertilizer.
- Hawai'i suffers from high farm-labor costs, largely because the agriculture industry must compete against the visitor industry and related industries for its labor.
- Compared to many other farm areas that supply U.S. markets, the cost of shipping agricultural supplies and equipment to Hawai'i is high, as is the cost of exporting produce from Hawai'i to mainland markets. High shipping costs are due to Hawai'i's remote location and to Federal regulations that require use of American-built ships and U.S. crews between U.S. ports.
- For a number of crops, consumption volumes in Hawai'i are too small to support large, efficient farms (i.e., the volumes are too small to realize economies of scale).
- Trends towards crops that are certified as safe and towards a single supplier of many food items favor large farms.
- Hawai'i farmers must compete against highly efficient mainland and foreign farms which, in a number of cases, can deliver produce to Hawai'i more cheaply than it can be produced locally. This is due to economies of scale and, in comparison to Hawai'i, low costs for land, labor, supplies, fertilizer, pest control, equipment, etc.

b. Statewide Availability of Land for Diversified Crops

Statewide, a vast amount of land has been released from plantation agriculture: about 249,900 acres between 1968 and 2004—an average decrease of over 6,940 acres per year over a 36-year period (see Figure 10).[12,28] The 2006 closure

of Del Monte's pineapple plantation on O'ahu increased this acreage by about 5,100 acres, resulting in a total release of at least 255,000 acres from plantation agriculture between 1968 and 2007.[29]

Over this same period, the demand for land for diversified crops increased by about 26,500 acres, or an average of about 740 acres per year. Since 1984, the growth has slowed to an average of 240 acres per year, as previously mentioned.

As the above indicates, the release of land from plantation agriculture has far outpaced the demand for land for diversified crops. The net decrease in crop land between 1968 and 2004 amounted to 223,400 acres; this figure has increased to about 228,500 acres after adding the land fallowed by Del Monte. While some of the released land has been converted or is scheduled to be converted to urban uses and tree plantations, an estimated 160,000+ acres remain available for diversified crops.[27] Because of the increased availability of agricultural land, a number of landowners report lower per-acre land rents on O'ahu and the Neighbor Islands compared to rents that were charged before the major contraction of plantation agriculture.[26]

Once the Superferry begins operating in 2007, cultivating crops on the Neighbor Islands for the Honolulu market, and vice versa, will become more economically feasible. For a full load carried in a large pick-up truck, the one-way fare will be about 2¢ per pound.[30] This will increase the importance of the statewide availability of agricultural land vis-a-vis the island-wide availability.

The above indicates that ample land is available in Hawai'i to accommodate the growth of diversified crops, whether demand is based on potential or recent trends. In other words, the limiting factor to the growth of diversified crops is *not* the *land supply*, but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

c. Maui Island Availability of Land for Diversified Crops

The above findings also apply to Maui. Since 1977, the contraction and eventual closure of Wailuku Sugar Co. and Pioneer Mill released about 11,200 acres from sugarcane production. In addition, the contraction of pineapple operations has released about 5,000 acres since 1993.

During the 1980s, about 4,700 acres of sugarcane land in Central Maui were made available for other uses. Some of this land was developed; some was planted in macadamia nuts which continued until 1999; some was planted in pineapple; some was transferred to HC&S; and some remains fallow.

During the 1990s, the reduction in sugarcane acreage occurred in West Maui, including about 6,000+ acres released in 2000. Similarly, most of the recent reduction in pineapple acreage occurred in West Maui, including about 3,200 acres that were released in 2003. Some of this former plantation land in

West Maui was developed and some was converted to other crops, but most of it remains fallow or is used for grazing cattle.

In summary, considerable land remains available on Maui for diversified agriculture, although most of it is in West Maui.

d. Potential Loss of Agricultural Land on Maui to Development[13,31-33]

Based on information provided by the Maui County Planning Department, Appendix A provides a summary of 202 major residential, resort, commercial, and industrial development projects on Maui Island that will either increase the number of residential and visitor units, or involve agricultural land. The listing, which reflects the known development projects as of April 2006 (with minor updates), excludes those having fewer than six dwelling units, and subdivisions having fewer than four lots.

The development projects listed in Appendix A are organized by District, entitlements, then alphabetically. Entitlements are defined as follows:

— Committed projects include (1) those having 201G approval, (2) those having Project District zoning, (3) Department of Hawaiian Home Lands (DHHL) projects, (4) approved agricultural subdivisions, and (5) other projects for which the land is zoned for development.

— Designated projects include those having (1) urban Community Plan designation, and (2) Project District zoning but no Phase 2 approval.

— Proposed projects include those lacking urban Community Plan designations.

To the extent that information was provided and is relevant, the information on each project listed in Appendix A includes:

— its entitlements;

— the number of homes (single-family and multi-family homes), the number of visitor units (hotel rooms and time-share units), and the total number of units;

— its total area (if provided and needed only for projects that involve agricultural land), along with the average acreage per unit (i.e., the reciprocal of the density, which applies only to projects that have residential or visitor units); and

— the acreage that is within the State Agricultural District, along with an acreage adjustment, explained below.

If all of the committed, designated and proposed residential and resort projects on Maui Island were approved, built and sold, they would supply about 45,740 homes, including about 30,250 single-family homes and 15,490 multi-family homes (see p. A-5).

Economic projections prepared by the Maui County Planning Department (June 2006) for the Maui County General Plan 2030 forecast that the number of homes on Maui Island will increase from about 49,870 in 2005 to about 84,350 in 2030, resulting in an increase of about 34,480 homes over this 25-year period. Over time, the pace of development is expected to follow a linear trend, fluctuating above and below the average of about 1,380 new homes per year (34,480 homes ÷ 25 years). At the projected demand of about 1,380 new homes per year, the potential supply of homes listed in Appendix A could be absorbed in about 33 years (a total of 45,740 homes ÷ 1,380 homes per year).

As can be seen on p. A-5, the projects listed in Appendix A would affect about 19,900 acres on Maui Island that are now in the State Agricultural District. Although this accounting includes some agricultural subdivisions where most of the land will be lost to homes, it also includes other agricultural subdivisions where most of the land will remain available for agriculture. In practice, an estimated 11,800 acres in the State Agricultural District would be lost to agriculture if all of these projects were approved and built. This estimate is based on the assumption that agricultural subdivisions having at least 2.5 acres per home will remain available for agriculture.

The estimated 11,800 acres of agricultural land includes prime agricultural land, low-quality land that is suitable for grazing but not farming, and gulch land. It represents less than 5% of the 244,600 acres on Maui Island that are in the State Agricultural District.

In summary, the eventual development over a period of about 33 years of all the committed, designated and proposed projects listed in Appendix A, including the loss of 210 acres for the Pu'unani Subdivision, would leave about 232,800 acres on Maui Island available for agricultural use (244,600 acres - 11,800 acres).

e. Cumulative Impact on the Growth of Diversified Crop Farming

Including the wastewater treatment plant, the Project will commit 262 acres of agricultural land to a non-agricultural use. If this land were used to grow a typical vegetable or fruit crop, then it could support about 33 farm jobs (based on about 12.5 jobs per 100 acres).

More realistically, development on this agricultural land—combined with other developments in Hawai'i and on Maui Island—involves the loss of too little agricultural land to significantly affect (1) the availability of land to farmers in Hawai'i, (2) agricultural land rents, (3) the growth of diversified crops, or (4) potential agricultural employment. This conclusion is based on the finding that, as a result of the contraction of plantation agriculture, ample land is available for diversified crops, with the available supply far exceeding likely or potential demand.

However, in Central Maui, the Project might adversely affect the growth of diversified agriculture somewhat since the market for agricultural land is tighter there than it is in most other areas of the state.

f. Mitigating Measures

In view of the small impact of the Project on the growth of diversified agriculture, mitigation measures for the lost agricultural land are not recommended.

11. OFFSETTING BENEFITS

a. Non-agricultural Benefits

The loss of 262 acres of agricultural land will be offset by the following benefits of the Project:

- 949 homes for Maui residents including senior care housing and affordable housing, along with a community center, parks, open space, and supporting infrastructure;
- construction jobs and other jobs provided by the development activity;
- at full development of the Project, jobs generated by residents of the Project who purchase goods and services on Maui;
- tax revenues (excise taxes, personal income taxes, corporate income taxes, property taxes, etc.) generated by development activity; and
- tax revenues generated by the families who occupy homes in the Project.

b. Agricultural Benefits

<u>Preservation of Prime Agricultural Land Supplied with Water</u>

In addition to the above, the Project will provide agricultural benefits—namely, it will preserve the 85-acre wastewater disposal area for future agricultural use. This is high-quality agricultural land consisting of soil type PtA, and rated IIe under the NRCS system, Prime under the ALISH system, and A under the LSB ratings (see Subsections 4.a and 4.b). Furthermore, about 600,000 gallons of water per day will be available for irrigating crops or pasture land (see Section 3). This volume is sufficient to irrigate about 150 acres at 4,000 gallons per acre per day. Furthermore, the water will be treated to the R-1 standard, which allows any method of irrigation of any crop. As mentioned in Subsection 9.b., agricultural uses that would be compatible with the Project would include orchard crops and cattle grazing. An irrigated pasture would allow a high-carrying capacity for grazing.

<u>Support for Affiliated Agricultural Operations</u>

The Project developer is affiliated with other Hawai'i companies that are engaged directly or indirectly in farming, including the following:

- Maui Tropical Plantation (MTP), which is a 60-acre commercial agricultural park that introduces various Hawaiian crops to visitors.
- Coffees of Hawai'i which restarted a 300-acre coffee plantation on Moloka'i in 2006, and which will be planting in 2007 a new 150-acre coffee farm on Maui *mauka* of MTP. The Moloka'i operation provides about 15 to 20 jobs during the off season, increasing to about 30 jobs during harvest. The Maui operation is expected to start with about 15 to 20 jobs.
- The owner of about 1,300 acres of agricultural land that is leased to HC&S for cultivating sugarcane. The fields are located *mauka* of Honoapi'ilani Highway and south of Waikapu.

Many agricultural operations in Hawai'i are marginally profitable, including MTP and probably most coffee farms. As such, the association of MTP and Coffees of Hawai'i with the Project may contribute to their economic health by having profits from development (1) cover losses from farming during lean years, and (2) contribute capital to improve or further expand the farms. For many major landowners in Hawai'i, this relationship between one or more development projects and affiliated agricultural operations has been evident since at least the 1960s.

12. CONSISTENCY WITH STATE AND COUNTY POLICIES[34]

a. Availability of Lands for Agriculture

The *Hawai'i State Constitution*, the *Hawai'i State Plan*, the *State Agriculture Functional Plan*, the *County of Maui General Plan 1990*, and the County's *Kihei-Makena Community Plan* call directly or implicitly for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture. To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to plantation agriculture, the Project site is no longer part of a sugarcane or pineapple plantation.

With regard to diversified agriculture, the Project will reduce the availability of agricultural land by a relatively small amount. However, the Project will not limit the statewide growth of diversified agriculture since ample agricultural land is available. This is due to the enormous supply of agricultural land that is now available due to the contraction of plantation agriculture (see Figure 10). However, the growth of diversified agriculture in Central Maui might be limited due to the tighter agricultural land market there.

b. Conservation of Agricultural Lands

In addition to the above, State and County policies call for conserving and protecting prime agricultural lands, including protecting agricultural lands from urban development.

However, these policies—which for the State were written before the major contraction of plantation agriculture in the 1990s—assume implicitly that profitable agricultural activities eventually will be available to utilize all available agricultural lands. This has proven to be a questionable assumption in view of the enormity of the contraction of plantation agriculture, the abundant supply of land that came available for diversified agriculture, and the slow growth in the amount of land being utilized for diversified agriculture (see Section 10 and Figure 10).

Furthermore, discussions in the Agriculture portion of the *State Functional Plan* recognize that redesignation of lands from Agricultural to Urban should be allowed "... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in ...agriculture;" that is, when an "overriding public interest exists." The enormous contraction in plantation agriculture, resulting in the supply of agricultural land far exceeding demand, constitutes a major change in economic conditions. Moreover, development of the Project will provide community and agricultural benefits (about 949 homes, construction jobs, jobs generated by the purchase of goods and services by Project residents, tax revenues, preservation of 85 acres of prime agricultural land supplied with an ample volume of high-quality agricultural water, and occasional financial support for affiliated agricultural operations) that far exceed those provided by agriculture (less than one job with the current grazing operation).

In practice, development of the Project site is expected to have no significant adverse impact on existing or potential agricultural employment. However, it could contribute new agricultural jobs on the nearby 85 acres that will be preserved, and could contribute to preserving or increasing employment for the affiliated agricultural operations.

c. State Districting

The Project site is within State Agricultural District (see Figure 4). However, Ma'alaea Properties is filing a petition with the State Land Use Commission for a District Boundary Amendment to redesignate the Project site to the "Urban" District.

d. County of Maui General Plan

County of Maui zoning for the project site is "Agricultural." However, Ma'alaea Properties plans to file a petition with the County for a change in zoning to conform to the *Kihei-Makena Community Plan.*

e. Kihei-Makena Community Plan

The Project is consistent with the *Kihei-Makena Community Plan* (Figure 5) which designates the site "Project District 12," thereby allowing for a residential community at Ma'alaea Mauka.

13. REFERENCES

[1] Munekiyo & Hiraga, Inc. "Environmental Impact Statement Preparation Notice, Proposed Ma'alaea Mauka Residential Subdivision." Wailuku, Hawai'i. March 2006.

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[33] Appendix A. Maui Island Development Projects: April 2006.

[34] Appendix B. "Selected State and County Goals, Objectives, Policies and Guidelines Related to Agricultural Lands."

FIGURES

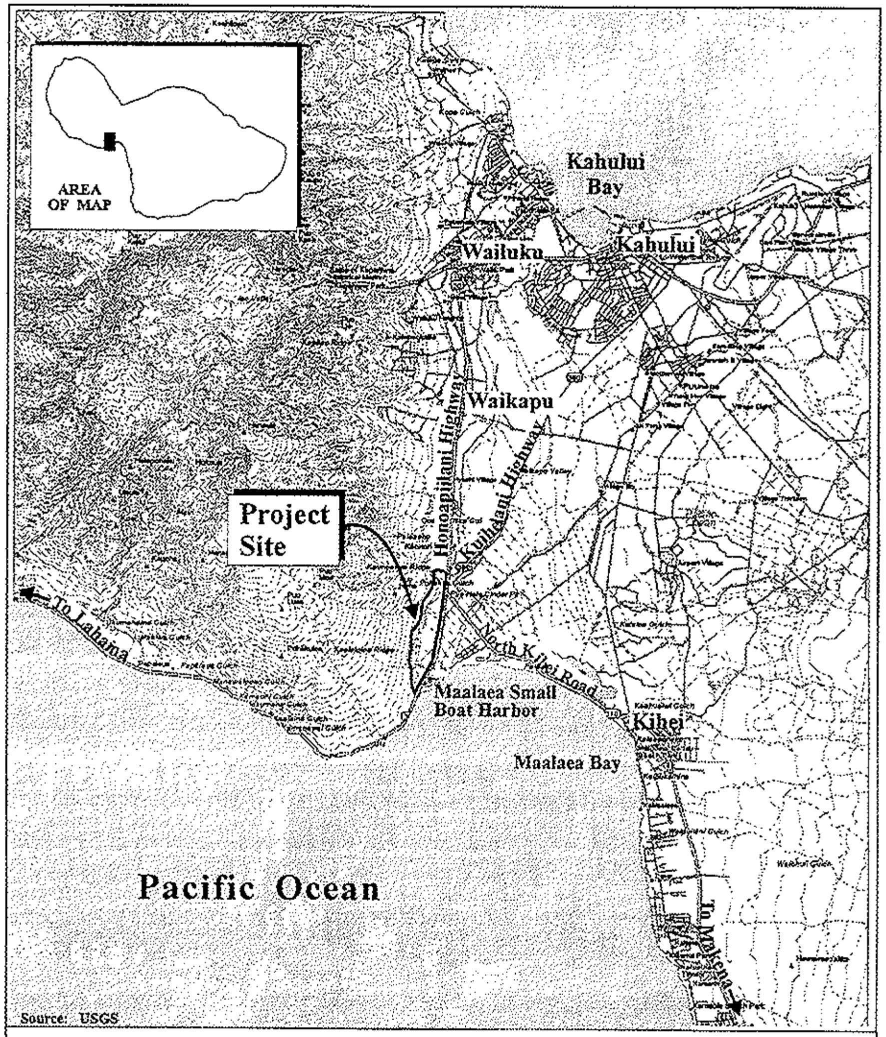


Figure 1 Proposed Ma`alaea Mauka Residential Subdivision Regional Location Map NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

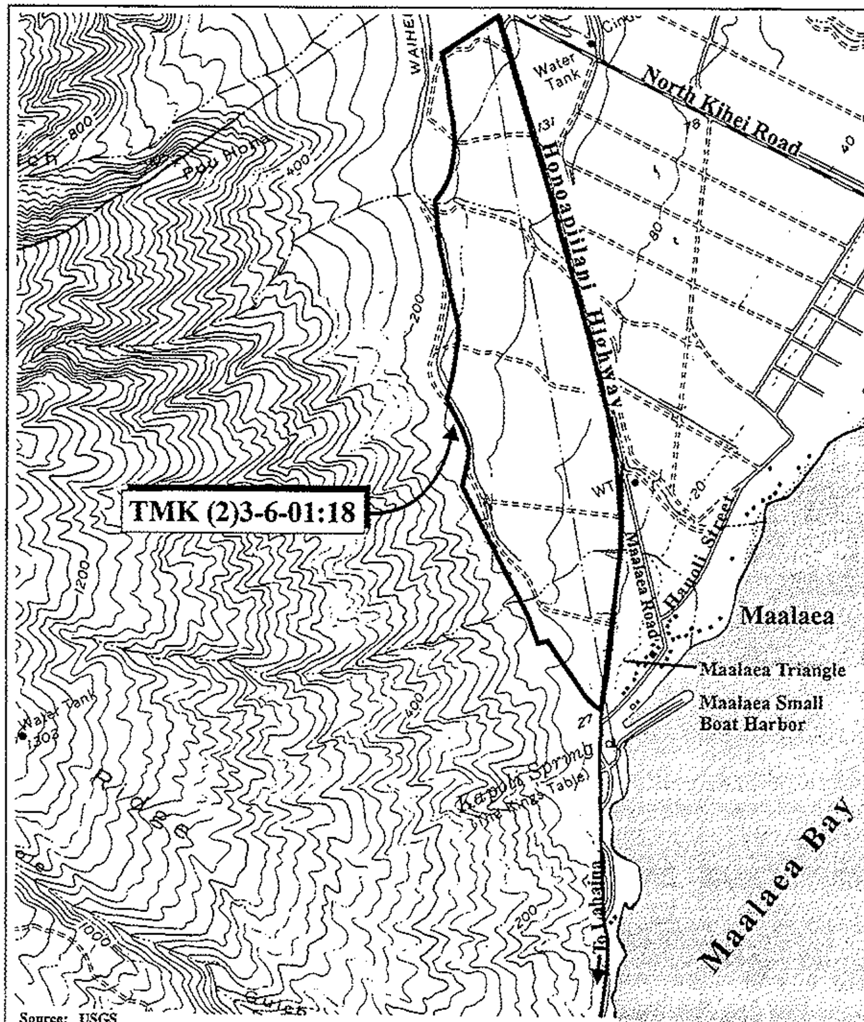
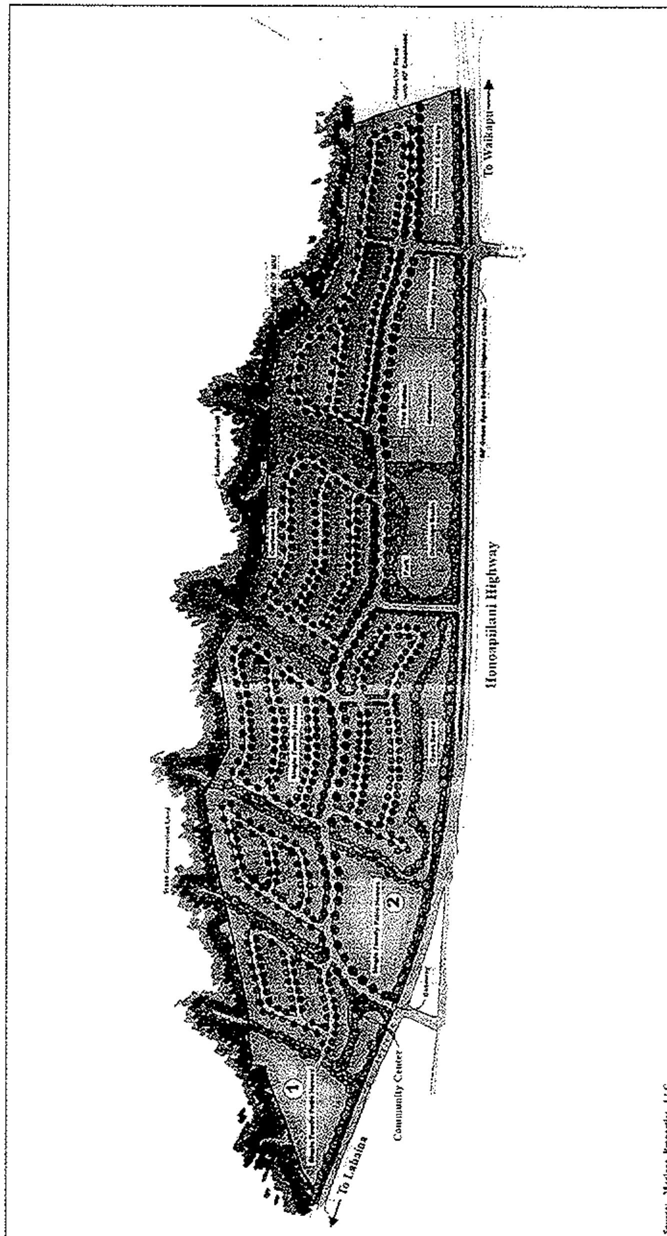


Figure 2 Proposed Ma`alaea Mauka Residential Subdivision Site Location Map NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.



Source: Maalaea Properties, LLC

Figure 3

Proposed Ma`alaea Mauka Residential Subdivision
Preliminary Subdivision Plan

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

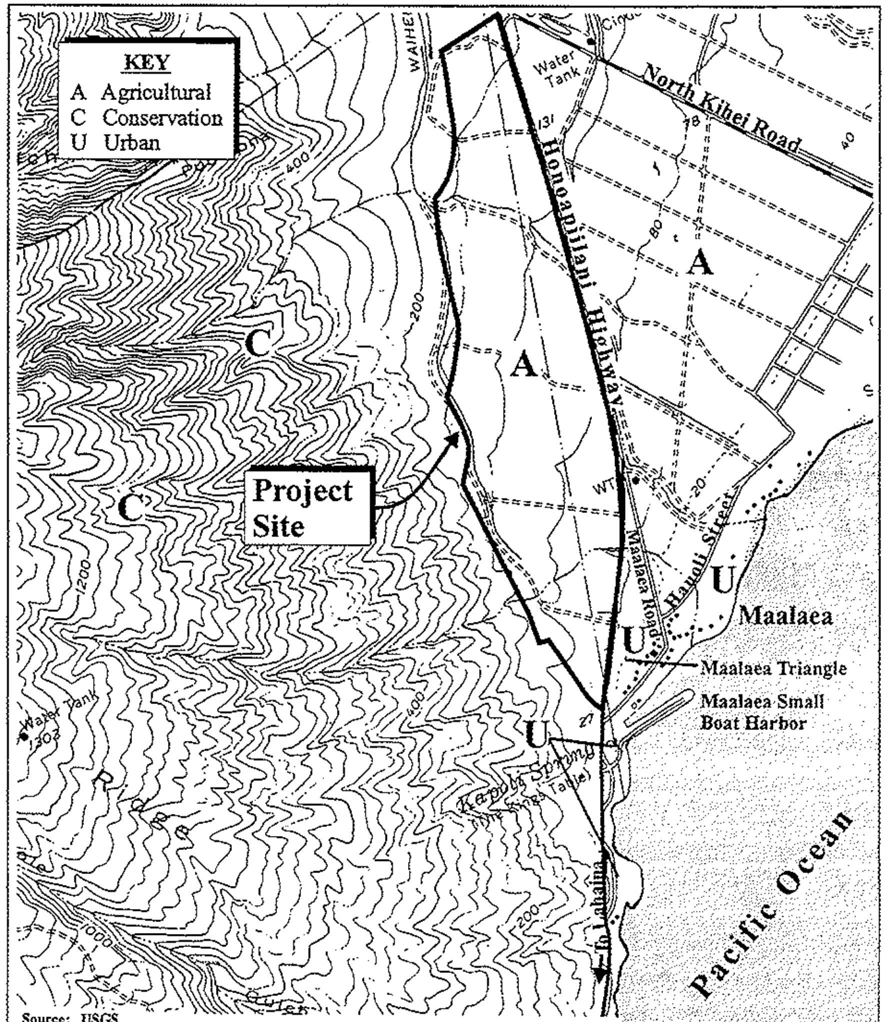


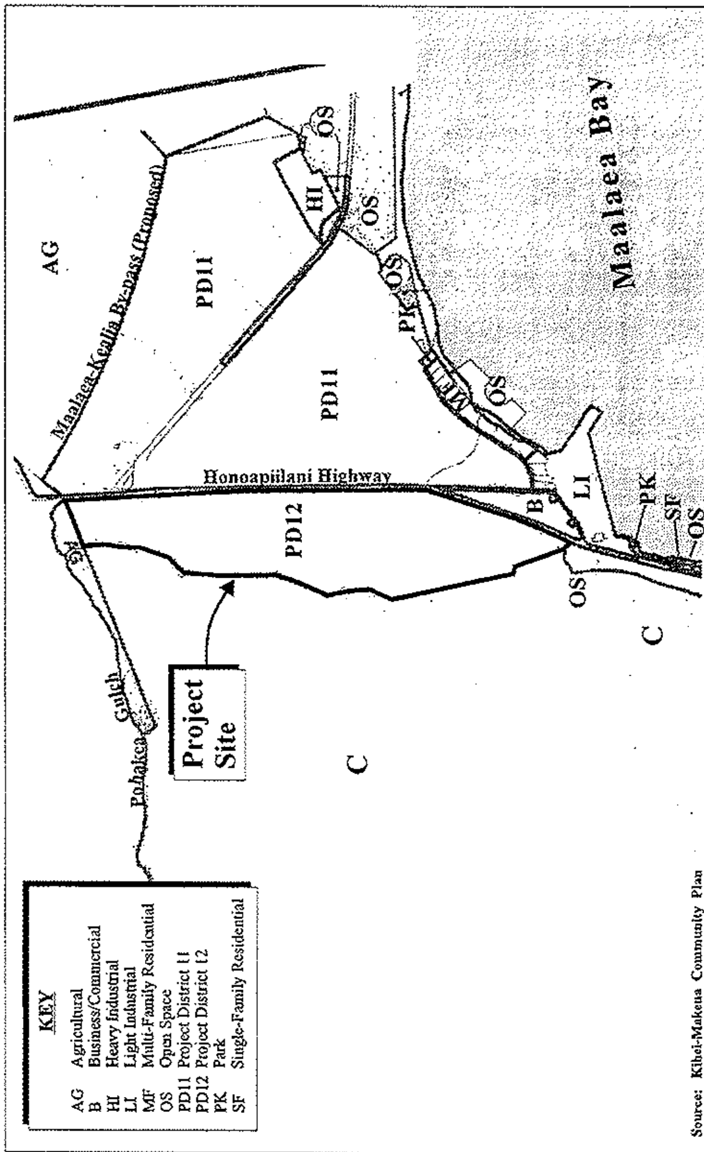
Figure 4

Proposed Ma`alaea Mauka
Residential Subdivision
State Land Use Classification

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.



Source: Kihei-Makena Community Plan

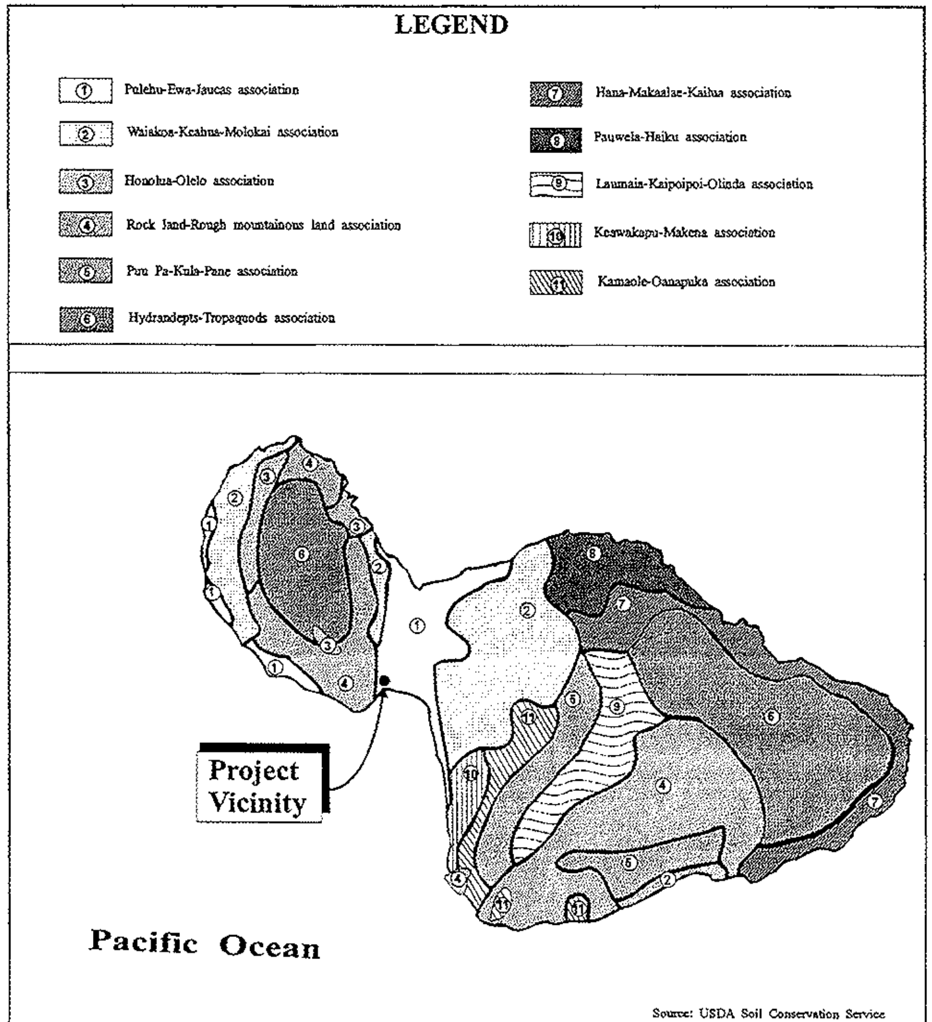
Figure 5

Proposed Ma`alaea Mauka Residential Subdivision
Kihei-Makena Community Plan Land Use Designations

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.



Source: USDA Soil Conservation Service

Figure 6

Proposed Ma`alaea Mauka
Residential Subdivision
Soil Association Map

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

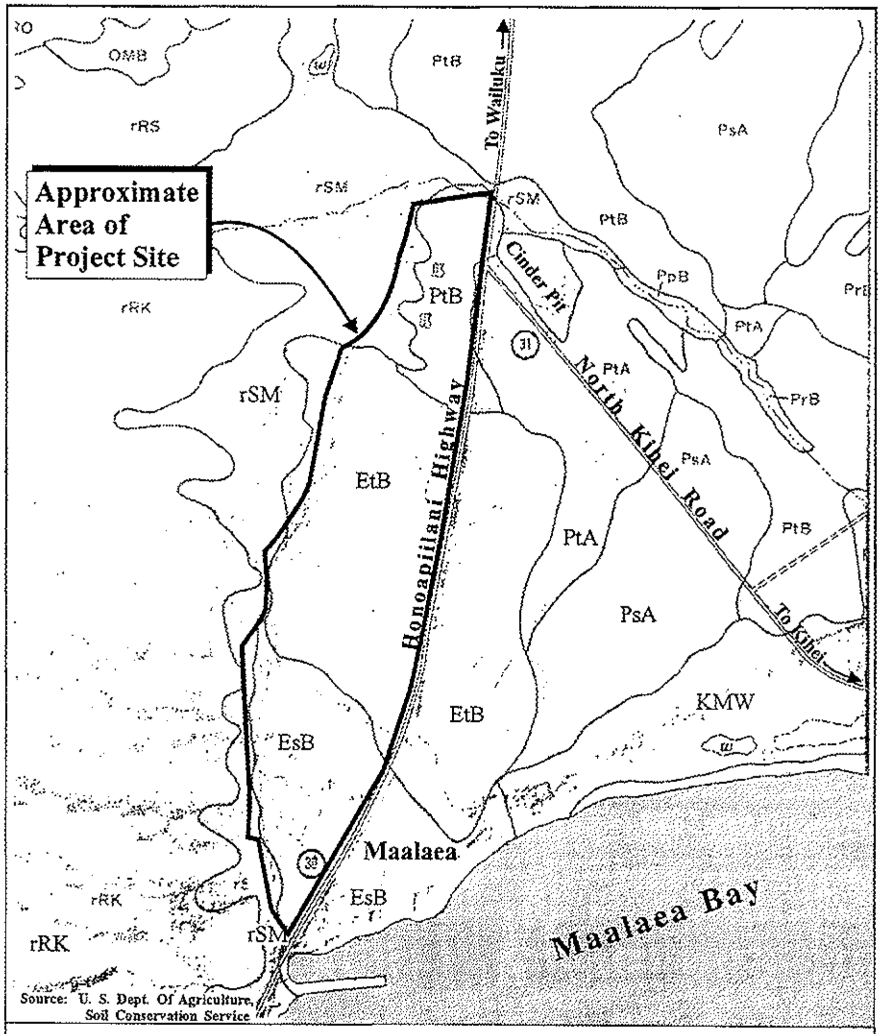


Figure 7 Proposed Ma`alaea Mauka Residential Subdivision Soil Classification Map

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

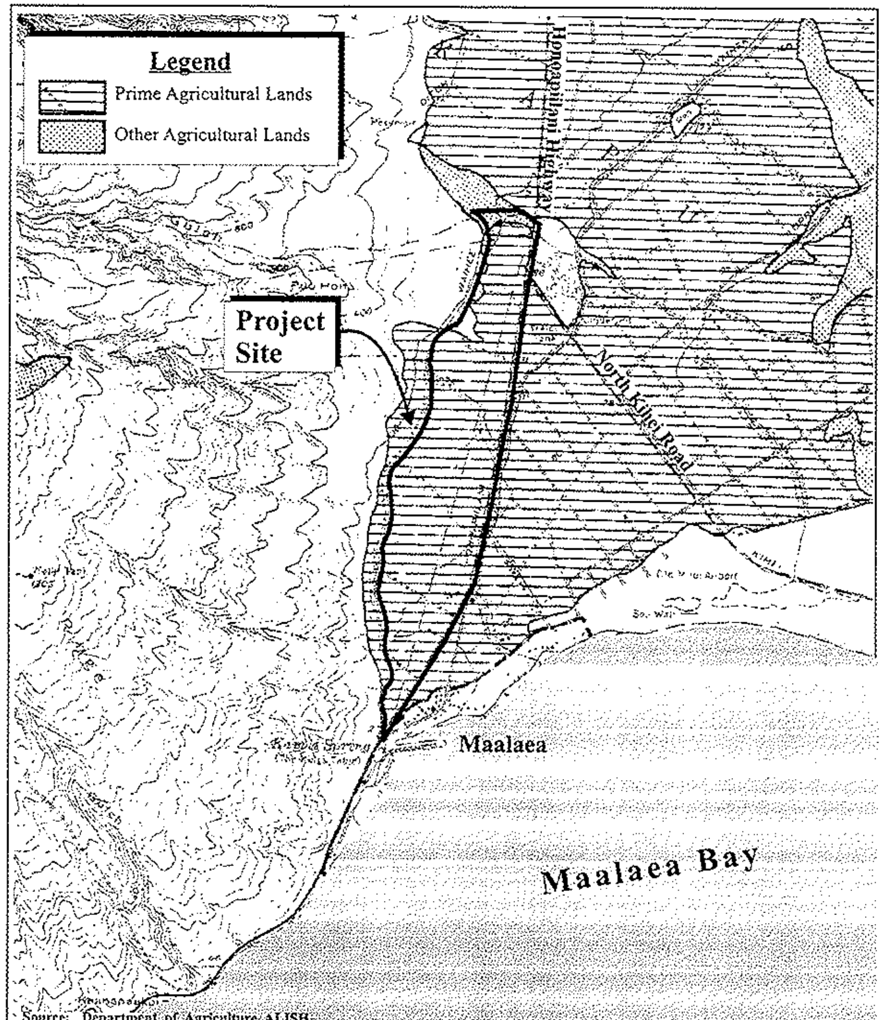


Figure 8 Proposed Ma`alaea Mauka Residential Subdivision Agricultural Lands of Importance to the State of Hawaii

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

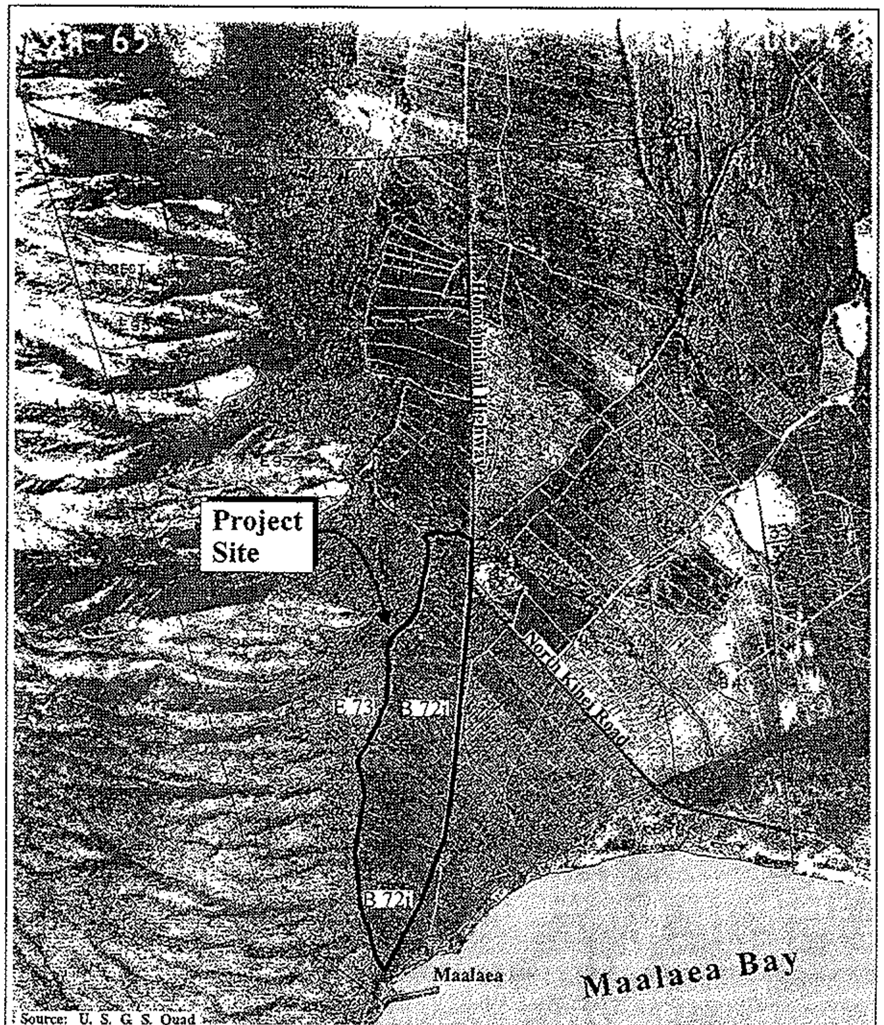


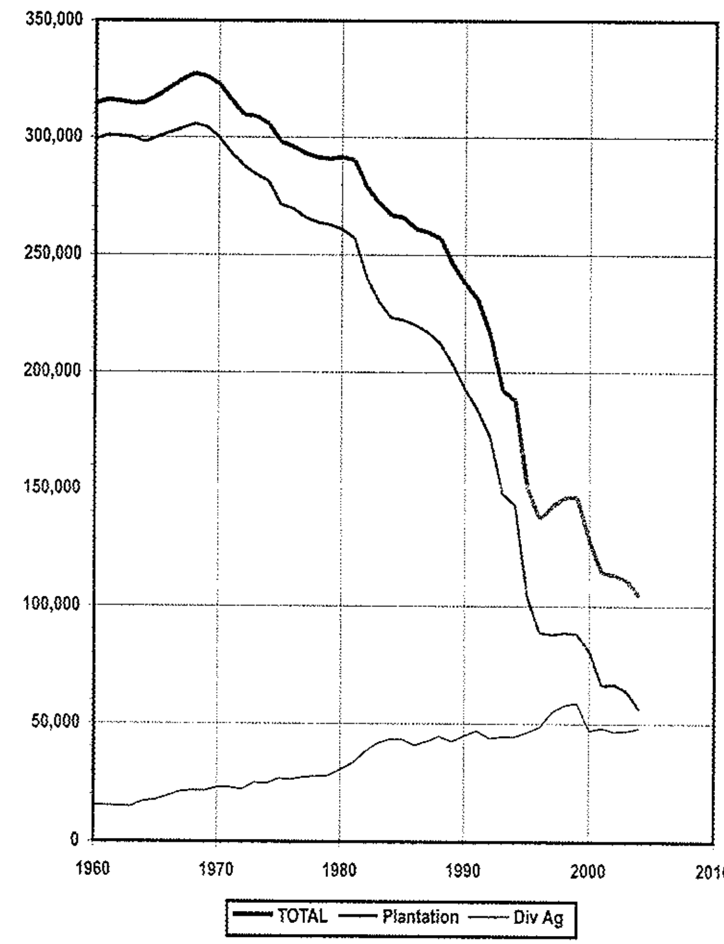
Figure 9 Proposed Ma`alaea Mauka Residential Subdivision Detailed Land Classification

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

Figure 10 - Statewide Acreage in Crop: 1960 to 2004



APPENDICES

Appendix A. Maui Island Development Projects: April 2006

Project Location and Name	Entitlements	Homes or Units: Single-family Homes	Multi-family Homes	Hotel & Time-share Units	Total	Project Area: Total Project (acres)	Acres per Unit	State Ag District: Total (acres)	Adjusted (acres)
West Maui									
Honokowai DHHL	Committed	1,250			1,250	780	0.62	780	780
Honolua Ridge: Ph. 1&2	Committed	50			50	441	8.82	439	
Intrawest Honua Kai (North Beach Lot 4)	Committed		700		700	n.e.	n.e.	-	
Ka'anapali Coffee Farms	Committed	58			58	336	5.79	336	
Kaanapali Residences - Landtech: Parcel 10-H	Committed	18			18	n.e.	n.e.	-	
Kahana Ridge Villas	Committed		117		117	n.e.	n.e.	-	
Kapalua Bay	Committed			155	155	n.e.	n.e.	-	
Kapalua Mauka: Master Plan; PD 2	Committed	690			690	1,085	1.57	1,085	1,085
Kapalua: _Master Plan; PD 1	Committed	900		1,050	1,950	249	0.13	-	
Kapalua_Mauka Residential	Committed	690			690	n.e.	n.e.	-	
Kapua Village: ML&P employees	Committed	45			45	n.e.	n.e.	-	
Laipoa Point Homesites	Committed	40			40	n.e.	n.e.	-	
Launiupoko: Mahanalua Nui: 1	Committed	131			131	438	3.34	438	
Lokahi Kuhua	Committed	12			12	n.e.	n.e.	-	
Mahanalua Nui: Ph. 5	Committed	9			9	n.e.	n.e	-	
Makila Plantation: Ph. 1 & 2	Committed	52			52	465	8.94	465	
Makila Ridge: Large Lots	Committed	11			11	458	41.64	458	
Marriott Maui Ocean Club: Sequel Towers	Committed			148	148	n.e.	n.e.	-	
Na Hale O Wainee: Ph. 2	Committed		26		26	5	0.19	5	5
Napili Kahuna (Kili Noe Subdiv)	Committed	10			10	n.e.	n.e.	-	
North Beach: Starwood (Lot 2)	Committed			516	516	n.e.	n.e.	-	
North Beach: Weston (Lot 1)	Committed			399	399	n.e.	n.e.	-	
Plantation Inn	Committed			14	14	n.e.	n.e.	-	
Pu'unoa: Ph. 1 & 2	Committed	24			24	168	7.00	168	
Royal Lahaina Resort revitalization	Committed			455	455	n.e.	n.e.	-	
Sunstone	Committed	5			5	n.e.	n.e.	-	
Ukumehame Homes: Ph. 1,2+Ohanas	Committed	46			46	280	6.09	280	
Ukumehame Park	Committed				-	111	n.a.	111	111
Villages of Leiali'i: Ph. 1A	Committed	104			104	n.e.	n.e.	-	
Villages of Leiali'i: Ph. 1B	Committed	253			253	99	0.39	-	
West Maui Breakers 1	Committed		90		90	n.e	n.e	-	
Hyatt Regency Maui: Timeshare Project	Proposed			806	806	n.e.	n.e.	-	
Ka'anapali 2020: _Residences	Proposed	1,257	1,553		2,810	2,004	0.71	1,695	1,695
Kahoma Employee Housing	Proposed	60	12		72	17	0.24	17	17
Kahoma: _Lots	Proposed	53			53	876	16.53	874	
Kamehameha Schools Ku'ia Residential Infill	Proposed	900			900	211	0.23	211	211
Lipoa Point Homes	Proposed	25			25	247	9.88	244	
Makila Farms: _Large Lots	Proposed	38			38	1,292	34.00	1,291	
Napili Mauka Residences	Proposed	10			10	n.e.	n.e.	-	
Olowalu Mauka & Makai Plan: Master	Proposed	1,500			1,500	631	0.42	609	609
Pineapple Ridge	Proposed	24			24	9	0.38	-	
Pulelehua: Maser, Proposed PD	Proposed	533	349		882	309	0.35	309	309
Villages of Leiali'i: Master	Proposed	2,006	2,840		4,846	n.e.	n.e.	-	
Wainee Villages	Proposed	401	464		865	193	0.22	184	184
Total West Maui		11,205	6,151	3,543	20,899	10,704		9,999	5,006

Project Location and Name	Entitlements	Homes or Units: Single-family Homes	Homes or Units: Multi-family Homes	Homes or Units: Hotel & Time-share Units	Homes or Units: Total	Project Area: Total Project (acres)	Project Area: Acres per Unit	State Ag District: Total (acres)	State Ag District: Adjusted (acres)
North Maui									
Kahui Pono Subdivision III	Committed	3			3	4	1.33	4	4
Krauss Subdivision	Committed	4			4	9	2.25	9	9
Maliko Bay Homes	Committed	8			8	45	5.63	45	
Maliko Ranch: _Lots	Committed	3			3	10	3.33	10	
Masaaki Doi Subdivision	Committed	3			3	36	12.00	33	
Pe'ahi Farms at Opana Point	Committed	16			16	270	16.88	270	
Pe'ahi Hui Lands	Committed	3			3	1	0.33	1	1
Puu o Malei Rural Subdivision	Committed	3			3	n.e.	n.e.	-	
Ross Subdivision	Committed	5			5	11	2.20	11	11
Wagner Subdivision	Committed	3			3	5	1.67	5	5
Paia School Community: Project District 1	Designated	330			330	n.e.	n.e.	-	
Kuau Residential A&S	Proposed	140			140	67	0.48	-	
Total North Maui		521	-	-	521	458		388	30
Central Maui									
Central Maui Landfill, Phase IV	Committed				-	29	n.a.	29	29
Consolidated Baseyards	Committed				-	21	n.a.	21	21
E Paepae Ka Pukoa: Spreckelsville	Committed	16			16	45	2.81	-	
Hale Kapili Project	Committed		4		4	n.e.	n.e.	-	
Iao Valley Large Lot Subdivision	Committed	7			7	n.e.	n.e.	-	
Kahalui Town Center Redevelopment	Committed		302		302	n.e.	n.e.	-	
Kane Street Condos and Shops	Committed		90		90	n.e.	n.e	-	
Kehalani Master Plan Project District 3	Committed	1,403	829		2,232	n.e	n.e.	-	
Lokenani Hale, Sr. Affordable Housing	Committed		62		62	n.e.	n.e.	-	
Malaihi Ag Subdivision	Committed	10			10	72	7.20	69	
Malaihi Mauka Ag Subdivision	Committed	2			2	n.e.	n.e.	-	
Marriott Courtyard Hotel, Kahalua Airport	Committed			140	140	n.e.	n.e.	-	
Maui Lani: Master Plan PD 1	Committed	3,163	502		3,665	1,085	0.30	76	76
Maui Student Housing	Committed		400		400	n.e.	n.e.	-	
Pīihana: _Project District 2	Committed	95	440		535	73	0.14	5	5
Waiehu Aina	Committed	17			17	279	16.41	261	
Waiehu Kou, Phase 3	Committed	115			115	42	0.37	20	20
Waihee Mauka Ag Subdivision	Committed	16			16	113	7.06	113	
Waihee Valley Large Lot Subdivision	Committed	24			24	373	15.54	373	
Waikapu Gardens	Committed	410			410	95	0.23	95	95
Waiko Mauka Ag Subdivision	Committed	2			2	22	11.00	22	
Wailuku Country Estates	Committed	184			184	452	2.46	449	449
Waiolani: Elua	Committed	37			37	n.e.	n.e.	-	
Waiolani: Mauka	Committed	104			104	n.e.	n.e.	-	
Winn 4lot	Committed	4			4	152	38.00	152	
Waiehu Kou, Phase 4	Committed	96			96	n.e.	n.e.	-	
Waiolani : Pikaki	Committed	38			38	n.e.	n.e.	-	
Hale Hoomanu_Mental Health Kokua	Designated		6		6	n.e.	n.e.	-	
Hale Mua	Designated	466			466	234	0.50	227	227

Appendix A. Maui Island Development Projects: April 2006

Project Location and Name	Entitlements	Homes or Units: Single-family Homes	Homes or Units: Multi-family Homes	Homes or Units: Hotel & Time-share Units	Homes or Units: Total	Project Area: Total Project (acres)	Project Area: Acres per Unit	State Ag District: Total (acres)	State Ag District: Adjusted (acres)
Maui Business Park Phase II	Designated				-	245	n.a.	232	232
Maui Expo Systems (Eko Systems)	Designated				-	58	n.a.	58	58
Meo B.E.S.T. House	Designated		12		12	n.e.	n.e.	-	
Betsill Bros. Mixed Use	Proposed		5		5	n.e.	n.e.	-	
Central Maui Senior Housing	Proposed		40		40	n.e.	n.e.	-	
Free Church of Tonga	Proposed				-	9	n.a.	9	9
Kikuchi Residential at Wai`ale	Proposed	500			500	154	0.31	154	154
Na Mala O Waihee Homes	Proposed	35			35	11	0.31	11	11
Pu`unani	Proposed	310	240		550	210	0.38	210	210
Spreckelsville Mauka A&B	Proposed	380			380	228	0.60	228	228
Wai`ale	Proposed	1,065	2,715		3,780	847	0.22	846	846
Waikapu Mauka Towne	Proposed	190	190		380	n.e.	n.e.	-	
Total Central Maui		8,689	5,837	140	14,666	4,849		3,660	2,670
South Maui									
Alii Village Subdiv.	Committed	27			27	n.e.	n.e.	-	
Aloha Village	Committed		78		78	n.e.	n.e.	-	
Ameron Hawaii	Committed				-	2	n.a.	2	2
Central Maui Baseyard	Committed				-	451	n.a.	-	
Chambers Apartments	Committed		18		18	n.e.	n.e.	-	
Club World Mark Kihei	Committed			200	200	n.e.	n.e.	-	
Cove Beach Villas	Committed		32		32	n.e.	n.e.	-	
Hale Mahaolu Ehiku 1, Phase 1	Committed		54		54	n.e.	n.e	-	
Hale Mahaolu Ehiku 2, Phase 2	Committed		58		58	n.e	n.e	-	
Hokulani Golf Villas	Committed	182	58		240	n.e.	n.e	-	
Honu Ala Hele	Committed	62			62	n.e.	n.e.	-	
Hoohani Subdivision	Committed	28			28	n.e.	n.e	-	
Hoolei Wailea MF-9	Committed		120		120	n.e.	n.e.	-	
Iliili Condos	Committed		4		4	n.e.	n.e.	-	
Kai Ani Village MF Residential Project	Committed		99		99	n.e.	n.e.	-	
Kai Makani	Committed		112		112	n.e.	n.e.	-	
Kai Malu Wailea Master	Committed		150		150	n.e.	n.e.	-	
Kalama Heights: Phase 2	Committed		80		80	n.e.	n.e.	-	
Kalama Hills	Committed	12			12	n.e.	n.e.	-	
Kamalii Alayna Estates (Waipuilani Estates)	Committed	92			92	n.e.	n.e.	-	
Kanani Wailea	Committed	38			38	n.e.	n.e.	-	
Ke Alii Homes	Committed	96			96	n.e.	n.e.	-	
Ke Alii Ocean Villas	Committed	14	144		158	n.e.	n.e.	-	
Kenolio Leilani Sub	Committed	7			7	n.e.	n.e.	-	
Kenolio Place	Committed	12			12	n.e.	n.e.	-	
Kihei Hanalei Condominiums	Committed		4		4	n.e.	n.e.	-	
Kihei Kauhale	Committed	26			26	n.e.	n.e.	-	
Kiohana: Hema	Committed	31			31	n.e.	n.e.	-	
Landry Apts.	Committed		18		18	n.e.	n.e.	-	
Liloa Village Subdivision	Committed	65			65	n.e.	n.e.	-	

Project Location and Name	Entitlements	Homes or Units				Project Area		State Ag District	
		Single-family Homes	Multi-family Homes	Hotel & Time-share Units	Total	Total Project (acres)	Acres per Unit	Total (acres)	Adjusted (acres)
Maluhia at Wailea: Condos	Committed		15		15	n.e.	n.e.	-	
Maui Lu Timeshare	Committed		388	400	788	n.e.	n.e.	-	
Maui Research & Tech Park: _Project District 6	Committed				-	387	n.a.	234	234
MF21 Subdivision: _PD 8	Committed	7			7	22	3.14	22	
Moana Estates	Committed	90			90	n.e.	n.e.	-	
One Palauea Bay: PD 8	Committed	17			17	n.e.	n.e.	-	
One Wailea Dev	Committed	20			20	n.e.	n.e.	-	
Osterstock Subidivision: 7 lot	Committed	7			7	n.e.	n.e.	-	
Papaanui Lots	Committed	16			16	5	0.31	3	3
Papaanui Subdivision	Committed	8			8	n.e.	n.e.	-	
Paradise Ridge Estates	Committed		32		32	n.e.	n.e.	-	
Wailea Beach Villas	Committed		105		105	n.e.	n.e.	-	
Wailea MF-10	Committed		144		144	n.e.	n.e.	-	
Wailea MF-10 Subdivision	Committed		9		9	n.e.	n.e.	-	
Wailea MF-11	Committed	12			12	n.e.	n.e.	-	
Wailea Villas (MF-4) (Papali)	Committed	25			25	n.e.	n.e.	-	
Garcia Makena Residences	Designated	10			10	5	0.50	5	5
Hale Pama Condos	Designated		6		6	n.e.	n.e.	-	
Kilohana: Mauka	Designated	73			73	n.e.	n.e.	-	
Kilohana: Waena	Designated	31			31	n.e.	n.e.	-	
Ma'alaea Mauka Residential: _Project District 12	Designated	499	450		949	257	0.27	262	262
Ma'alaea Village A&B: _Project District 11	Designated	2,000			2,000	808	0.40	765	765
Pu'unene Airstrip: _Project District 10	Designated				-	558	n.a.	558	558
Wailea 670 ('Honua`ula) _Project District 9	Designated	1,400			1,400	584	0.42	584	584
Ka Ono Ulu: _Industrial Park	Proposed				-	96	n.a.	96	96
Kalani Condos Makena	Proposed		4		4	1	0.25	1	1
Kamaole Heights	Proposed		98	24	122	n.e.	n.e.	-	
Kihei Kaiwahine Res. A&B	Proposed	600			600	114	0.19	114	114
Makena Resort: Hotel & Condos	Proposed		1,105	545	1,650	716	0.44	31	31
Total South Maui		5,507	3,385	1,169	10,061	4,008		2,677	2,655
Upcountry Maui									
A.L. & P. Philips Subdivision	Committed	3			3	11	3.67	11	
Abner Delima Subdivision	Committed	3			3	6	2.00	6	6
Bayong Subdivision	Committed	3			3	8	2.67	8	
Blackburn Subdivision	Committed	5			5	n.e.	n.e.	-	
Cameron Kaluanui Subdivision	Committed	3			3	n.e.	n.e.	-	
DeRego Subdivision	Committed	7			7	59	8.43	59	
Erehwon Estates Subdivision	Committed	7			7	40	5.71	40	
Freitas Subdivision	Committed	4			4	3	0.75	-	
Haleakala Homesteads 1 & 2	Committed	15			15	81	5.40	87	
Hali'imaile: _Residential	Committed	148			148	69	0.47	8	8
Jacaranda Hill	Committed	3			3	2	0.67	2	2
Joan Feiteira Subdivision	Committed	3			3	24	8.00	24	
Kealahou 1 & 2 Homesteads	Committed	7			7	16	2.29	7	7

Project Location and Name	Entitlements	Homes or Units				Project Area		State Ag District	
		Single-family Homes	Multi-family Homes	Hotel & Time-share Units	Total	Total Project (acres)	Acres per Unit	Total (acres)	Adjusted (acres)
Keokea/Waiohuli Subdivision DHHL	Committed	406			406	445	1.10	445	445
Kulamalu: Mauka Res	Committed	14			14	n.e.	n.e.	-	
Kulamanu Estates: Phase 1	Committed	40			40	n.e.	n.e.	-	
Kulamanu Estates: Phase 2, Jacaranda Grove	Committed	13			13	n.e.	n.e.	-	
Kulumanu Ridge: Ridge at Kulumanu	Committed	57			57	n.e.	n.e.	-	
Maha Village Subdivision	Committed	24			24	n.e.	n.e.	-	
Mary Decambra Subdivision	Committed	3			3	n.e.	n.e.	-	
MauWikoli Subdivision	Committed	3			3	7	2.33	7	7
Piiholo Farms Subd.	Committed	10			10	23	2.30	23	23
Stice Subdivision	Committed	3			3	n.e.	n.e.	-	
Waiohuli Hikina Subdivision (Kula Res 1,2) DHHL	Committed	36			36	261	7.25	261	
Waiohuli Lot 134 (Kula Res 1,2) DHHL	Committed	4			4	200	50.00	200	
Waiohuli Uka Subdivision (Kula Res 1,2) DHHL	Committed	56			56	192	3.43	192	
Wilfred "Hoopai" Philips Subd	Committed	3			3	2	0.67	2	2
Barto Project Crook Estate: Project District 3	Designated		64		64	n.e.	n.e.	-	
Kauhale Lani: _Pukalani Makai	Designated	155			155	81	0.52	81	81
Kula Lodge: Project District 1	Designated			15	15	n.e.	n.e.	-	
Silversword Inn: Project Disitrict 2	Designated			12	12	n.e.	n.e.	-	
Hali'imaile Expansion: _A&B400	Proposed	1,200			1,200	353	0.29	351	351
Hali'imaile Expansion: _ML&P348	Proposed	1,500			1,500	441	0.29	421	421
Ka Ono Ulu Lots	Proposed	2			2	3	1.50	-	
Kualono by Hanohano	Proposed	49			49	14	0.29	14	14
Kula Ridge Affordable Housing Subdivision	Proposed	116			116	48	0.41	48	36
Kula Senior Housing	Proposed		36		36	n.e.	n.e.	-	
Total Upcountry Maui		3,905	100	27	4,032	2,389		2,297	1,403
East Maui									
Hamoa Beach Subdivision	Committed	3			3	2	0.67	1	1
Hana Com. Health Ctr. Exp.	Committed		20		20	n.e.	n.a.	-	
Hana Ranch Affordable Housing	Committed	288			288	38	0.13	38	38
Hana Ranch Store	Committed				-	39	n.a.	3	3
Hana Substation Subdivision	Committed	3			3	25	8.33	20	
Honomaele Subdivision	Committed	8			8	42	5.25	42	
Wakiu Hana Homes: DHHL	Committed	102			102	724	7.10	724	
Garden of Eden Arboretum	Proposed	3			3	30	10.00	30	
Halani Gardens 2 Self Help Housing Corp	Proposed	14			14	6	0.43	6	6
Total East Maui		421	20	-	441	906		864	48
TOTAL MAUI ISLAND		30,248	15,493	4,879	50,620	23,314		19,885	11,812

n.e.: not estimated (i.e., acreages were not estimated for projects that do not involve agricultural land)
n.a.: not applicable (i.e., units per acre were not calculated for industrial and commercial projects)
Source: Maui County Planning Department. 2006.

Appendix B:
Selected State and County Goals, Objectives, Policies and Guidelines Related to Agricultural Lands

1. **Hawai'i State Constitution** (Article XI, Section 3):

   ...to conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands...

2. **Hawai'i State Plan** (Chapter 226, Hawaii Revised Statutes, as amended):[1,2]

Section 226-7 Objectives and policies for the economy--agriculture.

(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:

- (1) Viability in Hawaii's sugar and pineapple industries.
- (2) Growth and development of diversified agriculture throughout the State.
- (3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.

(b) To achieve the agricultural objectives, it shall be the policy of the State to:

- (2) Encourage agriculture by making best use of natural resources.
- (10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.
- (16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.

Section 226-103 Economic priority guidelines.

(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:

- (1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.

(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

- (1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.
- (10) Support the continuation of land currently in use for diversified agriculture.

Section 226-104 Population growth and land resources priority guidelines.

(b) Priority guidelines for regional growth distribution and land resource utilization:

- (2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

Section 226-106 Affordable housing

Priority guidelines for the provision of affordable housing:

- (1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of low- and moderate-income and gap-group households.

3. **Agricultural State Functional Plan** (1991)[3]
(Functional plans are guidelines for implementing the State Plan. They are approved by the Governor, but not adopted by the State Legislature.)

Objective H: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.

Policy H(2): Conserve and protect important agricultural lands in accordance with the Hawaii State Constitution.

Action H(2)(a): Propose enactment of standards and criteria to identify, conserve, and protect important agricultural lands and lands in agricultural use.

Action H(2)(c): Administer land use district boundary amendments, permitted land uses, infrastructure standards, and other planning and regulatory functions on important agricultural lands and lands in agricultural use, so as to ensure the availability of agriculturally suitable lands and promote diversified agriculture.

4. County of Maui General Plan 1990[4]

Theme No. 1: PROTECT MAUI COUNTY'S AGRICULTURAL LAND AND RURAL IDENTITY

Amendments to the General Plan will preserve agricultural lands for the continuing pursuits of both land intensive and labor intensive agricultural pursuits. This action will also achieve preservation of an open space resource.

I. POPULATION, LAND USE, THE ENVIRONMENT AND CULTURAL RESOURCES

B. Land Use

Objective

3. To preserve lands that are well suited for agricultural pursuits.

Policies

a. Protect prime agricultural lands from competing nonagricultural land uses.

b. Promote the use of agricultural lands for diversified agricultural pursuits by providing public incentives and encouraging private initiative.

c. Support the right to farm consistent with the identification of productive agricultural lands.

d. Discourage the conversion, through zoning or other means, of productive or potentially productive agricultural lands to nonagricultural uses, including but not limited to golf courses and residential subdivisions.

e. Provide adequate irrigation water and access to agricultural lands.

II. ECONOMIC ACTIVITY

C. Agriculture

Objective

1. To foster growth and diversification of agriculture and aquaculture throughout Maui County.

Policies

a. Support programs to maintain the viability of the sugar and pineapple industry.

b. Support and promote programs to maintain the viability of diversified agriculture, specialty crops, forestry and aquaculture.

Objective

2. To maximize the use and yield of productive agricultural land throughout the County.

Policies

a. Ensure the availability of land that is well suited for agricultural production.

b. Encourage the development of agricultural parks throughout Maui County.

f. Support "right-to-farm" provisions in the event potential conflicts arise from adjacent residential uses.

g. Discourage establishment of pseudo-agricultural subdivisions.

5. County of Maui, Kihei-Makena Community Plan (1998)[5]

LAND USE

Objectives and Policies

p. Prevent urbanization of important agricultural lands

r. Allow special permits in the State Agricultural Districts to accommodate unusual yet reasonable uses including: (1) limited agriculturally related commercial, public and quasi-public uses serving the immediate community; (2) uses clearly accessory or subordinate to a principal agricultural use on the property; (3) public facility uses such as utility installations or landfills whose location depends on technical considerations; and (4) extractive industries, such as quarrying, where the operation would not adversely affect the environment or surrounding agricultural uses.

Economic Activity

Objectives and Policies

e. Provide for the preservation and enhancement of important agricultural lands for a variety of agricultural activities, including sugar cane, diversified agriculture and aquaculture.

Planning Standards

2. Project District Standards

PROJECT DISTRICT 12 (Ma'alaea Mauka) 260 acres

This residential project is located mauka of Honoapi'ilani Highway from Ma'alaea Harbor to near the Kuihelani Highway intersection, and should provide a mix of single family and multi-family housing types for a range of consumer groups. Community amenities should include an open-space buffer along the highway, and a 15-acre community oriented park linked to the neighborhoods with a pedestrian/bicycle path.

The number of residential units based on an average gross density of 4.4 units per acre is 1,150 units.

Residential spacial allocations are:

Residential (single family and multi-family)	218 acres
Community Center	5 acres
Park, open space, and buffer zones	27 acres
Collector roadways	10 acres

6. References

[1] State of Hawaii, Office of State Planning, Office of the Governor. *The Hawaii State Plan, 1991*. Honolulu, Hawaii. 1991.

[2] Act 25, S.B. No. 1158, April 15, 1993.

[3] Hawaii Department of Agriculture. *The Hawaii State Plan: Agriculture, State Functional Plan*. Honolulu, Hawaii. 1991.

[4] County of Maui. *The General Plan of the County of Maui, 1990 Update*. Adopted by Ordinance No. 2039, as amended by Ordinance No. 2234. April 23, 1993

[5] County of Maui. *Kihei-Makena Community Plan*. Kahului, Maui. 1998.

APPENDIX D.

Phase I Environmental Site Assessment Reports

PHASE I
ENVIRONMENTAL SITE ASSESSMENT

MAALAEA MAUKA
WAILUKU, MAUI, HAWAII
TMK: (2) 3-6-001: PARCEL 018

November 15, 2006

Prepared for:

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Prepared by:

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Job No. 060050

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EXECUTIVE SUMMARY

Element Environmental LLC (E2) conducted a Phase I Environmental Site Assessment (ESA) on approximately 259.885 acres of land designated as Tax Map Key (TMK): (2) 3-6-001 parcel 018 (the property). The property is located in West Maui between Waikapu and Maalaea along the western side of Honoapiilani Highway. The property is currently used as a pasture for cattle ranching.

The Phase I ESA was performed in accordance with the scope and limitations of the American Society of Testing and Materials Practice E 1527-05 to identify the presence of recognized environmental conditions associated with the property and included a review of environmental regulatory records in the site vicinity, a review of the site history, a review of the site geology and hydrogeology, a site reconnaissance, and interviews.

This assessment has revealed no significant evidence of recognized environmental conditions in connection with the property with the exception of fourteen (14) unmarked 55-gallon high density polyethylene (HDPE) drums located along the dirt road bordering the southwestern end of the property. Twelve (12) of the drums were partially full with an unknown liquid at the time of the field inspection. Two of the drums were damaged and empty indicating a potential release. In an interview with Mr. Alex Franco, Manager of Maui Cattle Company, Mr. Franco noted that the drums were present prior to their use of the property over a year ago. Mr. Franco believes that the drums may have been left by one of the farmers that were previously utilizing the property. In a follow-up request for additional information, Mr. Chumbley of Wailuku Agribusiness, indicated that the drums must have been left by a former licensee. As of the date of this report, Mr. Chumbley is planning to have the drums removed by November 17, 2006.

E2 recommends that the contents of the drums be determined and that drums and contents be properly disposed and/or recycled in accordance with all Federal, State and local regulations. Upon removal of the drums, the soil and vegetation beneath the drums should be inspected for indications of a release by an environmental professional. If a significant release is suspected, appropriate sampling and cleanup should be conducted.

E2 has also identified that the property has been historically used for sugarcane cultivation. In an interview, Mr. Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. Therefore, residual levels of pesticides and herbicides are probably present on the property. Although proper applications of pesticides and herbicides does not constitute a release of hazardous chemicals, E2 recommends that limited composite soil sampling be conducted on the property should the intended land use of the property change from agricultural to residential. The purpose of the limited sampling would be to determine if residual levels of pesticides/herbicides are present in site soils. The sample analyses selected should be based on the list of potential pesticides and herbicides that may have been applied to the property as provided by Mr. Chumbley.

PHASE I ENVIRONMENTAL SITE ASSESSMENT

Maalaea Mauka
Wailuku, Maui, Hawaii
TMK: (2) 3-6-001: Parcel 018

November 15, 2006

1.0 INTRODUCTION

1.1 OVERVIEW

This report presents the results of Element Environmental LLC's (E2's) Phase I Environmental Site Assessment (ESA) of the subject property. The general location of the property is shown on Figure 1 (Site Vicinity Map) in Appendix A.

This report details the work performed to identify the presence of recognized environmental conditions associated with this property. Throughout this ESA the property of interest is referred to as *the subject property, the property, the site, or the facility.*

1.2 PURPOSE

E2 conducted this Phase I ESA to identify recognized environmental conditions associated with the property. American Society for Testing and Materials (ASTM) guidance defines *recognized environmental conditions* as the "presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property" (ASTM, 2005). Recognized environmental conditions do not include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies (ASTM, 2005).

This Phase I ESA constitutes all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice and is intended to permit the Phase I ESA user to satisfy one of the requirements to qualify for the innocent landowner, contiguous property owner, or bona fide prospective purchaser limitations on Comprehensive Environmental Response Compensation and Liability Act (CERCLA) liability, hereinafter, the "landowner liability protections" or "LLPs".

1.3 DETAILED SCOPE OF SERVICES

Our Phase I ESA was performed in accordance with the ASTM "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process" (ASTM Designation E 1527-05). The ASTM standard defines good commercial and customary practice in the United States of America for conducting an environmental site assessment of a parcel of commercial real estate with respect to the range of contaminants within the scope of Comprehensive Environmental Response, Compensation and

Liability Act (CERCLA) (42 U.S.C. §9601) and petroleum products (ASTM, 2005). Adherence to the ASTM standard is intended to limit liability of property owners from inherited environmental contamination.

We performed the following tasks in completion of the Phase I ESA:

- **Review of regulatory records.** We reviewed standard environmental record sources including the U.S. Environmental Protection Agency's (EPA's) Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) database, EPA's Resource Conservation and Recovery Act (RCRA) database, U.S. Institutional Controls database, U.S. Engineering Controls database, EPA's Emergency Response Notification System (ERNS) database, State of Hawaii Department of Health (DOH) Office of Hazard Evaluation and Emergency Response (HEER) site list, DOH Underground Storage Tank (UST) lists, DOH list of landfills and other solid waste facilities, DOH Voluntary Response Program (VRP) sites list, and DOH Brownfield sites list.
- **Review of site history.** We reviewed reasonably ascertainable standard historical sources including historical maps; aerial photographs; building permits, zoning records and property tax records available online; various printed publications as well as publications posted on the internet; and information from the interview with the owner's representative.
- **Review of site geology and hydrogeology.** We reviewed reasonably ascertainable published information on surface and subsurface conditions at the site and surrounding area. We used this information to assess topography, drainage, surface water bodies, anticipated subsurface geology, and groundwater occurrence and usage in the area.
- **Site reconnaissance.** We performed a site reconnaissance of the property to note visual signs of contamination, and we conducted a limited assessment of portions of the neighboring properties visible from the subject property boundaries. During our site reconnaissance we specifically looked for stained soil, dead or stressed vegetation, hazardous substances, petroleum products, electrical and hydraulic equipment, aboveground and underground storage tanks, disposal areas, maintenance areas, wells, sumps, drains, and cesspools/sewers.
- **Interviews.** We interviewed the user of the Phase I ESA and owner's representative, Mr. Steven Kikuchi, Partner of Maalaea Properties; current site user, Mr. Alex Franco, of Maui Cattle Company; and former owner's representative, Mr. Avery Chumbley, President of Wailuku Agribusiness regarding past and current use and activities on the property and adjoining properties.
- **Data evaluation and report preparation.** We evaluated the information collected and prepared this report that documents our assessment and presents our findings, opinions, and conclusions.

1.4 SIGNIFICANT ASSUMPTIONS

Significant assumptions include the following:

1) The information provided during the interview with the owner's representative is complete and accurate and

2) The information provided by the regulatory database search service is complete and accurate.

1.5 LIMITATIONS AND EXCEPTIONS

Phase I ESAs, by their very nature, are limited. E2 has endeavored to meet what it believes is the applicable standard of care and, in so doing is obliged to advise M&E Pacific, Inc. and Maalaea Properties LLC of Phase I ESA limitations. This ESA did not assess environmental issues or conditions at the property that are outside the scope of ASTM Practice 1527-05, including asbestos-containing materials (ACMs), radon, lead-based paint, lead in drinking water, wetlands, regulatory compliance, cultural and historic resources, industrial hygiene, health and safety, ecological resources, endangered species, indoor air quality, biological agents and mold, and site geotechnical concerns, nor did it include any sampling or testing for biological agents and mold, radon, methane, ACMs, lead-based paint, or other environmental contaminants. Our investigation was limited to the procedures described in the Phase I ESA Standard Practice (ASTM, 2005).

The conclusions presented in this report are professional opinions based solely upon visual observations of the site and vicinity and our interpretation of the available historical and regulatory information and documents reviewed. They are intended exclusively for the purpose outlined herein and apply only to the site location and project indicated.

Our findings and opinions are based on information that we obtained on given dates through records review, site reconnaissance, interviews, and related activities. It is possible that other information exists or subsequently has become known, just as it is possible for conditions we observed to have changed after our observation. For these and associated reasons, E2 and many of its peers routinely advise clients for ESA services that it would be a mistake to place unmerited faith in findings and opinions conveyed via ESA reports. E2 cannot under any circumstances warrant or guarantee that not finding indicators of hazardous substances or petroleum products means that hazardous substances or petroleum products do not exist on the site.

1.6 SPECIAL TERMS AND CONDITIONS

E2's services are performed, within the limits prescribed by our Clients, with the usual thoroughness and competence of the consulting profession in accordance with the standard for professional services at the time those services are rendered. No warranty or representation, either expressed or implied, is included or intended in our proposals, contracts, or reports.

Findings and opinions presented herein apply to site conditions existing at the time of our investigation and those reasonably foreseeable; they cannot necessarily apply to site changes of which we are not aware and have not had the opportunity to evaluate.

1.7 USER RELIANCE

This report is intended for the sole use of M&E Pacific Inc. and Maalaea Properties LLC. The scope of services performed in execution of this investigation may not be appropriate to satisfy the needs of other users, and any use or re-use of this document or the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

2.0 SITE DESCRIPTION

2.1 LOCATION AND LEGAL DESCRIPTION

The subject property consists of one parcel of developed land located in West Maui between Waikapu and Maalaea along the western side of Honoapiilani Highway. Figure 1 (Site Vicinity Map) and Figure 2 (Site Location Map) in Appendix A show the site location. The property consists of approximately 259.885 acres of land designated as Tax Map Key (TMK): (2) 3-6-001: parcel 018.

2.2 SITE AND VICINITY GENERAL CHARACTERISTICS

The subject property is located along the western side of Honoapiilani Highway (Route 30) between Kuihelani Highway (Route 380) and Kapoli Street on the Island of Maui. The western portion of the property is bounded by the eastern side of Kealaloloa Ridge.

The state land use designation for the property is Agricultural (County of Maui, 2006). The southern end of the property is located in a State Special Management Area (County of Maui, 2006). A portion of the southern end of the property is also located within the Federal Emergency Management Agency 500 year flood plain (County of Maui, 2006).

Maui is moderately warm with mean monthly temperatures ranging from 70° to 84° Fahrenheit. The average annual rainfall at the site is approximately 20 inches per year (Giambelluca et al., 1986).

2.3 CURRENT USE OF THE PROPERTY

The property is currently used as pasture land for cattle. The pasture is operated by Maui Cattle Company.

2.4 DESCRIPTIONS OF STRUCTURES, ROADS, AND OTHER IMPROVEMENTS ON THE SITE

The site is currently occupied by cattle and pasture land throughout most of the site. Maui Cattle Company has installed wire fences throughout the property to control grazing patterns of the cattle. Maui Cattle Company also has a cattle pen and storage area near the center of the property. Entrance to the cattle pen can be made via a dirt road and locked gate located along Honoapiilani Highway.

Honoapiilani Highway runs along the eastern and southern boundary of the site. A dirt road off of Honoapiilani Highway runs along the northern and western perimeter of the site. There is also a weather station along the perimeter, however, it could not be determined if the station was located within or outside of the property boundary. Photographs of the site showing some of the site improvements are included in Appendix A.

2.5 CURRENT USES OF THE ADJOINING PROPERTIES

Current uses of adjoining properties include the open lands and pineapple agricultural land to the north, a Hawaiian Cement quarry to the northwest, Maalaea Construction and Demolition Landfill to the northeast open lands and sugar cane agricultural land to the east, a gas station and aquarium to the southeast, Maalaea Small Boat Harbor to the south, and Kealaloloa Ridge to the west.

3.0 USER PROVIDED INFORMATION

3.1 ENVIRONMENTAL LIENS OR ACTIVITY AND USE LIMITATIONS

Mr. Steven Kikuchi, of Maalaea Properties LLC, is not aware of any environmental cleanup liens against the property. A copy of the User Questionnaire completed by Mr. Kikuchi is included in Appendix C.

3.2 SPECIALIZED KNOWLEDGE

Mr. Kikuchi has no specialized knowledge or experience related to the property or nearby properties.

3.3 COMMONLY KNOWN OR REASONABLE ASCERTAINABLE INFORMATION

Mr. Kikuchi is not aware of commonly known or reasonably ascertainable information about the property that would help identify conditions indicative of releases or threatened releases of hazardous substances or petroleum products.

3.4 VALUATION REDUCTION FOR ENVIRONMENTAL ISSUES

Mr. Kikuchi did not indicate any valuation reduction of the subject property due to environmental issues.

3.5 OWNER, PROPERTY MANAGER, AND OCCUPANT INFORMATION

Maalaea Properties LLC owns the property and Maui Cattle Company currently uses the site for cattle grazing. Mr. Steven Kikuchi is a Partner of Maalaea Properties and Mr. Alex Franco is a representative of Maui Cattle Company. According to Mr. Kikuchi and Mr. Franco, no employees or tenants reside on the subject property.

3.6 REASON FOR PERFORMING THE PHASE I ESA

The Phase I ESA was conducted at the request of Maalaea Properties LLC as part of the due diligence process prior to developing the subject property for residential use.

3.7 OTHER INFORMATION

No other information was provided by the user.

4.0 RECORDS REVIEW

4.1 STANDARD ENVIRONMENTAL RECORD SOURCES

4.1.1 Overview

To identify the presence of adverse environmental conditions at the subject property, several published sources of environmental records were reviewed. This section lists the records that were searched and the results of each search.

ASTM E 1527-05 specifies a search distance for specific environmental record sources. The following record sources were searched for incidents or sites within the listed search distances of the subject property:

Standard Environmental Record Sources	Search Distance (miles)
Federal NPL (National Priorities List) site list	1.0
Federal Delisted NPL site list	0.5
Federal CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System) list	0.5
Federal CERCLIS NFRAP (No Further Remedial Action Planned) site list	0.5
Federal RCRA (Resource Conservation and Recovery Act) CORRACTS facilities list (facilities subject to Corrective Action under RCRA)	1.0
Federal RCRAInfo list for TSDF (treatment, storage, and disposal facilities)	0.5
Federal RCRAInfo list for generators	Site and adjoining properties
Federal institutional control/engineering control registries	Site only
Federal ERNS (Emergency Response Notification System) list	Site only
State list of hazardous waste sites identified for investigation or remediation (NPL or CERCLIS equivalents)	1.0
State landfill and/or solid waste disposal site list	0.5
State leaking UST (underground storage tank) list	0.5
State registered UST list	Site and adjoining properties
State institutional control/engineering control registries	Site only
State voluntary cleanup sites	0.5
State Brownfield sites	0.5

E2 used a regulatory database search service, provided by Environmental Data Resources, Inc. (EDR), to review the above Federal and State government databases. A copy of *The EDR Radius Map with GeoCheck®* is included in Appendix B. The following sections summarize the findings of the regulatory database search. In reviewing the environmental databases, it should be noted that such databases are not instantaneously updated by the specific regulatory agencies. Depending on the database and the agency, update frequency may be as infrequent as annually. The dates of the most recent updates for the searched environmental databases are listed in the EDR report in Appendix B.

4.1.2 U.S. EPA National Priorities Site List

The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. The ASTM designated search distance for the NPL is one mile. EDR did not locate NPL sites within one mile of the subject property.

4.1.3 U.S. EPA Delisted NPL Site List

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425(e), sites may be deleted from the NPL where no further response is appropriate. The ASTM designated search distance for delisted NPL sites is one-half mile. EDR did not locate delisted NPL sites within one-half mile of the subject property.

4.1.4 U.S. EPA CERCLIS List

The CERCLIS list contains data on potentially hazardous sites that have been reported to the EPA by states, municipalities, private companies, and private persons pursuant to Section 103 of CERCLA. CERCLIS contains sites which are either proposed to or on the NPL and sites which are in the screening and assessment phase for possible inclusion on the NPL. The ASTM designated search distance for CERCLIS sites is one-half mile. EDR did not identify CERCLIS sites within one-half mile of the subject property.

4.1.5 U.S. EPA CERCLIS NFRAP Site List

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the NPL, unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site. The ASTM designated search distance for NFRAP sites is one-half mile. EDR did not locate CERCLIS NFRAP sites within one-half mile of the property.

4.1.6 U.S. EPA RCRA CORRACTS Facilities List

EPA's CORRACTS, or Corrective Action Sites database, identifies facilities that generate, treat, store, or dispose of hazardous wastes where RCRA corrective action activity has occurred. These sites have experienced spills or releases of hazardous chemicals prompting the need for corrective action. The ASTM designated search distance for the CORRACTS list is one mile. EDR did not identify any CORRACTS sites within one mile of the subject property.

4.1.7 U.S. EPA RCRAInfo List for TSD Facilities

The RCRAInfo list includes facilities that treat, store, dispose of, or incinerate hazardous waste (TSD facilities). The ASTM designated search distance for TSD facilities is one-half mile. EDR did not identify TSD facilities within one-half mile of the subject property.

4.1.8 U.S. EPA RCRA Generators List

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS). The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kilograms (kg) of hazardous waste, or less than one kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over one kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste. The ASTM designated search distance for RCRA generators is the subject property and adjoining properties. EDR located one orphan RCRA generators on an adjoining property.

RCRA Generator Name	Location Relative to the Subject Property	Site Status/Comments
Maalaea Store RR1 Box 374 Maalaea Road Wailuku, HI 96793	1/8 to ¼ miles southwest (lower elevation)	CESQG. No TSDF activities reported. No violations found.

It is unlikely that the CESQGs site has negatively impacted the subject property due to the relative elevation from the property (lower), and the "no violations found" status.

4.1.9 U.S. Institutional / Engineering Control Registries

U.S. Institutional / Engineering Control (IEC) registries are lists of sites that have institutional and/or engineering controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health. The ASTM designated search distance for federal institutional / engineering control registries is the subject property only. EDR did not locate federal IEC sites on the subject property or within one mile of the subject property.

4.1.10 U.S. EPA ERNS List

ERNS is a national database of more than 365,000 records, which contains information on specific notification of releases of oil and hazardous substances to the environment. The ASTM designated search distance for ERNS incidents is the subject property only. No reported ERNS incidents have occurred on the subject property.

4.1.11 State of Hawaii Hazardous Waste Sites List

The State Hazardous Waste Sites records are the states' equivalent to NPL or CERCLIS. These sites may or may not already be listed on the federal NPL or CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. The DOH HEER office maintains a Sites of Interest Database, which includes sites that HEER has an interest in, has investigated, or may investigate under Hawaii Revised Statute 128D (the State Superfund law). The ASTM designated search distance for the State Hazardous Waste Sites List is one mile. EDR did not identify any State Hazardous Waste sites within one mile of the subject property.

4.1.12 State of Hawaii Landfill / Solid Waste Disposal Site List

The State DOH Solid and Hazardous Waste Branch has a list of permitted solid waste disposal facilities and landfills in the State of Hawaii. The ASTM designated search distance for permitted solid waste disposal sites / landfills is one-half mile. EDR did not locate permitted landfills or disposal sites within one-half mile of the subject property.

4.1.13 State of Hawaii LUST List

The leaking underground storage tank (LUST) database, compiled by the State DOH Solid and Hazardous Waste Branch (SHWB) UST Section, contains an inventory of reported leaking underground storage tank incidents. The ASTM designated search distance for LUST sites is one-half mile. EDR located three (one orphan) LUST sites within one-half mile of the subject property. The sites are listed below.

LUST Site Name	Location Relative to the Subject Property	Site Status/Comments
Hawaiian Cement - Waikapu Quarry Honoapiilani Highway Wailuku, HI 96793	1/8 to ¼ miles northwest (up gradient)	Site Cleanup Completed 5/16/95.
Maalaea 76 Station 15 Kapoli Street Wailuku, HI 96793	1/8 to ¼ miles southeast (down gradient)	Site Cleanup Initiated 10/25/04.
Maalaea Store RR1 Box 374 Maalaea Road Wailuku, HI 96793	1/8 to ¼ miles southeast (down gradient)	Site Cleanup Completed 8/23/05.

Note: Gradient direction refers to approximate groundwater flow direction.

It is unlikely that off-site LUST sites have negatively impacted the subject property due to the "Site Cleanup Completed" status for the up gradient site and the anticipated groundwater flow direction from the down gradient sites.

4.1.14 State of Hawaii Registered UST List

USTs are regulated under RCRA and must be registered with the state department responsible for administering the UST program. The list of registered UST sites is compiled by the State DOH SHWB UST Section. The ASTM designated search distance for UST sites is one-quarter mile. EDR located three (one orphan) UST sites within one-quarter mile of the subject property. The sites are listed below.

UST Site Name	Location Relative to the Subject Property	Site Status/Comments
Hawaiian Cement - Waikapu Quarry Honoapiilani Highway Wailuku, HI 96793	1/8 to ¼ miles northwest (up gradient)	6 USTs Permanently Out of Use.
Maalaea 76 Station 15 Kapoli Street Wailuku, HI 96793	1/8 to ¼ miles southeast (down gradient)	3 USTs Currently In Use: Tank ID: 2a-92 Capacity: 10,000 Gallons Substance: Gasoline Installed: 10/20/00 Tank ID: 87 Capacity: 15,000 Gallons Substance: Gasoline Installed: 10/20/00 Tank ID: 2b Capacity: 6,000 Gallons Substance: Diesel Installed: 10/20/00
Maalaea Store RR1 Box 374 Maalaea Road Wailuku, HI 96793	1/8 to ¼ miles southeast (down gradient)	2 USTs Permanently Out of Use.

Note: Gradient direction refers to approximate groundwater flow direction.

It is unlikely that off-site UST sites have negatively impacted the subject property due to the status of the closed USTS and groundwater flow direction (down gradient) of the USTs in service.

4.1.15 State of Hawaii Institutional Control Registry

Institutional controls on properties were obtained from the DOH VRP and Brownfield databases. The ASTM designated search distance for state institutional / engineering control registries is the subject property only. EDR did not identify the subject property on state institutional / engineering controls lists.

4.1.16 State of Hawaii Voluntary Response Program Sites

The ASTM designated search distance for VRP sites is one-half mile. EDR did not identify any VRP sites listed within one-half mile of the subject property.

4.1.17 State of Hawaii Brownfield Sites

The ASTM designated search distance for Brownfield sites is one-half mile. EDR did not list any state Brownfield sites within one-half mile of the subject property.

4.2 ADDITIONAL ENVIRONMENTAL RECORD SOURCES

Additional environmental record sources that were reviewed for this Phase I ESA included Maui County building permit and zoning records available online. The findings from review of these records are discussed in Section 4.4.2.

4.3 PHYSICAL SETTING SOURCES

4.3.1 USGS Topographic Map Coverage

According to the U.S. Geological Survey (USGS) topographic maps of the area (Maalaea Quadrangle), the property is located at approximately 20° 48' 14.4'' north latitude and 156° 30' 41.1'' west longitude. The elevation of the subject property ranges from approximately 40 feet above mean sea level at the southern end near Maalaea Small Boat Harbor to approximately 200 feet above mean sea level at the northern end near Kuihelani Highway. Topographic map coverage of the subject site is shown on Figure 1 in Appendix A.

4.3.2 Geologic and Hydrogeologic Setting

E2 reviewed published geologic and hydrogeologic reports and maps to obtain information regarding subsurface conditions in the general area of the site to evaluate potential migration of contaminants.

Geology and Soils

The subject property is located along the eastern base of the West Maui Mountains.

According to the U. S. Soil Conservation Service (Foote et al., 1972) the predominant soil types located in the site vicinity are:

> Pulelu cobbly loam – well drained and excessively drained, medium textured, moderately textured, and coarse-textured soils on alluvial fans and in basins on the island of Maui.
>
> Stony alluvial land – moderately well and well drained, moderately coarse textured soils with moderate infiltration rates.

Hydrogeology

The subject property is located within the Waikapu Aquifer System of the Wailuku Aquifer Sector (Mink and Lau, 1990). Two aquifers are located beneath the site, an upper aquifer that occurs in sedimentary (alluvial) deposits and a lower (deeper) aquifer that occurs in horizontally extensive lavas. Both aquifers are basal, where freshwater is in contact with seawater. The upper aquifer is unconfined, where the water table is the upper surface of the saturated aquifer; and the lower aquifer is confined by impermeable or poorly permeable formations (the sedimentary deposits) with the top of the saturated aquifer below the surface of the groundwater (Mink and Lau, 1990).

The upper aquifer has the potential to be used, is not a drinking water source or ecologically important, has a moderate salinity (1,000 to 5,000 milligrams per liter of chloride), is replaceable, and is moderately vulnerable to contamination. The lower aquifer has the potential to be used, is not a drinking water source or ecologically important, has a moderate salinity (1,000 to 5,000 milligrams per liter of chloride), is replaceable, and has a low vulnerability to contamination.

Based on regional topography, regional groundwater flow direction is expected to be south-southeast towards the ocean. The nearest drinking water supply wells are located over one mile from subject property to the northwest (EDR, 2006). There are five wells registered with the State Department of Land and Natural Resources within a one mile radius of the property. Three wells are being used for irrigation, one well may be used for drinking water for future residential development, and one well does not have a listed use.

Surface Water

The closest surface water body to the site is the Maalaea Small Boat Harbor, which is approximately 500 feet south of the southern end of the site, and is contiguous with the Pacific Ocean. The location of the Maalaea Small Boat Harbor in relation to the site is shown on Figure 1 in Appendix A. There is also an earthen reservoir located approximately 1,000 feet northwest of the site.

Storm water runoff appears that it would flow into swales and gullies to the south-southwest of the site towards Honoapiilani Highway and Maalaea Harbor.

4.4 HISTORICAL USE INFORMATION

4.4.1 Historical Review Sources

Past use of the subject property and adjoining properties was ascertained by reviewing the following standard historical sources: aerial photographs; building permits, zoning records, and property tax records available online; various printed publications; as well as publications posted on the internet; and information from the interview with the owner's representative. Appendix D contains copies of pertinent maps.

4.4.2 Past Uses of the Subject Property and Adjoining Properties

Past Uses of the Subject Property

Review of aerial photographs from 1950 through 1995 indicates that the property was used for agricultural purposes, specifically sugarcane cultivation, throughout the entire period.

Mr. Chumbley, of Wailuku Agribisuness, indicated that various pesticides and herbicides were properly applied to the property for sugarcane cultivation. Mr. Chumbley has provided a list of pesticides and herbicides, which is included in Appendix C.

Past Uses of Adjoining Properties

The earliest aerial photographs from 1950 indicate that a quarry was active at the location of the current Maalaea Construction and Demolition Landfill. The land to the north and east were being used for agriculture. There were many small structures, probably commercial, located to the south near Maalaea Harbor. The land to the west was undeveloped.

No changes are visible until the 1980s when larger structures were built near Maalaea Harbor. Quarry activities at the current Maalaea Construction and Demolition Landfill appear to be ongoing at this time.

The last aerial photograph in 1995 shows no changes, with the possible exception that quarry activity may have stopped.

From the site reconnaissance and interviews, also to be discussed in the following sections, we know that the quarry that had begun operations before 1950 is now being used as a demolition and construction debris landfill. Also, a new quarry began operations to the northwest of the site and is still in operation at this time.

5.0 SITE RECONNAISSANCE

5.1 METHODOLOGY AND LIMITING CONDITIONS

E2 personnel conducted the site reconnaissance November 1, 2006. The site reconnaissance consisted of a visual inspection of the property and the surrounding area.

The site reconnaissance was limited by the following condition:

1) The site had only a few dirt roads that were drivable. Overgrown grass in areas where the site was inaccessible by car may have obstructed the view of some surface or subsurface objects.

2) Drums containing liquids of unknown contents were found at the site. No sampling was performed to determine the contents.

5.2 GENERAL SITE SETTING

Site reconnaissance was conducted on November 1, 2006 by Mr. Roger Aoki and Mr. Ryan Yamauchi of E2. The reconnaissance included visual a survey of the property and a brief survey of the visible portions of the adjacent properties. Photographs are included in Appendix A.

The site is former sugar cane agricultural land that is currently being used as pasture land for cattle grazing. The cattle grazing is operated by the Maui Cattle Company. In addition to grazing fields, the Maui Cattle Company has a few pens and a feeding area near the center of the property. The Maui Cattle Company stores small quantities of gasoline and other petroleum products near the pen area to operate small tractors.

An active quarry facility is in operation to the northwest. Also, across Honoapiilani Highway to the northeast there is a former quarry that is currently being used as a demolition and construction debris landfill. The area to the west is undeveloped. The area to the east was used for sugar cane agriculture. Maalaea Small Boat Harbor and several commercial establishments are located to the south of the property.

5.3 HAZARDOUS SUBSTANCE AND PETROLEUM PRODUCTS IN CONNECTION WITH IDENTIFIED USES

E2 identified small quantities of petroleum products associated with the Maui Cattle Company operations during the site reconnaissance. There were five 5-gallon gasoline containers and seven 5-gallon containers of hydraulic and transmission oil stored near the pen area in the center of the property. Some of the containers were empty and none of the containers were completely full. One car battery was also observed in the pen area. No significant surface staining was observed in the petroleum product storage area.

5.4 HAZARDOUS SUBSTANCE AND PETROLEUM CONTAINERS *(NOT NECESSARILY IN CONNECTION WITH IDENTIFIED USES)*

E2 did not observe any hazardous substances or petroleum containers not necessarily associated with identified uses.

5.5 UNIDENTIFIED SUBSTANCE CONTAINERS

E2 observed fourteen (14) 55-gallon high density polyethylene (HDPE) drums along the southwestern perimeter of the property. Most of the drums were full with liquid. Two damaged drums were empty. The drums were not labeled and the contents of the drums are unknown at this time. Mr. Kikuchi was unaware of the drums being on-site. Mr. Franco indicated that the drums were on site before Maui Cattle Company began using the site about a year ago. As of the date of this report, Mr. Chumbley is planning to have the drums removed by November 17, 2006.

5.6 STORAGE TANKS

E2 did not observe the presence of storage tanks on the property during the site reconnaissance.

E2 observed two plastic storage containers (approximately 1 cubic yard in size) within the pen area. According to Mr. Franco, these containers are used to store molasses that is used in feed for the cattle.

5.7 INDICATIONS OF PCBS

E2 did not observe indications of the potential presence of PCBs on the property during the site reconnaissance.

5.8 INDICATIONS OF SOLID WASTE DISPOSAL

E2 observed one pile of solid waste, which appears to be discarded rain gauges, on the property. The pile was located near the southwestern end of the site. Also, the recent fire in September has exposed some illicit dumping of propane tanks along the western perimeter of the site.

5.9 MIGRATION OF OFF-SITE CONTAMINATION

E2 did not observe off-site contaminant migration onto the property.

5.10 OTHER CONDITIONS OF CONCERN

<u>Odors</u>
No strong, pungent, or noxious odors were identified at the property during the site reconnaissance.

<u>Stressed Vegetation</u>
No stressed vegetation was identified at the property during the site reconnaissance.

<u>Wastewater and Septic Systems</u>
No wastewater or septic systems were identified at the property during the site visit or from records reviewed.

<u>Storm Water</u>
Storm water run-on and/or run-off were not observed on the property during the site reconnaissance. Storm water runoff appears that it would flow into swales and gullies to the south-southwest of the site towards Honoapiilani Highway and Maalaea Harbor.

<u>Drains and Sumps</u>
No drains or sumps were identified at the property during the site reconnaissance.

<u>Stained Soil or Pavement</u>
No stained soil or pavement was identified at the property during the site reconnaissance.

<u>Wells</u>
No wells were identified at the property during the site reconnaissance. A well head located just adjacent to the property was observed along the western perimeter of the property. Wells are discussed in Section 4.3.2.

<u>Pits, Ponds, or Lagoons</u>
No pits, ponds, or lagoons were identified at the property during the site reconnaissance.

6.0 INTERVIEWS

6.1 INTERVIEW WITH CURRENT OWNER / FORMER OWNER / OCCUPANTS

E2 interviewed Mr. Steven Kikuchi, Partner of Maalaea Properties LLC; Mr. Avery Chumbley, President of Wailuku Agribusiness; and Alex Franco, Manager of Maui Cattle Company regarding the subject property. Information obtained during the interviews is included in pertinent sections of this report.

6.2 INTERVIEW WITH LOCAL GOVERNMENTAL OFFICIALS

Written requests for information were sent to the State of Hawaii Department of Health, the Maui County Department of Fire Control, and the Local Emergency Planning Committee. Copies of the information request and responses are included in Appendix D and information obtained is included in pertinent sections of this report.

7.0 FINDINGS AND OPINIONS

<u>Review of Standard Environmental Record Sources</u>

A review of the environmental regulatory databases indicated that the subject property was not listed on any of the federal or state databases searched by EDR.

A review of the environmental regulatory databases identified one SQG site, located within the respective search radii. However, due to its location, relative elevation, and status, the site is unlikely to have a significant environmental impact on the subject property.

Three LUST sites are located within one-half mile of the subject property. These sites have completed cleanup or are located at such a distance down gradient of the subject property that they are unlikely to have an environmental impact on the subject property. Likewise, three registered UST sites, one UST site currently in use and 2 UST sites permanently out of use, were identified within ¼ mile of the subject property. The active UST site has three USTs, a 10,000 gallon gasoline, a 15,000 gallon gasoline and a 6,000 gallon diesel. This UST site is located down gradient of the subject property and is unlikely to have an environmental impact on the subject property.

Historical Review

E2 identified that the property was historically used for agriculture, specifically for sugar cane cultivation. In an interview, Mr. Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. Mr. Chumbley provided a list of potential pesticides and herbicides that may have been applied to the property (Appendix C).

E2 also identified a construction and demolition debris landfill, and a gas station operating adjacent to the subject property. Gas stations are also known to have petroleum products that are harmful to and persistent in the environment. However, no records have been filed with the Department of Health regarding hazardous material or substance releases from either of these sites.

Site Reconnaissance

E2 identified five (5) 5-gallon containers of gasoline, seven (7) 5-gallon containers of hydraulic and transmission oil, and one car battery within the pen area operated by the Maui Cattle Company near the center of the property. Gasoline and other petroleum products, if released, may be harmful to and persistent in the environment. No staining was observed on the ground surface below or around the gasoline containers, transmission oil, or battery.

Fourteen (14) 55-gallon unmarked HDPE drums containing an unknown liquid were observed along the western perimeter of the property. Twelve of the drums were partially full with liquid and two drums were empty, possibly indicating a potential release. Mr. Franco indicated that the drums were on site before the Maui Cattle Company began using the site about a year ago. In a follow-up request for additional information, Mr. Chumbley of Wailuku Agribusiness, indicated that the drums must have been left by a former licensee. As of the date of this report, Mr. Chumbley is planning to have the drums removed by November 17, 2006.

E2 did not observe any other recognized environmental conditions during the site reconnaissance.

8.0 CONCLUSIONS

We have performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E 1527-05 of the subject property, located in Maalaea Mauka, Wailuku, Hawaii, designated as TMK: (2) 3-6-001: parcel 018. Any exceptions to, or deletions from, this practice are described in Section 1.5 of this report. This assessment has revealed no significant evidence of recognized environmental conditions in connection with the property with the exception of the fourteen (14) unmarked 55-gallon HDPE drums located along the dirt road bordering the southwestern end of the property. Twelve (12) of the drums were partially full with an unknown liquid at the time of the field

inspection. Two of the drums were damaged and empty indicating a potential release. In an interview with Mr. Alex Franco, Manager of Maui Cattle Company, Mr. Franco noted that the drums were present prior to their use of the property over a year ago. Mr. Franco believes that the drums may have been left by one of the farmers that were previously utilizing the property. In a follow-up request for additional information, Mr. Chumbley of Wailuku Agribusiness, indicated that the drums must have been left by a former licensee. As of the date of this report, Mr. Chumbley is planning to have the drums removed by November 17, 2006.

E2 recommends that the contents of the drums be determined and that drums and contents be properly disposed and/or recycled in accordance with all Federal, State and local regulations. Upon removal of the drums, the soil and vegetation beneath the drums should be inspected for indications of a release by an environmental professional. If a significant release is suspected, appropriate sampling and cleanup should be conducted.

E2 has also identified that the property has been historically used for sugarcane cultivation. In an interview, Mr. Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. Therefore, residual levels of pesticides and herbicides are probably present on the property. Although proper applications of pesticides and herbicides does not constitute a release of hazardous chemicals, E2 recommends that limited composite soil sampling be conducted on the property should the intended land use of the property change from agricultural to residential. The purpose of the limited sampling would be to determine if residual levels of pesticides/herbicides are present in site soils. The sample analyses selected should be based on the list of potential pesticides and herbicides that may have been applied to the property as provided by Mr. Chumbley.

9.0 DEVIATIONS

In conducting this Phase I ESA, there were no deletions from the standard practice (ASTM Designation E1527-05) and no client-imposed constraints. In addition, no data gaps were encountered, other than the limitations described in Section 5.1.

10.0 REFERENCES

ASTM, 2005. *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM Designation E 1527-05). American Society for Testing and Materials (ASTM)*, Washington, 2005.

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Mink, J. F. and Lau, S., 1990. *Aquifer Identification and Classification for Maui Groundwater Protection Strategy for Hawaii.* Water Resources Research Center, University of Hawaii, Technical Report 185, February.

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11.0 SIGNATURE OF ENVIRONMENTAL PROFESSIONALS

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental professional as defined in §312.10 of 40 CFR 312 and we have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Roger C. Aoki

Roger C. Aoki, P.E. Date: November 15, 2006

Ryan S. Yamauchi, P.E. Date: November 15, 2006

12.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

Qualifications of the environmental professional are included in Appendix E.

LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response Compensation and Liability Information System
CESQG	Conditionally Exempt Small Quantity Generator
CORRACTS	Corrective Action Sites under RCRA
DOH	State of Hawaii, Department of Health
E2	Element Environmental LLC
EDR	Environmental Data Resources, Inc.
EPA	US Environmental Protection Agency
ERNS	Emergency Response Notification System
ESA	Environmental Site Assessment
FINDS	Facility Index System
HECO	Hawaiian Electric Company, Inc.
HEER	Department of Health, Office of Hazard Evaluation and Emergency Response
IEC	Institutional / Engineering Controls
kg	kilogram
LLPs	Landowner Liability Protections
LQG	Large Quantity Generator
LUST	leaking underground storage tank
mg/l	milligrams per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	DOH issued No Further Action status for sites
NFRAP	No Further Remedial Action Planned
NPL	National Priorities List (Superfund sites)
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
SHWB	Department of Health, Solid and Hazardous Waste Branch
SQG	Small Quantity Generator
TMK	Tax Map Key
TSD	treatment, storage and disposal (category of RCRA facility)
USGS	United States Geological Survey (US Dept. of the Interior)
UST	underground storage tank
VRP	Department of Health, Voluntary Response Program

APPENDIX A

Figures and Photo Plates

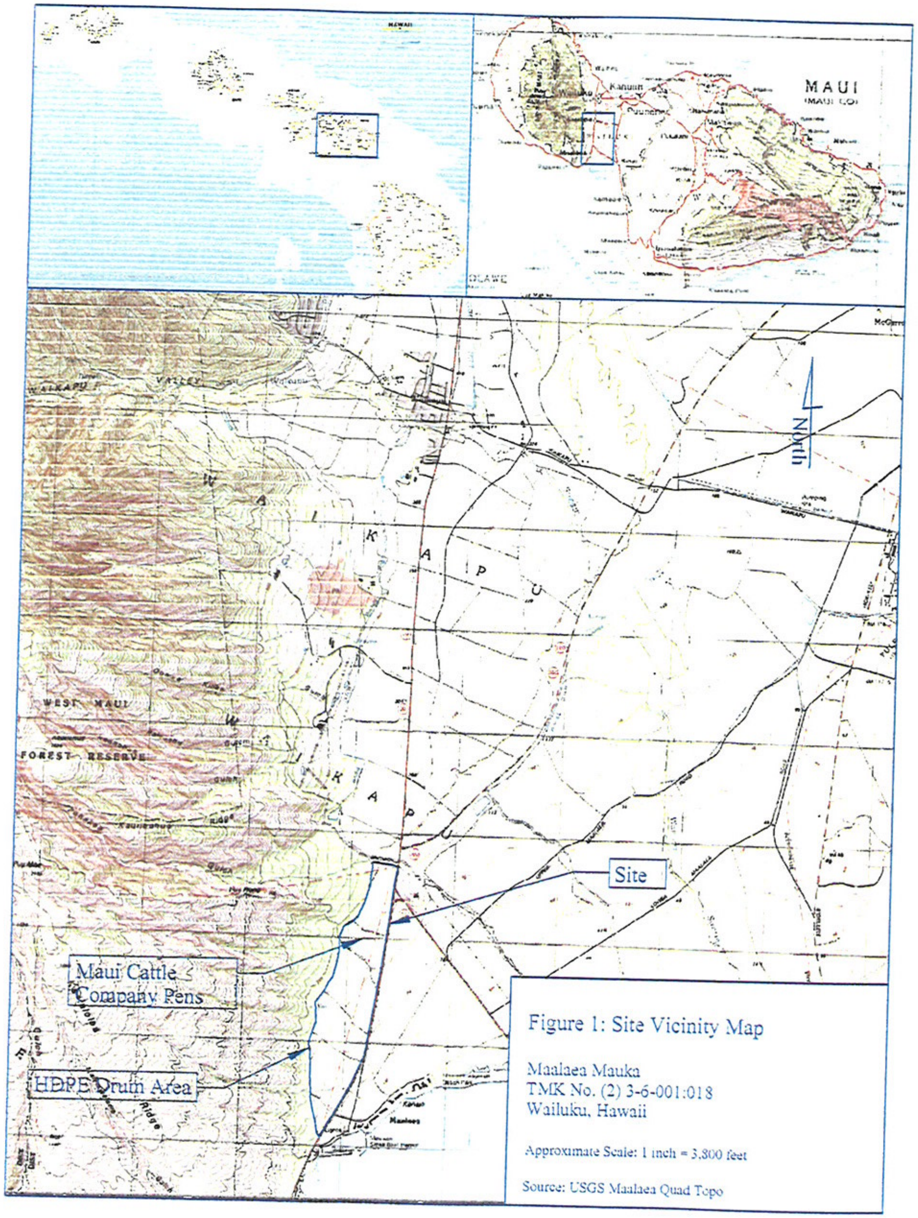


Figure 1: Site Vicinity Map

Maalaea Mauka
TMK No. (2) 3-6-001:018
Wailuku, Hawaii

Approximate Scale: 1 inch = 3,800 feet

Source: USGS Maalaea Quad Topo

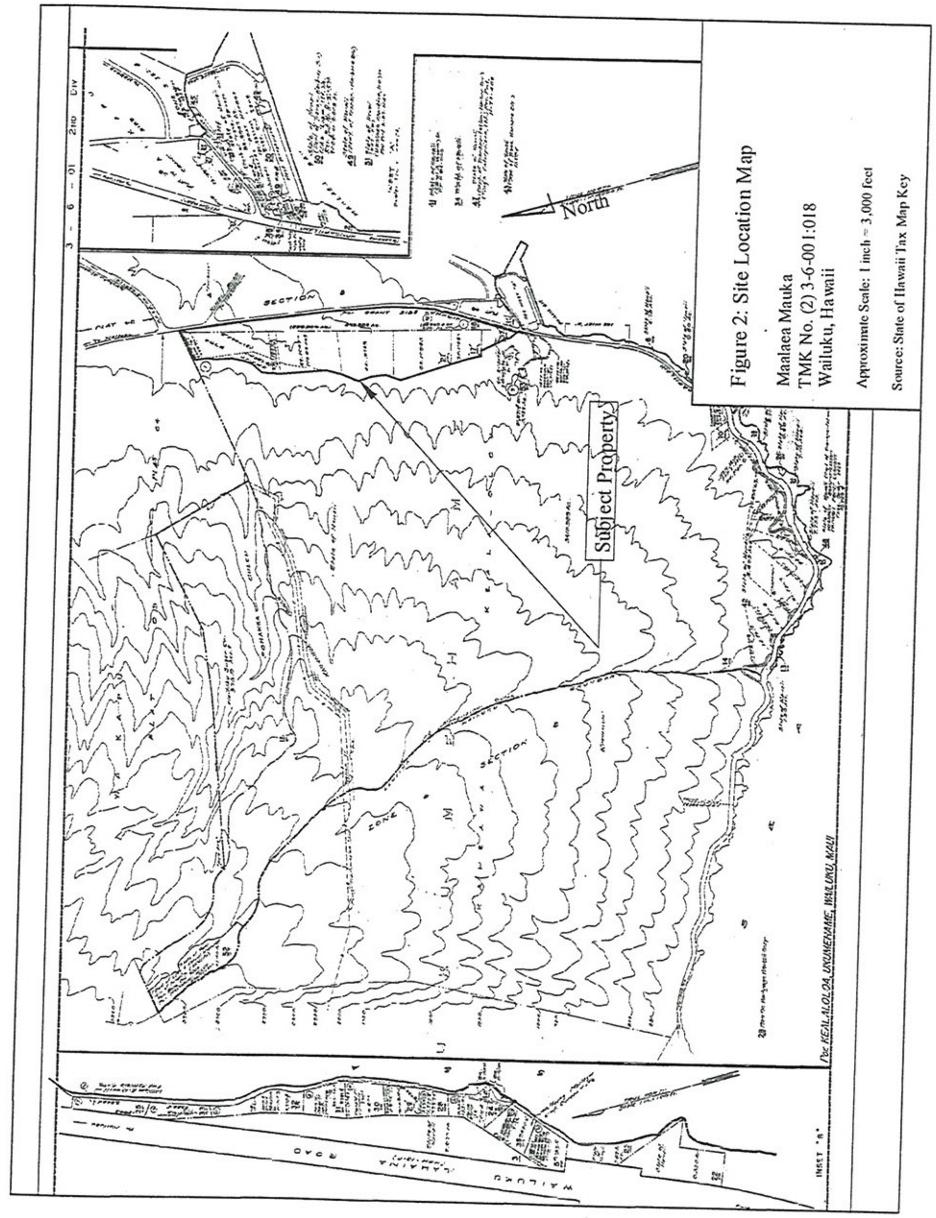


Figure 2: Site Location Map

Maalaea Mauka
TMK No. (2) 3-6-001:018
Wailuku, Hawaii

Approximate Scale: 1 inch = 3,000 feet

Source: State of Hawaii Tax Map Key


Photograph 1: Maalaea Mauka property. Direction: Northeast.


Photograph 2: Dirt road with cattle feed supplement. Honoapiilani Highway seen beyond the dirt road. Direction: East.


Photograph 3: Maui Cattle Company gasoline and transmission oil storage. Direction: West.


Photograph 4: Maui Cattle Company tractor and pens. Direction: South.


Photograph 5: Fourteen 55-gallon HDPE drums along southwestern perimeter of the site. Direction: South.


Photograph 6: Pile of apparent solid waste near the southwestern portion of the property. Honoapiilani Highway seen in the background. Direction: Southeast.


Photograph 1: Maalaea Mauka property. Direction: Northeast.


Photograph 2: Dirt road with cattle feed supplement. Honoapiilani Highway seen beyond the dirt road. Direction: East.

Photograph 3: Maui Cattle Company gasoline and transmission oil storage. Direction: West.

Photograph 4: Maui Cattle Company tractor and pens. Direction: South.

Photograph 5: Fourteen 55-gallon HDPE drums along southwestern perimeter of the site. Direction: South.

Photograph 6: Pile of apparent solid waste near the southwestern portion of the property. Honoapiilani Highway seen in the background. Direction: Southeast.

APPENDIX B

The EDR Radius Map with GeoCheck®

The EDR Radius Map
with GeoCheck®

Maalaea Mauka
Honoapiilani Highway
WAILUKU, HI 96793

Inquiry Number: 1790052.2s

November 06, 2006

EDR® Environmental Data Resources Inc

The Standard in Environmental Risk Management Information

440 Wheelers Farms Road
Milford, Connecticut 06461

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

HONOAPIILANI HIGHWAY
WAILUKU, HI 96793

COORDINATES

Latitude (North):	20.804000 - 20˚ 48' 14.4"
Longitude (West):	156.511500 - 156˚ 30' 41.4"
Universal Tranverse Mercator:	Zone 4
UTM X (Meters):	759028.3
UTM Y (Meters):	2302318.8
Elevation:	131 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	20156-G5 LAHAINA, HI
Most Recent Revision:	Not reported
East Map:	20156-G4 WAILUKU, HI
Most Recent Revision:	Not reported

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

FEDERAL RECORDS

NPL........................ National Priority List
Proposed NPL............... Proposed National Priority List Sites
Delisted NPL............... National Priority List Deletions
NPL RECOVERY............... Federal Superfund Liens
CERCLIS.................... Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP................. CERCLIS No Further Remedial Action Planned

EXECUTIVE SUMMARY

CORRACTS................... Corrective Action Report
RCRA-TSDF.................. Resource Conservation and Recovery Act Information
RCRA-LQG................... Resource Conservation and Recovery Act Information
RCRA-SQG................... Resource Conservation and Recovery Act Information
ERNS....................... Emergency Response Notification System
HMIRS...................... Hazardous Materials Information Reporting System
US ENG CONTROLS............ Engineering Controls Sites List
US INST CONTROL............ Sites with Institutional Controls
DOD........................ Department of Defense Sites
FUDS....................... Formerly Used Defense Sites
US BROWNFIELDS............. A Listing of Brownfields Sites
CONSENT.................... Superfund (CERCLA) Consent Decrees
ROD........................ Records Of Decision
UMTRA...................... Uranium Mill Tailings Sites
ODI........................ Open Dump Inventory
TRIS....................... Toxic Chemical Release Inventory System
TSCA....................... Toxic Substances Control Act
FTTS....................... FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
SSTS....................... Section 7 Tracking Systems
ICIS....................... Integrated Compliance Information System
PADS....................... PCB Activity Database System
MLTS....................... Material Licensing Tracking System
MINES...................... Mines Master Index File
FINDS...................... Facility Index System/Facility Registry System
RAATS...................... RCRA Administrative Action Tracking System

STATE AND LOCAL RECORDS

SHWS....................... Sites List
SWF/LF..................... Permitted Landfills in the State of Hawaii
SPILLS..................... Release Notifications
INST CONTROL............... Sites with Institutional Controls
VCP........................ Voluntary Response Program Sites
DRYCLEANERS................ Permitted Drycleaner Facility Listing
BROWNFIELDS................ Brownfields Sites
AIRS....................... List of Permitted Facilities

TRIBAL RECORDS

INDIAN RESERV.............. Indian Reservations
INDIAN LUST................ Leaking Underground Storage Tanks on Indian Land
INDIAN UST................. Underground Storage Tanks on Indian Land

EDR PROPRIETARY RECORDS

Manufactured Gas Plants.... EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

STATE AND LOCAL RECORDS

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Health's Active Leaking Underground Storage Tank Log Listing.

A review of the LUST list, as provided by EDR, and dated 08/11/2006 has revealed that there are 2 LUST sites within approximately 1 mile of the target property.

Lower Elevation	Address	Dist / Dir	Map ID	Page
MAALAEA 76 STATION Facility Status: LUST Cleanup Initiated: Petroleum	*15 KAPOLI ST.*	*1/2 - 1 S*	*1*	*6*
MAALAEA STORE Facility Status: Site Cleanup Completed	*RR1 BOX 374 MAALAEA RD*	*1/2 - 1 S*	*2*	*7*

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Health's Listing of Underground Storage Tanks.

A review of the UST list, as provided by EDR, and dated 08/11/2006 has revealed that there is 1 UST site within approximately 0.75 miles of the target property.

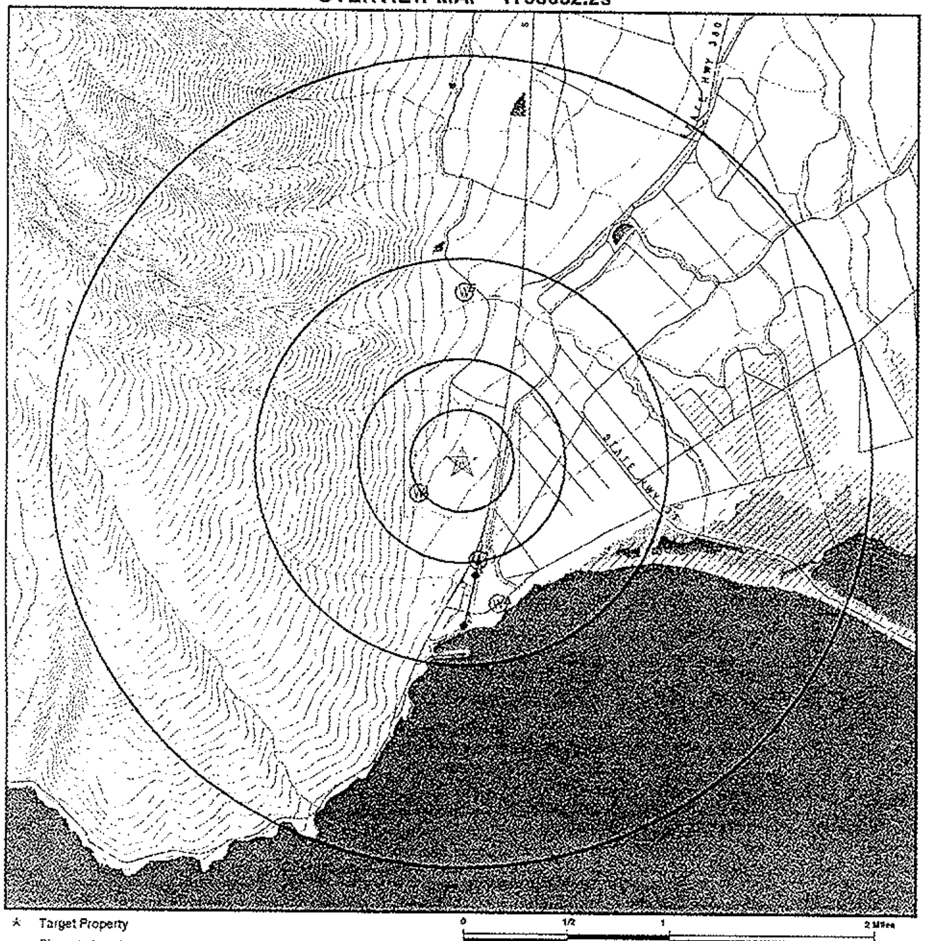
Lower Elevation	Address	Dist / Dir	Map ID	Page
MAALAEA 76 STATION	*15 KAPOLI ST.*	*1/2 - 1 S*	*1*	*6*

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
WAIHEE ELEMENTARY SCHOOL	FINDS, FTTS
VECTOR CONTROL BRANCH, MAUI	SHWS
KALAMAULA LANDFILL	SHWS
WAIALE ASH PILE	SHWS, FINDS
Y HATA- MAUI	SHWS
Y HATA- MAUI	INST CONTROL
KAHOOLAWE ISLAND	CERCLIS
MAKANI LDFL	CERC-NFRAP
OLOWALU LDFL	CERC-NFRAP
HANA LANDFILL	SWF/LF
CENTRAL MAUI LANDFILL	SWF/LF
KIHEI SPS #5 (EAST WELAKAHAO)	FINDS, LUST
KIHEI WWTP	LUST, UST
HAWAIIAN CEMENT - WAIKAPU QUARRY	FINDS, LUST
KIHEI SPS #3 (MENEHUNE SHORES)	UST
KIHEI SPS #6 (KIHEI FIRE HOUSE)	UST
KIHEI SPS #4 (YE'S ORCHARD)	UST
KIHEI SPS #5 (EAST WELAKAHAO)	UST
GTE HAWAIIAN TEL NORTH KIHEI REMOTE EQUIP BLDG	UST
KIHEI MINIT STOP	UST
ESTATE OF MARY HELELA	UST
BOARD OF WATER SUPPLY	UST
HERBERT HORITA REALTY INC.	UST
LANAI CITY LANDSCAPING	UST
VACANT LAND TMK NO (2) 3-8-7:101	RCRA-SQG
MAUI DISTRICT OFFICE DOE	RCRA-SQG
MAALAEA GENERATING STATION	RCRA-SQG
MAALAEA STORE	RCRA-SQG
US NAVY KAHO'OLAWE ISLAND RESERVE	RCRA-SQG, FINDS
MAALAEA HARBOR	FINDS, RCRA-LQG
KEHALANI MAUKA ROADWAY PLANS	ERNS
KEHALANI MAUKA LARGE LOT	FINDS
SUDA CONST & MASON INC	FINDS
COUNTY OF MAUI	ICIS
BREWER ENVIRONMENTAL INDUSTRIES L.L.C.	ICIS
BEI HAWAII - MAUI	ICIS
MAUI'S QUALITY DRY CLEANING & LAUNDRY, INC.	SSTS
HAWAIIAN CHARCOAL COMPANY	DRYCLEANERS
HAWAIIAN CEMENT	AIRS
	AIRS

OVERVIEW MAP - 1790052.2s

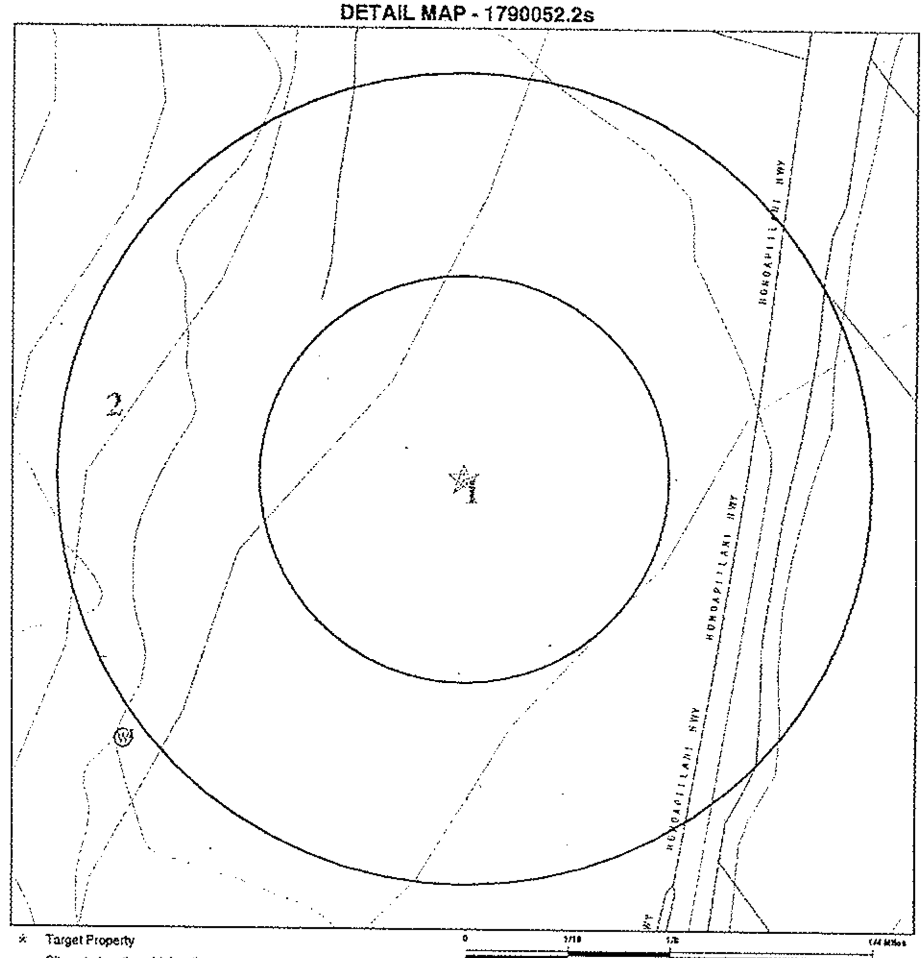


- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Landfill Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Maalaea Mauka ADDRESS: Honoapiilani Highway WAILUKU HI 96793 LAT/LONG: 20.8040 / 156.5115	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY #: 1790052.2s DATE: November 06, 2006 1:52 pm

DETAIL MAP - 1790052.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Landfill Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Maalaea Mauka ADDRESS: Honoapiilani Highway WAILUKU HI 96793 LAT/LONG: 20.8040 / 156.5115	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY #: 1790052.2s DATE: November 06, 2006 1:52 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FEDERAL RECORDS								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
Delisted NPL		1.500	0	0	0	0	0	0
NPL RECOVERY		0.500	0	0	0	NR	NR	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		1.000	0	0	0	0	NR	0
CORRACTS		1.500	0	0	0	0	0	0
RCRA TSD		1.000	0	0	0	0	NR	0
RCRA Lg. Quan. Gen.		0.750	0	0	0	0	NR	0
RCRA Sm. Quan. Gen.		0.750	0	0	0	0	NR	0
ERNS		0.500	0	0	0	NR	NR	0
HMIRS		0.500	0	0	0	NR	NR	0
US ENG CONTROLS		1.000	0	0	0	0	NR	0
US INST CONTROL		1.000	0	0	0	0	NR	0
DOD		1.500	0	0	0	0	0	0
FUDS		1.500	0	0	0	0	0	0
US BROWNFIELDS		1.000	0	0	0	0	NR	0
CONSENT		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
UMTRA		1.000	0	0	0	0	NR	0
ODI		1.000	0	0	0	0	NR	0
TRIS		0.500	0	0	0	NR	NR	0
TSCA		0.500	0	0	0	NR	NR	0
FTTS		0.500	0	0	0	NR	NR	0
SSTS		0.500	0	0	0	NR	NR	0
ICIS		0.500	0	0	0	NR	NR	0
PADS		0.500	0	0	0	NR	NR	0
MLTS		0.500	0	0	0	NR	NR	0
MINES		0.750	0	0	0	0	NR	0
FINDS		0.500	0	0	0	NR	NR	0
RAATS		0.500	0	0	0	NR	NR	0
STATE AND LOCAL RECORDS								
SHWS		1.500	0	0	0	0	0	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	2	NR	2
UST		0.750	0	0	0	1	NR	1
SPILLS		0.500	0	0	0	NR	NR	0
INST CONTROL		1.000	0	0	0	0	NR	0
VCP		1.000	0	0	0	0	NR	0
DRYCLEANERS		0.750	0	0	0	0	NR	0
BROWNFIELDS		1.000	0	0	0	0	NR	0
AIRS		0.500	0	0	0	NR	NR	0
TRIBAL RECORDS								
INDIAN RESERV		1.500	0	0	0	0	0	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN LUST		1.000	0	0	0	0	NR	0
INDIAN UST		0.750	0	0	0	0	NR	0
EDR PROPRIETARY RECORDS								
Manufactured Gas Plants		1.500	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

Map ID / Direction / Distance / Distance (ft.) / Elevation	Site	Database(s)	EDR ID Number / EPA ID Number
1 South 1/2-1 2983 ft.	MAALAEA 78 STATION 15 KAPOLI ST. WAILUKU, HI 96793	LUST UST	U003732593 N/A

Relative: Lower

Actual: 35 ft.

LUST:
- Facility ID: 9-503641
- Release ID: 040064
- Facility Status Date: 2004-10-25 00:00:00
- Facility Status: LUST Cleanup Initiated; Petroleum
- Project Officer: Fu

UST:
- Facility ID: 9-503641
- Owner: Mid Pac Petroleum LLC
- Owner Address: 745 Fort Street, TOPA Financial Center, Suite 1800
- Ownder City,St,Zip: Wailuku, 96793 96793
- Tank ID: 2a-- 92
- Installed: 10/20/2000
- **Tank Status:** **Currently In Use**
- Date Closed: Not reported
- Tank Capacity: 10000
- Substance: Gasoline
- Pipe Material: Fiberglass Reinforced Plastic
- Pipe Other Material: Not reported
- Pipe 2nd Construction: Double-Walled

- Facility ID: 9-503641
- Owner: Mid Pac Petroleum LLC
- Owner Address: 745 Fort Street, TOPA Financial Center, Suite 1800
- Ownder City,St,Zip: Wailuku, 96793 96793
- Tank ID: 87
- Installed: 10/20/2000
- **Tank Status:** **Currently In Use**
- Date Closed: Not reported
- Tank Capacity: 15000
- Substance: Gasoline
- Pipe Material: Fiberglass Reinforced Plastic
- Pipe Other Material: Not reported
- Pipe 2nd Construction: Double-Walled

- Facility ID: 9-503641
- Owner: Mid Pac Petroleum LLC
- Owner Address: 745 Fort Street, TOPA Financial Center, Suite 1800
- Ownder City,St,Zip: Wailuku, 96793 96793
- Tank ID: 2b
- Installed: 10/20/2000
- **Tank Status:** **Currently In Use**
- Date Closed: Not reported
- Tank Capacity: 6000
- Substance: Diesel
- Pipe Material: Fiberglass Reinforced Plastic
- Pipe Other Material: Not reported
- Pipe 2nd Construction: Double-Walled

Map ID / Direction / Distance / Distance (ft.) / Elevation	Site	Database(s)	EDR ID Number / EPA ID Number
2 South 1/2-1 4247 ft.	MAALAEA STORE RR1 BOX 374 MAALAEA RD WAILUKU, HI 96793	LUST UST	U003222254 N/A

Relative: Lower

Actual: 7 ft.

LUST:
- Facility ID: 9-502481
- Release ID: 930126
- Facility Status Date: 2005-08-23 00:00:00
- Facility Status: Site Cleanup Completed
- Project Officer: Takaba

UST:
- Facility ID: 9-502481
- Owner: UNO, INC DBA MAALAEA ST
- Owner Address: RR1 BOX 374 MAALAEA RD
- Ownder City,St,Zip: Wailuku, 96793 96793
- Tank ID: R-2
- Installed: 12/30/1960
- **Tank Status:** **Permanently Out of Use**
- Date Closed: 8/26/1991
- Tank Capacity: 1000
- Substance: Gasoline
- Pipe Material: Galvanized Steel
- Pipe Other Material: Not reported
- Pipe 2nd Construction: None

- Facility ID: 9-502481
- Owner: UNO, INC DBA MAALAEA ST
- Owner Address: RR1 BOX 374 MAALAEA RD
- Ownder City,St,Zip: Wailuku, 96793 96793
- Tank ID: R-1
- Installed: 12/30/1960
- **Tank Status:** **Permanently Out of Use**
- Date Closed: 8/26/1991
- Tank Capacity: 1000
- Substance: Gasoline
- Pipe Material: Galvanized Steel
- Pipe Other Material: Not reported
- Pipe 2nd Construction: None

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
HANA, MAUI	S108401332	HANA LANDFILL	HANA, MAUI	96793	SWF/LF
ISLAND OF LANAI	1008402608	LANAI CITY LANDSCAPING	3/10 MI FROM FREIGHT YARD ROAD	96793	RCRA-SQG
KAHULUI	S108820852	VECTOR CONTROL BRANCH, MAUI	54 HIGH ST, 641 MUA ST, KAHALE DR / PALAPALA ST	96793	SHWS
KALAMAULA	S106818091	KALAMAULA LANDFILL	HOAWA RD	96793	SHWS
KIHEI	1001227636	US NAVY KAHO'OLAWE ISLAND RESERVE	KAHOOLAWE ISLAND RESERVE	96753	FINDS, RCRA-LQG
KIHEI	U003222170	KIHEI SPS #3 (MENEHUNE SHORES)	N KIHEI RD	96753	UST
KIHEI	U003222168	KIHEI SPS #6 (KIHEI FIRE HOUSE)	N KIHEI RD	96753	UST
KIHEI	U003222167	KIHEI SPS #4 (YE'S ORCHARD)	N KIHEI RD	96753	UST
KIHEI	U003155105	KIHEI SPS #5 (EAST WELAKAHAO)	N KIHEI RD	96753	UST
KIHEI	1006842431	KIHEI SPS #5 (EAST WELAKAHAO)	N KIHEI RD	96753	FINDS, LUST
KIHEI	1000488449	KAHOOLAWE ISLAND	LAT 20 32' 30', LONG 156 37' 30'	96753	CERCLIS
KIHEI	U003732595	GTE HAWAIIAN TEL NORTH KIHEI REMOTE EQUIP BLDG	KA ONO ULU ESATE, LOT 15 HALALAI PLACE	96753	UST
KIHEI	U003762157	KIHEI MINIT STOP	PIILANI VILLAGE SHOPPING CENTER 233 PIIKEA AVE	96753	UST
KIHEI	U001238605	KIHEI WWTP	480 WELEKAHAO RD/PIILANI HWY	96753	LUST, UST
MAKANI	1003879124	MAKANI LDFL	MAUI	96793	CERC-NFRAP
OLOWALU	1003879127	OLOWALU LDFL	OLOWALU	96793	CERC-NFRAP
PUUNENE, MAUI	S103763652	CENTRAL MAUI LANDFILL	PUNENE, MAUI	96793	SWF/LF
WAIKAPU	1008194955	VACANT LAND TMK NO (2) 3-8-7-101	KUIHELANI HWY NEAR WAIKO RD	96793	RCRA-SQG
WAILEA	U003222380	ESTATE OF MARY HELELA	OLD COUNTRY RD	96753	UST
WAILUKU	1009295089	SUDA CONST & MASON INC	831 EHA ST	96793	ICIS
WAILUKU	1009260028	COUNTY OF MAUI	200 S HIGH ST	96793	ICIS
WAILUKU	1000244831	MAUI DISTRICT OFFICE DOE	54 HIGH ST	96793	RCRA-SQG
WAILUKU	S107769073	MAUI'S QUALITY DRY CLEANING & LAUNDRY, INC.	380 HO'OKAHI ST., #101	96793	DRYCLEANERS
WAILUKU	1006842014	HAWAIIAN CEMENT - WAIKAPU QUARRY	HONOAPIILANI HWY	96793	FINDS, LUST
WAILUKU	1004464674	WAIHEE ELEMENTARY SCHOOL	KAHEKILI HWY RT	96793	FINDS, FTTS
WAILUKU	1008171876	KEHALANI MAUKA ROADWAY PLANS	56-566 KAMEHAMEHA HWY	96793	FINDS
WAILUKU	1007092114	MAALAEA GENERATING STATION	NORTH KIHEI RD	96793	RCRA-SQG
WAILUKU	2001555343	MAALAEA HARBOR	MAALAEA HARBOR		ERNS
WAILUKU	1004686804	MAALAEA STORE	MAALAEA ROAD	96793	RCRA-SQG, FINDS
WAILUKU	1006819707	WAIALE ASH PILE	MAHALANI ST	96793	SHWS, FINDS
WAILUKU	U003402951	BOARD OF WATER SUPPLY	MOKUHAU RENOVATION END OF MOKUAHU RD	96793	UST
WAILUKU	S107769225	HAWAIIAN CHARCOAL COMPANY	SOUTH OF OLD WAIKAPU LANDFILL	96793	AIRS
WAILUKU	1009403395	KEHALANI MAUKA LARGE LOT	THE MAJORITY OF THE PROJECT	96793	FINDS
WAILUKU	U001236822	HERBERT HORITA REALTY INC.	TMK 2-3-4-13:100	96793	UST
WAILUKU	S107769222	HAWAIIAN CEMENT	TMK 3-6-04: POR. 7	96793	AIRS
WAILUKU	S108008644	Y HATA- MAUI	200 WAIEHU BEACH RD AND KAHULU BEACH RD	96793	SHWS
WAILUKU	S108008465	Y HATA- MAUI	200 WAIEHU BEACH RD AND KAHULU BEACH RD	96793	INST CONTROL
WAILUKU	1009303919	BEI HAWAII - MAUI	275 E WAIKO RD	96793	SSTS
WAILUKU	1009254377	BREWER ENVIRONMENTAL INDUSTRIES L.L.C.	275 E. WAIKO RD.	96793	ICIS

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

FEDERAL RECORDS

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/05/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: N/A
Last EDR Contact: 11/01/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

Date of Government Version: 07/05/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: N/A
Last EDR Contact: 11/01/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Quarterly

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/05/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: N/A
Last EDR Contact: 11/01/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Quarterly

NPL RECOVERY: Federal Superfund Liens
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: No Update Planned

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 06/19/2006
Date Data Arrived at EDR: 06/22/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 62

Source: EPA
Telephone: 703-603-8960
Last EDR Contact: 09/21/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 07/17/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: 703-603-8960
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

CORRACTS: Corrective Action Report
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/15/2006
Date Data Arrived at EDR: 03/17/2006
Date Made Active in Reports: 04/13/2006
Number of Days to Update: 27

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 09/05/2006
Next Scheduled EDR Contact: 12/04/2006
Data Release Frequency: Quarterly

RCRA: Resource Conservation and Recovery Act Information

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS). The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/13/2006
Date Data Arrived at EDR: 06/28/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 56

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 09/28/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

ERNS: Emergency Response Notification System
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 01/12/2006
Date Made Active in Reports: 02/21/2006
Number of Days to Update: 40

Source: National Response Center, United States Coast Guard
Telephone: 202-260-2342
Last EDR Contact: 10/24/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: Annually

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 07/03/2006
Date Data Arrived at EDR: 07/19/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 35

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 10/18/2006
Next Scheduled EDR Contact: 01/15/2007
Data Release Frequency: Annually

US ENG CONTROLS: Engineering Controls Sites List
A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 03/21/2006
Date Data Arrived at EDR: 03/27/2006
Date Made Active in Reports: 05/22/2006
Number of Days to Update: 56

Source: Environmental Protection Agency
Telephone: 703-603-8905
Last EDR Contact: 09/07/2006
Next Scheduled EDR Contact: 10/02/2006
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls
A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls

Date of Government Version: 03/21/2006
Date Data Arrived at EDR: 03/27/2006
Date Made Active in Reports: 05/22/2006
Number of Days to Update: 56

Source: Environmental Protection Agency
Telephone: 703-603-8905
Last EDR Contact: 09/07/2006
Next Scheduled EDR Contact: 10/02/2006
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 02/08/2005
Date Made Active in Reports: 08/04/2005
Number of Days to Update: 177

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 08/11/2006
Next Scheduled EDR Contact: 11/06/2006
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 01/19/2006
Date Made Active in Reports: 02/21/2006
Number of Days to Update: 33

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Varies

US BROWNFIELDS: A Listing of Brownfields Sites

Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields related cleanup activities.

Date of Government Version: 07/10/2006
Date Data Arrived at EDR: 07/13/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 55

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 09/11/2006
Next Scheduled EDR Contact: 12/11/2006
Data Release Frequency: Semi-Annually

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/14/2004
Date Data Arrived at EDR: 02/15/2005
Date Made Active in Reports: 04/25/2005
Number of Days to Update: 69

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 10/23/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 07/10/2006
Date Data Arrived at EDR: 07/21/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 47

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 11/04/2005
Date Data Arrived at EDR: 11/28/2005
Date Made Active in Reports: 01/30/2006
Number of Days to Update: 63

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 09/05/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 07/20/2006
Date Data Arrived at EDR: 07/21/2006
Date Made Active in Reports: 08/22/2006
Number of Days to Update: 32

Source: EPA
Telephone: 202-564-6064
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Quarterly

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 06/22/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 62

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002
Date Data Arrived at EDR: 04/14/2006
Date Made Active in Reports: 05/30/2006
Number of Days to Update: 46

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 10/18/2006
Next Scheduled EDR Contact: 01/15/2007
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/14/2006
Date Data Arrived at EDR: 07/18/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 50

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

Date of Government Version: 07/14/2006
Date Data Arrived at EDR: 07/18/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 50

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

SSTS: Section 7 Tracking Systems
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 05/11/2006
Date Made Active in Reports: 05/22/2006
Number of Days to Update: 11

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 10/30/2006
Next Scheduled EDR Contact: 01/15/2007
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 02/13/2006
Date Data Arrived at EDR: 04/21/2006
Date Made Active in Reports: 05/11/2006
Number of Days to Update: 20

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 07/17/2006
Next Scheduled EDR Contact: 10/16/2006
Data Release Frequency: Quarterly

PADS: PCB Activity Database System
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/07/2006
Date Data Arrived at EDR: 08/09/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 28

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 08/09/2006
Next Scheduled EDR Contact: 11/06/2006
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/10/2006
Date Data Arrived at EDR: 07/20/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 48

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Quarterly

MINES: Mines Master Index File
Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 05/16/2006
Date Data Arrived at EDR: 06/28/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 56

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 09/27/2006
Next Scheduled EDR Contact: 12/25/2006
Data Release Frequency: Semi-Annually

FINDS: Facility Index System/Facility Registry System
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/21/2006
Date Data Arrived at EDR: 07/25/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 43

Source: EPA
Telephone: N/A
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 09/05/2006
Next Scheduled EDR Contact: 12/04/2006
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2003
Date Data Arrived at EDR: 06/17/2005
Date Made Active in Reports: 08/04/2005
Number of Days to Update: 48

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 10/20/2006
Next Scheduled EDR Contact: 12/11/2006
Data Release Frequency: Biennially

STATE AND LOCAL RECORDS

SHWS: Sites List
Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Semi-Annually

SWF/LF: Permitted Landfills in the State of Hawaii
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 05/19/2004
Date Data Arrived at EDR: 05/20/2004
Date Made Active in Reports: 06/22/2004
Number of Days to Update: 33

Source: Department of Health
Telephone: 808-586-4245
Last EDR Contact: 10/24/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: Varies

LUST: Leaking Underground Storage Tank Database
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/11/2006
Date Data Arrived at EDR: 08/14/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 16

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 09/26/2006
Next Scheduled EDR Contact: 12/25/2006
Data Release Frequency: Semi-Annually

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/11/2006
Date Data Arrived at EDR: 08/14/2006
Date Made Active in Reports: 09/20/2006
Number of Days to Update: 37

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 09/26/2006
Next Scheduled EDR Contact: 12/25/2006
Data Release Frequency: Semi-Annually

SPILLS: Release Notifications
Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

INST CONTROL: Sites with Institutional Controls
Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

VCP: Voluntary Response Program Sites

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

DRYCLEANERS: Permitted Drycleaner Facility Listing
A listing of permitted drycleaner facilities in the state.

Date of Government Version: 09/07/2006
Date Data Arrived at EDR: 09/08/2006
Date Made Active in Reports: 10/13/2006
Number of Days to Update: 35

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/30/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Varies

BROWNFIELDS: Brownfields Sites

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

AIRS: List of Permitted Facilities
A listing of permitted facilities in the state.

Date of Government Version: 09/07/2006
Date Data Arrived at EDR: 09/08/2006
Date Made Active in Reports: 10/13/2006
Number of Days to Update: 35

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/30/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Varies

TRIBAL RECORDS

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 02/08/2005
Date Made Active in Reports: 08/04/2005
Number of Days to Update: 177

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 08/11/2006
Next Scheduled EDR Contact: 11/06/2006
Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 06/08/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 06/28/2006
Number of Days to Update: 19

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 01/04/2005
Date Data Arrived at EDR: 01/21/2005
Date Made Active in Reports: 02/28/2005
Number of Days to Update: 38

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 06/06/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 06/08/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 06/01/2006
Date Data Arrived at EDR: 06/23/2006
Date Made Active in Reports: 08/02/2006
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 06/01/2006
Date Data Arrived at EDR: 07/10/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Minnesota, Mississippi and North Carolina.

Date of Government Version: 01/01/2006
Date Data Arrived at EDR: 02/27/2006
Date Made Active in Reports: 03/28/2006
Number of Days to Update: 29

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Semi-Annually

INDIAN UST R4: Underground Storage Tanks on Indian Land

Date of Government Version: 01/01/2006
Date Data Arrived at EDR: 02/27/2006
Date Made Active in Reports: 03/28/2006
Number of Days to Update: 29

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

Date of Government Version: 06/01/2006
Date Data Arrived at EDR: 07/10/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

Date of Government Version: 12/02/2004
Date Data Arrived at EDR: 12/29/2004
Date Made Active in Reports: 02/04/2005
Number of Days to Update: 37

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

Date of Government Version: 06/06/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

Date of Government Version: 06/08/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land
A listing of underground storage tank locations on Indian Land.

Date of Government Version: 06/08/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 06/30/2006
Number of Days to Update: 21

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

Date of Government Version: 06/30/2006
Date Data Arrived at EDR: 07/03/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 65

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Semi-Annually

INDIAN UST R9: Underground Storage Tanks on Indian Land

Date of Government Version: 06/01/2006
Date Data Arrived at EDR: 06/23/2006
Date Made Active in Reports: 08/02/2006
Number of Days to Update: 40

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

EDR PROPRIETARY RECORDS

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: PennWell Corporation
Telephone: (800) 823-6277
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AHA Hospitals:
Source: American Hospital Association, Inc
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.
Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services
Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.
Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.
Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

GEOCHECK®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

MAALAEA MAUKA
HONOAPIILANI HIGHWAY
WAILUKU, HI 96793

TARGET PROPERTY COORDINATES

Latitude (North):	20.80400 - 20˚ 48' 14.4"
Longitude (West):	156.5115 - 156˚ 30' 41.4"
Universal Tranverse Mercator:	Zone 4
UTM X (Meters):	759028.3
UTM Y (Meters):	2302318.8
Elevation:	131 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	20156-G5 LAHAINA, HI
Most Recent Revision:	Not reported
East Map:	20156-G4 WAILUKU, HI
Most Recent Revision:	Not reported

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

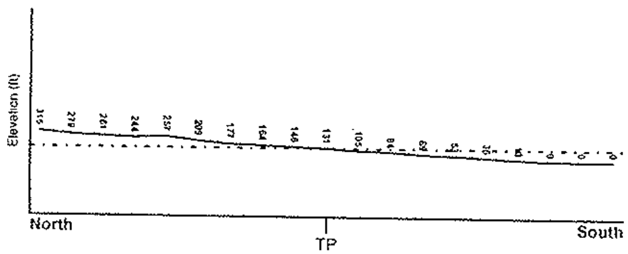
TOPOGRAPHIC INFORMATION

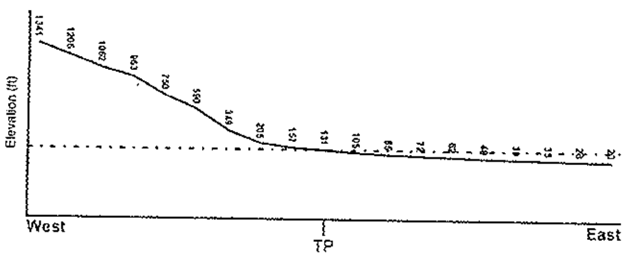
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

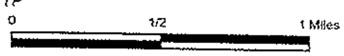
General Topographic Gradient: General ESE

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 131 ft.



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
MAUI, HI	YES - refer to the Overview Map and Detail Map
Flood Plain Panel at Target Property:	1500030235B
Additional Panels in search area:	1500030255B

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
NOT AVAILABLE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

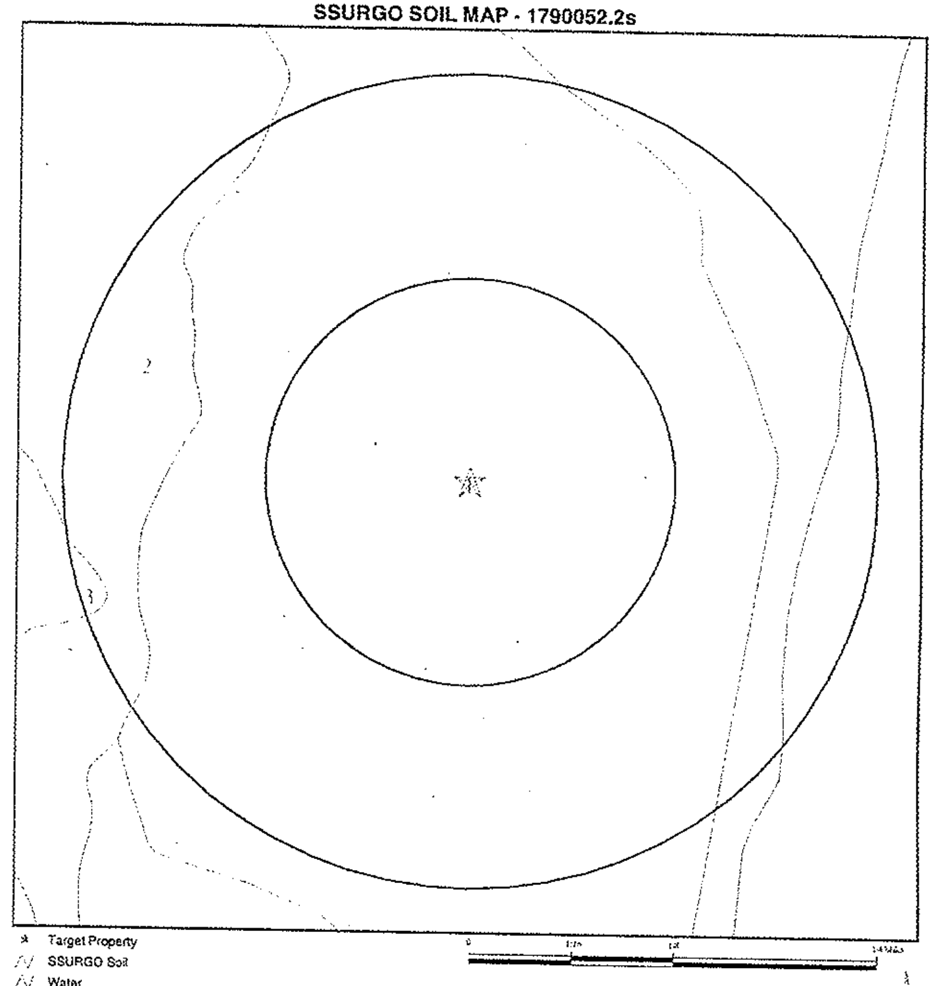
Era: -
System: -
Series: -
Code: N/A *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: -

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 1790052.2s



SITE NAME:	Maalaea Mauka	CLIENT:	Element Environmental, LLC
ADDRESS:	Honoapiilani Highway WAILUKU HI 96793	CONTACT:	Roger Aoki
		INQUIRY #:	1790052.2s
LAT/LONG:	20.8040 / 156.5115	DATE:	November 06, 2006 1:52 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: EWA

Soil Surface Texture: cobbly - silty clay

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel: MODERATE

Depth to Bedrock Min: > 0 inches

Depth to Bedrock Max: > 0 inches

Soil Layer Information

	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	18 inches	cobbly - silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Kaolinitic suffix for CL.	Max: 2.00 Min: 0.60	Max: 7.80 Min: 6.60
2	18 inches	60 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Kaolinitic suffix for CL.	Max: 2.00 Min: 0.60	Max: 7.80 Min: 6.60

Soil Map ID: 2

Soil Component Name: STONY ALLUVIAL LAND

Soil Surface Texture: extremely stony - clay loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel: MODERATE

Depth to Bedrock Min: > 0 inches

Depth to Bedrock Max: > 0 inches

Soil Layer Information

	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	10 inches	extremely stony - clay loam	Silt-Clay Materials (more than 35 pct passing No 200), Clayey Soils.	Kaolinitic suffix for MH	Max: 6.00 Min: 2.00	Max: 7.30 Min: 6.60
2	10 inches	60 inches	stratified	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Kaolinitic suffix for MH	Max: 6.00 Min: 2.00	Max: 7.30 Min: 6.60

Soil Map ID: 3

Soil Component Name: ROCK LAND

Soil Surface Texture: silty clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel: MODERATE

Depth to Bedrock Min: > 4 inches

Depth to Bedrock Max: > 10 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	4 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Kaolinitic suffix for MH	Max: 2.00 Min: 0.60	Max: 7.30 Min: 6.60
2	4 inches	8 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Kaolinitic suffix for MH	Max: 2.00 Min: 0.60	Max: 7.30 Min: 6.60
3	8 inches	20 inches	unweathered bedrock	Not reported	Not reported	Max: 0.60 Min: 0.00	Max: 0.00 Min: 0.00

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

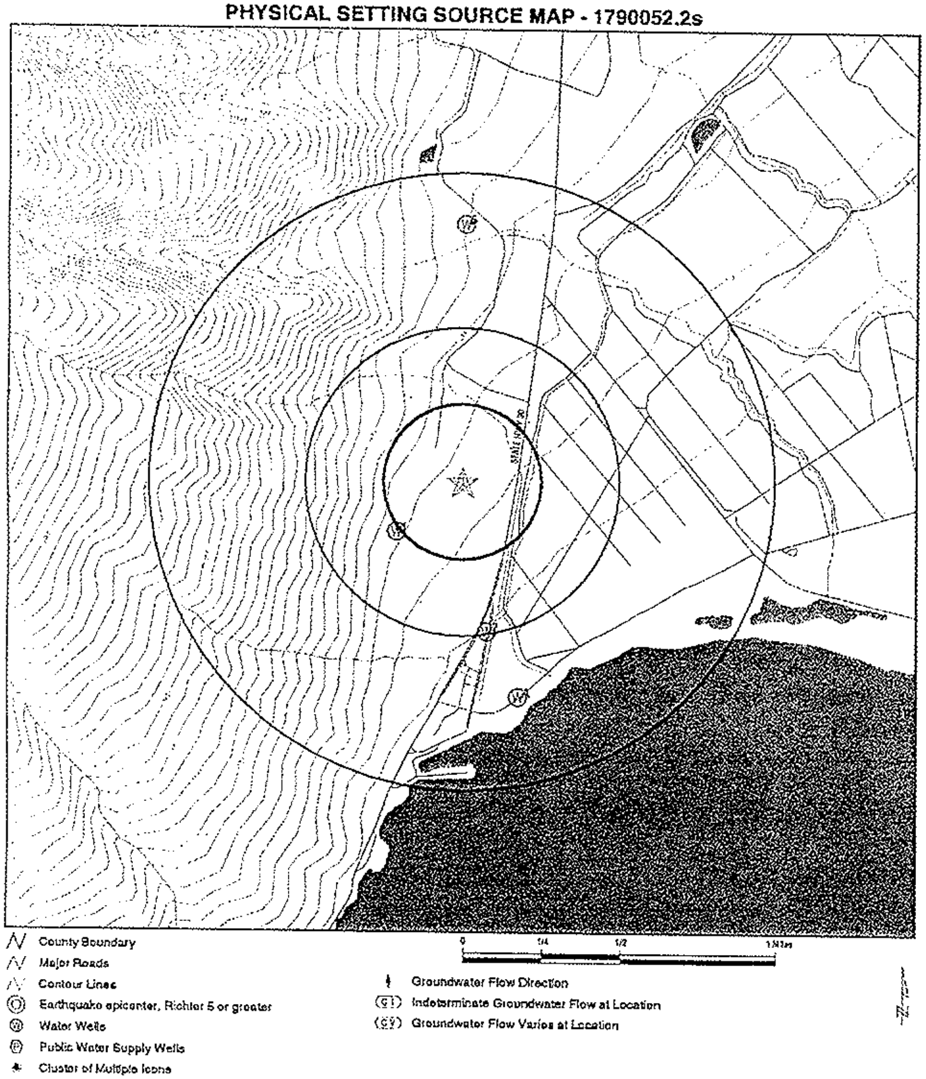
Note: PWS System location is not always the same as well location.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	HI10000848	1/4 - 1/2 Mile SW
2	HI10000823	1/4 - 1/2 Mile South
A3	HI10000810	1/2 - 1 Mile SSE
A4	HI10000809	1/2 - 1 Mile SSE
5	HI10000969	1/2 - 1 Mile North

PHYSICAL SETTING SOURCE MAP - 1790052.2s



SITE NAME: Maalaea Mauka ADDRESS: Honoapiilani Highway WAILUKU HI 96793 LAT/LONG: 20.8040 / 156.5115	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY #: 1790052.2s DATE: November 06, 2006 1:52 pm

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

		Database	EDR ID Number
1 SW 1/4 - 1/2 Mile Higher		HI WELLS	HI10000848

Wid:	6-4831-001	Island:	6
Well no:	4831-01	Well name:	Maalaea 272
Old name:	Not Reported	Yr drilled:	1965
Driller:	LAYNE INTL	Quad map:	06
Latitude27:	204818	Longitude2:	1563103
Latitude83:	204806	Longitude8:	1563053
Gps:	0	Utm:	1
Owner user:	State Dowald	Old number:	272-
Well type:	PER	Casing dia:	8
Ground el:	186	Well depth:	219
Solid case:	167	Perf case:	187
Use:	OBS	Use year:	Not Reported
Init water:	4.7		
Init head:	4.7		
Init chlor:	250		
Init cl:	250		
Test date:	Not Reported	Test gpm:	400
Test ddown:	4.0	Test chlor:	260
Test temp:	21.0	Temp unit:	C
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	4.7
Max chlor:	284	Min chlor:	Not Reported
Geology:	Tw	Pump yr:	Not Reported
Draft yr:	Not Reported	Head yr:	65
Maxchl:	Not Reported	Maxchl yr:	0
Minchl:	Not Reported	Minchl yr:	0
Bot hole:	-53	Bot solid:	-1
Bot perf:	-21	Spec capac:	100
Pump mgd:	Not Reported	Draft mgd:	Not Reported
Aquifer:	60101	Tmk:	3-6-001 014
Old aqui:	Not Reported	Aqui code:	60101
Latest hd:	4.7		
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	Not Reported
Pir:	Not Reported	Surveyor:	Not Reported
T:	0		
Pump elev:	Not Reported	Pump depth:	Not Reported

		Database	EDR ID Number
2 South 1/4 - 1/2 Mile Lower		HI WELLS	HI10000823

Wid:	6-4830-001	Island:	6
Well no:	4830-01	Well name:	Maalaea Triangle
Old name:	Not Reported	Yr drilled:	1997
Driller:	ROSCOE MOSS	Quad map:	06
Latitude27:	204801	Longitude2:	1563047
Latitude83:	204749	Longitude8:	1563037
Gps:	0	Utm:	1
Owner user:	Triangle Part	Old number:	Not Reported
Well type:	PER	Casing dia:	8
Ground el:	52	Well depth:	84

Solid case:	54	Perf case:	74
Use:	IRRLA	Use year:	97
Init water:	Not Reported		
Init head	4.37		
Init chlor:	Not Reported		
Init cl:	215		
Test date:	Not Reported	Test gpm	82
Test ddown:	0.0	Test chlor:	210
Test temp	23.3	Temp unit:	C
Pump gpm:	75		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	Tw	Pump yr:	97
Draft yr:	Not Reported	Head yr:	Not Reported
Maxchl:	Not Reported	Maxchl yr:	0
Minchl:	Not Reported	Minchl yr:	0
Bot hole:	-32	Bot solid:	-2
Bot perf:	-22	Spec capac:	Not Reported
Pump mgd:	0.108	Draft mgd:	Not Reported
Aquifer:	Not Reported	Tmk:	3-6-001:001
Old aqui:	Not Reported	Aqui code:	60101
Latest hd:	0		
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	Not Reported
Pir:	Not Reported	Surveyor:	S D DEPONTE
T:	0		
Pump elev:	-2	Pump depth:	55

A3
SSE
1/2 - 1 Mile
Lower

HI WELLS HI10000810

Wid:	6-4730-001	Island:	6
Well no	4730-01	Well name:	Tmk 3-8-14-18
Old name:	Not Reported	Yr drilled:	Not Reported
Driller	PAUL SMITH	Quad map:	06
Latitude27:	204751	Longitude2:	1563041
Latitude83:	204739	Longitude8:	1563031
Gps:	0	Ubn:	1
Owner user:	Mawson R	Old number:	Not Reported
Well type:	ROT	Casing dia:	Not Reported
Ground el:	Not Reported	Well depth:	35
Solid case:	Not Reported	Perf case:	35
Use:	Not Reported	Use year:	Not Reported
Init water:	Not Reported		
Init head:	0		
Init chlor:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Temp unit:	Not Reported
Pump gpm:	0		

Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	490
Geology:	Tw	Pump yr:	Not Reported
Draft yr:	Not Reported	Head yr:	Not Reported
Maxchl:	Not Reported	Maxchl yr:	64
Minchl:	Not Reported	Minchl yr:	Not Reported
Bot hole:	Not Reported	Bot solid:	Not Reported
Bot perf:	Not Reported	Spec capac:	Not Reported
Pump mgd:	Not Reported	Draft mgd:	Not Reported
Aquifer:	60101	Tmk:	3-8-014:018
Old aqui:	Not Reported	Aqui code:	60101
Latest hd:	0		
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	Not Reported
Pir:	Not Reported	Surveyor:	Not Reported
T:	0		
Pump elev:	Not Reported	Pump depth:	Not Reported

A4
SSE
1/2 - 1 Mile
Lower

HI WELLS HI10000809

Wid:	6-4730-002	Island:	6
Well no:	4730-02	Well name:	Tmk 3-8-14-19
Old name:	Not Reported	Yr drilled:	1956
Driller:	PACIFIC DRLG	Quad map:	06
Latitude27:	204749	Longitude2:	1563042
Latitude83:	204737	Longitude8:	1563032
Gps:	0	Ubn:	1
Owner user:	Lindberg E	Old number:	271-
Well type:	ROT	Casing dia:	6
Ground el:	15	Well depth:	45
Solid case:	20	Perf case:	Not Reported
Use:	IRR	Use year:	71
Init water:	1.8		
Init head:	1.83		
Init chlor:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Temp unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	3.8
Max chlor:	634	Min chlor:	Not Reported
Geology:	Tw	Pump yr:	Not Reported
Draft yr:	Not Reported	Head yr:	70
Maxchl:	Not Reported	Maxchl yr:	0
Minchl:	Not Reported	Minchl yr:	0
Bot hole:	-30	Bot solid:	-5
Bot perf:	Not Reported	Spec capac:	Not Reported
Pump mgd:	Not Reported	Draft mgd:	Not Reported
Aquifer:	60101	Tmk:	3-8-014:019

Old aqui:	Not Reported	Aqui code:	60101
Latest hd:	0		
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	Not Reported
Pir:	Not Reported	Surveyor:	Not Reported
T:	0		
Pump elev:	Not Reported	Pump depth:	Not Reported

5
North
1/2 - 1 Mile
Higher

HI WELLS HI10000969

Wid:	6-4930-001	Island:	6
Well no:	4930-01	Well name:	Pohakea
Old name:	Not Reported	Yr drilled:	2004
Driller:	WAILANI DRLG	Quad map:	08
Latitude27:	204910	Longitude2:	1563051
Latitude83:	204858	Longitude8:	1563041
Gps:	1	Utm:	0
Owner user:	A & B Properties	Old number:	Not Reported
Well type:	Not Reported	Casing dia:	6
Ground el:	321	Well depth:	350
Solid case:	330	Perf case:	350
Use:	MUNPR	Use year:	04
Init water:	Not Reported		
Init head:	7.43		
Init chlor:	Not Reported		
Init cl:	160		
Test date:	Not Reported	Test gpm:	316
Test ddown:	4.0	Test chlor:	160
Test temp:	72.0	Temp unit:	F
Pump gpm:	300		
Draft mgy:	Not Reported	Head feet:	7.43
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology	Tw	Pump yr:	04
Draft yr:	Not Reported	Head yr:	Not Reported
Maxchl:	Not Reported	Maxchl yr:	Not Reported
Minchl:	Not Reported	Minchl yr:	Not Reported
Bot hole:	-29	Bot solid:	-9
Bot perf:	-29	Spec capac:	Not Reported
Pump mgd:	0.432	Draft mgd:	Not Reported
Aquifer:	Not Reported	Tmk:	3-6-004:003
Old aqui:	Not Reported	Aqui code:	60101
Latest hd:	0		
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	Not Reported
Pir:	Not Reported	Surveyor:	REED M ARIYOSHI
T:	10000		
Pump elev:	-19	Pump depth:	340

AREA RADON INFORMATION

Federal EPA Radon Zone for MAUI County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 96793

Number of sites tested: 11

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.291 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map. USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Ground Water Wells
Source: Department of Land and Natural Resources
Telephone: 808-587-0242

OTHER STATE DATABASE INFORMATION

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

EDR Site Report™

MAALAEA STORE
MAALAEA ROAD
WAILUKU, HI 96793

Inquiry Number:

November 10, 2006

EDR® Environmental Data Resources Inc

The Standard in Environmental Risk Management Information

440 Wheelers Farms Road
Milford, Connecticut 06461

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

The EDR-Site Report™ is a comprehensive presentation of government filings on a facility identified in a search of over 4 million government records from more than 600 federal, state and local environmental databases. The report is divided into three sections:

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

SECTION 1: FACILITY SUMMARY

FACILITY AREA	FACILITY 1 MAALAEA STORE MAALAEA ROAD WAILUKU, HI 96793 EDR ID #1004688804 EPA #HID981656242
WASTE MANAGEMENT Facility generates hazardous waste (RCRA)	YES - p4
Facility treats, stores, or disposes of hazardous waste on-site (RCRA/TSDF)	NO
Facility has received Notices of Violations (RCRA/VIOL)	NO
Facility has been subject to RCRA administrative actions (RAATS)	NO
Facility has been subject to corrective actions (CORRACTS)	NO
Facility handles PCBs (PADS)	NO
Facility uses radioactive materials (MLTS)	NO
Facility manages registered aboveground storage tanks (AST)	NO
Facility manages registered underground storage tanks (UST)	NO
Facility has reported leaking underground storage tank incidents (LUST)	NO
Facility has reported emergency releases to the soil (ERNS)	NO
Facility has reported hazardous material incidents to DOT (HMIRS)	NO
WASTE DISPOSAL Facility is a Superfund Site (NPL)	NO
Facility has a known or suspect abandoned, inactive or uncontrolled hazardous waste site (CERCLIS)	NO
Facility has a reported Superfund Lien on it (LIENS)	NO
Facility is listed as a state hazardous waste site (SHWS)	NO
Facility has disposed of solid waste on-site (SWF/LF)	NO
MULTIMEDIA Facility uses toxic chemicals and has notified EPA under SARA Title III, Section 313 (TRIS)	NO
Facility produces pesticides and has notified EPA under Section 7 of FIFRA (SSTS)	NO
Facility manufactures or imports toxic chemicals on the TSCA list (TSCA)	NO
Facility has inspections under FIFRA, TSCA or EPCRA (FTTS)	NO
Facility is listed in EPA's index system (FINDS)	YES - p5
Facility is listed in a county/local unique database (LOCAL)	NO
POTENTIAL SUPERFUND LIABILITY Facility has a list of potentially responsible parties PRP	NO
TOTAL (YES)	2

SECTION 2: FACILITY DETAIL REPORTS

WASTE MANAGEMENT

Facility generates hazardous waste

DATABASE: Resource Conservation and Recovery Information (RCRAInfo)

MAALAEA STORE
MAALAEA ROAD
WAILUKU, HI 96793
EDR ID #1004688804

Facility Name:	MAALAEA STORE MAALAEA ROAD WAILUKU, HI 96793
Mailing Address:	RR-1 BOX THIRD HUNDRED SEVENTY WAILUKU MAUI, HI 96793
Contact:	KATHLEEN UNO (808) 244-9888
EPA-ID:	HID981656242
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: - generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or - generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: - 1 kg or less of acutely hazardous waste; or - 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or - generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: - 1 kg or less of acutely hazardous waste; or - 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste
Legal Status:	Private
Owner:	JAMES UNO SR NOT REQUIRED NOT REQUIRED, ME 41555 - 5121 (415) 555-1212

SECTION 2: FACILITY DETAIL REPORTS
...Continued...

MULTIMEDIA

Facility is listed in EPA's index system

DATABASE: Facility Index System (FINDS)

MAALAEA STORE
MAALAEA ROAD
WAILUKU, HI 96793
EDR ID #1004688804

This site is listed in the Federal FINDS database. The FINDS database may contain references to records from government databases included elsewhere in the report.
Please note: the FINDS database may also contain references to out of date records formerly associated with the site.

Registry ID: 110007502078
Facility Name: MAALAEA STORE
Facility Address: MAALAEA ROAD
WAILUKU, HI 96793
Facility County: MAUI
EPA Region: 09
Fed. Gov. Facility: No
Indian Tribal Land: No
EPA Records Indicate Facility Is Listed In

The HI-ECS (Hawaii Environmental Compliance Program) is the Hawaii state regulatory program relating to environmental compliance and hazardous materials that ensures that program areas and facilities are in compliance with environmental regulations

HI-UST (Hawaii - Underground Storage Tank). Hawaii Underground Storage Tank Program regulates underground storage tanks which store petroleum or hazardous substances and offers documents and data products for downloading.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

Prg. Sys. ID: X104495
Supplemental Interest: Not reported
Facility SIC Codes: Not reported
Facility NAICS Codes: Not reported

Prg. Sys. ID: 9-502481
Supplemental Interest: Not reported
Facility SIC Codes: Not reported
Facility NAICS Codes: Not reported

Prg. Sys. ID: HID981656242
Supplemental Interest: Not reported
Facility SIC Codes: Not reported
Facility NAICS Codes: 441222

Alternative name: MAALAEA STORE

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

To maintain currency of the following federal, state and local databases, EDR contacts the appropriate government agency on a monthly or quarterly basis as required.

Elapsed ASTM days: Provides confirmation that this report meets or exceeds the 90-day updating requirement of the ASTM standard.

WASTE MANAGEMENT

RCRA: Resource Conservation and Recovery Act Information
Source: EPA
Telephone: 800-424-9346
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS). The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/13/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/28/2006
Date of Next Scheduled Update: 11/20/2006

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2003
Database Release Frequency: Biennially
Date of Last EDR Contact: 10/20/2006
Date of Next Scheduled Update: 12/11/2006

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 09/05/2006
Date of Next Scheduled Update: 12/04/2006

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/15/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/05/2006
Date of Next Scheduled Update: 12/04/2006

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-566-0500
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/07/2006
Database Release Frequency: Annually
Date of Last EDR Contact: 08/09/2006
Date of Next Scheduled Update: 11/06/2006

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/10/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

HI UST: Underground Storage Tank Database
Source: Department of Health
Telephone: 808-586-4228
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/11/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/26/2006
Date of Next Scheduled Update: 12/25/2006

HI LUST: Leaking Underground Storage Tank Database
Source: Department of Health
Telephone: 808-586-4228
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/11/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/26/2006
Date of Next Scheduled Update: 12/25/2006

ERNS: Emergency Response Notification System
Source: National Response Center, United States Coast Guard
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2005
Database Release Frequency: Annually
Date of Last EDR Contact: 10/24/2006
Date of Next Scheduled Update: 01/22/2007

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4555
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 07/03/2006
Database Release Frequency: Annually
Date of Last EDR Contact: 10/18/2006
Date of Next Scheduled Update: 01/15/2007

WASTE DISPOSAL

NPL: National Priority List
Source: EPA
Telephone: Not reported
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/05/2006
Date Made Active at EDR: 09/12/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/02/2006
Elapsed ASTM Days: 41
Date of Last EDR Contact: 11/01/2006

Proposed NPL: Proposed National Priority List Sites
Source: EPA
Telephone: Not reported

Date of Government Version: 07/05/2006
Date Made Active at EDR: 09/12/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/02/2006
Elapsed ASTM Days: 41
Date of Last EDR Contact: 11/01/2006

DELISTED NPL: National Priority List Deletions
Source: EPA
Telephone: Not reported
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/05/2006
Date Made Active at EDR: 09/12/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/02/2006
Elapsed ASTM Days: 41
Date of Last EDR Contact: 11/01/2006

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-603-8960
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 06/19/2006
Date Made Active at EDR: 08/23/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 06/22/2006
Elapsed ASTM Days: 62
Date of Last EDR Contact: 09/21/2006

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Source: EPA
Telephone: 703-603-8960
Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 07/17/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/18/2006
Date of Next Scheduled Update: 12/18/2006

ROD: Records Of Decision
Source: EPA
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 07/10/2006
Database Release Frequency: Annually
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

NPL RECOVERY: Federal Superfund Liens
Source: EPA
Telephone: 202-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Made Active at EDR: 03/30/1994
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 02/02/1994
Elapsed ASTM Days: 56
Date of Last EDR Contact: 08/21/2006

HI SHWS: Sites List
Source: Department of Health
Telephone: 808-586-4249
Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 07/24/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

...Continued...

HI SWF/LF: Permitted Landfills in the State of Hawaii
Source: Department of Health
Telephone: 808-586-4245
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 05/19/2004
Database Release Frequency: Varies
Date of Last EDR Contact: 10/24/2006
Date of Next Scheduled Update: 01/22/2007

MULTIMEDIA

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-566-0250
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2004
Database Release Frequency: Annually
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

SSTS: Section 7 Tracking Systems
Source: EPA
Telephone: 202-564-4203
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2004
Database Release Frequency: Annually
Date of Last EDR Contact: 11/07/2006
Date of Next Scheduled Update: 01/15/2007

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-5521
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002
Database Release Frequency: N/A
Date of Last EDR Contact: 10/18/2006
Date of Next Scheduled Update: 01/15/2007

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/14/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/18/2006
Date of Next Scheduled Update: 12/18/2006

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA
Telephone: 202-566-1667

Date of Government Version: 07/14/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/18/2006
Date of Next Scheduled Update: 12/18/2006

FINDS: Facility Index System/Facility Registry System
Source: EPA
Telephone: Not reported
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/21/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

RMP: Risk Management Plans
Source: Environmental Protection Agency
Telephone: 202-564-8600
When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 06/01/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 08/21/2006
Date of Next Scheduled Update: 11/20/2006

STORMWATER: Storm Water General Permits
Source: Environmental Protection Agency
Telephone: 202-564-0746
A listing of all facilities with Storm Water General Permits.

Date of Government Version: 08/02/2005
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/31/2006
Date of Next Scheduled Update: 01/01/2007

US ENG CONTROLS: Engineering Controls Sites List
Source: Environmental Protection Agency
Telephone: 703-603-8905
A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 03/21/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 09/07/2006
Date of Next Scheduled Update: 10/02/2006

US INST CONTROL: Sites with Institutional Controls
Source: Environmental Protection Agency
Telephone: 703-603-8905
A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 03/21/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 09/07/2006
Date of Next Scheduled Update: 10/02/2006

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
Source: EPA Region 1
Telephone: 617-918-1313
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 08/07/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 08/21/2006
Date of Next Scheduled Update: 11/20/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES
...Continued...

HI SPILLS: Release Notifications
Source: Department of Health
Telephone: 808-586-4249
Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI INST CONTROL: Sites with Institutional Controls
Source: Department of Health
Telephone: 808-586-4249
Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI VCP: Voluntary Response Program Sites
Source: Department of Health
Telephone: 808-586-4249

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI DRYCLEANERS: Permitted Drycleaner Facility Listing
Source: Department of Health
Telephone: 808-586-4200
A listing of permitted drycleaner facilities in the state.

Date of Government Version: 09/07/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 10/30/2006
Date of Next Scheduled Update: 01/29/2007

HI BROWNFIELDS: Brownfields Sites
Source: Department of Health
Telephone: 808-586-4249

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI AIRS: List of Permitted Facilities
Source: Department of Health
Telephone: 808-586-4200
A listing of permitted facilities in the state.

Date of Government Version: 09/07/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 10/30/2006
Date of Next Scheduled Update: 01/29/2007

POTENTIAL SUPERFUND LIABILITY

PRP: Potentially Responsible Parties
Source: EPA
Telephone: 202-564-6064
A listing of verified Potentially Responsible Parties

Date of Government Version: 07/20/2006
Database Release Frequency: Quarterly

Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

EDR Site Report™

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793

Inquiry Number:

November 10, 2006

EDR® Environmental Data Resources Inc

The Standard in Environmental Risk Management Information

440 Wheelers Farms Road
Milford, Connecticut 06461

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with any questions or comments.

SECTION 1: FACILITY SUMMARY

AREA	FACILITY 1 HAWAIIAN CEMENT - WAIKAPU QUARRY HONOAPIILANI HWY WAILUKU, HI 96793 EDR ID #1006842014 EPA #110014034035
WASTE MANAGEMENT Facility generates hazardous waste (RCRA)	NO
Facility treats, stores, or disposes of hazardous waste on-site (RCRA/TSDF)	NO
Facility has received Notices of Violations (RCRA/VIOL)	NO
Facility has been subject to RCRA administrative actions (RAATS)	NO
Facility has been subject to corrective actions (CORRACTS)	NO
Facility handles PCBs (PADS)	NO
Facility uses radioactive materials (MLTS)	NO
Facility manages registered aboveground storage tanks (AST)	NO
Facility manages registered underground storage tanks (UST)	NO
Facility has reported leaking underground storage tank incidents (LUST)	YES - p4
Facility has reported emergency releases to the soil (ERNS)	NO
Facility has reported hazardous material incidents to DOT (HMIRS)	NO
WASTE DISPOSAL Facility is a Superfund Site (NPL)	NO
Facility has a known or suspect abandoned, inactive or uncontrolled hazardous waste site (CERCLIS)	NO
Facility has a reported Superfund Lien on it (LIENS)	NO
Facility is listed as a state hazardous waste site (SHWS)	NO
Facility has disposed of solid waste on-site (SWF/LF)	NO
MULTIMEDIA Facility uses toxic chemicals and has notified EPA under SARA Title III, Section 313 (TRIS)	NO
Facility produces pesticides and has notified EPA under Section 7 of FIFRA (SSTS)	NO
Facility manufactures or imports toxic chemicals on the TSCA list (TSCA)	NO
Facility has inspections under FIFRA, TSCA or EPCRA (FTTS)	NO
Facility is listed in EPA's index system (FINDS)	YES - p5
Facility is listed in a county/local unique database (LOCAL)	YES - p6
POTENTIAL SUPERFUND LIABILITY Facility has a list of potentially responsible parties PRP	NO
TOTAL (YES)	3

SECTION 2: FACILITY DETAIL REPORTS

WASTE MANAGEMENT

Facility has reported leaking underground storage tank incidents

DATABASE: Leaking Petroleum Storage Tank Database (LUST)

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793
EDR ID #1006842014

LUST:

Facility ID:	9-502529
Release ID:	950015
Facility Status Date:	1995-05-16 00:00:00
Facility Status:	Site Cleanup Completed
Project Officer:	Brewer

MULTIMEDIA

Facility is listed in EPA's index system

DATABASE: Facility Index System (FINDS)

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793
EDR ID #1006842014

This site is listed in the Federal FINDS database. The FINDS database may contain references to records from government databases included elsewhere in the report.
Please note: the FINDS database may also contain references to out of date records formerly associated with the site.

Registry ID:	110014034035
Facility Name:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Facility Address:	HONOAPIILANI HWY WAILUKU, HI 96793
Facility County:	MAUI
EPA Region:	09
Fed. Gov. Facility:	No
Indian Tribal Land:	Not reported

EPA Records Indicate Facility Is Listed In
HI-UST (Hawaii - Underground Storage Tank). Hawaii Underground Storage Tank Program regulates underground storage tanks which store petroleum or hazardous substances and offers documents and data products for downloading.

Prg. Sys. ID:	9-502529
Supplemental Interest:	Not reported
Facility SIC Codes:	Not reported
Facility NAICS Codes:	Not reported

Alternative name. HAWAIIAN CEMENT - WAIKAPU QUARRY

MULTIMEDIA

Facility is listed in a county/local unique database

DATABASE: State/County (LOCAL)

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793
EDR ID #1006842014

Database:
HI FINANCIAL ASSURANCE:

edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use

SECTION 2: FACILITY DETAIL REPORTS

...Continued...

All Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

To maintain currency of the following federal, state and local databases, EDR contacts the appropriate government agency on a monthly or quarterly basis as required.

Elapsed ASTM days: Provides confirmation that this report meets or exceeds the 90-day updating requirement of the ASTM standard.

WASTE MANAGEMENT

RCRA: Resource Conservation and Recovery Act Information

Source: EPA
Telephone: 800-424-9346

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS). The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/13/2006 | Date of Last EDR Contact: 09/28/2006
Database Release Frequency: Quarterly | Date of Next Scheduled Update: 11/20/2006

BRS: Biennial Reporting System

Source: EPA/NTIS
Telephone: 800-424-9346

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities

Date of Government Version: 12/31/2003 | Date of Last EDR Contact: 10/20/2006
Database Release Frequency: Biennially | Date of Next Scheduled Update: 12/11/2006

RAATS: RCRA Administrative Action Tracking System

Source: EPA
Telephone: 202-564-4104

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995 | Date of Last EDR Contact: 09/05/2006
Database Release Frequency: No Update Planned | Date of Next Scheduled Update: 12/04/2006

CORRACTS: Corrective Action Report

Source: EPA
Telephone: 800-424-9346

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/15/2006 | Date of Last EDR Contact: 09/05/2006
Database Release Frequency: Quarterly | Date of Next Scheduled Update: 12/04/2006

PADS: PCB Activity Database System

Source: EPA
Telephone: 202-566-0500

PCB Activity Database. PADS identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/07/2006 | Date of Last EDR Contact: 08/09/2006
Database Release Frequency: Annually | Date of Next Scheduled Update: 11/06/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

...Continued...

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/10/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

HI UST: Underground Storage Tank Database
Source: Department of Health
Telephone: 808-586-4228
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/11/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/26/2006
Date of Next Scheduled Update: 12/25/2006

HI LUST: Leaking Underground Storage Tank Database
Source: Department of Health
Telephone: 808-586-4228
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/11/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/26/2006
Date of Next Scheduled Update: 12/25/2006

ERNS: Emergency Response Notification System
Source: National Response Center, United States Coast Guard
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2005
Database Release Frequency: Annually
Date of Last EDR Contact: 10/24/2006
Date of Next Scheduled Update: 01/22/2007

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4555
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 07/03/2006
Database Release Frequency: Annually
Date of Last EDR Contact: 10/16/2006
Date of Next Scheduled Update: 01/15/2007

WASTE DISPOSAL

NPL: National Priority List
Source: EPA
Telephone: Not reported
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/05/2006
Date Made Active at EDR: 09/12/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/02/2006
Elapsed ASTM Days: 41
Date of Last EDR Contact: 11/01/2006

Proposed NPL: Proposed National Priority List Sites
Source: EPA
Telephone: Not reported

Date of Government Version: 07/05/2006
Date Made Active at EDR: 09/12/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/02/2006
Elapsed ASTM Days: 41
Date of Last EDR Contact: 11/01/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

...Continued...

DELISTED NPL: National Priority List Deletions
Source: EPA
Telephone: Not reported
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/05/2006
Date Made Active at EDR: 09/12/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/02/2006
Elapsed ASTM Days: 41
Date of Last EDR Contact: 11/01/2006

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-603-8960
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 08/19/2006
Date Made Active at EDR: 08/23/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 06/22/2006
Elapsed ASTM Days: 62
Date of Last EDR Contact: 09/21/2006

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Source: EPA
Telephone: 703-603-8960
Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 07/17/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/18/2006
Date of Next Scheduled Update: 12/18/2006

ROD: Records Of Decision
Source: EPA
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 07/10/2006
Database Release Frequency: Annually
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

NPL RECOVERY: Federal Superfund Liens
Source: EPA
Telephone: 202-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Made Active at EDR: 03/30/1994
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 02/02/1994
Elapsed ASTM Days: 56
Date of Last EDR Contact: 08/21/2006

HI SHWS: Sites List
Source: Department of Health
Telephone: 808-586-4249
Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 07/24/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI SWF/LF: Permitted Landfills in the State of Hawaii
Source: Department of Health
Telephone: 808-586-4245
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 05/19/2004 | Date of Last EDR Contact: 10/24/2006
Database Release Frequency: Varies | Date of Next Scheduled Update: 01/22/2007

MULTIMEDIA

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-566-0250
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2004 | Date of Last EDR Contact: 09/22/2006
Database Release Frequency: Annually | Date of Next Scheduled Update: 12/18/2006

SSTS: Section 7 Tracking Systems
Source: EPA
Telephone: 202-564-4203
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2004 | Date of Last EDR Contact: 11/07/2006
Database Release Frequency: Annually | Date of Next Scheduled Update: 01/15/2007

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-5521
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002 | Date of Last EDR Contact: 10/16/2006
Database Release Frequency: N/A | Date of Next Scheduled Update: 01/15/2007

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/14/2006 | Date of Last EDR Contact: 09/18/2006
Database Release Frequency: Quarterly | Date of Next Scheduled Update: 12/18/2006

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA
Telephone: 202-566-1667

Date of Government Version: 07/14/2006 | Date of Last EDR Contact: 09/18/2006
Database Release Frequency: Quarterly | Date of Next Scheduled Update: 12/18/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES
...Continued...

FINDS: Facility Index System/Facility Registry System
Source: EPA
Telephone: Not reported
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/21/2006 | Date of Last EDR Contact: 10/02/2006
Database Release Frequency: Quarterly | Date of Next Scheduled Update: 01/01/2007

RMP: Risk Management Plans
Source: Environmental Protection Agency
Telephone: 202-564-8600
When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 06/01/2006 | Date of Last EDR Contact: 08/21/2006
Database Release Frequency: Varies | Date of Next Scheduled Update: 11/20/2006

STORMWATER: Storm Water General Permits
Source: Environmental Protection Agency
Telephone: 202-564-0746
A listing of all facilities with Storm Water General Permits.

Date of Government Version: 06/02/2005 | Date of Last EDR Contact: 10/31/2006
Database Release Frequency: Quarterly | Date of Next Scheduled Update: 01/01/2007

US ENG CONTROLS: Engineering Controls Sites List
Source: Environmental Protection Agency
Telephone: 703-603-8905
A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 03/21/2006 | Date of Last EDR Contact: 09/07/2006
Database Release Frequency: Varies | Date of Next Scheduled Update: 10/02/2006

US INST CONTROL: Sites with Institutional Controls
Source: Environmental Protection Agency
Telephone: 703-603-8905
A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 03/21/2006 | Date of Last EDR Contact: 09/07/2006
Database Release Frequency: Varies | Date of Next Scheduled Update: 10/02/2006

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
Source: EPA Region 1
Telephone: 617-918-1313
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 09/07/2006 | Date of Last EDR Contact: 08/21/2006
Database Release Frequency: Varies | Date of Next Scheduled Update: 11/20/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

...Continued...

HI SPILLS: Release Notifications
Source: Department of Health
Telephone: 808-586-4249
Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI INST CONTROL: Sites with Institutional Controls
Source: Department of Health
Telephone: 808-586-4249
Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI VCP: Voluntary Response Program Sites
Source: Department of Health
Telephone: 808 586-4249

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI DRYCLEANERS: Permitted Drycleaner Facility Listing
Source: Department of Health
Telephone: 808-586-4200
A listing of permitted drycleaner facilities in the state.

Date of Government Version: 09/07/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 10/30/2006
Date of Next Scheduled Update: 01/29/2007

HI BROWNFIELDS: Brownfields Sites
Source: Department of Health
Telephone: 808-586-4249

Date of Government Version: 07/24/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI AIRS: List of Permitted Facilities
Source: Department of Health
Telephone: 808-586-4200
A listing of permitted facilities in the state.

Date of Government Version: 09/07/2006
Database Release Frequency: Varies

Date of Last EDR Contact: 10/30/2006
Date of Next Scheduled Update: 01/29/2007

POTENTIAL SUPERFUND LIABILITY

PRP: Potentially Responsible Parties
Source: EPA
Telephone: 202-564-6064
A listing of verified Potentially Responsible Parties

Date of Government Version: 07/20/2006
Database Release Frequency: Quarterly

Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

EDR® Environmental Data Resources Inc

"Linking Technology with Tradition"®

Sanborn® Map Report

Ship To: Roger Aoki
Element Environmental ,
95-1038 Kihene Street
Mililani, HI 96789

Customer Project: NA
8013084BRU 808-479-3881

Order Date: 11/6/2006 **Completion Date:** 11/6/2006
Inquiry #: 1790052.3
P.O. #: NA
Site Name: Maalaea Mauka
Address: Honoapiilani Highway
City/State: WAILUKU, HI 96793
Cross Streets:

This document reports that the largest and most complete collection of Sanborn fire insurance maps has been reviewed based on client supplied information, and fire insurance maps depicting the target property at the specified address were not identified.

NO COVERAGE

EDR Historical Topographic Map Report

Maalaea Mauka
Honoapiilani Highway
WAILUKU, HI 96793

Inquiry Number: 1790052.4

November 06, 2006

EDR® Environmental Data Resources Inc

The Standard in Environmental Risk Management Information

440 Wheelers Farms Rd
Milford, Connecticut 06461

Nationwide Customer Service

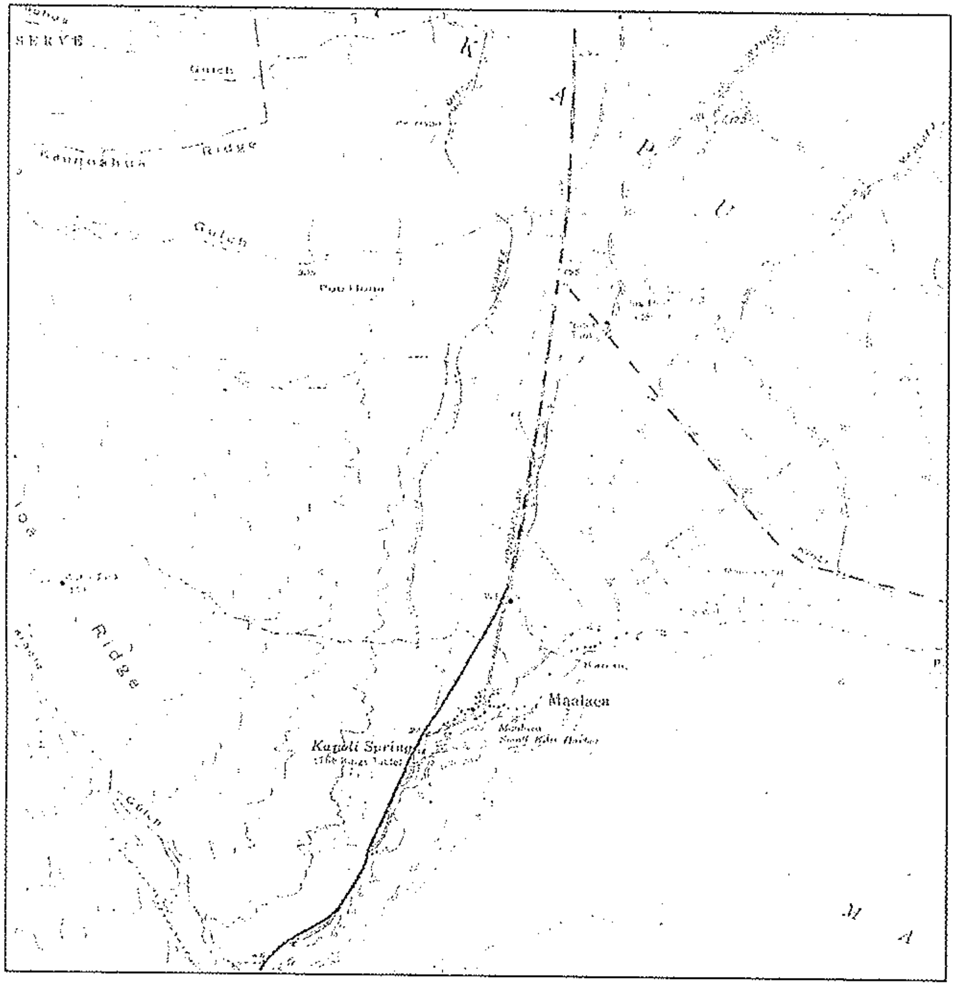
Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

EDR Historical Topographic Map Report

Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

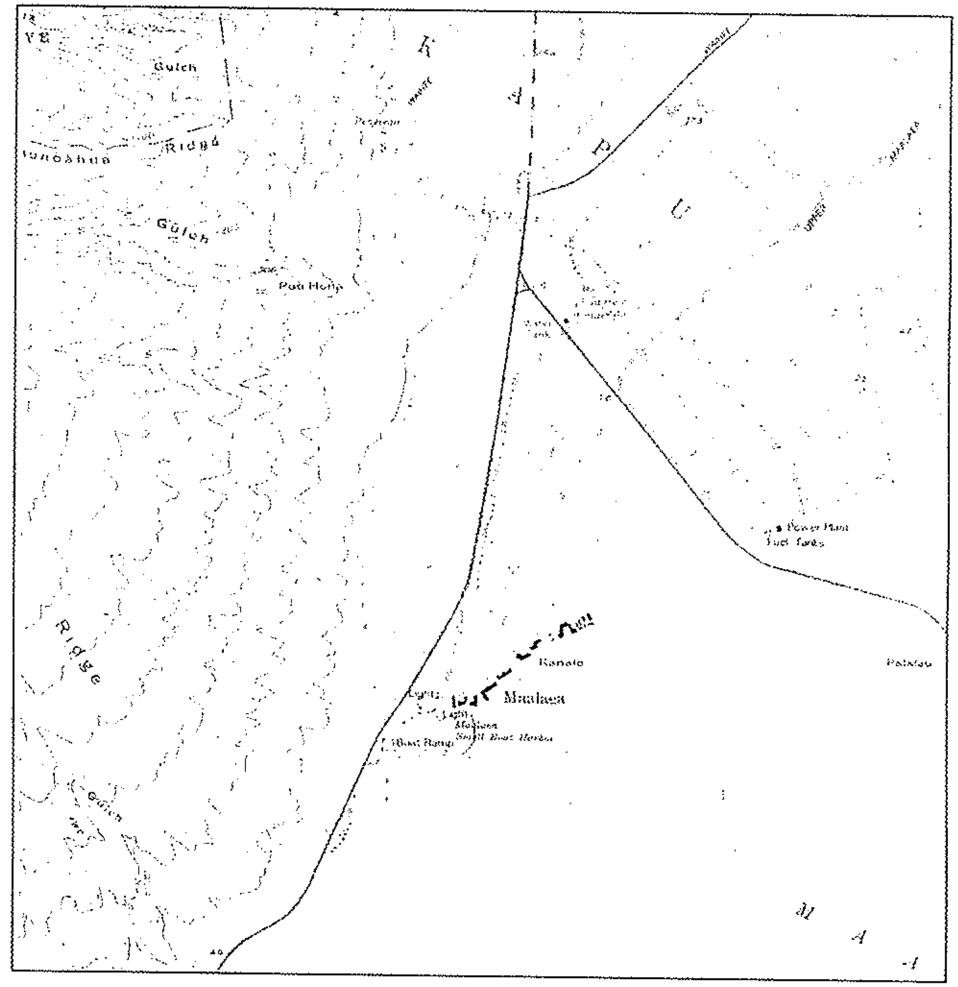
Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Historical Topographic Map



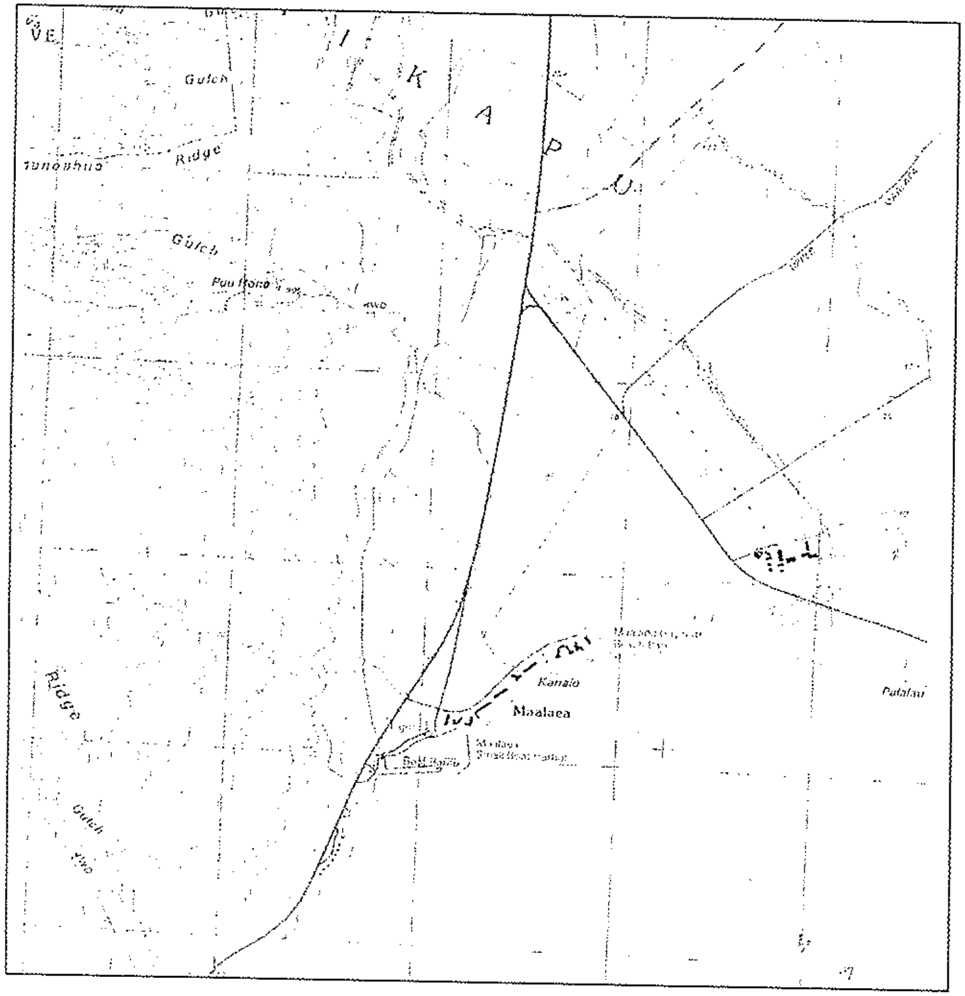
TARGET QUAD NAME: Maalaea, HI MAP YEAR: 1954 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Maalaea Mauka ADDRESS: Honoapiilani Highway WAILUKU, HI 96793 LAT/LONG: 20.804 / 156.5115	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY#: 1790052.4 RESEARCH DATE: 11/06/2006

Historical Topographic Map



TARGET QUAD NAME: Maalaea, HI MAP YEAR: 1983 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Maalaea Mauka ADDRESS: Honoapiilani Highway WAILUKU, HI 96793 LAT/LONG: 20.804 / 156.5115	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY#: 1790052.4 RESEARCH DATE: 11/06/2006

Historical Topographic Map



N ↑	TARGET QUAD NAME: Maalaea, HI MAP YEAR: 1996 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Maalaea Mauka ADDRESS: Honoapiilani Highway WAILUKU, HI 96793 LAT/LONG: 20.804 / 156.5115	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY#: 1790052.4 RESEARCH DATE: 11/06/2006

APPENDIX C

User Questionnaire

Site Evaluation Questionnaire

1. Date of Inquiry: November 2, 2006	
2. Facility or Project Name: Maalaea Properties: Maalaea Mauka, 710-acre site and 909-acre site.	
3. Facility Address: TMK (2) 3-6-001 Parcel 016; (2) 3-6-004 Parcels 3 and 6; (2) 3-6-002 Parcels 1 and 3 in Wailuku, Maui, Hawaii	
4. Describe activities that occur on the Subject Property: Agriculture: former sugar cane and pineapple, cattle grazing.	
5. Name, title, address, and phone number of the person conducting the interview: Roger Aoki, Element Environmental LLC, Senior Environmental Engineer, (808) 479-3881	
6a. Name and Title of Person Interviewed: Steven J. Kikuchi	6b. Telephone number: 209-481-8778
7a. How many years has the person being interviewed been familiar with the site: 3 years	7b. What is his or her association with the site: Partner of Maalaea Properties, Owner
8a. Are there individuals who have greater knowledge of the Subject Property that are available for interview? Yes.	8b. If so, please provide names and telephone numbers: Mr. Avery Chumbley, President of Wailuku Agribusiness, former owner of the site. Mr. Alex Franco, Manager of Maui Cattle Company, user of the site.
9a. Is the Subject Property or any adjoining property currently used, or has it been used in the past, for an industrial or manufacturing use? No	9b. If so, please provide a description of those activities below: N/A

10a. What is the source of Potable Water at the Subject Property? The Waihee Flume. Also one water well within 710-acre site. Water resources are maintained by Wailuku Agribusiness	10b. How is sewerage provided to the Subject Property (e.g., city, private)? None	10c. How is electricity provided to the Subject Property (electric company, private)? None
10d. Is there any gas service provided to the Subject Property? If so, who provides the service? None	10e. If water is provided by well, has the well been designated as contaminated by any governmental or health agency? No	
10f. Are there backflow preventers associated with the water system at the Subject Property? No		

11a. Does the facility generate or store, or has it ever generated or stored hazardous wastes? No.	11b. If so, where are, or were, the hazardous wastes generated and/or stored? How are these wastes disposed of? N/A
12a. Does the Subject Property generate, use, or store hazardous materials including pesticides, lead-acid batteries, paints, medical wastes, etc.? No.	12b. If so, where are these materials generated, used, and/or stored? N/A
13a. Does the Subject Property generate, use, or store petroleum products, including petroleum stored in pipelines? No	13b. If so, where are the petroleum products generated, used, and/or stored on site? N/A
14a. Have there ever been any on-site accumulation points for wastes? No	14b. If so, where have they been? N/A
15a. Has there been dirt fill brought on to the site? No If so, did the material originate from a contaminated site or unknown origin? N/A	15b. If contaminated soil or soil from an unknown origin has been used as fill material, where was it placed? N/A

16a. Are there currently, or have there been, any pits, ponds, or lagoons on the property or adjacent properties that have been used in connection with waste treatment or waste disposal (i.e. trash burning, pits, collection basins, etc.)? No.	16b. If so, where are, or were, they located? N/A	16c. Are there any permits associated with these facilities (NPDES, solid waste, RCRA)? N/A
17. Are there, or were there, any of the following on the Subject Property?	If so, where are, or were, they located?	Are there any chemical releases associated with these items or activities?
a. Aboveground storage tanks No	N/A	N/A
b. Underground storage tanks No	"	
c. Oil-separators No	"	
d. Septic tanks No	"	
e. Waste piles No	"	
f. Polychlorinated biphenyl (PCB)-containing equipment (including transformers, electrical equipment, hydraulic equipment, etc.) No		

g. Outdoor material storage areas No		
h. Painting and/or sandblasting operations No		
i. Drums or drum storage No		
j. Landfills No		
k. Wells (including monitoring wells, injection wells, water wells, etc.) One groundwater well	Near southwestern reservoir at 710-site	No
l. Lead based paints No		
m. Suspected asbestos containing materials No		
n. Buried objects No		
o. Pesticides and/or herbicides No		
p. Medical or biological wastes No		
q. Ordnance No		
r. Radioactive materials No		
s. Mixed wastes No		
t. Wash facilities No		
u. Radon No		
v. Heavy metals No		

18a. Are there any deteriorated painted surfaces on the Subject Property? No	18b. If so, where are these surface located? N/A
19a. Are there any stained sinks or floor drains? No	19b. If so, where are they located? N/A
20a. Is there any evidence of chemical spills or releases on the Subject Property? No	N/A
21a. Is there any evidence of improper disposal of solid or hazardous waste at the Subject Property? No	21b. If so, where are these wastes located? N/A
22a. Is there any evidence of any discolored soil on the Subject Property? No	22b. If so, where are these soils located? N/A
23a. Is there any evidence of any stressed or unseasonably dead vegetation on the Subject Property? No	23b. If so, where was the dead or stressed vegetation observed? N/A
24a. Are there any noxious odors associated with the Subject Property? No	24b. If so, where were the noxious odors observed? N/A

25a. Are there any sensitive receptors including protected or endangered natural resources at the Subject Property? No	25b. If so, what are they? N/A
26a. Are there any cultural resources at the Subject Property? Yes.	26b. If so, what are they? There is a burial site and various other archeological sites as documented in the Archeological Inventory Survey by Cultural Surveys Hawaii (Robins et al) as revised January 2000
27a. Are there any surface water bodies at the Subject Property? Two reservoirs and one flume-- One reservoir located at the top (northwestern end) of the view plane of the 710-acre site.	27b. If so, where are they located? The second reservoir is located near the located at the southwestern end of the 710-acre site. Both reservoirs are associates with agricultural irrigation.
28. Are there any air permits currently or planned to be in use at the Subject Property? No	29. What is the estimated depth to groundwater at the Subject Property? Unknown
30a. Are there any areas on site that have been identified as requiring on-going monitoring or additional investigation by the USEPA, HDOH, or other agency including installation restoration program sites and/or areas of concern and environmental compliance sites that have not been issued a NFRAP or a letter of concurrence regarding no further action (e.g., sites that are still considered open and require additional work)? No	30b. If so, where are they located and what is the nature of the monitoring/investigation? N/A

31. Are there any Environmental Liens or activity and use limitations on the Subject Property? No
32. Do you have any specialized knowledge, related to environmental issues of the Subject Property? No.
33. Do you any additional commonly known or reasonable ascertainable information, related to environmental issues of the Subject Property? No.
34. Do you know of any valuation reduction for environmental issues of the Subject Property? No
35. What is the reason for performing the Phase I ESA? Confirm that no hazardous materials or disposal exist.

C. BREWER AND COMPANY, LIMITED

Real Estate and Corporate Development

FACSIMILE TRANSMITTAL SHEET

TO: Roger Aoki | FROM: Avery B. Chumbley, Executive Vice President

COMPANY: 626-3881 | DATE: 10-31-06

FAX NUMBER: | TOTAL NO. OF PAGES (INCLUDING COVER):

PHONE NUMBER: | COPY TO:

RE: Maui Property - Maalaea Mauka

☐ URGENT ☐ FOR REVIEW/COMMENT ☐ PLEASE CALL ☐ PLEASE HANDLE ☐ FOR YOUR FILES

NOTES/COMMENTS:

Aloha Roger

here is the response to

the questions —

Avery

P.O. BOX 1826
PAPAIKOU, HAWAII 96781-1826
TEL: (808) 964-8434 / FAX: (808) 964-8426
EMAIL: cbc@aloha.net

Site Evaluation Questionnaire

1. Date of Inquiry: October 31, 2006

2. Facility or Project Name: Maalaea Properties Phase I Environmental Site Assessment

3. Facility Address: TMK 3-6-01 Parcel 18; 3-6-02 Parcels 1 and 3; 3-6-04 Parcels 3 and 6

4. Describe activities that occur on the Subject Property:

5. Name, title, address, and phone number of the person conducting the interview: Roger Aoki, Senior Environmental Engineer, Element Environmental, (808) 479-3881

6a. Name and Title of Person Interviewed: AVERY B. CHUMBLEY

6b. Telephone number 244-7079

7a. How many years has the person being interviewed been familiar with the site: 24 YEARS

7b. What is his or her association with the site: President of Co.

8a. Are there individuals who have greater knowledge of the Subject Property that are available for interview? YES

8b. If so, please provide names and telephone numbers: CLAYTON SUZUKI 250-4370

9a. Is the Subject Property or any adjoining property currently used, or has it been used in the past, for an industrial or manufacturing use? NO

9b. If so, please provide a description of those activities below: N/A

10a. What is the source of Potable Water at the Subject Property? NONE

10b. How is sewerage provided to the Subject Property (e.g., city, private)? NONE

10c. How is electricity provided to the Subject Property (electric company, private)? MECO

10d. Is there any gas service provided to the Subject Property? If so, who provides the service? NONE

10e. If water is provided by well, has the well been designated as contaminated by any governmental or health agency? N/A

10f. Are there backflow preventers associated with the water system at the Subject Property? N/A

11a. Does the facility generate or store, or has it ever generated or stored hazardous wastes? NONE

11b. If so, where are, or were, the hazardous wastes generated and/or stored? How are these wastes disposed of? N/A

12a. Does the Subject Property generate, use, or store hazardous materials including pesticides, lead-acid batteries, paints, medical wastes, etc.? AG CHEMICALS	12b. If so, where are these materials generated, used, and/or stored? OFF Site
13a. Does the Subject Property generate, use, or store petroleum products, including petroleum stored in pipelines? NONE	13b. If so, where are the petroleum products generated, used, and/or stored on site? N/A
14a. Have there ever been any on-site accumulation points for wastes? NONE	14b. If so, where have they been?. N/A
15a. Has there been dirt fill brought on to the site? If so, did the material originate from a contaminated site or unknown origin? NONE	15b. If contaminated soil or soil from an unknown origin has been used as fill material, where was it placed? N/A

16a. Are there currently, or have there been, any pits, ponds, or lagoons on the property or adjacent properties that have been used in connection with waste treatment or waste disposal (i.e. trash burning, pits, collection basins, etc.)? NONE	16b. If so, where are, or were, they located? N/A	16c. Are there any permits associated with these facilities (NPDES, solid waste, RCRA)? N/A
17. Are there, or were there, any of the following on the Subject Property?	If so, where are, or were, they located?	Are there any chemical releases associated with these items or activities?
a. Aboveground storage tanks NO		
b. Underground storage tanks. NO		
c. Oil-separators NO		
d. Septic tanks NO		
e. Waste piles NO		N/A
f. Polychlorinated biphenyl (PCB)-containing equipment (including transformers, electrical equipment, hydraulic equipment, etc.) NO		
g. Outdoor material storage areas NO		
h. Painting and/or sandblasting operations NO		
i. Drums or drum storage NO		
j. landfills NO		

k. Wells (including monitoring wells, injection wells, water wells, etc.)		
l. Lead based paints	NO	
m. Suspected asbestos containing materials	NO	
n. Buried objects	NO	
o. Pesticides and/or herbicides	yes	Sugar / Pineapple use
p. Medical or biological wastes	NO	
q. Ordnance	NO	
r. Radioactive materials	NO	
s. Mixed wastes	NO	
t. Wash facilities	NO	
u. Radon	NO	
v. Heavy metals	NO	

18a. Are there any deteriorated painted surfaces on the Subject Property? NO	18b. If so, where are these surface located?
19a. Are there any stained sinks or floor drains? NO	19b. If so, where are they located?
20a. Is there any evidence of chemical spills or releases on the Subject Property? NONE	20b. If so, where were the releases observed?
21a. Is there any evidence of improper disposal of solid or hazardous waste at the Subject Property? NO	21b. If so, where are these wastes located?
22a. Is there any evidence of any discolored soil on the Subject Property? NO	22b. If so, where are these soils located?
23a. Is there any evidence of any stressed or unseasonably dead vegetation on the Subject Property? NO	23b. If so, where was the dead or stressed vegetation observed?
24a. Are there any noxious odors associated with the Subject Property? NONE	24b. If so, where were the noxious odors observed?
25a. Are there any sensitive receptors including protected or endangered natural resources at the Subject Property? NONE	25b. If so, what are they?
26a. Are there any cultural resources at the Subject Property? NO	26b. If so, what are they?
27a. Are there any surface water bodies at the Subject Property? NO	27b. If so, where are they located?

28. Are there any air permits currently or planned to be in use at the Subject Property? NO	29. What is the estimated depth to groundwater at the Subject Property?
30a. Are there any areas on site that have been identified as requiring on-going monitoring or additional investigation by the USEPA, HDOH, or other agency including installation restoration program sites and/or areas of concern and environmental compliance sites that have not been issued a NFRAP or a letter of concurrence regarding no further action (e.g., sites that are still considered open and require additional work)? NO	30b. If so, where are they located and what is the nature of the monitoring/investigation?

WAILUKU WATER CO.
WAIKAPU • IAO • WAIEHU • WAIHEE
Na Wai Eha

November 1, 2006

To: Avery Chumbley
From: Clayton Suzuki

Subject: Waikapu to Maalaea Fields

The following chemicals may have been used during the cultivation of sugarcane in the Waikapu to Maalaea Fields.

Active Ingredient:	Brand Name:
Atrazine	Aatrex Nine-O
Ametryn	Evik 80W
2, 4-D	Formula 40
Diuron	Karmex DF
Glyphosate	Roundup
Metribuzin	Sinbar
Hexazinone	Velpar
Glyphosate	Polado

The following fertilizers were used in the cultivation of sugarcane.

- Nitrogen
- Potassium
- Phosphorus
- Calcium carbonate

The following chemicals may have been used during the cultivation of pineapple in the Waikapu to Maalaea fields.

Aliette	Ethrel
Amdro	Evik
Diazinon	Hyvar X
Karmex (Diuron)	Velpar DF
Roundup (non crop area)	Atrazine
Fruitone	Nemcur 3

The following fertilizers were used in the cultivation of pineapple.

Nitrogen	Sulfate of Potash
Iron Sulfate	Magnesium Sulfate
Zinc Sulfate	Sulfate of Amonia
Phosic Acid	

255 EAST WAIKO ROAD • WAILUKU, MAUI, HAWAII 96793-9355 • TELEPHONE (808) 244-9570 • FACSIMILE (808) 242-7068

Site Evaluation Questionnaire

1. Date of Inquiry: October 31, 2006

2. Facility or Project ~~Name: Maa~~laea Properties Phase I Environmental Site Assessment

3. Facility Address: TMK 3-6-01 Parcel 18; 3-6-02 Parcels 1 and 3; 3-6-04 Parcels 3 and 6

4. Describe activities that occur on the Subject Property: Pasture

5. Name, title, address, and phone number of the person conducting the interview: Roger Aoki, Senior Environmental Engineer, Element Environmental, (808) 479-3881

6a. Name and Title of Person Interviewed: ALEX FRANCO MGR	6b. Telephone number 3571720
7a. How many years has the person being interviewed been familiar with the site: 1 YEAR	7b. What is his or her association with the site: CATTLE RANCHING

8a. Are there individuals who have greater knowledge of the Subject Property that are available for interview?	8b. If so, please provide names and telephone numbers: Wailuku AG.
9a. Is the Subject Property or any adjoining property currently used, or has it been used in the past, for an industrial or manufacturing use? [illegible]	9b. If so, please provide a description of those activities below:

10a. What is the source of Potable Water at the Subject Property? NONE	10b. How is sewerage provided to the Subject Property (e.g., city, private)? NONE	10c. How is electricity provided to the Subject Property (electric company, private)? NONE

10d. Is there any gas service provided to the Subject Property? If so, who provides the service? NONE	10e. If water is provided by well, has the well been designated as contaminated by any governmental or health agency? NONE

10f. Are there backflow preventers associated with the water system at the Subject Property? NONE

11a. Does the facility generate or store, or has it ever generated or stored hazardous wastes?	11b. If so, where are, or were, the hazardous wastes generated and/or stored? How are these wastes disposed of? .

TO OUR USE PLEASE CHECK W/ WAILUKU AG.

12a. Does the Subject Property generate, use, or store hazardous materials including pesticides, lead-acid batteries, paints, medical wastes, etc.? PROPERTY WAS OCCUPIED BY FARMERS PRIOR	12b. If so, where are these materials generated, used, and/or stored?
13a. Does the Subject Property generate, use, or store petroleum products, including petroleum stored in pipelines? NONE (WE DO HAVE ABOUT 3-5 GA CANS OF GASOLINE ON SITE	13b. If so, where are the petroleum products generated, used, and/or stored on site? .
14a. Have there ever been any on-site accumulation points for wastes?	14b. If so, where have they been?.
15a. Has there been dirt fill brought on to the site? If so, did the material originate from a contaminated site or unknown origin?	15b. If contaminated soil or soil from an unknown origin has been used as fill material, where was it placed?

16a. Are there currently, or have there been, any pits, ponds, or lagoons on the property or adjacent properties that have been used in connection with waste treatment or waste disposal (i.e. trash burning, pits, collection basins, etc.)?	16b. If so, where are, or were, they located?	16c. Are there any permits associated with these facilities (NPDES, solid waste, RCRA)?
17. Are there, or were there, any of the following on the Subject Property?	If so, where are, or were, they located?	Are there any chemical releases associated with these items or activities?
a. Aboveground storage tanks		
b. Underground storage tanks.		
c. Oil-separators		
d. Septic tanks		
e. Waste piles		
f. Polychlorinated biphenyl (PCB)-containing equipment (including transformers, electrical equipment, hydraulic equipment, etc.)		
g. Outdoor material storage areas		
h. Painting and/or sandblasting operations		
i. Drums or drum storage		
j. landfills		

k. Wells (including monitoring wells, injection wells, water wells, etc.)		
l. Lead based paints		
m. Suspected asbestos containing materials		
n. Buried objects		
o. Pesticides and/or herbicides		
p. Medical or biological wastes		
q. Ordnance		
r. Radioactive materials		
s. Mixed wastes		
t. Wash facilities		
u. Radon		
v. Heavy metals		

18a. Are there any deteriorated painted surfaces on the Subject Property? .	18b. If so, where are these surface located?
19a. Are there any stained sinks or floor drains?	19b. If so, where are they located?
20a. Is there any evidence of chemical spills or releases on the Subject Property?	20b. If so, where were the releases observed?
21a. Is there any evidence of improper disposal of solid or hazardous waste at the Subject Property?	21b. If so, where are these wastes located?
22a. Is there any evidence of any discolored soil on the Subject Property?	22b. If so, where are these soils located?
23a. Is there any evidence of any stressed or unseasonably dead vegetation on the Subject Property?	23b. If so, where was the dead or stressed vegetation observed?
24a. Are there any noxious odors associated with the Subject Property?	24b. If so, where were the noxious odors observed?
25a. Are there any sensitive receptors including protected or endangered natural resources at the Subject Property?	25b. If so, what are they?
26a. Are there any cultural resources at the Subject Property?	26b. If so, what are they?
27a. Are there any surface water bodies at the Subject Property?	27b. If so, where are they located?

28. Are there any air permits currently or planned to be in use at the Subject Property?	29. What is the estimated depth to groundwater at the Subject Property? .
30a. Are there any areas on site that have been identified as requiring on-going monitoring or additional investigation by the USEPA, HDOH, or other agency including installation restoration program sites and/or areas of concern and environmental compliance sites that have not been issued a NFRAP or a letter of concurrence regarding no further action (e.g., sites that are still considered open and require additional work)?	30b. If so, where are they located and what is the nature of the monitoring/investigation?

APPENDIX D

Historical Research Documentation

MAUI COUNTY PARCEL HISTORY (TT102) FOR:
TMK: 3-6-001-018-0000

05/30/2003 --
INSTR-DESC:LUCA
TRANS NO:265927
INSTR-DATE:05/30/2003
REC-DATE:05/30/2003

AREA:259.8850 ACRES
- HONOAPIILANI HIGHWAY WIDENING MAALAEA ROAD TO NORTH
KIHEI ROAD - LUCA 3.1976 APPROVED 5/30/2003
-
TMK: 3601-18
SUBDIVIDE LOT 1 INTO LOTS 1-A (38,369 SF OR 0.881 AC) & 1-B
(10,656 SF OR 0.245 AC) & LOT 2 INTO LOTS 2-A (259.004 AC) & 2-B
(32,645 SF OR 0.749 AC), PER PLAN BY STATE OF HAWAII, D.O.T.,
HWYS DIVISION, APPROVED 5/30/2003

TMB NOTE: LOTS 1-B & 2-B, CONVEYED (AS PARCELS 1 & 2) TO
STATE OF HAWAII, D.O.T., BY DEED DOC 2002-10678

F/D: LOTS 1-A & 2-A

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU AGRIBUSINESS CO INC

01/22/2002 --
INSTR-DESC:WARNT DEED
INSTR_NO:02-10678
TRANS NO:244772
INSTR-DATE:01/16/2002
REC-DATE:01/22/2002

AREA:259.8850 ACRES STATE-CONV-TAX: $ 0
(10,656 SF OR 0.245 AC, PARCEL 1, &
32,645 SF OR 0.749 AC, PARCEL 2), DROPPED INTO ROAD
FROM: WAILUKU AGRIBUSINESS CO., INC., ON 5/24/85 PER DCCA
TO: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION
TMB NOTE: NAME OF WAILUKU SUGAR COMPANY CHANGED TO
WAILUKU AGRIBUSINESS CO., INC., ON 5/24/85 PER DCCA
F/D: AREA, BDRY

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU AGRIBUSINESS CO INC

07/13/1998 --
INSTR-DESC:AMENDMENT OF ESMT
INSTR_NO:9800101152
TRANS NO:59029
INSTR-DATE:07/01/1998
REC-DATE:07/13/1998
ACK/EFF DATE:07/13/1998

AREA:260.8790 ACRES
WAILUKU AGRIBUSINESS CO INC "GRANTOR"
MAUI ELECTRIC COMPANY LIMITED "GRANTEE"
GRANTOR AND GRANTEE AMEND ESMT GRANT, DOCS 95-1279 & 95-1612
80 TO DELETE
EXH "A" & SUBSTITUTE EXH "A" ATTACHED.
ESMT B ELECTRICAL TRANSMISSION PORS GR 3152 & 9794 6,9
49 SF DES
F/D: SUBJ TO ELEC TRANSMISSION ESMT "B" (6,949 SF) IN FAVOR
OF MAUI
ELEC CO LTD

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU SUGAR COMPANY

08/27/1997 --
INSTR-DESC:SUBD LUCA# 3.1717
INSTR_NO:0000000000
TRANS NO:59027
INSTR-DATE:02/05/1998
ACK/EFF DATE:08/27/1997

AREA:260.8790 ACRES
SUBD GR'S S-131975, 11067, 10962, 10745, 10497, 10294 & 9794
INTO LOTS 1 & 2 PER PLAN BY WARREN S UNEMORI APPROVED 8/2
7/97
F/D: LOTS 1 & 2

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU SUGAR COMPANY

12/13/1995 --
INSTR-DESC:UTILITY ESMT
INSTR_NO:9500161279
TRANS NO:59028
INSTR-DATE:11/01/1995
REC-DATE:12/13/1995
ACK/EFF DATE:12/13/1995

MAUI COUNTY PARCEL HISTORY (TT102) FOR:
TMK: 3-6-001-018-0000

AREA:260.8790 ACRES
FROM: WAILUKU AGRIBUSINESS CO INC
TO: MAUI ELECTRIC COMPANY LIMITED
GRANTOR GRANT UNTO GRANTEE A PERPETUAL RIGHT & ESMT TO CONST
RUCT,
MAINTAIN & OPERATE POLE, WIRE LINES & UNDERGROUND POWER LINE
S FOR THE
TRANSMISSION OF ELECTRICITY FOR LIGHT, POWER & COMMUNICATION
, OVER,
ACROSS & UNDER PARCEL SHOWN ON MAP ATTACHED AS EXH "A". TOG
ETHER WITH
RIGHT OF INGRESS & EGRESS.
ESMT B 9.95 SF
TMB NOTE: ESMT NOT SHOWN; NO DESC. WAILUKU SUGAR CO NKA WA
ILUKU
AGRIBUSINESS CO INC PER LCO 83522.
F/D: SUBJ TO ELEC TRANS LINE ESMT "B" IN FAVOR OF MAUI ELEC
CO LTD

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU SUGAR COMPANY

01/04/1993 --
INSTR-DESC:LUC MAP R/S
INSTR_NO:0000000000
TRANS NO:59026
INSTR-DATE:03/30/1993
ACK/EFF DATE:01/04/1993

AREA:260.8790 ACRES
FORMER ZONING: A & C
CHANGED TO: A
A: 260.879 AC
TOTAL: 260.879 AC
SOURCE: LUC BDRY AWD A91-672 12/1/92
TMB NOTE: AREA BY TAX MAPS BR FOR ASSESSMENT PURPOSES ONLY
.

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU SUGAR COMPANY

05/27/1992 --
INSTR-DESC:LUC MAP R/S
INSTR_NO:0000000000
TRANS NO:59025
INSTR-DATE:05/27/1992
ACK/EFF DATE:05/27/1992

AREA:260.8790 ACRES
FORMER ZONING: A
CHANGED TO: A & C
A: 232.604 AC
C: (17.4 AC) (0.115 AC) (10.0 AC) (0.62 AC)
(0.14 AC)
TOTAL: 260.879 AC
SOURCE: LUC BDRY INT 92-15 4/7/92
TMB NOTE: AREA BY TAX MAPS BR. FOR ASSESSMENT PURPOSES ONLY
.

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU SUGAR COMPANY

10/07/1987 --

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU SUGAR COMPANY

------------------SEE HISTORY SHEET FOR MORE INFORMATION----------------

TERRITORY OF HAWAII

FIELD BOOK LAND SHEET

DESCRIPTION		Second			DIVISION
Portion Grant 3152, Ukumehame, Wailuku		ZONE	SEC.	PLAT.	PARCEL
		3	6	01	18
OWNER	**TITLE HISTORY**	MAILING ADDRESS			
Wailuku Sugar Company	TLB 1341 1/4/63 7.219 Ac dropped into 18	Wailuku, Maui 260.879 Ac			

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AREA							43930			
LAND	83615	81610	87383	87353	87310	87383				
IMP.										
TOT.									C A M A	
EX.				–						
NET	83615	87611	87383	87352	87310	87383				
TAX										

YEAR	1959	1960	1961	1962	1963	1964	1965	1966	1967
AREA	253.66 Ac	253.66 Ac	253.66 Ac	253.66 Ac	260.879 Ac	260.879 Ac			
LAND	45,852	70,423.	68869.	69,059	71280	71280	[illegible]	[illegible]	76685
IMP.	150	–	–	–	–				
TOT.	46,002	70,423.	68,869.	69,059	71280	71280			
EX.	–	–	–	–					
NET	46,002	70,423.	68,869.	69,059	71280	71280			
TAX	762.25	958.46	937.31	939.89	997.92	997.92			

REQUEST TO ACCESS A GOVERNMENT RECORD

DATE: October 31, 2006

TO: Hazard Evaluation & Emergency Response Office (Fax: 586-7537)

FROM: Roger Aoki
Element Environmental, LLC
62-180 Emerson Road
Haleiwa, HI 96712
Tel: 479-3881 (cell)
Fax: 637-0001
Email: raoki@e2hi.com

Although you are not required to provide any personal information, you should provide enough information to allow the agency to contact you about this request. The processing of this request may be stopped if the agency is unable to contact you. Therefore, please provide any information that will allow the agency to contact you (name or alias, telephone or fax number, mailing address, e-mail address, etc.).

I WOULD LIKE THE FOLLOWING GOVERNMENT RECORD

Describe the government record as specifically as possible so that it can be located. Try to provide a record name, subject matter, date, location, purpose, or name of persons to whom the record refers, or other information that could help the agency identify the record. A complete and accurate description of the government record you request will prevent delays in locating the record. Attach a second page if needed.

Maalaea Property located at Honoapiilani Highway, Wailuku, Maui, Hawaii 96793

TMK (2) 3-6-001:018

I WOULD LIKE : (please check one or more of the options below)

x To inspect the government record.
☐ A copy of the government record: (Please check one of the options below.) See the back of this page for information about fees that you may be required to pay for agency services to process your record request.
Note: Copying and transmission charges may also apply to certain options.
- ☐ Pick up at agency (date and time):
- ☐ Mail
- ☐ Fax (toll free and only if available)
- ☐ Other, if available (please specify):

☐ If the agency maintains the records in a form other than paper, please advise in which format you would prefer to have the record.

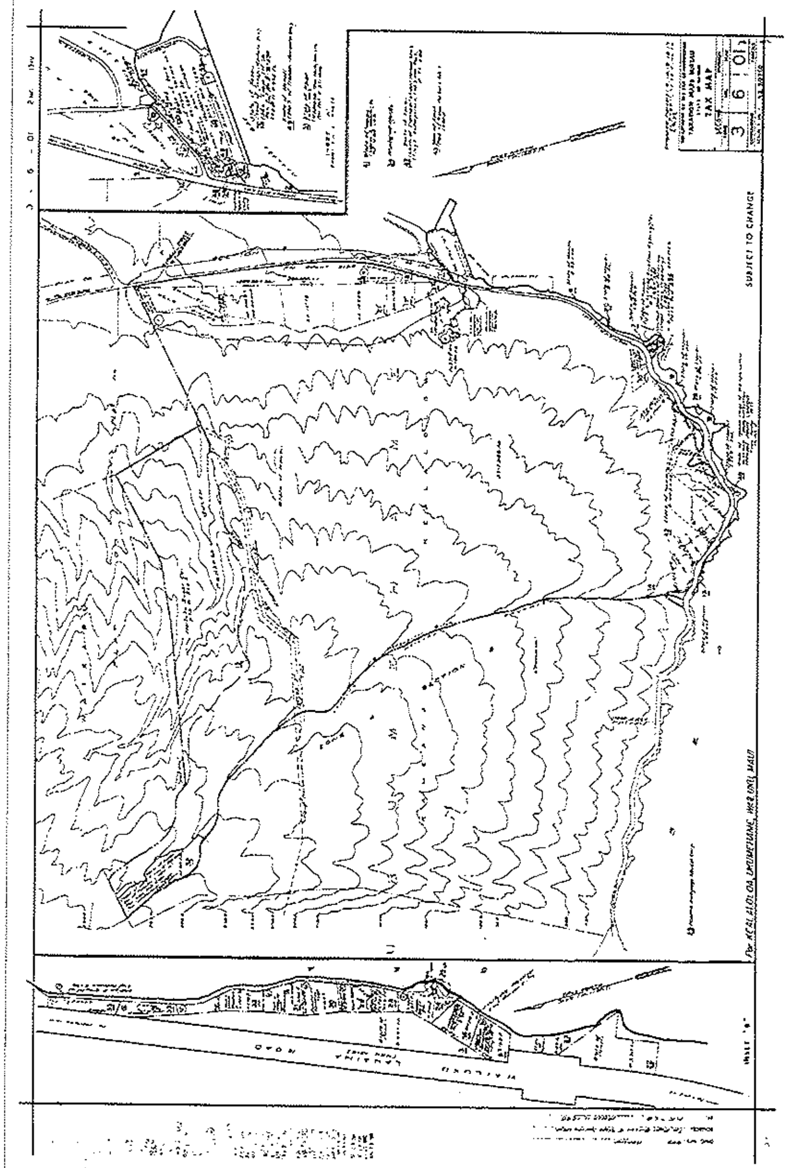
x Electronic ☐Audio ☐Other (please specify):,

☐ Check this box if you are attaching a request for waiver of fees in the public interest (see waiver information on back).

SEE BACK FOR IMPORTANT INFORMATION

OFFICIAL USE ONLY:

Office Manager ____________________ Date ____________________



element environmental llc

October 31, 2006

Department of Fire Control
Assistant Chief's Office
200 Dairy Road
Kahului, HI 96732

Subject: Request for Records on Reported Hazardous Material Spill Events

To Whom It May Concern:

Element Environmental, LLC (E2) is engaged in a Phase I Environmental Site Assessment for the TMK 3-6-001 Parcel 018 Property located along Honoapiilani Highway, Wailuku, Hawaii 96793. A map showing the site location is attached with this request.

The site assessment includes the identification of facilities on the site or adjacent to it which use or generate hazardous substances on their premises. It is our understanding that the Maui County Department of Fire Control has maintained files containing such information. We would be interested in any information regarding unauthorized hazardous material spills/releases, violations (including safety violations), or aboveground tank registrations for any facility located at or within a ¼ mile radius of the subject property. If no such records exist, a negative response would be appreciated. The information will be used in a Phase I – Environmental Site Assessment. It would be greatly appreciated if you could respond as soon as possible.

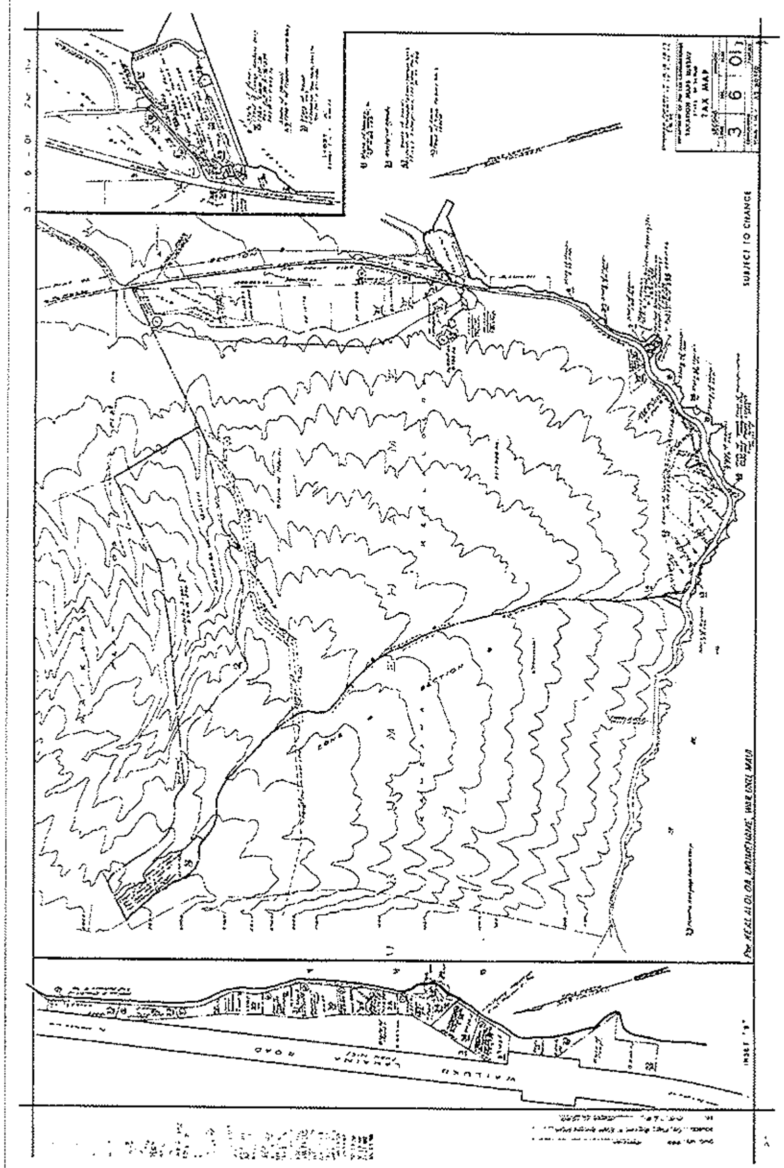
Should you have further questions, please do not hesitate to contact me at (808) 479-3881 (cell).

Sincerely:
Element Environmental, LLC

Roger C. Aoki, P.E.
Senior Environmental Engineer

Enclosure

62-180 Emerson Road, Haleiwa, Hawaii 96712 tel: (808) 637-1200 fax: (808) 637-0001 email: raoki@hawaii.rr.com



element environmental llc

October 31, 2006

Maui County Local Emergency Planning Committee
200 Dairy Road
Kahului, HI 96732

Attention: Mr. Scott Kekuewa

Subject: Revision to a Request for Tier 2 Reports

Dear Mr. Kekuewa:

Element Environmental, LLC (E2) is conducting an environmental site assessment project for the TMK 3-6-001 Parcel 018 Property located along Honoapiilani Highway, Wailuku, Hawaii 96793. A map showing the site location is attached with this request.

The site assessment includes the identification of facilities on the site or adjacent to it which store, use, or generate hazardous materials/substances on their premises. It is our understanding that the Maui County Local Emergency Planning Committee (LEPC) has maintained Tier 2 Reports under the Superfund Amendments and Reauthorization Act (SARA) Title III containing such information. We would be interested in receiving Tier 2 Reports for any such property or facility. If no such records exist, a negative response would be appreciated. The information will be used in a Phase I – Environmental Site Assessment.

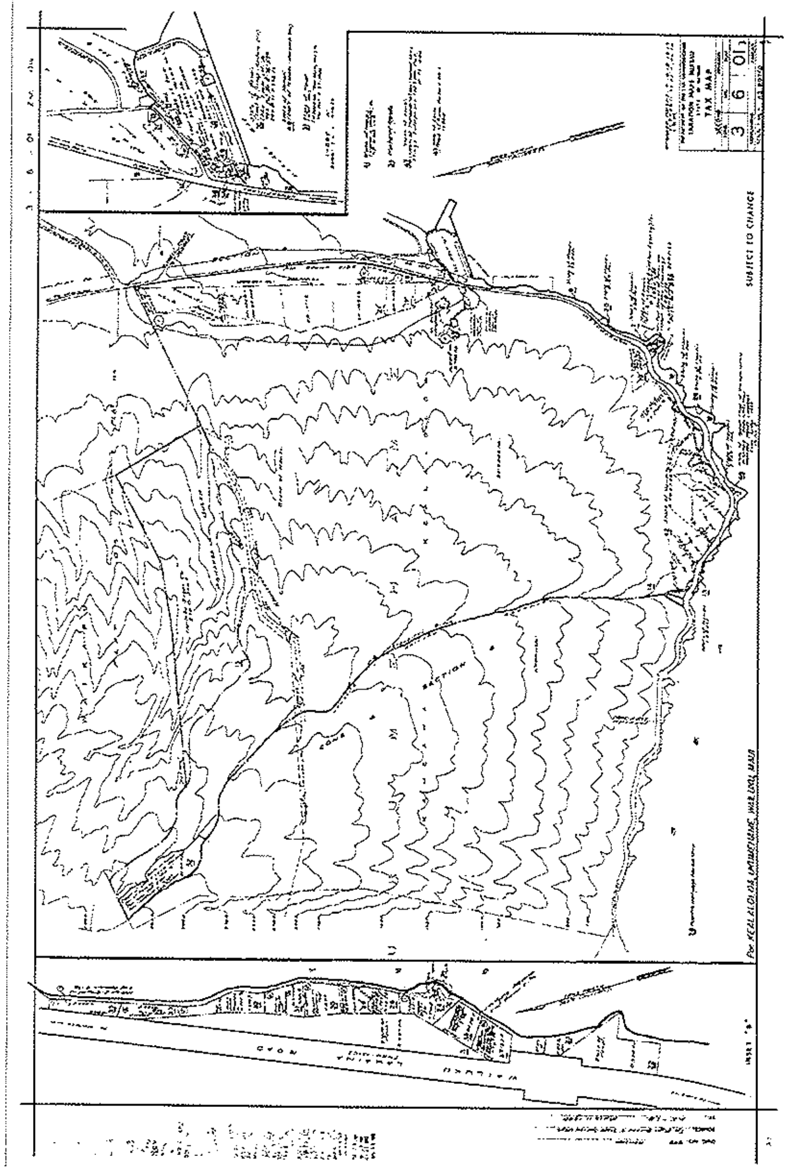
Should you have any questions or need more information, please do not hesitate to contact me at (808) 479-3881.

Your help and prompt response is greatly appreciated.

Sincerely:
Element Environmental, LLC

Roger C. Aoki, P.E.
Senior Environmental Engineer

62-180 Emerson Road, Haleiwa, Hawaii 96712 tel: (808) 637-1200 fax: (808) 637-0003 email: raoki@hawaii.rr.com



APPENDIX E

Qualifications of the Environmental Professionals

Roger C. Aoki, P.E.
Senior Environmental Engineer

BACKGROUND:

EDUCATION

Masters of Science in Civil (Environmental) Engineering – Purdue University, 1995
B.S., Civil Engineering - University of Hawaii at Manoa, 1994

PROFESSIONAL REGISTRATIONS

Licensed Professional Engineer – Civil (Hawaii 2000), Certificate No. 10019-C

SPECIALIZED TRAINING

OSHA 40-hour Initial HAZWOPER Training and Current 8-hour Refresher
Hazardous Waste Site Supervisor Training
First Aid and CPR Training

SUMMARY OF EXPERIENCE

Mr. Aoki is has over ten years (10) of experience in the environmental consulting industry. He has over five (5) years of project management experience and has managed Federal Indefinite Delivery, Indefinite Quantity Contracts and environmental consulting/engineering design contracts.

Mr. Aoki has been involved in a wide range of environmental investigation and engineering projects dealing with water, wastewater, petroleum contamination, solid waste, and hazardous waste. His professional experience has included work on projects in Hawaii and Guam. Mr. Aoki's areas of expertise consist of environmental investigations, environmental baseline surveys, regulatory compliance, remedial design, storm water planning, and wastewater engineering. He has prepared risk-based corrective action reports on sites contaminated with petroleum-related compounds, polychlorinated biphenyls (PCBs) and heavy metals, is experienced in preparing work plans, project management plans, sampling and analysis plans, site safety and health plans, and reports for soil and groundwater investigation projects.

Keehi Place Pump Station Evaluation, State of Hawaii Department of Transportation: Engineer assisting with the evaluation of the existing pump station and determining a rational service population estimate to generate projected wastewater flows to allow for planning of future wastewater facility infrastructure.

3/01 – 7/06
Project Engineer and Project Manager with Environet, Inc.

Waimanalo Wastewater Treatment Plant Improvements, State of Hawaii Department of Land and Natural Resources: At Engineer assisting in the design of a new secondary treatment system. Responsibilities included calculations for tank and equipment sizing, hydraulic calculations, mechanical process design including equipment selection, and design and layout of the dissolved air floatation thickener process units and equipment. Mr. Aoki also assisted with the preparation of construction plans and specifications.

Environmental Assessments: Project Manager for the preparation of several Environmental Assessments for the private clients, City and County of Honolulu, State of Hawaii, and US Army Corps of Engineers. The Environmental Assessments supported wide ranging developments and rehabilitation

work including sewer line replacement, new housing developments, and flood control improvements.

Remedial Action Operations/Long Term Monitoring Contract N62742-01-D-1805. Served as the Project Manager for all 19 Contract Task Orders (CTOs) during the 5 years of the contract.

Environmental Engineering Services Contract N62742-02-D-1801. Served as the Project Manager for 10 of the 30 CTOs during 4 years of the contract. Served as the primary Technical Program Manager for the Environmental Baseline Surveys, Findings of Suitability to Lease/Transfer CTOs.

Environmental Technical Services Contract N62742-04-D-1863. Served as the Project Manager for all three Contract Task Orders (CTOs) during the one-and-a-half years of the contract.

Site Investigation at Building 15-46A at the Former Naval Air Station, Agana in Tiyan, Guam. Served as the Project Manager for a site investigation to evaluate an illicit sewer system that was historically used for waste oil disposal. Work tasks included conducting a site reconnaissance to identify the sewer system, field sampling to evaluate the nature and extent of contamination, and data evaluation and reporting to promote an expedited site closure.

Groundwater Monitoring at the Former Agana Power Plant in Mongmong, Guam. Served as the Project Manager to assess the quality of groundwater at the former Agana Power Plant. The results were compared to drinking water and EPA Region 9 tap water criteria to assess the quality of groundwater for the on-going Remedial Investigation of the site. Work tasks included installing two groundwater wells, conducting two rounds of groundwater sampling at six wells; having the sample analyzed by several analytical methods; developing trends from historic data; and comparing the results to current regulatory standards.

Maintenance and Groundwater Monitoring at Former Naval Air Station (NAS), Barbers Point, Oahu, Hawaii. Served as the Project Manager to assess the quality of groundwater beneath the former NAS Barbers Point. The results were compared to drinking water criteria to assess the quality of groundwater for property transfer. Data were also compared to State of Hawaii Water Quality Standards for surface water to determine potential risk via transport to the Pacific Ocean. Work tasks included conducting a groundwater sampling at 21 wells; having the sample analyzed by over 20 analytical methods; developing trends from historic data; and comparing the results to current regulatory standards.

Long-Term Maintenance and Monitoring at the Construction Battalion Landfill in South Finegayan, Guam. Served as the Project Manager to conduct landfill gas monitoring at three landfill gas vents and collected two landfill gas samples to determine the volatile organic compound constituents. Six settlement monuments located atop the cap were surveyed to determine settlement of the cap. Vegetation was cleared on the landfill cap and drainage swales.

Phytoremediation of PCB-Contaminated Soils at Haiku Valley. Served as Project Engineer for the phytoremediation project. Preliminary laboratory screening trials and data search were conducted prior to the field study. A pilot-scale phytoremediation demonstration system was performed in the field with the selected processes in combination with the selected plants. The field study evaluated contaminant removal efficiency of the selected phytoremediation system and design issues such as plant growth, microbial populations in the rhizosphere, soil contaminant levels, phytotoxicity, and rooting depth.

Phytoremediation at the Former Open Burn/Open Detonation (OB/OD) Unit at the Makua Military Reservation. Served as Project Engineer for the phytoremediation project. The project consisted of a greenhouse study to be conducted at the University of Hawaii College of Tropical Agriculture and Human Resources (CTAHR). The purpose of the greenhouse screening trials was to identify candidate plant species for phytoremediation. Approximately six to ten different plant species were screened for their effectiveness in bioaccumulating/biodegrading the contaminants of concern. The greenhouse study also determined planting requirements, fertilization levels, soil characterization and applicable amendment requirements, irrigation needs, and any other requirements for enhancing plant propagation in the Makua OB/OD soils based on the existing contaminant concentrations. The goal of the field study is to apply the results obtained in the greenhouse study in an actual field setting.

Kapalama Incinerator Cleanup. Served as Project Manager. Provided the following services for the removal of hazardous (brick and ash) and non-hazardous (lead-contaminated soil) wastes from the former Kapalama incinerator: prepared a site health and safety plan; prepared a project work plan; prepared a sampling and analysis plan; prepared construction plans and specifications; provided oversight of the cleanup; and reviewed manifests and other cleanup documentation.

RCRA Corrective Action of Solid Waste Management Units, Areas of Interest and Various Bunkers, Johnston Island Phase II. Participated in the site characterization, remedial design, removal action, confirmation testing, and final report writing for remedial work conducted at a number of solid waste management units located on Johnston Atoll. A total of 1,000 tons of hazardous and non-hazardous contaminated soil was being excavated and disposed off-island. Environmental Chemical Corporation (ECC) a subconsultant, assisted Environet on Johnston Island with the excavation and packaging of the contaminated soil/materials for shipment to U.S. Ecology's landfill in Nevada.

4/96 – 3/01
Staff Engineer and Project Engineer with Earth Tech

Site Summary Report (SSR), Pearl Harbor Naval Complex (PHNC), Oahu, Hawaii. Environmental Project Engineer for an environmental site evaluation of existing and past activities with potential hazardous substance or waste releases throughout PHNC. This project involved the review of historical records at various government agencies including PACDIV, the Hawaii Department of Health, and the USEPA, regarding the use, storage, disposal, and release of hazardous materials and wastes at PHNC. The assessment also included a review of site and hydrogeologic characteristics, (based on topographic maps, aerial photographs, previous site characterization reports, and other documents) and a site reconnaissance of Navy property. An electronic database associated with a GIS was developed to manage the large volume of data collected.

PCB Removal Actions at Transformer Substations, NAS Barbers Point. Primary author for an engineering evaluation/cost analysis (EE/CA) that involved analyzing 16 removal action technologies, estimating costs for recommended remediation alternatives, researching and evaluating various federal and state statutes and regulations for Applicable or Relevant and Appropriate Requirements (ARARs) for a non-time critical removal action for PCB-contaminated soils and concrete. Supervised the site reconnaissance and field sampling teams. Estimated removal action costs using Remediation Action Cost Engineering and Requirements (RACER). Oversaw PCB removal activities. Primary author for the Remediation Verification Report and Record of Decision closure documents.

Stormwater Pollution Control Plan (SWPCP) Updates, Naval Station and Naval Magazine, Pearl Harbor, Oahu, Hawaii. Evaluated Naval Station facilities at the PHNC and Naval Magazine facilities at Naval Magazine Lualualei Headquarters Branch and West Loch Branch. Facilities were investigated to identify the practices used to reduce the pollutants in storm water discharges associated with industrial activities and to assure compliance with their respective National Pollutants Discharge Elimination System (NPDES) permits. Facility assessments determined the types and quantities of significant materials stored, and their utilization. Best management practices to prevent non-stormwater discharges were then proposed for implementation.

Petroleum, Oils, and Lubricants (POL) Remediation Study, Honolulu Harbor, Hawaii. Conducted an environmental site assessment of Piers 16 through 38. Although the site assessment looked at hazardous materials in general, the project focused on the presence and use of petroleum products in the area. Reviewed historical records at various government agencies, including the Hawaii Department of Health, the Hawaii Department of Transportation, and the U.S. Coast Guard, regarding the use and storage of hazardous materials. Assisted with the development of an electronic database associated with a GIS to manage the large volume of data collected.

09/92 – 01/95
Student Aide and Engineer's Aide with R.M. Towill Corporation

Drainage Structure Design, Ewa Villages Municipal Golf Course, City & County of Honolulu, Ewa, Oahu, Hawaii. Assisted in the design of drainage structures for the municipal golf course in Ewa. Used hydraulic computer programs to determine drainage flow rates and water surface elevations during flood events for the design of a spillway, golf cart underpasses, and drainage retention basins and culverts.

Villages of Kapolei Master Plan. Assisted registered civil engineers and planners with design of storm drain, sewer, and water distribution systems for the Villages of Kapolei Master Plan. Prepared preliminary design of the stormwater drainage system with the capability of managing various flood events. Determined peak, average, and fire flow requirements of the sewer and water systems for residential and commercial land use areas with varying population densities.

element environmental llc
environmental · engineering · water resources

Ryan S. W. Yamauchi, P.E.
President
Senior Environmental Engineer

BACKGROUND:

EDUCATION
Masters of Science in Civil (Environmental) Engineering (1995) - University of California at Berkeley
Bachelor of Science in Civil Engineering (1994) - University of Hawaii at Manoa

PROFESSIONAL REGISTRATIONS
Licensed Professional Engineer – Civil (Hawaii 1998), Certificate No. 9566-C
Registered Environmental Assessor-California-2003

SPECIALIZED TRAINING
OSHA 40-hour Initial HAZWOPER Training and Current 8-hour Refresher
Hazardous Waste Site Supervisor Training
First Aid and CPR Training

Mr. Yamauchi is the Responsible Corporate Officer for Element Environmental, LLC. He has one year of experience as a Chief Executive Officer and five years of experience as a Program/Project manager. He has over twelve years (12) of experience in the environmental consulting industry. He has over six (6) years of project management experience and has managed Federal Indefinite Delivery, Indefinite Quantity Contracts and environmental consulting/engineering design contracts. He is customer-focused and performance-driven.

Mr. Yamauchi has been involved in a wide range of environmental investigation and engineering projects dealing with water, wastewater, petroleum contamination, solid waste, and hazardous waste. His professional experience has included work on projects in Hawaii, Guam, Korea and the Pacific Islands. Mr. Yamauchi's areas of expertise consist of environmental investigations, remedial design and engineering, groundwater modeling, storm water planning, and wastewater engineering. He has prepared risk-based corrective action reports on sites contaminated with polychlorinated biphenyls (PCBs) and heavy metals, is experienced in preparing work plans, project management plans, sampling and analysis plans, site safety and health plans, and final reports for soil, groundwater and sediment investigation projects.

Mr. Yamauchi has also completed several large storm water and wastewater engineering design projects and studies. He has also performed and managed water and wastewater treatment design, wastewater reuse, sewer collection system preventive maintenance, and sewage spill response procedure development projects. He is an active member of the American Water Works Association and the Water Environment Federation.

SPECIFIC PROJECT EXPERIENCE:

Environmental Management Program, State of Hawaii, Department of Transportation, Highways Division: Project Manager for the development of a comprehensive Environmental Management Program (EMP). The program components included: completion of Storm Water Pollution Control Plans (SWPCPs) for the eight Oahu maintenance baseyards, development of training materials for storm water awareness, SWPCP elements, and construction BMPs; development of a training plan for the Chemical Application BMP Program Plan; and development of a Hazard Communication Program, Hazardous Waste Management Program, Solid Waste Management Program, Petroleum, Oil and Lubricant

Management Program, and Facility Maintenance Program. The EMP targeted maintenance operations and maintenance baseyards statewide.

Sand Island Wastewater Treatment Plant Site Assessment and Remedial Design, City and County of Honolulu: Project Manager for the site investigation and Toxic Substances Control Act (TSCA) cleanup of contaminated soil. Responsibilities included overall project management, coordination of subconsultants, development of the technical approach for all environmental investigations and the remedial design, and negotiating with the USEPA Region 9 and the State Department of Health (DOH) for all investigative and remedial activities. Supervised the preparation of the Phase I Environmental Site Assessment (ESA). Conducted and prepared the Phase II ESA, the Human Health Risk Assessment, the TSCA Notification Remediation Report, and the Soil Management Plan. Prepared construction plans and specifications and a construction cost estimate for the TSCA remediation. Performed services during construction including oversight and review of the TSCA cleanup. Coordinated all of the investigation and cleanup work for the two ongoing construction projects. Negotiated with the USEPA Region 9 and the State DOH throughout the duration of the project to allow construction to proceed concurrently with the investigation and cleanup. A follow- on remedial design including the completion of construction documents for the reuse of remaining low level PCB contaminated soil was completed for 76,000 cubic yards of stockpiled soil. Mr. Yamauchi served as the senior design engineer and designed a geofabric retaining wall system to contain the contaminated soil, which allowed for immediate future use of the site as a construction staging area.

Miscellaneous Public Building Facilities Improvements at Ewa Sugar Mill, City and County of Honolulu, Department of Design and Construction: Project Engineer for the remediation project involving preparation of construction documents including plans, specifications, and cost estimates. Other work included an asbestos and lead paint survey and hazardous waste/material survey. Responsibilities included: management of all environmental sampling and analysis work, conducting soil and groundwater sampling and analysis, performance of a magnetometer survey for underground storage tanks and pipelines, preparation of all environmental reports, preparation of construction plans and specifications for the soil removal and soil capping, and negotiating with the Hawaii State Department of Health (DOH) to obtain approval of the remediation plan. Reviewed contractor's work plan, waste manifests and confirmation sampling results during construction. Reviewed and approved closure report, and obtained DOH acceptance of soil removal action and soil cap construction. Due to immediate exposure risks, Mr. Yamauchi also managed the sampling, analysis, removal, and disposal of on-site solid waste/hazardous waste surface debris.

Waimanalo Wastewater Treatment Plant Improvements, State of Hawaii Department of Land and Natural Resources: Project Engineer for the design of a new secondary treatment system. Responsibilities included secondary biological process calculations for tank and equipment sizing, hydraulic calculations for plant hydraulics, mechanical process design including equipment selection, design and layout of new site piping, and development of process control strategies. Process units that Mr. Yamauchi was responsible for included the new anoxic/aerobic tanks, the new equalization basin, the new equalization flow splitter box, the additional effluent sand filters, the new injection wells, and the new dissolved air floatation thickener. Process equipment that Mr. Yamauchi was responsible for included fine air bubble diffusers, coarse air bubble diffusers, process air blowers, mixed liquor internal recycle pumps, return activated sludge pumps, thickened sludge transfer pumps, dissolved air floatation recirculation pumps and pressurization tanks, magnetic flow meters, and ultrasonic flow measuring devices. Prepared plans and specifications for construction, and assisted with the construction cost estimate and construction phasing schedule.

Moanalua and Kalihi Stream Dredging, State of Hawaii Department of Land and Natural Resources: Project Manager for the maintenance dredging sediment sampling and design project. Responsibilities included overall project management including coordinating subconsultants, development and execution of the sediment sampling plans, preparation of the sediment sampling results and alternatives analysis report, and management and coordination of the environmental assessment (EA) and hydrographic survey. As part of the sediment sampling and analysis report, Mr. Yamauchi researched the alternatives for disposal of the sediment.

Inflow and Infiltration Study at Schofield Barracks, Wheeler Army Airfield, and Helemano Military Reservation: Project Manager for this inflow and infiltration (I&I) study. Responsibilities included overall project management; coordination of subconsultants, preparation of the work plan and site safety and health plan, supervision and coordination of the smoke testing, CCTV inspections, manhole inspections, and minor construction repairs, and preparation of the preliminary engineering analysis of the recommended I&I construction repairs, including analysis of repair alternatives and development of construction cost estimates.

Saipan Lagoon Aquatic Ecosystem Restoration Study, Saipan, U.S. Army Corps of Engineers – Honolulu Engineering District: Project Engineer for this study to identify potential restoration alternatives for the nearshore lagoon environment. Responsibilities included calculation of stormwater runoff volumes using rainfall frequency intensity curves and preliminary engineering design of two stormwater conveyance and treatment system alternatives. Completed preliminary engineering design, including sizing and layout of conveyance structures and infiltration basins, and cost estimates for construction.

RCRA Corrective Action of Solid Waste Management Units, Areas of Interest, and Various Bunkers on Johnston Atoll, U.S. Army Corps of Engineers – Honolulu Engineering District: Project Engineer for the excavation and removal of contaminated soils from a number of former SWMU and AOI on Johnston Island. Assisted with preparation of the remediation work plan and site safety and health plan. Performed confirmation sample management and coordinated shipment of confirmation samples from Hawaii to the mainland laboratory. Assisted in the preparation of post-remediation excavation and sampling drawings.

Jonathan Springs Well Granulated Activated Carbon Treatment Unit Design, Honolulu Board of Water Supply: Project Manager for the preliminary sizing and design of the new granular activated carbon (GAC) treatment facility. This was the first project within Hawaii to utilize GAC technology for the removal of dieldrin and chlordane. Responsibilities included overall project management, coordination of subconsultants, and preparation of the preliminary design. Performed preliminary sizing calculations for the GAC unit, and the backwash settling tank and filter units. Prepared the preliminary layout of the GAC facilities and the construction cost estimate.

Collection System Maintenance Spill Response Procedures Manual, City and County of Honolulu: Project Engineer for the development of standardized spill response procedures for the City. Wrote a Spill Response Procedures Manual for the handling of wastewater spills in the collection system.

PUBLICATIONS:

S.R. Spengler, W. Freeman, D.W. Schlack, and R.S. Yamauchi. 1997. Exploring Electronic Project Data Management Alternatives for Environmental Projects. Paper presented at 1998 Pacific Basin Conference on Hazardous Waste, East-West Center, Program on Environment.

S.R. Spengler, R.S.W. Yamauchi, B.M.B. Pabingwit, and R. Babcock. 1999. Evaluating the Environmental Impact from Injection of Treated Wastewater in a Coastal Aquifer. Paper presented at ModelCARE'99 Conference, Zurich, Switzerland, September 20-23, 1999.

PHASE I
ENVIRONMENTAL SITE ASSESSMENT

MAALAEA 710-ACRE SITE
WAILUKU, MAUI, HAWAII
TMK: (2) 3-6-004: PARCELS 003 & 006

December 12, 2006

Prepared for:

M&E Pacific, Inc.
841 Bishop Street, Suite 1900
Honolulu, Hawaii 96813

Prepared by:

element environmental llc
environmental engineering · water resources
62-180 Emerson Road
Haleiwa, Hawaii 96712
Phone (808) 637-1200 • Fax (808) 637-0001

Job No. 060050

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APPENDICES

EXECUTIVE SUMMARY

Element Environmental LLC (E2) conducted a Phase I Environmental Site Assessment (ESA) on approximately 710.171 acres of land designated as Tax Map Key (TMK): (2) 3-6-004 parcels 003 and 006 (the property). The property is located in West Maui between Waikapu and Maalaea along the western side of Honoapiilani Highway. The property was formerly used for sugar cane and pineapple cultivation and is still partially used for sugar cane cultivation.

The Phase I ESA was performed in accordance with the scope and limitations of the American Society of Testing and Materials Practice E 1527-05 to identify the presence of recognized environmental conditions associated with the property and included a review of environmental regulatory records in the site vicinity, a review of the site history, a review of the site geology and hydrogeology, a site reconnaissance, and interviews.

This assessment has revealed no significant evidence of recognized environmental conditions in connection with the property with the exception of chlorine and fertilizer storage and mixing tanks, pole-mounted transformers, and illicit solid waste dumping areas. It is not known if the chlorine gas canisters and fertilizer storage tanks or the mixing tanks still contain chlorine or fertilizers, although the chlorine gas storage cabinets did have a chlorine odor. The pole-mounted transformers did not have visible labels that would indicate whether they contain polychlorinated biphenyls (PCBs). The solid waste dump areas consisted of abandoned vehicles, disposed tires, refrigerators, and other appliances.

E2 recommends that the chlorine and fertilizer storage and mixing tanks be properly disposed and/or recycled in accordance with all Federal, State and local regulations. Upon removal of the storage and mixing tanks, the soil and vegetation beneath the storage and mixing tanks should be inspected for indications of a release by an environmental professional. If a significant release is suspected, appropriate sampling and cleanup should be conducted.

E2 recommends that the pole-mounted transformers be tested for PCBs. If a significant release of PCBs is suspected, appropriate sampling and cleanup should be conducted.

E2 recommends that the illicit solid waste dumping areas be cleared and the solid wastes be disposed in accordance with all Federal, State and local regulations. Upon removal of the solid waste, the soil and vegetation beneath the solid waste should be inspected for indications of a release by an environmental professional. If a significant release is suspected, appropriate sampling and cleanup should be conducted.

E2 has also identified that the property has been historically used for sugarcane and pineapple cultivation. In an interview, Mr. Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. Therefore, residual levels of pesticides and herbicides are probably present on the property. Although proper applications of pesticides and herbicides does not constitute a release of hazardous chemicals, E2 recommends that limited composite soil sampling be conducted on the property should the intended land use of the property change from agricultural to residential. The purpose of the limited sampling would be to determine if residual levels of pesticides/herbicides are present in site soils. The sample analyses selected should be based on the list of potential pesticides and herbicides that may have been applied to the property as provided by Mr. Chumbley.

PHASE I ENVIRONMENTAL SITE ASSESSMENT

Maalaea Mauka
Wailuku, Maui, Hawaii
TMK: (2) 3-6-004: Parcels 003 & 006

December 12, 2006

1.0 INTRODUCTION

1.1 OVERVIEW

This report presents the results of Element Environmental LLC's (E2's) Phase I Environmental Site Assessment (ESA) of the subject property. The general location of the property is shown on Figure 1 (Site Vicinity Map) in Appendix A.

This report details the work performed to identify the presence of recognized environmental conditions associated with this property. Throughout this ESA the property of interest is referred to as *the subject property, the property, the site, or the facility.*

1.2 PURPOSE

E2 conducted this Phase I ESA to identify recognized environmental conditions associated with the property. American Society for Testing and Materials (ASTM) guidance defines *recognized environmental conditions* as the "presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property" (ASTM, 2005). Recognized environmental conditions do not include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies (ASTM, 2005).

This Phase I ESA constitutes all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice and is intended to permit the Phase I ESA user to satisfy one of the requirements to qualify for the innocent landowner, contiguous property owner, or bona fide prospective purchaser limitations on Comprehensive Environmental Response Compensation and Liability Act (CERCLA) liability, hereinafter, the "landowner liability protections" or "LLPs".

1.3 DETAILED SCOPE OF SERVICES

Our Phase I ESA was performed in accordance with the ASTM "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process" (ASTM Designation E 1527-05). The ASTM standard defines good commercial and customary practice in the United States of America for conducting an environmental site assessment of a parcel of commercial real estate with respect to the range of contaminants within the scope of Comprehensive Environmental Response, Compensation and

Liability Act (CERCLA) (42 U.S.C. §9601) and petroleum products (ASTM, 2005). Adherence to the ASTM standard is intended to limit liability of property owners from inherited environmental contamination.

We performed the following tasks in completion of the Phase I ESA:

- **Review of regulatory records.** We reviewed standard environmental record sources including the U.S. Environmental Protection Agency's (EPA's) Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) database, EPA's Resource Conservation and Recovery Act (RCRA) database, U.S. Institutional Controls database, U.S. Engineering Controls database, EPA's Emergency Response Notification System (ERNS) database, State of Hawaii Department of Health (DOH) Office of Hazard Evaluation and Emergency Response (HEER) site list, DOH Underground Storage Tank (UST) lists, DOH list of landfills and other solid waste facilities, DOH Voluntary Response Program (VRP) sites list, and DOH Brownfield sites list.
- **Review of site history.** We reviewed reasonably ascertainable standard historical sources including historical maps; aerial photographs; building permits, zoning records and property tax records available online; various printed publications as well as publications posted on the internet; and information from the interview with the owner's representative.
- **Review of site geology and hydrogeology.** We reviewed reasonably ascertainable published information on surface and subsurface conditions at the site and surrounding area. We used this information to assess topography, drainage, surface water bodies, anticipated subsurface geology, and groundwater occurrence and usage in the area.
- **Site reconnaissance.** We performed a site reconnaissance of the property to note visual signs of contamination, and we conducted a limited assessment of portions of the neighboring properties visible from the subject property boundaries. During our site reconnaissance we specifically looked for stained soil, dead or stressed vegetation, hazardous substances, petroleum products, electrical and hydraulic equipment, aboveground and underground storage tanks, disposal areas, maintenance areas, wells, sumps, drains, and cesspools/sewers.
- **Interviews.** We interviewed the user of the Phase I ESA and owner's representative, Mr. Steven Kikuchi, Partner of Maalaea Properties; and former owner's representative, Mr. Avery Chumbley, President of Wailuku Agribusiness regarding past and current use and activities on the property and adjoining properties.
- **Data evaluation and report preparation.** We evaluated the information collected and prepared this report that documents our assessment and presents our findings, opinions, and conclusions.

1.4 SIGNIFICANT ASSUMPTIONS

Significant assumptions include the following:

1) The information provided during the interview with the owner's representative is complete and accurate and
2) The information provided by the regulatory database search service is complete and accurate.

1.5 LIMITATIONS AND EXCEPTIONS

Phase I ESAs, by their very nature, are limited. E2 has endeavored to meet what it believes is the applicable standard of care and, in so doing is obliged to advise M&E Pacific, Inc. and Maalaea Properties LLC of Phase I ESA limitations. This ESA did not assess environmental issues or conditions at the property that are outside the scope of ASTM Practice 1527-05, including asbestos-containing materials (ACMs), radon, lead-based paint, lead in drinking water, wetlands, regulatory compliance, cultural and historic resources, industrial hygiene, health and safety, ecological resources, endangered species, indoor air quality, biological agents and mold, and site geotechnical concerns, nor did it include any sampling or testing for biological agents and mold, radon, methane, ACMs, lead-based paint, or other environmental contaminants. Our investigation was limited to the procedures described in the Phase I ESA Standard Practice (ASTM, 2005).

The conclusions presented in this report are professional opinions based solely upon visual observations of the site and vicinity and our interpretation of the available historical and regulatory information and documents reviewed. They are intended exclusively for the purpose outlined herein and apply only to the site location and project indicated.

Our findings and opinions are based on information that we obtained on given dates through records review, site reconnaissance, interviews, and related activities. It is possible that other information exists or subsequently has become known, just as it is possible for conditions we observed to have changed after our observation. For these and associated reasons, E2 and many of its peers routinely advise clients for ESA services that it would be a mistake to place unmerited faith in findings and opinions conveyed via ESA reports. E2 cannot under any circumstances warrant or guarantee that not finding indicators of hazardous substances or petroleum products means that hazardous substances or petroleum products do not exist on the site.

1.6 SPECIAL TERMS AND CONDITIONS

E2's services are performed, within the limits prescribed by our Clients, with the usual thoroughness and competence of the consulting profession in accordance with the standard for professional services at the time those services are rendered. No warranty or representation, either expressed or implied, is included or intended in our proposals, contracts, or reports.

Findings and opinions presented herein apply to site conditions existing at the time of our investigation and those reasonably foreseeable; they cannot necessarily apply to site changes of which we are not aware and have not had the opportunity to evaluate.

1.7 USER RELIANCE

This report is intended for the sole use of M&E Pacific Inc. and Maalaea Properties LLC. The scope of services performed in execution of this investigation may not be appropriate to satisfy the needs of other users, and any use or re-use of this document or the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

2.0 SITE DESCRIPTION

2.1 LOCATION AND LEGAL DESCRIPTION

The subject property consists of two parcels of developed land located in West Maui between Waikapu and Maalaea along the western side of Honoapiilani Highway. Figure 1 (Site Vicinity Map) and Figure 2 (Site Location Map) in Appendix A show the site location. The property consists of approximately 710.171 acres of land designated as Tax Map Key (TMK): (2) 3-6-004: parcels 003 & 006.

2.2 SITE AND VICINITY GENERAL CHARACTERISTICS

The subject property is located along the western side of Honoapiilani Highway (Route 30) between Waikapu Stream (Waikapu Ditch) and Kuihelani Highway on the Island of Maui. The western portion of the property is partially bounded by the Waihee Ditch, the eastern side of the West Maui Mountains between Waikapu Valley and Kauneahua Ridge, the King Kamehameha Golf Course, Kahili Golf Course, and a former quarry.

The state land use designation for the property is Agricultural (County of Maui, 2006). The property is not located in a State Special Management Area (County of Maui, 2006). The property is not located within the Federal Emergency Management Agency 500 year flood plain (County of Maui, 2006).

Maui is moderately warm with mean monthly temperatures ranging from 70° to 84° Fahrenheit. The average annual rainfall at the site is approximately 20 inches per year (Giambelluca et al., 1986).

2.3 CURRENT USE OF THE PROPERTY

A portion of the property is currently used for sugar cane cultivation. The sugar cane cultivation activities are operated by Hawaii Commercial & Sugar Company (HC&S). The Waihee Ditch is currently operated by Wailuku Water Company.

2.4 DESCRIPTIONS OF STRUCTURES, ROADS, AND OTHER IMPROVEMENTS ON THE SITE

The site is currently occupied by sugar cane cultivation throughout a portion of the site. HC&S has operated drip irrigation lines throughout the property to irrigate the sugar cane crops. Wailuku Water Company operates the Waihee Ditch, which is located primarily along the western boundary of the site. Honoapiilani Highway runs along the eastern boundary of the site.

At least three sets of chlorine and fertilizer storage and mixing tanks are located throughout the site. An access road from Honoapiilani Highway to the King Kamehameha and Kahili Golf Courses bisects the northern and southern portions of the site. Dirt roads also traverse various portions of the site. There is also two reservoirs, one near the northwestern corner of the site and one near the south western corner of the site.

Photographs of the site showing some of the site improvements are included in Appendix A.

2.5 CURRENT USES OF THE ADJOINING PROPERTIES

Current uses of adjoining properties include the open land to the north, the Maui Tropical Plantation to the northeast; sugar cane and former pineapple cultivation areas across Honoapiilani Highway to the east; Maalaea Construction and Demolition Landfill to the southeast; open lands and former sugar cane agricultural land to the south; the Hawaiian Cement quarry to the southwest; the Waihee Ditch, Kahili Golf Course, King Kamehameha Golf Course, and former quarry, and the West Maui Mountains to the west.

3.0 USER PROVIDED INFORMATION

3.1 ENVIRONMENTAL LIENS OR ACTIVITY AND USE LIMITATIONS

Mr. Steven Kikuchi, of Maalaea Properties LLC, is not aware of any environmental cleanup liens against the property. A copy of the User Questionnaire completed by Mr. Kikuchi is included in Appendix C.

3.2 SPECIALIZED KNOWLEDGE

Mr. Kikuchi has no specialized knowledge or experience related to the property or nearby properties.

3.3 COMMONLY KNOWN OR REASONABLE ASCERTAINABLE INFORMATION

Mr. Kikuchi is not aware of commonly known or reasonably ascertainable information about the property that would help identify conditions indicative of releases or threatened releases of hazardous substances or petroleum products.

3.4 VALUATION REDUCTION FOR ENVIRONMENTAL ISSUES

Mr. Kikuchi did not indicate any valuation reduction of the subject property due to environmental issues.

3.5 OWNER, PROPERTY MANAGER, AND OCCUPANT INFORMATION

Maalaea Properties LLC owns the property and HS&C currently uses a portion of the site for sugar cane cultivation. Mr. Steven Kikuchi is a Partner of Maalaea Properties. According to Mr. Kikuchi no employees or tenants reside on the subject property.

3.6 REASON FOR PERFORMING THE PHASE I ESA

The Phase I ESA was conducted at the request of Maalaea Properties LLC as part of the due diligence process prior to developing the subject property for varied agricultural and potential residential uses.

3.7 OTHER INFORMATION

No other information was provided by the user.

4.0 RECORDS REVIEW

4.1 STANDARD ENVIRONMENTAL RECORD SOURCES

4.1.1 Overview

To identify the presence of adverse environmental conditions at the subject property, several published sources of environmental records were reviewed. This section lists the records that were searched and the results of each search.

ASTM E 1527-05 specifies a search distance for specific environmental record sources. The following record sources were searched for incidents or sites within the listed search distances of the subject property:

Standard Environmental Record Sources	Search Distance (miles)
Federal NPL (National Priorities List) site list	1.0
Federal Delisted NPL site list	0.5
Federal CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System) list	0.5
Federal CERCLIS NFRAP (No Further Remedial Action Planned) site list	0.5
Federal RCRA (Resource Conservation and Recovery Act) CORRACTS facilities list (facilities subject to Corrective Action under RCRA)	1.0
Federal RCRAInfo list for TSDF (treatment, storage, and disposal facilities)	0.5
Federal RCRAInfo list for generators	Site and adjoining properties
Federal institutional control/engineering control registries	Site only
Federal ERNS (Emergency Response Notification System) list	Site only
State list of hazardous waste sites identified for investigation or remediation (NPL or CERCLIS equivalents)	1.0
State landfill and/or solid waste disposal site list	0.5
State leaking UST (underground storage tank) list	0.5
State registered UST list	Site and adjoining properties
State institutional control/engineering control registries	Site only
State voluntary cleanup sites	0.5
State Brownfield sites	0.5

E2 used a regulatory database search service, provided by Environmental Data Resources, Inc. (EDR), to review the above Federal and State government databases. A copy of *The EDR Radius Map* is included in Appendix B. The following sections summarize the findings of the regulatory database search. In reviewing the environmental databases, it should be noted that such databases are not instantaneously updated by the specific regulatory agencies. Depending on the database and the agency, update frequency update frequency may be as infrequent as annually. The dates of the most recent updates for the searched environmental databases are listed in the EDR report in Appendix B.

4.1.2 U.S. EPA National Priorities Site List

The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. The ASTM designated search distance for the NPL is one mile. EDR did not locate NPL sites within one mile of the subject property.

4.1.3 U.S. EPA Delisted NPL Site List

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425(e), sites may be deleted from the NPL where no further response is appropriate. The ASTM designated search distance for delisted NPL sites is one-half mile. EDR did not locate delisted NPL sites within one-half mile of the subject property.

4.1.4 U.S. EPA CERCLIS List

The CERCLIS list contains data on potentially hazardous sites that have been reported to the EPA by states, municipalities, private companies, and private persons pursuant to Section 103 of CERCLA. CERCLIS contains sites which are either proposed to or on the NPL and sites which are in the screening and assessment phase for possible inclusion on the NPL. The ASTM designated search distance for CERCLIS sites is one-half mile. EDR did not identify CERCLIS sites within one-half mile of the subject property.

4.1.5 U.S. EPA CERCLIS NFRAP Site List

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the NPL, unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site. The ASTM designated search distance for NFRAP sites is one-half mile. EDR did not locate CERCLIS NFRAP sites within one-half mile of the property.

4.1.6 U.S. EPA RCRA CORRACTS Facilities List

EPA's CORRACTS, or Corrective Action Sites database, identifies facilities that generate, treat, store, or dispose of hazardous wastes where RCRA corrective action activity has occurred. These sites have experienced spills or releases of hazardous chemicals prompting the need for corrective action. The ASTM designated search distance for the CORRACTS list is one mile. EDR did not identify any CORRACTS sites within one mile of the subject property.

4.1.7 U.S. EPA RCRAInfo List for TSD Facilities

The RCRAInfo list includes facilities that treat, store, dispose of, or incinerate hazardous waste (TSD facilities). The ASTM designated search distance for TSD facilities is one-half mile. EDR did not identify any TSD facilities within one-half mile of the subject property.

4.1.8 U.S. EPA RCRA Generators List

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS). The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kilograms (kg) of hazardous waste, or less than one kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over one kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste. The ASTM designated search distance for RCRA generators is the subject property and adjoining properties. EDR did not identify any RCRA generators on an adjoining property.

4.1.9 U.S. Institutional / Engineering Control Registries

U.S. Institutional / Engineering Control (IEC) registries are lists of sites that have institutional and/or engineering controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health. The ASTM designated search distance for federal institutional / engineering control registries is the subject property only. EDR did not locate any federal IEC sites on the subject property or within one mile of the subject property.

4.1.10 U.S. EPA ERNS List

ERNS is a national database of more than 365,000 records, which contains information on specific notification of releases of oil and hazardous substances to the environment. The ASTM designated search distance for ERNS incidents is the subject property only. No reported ERNS incidents have occurred on the subject property.

4.1.11 State of Hawaii Hazardous Waste Sites List

The State Hazardous Waste Sites records are the states' equivalent to NPL or CERCLIS. These sites may or may not already be listed on the federal NPL or CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. The DOH HEER office maintains a Sites of Interest Database, which includes sites that HEER has an interest in, has investigated, or may investigate under Hawaii Revised Statute 128D (the State Superfund law). The ASTM designated search distance for the State Hazardous Waste Sites List is one mile. EDR did not identify any State Hazardous Waste sites within one mile of the subject property.

4.1.12 State of Hawaii Landfill / Solid Waste Disposal Site List

The State DOH Solid and Hazardous Waste Branch has a list of permitted solid waste disposal facilities and landfills in the State of Hawaii. The ASTM designated search distance for permitted solid waste disposal sites / landfills is one-half mile. EDR did not locate any permitted landfills or disposal sites within one-half mile of the subject property.

4.1.13 State of Hawaii LUST List

The leaking underground storage tank (LUST) database, compiled by the State DOH Solid and Hazardous Waste Branch (SHWB) UST Section, contains an inventory of reported leaking underground storage tank incidents. The ASTM designated search distance for LUST sites is one-half mile. EDR located two (one orphan) LUST sites within one-half mile of the subject property. The sites are listed below.

LUST Site Name	Location Relative to the Subject Property	Site Status/Comments
Hawaiian Cement - Waikapu Quarry Honoapiilani Highway Wailuku, HI 96793	adjacent to site – northeast (down gradient)	Site Cleanup Completed 5/16/95.
Maui Tropical Plantation 1670 Honoapiilani Highway Wailuku, HI 96793	adjacent to site – southwest (down gradient)	Site Cleanup Completed 8/25/05.

Note: Gradient direction refers to approximate groundwater flow direction.

It is unlikely that off-site LUST sites have negatively impacted the subject property due to the "Site Cleanup Completed" status of the sites and the anticipated groundwater flow direction from the down gradient sites.

4.1.14 State of Hawaii Registered UST List

USTs are regulated under RCRA and must be registered with the state department responsible for administering the UST program. The list of registered UST sites is compiled by the State DOH SHWB UST Section. The ASTM designated search distance for UST sites is one-quarter mile. EDR located two UST sites within one-quarter mile of the subject property. The sites are listed below.

UST Site Name	Location Relative to the Subject Property	Site Status/Comments
Hawaiian Cement - Waikapu Quarry Honoapiilani Highway Wailuku, HI 96793	adjacent to site – northeast (down gradient)	6 USTs Permanently Out of Use.
Maui Tropical Plantation 1670 Honoapiilani Highway Wailuku, HI 96793	adjacent to site – northeast (down gradient)	2 USTs Permanently Out of Use.

Note: Gradient direction refers to approximate groundwater flow direction.

It is unlikely that the off-site UST sites have negatively impacted the subject property due to the status and groundwater flow direction (down gradient) of the USTs.

4.1.15 State of Hawaii Institutional Control Registry

Institutional controls on properties were obtained from the DOH VRP and Brownfield databases. The ASTM designated search distance for state institutional / engineering control registries is the subject property only. EDR did not identify the subject property on state institutional / engineering controls lists.

4.1.16 State of Hawaii Voluntary Response Program Sites

The ASTM designated search distance for VRP sites is one-half mile. EDR did not identify any VRP sites listed within one-half mile of the subject property.

4.1.17 State of Hawaii Brownfield Sites

The ASTM designated search distance for Brownfield sites is one-half mile. EDR did not list any state Brownfield sites within one-half mile of the subject property.

4.2 ADDITIONAL ENVIRONMENTAL RECORD SOURCES

Additional environmental record sources that were reviewed for this Phase I ESA included Maui County building permit and zoning records available online. The findings from review of these records are discussed in Section 4.4.2.

4.3 PHYSICAL SETTING SOURCES

4.3.1 USGS Topographic Map Coverage

According to the U.S. Geological Survey (USGS) topographic maps of the area (Wailuku and Maalaea Quadrangles), the property is located at approximately 20° 50' 17.5" north latitude and 156° 30' 28.3" west longitude. The elevation of the subject property ranges from approximately 200 feet above mean sea level at the southeastern end near Kuihelani Highway to approximately 1,080 feet above mean sea level at the northwestern end near the Maui Tropical Plantation. Topographic map coverage of the subject site is shown on Figure 1 in Appendix A.

4.3.2 Geologic and Hydrogeologic Setting

E2 reviewed published geologic and hydrogeologic reports and maps to obtain information regarding subsurface conditions in the general area of the site to evaluate potential migration of contaminants.

<u>Geology and Soils</u>

The subject property is located along the eastern base of the West Maui Mountains.

According to the U. S. Soil Conservation Service (Foote et al., 1972) the predominant soil types located in the site vicinity are:

Wailuku silty clay – well drained soils on alluvial fans on the island of Maui.

Iao clay – well drained soils on alluvial fans and in basins on the island of Maui.

Pulelu cobbly loam – well drained and excessively drained, medium textured, moderately textured, and coarse-textured soils on alluvial fans and in basins on the island of Maui.

Stony alluvial land – moderately well and well drained, moderately coarse textured soils with moderate infiltration rates.

Ewa silty clay – well drained on alluvial fans and in basins on the islands of Maui and Oahu.

Hydrogeology

The subject property is located within the Waikapu Aquifer System of the Wailuku Aquifer Sector (Mink and Lau, 1990). There are two aquifers located beneath the majority of the site, which is located east of the Waihee Ditch, an upper aquifer that occurs in sedimentary (alluvial) deposits and a lower (deeper) aquifer that occurs in horizontally extensive lavas. Both aquifers are basal, where freshwater is in contact with seawater. The upper aquifer is unconfined, where the water table is the upper surface of the saturated aquifer; and the lower aquifer is confined by impermeable or poorly permeable formations (the sedimentary deposits) with the top of the saturated aquifer below the surface of the groundwater (Mink and Lau, 1990).

The upper aquifer has the potential to be used, is not a drinking water source or ecologically important, has a moderate salinity (1,000 to 5,000 milligrams per liter of chloride), is replaceable, and is moderately vulnerable to contamination. The lower aquifer has the potential to be used, is not a drinking water source or ecologically important, has a moderate salinity (1,000 to 5,000 milligrams per liter of chloride), is replaceable, and has a low vulnerability to contamination.

For a portion of the site, which is located west of the Waihee Ditch, there is an aquifer located beneath the site. The aquifer occurs in horizontally extensive lavas; is basal, where freshwater is in contact with seawater; and is unconfined, where the water table is the upper surface of the saturated aquifer (Mink and Lau, 1990).

Based on regional topography, regional groundwater flow direction is expected to be south-southeast towards the ocean. The nearest drinking water supply wells are located within the site near the southwestern reservoir (EDR, 2006). There are five wells registered with the State Department of Land and Natural Resources within a one mile radius of the property. Three wells are being used for irrigation, one well may be used for drinking water for future residential development, and one well does not have a listed use.

Surface Water

There are two earthen reservoirs located on the site. Both reservoirs are located topographically up gradient of the surrounding on-site areas. The closest down-gradient surface water body to the site is the Maalaea Small Boat Harbor, which is approximately 1 mile south of the southern end of the site, and is contiguous with the Pacific Ocean. The location of the Maalaea Small Boat Harbor in relation to the site is shown on Figure 1 in Appendix A.

Storm water runoff appears that it would flow into streams, swales and gullies throughout the site towards Honoapiilani Highway and Maalaea Harbor.

4.4 HISTORICAL USE INFORMATION

4.4.1 Historical Review Sources

Past use of the subject property and adjoining properties was ascertained by reviewing the following standard historical sources: aerial photographs; building permits, zoning records, and property tax records available online; various printed publications; as well as publications posted on the internet; and information from the interview with the owner's representative. Appendix D contains copies of pertinent maps.

4.4.2 Past Uses of the Subject Property and Adjoining Properties

Past Uses of the Subject Property

Review of aerial photographs from 1950 through 1995 indicates that the property was used for agricultural purposes throughout the entire period.

In the 1950 aerial photograph indicates that a plantation village was located near the center of the property. As many as 12 to 20 small structures are visible in the aerial photograph. The 1964 aerial photograph shows that all of the structures have been removed.

The property was historically used for agriculture, specifically for pineapple and sugar cane cultivation. In an interview, Mr. Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. Mr. Chumbley provided a list of potential pesticides and herbicides that may have been applied to the property (Appendix C).

Past Uses of Adjoining Properties

The earliest aerial photographs from 1950 indicate that a quarry was active at the location of the current Maalaea Construction and Demolition Landfill, located to the southeast of the property. The aerial photograph indicates that the land to the north had some residential development that was part of Waikapu; to the south was open, undeveloped land; and to the east, across Honoapiilani Highway, the land was being used for agriculture.

No changes are visible until the 1974 aerial photograph where new quarry activities had begun to the west of the central portion of the site.

In the 1985 aerial photograph, two large reservoirs to the northeast of the site had been filled in and two large structures were constructed at the current location of the Maui Tropical Plantation.

The last aerial photograph in 1995 shows that quarry activity to the west may have stopped and two golf courses have been developed to the west of the site.

From the site reconnaissance and interviews, also to be discussed in the following sections, we know that the quarry to the southeast had begun operations before 1950 is now being used as a demolition and construction debris landfill. The quarry to the west of the site that began operations in the early 1970s closed sometime in the 1990s. Also, another new quarry (currently operated by Hawaiian Cement) began operations to the southwest of the site and is still in operation at this time.

5.0 SITE RECONNAISSANCE

5.1 METHODOLOGY AND LIMITING CONDITIONS

E2 personnel conducted the site reconnaissance from November 1, 2006 through November 3, 2006. The site reconnaissance consisted of a visual inspection of the property and the surrounding area.

The site reconnaissance was limited by the following condition:

1) The site had only a few dirt roads that were drivable. Overgrown grass and the site topography in areas where the site was inaccessible by car may have obstructed the view of some surface or subsurface objects.

2) Chlorine and fertilizer storage and mixing tanks were found at the site. No sampling was performed to determine the exact contents.

3) Abandoned vehicles, vehicle parts, and household appliances were found at the site. No sampling was performed to determine if hazardous materials or wastes were present.

5.2 GENERAL SITE SETTING

Site reconnaissance was conducted from November 1, 2006 through November 3, 2006 by Mr. Roger Aoki and Mr. Ryan Yamauchi of E2. The reconnaissance included visual a survey of the property and a brief survey of the visible portions of the adjacent properties. Photographs are included in Appendix A.

The site is former sugar cane and pineapple agricultural land that is currently being used as sugar cane agricultural land operated by HS&C.

An active quarry facility is in operation to the southwest. Also, across Honoapiilani Highway to the southeast there is a former quarry that is currently being used as a demolition and construction debris landfill. There is a former quarry and two golf courses to the west. The area to the east was used for sugar cane agriculture. The Maui Tropical Plantation is located to the northeast of the property.

5.3 HAZARDOUS SUBSTANCE AND PETROLEUM PRODUCTS IN CONNECTION WITH IDENTIFIED USES

E2 did not identify any hazardous substance and petroleum products during the site reconnaissance.

5.4 HAZARDOUS SUBSTANCE AND PETROLEUM CONTAINERS *(NOT NECESSARILY IN CONNECTION WITH IDENTIFIED USES)*

E2 did not observe any hazardous substances or petroleum containers not necessarily associated with identified uses.

5.5 UNIDENTIFIED SUBSTANCE CONTAINERS

E2 did not locate any unidentified substance containers within the property.

5.6 STORAGE TANKS

E2 observed three sets of chlorine and fertilizer storage and mixing tanks on the property during the site reconnaissance.

5.7 INDICATIONS OF PCBS

E2 observed three canister pole-mounted transformers located near the earthen reservoir at the southwestern corner of the property. No labels were apparent on the canisters, which could indicate the potential presence of PCBs. No staining was observed on the ground surface below the pole mounted transformers. According to the Mr. Steven Kikuchi, partner of Maalaea Properties, the transformers located on, or adjacent to the property are owned by the Maui Electric Company (MECO). It is possible that some of these transformers contain PCBs in their dielectric fluid. According to the HECO, all MECO-owned leaking transformers are replaced, and any associated oil spills are remediated (at their expense) in accordance with all applicable EPA and DOH guidelines.

5.8 INDICATIONS OF SOLID WASTE DISPOSAL

E2 observed several piles of solid waste, which appears to be abandoned vehicles, discarded vehicle parts and major household appliances, on the property. The piles of illicit dumping were located near the central portion of the site near a paved road off of Honoapiilani Highway.

5.9 MIGRATION OF OFF-SITE CONTAMINATION

E2 did not observe off-site contaminant migration onto the property.

5.10 OTHER CONDITIONS OF CONCERN

Odors
No strong, pungent, or noxious odors were identified at the property during the site reconnaissance.

Stressed Vegetation
No stressed vegetation was identified at the property during the site reconnaissance.

Wastewater and Septic Systems
No wastewater or septic systems were identified at the property during the site visit or from records reviewed.

Storm Water
Storm water run-on and/or run-off was observed on the property during the site reconnaissance. Storm water runoff flowed into streams, swales and gullies to the south-southwest of the site towards Honoapiilani Highway and Maalaea Harbor.

Drains and Sumps
No drains or sumps were identified at the property during the site reconnaissance.

Stained Soil or Pavement
No stained soil or pavement was identified at the property during the site reconnaissance.

Wells
Although a registered well is located near the reservoir in the southwestern corner of the site, no wells were identified at the property during the site reconnaissance. Wells are discussed in Section 4.3.2.

Pits, Ponds, or Lagoons
One earthen reservoir was located at the southwestern corner of the site. A second earthen reservoir was reported to be located at the northwestern corner of the site, however, due to road and weather conditions, this reservoir was not accessible and was not visually located. No other pits, ponds, or lagoons were identified at the property during the site reconnaissance.

6.0 INTERVIEWS

6.1 INTERVIEW WITH CURRENT OWNER / FORMER OWNER / OCCUPANTS

E2 interviewed Mr. Steven Kikuchi, Partner of Maalaea Properties LLC and Mr. Avery Chumbley, President of Wailuku Agribusiness regarding the subject property. Information obtained during the interviews is included in pertinent sections of this report.

6.2 INTERVIEW WITH LOCAL GOVERNMENTAL OFFICIALS

Written requests for information were sent to the State of Hawaii Department of Health, the Maui County Department of Fire Control, and the Local Emergency Planning Committee. Copies of the information request and responses are included in Appendix D and information obtained is included in pertinent sections of this report.

7.0 FINDINGS AND OPINIONS

Review of Standard Environmental Record Sources

A review of the environmental regulatory databases indicated that the subject property was not listed on any of the federal or state databases searched by EDR.

Two LUST sites are located within one-half mile of the subject property. These sites have completed cleanup and are located down gradient of the subject property, therefore, are unlikely to have an environmental impact on the subject property. Likewise, two registered UST sites, both with UST sites

permanently out of use, were identified within ¼ mile of the subject property. The UST sites are located down gradient of the subject property and are unlikely to have an environmental impact on the subject property.

Historical Review

E2 identified that the property was historically used for agriculture, specifically for pineapple and sugar cane cultivation. In an interview, Mr. Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. Mr. Chumbley provided a list of potential pesticides and herbicides that may have been applied to the property (Appendix C).

E2 also identified a construction and demolition debris landfill operating adjacent to the subject property. No records have been filed with the Department of Health regarding hazardous material or substance releases from this site.

Site Reconnaissance

E2 identified two (2) abandoned cars, one (1) abandoned motorcycle, 1 discarded vehicle engine, four (4) tires, at least nine (9) discarded major household appliances and other miscellaneous solid waste at the site. Gasoline and other petroleum products, if released from this debris, may be harmful to and persistent in the environment. No staining was observed on the ground surface below or around the vehicles or vehicle parts.

Three (3) sets of chlorine and fertilizer storage and mixing tanks were observed along the western and eastern perimeter of the property. Each of the sites contained a cabinet with chlorine gas canisters, storage tanks labeled as fertilizer and mixing/contact chambers.

Three (3) pole-mounted transformers were observed near the earthen reservoir located at the southwestern corner of the property. No labels were visible to indicate whether the transformer oil contains PCBs. No staining was observed on the ground surface below the pole mounted transformers. According to the Mr. Steven Kikuchi, partner of Maalaea Properties, the transformers located on, or adjacent to the property are owned by the Maui Electric Company (MECO). It is possible that some of these transformers contain PCBs in their dielectric fluid. According to the HECO, all MECO-owned leaking transformers are replaced, and any associated oil spills are remediated (at their expense) in accordance with all applicable EPA and DOH guidelines.

E2 did not observe any other recognized environmental conditions during the site reconnaissance.

8.0 CONCLUSIONS

We have performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E 1527-05 of the subject property, located in Wailuku, Hawaii, designated as TMK: (2) 3-6-004: parcels 003 & 006. Any exceptions to, or deletions from, this practice are described in Section 1.5 of this report. This assessment has revealed no significant evidence of recognized environmental conditions in connection with the property with the exception of the solid waste piles and abandoned vehicles located along the paved and dirt road off of Honoapiilani Highway near the central potion of the property; three sets of chlorine and fertilizer storage and mixing tanks, and three pole mounted transformers located near the earthen reservoir located at the southwestern corner of the property.

E2 recommends that the abandoned vehicles and other solid waste be removed and properly disposed and/or recycled in accordance with all Federal, State and local regulations. Upon removal of the solid waste, the soil and vegetation beneath the solid waste debris should be inspected for indications of a release by an environmental professional. If a significant release is suspected, appropriate sampling and cleanup should be conducted.

E2 recommends that the chlorine and fertilizer storage and mixing tanks be properly disposed and/or recycled in accordance with all Federal, State and local regulations. Upon removal of the storage and mixing tanks, the soil and vegetation beneath the storage and mixing tanks should be inspected for indications of a release by an environmental professional. If a significant release is suspected, appropriate sampling and cleanup should be conducted.

E2 recommends that the pole-mounted transformers be tested for PCBs. If a significant release of PCBs is suspected, appropriate sampling and cleanup should be conducted.

E2 has also identified that the property has been historically used for sugarcane and pineapple cultivation. In an interview, Mr. Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. Therefore, residual levels of pesticides and herbicides are probably present on the property. Although proper applications of pesticides and herbicides does not constitute a release of hazardous chemicals, E2 recommends that limited composite soil sampling be conducted on the property should the intended land use of the property change from agricultural to residential. The purpose of the limited sampling would be to determine if residual levels of pesticides/herbicides are present in site soils. The sample analyses selected should be based on the list of potential pesticides and herbicides that may have been applied to the property as provided by Mr. Chumbley.

9.0 DEVIATIONS

In conducting this Phase I ESA, there were no deletions from the standard practice (ASTM Designation E1527-05) and no client-imposed constraints. In addition, no data gaps were encountered, other than the limitations described in Section 5.1.

10.0 REFERENCES

ASTM, 2005. *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM Designation E 1527-05). American Society for Testing and Materials (ASTM)*, Washington, 2005.

County of Maui, 2006. *Maui County Online Services.* County of Maui, November 2006. http://www.mauicounty.gov/online_services/index1.htm

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Foote, D.E., E. L. Hill, S. Nakamura, F. Stephens, 1972. *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* U.S. Dept. of Agriculture Soil Conservation Science, U.S. Government Printing Office, 1972.

EDR, 2006. *The EDR Radius Map, TMK 3-6-04, Wailuku, HI 96793. Inquiry Number: 1787728.3r.* EDR Environmental Data Resources, Inc., November 08, 2006.

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Mink, J. F. and Lau, S., 1990. *Aquifer Identification and Classification for Maui Groundwater Protection Strategy for Hawaii.* Water Resources Research Center, University of Hawaii, Technical Report 185. February.

R.M. Towill Corporation, 9/28/1950, 12/20/1950, 5/19/1964, 6/2/1964, 3/17/1974, 1/6/1977, 9/11/1985, 6/23/1995. *Aerial Photograph.* R.M. Towill, Aerial Photograph Collection.

11.0 SIGNATURE OF ENVIRONMENTAL PROFESSIONALS

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental professional as defined in §312.10 of 40 CFR 312 and we have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Roger C. Aoki

Roger C. Aoki, P.E. Date: December 12, 2006

Ryan S. Yamauchi, P.E. Date: December 12, 2006

12.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

Qualifications of the environmental professional are included in Appendix E.

LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response Compensation and Liability Information System
CESQG	Conditionally Exempt Small Quantity Generator
CORRACTS	Corrective Action Sites under RCRA
DOH	State of Hawaii, Department of Health
E2	Element Environmental LLC
EDR	Environmental Data Resources, Inc.
EPA	US Environmental Protection Agency
ERNS	Emergency Response Notification System
ESA	Environmental Site Assessment
FINDS	Facility Index System
HEER	Department of Health, Office of Hazard Evaluation and Emergency Response
HSC	Hawaii Commercial & Sugar Company
IEC	Institutional / Engineering Controls
kg	kilogram
LLPs	Landowner Liability Protections
LQG	Large Quantity Generator
LUST	leaking underground storage tank
mg/l	milligrams per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	DOH issued No Further Action status for sites
NFRAP	No Further Remedial Action Planned
NPL	National Priorities List (Superfund sites)
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
SHWB	Department of Health, Solid and Hazardous Waste Branch
SQG	Small Quantity Generator
TMK	Tax Map Key
TSD	treatment, storage and disposal (category of RCRA facility)
USGS	United States Geological Survey (US Dept. of the Interior)
UST	underground storage tank
VRP	Department of Health, Voluntary Response Program

APPENDIX A

Figures and Photo Plates

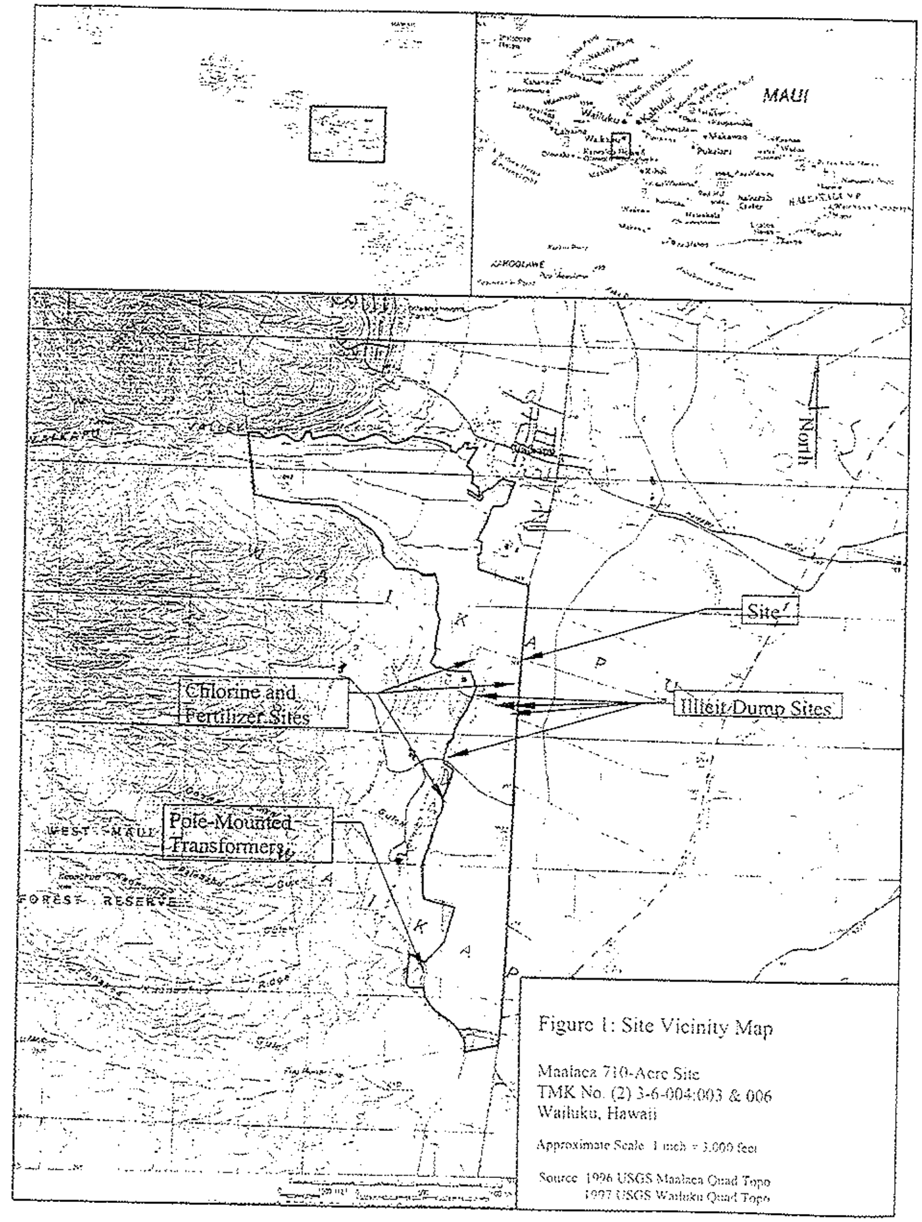
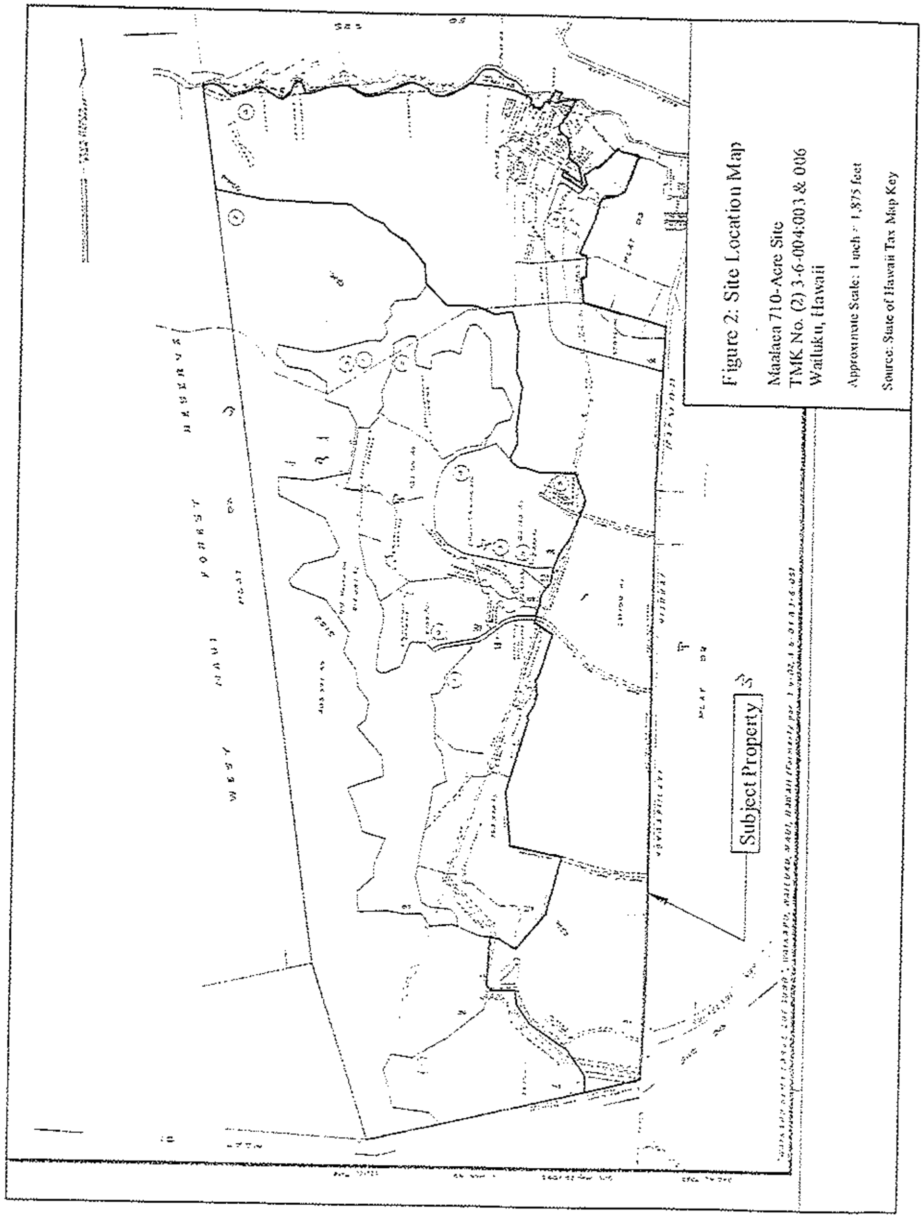


Figure 1: Site Vicinity Map

Maalaea 710-Acre Site
TMK No. (2) 3-6-004:003 & 006
Wailuku, Hawaii

Approximate Scale 1 inch = 3,000 feet

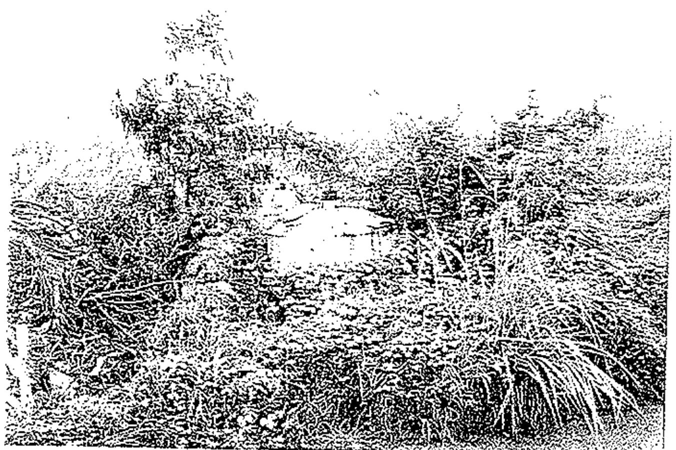
Source 1996 USGS Maalaea Quad Topo
1997 USGS Wailuku Quad Topo



Photograph 1: Southern end of Maalaea 710-acre property, former pineapple cultivation area. Direction: Southeast.

Photograph 2: Illicit dump pile near access road to former quarry off of Honoapiilani Highway. Direction: North.

Photograph 3: Chlorine mixing chambers at one of three water treatment areas observed at the site. Direction: Northeast.



Photograph 4: Abandoned mixing chambers at one of three water treatment areas observed at the site. Direction: Southeast.

Photograph 5: Liquid fertilizer storage tanks at one of three water treatment areas observed at the site. Direction: East.

Photograph 6: Three pole-mounted transformers near the earthen reservoir located at the southwestern end of the property. Direction: Southeast.

APPENDIX B

The EDR Radius Map

EDR DataMap®
Area Study

TMK 3-6-04 : 3,6
Wailuku, HI 96793

November 08, 2006

Inquiry number 01787728.3r

EDR® Environmental Data Resources Inc

The Standard in Environmental Risk Management Information

440 Wheelers Farms Road
Milford, Connecticut 06461

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR).

TARGET PROPERTY INFORMATION

ADDRESS

WAILUKU, HI 96793
WAILUKU, HI 96793

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records within the requested search area for the following databases:

FEDERAL RECORDS

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
Delisted NPL	National Priority List Deletions
NPL RECOVERY	Federal Superfund Liens
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP	CERCLIS No Further Remedial Action Planned
CORRACTS	Corrective Action Report
RCRA-TSDF	Resource Conservation and Recovery Act Information
RCRA-LQG	Resource Conservation and Recovery Act Information
RCRA-SQG	Resource Conservation and Recovery Act Information
ERNS	Emergency Response Notification System
HMIRS	Hazardous Materials Information Reporting System
US ENG CONTROLS	Engineering Controls Sites List
US INST CONTROL	Sites with Institutional Controls
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
US BROWNFIELDS	A Listing of Brownfields Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
ODI	Open Dump Inventory
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
MINES	Mines Master Index File
RAATS	RCRA Administrative Action Tracking System

EXECUTIVE SUMMARY

STATE AND LOCAL RECORDS

SHWS	Sites List
SWF/LF	Permitted Landfills in the State of Hawaii
SPILLS	Release Notifications
INST CONTROL	Sites with Institutional Controls
VCP	Voluntary Response Program Sites
DRYCLEANERS	Permitted Drycleaner Facility Listing
BROWNFIELDS	Brownfields Sites
AIRS	List of Permitted Facilities

TRIBAL RECORDS

INDIAN RESERV	Indian Reservations
INDIAN LUST	Leaking Underground Storage Tanks on Indian Land
INDIAN UST	Underground Storage Tanks on Indian Land

EDR PROPRIETARY RECORDS

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified.

Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

FEDERAL RECORDS

FINDS: The Facility Index System contains both facility information and "pointers" to other sources of information that contain more detail. These include: RCRIS; Permit Compliance System (PCS); Aerometric Information Retrieval System (AIRS); FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, FTTS [FIFRA/TSCA Tracking System]; CERCLIS; DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes); Federal Underground Injection Control (FURS); Federal Reporting Data System (FRDS); Surface Impoundments (SIA); TSCA Chemicals in Commerce Information System (CICS); PADS; RCRA-J (medical waste transporters/disposers); TRIS; and TSCA. The source of this database is the U.S. EPA/NTIS.

A review of the FINDS list, as provided by EDR, and dated 07/21/2006 has revealed that there is 1 FINDS site within the searched area.

Site	Address	Map ID	Page
MAUI TROPICAL PLANTATION	*1670 HONOAPIILANI HWY*	1	3

EXECUTIVE SUMMARY

STATE AND LOCAL RECORDS

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Health's Active Leaking Underground Storage Tank Log Listing.

A review of the LUST list, as provided by EDH, and dated 08/11/2006 has revealed that there is 1 LUST site within the searched area.

Site	Address	Map ID	Page
MAUI TROPICAL PLANTATION Facility Status: Site Cleanup Completed	*1670 HONOAPIILANI HWY*	*1*	*3*

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Health's Listing of Underground Storage Tanks.

A review of the UST list, as provided by EDR, and dated 08/11/2006 has revealed that there are 2 UST sites within the searched area.

Site	Address	Map ID	Page
MAUI TROPICAL PLANTATION	1670 HONOAPIILANI HWY	1	3
HAWAIIAN CEMENT - WAIKAPU QUAR	HONOAPIILANI HWY	2	4

EXECUTIVE SUMMARY

Please refer to the end of the findings report for unmapped orphan sites due to poor or inadequate address information.

MAP FINDINGS SUMMARY

Database	Total Plotted
FEDERAL RECORDS	
NPL	0
Proposed NPL	0
Delisted NPL	0
NPL RECOVERY	0
CERCLIS	0
CERC-NFRAP	0
CORRACTS	0
RCRA TSD	0
RCRA Lg. Quan. Gen.	0
RCRA Sm. Quan. Gen.	0
ERNS	0
HMIRS	0
US ENG CONTROLS	0
US INST CONTROL	0
DOD	0
FUDS	0
US BROWNFIELDS	0
CONSENT	0
ROD	0
UMTRA	0
ODI	0
TRIS	0
TSCA	0
FTTS	0
SSTS	0
ICIS	0
PADS	0
MLTS	0
MINES	0
FINDS	1
RAATS	0
STATE AND LOCAL RECORDS	
SHWS	0
State Landfill	0
LUST	1
UST	2
SPILLS	0
INST CONTROL	0
VCP	0
DRYCLEANERS	0
BROWNFIELDS	0
AIRS	0
TRIBAL RECORDS	
INDIAN RESERV	0

MAP FINDINGS SUMMARY

Database	Total Plotted
INDIAN LUST	0
INDIAN UST	0
EDR PROPRIETARY RECORDS	
Manufactured Gas Plants	0

NOTES:

Sites may be listed in more than one database

Map ID
Direction
Distance
Distance (ft.)Site

Database(s) | EDR ID Number / EPA ID Number

1
MAUI TROPICAL PLANTATION
1670 HONOAPIILANI HWY
WAILUKU, HI 96793

FINDS 1006843720
LUST 110014052915

FINDS:
Other Pertinent Environmental Activity Identified at Site

HI-UST (Hawaii - Underground Storage Tank). Hawaii Underground Storage Tank Program regulates underground storage tanks which store petroleum or hazardous substances and offers documents and data products for downloading.

LUST:
Facility ID: 9-503723
Release ID: 010046
Facility Status Date: 2005-08-25 00:00:00
Facility Status: Site Cleanup Completed
Project Officer: Takaba

1
MAUI TROPICAL PLANTATION
1670 HONOAPIILANI HWY
WAILUKU, HI 96793

UST U003790355
N/A

UST:
Facility ID: 9-503723
Owner: MAUI TROPICAL PLANTATION
Owner Address: 1670 HONOAPIILANI HWY
Owndor City,St,Zip: Wailuku, 96793 96793
Tank ID: R-2
Installed: 7/25/2001
Tank Status: **Permanently Out of Use**
Date Closed: 8/1/2001
Tank Capacity: 500
Substance: Diesel
Pipe Material: Other
Pipe Other Material: Not reported
Pipe 2nd Construction: None

Facility ID: 9-503723
Owner: MAUI TROPICAL PLANTATION
Owner Address: 1670 HONOAPIILANI HWY
Owndor City,St,Zip: Wailuku, 96793 96793
Tank ID: R-1
Installed: 7/25/2001
Tank Status: **Permanently Out of Use**
Date Closed: 8/1/2001
Tank Capacity: 500
Substance: Gasoline
Pipe Material: Other
Pipe Other Material: Not reported
Pipe 2nd Construction: None

MAP FINDINGS

Map ID
Direction
Distance
Distance (ft.)Site

Database(s) | EDR ID Number / EPA ID Number

2
HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793

UST U001236686
N/A

UST:
Facility ID: 9-502529
Owner: HAWAIIAN CEMENT CO
Owner Address: P.O. BOX 488 / WAIKAPU QUARRY
Owndor City,St,Zip: Wailuku, 96793 96793
Tank ID: R-1
Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 9/13/1991
Tank Capacity: 25000
Substance: Other
Pipe Material: Not Listed
Pipe Other Material: Not reported
Pipe 2nd Construction: None

Facility ID: 9-502529
Owner: HAWAIIAN CEMENT CO
Owner Address: P.O. BOX 488 / WAIKAPU QUARRY
Owndor City,St,Zip: Wailuku, 96793 96793
Tank ID: R-2
Installed: 12/30/1966
Tank Status: **Permanently Out of Use**
Date Closed: 11/20/1991
Tank Capacity: 3000
Substance: Gasoline
Pipe Material: Bare Steel
Pipe Other Material: Not reported
Pipe 2nd Construction: None

Facility ID: 9-502529
Owner: HAWAIIAN CEMENT CO
Owner Address: P.O. BOX 488 / WAIKAPU QUARRY
Owndor City,St,Zip: Wailuku, 96793 96793
Tank ID: R-4
Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 3/19/1992
Tank Capacity: 7000
Substance: Other
Pipe Material: Not Listed
Pipe Other Material: Not reported
Pipe 2nd Construction: None

Facility ID: 9-502529
Owner: HAWAIIAN CEMENT CO
Owner Address: P.O. BOX 488 / WAIKAPU QUARRY
Owndor City,St,Zip: Wailuku, 96793 96793
Tank ID: R-5
Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 3/19/1992
Tank Capacity: 28000
Substance: Other
Pipe Material: Not Listed
Pipe Other Material: Not reported

MAP FINDINGS

Map ID
Direction
Distance
Distance (ft.)Site

Database(s) | EDR ID Number
EPA ID Number

HAWAIIAN CEMENT - WAIKAPU QUARRY (Continued)

U001236686

Pipe 2nd Construction: None

Facility ID: 9-502529
Owner: HAWAIIAN CEMENT CO
Owner Address: P.O. BOX 488 / WAIKAPU QUARRY
Owner City,St,Zip: Wailuku, 96793 96793
Tank ID: R-3
Installed: Not reported
Tank Status: Permanently Out of Use
Date Closed: 3/19/1992
Tank Capacity: 7000
Substance: Other
Pipe Material: Not Listed
Pipe Other Material: Not reported
Pipe 2nd Construction: None

Facility ID: 9-502529
Owner: HAWAIIAN CEMENT CO
Owner Address: P.O. BOX 488 / WAIKAPU QUARRY
Owner City,St,Zip: Wailuku, 96793 96793
Tank ID: R-6
Installed: Not reported
Tank Status: Permanently Out of Use
Date Closed: 3/19/1992
Tank Capacity: 28000
Substance: Other
Pipe Material: Not Listed
Pipe Other Material: Not reported
Pipe 2nd Construction: None

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
HANA, MAUI	S106401322	HANA LANDFILL	HANA MAUI	96793	SWF/LF
KAHULUI	1001475719	KANAHA POND EAST	AMALA PLACE	96732	SHWS, CERC-NFRAP
KAHULUI	1006819966	RAINBOW HAULING	AMALA PL	96732	SHWS, FINDS
KAHULUI	1006820295	E & E BLACK CONTRACTORS	AMALA PL	96732	SHWS, FINDS
KAHULUI	S106816558	BIRD BUILDERS	AMALA PL	96732	SHWS
KAHULUI	S106817019	F & M CONTRACTORS	AMALA PL	96732	SHWS
KAHULUI	S106818550	KING'S TOWING	AMALA PL	96732	SHWS
KAHULUI	S106820468	SMILE'S AUTO SPECIALISTS	AMALA PL	96732	SHWS
KAHULUI	S106820852	VECTOR CONTROL BRANCH, MAUI	54 HIGH ST, 641 MUA ST, KAHALE DR / PALAPALA ST	96793	SHWS
KAHULUI	1006818919	MAUI PETROLEUM HOBRON AVENUE	HOBRON AVE	96732	SHWS
KAHULUI	1006820577	HOBRON AVE AREA (KAHULUI)	HOBRON AVE	96732	SHWS, FINDS
KAHULUI	S106817098	FONG CONSTRUCTION	HUKILIKI ST	96732	SHWS
KAHULUI	1006818999	MCC-AUTOMOTIVE TECHNOLOGY BUILDING CONTAMINATION	310 KAAHUMANU AVE	96732	SHWS, FINDS, SPILLS
KAHULUI	S104534290	MAUI PALMS HOTEL UST	150 KAAHUMANU AVE	96732	SHWS
KAHULUI	1006841969	DAVID PICO CESSPOOL DIGGING	OLD HALEAKALA HWY	96732	FINDS, LUST
KAHULUI	U001236769	DAVID PICO CESSPOOL DIGGING	OLD HALEAKALA HWY	96732	UST
KAHULUI	1006820345	A&B DUMP SITE	W PAPA AVE	96732	SHWS, FINDS
KAHULUI	U003222223	PAIA SEWER PUMP STATION	PUNA RD/HANA HWY	96732	UST
KAHULUI	S106819004	MAUI MEAT COMPANY FACILITY (FORMER), UST CLOSURE	601 2ND ST	96732	SHWS, SPILLS
KAHULUI	1006819647	WAIKAPU DUMP-MAUI COUNTY DUMP	WAIKAPU RD	96732	SHWS, FINDS
KALAMAULA	S106818091	KALAMAULA LANDFILL	HOAWA RD	96793	SHWS
KIHEI	U003222170	KIHEI SPS #3 (MENEHUNE SHORES)	N KIHEI RD	96753	UST
KIHEI	U003222168	KIHEI SPS #6 (KIHEI FIRE HOUSE)	N KIHEI RD	96753	UST
KIHEI	1006844053	KIHEI SPS #6 (KIHEI FIRE HOUSE)	N KIHEI RD	96753	FINDS
KIHEI	1006842882	KIHEI SPS #3 (MENEHUNE SHORES)	N KIHEI RD	96753	FINDS
KIHEI	U003155105	KIHEI SPS #5 (EAST WELAKAHAO)	N KIHEI RD	96753	UST
KIHEI	U003222167	KIHEI SPS #4 (YE'S ORCHARD)	N KIHEI RD	96753	UST
KIHEI	1006842431	KIHEI SPS #5 (EAST WELAKAHAO)	N KIHEI RD	96753	FINDS, LUST
KIHEI	1000486449	KAHOOLAWE ISLAND.	LAT 20 32' 30", LONG 156 37' 30"	96753	CERCLIS
KIHEI	U001236805	KIHEI WWTP	480 WELEKAHAO RD/PIILANI HWY	96753	LUST, UST
PUUNENE, MAUI	S103763652	CENTRAL MAUI LANDFILL	PUNENE, MAUI	96793	SWF/LF
WAIKAPU	1008230886	VACANT LAND TMK NO (2) 3-8-7:101	KUIHELANI HWY NEAR WAIKO RD	96793	FINDS
WAIKAPU	1008194955	VACANT LAND TMK NO (2) 3-8-7:101	KUIHELANI HWY NEAR WAIKO RD	96793	RCRA-SQG
WAILEA	U003222360	ESTATE OF MARY HELELA	OLD COUNTRY RD	96753	UST
WAILUKU	1006842014	HAWAIIAN CEMENT - WAIKAPU QUARRY	HONOAPIILANI HWY	96793	FINDS, LUST
WAILUKU	1007092114	MAALAEA GENERATING STATION	NORTH KIHEI RD	96793	RCRA-SQG
WAILUKU	1006819707	WAIALE ASH PILE	MAHALANI ST	96793	SHWS, FINDS
WAILUKU	S108008644	Y HATA- MAUI	200 WAIEHU BEACH RD AND KAHULU BEACH RD	96793	SHWS

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

FEDERAL RECORDS

NPL: National Priority List
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/05/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: N/A
Last EDR Contact: 11/01/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

Date of Government Version: 07/05/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: N/A
Last EDR Contact: 11/01/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Quarterly

DELISTED NPL: National Priority List Deletions
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/05/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: N/A
Last EDR Contact: 11/01/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Quarterly

NPL RECOVERY: Federal Superfund Liens
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: No Update Planned

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 06/19/2006
Date Data Arrived at EDR: 06/22/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 62

Source: EPA
Telephone: 703-603-8960
Last EDR Contact: 09/21/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 07/17/2006
Date Data Arrived at EDR: 08/02/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 41

Source: EPA
Telephone: 703-603-8960
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

CORRACTS: Corrective Action Report
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/15/2006
Date Data Arrived at EDR: 03/17/2006
Date Made Active in Reports: 04/13/2006
Number of Days to Update: 27

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 09/05/2006
Next Scheduled EDR Contact: 12/04/2006
Data Release Frequency: Quarterly

RCRA: Resource Conservation and Recovery Act Information

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS). The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/13/2006
Date Data Arrived at EDR: 06/28/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 56

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 09/28/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

ERNS: Emergency Response Notification System
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 01/12/2006
Date Made Active in Reports: 02/21/2006
Number of Days to Update: 40

Source: National Response Center, United States Coast Guard
Telephone: 202-260-2342
Last EDR Contact: 10/24/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: Annually

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 07/03/2006
Date Data Arrived at EDR: 07/19/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 35

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 10/18/2006
Next Scheduled EDR Contact: 01/15/2007
Data Release Frequency: Annually

US ENG CONTROLS: Engineering Controls Sites List
A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or affect human health

Date of Government Version: 03/21/2006
Date Data Arrived at EDR: 03/27/2006
Date Made Active in Reports: 05/22/2006
Number of Days to Update: 56

Source: Environmental Protection Agency
Telephone: 703-603-8905
Last EDR Contact: 09/07/2006
Next Scheduled EDR Contact: 10/02/2006
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls
A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 03/21/2006
Date Data Arrived at EDR: 03/27/2006
Date Made Active in Reports: 05/22/2006
Number of Days to Update: 56

Source: Environmental Protection Agency
Telephone: 703-603-8905
Last EDR Contact: 09/07/2006
Next Scheduled EDR Contact: 10/02/2006
Data Release Frequency: Varies

DOD: Department of Defense Sites
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 02/08/2005
Date Made Active in Reports: 08/04/2005
Number of Days to Update: 177

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 08/11/2006
Next Scheduled EDR Contact: 11/06/2006
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites
The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 01/19/2006
Date Made Active in Reports: 02/21/2006
Number of Days to Update: 33

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Varies

US BROWNFIELDS: A Listing of Brownfields Sites
Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 07/10/2006
Date Data Arrived at EDR: 07/13/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 55

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 09/11/2006
Next Scheduled EDR Contact: 12/11/2006
Data Release Frequency: Semi-Annually

CONSENT: Superfund (CERCLA) Consent Decrees
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/14/2004
Date Data Arrived at EDR: 02/15/2005
Date Made Active in Reports: 04/25/2005
Number of Days to Update: 69

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 10/23/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: Varies

ROD: Records Of Decision
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 07/10/2006
Date Data Arrived at EDR: 07/21/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 47

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites
Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 11/04/2005
Date Data Arrived at EDR: 11/28/2005
Date Made Active in Reports: 01/30/2006
Number of Days to Update: 63

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 09/05/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 07/20/2006
Date Data Arrived at EDR: 07/21/2006
Date Made Active in Reports: 08/22/2006
Number of Days to Update: 32

Source: EPA
Telephone: 202-564-6064
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Quarterly

TRIS: Toxic Chemical Release Inventory System
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 06/22/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 62

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002
Date Data Arrived at EDR: 04/14/2006
Date Made Active in Reports: 05/30/2006
Number of Days to Update: 46

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 10/18/2005
Next Scheduled EDR Contact: 01/15/2007
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/14/2006
Date Data Arrived at EDR: 07/18/2006
Date Made Active in Reports: 09/05/2006
Number of Days to Update: 50

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

Date of Government Version: 07/14/2006
Date Data Arrived at EDR: 07/18/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 50

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 09/18/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Quarterly

SSTS: Section 7 Tracking Systems
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 05/11/2006
Date Made Active in Reports: 05/22/2006
Number of Days to Update: 11

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 11/07/2006
Next Scheduled EDR Contact: 01/15/2007
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 02/13/2006
Date Data Arrived at EDR: 04/21/2006
Date Made Active in Reports: 05/11/2006
Number of Days to Update: 20

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 07/17/2006
Next Scheduled EDR Contact: 10/16/2006
Data Release Frequency: Quarterly

PADS: PCB Activity Database System
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/07/2006
Date Data Arrived at EDR: 08/09/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 28

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 08/09/2006
Next Scheduled EDR Contact: 11/06/2006
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/10/2006
Date Data Arrived at EDR: 07/20/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 48

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Quarterly

MINES: Mines Master Index File
Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 05/16/2006
Date Data Arrived at EDR: 06/28/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 56

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 09/27/2006
Next Scheduled EDR Contact: 12/25/2006
Data Release Frequency: Semi-Annually

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/21/2006
Date Data Arrived at EDR: 07/25/2006
Date Made Active in Reports: 09/06/2006
Number of Days to Update: 43

Source: EPA
Telephone: N/A
Last EDR Contact: 10/02/2006
Next Scheduled EDR Contact: 01/01/2007
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 09/05/2006
Next Scheduled EDR Contact: 12/04/2006
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2003
Date Data Arrived at EDR: 06/17/2005
Date Made Active in Reports: 08/04/2005
Number of Days to Update: 48

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 10/20/2006
Next Scheduled EDR Contact: 12/11/2006
Data Release Frequency: Biennially

STATE AND LOCAL RECORDS

SHWS: Sites List

Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Semi-Annually

SWF/LF: Permitted Landfills in the State of Hawaii

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 05/19/2004
Date Data Arrived at EDR: 05/20/2004
Date Made Active in Reports: 06/22/2004
Number of Days to Update: 33

Source: Department of Health
Telephone: 808-586-4245
Last EDR Contact: 10/24/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: Varies

LUST: Leaking Underground Storage Tank Database

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/11/2006
Date Data Arrived at EDR: 08/14/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 16

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 09/26/2006
Next Scheduled EDR Contact: 12/25/2006
Data Release Frequency: Semi-Annually

UST: Underground Storage Tank Database

Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/11/2006
Date Data Arrived at EDR: 08/14/2006
Date Made Active in Reports: 09/20/2006
Number of Days to Update: 37

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 09/26/2006
Next Scheduled EDR Contact: 12/25/2006
Data Release Frequency: Semi-Annually

SPILLS: Release Notifications

Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

INST CONTROL: Sites with Institutional Controls

Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

VCP: Voluntary Response Program Sites

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

DRYCLEANERS: Permitted Drycleaner Facility Listing

A listing of permitted drycleaner facilities in the state.

Date of Government Version: 09/07/2006
Date Data Arrived at EDR: 09/08/2006
Date Made Active in Reports: 10/13/2006
Number of Days to Update: 35

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/30/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Varies

BROWNFIELDS: Brownfields Sites

Date of Government Version: 07/24/2006
Date Data Arrived at EDR: 07/27/2006
Date Made Active in Reports: 08/30/2006
Number of Days to Update: 34

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 09/22/2006
Next Scheduled EDR Contact: 12/18/2006
Data Release Frequency: Varies

AIRS: List of Permitted Facilities
A listing of permitted facilities in the state

Date of Government Version: 09/07/2006
Date Data Arrived at EDR: 09/08/2006
Date Made Active in Reports: 10/13/2006
Number of Days to Update: 35

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/30/2006
Next Scheduled EDR Contact: 01/29/2007
Data Release Frequency: Varies

TRIBAL RECORDS

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2004
Date Data Arrived at EDR: 02/08/2005
Date Made Active in Reports: 08/04/2005
Number of Days to Update: 177

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 08/11/2006
Next Scheduled EDR Contact: 11/06/2006
Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 08/08/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 06/28/2006
Number of Days to Update: 19

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 01/04/2005
Date Data Arrived at EDR: 01/21/2005
Date Made Active in Reports: 02/28/2005
Number of Days to Update: 38

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 06/06/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 06/08/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 08/01/2006
Date Data Arrived at EDR: 06/23/2006
Date Made Active in Reports: 08/02/2006
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 06/01/2006
Date Data Arrived at EDR: 07/10/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Minnesota, Mississippi and North Carolina.

Date of Government Version: 01/01/2006
Date Data Arrived at EDR: 02/27/2006
Date Made Active in Reports: 03/28/2006
Number of Days to Update: 29

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Semi-Annually

INDIAN UST R4: Underground Storage Tanks on Indian Land

Date of Government Version: 01/01/2006
Date Data Arrived at EDR: 02/27/2006
Date Made Active in Reports: 03/28/2006
Number of Days to Update: 29

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

Date of Government Version: 06/01/2006
Date Data Arrived at EDR: 07/10/2006
Date Made Active in Reports: 09/12/2006
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

Date of Government Version: 12/02/2004
Date Data Arrived at EDR: 12/29/2004
Date Made Active in Reports: 02/04/2005
Number of Days to Update: 37

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

Date of Government Version: 06/06/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

Date of Government Version: 06/08/2006
Date Data Arrived at EDR: 06/09/2006
Date Made Active in Reports: 07/28/2006
Number of Days to Update: 49

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 08/21/2006
Next Scheduled EDR Contact: 11/20/2006
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land
A listing of underground storage tank locations on Indian Land.

Date of Government Version: 06/08/2006	Source: EPA, Region 1
Date Data Arrived at EDR: 06/09/2006	Telephone: 617-918-1313
Date Made Active in Reports: 08/30/2006	Last EDR Contact: 08/21/2006
Number of Days to Update: 21	Next Scheduled EDR Contact: 11/20/2006
	Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

Date of Government Version: 06/30/2006	Source: EPA Region 6
Date Data Arrived at EDR: 07/03/2006	Telephone: 214-665-7591
Date Made Active in Reports: 09/06/2006	Last EDR Contact: 08/21/2006
Number of Days to Update: 65	Next Scheduled EDR Contact: 11/20/2006
	Data Release Frequency: Semi-Annually

INDIAN UST R9: Underground Storage Tanks on Indian Land

Date of Government Version: 06/01/2006	Source: EPA Region 9
Date Data Arrived at EDR: 06/23/2006	Telephone: 415-972-3368
Date Made Active in Reports: 08/02/2006	Last EDR Contact: 08/21/2006
Number of Days to Update: 40	Next Scheduled EDR Contact: 11/20/2006
	Data Release Frequency: Quarterly

EDR PROPRIETARY RECORDS

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

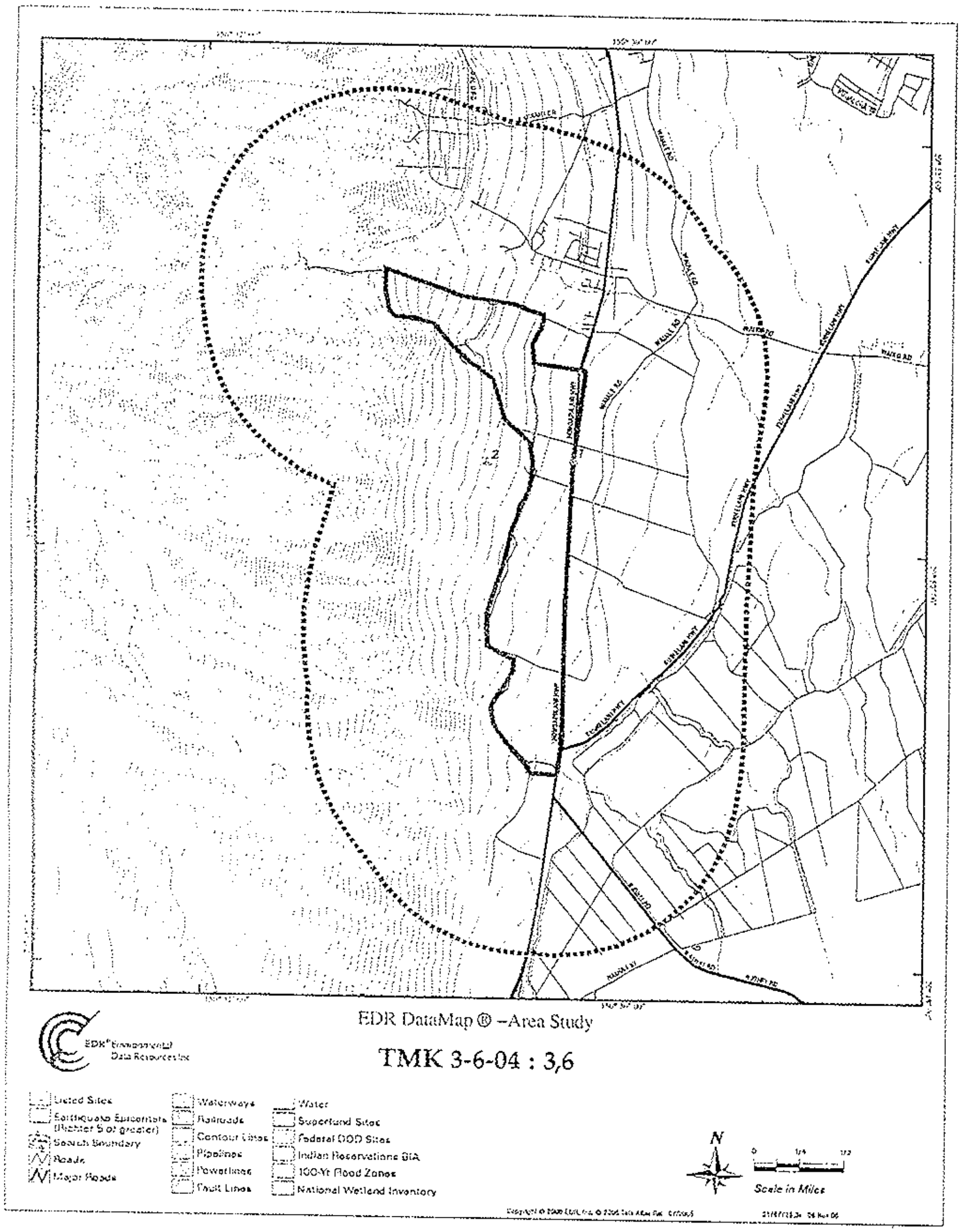
AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.
Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.
Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.
Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

STREET AND ADDRESS INFORMATION



EDR DataMap ® –Area Study
TMK 3-6-04 : 3,6
Listed Sites
Earthquake Epicenters (Richter 5 or greater)
Search Boundary
Roads
Major Roads
Waterways
Railroads
Contour Lines
Pipelines
Powerlines
Fault Lines
Water
Superfund Sites
Federal DOD Sites
Indian Reservations BIA
100-Yr Flood Zones
National Wetland Inventory
N
Scale in Miles

EDR Site Report™

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793

Inquiry Number:

December 12, 2006

EDR® Environmental Data Resources Inc

The Standard in Environmental Risk Management Information

440 Wheelers Farms Road
Milford, Connecticut 06461

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

The EDR-Site Report™ is a comprehensive presentation of government filings on a facility identified in a search of over 4 million government records from more than 600 federal, state and local environmental databases. The report is divided into three sections:

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

SECTION 1: FACILITY SUMMARY

FACILITY AREA	FACILITY 1 HAWAIIAN CEMENT - WAIKAPU QUARRY HONOAPIILANI HWY WAILUKU, HI 96793 EDR ID #1006842014 EPA #110014034035
WASTE MANAGEMENT Facility generates hazardous waste (RCRA)	NO
Facility treats, stores, or disposes of hazardous waste on-site (RCRA/TSDF)	NO
Facility has received Notices of Violations (RCRA/VIOL)	NO
Facility has been subject to RCRA administrative actions (RAATS)	NO
Facility has been subject to corrective actions (CORRACTS)	NO
Facility handles PCBs (PADS)	NO
Facility uses radioactive materials (MLTS)	NO
Facility manages registered aboveground storage tanks (AST)	NO
Facility manages registered underground storage tanks (UST)	NO
Facility has reported leaking underground storage tank incidents (LUST)	YES - p4
Facility has reported emergency releases to the soil (ERNS)	NO
Facility has reported hazardous material incidents to DOT (HMIRS)	NO
WASTE DISPOSAL Facility is a Superfund Site (NPL)	NO
Facility has a known or suspect abandoned, inactive or uncontrolled hazardous waste site (CERCLIS)	NO
Facility has a reported Superfund Lien on it (LIENS)	NO
Facility is listed as a state hazardous waste site (SHWS)	NO
Facility has disposed of solid waste on-site (SWF/LF)	NO
MULTIMEDIA Facility uses toxic chemicals and has notified EPA under SARA Title III, Section 313 (TRIS)	NO
Facility produces pesticides and has notified EPA under Section 7 of FIFRA (SSTS)	NO
Facility manufactures or imports toxic chemicals on the TSCA list (TSCA)	NO
Facility has inspections under FIFRA, TSCA or EPCRA (FTTS)	NO
Facility is listed in EPA's index system (FINDS)	YES - p5
Facility is listed in a county/local unique database (LOCAL)	YES - p6
POTENTIAL SUPERFUND LIABILITY Facility has a list of potentially responsible parties PRP	NO
TOTAL (YES)	3

SECTION 2: FACILITY DETAIL REPORTS

WASTE MANAGEMENT

Facility has reported leaking underground storage tank incidents

DATABASE: Leaking Petroleum Storage Tank Database (LUST)

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793
EDR ID #1006842014

LUST:

Facility ID:	9-502529
Release ID:	950015
Facility Status Date:	1995-05-16 00:00:00
Facility Status:	Site Cleanup Completed
Project Officer:	Brewer

MULTIMEDIA

Facility is listed in EPA's index system

DATABASE: Facility Index System (FINDS)

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793
EDR ID #1006842014

This site is listed in the Federal FINDS database. The FINDS database may contain references to records from government databases included elsewhere in the report.
Please note: the FINDS database may also contain references to out of date records formerly associated with the site.

Registry ID: 110014034035
Facility Name: HAWAIIAN CEMENT - WAIKAPU QUARRY
Facility Address: HONOAPIILANI HWY
WAILUKU, HI 96793
Facility County: MAUI
EPA Region: 09
Fed. Gov. Facility: No
Indian Tribal Land: Not reported
EPA Records Indicate Facility Is Listed In:
HI-UST (Hawaii - Underground Storage Tank). Hawaii Underground Storage Tank Program regulates underground storage tanks which store petroleum or hazardous substances and offers documents and data products for downloading.

Pg. Sys. ID: 9-502529
Supplemental Interest: Not reported
Facility SIC Codes: Not reported
Facility NAICS Codes: Not reported

Alternative name: HAWAIIAN CEMENT - WAIKAPU QUARRY

MULTIMEDIA

Facility is listed in a county/local unique database

DATABASE: State/County (LOCAL)

HAWAIIAN CEMENT - WAIKAPU QUARRY
HONOAPIILANI HWY
WAILUKU, HI 96793
EDR ID #1006842014

Database:
HI FINANCIAL ASSURANCE:

edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use
Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance:	F
Risk Retention Group:	F
Surety Bond:	F
Guarantee:	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance:	F
edr_fname:	HAWAIIAN CEMENT - WAIKAPU QUARRY
Tank Status Desc:	Permanently Out of Use

SECTION 2: FACILITY DETAIL REPORTS

...Continued...

Alt Facility ID:	9-502529
Street Address:	HONOAPIILANI HWY
Insurance	F
Risk Retention Group:	F
Surety Bond	F
Guarantee	F
Letter of Credit:	F
State Fund:	F
Trust Fund:	F
Other Finance	F

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

To maintain currency of the following federal, state and local databases, EDR contacts the appropriate government agency on a monthly or quarterly basis as required.

Elapsed ASTM days: Provides confirmation that this report meets or exceeds the 90-day updating requirement of the ASTM standard.

WASTE MANAGEMENT

RCRA: Resource Conservation and Recovery Act Information
Source: EPA
Telephone: 800-424-9346
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS). The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/13/2006 — Date of Last EDR Contact: 12/08/2006
Database Release Frequency: Quarterly — Date of Next Scheduled Update: 02/19/2007

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2003 — Date of Last EDR Contact: 10/20/2006
Database Release Frequency: Biennially — Date of Next Scheduled Update: 12/11/2006

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995 — Date of Last EDR Contact: 12/04/2006
Database Release Frequency: No Update Planned — Date of Next Scheduled Update: 03/05/2007

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/15/2006 — Date of Last EDR Contact: 12/04/2006
Database Release Frequency: Quarterly — Date of Next Scheduled Update: 03/05/2007

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-566-0500
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/07/2006 — Date of Last EDR Contact: 11/29/2006
Database Release Frequency: Annually — Date of Next Scheduled Update: 02/05/2007

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/10/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

HI UST: Underground Storage Tank Database
Source: Department of Health
Telephone: 808-586-4226
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 09/11/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/26/2006
Date of Next Scheduled Update: 12/25/2006

HI LUST: Leaking Underground Storage Tank Database
Source: Department of Health
Telephone: 808-586-4228
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 09/11/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/26/2006
Date of Next Scheduled Update: 12/25/2006

ERNS: Emergency Response Notification System
Source: National Response Center, United States Coast Guard
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2005
Database Release Frequency: Annually
Date of Last EDR Contact: 10/24/2006
Date of Next Scheduled Update: 01/22/2007

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4555
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 08/01/2006
Database Release Frequency: Annually
Date of Last EDR Contact: 10/18/2006
Date of Next Scheduled Update: 01/15/2007

WASTE DISPOSAL

NPL: National Priority List
Source: EPA
Telephone: Not reported
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 09/27/2006
Date Made Active at EDR: 11/22/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 11/01/2006
Elapsed ASTM Days: 21
Date of Last EDR Contact: 11/01/2006

Proposed NPL: Proposed National Priority List Sites
Source: EPA
Telephone: Not reported

Date of Government Version: 09/27/2006
Date Made Active at EDR: 11/22/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 11/01/2006
Elapsed ASTM Days: 21
Date of Last EDR Contact: 11/01/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES
...Continued...

DELISTED NPL: National Priority List Deletions
Source: EPA
Telephone: Not reported
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 09/27/2006
Date Made Active at EDR: 11/22/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 11/01/2006
Elapsed ASTM Days: 21
Date of Last EDR Contact: 11/01/2006

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-603-8960
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 08/09/2006
Date Made Active at EDR: 11/22/2006
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 09/21/2006
Elapsed ASTM Days: 62
Date of Last EDR Contact: 09/21/2006

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Source: EPA
Telephone: 703-603-8960
Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/10/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/18/2006
Date of Next Scheduled Update: 12/18/2006

ROD: Records Of Decision
Source: EPA
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 07/10/2006
Database Release Frequency: Annually
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

NPL RECOVERY: Federal Superfund Liens
Source: EPA
Telephone: 202-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Made Active at EDR: 03/30/1994
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 02/02/1994
Elapsed ASTM Days: 56
Date of Last EDR Contact: 11/17/2006

HI SHWS: Sites List
Source: Department of Health
Telephone: 808-586-4249
Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 07/24/2006
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES
...Continued...

HI SWF/LF: Permitted Landfills in the State of Hawaii
Source: Department of Health
Telephone: 808-586-4245
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 05/19/2004 — Date of Last EDR Contact: 10/24/2006
Database Release Frequency: Varies — Date of Next Scheduled Update: 01/22/2007

MULTIMEDIA

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-566-0250
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2004 — Date of Last EDR Contact: 09/22/2006
Database Release Frequency: Annually — Date of Next Scheduled Update: 12/18/2006

SSTS: Section 7 Tracking Systems
Source: EPA
Telephone: 202-564-4203
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2004 — Date of Last EDR Contact: 11/07/2006
Database Release Frequency: Annually — Date of Next Scheduled Update: 01/15/2007

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-5521
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002 — Date of Last EDR Contact: 10/16/2006
Database Release Frequency: N/A — Date of Next Scheduled Update: 01/15/2007

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 10/19/2006 — Date of Last EDR Contact: 09/18/2006
Database Release Frequency: Quarterly — Date of Next Scheduled Update: 12/18/2006

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA
Telephone: 202-566-1667

Date of Government Version: 10/19/2006 — Date of Last EDR Contact: 09/18/2006
Database Release Frequency: Quarterly — Date of Next Scheduled Update: 12/18/2006

SECTION 3: DATABASES SEARCHED AND UPDATE DATES
...Continued...

FINDS: Facility Index System/Facility Registry System
Source: EPA
Telephone: Not reported
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/21/2006 — Date of Last EDR Contact: 10/02/2006
Database Release Frequency: Quarterly — Date of Next Scheduled Update: 01/01/2007

RMP: Risk Management Plans
Source: Environmental Protection Agency
Telephone: 202-564-8600
When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 06/01/2006 — Date of Last EDR Contact: 11/17/2006
Database Release Frequency: Varies — Date of Next Scheduled Update: 02/19/2007

STORMWATER: Storm Water General Permits
Source: Environmental Protection Agency
Telephone: 202-564-0746
A listing of all facilities with Storm Water General Permits.

Date of Government Version: 06/02/2005 — Date of Last EDR Contact: 11/28/2006
Database Release Frequency: Quarterly — Date of Next Scheduled Update: 01/01/2007

US ENG CONTROLS: Engineering Controls Sites List
Source: Environmental Protection Agency
Telephone: 703-603-8905
A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 03/21/2006 — Date of Last EDR Contact: 09/07/2006
Database Release Frequency: Varies — Date of Next Scheduled Update: 10/02/2006

US INST CONTROL: Sites with Institutional Controls
Source: Environmental Protection Agency
Telephone: 703-603-8905
A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 03/21/2006 — Date of Last EDR Contact: 09/07/2006
Database Release Frequency: Varies — Date of Next Scheduled Update: 10/02/2006

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
Source: EPA Region 1
Telephone: 617-918-1313
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 09/07/2006 — Date of Last EDR Contact: 11/17/2006
Database Release Frequency: Varies — Date of Next Scheduled Update: 02/19/2007

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

...Continued...

HI SPILLS: Release Notifications
Source: Department of Health
Telephone: 808-586-4249
Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 07/24/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI INST CONTROL: Sites with Institutional Controls
Source: Department of Health
Telephone: 808-586-4249
Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 07/24/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI VCP: Voluntary Response Program Sites
Source: Department of Health
Telephone: 808-586-4249

Date of Government Version: 07/24/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI DRYCLEANERS: Permitted Drycleaner Facility Listing
Source: Department of Health
Telephone: 808-586-4200
A listing of permitted drycleaner facilities in the state.

Date of Government Version: 09/07/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 10/30/2006
Date of Next Scheduled Update: 01/29/2007

HI BROWNFIELDS: Brownfields Sites
Source: Department of Health
Telephone: 808-586-4249

Date of Government Version: 07/24/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 09/22/2006
Date of Next Scheduled Update: 12/18/2006

HI AIRS: List of Permitted Facilities
Source: Department of Health
Telephone: 808-586-4200
A listing of permitted facilities in the state

Date of Government Version: 09/07/2006
Database Release Frequency: Varies
Date of Last EDR Contact: 10/30/2006
Date of Next Scheduled Update: 01/29/2007

POTENTIAL SUPERFUND LIABILITY

PRP: Potentially Responsible Parties
Source: EPA
Telephone: 202-564-6054
A listing of verified Potentially Responsible Parties

Date of Government Version: 10/07/2006
Database Release Frequency: Quarterly
Date of Last EDR Contact: 10/02/2006
Date of Next Scheduled Update: 01/01/2007

EDR Environmental Data Resources Inc

"Linking Technology with Tradition"®

Sanborn® Map Report

Ship To: Roger Aoki
Element Environmental ,
95-1038 Kihene Street
Mililani, HI 96789

Order Date: 11/1/2006 **Completion Date:** 11/2/2006
Inquiry #: 1787728.1S
P.O. #: na
Site Name: TMK 3-6-04/3 6
Address: TMK 3-6-04&3 6
City/State: Wailuku, HI 96793
Cross Streets:

Customer Project: na
8013084BRU 808-864-3952

This document reports that the largest and most complete collection of Sanborn fire insurance maps has been reviewed based on client supplied information, and fire insurance maps depicting the target property at the specified address were not identified.

NO COVERAGE

EDR Historical Topographic Map Report

TMK 3-6-04/3,6
TMK 3-6-04/3,6
Wailuku, HI 96793

Inquiry Number: 1787728.2

November 02, 2006

EDR® Environmental Data Resources Inc

The Standard in Environmental Risk Management Information

440 Wheelers Farms Rd
Milford, Connecticut 06461

Nationwide Customer Service

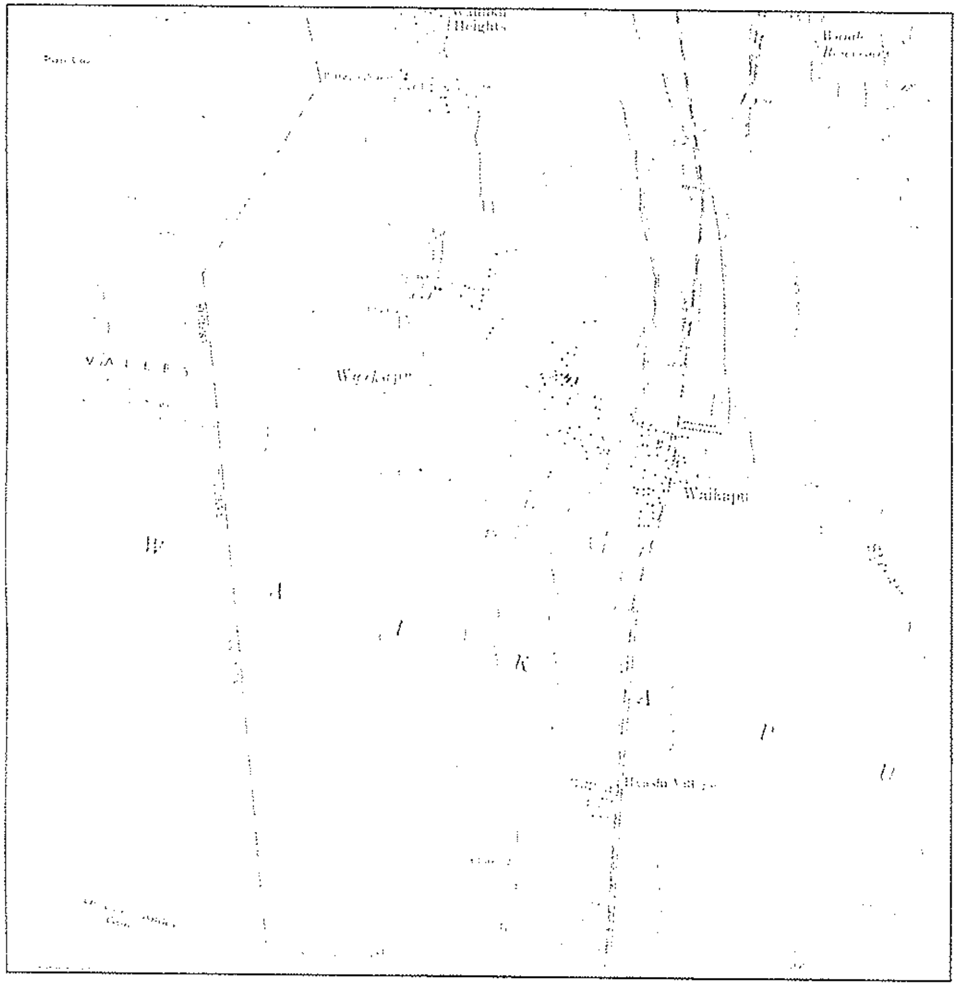
Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

EDR Historical Topographic Map Report

Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

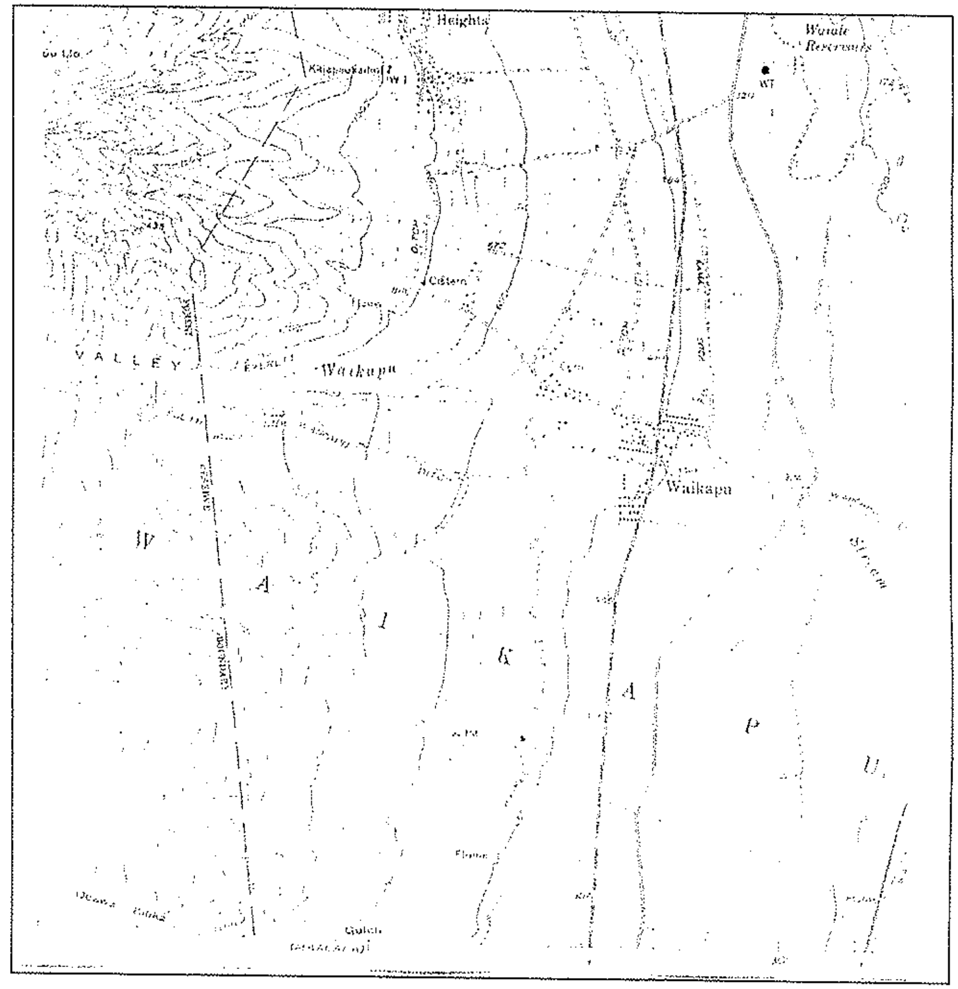
Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Historical Topographic Map



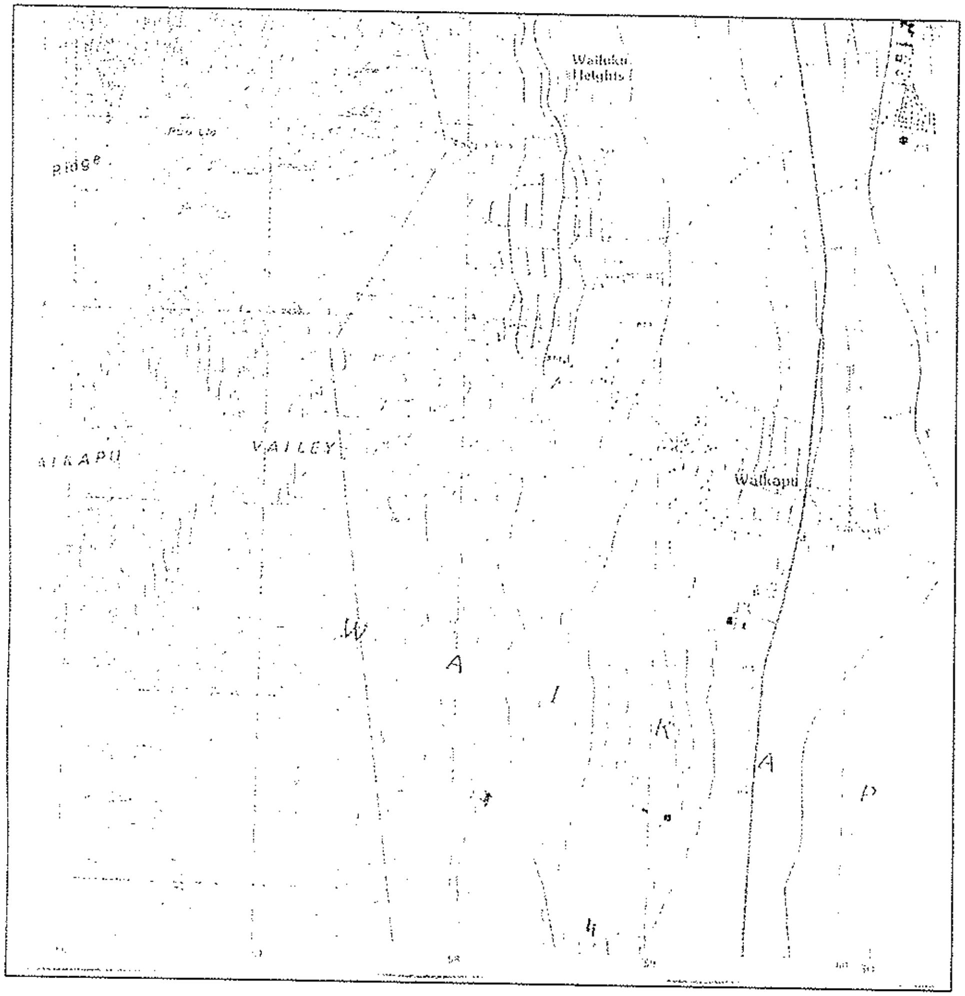
N	TARGET QUAD NAME: Wailuku, HI MAP YEAR: 1955 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: TMK 3-6-04/3,6 ADDRESS: TMK 3-6-04/3,6 Wailuku, HI 96793 LAT/LONG: /	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY#: 1787728.2 RESEARCH DATE: 11/02/2006

Historical Topographic Map



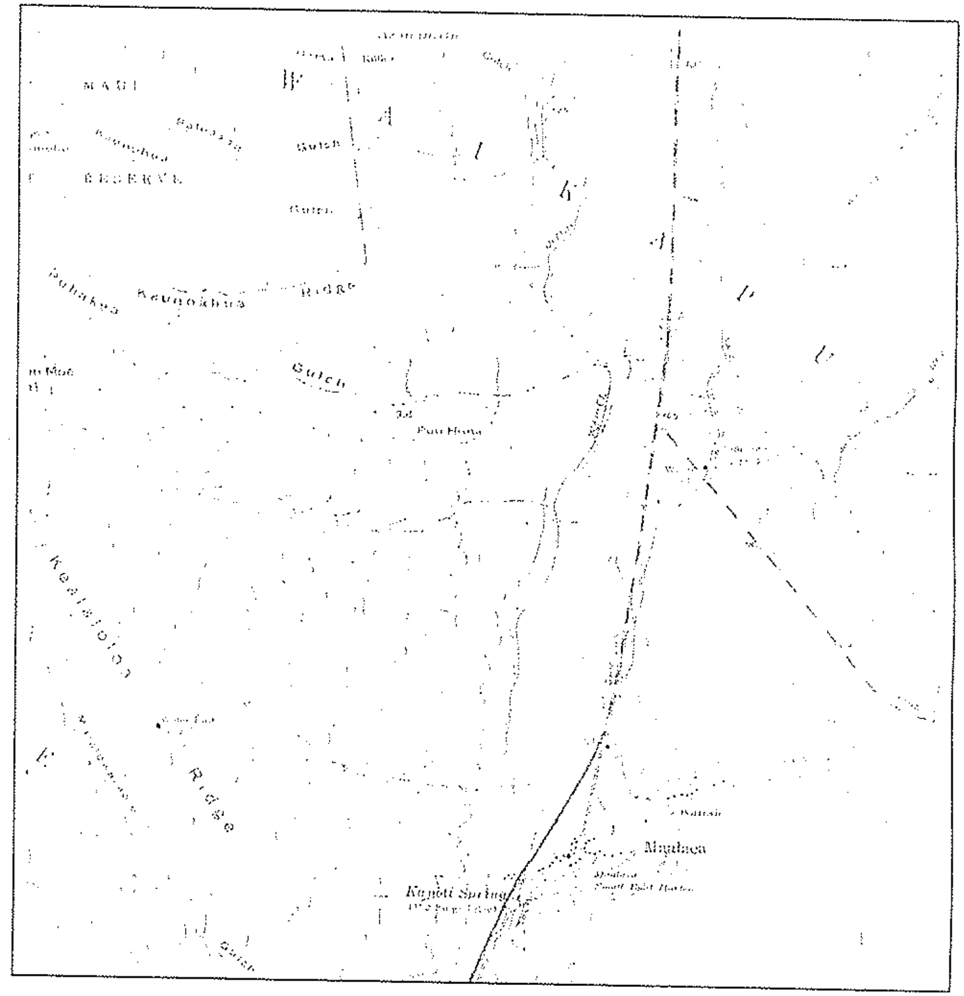
N	TARGET QUAD NAME: Wailuku, HI MAP YEAR: 1983 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: TMK 3-6-04/3,6 ADDRESS: TMK 3-6-04/3,6 Wailuku, HI 96793 LAT/LONG: /	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY#: 1787728.2 RESEARCH DATE: 11/02/2006

Historical Topographic Map



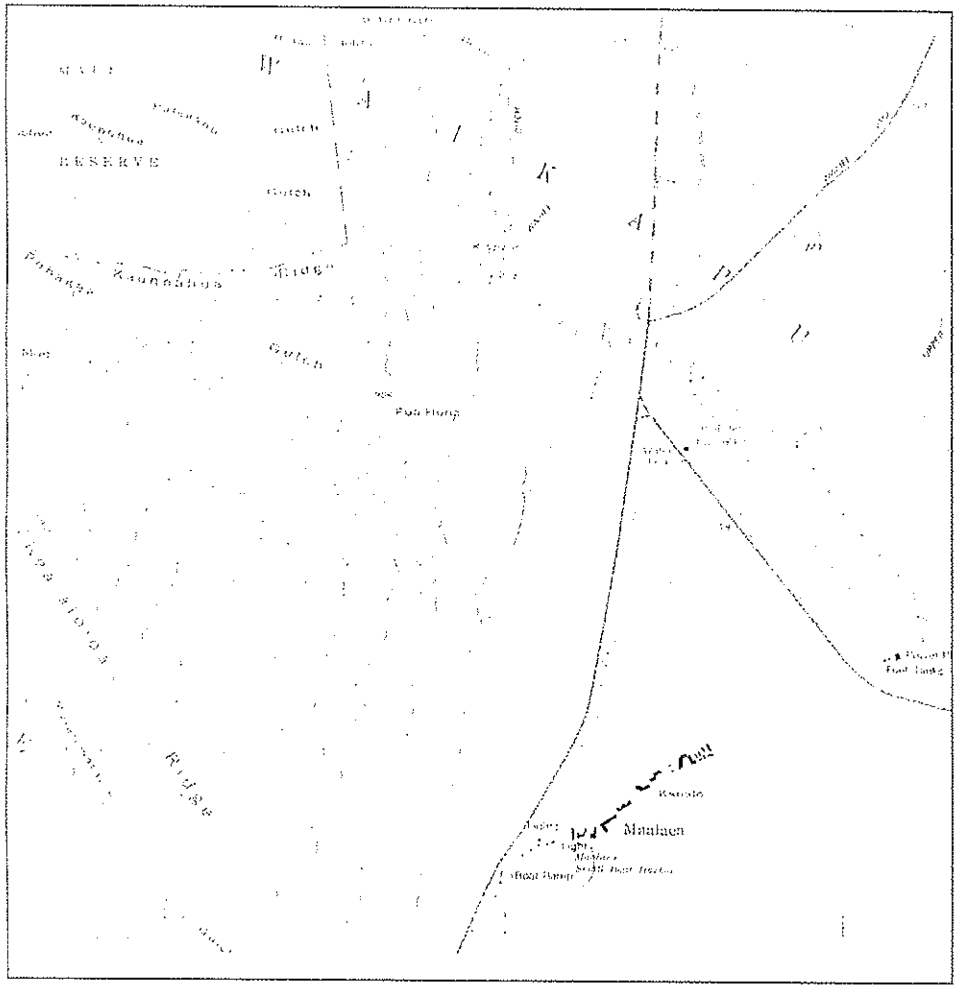
N	TARGET QUAD	SITE NAME:	TMK 3-6-04/3,6	CLIENT:	Element Environmental , LLC
	NAME: Wailuku, HI	ADDRESS:	TMK 3-6-04/3,6	CONTACT:	Roger Aoki
	MAP YEAR: 1997		Wailuku, HI 96793	INQUIRY#:	1787728.2
	SERIES: 7.5	LAT/LONG:	/	RESEARCH DATE:	11/02/2006
	SCALE: 1:24,000				

Historical Topographic Map



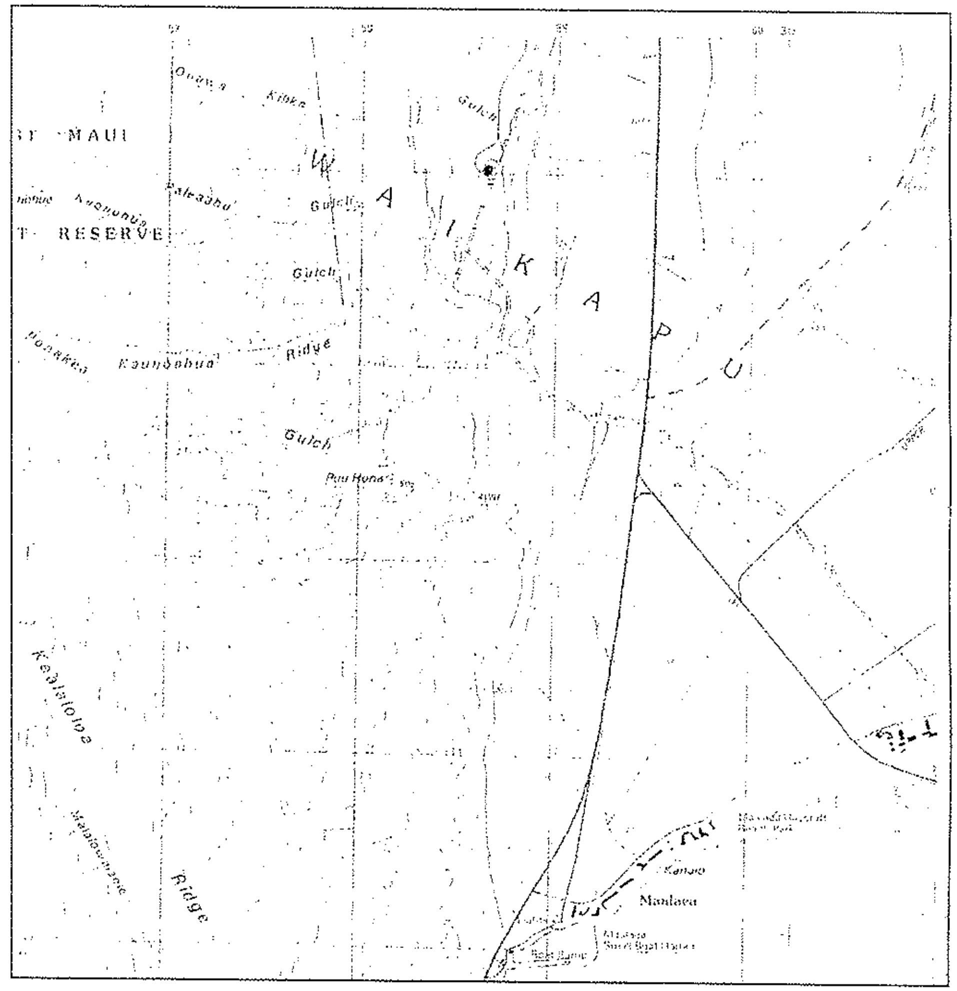
N	ADJOINING QUAD	SITE NAME:	TMK 3-6-04/3,6	CLIENT:	Element Environmental , LLC
	NAME: Maalaea, HI	ADDRESS:	TMK 3-6-04/3,6	CONTACT:	Roger Aoki
	MAP YEAR: 1954		Wailuku, HI 96793	INQUIRY#:	1787728.2
	SERIES: 7.5	LAT/LONG:	/	RESEARCH DATE:	11/02/2006
	SCALE: 1:24,000				

Historical Topographic Map



N	ADJOINING QUAD NAME: Maalaea, HI MAP YEAR: 1983 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: TMK 3-6-04/3,6 ADDRESS: TMK 3-6-04/3,6 Wailuku, HI 96793 LAT/LONG: /	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY#: 1787728.2 RESEARCH DATE: 11/02/2006

Historical Topographic Map



N	ADJOINING QUAD NAME: Maalaea, HI MAP YEAR: 1996 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: TMK 3-6-04/3,6 ADDRESS: TMK 3-6-04/3,6 Wailuku, HI 96793 LAT/LONG: /	CLIENT: Element Environmental , LLC CONTACT: Roger Aoki INQUIRY#: 1787728.2 RESEARCH DATE: 11/02/2006

APPENDIX C

User Questionnaire

Site Evaluation Questionnaire

1. Date of Inquiry: November 2, 2006

2. Facility or Project Name: Maalaea Properties: Maalaea Mauka, 710-acre site and 909-acre site.

3. Facility Address: TMK (2) 3-6-001 Parcel 016; (2) 3-6-004 Parcels 3 and 6; (2) 3-6-002 Parcels 1 and 3 in Wailuku, Maui, Hawaii

4. Describe activities that occur on the Subject Property: Agriculture: former sugar cane and pineapple, cattle grazing.

5. Name, title, address, and phone number of the person conducting the interview: Roger Aoki, Element Environmental LLC, Senior Environmental Engineer, (808) 479-3881

6a. Name and Title of Person Interviewed: Steven J. Kikuchi	6b. Telephone number: 209-481-8778
7a. How many years has the person being interviewed been familiar with the site: 3 years	7b. What is his or her association with the site: Partner of Maalaea Properties, Owner
8a. Are there individuals who have greater knowledge of the Subject Property that are available for interview? Yes.	8b. If so, please provide names and telephone numbers: Mr. Avery Chumbley, President of Wailuku Agribusiness, former owner of the site. Mr. Alex Franco, Manager of Maui Cattle Company, user of the site.
9a. Is the Subject Property or any adjoining property currently used, or has it been used in the past, for an industrial or manufacturing use? No	9b. If so, please provide a description of those activities below: N/A

10a. What is the source of Potable Water at the Subject Property? The Waihee Flume. Also one water well within 710-acre site. Water resources are maintained by Wailuku Agribusiness	10b. How is sewerage provided to the Subject Property (e.g., city, private)? None	10c. How is electricity provided to the Subject Property (electric company, private)? None
10d. Is there any gas service provided to the Subject Property? If so, who provides the service? None	10e. If water is provided by well, has the well been designated as contaminated by any governmental or health agency? No	
10f. Are there backflow preventers associated with the water system at the Subject Property? No		

11a. Does the facility generate or store, or has it ever generated or stored hazardous wastes? No.	11b. If so, where are, or were, the hazardous wastes generated and/or stored? How are these wastes disposed of? N/A
12a. Does the Subject Property generate, use, or store hazardous materials including pesticides, lead-acid batteries, paints, medical wastes, etc.? No.	12b. If so, where are these materials generated, used, and/or stored? N/A
13a. Does the Subject Property generate, use, or store petroleum products, including petroleum stored in pipelines? No	13b. If so, where are the petroleum products generated, used, and/or stored on site? N/A
14a. Have there ever been any on-site accumulation points for wastes? No	14b. If so, where have they been? N/A
15a. Has there been dirt fill brought on to the site? No If so, did the material originate from a contaminated site or unknown origin? N/A	15b. If contaminated soil or soil from an unknown origin has been used as fill material, where was it placed? N/A

16a. Are there currently, or have there been, any pits, ponds, or lagoons on the property or adjacent properties that have been used in connection with waste treatment or waste disposal (i.e. trash burning, pits, collection basins, etc.)? No.	16b. If so, where are, or were, they located? N/A	16c. Are there any permits associated with these facilities (NPDES, solid waste, RCRA)? N/A
17. Are there, or were there, any of the following on the Subject Property?	If so, where are, or were, they located?	Are there any chemical releases associated with these items or activities?
a. Aboveground storage tanks No	N/A	N/A
b. Underground storage tanks No	"	
c. Oil-separators No	"	
d. Septic tanks No	"	
e. Waste piles No	"	
f. Polychlorinated biphenyl (PCB)-containing equipment (including transformers, electrical equipment, hydraulic equipment, etc.) No		

g. Outdoor material storage areas No		
h. Painting and/or sandblasting operations No		
i. Drums or drum storage No		
j. Landfills No		
k. Wells (including monitoring wells, injection wells, water wells, etc.) One groundwater well	Near southwestern reservoir at 710-site	No
l. Lead based paints No		
m. Suspected asbestos containing materials No		
n. Buried objects No		
o. Pesticides and/or herbicides No		
p. Medical or biological wastes No		
q. Ordnance No		
r. Radioactive materials No		
s. Mixed wastes No		
t. Wash facilities No		
u. Radon No		
v. Heavy metals No		

18a. Are there any deteriorated painted surfaces on the Subject Property? No	18b. If so, where are these surface located? N/A
19a. Are there any stained sinks or floor drains? No	19b. If so, where are they located? N/A
20a. Is there any evidence of chemical spills or releases on the Subject Property? No	N/A
21a. Is there any evidence of improper disposal of solid or hazardous waste at the Subject Property? No	21b. If so, where are these wastes located? N/A
22a. Is there any evidence of any discolored soil on the Subject Property? No	22b. If so, where are these soils located? N/A
23a. Is there any evidence of any stressed or unseasonably dead vegetation on the Subject Property? No	23b. If so, where was the dead or stressed vegetation observed? N/A
24a. Are there any noxious odors associated with the Subject Property? No	24b. If so, where were the noxious odors observed? N/A

25a. Are there any sensitive receptors including protected or endangered natural resources at the Subject Property? No	25b. If so, what are they? N/A
26a. Are there any cultural resources at the Subject Property? Yes.	26b. If so, what are they? There is a burial site and various other archeological sites as documented in the Archeological Inventory Survey by Cultural Surveys Hawaii (Robins et al) as revised January 2000
27a. Are there any surface water bodies at the Subject Property? Two reservoirs and one flume-- One reservoir located at the top (northwestern end) of the view plane of the 710-acre site.	27b. If so, where are they located? The second reservoir is located near the located at the southwestern end of the 710-acre site. Both reservoirs are associates with agricultural irrigation.
28. Are there any air permits currently or planned to be in use at the Subject Property? No	29. What is the estimated depth to groundwater at the Subject Property? Unknown
30a. Are there any areas on site that have been identified as requiring on-going monitoring or additional investigation by the USEPA, HDOH, or other agency including installation restoration program sites and/or areas of concern and environmental compliance sites that have not been issued a NFRAP or a letter of concurrence regarding no further action (e.g., sites that are still considered open and require additional work)? No	30b. If so, where are they located and what is the nature of the monitoring/investigation? N/A
31. Are there any Environmental Liens or activity and use limitations on the Subject Property? No	
32. Do you have any specialized knowledge, related to environmental issues of the Subject Property? No.	
33. Do you any additional commonly known or reasonable ascertainable information, related to environmental issues of the Subject Property? No.	
34. Do you know of any valuation reduction for environmental issues of the Subject Property? No	
35. What is the reason for performing the Phase I ESA? Confirm that no hazardous materials or disposal exist.	

C. BREWER AND COMPANY, LIMITED

Real Estate and Corporate Development

FACSIMILE TRANSMITTAL SHEET

TO: Roger Aoki	FROM: Avery B. Chumbley, Executive Vice President
COMPANY: 626-3881	DATE: 10-31-06
FAX NUMBER:	TOTAL NO. OF PAGES (INCLUDING COVER):
PHONE NUMBER:	COPY TO:
RE: Maui Property - Maalaea Mauka	

☐ URGENT ☐ FOR REVIEW/COMMENT ☐ PLEASE CALL ☐ PLEASE HANDLE ☐ FOR YOUR FILES

NOTES/COMMENTS:

Aloha Roger

here is the response to

the questions —

Avery

P.O. BOX 1826
PAPAIKOU, HAWAII 96781-1826
TEL: (808) 964-8434 / FAX: (808) 964-8426
EMAIL: abc@aloha.net

Site Evaluation Questionnaire

1. Date of Inquiry: October 31, 2006
2. Facility or Project Name: Maalaea Properties Phase I Environmental Site Assessment
3. Facility Address: TMK 3-6-01 Parcel 18; 3-6-02 Parcels 1 and 3; 3-6-04 Parcels 3 and 6
4. Describe activities that occur on the Subject Property:
5. Name, title, address, and phone number of the person conducting the interview: Roger Aoki, Senior Environmental Engineer, Element Environmental, (808) 479-3881

6a. Name and Title of Person Interviewed: AVERY B. CHUMBLEY		6b. Telephone number 244-7079
7a. How many years has the person being interviewed been familiar with the site: 24 YEARS		7b. What is his or her association with the site: President of Co.
8a. Are there individuals who have greater knowledge of the Subject Property that are available for interview? YES	8b. If so, please provide names and telephone numbers: CLAYTON SUZUKI 250-4370	
9a. Is the Subject Property or any adjoining property currently used, or has it been used in the past, for an industrial or manufacturing use? NO	9b. If so, please provide a description of those activities below: N/A	
10a. What is the source of Potable Water at the Subject Property? NONE	10b. How is sewerage provided to the Subject Property (e.g., city, private)? NONE	10c. How is electricity provided to the Subject Property (electric company, private)? MECO
10d. Is there any gas service provided to the Subject Property? If so, who provides the service? NONE	10e. If water is provided by well, has the well been designated as contaminated by any governmental or health agency? N/A	
10f. Are there backflow preventers associated with the water system at the Subject Property? N/A		
11a. Does the facility generate or store, or has it ever generated or stored hazardous wastes? NONE	11b. If so, where are, or were, the hazardous wastes generated and/or stored? How are these wastes disposed of? N/A	

12a. Does the Subject Property generate, use, or store hazardous materials including pesticides, lead-acid batteries, paints, medical wastes, etc.? AG CHEMICALS	12b. If so, where are these materials generated, used, and/or stored? OFF SITE
13a. Does the Subject Property generate, use, or store petroleum products, including petroleum stored in pipelines? None	13b. If so, where are the petroleum products generated, used, and/or stored on site? N/A
14a. Have there ever been any on-site accumulation points for wastes? None	14b. If so, where have they been? N/A
15a. Has there been dirt fill brought on to the site? If so, did the material originate from a contaminated site or unknown origin? None	15b. If contaminated soil or soil from an unknown origin has been used as fill material, where was it placed? N/A

16a. Are there currently, or have there been, any pits, ponds, or lagoons on the property or adjacent properties that have been used in connection with waste treatment or waste disposal (i.e. trash burning, pits, collection basins, etc.)? None	16b. If so, where are, or were, they located? N/A	16c. Are there any permits associated with these facilities (NPDES, solid waste, RCRA)? N/A
17. Are there, or were there, any of the following on the Subject Property?	If so, where are, or were, they located?	Are there any chemical releases associated with these items or activities?
a. Aboveground storage tanks NO		
b. Underground storage tanks. NO		
c. Oil-separators NO		
d. Septic tanks NO		
e. Waste piles NO		N/A
f. Polychlorinated biphenyl (PCB)-containing equipment (including transformers, electrical equipment, hydraulic equipment, etc.) NO		
g. Outdoor material storage areas NO		
h. Painting and/or sandblasting operations NO		
i. Drums or drum storage NO		
j. landfills NO		

k. Wells (including monitoring wells, injection wells, water wells, etc.)		
l. Lead based paints	NO	
m. Suspected asbestos containing materials	NO	
n. Buried objects	NO	
o. Pesticides and/or herbicides	NO	
p. Medical or biological wastes	yes	Sugar / Pineapple ue
q. Ordnance	NO	
r. Radioactive materials	NO	
s. Mixed wastes	NO	
t. Wash facilities	NO	
u. Radon	NO	
v. Heavy metals	NO	

18a. Are there any deteriorated painted surfaces on the Subject Property? . NO	18b. If so, where are these surface located?
19a. Are there any stained sinks or floor drains? NO	19b. If so, where are they located?
20a. Is there any evidence of chemical spills or releases on the Subject Property? None	20b. If so, where were the releases observed?
21a. Is there any evidence of improper disposal of solid or hazardous waste at the Subject Property? NO	21b. If so, where are these wastes located?
22a. Is there any evidence of any discolored soil on the Subject Property? NO	22b. If so, where are these soils located?
23a. Is there any evidence of any stressed or unseasonably dead vegetation on the Subject Property? NO	23b. If so, where was the dead or stressed vegetation observed?
24a. Are there any noxious odors associated with the Subject Property? None	24b. If so, where were the noxious odors observed?
25a. Are there any sensitive receptors including protected or endangered natural resources at the Subject Property? None	25b. If so, what are they?
26a. Are there any cultural resources at the Subject Property? NO	26b. If so, what are they?
27a. Are there any surface water bodies at the Subject Property? NO	27b. If so, where are they located?

28. Are there any air permits currently or planned to be in use at the Subject Property? NO	29. What is the estimated depth to groundwater at the Subject Property?
30a. Are there any areas on site that have been identified as requiring on-going monitoring or additional investigation by the USEPA, HDOH, or other agency including installation restoration program sites and/or areas of concern and environmental compliance sites that have not been issued a NFRAP or a letter of concurrence regarding no further action (e.g., sites that are still considered open and require additional work)? NO	30b. If so, where are they located and what is the nature of the monitoring/investigation?

WAILUKU WATER CO.

Na Wai Eha

November 1, 2006

To: Avery Chumbley
From: Clayton Suzuki

Subject: Waikapu to Maalaea Fields

The following chemicals may have been used during the cultivation of sugarcane in the Waikapu to Maalaea Fields.

Active Ingredient:	Brand Name:
Atrazine	Aatrex Nine-O
Ametryn	Evik 80W
2, 4-D	Formula 40
Diuron	Karmex DF
Glyphosate	Roundup
Metribuzin	Sinbar
Hexazinone	Velpar
Glyphosate	Polado

The following fertilizers were used in the cultivation of sugarcane.

- Nitrogen
- Potassium
- Phosphorus
- Calcium carbonate

The following chemicals may have been used during the cultivation of pineapple in the Waikapu to Maalaea fields.

Aliette	Ethrel
Amdro	Evik
Diazinon	Hyvar X
Karmex (Diuron)	Velpar DF
Roundup (non crop area)	Atrazine
Fruitone	Nemcur 3

The following fertilizers were used in the cultivation of pineapple.

Nitrogen	Sulfate of Potash
Iron Sulfate	Magnesium Sulfate
Zinc Sulfate	Sulfate of Amonia
Phosic Acid	

255 EAST WAIKO ROAD • WAILUKU, MAUI, HAWAII 96793-9355 • TELEPHONE (808) 244-9570 • FACSIMILE (808) 242-7068

APPENDIX D

Historical Research Documentation

MAUI COUNTY PARCEL HISTORY (TT102) FOR:
TMK: 3-6-004-003-0000 PAGE:1

07/13/1998 --
INSTR-DESC:AMENDMENT OF ESMT
INSTR_NO:9800101152 TRANS NO:59086
INSTR-DATE:07/01/1998
REC-DATE:07/13/1998
ACK/EFF DATE:07/13/1998

AREA:657.1950 ACRES
WAILUKU AGRIBUSINESS CO INC "GRANTOR"
MAUI ELECTRIC COMPANY LIMITED "GRANTEE"
GRANTOR AND GRANTEE AMEND ESMT GRANT, DOCS 95-1279 & 95-1612
80 TO DELETE
EXH "A" & SUBSTITUTE EXH "A" ATTACHED.
ESMT C ELECTRICAL TRANSMISSION FOR GR 3152 62,877 SF
DES
F/D: SUBJ TO ELEC TRANSMISSION ESMT "C" (62,877 SF) IN FAVO
R OF MAUI
ELEC CO LTD

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU AGRIBUSINESS CO INC

12/13/1995 --
INSTR-DESC:UTILITY ESMT
INSTR_NO:9500161279 TRANS NO:59085
INSTR-DATE:11/01/1995
REC-DATE:12/13/1995
ACK/EFF DATE:12/13/1995

AREA:657.1920 ACRES
FROM: WAILUKU AGRIBUSINESS CO INC
TO: MAUI ELECTRIC COMPANY LIMITED
GRANTOR GRANT UNTO GRANTEE A PERPETUAL RIGHT & ESMT TO CONST
RUCT,
MAINTAIN & OPERATE POLE, WIRE LINES & UNDERGROUND POWER LINE
S FOR THE
TRANSMISSION OF ELECTRICITY FOR LIGHT, POWER & COMMUNICATION
, OVER,
ACROSS & UNDER PARCEL SHOWN ON MAP ATTACHED AS EXH "A". TOG
ETHER WITH
RIGHT OF INGRESS & EGRESS.
ESMT C 62,678 SF
TMB NOTE: ESMT NOT SHOWN; NO DES.
F/D: SUBJ TO ELEC TRANS LINE ESMT "C" IN FAVOR OF MAUI ELE
CO LTD

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU AGRIBUSINESS CO INC

08/04/1992 --
INSTR-DESC:MAP/R WAIKAPU HEMA LARGE LOT SUBD
INSTR_NO:0000000000 TRANS NO:59084
INSTR-DATE:02/24/1993
ACK/EFF DATE:08/04/1992

AREA:657.1920 ACRES
FROM: 3602-2 657.192 AC LOT 6
F/D: PICK UP; LOT 6

GROUP# NAME F TC %-OWNER TITLE-DESC
2 0011 WAILUKU AGRIBUSINESS CO INC

-----------------SEE HISTORY SHEET FOR MORE INFORMATION-----------------

TERRITORY OF HAWAII

FIELD BOOK LAND SHEET

Waikapu

DESCRIPTION

ZONE	SEC.	PLAT.	PARCEL	DIVISION
3	6	02	02	Second

OWNER: Wailuku Sugar Company

MAILING ADDRESS: Wailuku, Maui T.H.

TITLE HISTORY

YEAR	1959	1960	1961	1962	1963	1964	1965	1966
AREA	961.30 Ac	961.30 Ac	961.30 Ac	961.30 Ac	[illegible]	[illegible]		
LAND	82,569	79,610	94,819	88,474	[illegible]	[illegible]		
IMP.								
TOT.	82,569	79,610	94,819	88,474	[illegible]	[illegible]		
EX.								
NET	82,569	79,610	84,819	88,474	[illegible]	[illegible]		
TAX	1,368.17	1,083.69	1,154.39	1204.13	[illegible]	[illegible]		

YEAR	1968	1969	1970	1971	1972	1974	1976
LAND	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
NET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

C A M A

0034 0716

MAUI COUNTY PARCEL HISTORY (TT102) FOR:
TMK: 3-6-004-006-0000

PAGE:1

```
06/16/1992 ----------------------------------------------------------------
INSTR-DESC:ORDER GRANTING PLAINTIFFS EX PARTE
        MOTIO                                              TRANS NO:59099
                       INSTR_NO:9200095607             INSTR-DATE:01/01/1900
                                                         REC-DATE:06/16/1992
   AREA:52.9760 ACRES       STATE-CONV-TAX: $ 0.00   ACK/EFF DATE:06/16/1992
ACK:  6/12/92
ORDER GRANTING PLAINTIFF'S EX PARTE MOTION FOR JUDGMENT BY D
EFAULT AND
JUDGMENT  CIVIL NO 92-0270(3)  2ND CIRCUIT COURT
IT IS HEREBY ORDERED, ADJUDGED AND DECREED THAT PLAINTIFF, W
AILUKU
AGRIBUSINESS CO INC IS THE OWNER IN FEE SIMPLE OF THE REAL P
ROPERTY
DESCRIBED IN EXHIBIT A ANNEXED HERETO
F/D:  KEYED ONLY - CLEAR TITLE

GROUP# NAME                              F  TC   %-OWNER   TITLE-DESC
2 0011 WAILUKU AGRIBUSINESS CO INC

04/06/1992 ----------------------------------------------------------------
INSTR-DESC:JUDGEMENT
                       INSTR_NO:9200050491                 TRANS NO:59098
                                                       INSTR-DATE:01/01/1900
                                                         REC-DATE:04/06/1992
   AREA:52.9760 ACRES       STATE-CONV-TAX: $ 0.00   ACK/EFF DATE:04/06/1992
ACK:  4/2/92
ORDER GRANTING PLAINTIFF'S EX PARTE MOTION FOR DEFAULT JUDGM
ENT AND
JUDGMENT  2ND CIRCUIT COURT   CIVIL NO 92-0071(1)
WAILUKU AGRIBUSINESS CO INC, PLAINTIFF, VS KANEAE, HEIRS AND
ASSIGNS,
AND ALL WHOM IT MAY CONCERN, DEFENDANTS.
-
IT IS HEREBY ORDERED, ADJUDGED AND DECREED THAT PLAINTIFF, W
AILUKU
AGRIBUSINESS CO INC, IS THE OWNER IN FEE SIMPLE OF THE REAL
PROPERTY
DESCRIBED IN EXHIBIT A
F/D:  KEYED ONLY - CLEAR TITLE

11/13/1990 ----------------------------------------------------------------
INSTR-DESC:RECONVEYANCE DEED
                       INSTR_NO:9000174768                 TRANS NO:59097
                                                       INSTR-DATE:08/22/1990
                                                         REC-DATE:11/13/1990
   AREA:52.9760 ACRES       STATE-CONV-TAX: $ 0.00   ACK/EFF DATE:11/13/1990
FROM:  THE HAWAII TROPICAL PLANTATION
TO:    WAILUKU AGRIBUSINESS CO INC
3604-06:  LOT 2   52.976 AC   SUBJ/ES

GROUP# NAME                              F  TC   %-OWNER   TITLE-DESC
2 0011 WAILUKU AGRIBUSINESS CO INC

10/07/1987 ----------------------------------------------------------------


GROUP# NAME                              F  TC   %-OWNER   TITLE-DESC
2 0011 WAILUKU SUGAR COMPANY                               OVER 42.316 A+-
2 0021 HAWAII TROPICAL PLANTATION                          OVER 10.660 A+-
------------------SEE HISTORY  SHEET FOR MORE INFORMATION------------------
```

COUNTY OF MAUI
PROPERTY TAX DIVISION

LAND APPRAISAL CARD

Tax Key Z	S	Plat	Parcel	HPR Unit No.	Fill Code	Neighborhood Code
3	6	004	006	0000	520	3655

DESCRIPTION: Grant 1844
Por lot 2

OWNER	TITLE HISTORY	NET AREA
WAILUKU SUGAR CO (over 42.816 Ac±)	TRB M-79 1984 R/S New for 1985 from 3604-2	52.976 Ac
THE HAWAII TROPICAL PLANTATION (over 10.660 Ac±)		

C A M A

0034 0745

REQUEST TO ACCESS A GOVERNMENT RECORD

DATE: October 31, 2006

TO: Hazard Evaluation & Emergency Response Office (Fax: 586-7537)

FROM: Roger Aoki
Element Environmental, LLC
62-180 Emerson Road
Haleiwa, HI 96712
Tel: 479-3881 (cell)
Fax: 637-0001
Email: raoki@e2hi.com

Although you are not required to provide any personal information, you should provide enough information to allow the agency to contact you about this request. The processing of this request may be stopped if the agency is unable to contact you. Therefore, please provide any information that will allow the agency to contact you (name or alias, telephone or fax number, mailing address, e-mail address, etc.).

I WOULD LIKE THE FOLLOWING GOVERNMENT RECORD

Describe the government record as specifically as possible so that it can be located. Try to provide a record name, subject matter, date, location, purpose, or name of persons to whom the record refers, or other information that could help the agency identify the record. A complete and accurate description of the government record you request will prevent delays in locating the record. Attach a second page if needed.

Maalaea Property located at Honoapiilani Highway, Wailuku, Maui, Hawaii 96793

TMK (2) 3-6-004:003 and 006

I WOULD LIKE : (please check one or more of the options below)

x To inspect the government record.

☐ A copy of the government record: (Please check one of the options below.) See the back of this page for information about fees that you may be required to pay for agency services to process your record request.

Note: Copying and transmission charges may also apply to certain options.

- ☐ Pick up at agency (date and time):
- ☐ Mail
- ☐ Fax (toll free and only if available)
- ☐ Other, if available (please specify):

☐ If the agency maintains the records in a form other than paper, please advise in which format you would prefer to have the record.

x Electronic ☐Audio ☐Other (please specify):.

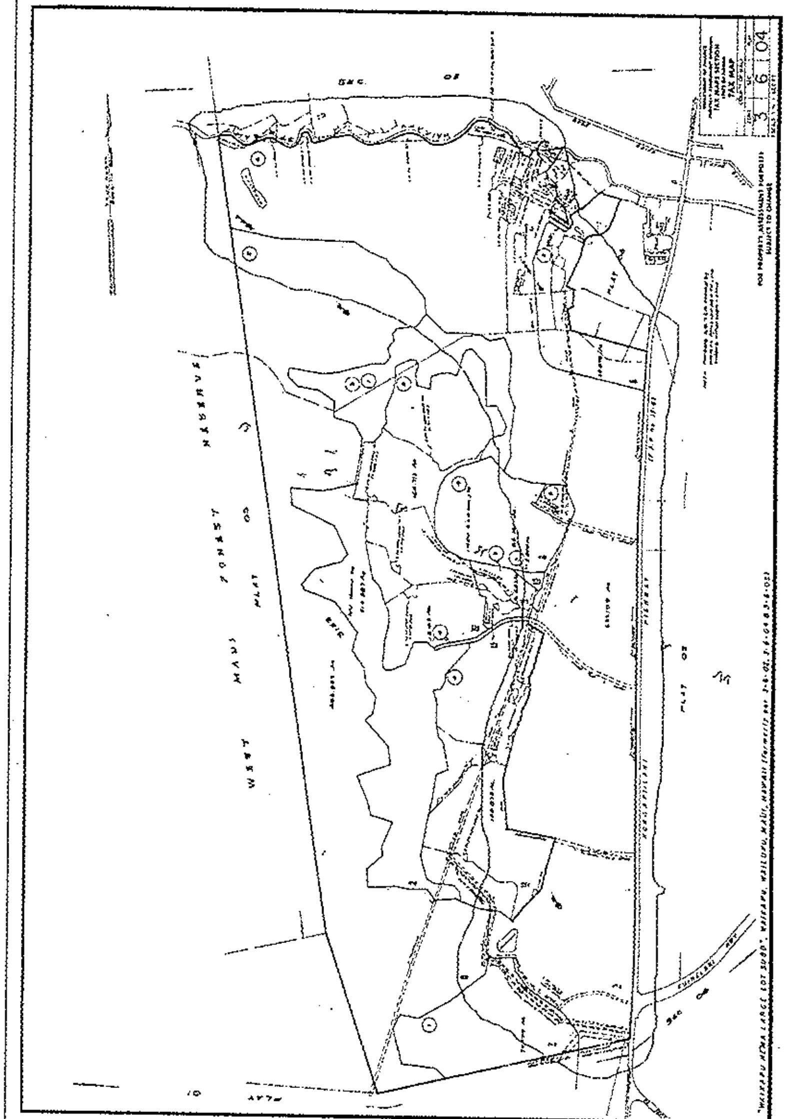
☐ Check this box if you are attaching a request for waiver of fees in the public interest (see waiver information on back).

SEE BACK FOR IMPORTANT INFORMATION

OFFICIAL USE ONLY:

Office Manager

Date



element environmental llc
environmental · engineering · water resources

October 31, 2006

Department of Fire Control
Assistant Chief's Office
200 Dairy Road
Kahului, HI 96732

Subject: Request for Records on Reported Hazardous Material Spill Events

To Whom It May Concern:

Element Environmental, LLC (E2) is engaged in a Phase I Environmental Site Assessment for the TMK 3-6-004 Parcels 003 and 006 Property located along Honoapiilani Highway, Wailuku, Hawaii 96793. A map showing the site location is attached with this request.

The site assessment includes the identification of facilities on the site or adjacent to it which use or generate hazardous substances on their premises. It is our understanding that the Maui County Department of Fire Control has maintained files containing such information. We would be interested in any information regarding unauthorized hazardous material spills/releases, violations (including safety violations), or aboveground tank registrations for any facility located at or within a ¼ mile radius of the subject property. If no such records exist, a negative response would be appreciated. The information will be used in a Phase I – Environmental Site Assessment. It would be greatly appreciated if you could respond as soon as possible.

Should you have further questions, please do not hesitate to contact me at (808) 479-3881 (cell).

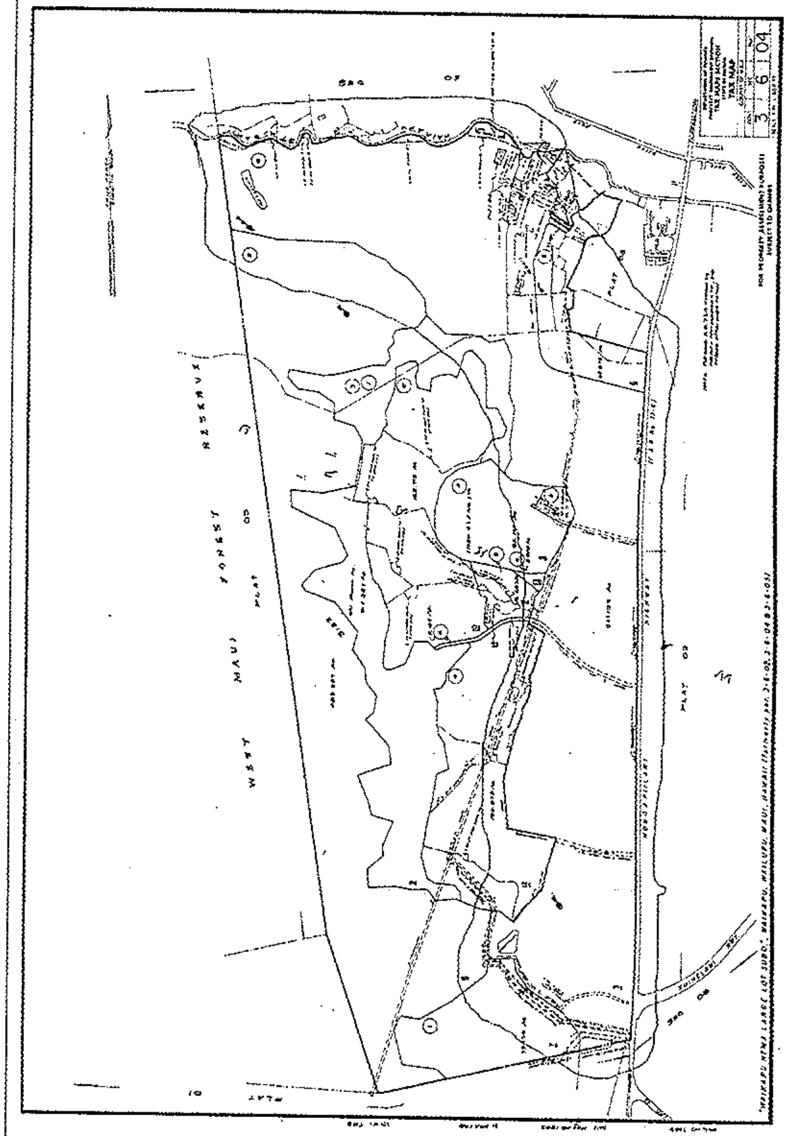
Sincerely:
Element Environmental, LLC

Roger C. Aoki

Roger C. Aoki, P.E.
Senior Environmental Engineer

Enclosure

62-180 Emerson Road, Haleiwa, Hawaii 96712 tel: (808) 637-1200 fax: (808) 637-0001 email: raoki@hawaii.rr.com



element environmental llc
environmental engineering water resources

October 31, 2006

Maui County Local Emergency Planning Committee
200 Dairy Road
Kahului, HI 96732

Attention: Mr. Scott Kekuewa

Subject: Request for Tier 2 Reports

Dear Mr. Kekuewa:

Element Environmental, LLC (E2) is conducting an environmental site assessment project for the TMK 3-6-004 Parcels 003 and 006 Property located along Honoapiilani Highway, Wailuku, Hawaii 96793. A map showing the site location is attached with this request.

The site assessment includes the identification of facilities on the site or adjacent to it which store, use, or generate hazardous materials/substances on their premises. It is our understanding that the Maui County Local Emergency Planning Committee (LEPC) has maintained Tier 2 Reports under the Superfund Amendments and Reauthorization Act (SARA) Title III containing such information. We would be interested in receiving Tier 2 Reports for any such property or facility. If no such records exist, a negative response would be appreciated. The information will be used in a Phase I – Environmental Site Assessment.

Should you have any questions or need more information, please do not hesitate to contact me at (808) 479-3881.

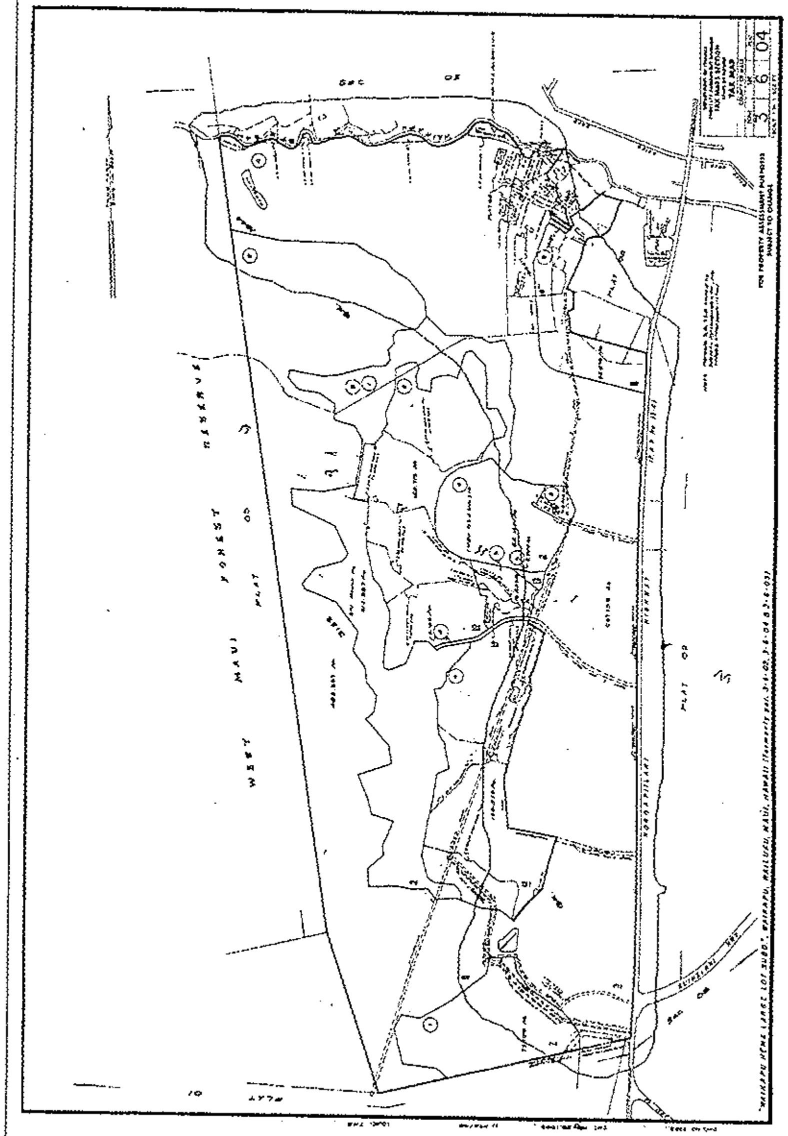
Your help and prompt response is greatly appreciated.

Sincerely:
Element Environmental, LLC

Roger Aoki

Roger C. Aoki, P.E.
Senior Environmental Engineer

62-180 Emerson Road, Haleiwa, Hawaii 96712 tel: (808) 637-1200 fax: (808) 637-0001 email: raoki@hawaii.rr.com



APPENDIX E

Qualifications of the Environmental Professionals

Roger C. Aoki, P.E.
Senior Environmental Engineer

BACKGROUND:

EDUCATION
Masters of Science in Civil (Environmental) Engineering – Purdue University, 1995
B.S., Civil Engineering - University of Hawaii at Manoa, 1994

PROFESSIONAL REGISTRATIONS
Licensed Professional Engineer – Civil (Hawaii 2000), Certificate No. 10019-C

SPECIALIZED TRAINING
OSHA 40-hour Initial HAZWOPER Training and Current 8-hour Refresher
Hazardous Waste Site Supervisor Training
First Aid and CPR Training

SUMMARY OF EXPERIENCE

Mr. Aoki is has over ten years (10) of experience in the environmental consulting industry. He has over five (5) years of project management experience and has managed Federal Indefinite Delivery, Indefinite Quantity Contracts and environmental consulting/engineering design contracts.

Mr. Aoki has been involved in a wide range of environmental investigation and engineering projects dealing with water, wastewater, petroleum contamination, solid waste, and hazardous waste. His professional experience has included work on projects in Hawaii and Guam. Mr. Aoki's areas of expertise consist of environmental investigations, environmental baseline surveys, regulatory compliance, remedial design, storm water planning, and wastewater engineering. He has prepared risk-based corrective action reports on sites contaminated with petroleum-related compounds, polychlorinated biphenyls (PCBs) and heavy metals, is experienced in preparing work plans, project management plans, sampling and analysis plans, site safety and health plans, and reports for soil and groundwater investigation projects.

Keehi Place Pump Station Evaluation, State of Hawaii Department of Transportation: Engineer assisting with the evaluation of the existing pump station and determining a rational service population estimate to generate projected wastewater flows to allow for planning of future wastewater facility infrastructure.

3/01 – 7/06
Project Engineer and Project Manager with Environet, Inc.

Waimanalo Wastewater Treatment Plant Improvements, State of Hawaii Department of Land and Natural Resources: At Engineer assisting in the design of a new secondary treatment system. Responsibilities included calculations for tank and equipment sizing, hydraulic calculations, mechanical process design including equipment selection, and design and layout of the dissolved air floatation thickener process units and equipment. Mr. Aoki also assisted with the preparation of construction plans and specifications.

Environmental Assessments: Project Manager for the preparation of several Environmental Assessments for the private clients, City and County of Honolulu, State of Hawaii, and US Army Corps of Engineers. The Environmental Assessments supported wide ranging developments and rehabilitation

work including sewer line replacement, new housing developments, and flood control improvements.

Remedial Action Operations/Long Term Monitoring Contract N62742-01-D-1805. Served as the Project Manager for all 19 Contract Task Orders (CTOs) during the 5 years of the contract.

Environmental Engineering Services Contract N62742-02-D-1801. Served as the Project Manager for 10 of the 30 CTOs during 4 years of the contract. Served as the primary Technical Program Manager for the Environmental Baseline Surveys, Findings of Suitability to Lease/Transfer CTOs.

Environmental Technical Services Contract N62742-04-D-1863. Served as the Project Manager for all three Contract Task Orders (CTOs) during the one-and-a-half years of the contract.

Site Investigation at Building 15-46A at the Former Naval Air Station, Agana in Tiyan, Guam. Served as the Project Manager for a site investigation to evaluate an illicit sewer system that was historically used for waste oil disposal. Work tasks included conducting a site reconnaissance to identify the sewer system, field sampling to evaluate the nature and extent of contamination, and data evaluation and reporting to promote an expedited site closure.

Groundwater Monitoring at the Former Agana Power Plant in Mongmong, Guam. Served as the Project Manager to assess the quality of groundwater at the former Agana Power Plant. The results were compared to drinking water and EPA Region 9 tap water criteria to assess the quality of groundwater for the on-going Remedial Investigation of the site. Work tasks included installing two groundwater wells, conducting two rounds of groundwater sampling at six wells; having the sample analyzed by several analytical methods; developing trends from historic data; and comparing the results to current regulatory standards.

Maintenance and Groundwater Monitoring at Former Naval Air Station (NAS), Barbers Point, Oahu, Hawaii. Served as the Project Manager to assess the quality of groundwater beneath the former NAS Barbers Point. The results were compared to drinking water criteria to assess the quality of groundwater for property transfer. Data were also compared to State of Hawaii Water Quality Standards for surface water to determine potential risk via transport to the Pacific Ocean. Work tasks included conducting a groundwater sampling at 21 wells; having the sample analyzed by over 20 analytical methods; developing trends from historic data; and comparing the results to current regulatory standards.

Long-Term Maintenance and Monitoring at the Construction Battalion Landfill in South Finegayan, Guam. Served as the Project Manager to conduct landfill gas monitoring at three landfill gas vents and collected two landfill gas samples to determine the volatile organic compound constituents. Six settlement monuments located atop the cap were surveyed to determine settlement of the cap. Vegetation was cleared on the landfill cap and drainage swales.

Phytoremediation of PCB-Contaminated Soils at Haiku Valley. Served as Project Engineer for the phytoremediation project. Preliminary laboratory screening trials and data search were conducted prior to the field study. A pilot-scale phytoremediation demonstration system was performed in the field with the selected processes in combination with the selected plants. The field study evaluated contaminant removal efficiency of the selected phytoremediation system and design issues such as plant growth, microbial populations in the rhizosphere, soil contaminant levels, phytotoxicity, and rooting depth.

Phytoremediation at the Former Open Burn/Open Detonation (OB/OD) Unit at the Makua Military Reservation. Served as Project Engineer for the phytoremediation project. The project consisted of a greenhouse study to be conducted at the University of Hawaii College of Tropical Agriculture and Human Resources (CTAHR). The purpose of the greenhouse screening trials was to identify candidate plant species for phytoremediation. Approximately six to ten different plant species were screened for their effectiveness in bioaccumulating/biodegrading the contaminants of concern. The greenhouse study also determined planting requirements, fertilization levels, soil characterization and applicable amendment requirements, irrigation needs, and any other requirements for enhancing plant propagation in the Makua OB/OD soils based on the existing contaminant concentrations. The goal of the field study is to apply the results obtained in the greenhouse study in an actual field setting.

Kapalama Incinerator Cleanup. Served as Project Manager. Provided the following services for the removal of hazardous (brick and ash) and non-hazardous (lead-contaminated soil) wastes from the former Kapalama incinerator: prepared a site health and safety plan; prepared a project work plan; prepared a sampling and analysis plan; prepared construction plans and specifications; provided oversight of the cleanup; and reviewed manifests and other cleanup documentation.

RCRA Corrective Action of Solid Waste Management Units, Areas of Interest and Various Bunkers, Johnston Island Phase II. Participated in the site characterization, remedial design, removal action, confirmation testing, and final report writing for remedial work conducted at a number of solid waste management units located on Johnston Atoll. A total of 1,000 tons of hazardous and non-hazardous contaminated soil was being excavated and disposed off-island. Environmental Chemical Corporation (ECC) a subconsultant, assisted Environet on Johnston Island with the excavation and packaging of the contaminated soil/materials for shipment to U.S. Ecology's landfill in Nevada.

4/96 – 3/01
Staff Engineer and Project Engineer with Earth Tech

Site Summary Report (SSR), Pearl Harbor Naval Complex (PHNC), Oahu, Hawaii. Environmental Project Engineer for an environmental site evaluation of existing and past activities with potential hazardous substance or waste releases throughout PHNC. This project involved the review of historical records at various government agencies including PACDIV, the Hawaii Department of Health, and the USEPA, regarding the use, storage, disposal, and release of hazardous materials and wastes at PHNC. The assessment also included a review of site and hydrogeologic characteristics, (based on topographic maps, aerial photographs, previous site characterization reports, and other documents) and a site reconnaissance of Navy property. An electronic database associated with a GIS was developed to manage the large volume of data collected.

PCB Removal Actions at Transformer Substations, NAS Barbers Point. Primary author for an engineering evaluation/cost analysis (EE/CA) that involved analyzing 16 removal action technologies, estimating costs for recommended remediation alternatives, researching and evaluating various federal and state statutes and regulations for Applicable or Relevant and Appropriate Requirements (ARARs) for a non-time critical removal action for PCB-contaminated soils and concrete. Supervised the site reconnaissance and field sampling teams. Estimated removal action costs using Remediation Action Cost Engineering and Requirements (RACER). Oversaw PCB removal activities. Primary author for the Remediation Verification Report and Record of Decision closure documents.

Stormwater Pollution Control Plan (SWPCP) Updates, Naval Station and Naval Magazine, Pearl Harbor, Oahu, Hawaii. Evaluated Naval Station facilities at the PHNC and Naval Magazine facilities at Naval Magazine Lualualei Headquarters Branch and West Loch Branch. Facilities were investigated to identify the practices used to reduce the pollutants in storm water discharges associated with industrial activities and to assure compliance with their respective National Pollutants Discharge Elimination System (NPDES) permits. Facility assessments determined the types and quantities of significant materials stored, and their utilization. Best management practices to prevent non-stormwater discharges were then proposed for implementation.

Petroleum, Oils, and Lubricants (POL) Remediation Study, Honolulu Harbor, Hawaii. Conducted an environmental site assessment of Piers 16 through 38. Although the site assessment looked at hazardous materials in general, the project focused on the presence and use of petroleum products in the area. Reviewed historical records at various government agencies, including the Hawaii Department of Health, the Hawaii Department of Transportation, and the U.S. Coast Guard, regarding the use and storage of hazardous materials. Assisted with the development of an electronic database associated with a GIS to manage the large volume of data collected.

09/92 – 01/95
Student Aide and Engineer's Aide with R.M. Towill Corporation

Drainage Structure Design, Ewa Villages Municipal Golf Course, City & County of Honolulu, Ewa, Oahu, Hawaii. Assisted in the design of drainage structures for the municipal golf course in Ewa. Used hydraulic computer programs to determine drainage flow rates and water surface elevations during flood events for the design of a spillway, golf cart underpasses, and drainage retention basins and culverts.

Villages of Kapolei Master Plan. Assisted registered civil engineers and planners with design of storm drain, sewer, and water distribution systems for the Villages of Kapolei Master Plan. Prepared preliminary design of the stormwater drainage system with the capability of managing various flood events. Determined peak, average, and fire flow requirements of the sewer and water systems for residential and commercial land use areas with varying population densities.

element environmental llc
environmental · engineering · water resources

Ryan S. W. Yamauchi, P.E.
President
Senior Environmental Engineer

BACKGROUND:

EDUCATION
Masters of Science in Civil (Environmental) Engineering (1995) - University of California at Berkeley
Bachelor of Science in Civil Engineering (1994) - University of Hawaii at Manoa

PROFESSIONAL REGISTRATIONS
Licensed Professional Engineer – Civil (Hawaii 1998), Certificate No. 9566-C
Registered Environmental Assessor-California-2003

SPECIALIZED TRAINING
OSHA 40-hour Initial HAZWOPER Training and Current 8-hour Refresher
Hazardous Waste Site Supervisor Training
First Aid and CPR Training

Mr. Yamauchi is the Responsible Corporate Officer for Element Environmental, LLC. He has one year of experience as a Chief Executive Officer and five years of experience as a Program/Project manager. He has over twelve years (12) of experience in the environmental consulting industry. He has over six (6) years of project management experience and has managed Federal Indefinite Delivery, Indefinite Quantity Contracts and environmental consulting/engineering design contracts. He is customer-focused and performance-driven.

Mr. Yamauchi has been involved in a wide range of environmental investigation and engineering projects dealing with water, wastewater, petroleum contamination, solid waste, and hazardous waste. His professional experience has included work on projects in Hawaii, Guam, Korea and the Pacific Islands. Mr. Yamauchi's areas of expertise consist of environmental investigations, remedial design and engineering, groundwater modeling, storm water planning, and wastewater engineering. He has prepared risk-based corrective action reports on sites contaminated with polychlorinated biphenyls (PCBs) and heavy metals, is experienced in preparing work plans, project management plans, sampling and analysis plans, site safety and health plans, and final reports for soil, groundwater and sediment investigation projects.

Mr. Yamauchi has also completed several large storm water and wastewater engineering design projects and studies. He has also performed and managed water and wastewater treatment design, wastewater reuse, sewer collection system preventive maintenance, and sewage spill response procedure development projects. He is an active member of the American Water Works Association and the Water Environment Federation.

SPECIFIC PROJECT EXPERIENCE:

Environmental Management Program, State of Hawaii, Department of Transportation, Highways Division: Project Manager for the development of a comprehensive Environmental Management Program (EMP). The program components included: completion of Storm Water Pollution Control Plans (SWPCPs) for the eight Oahu maintenance baseyards, development of training materials for storm water awareness, SWPCP elements, and construction BMPs; development of a training plan for the Chemical Application BMP Program Plan; and development of a Hazard Communication Program, Hazardous Waste Management Program, Solid Waste Management Program, Petroleum, Oil and Lubricant

Management Program, and Facility Maintenance Program. The EMP targeted maintenance operations and maintenance baseyards statewide.

Sand Island Wastewater Treatment Plant Site Assessment and Remedial Design, City and County of Honolulu: Project Manager for the site investigation and Toxic Substances Control Act (TSCA) cleanup of contaminated soil. Responsibilities included overall project management, coordination of subconsultants, development of the technical approach for all environmental investigations and the remedial design, and negotiating with the USEPA Region 9 and the State Department of Health (DOH) for all investigative and remedial activities. Supervised the preparation of the Phase I Environmental Site Assessment (ESA). Conducted and prepared the Phase II ESA, the Human Health Risk Assessment, the TSCA Notification Remediation Report, and the Soil Management Plan. Prepared construction plans and specifications and a construction cost estimate for the TSCA remediation. Performed services during construction including oversight and review of the TSCA cleanup. Coordinated all of the investigation and cleanup work for the two ongoing construction projects. Negotiated with the USEPA Region 9 and the State DOH throughout the duration of the project to allow construction to proceed concurrently with the investigation and cleanup. A follow- on remedial design including the completion of construction documents for the reuse of remaining low level PCB contaminated soil was completed for 76,000 cubic yards of stockpiled soil. Mr. Yamauchi served as the senior design engineer and designed a geofabric retaining wall system to contain the contaminated soil, which allowed for immediate future use of the site as a construction staging area.

Miscellaneous Public Building Facilities Improvements at Ewa Sugar Mill, City and County of Honolulu, Department of Design and Construction: Project Engineer for the remediation project involving preparation of construction documents including plans, specifications, and cost estimates. Other work included an asbestos and lead paint survey and hazardous waste/material survey. Responsibilities included: management of all environmental sampling and analysis work, conducting soil and groundwater sampling and analysis, performance of a magnetometer survey for underground storage tanks and pipelines, preparation of all environmental reports, preparation of construction plans and specifications for the soil removal and soil capping, and negotiating with the Hawaii State Department of Health (DOH) to obtain approval of the remediation plan. Reviewed contractor's work plan, waste manifests and confirmation sampling results during construction. Reviewed and approved closure report, and obtained DOH acceptance of soil removal action and soil cap construction. Due to immediate exposure risks, Mr. Yamauchi also managed the sampling, analysis, removal, and disposal of on-site solid waste/hazardous waste surface debris.

Waimanalo Wastewater Treatment Plant Improvements, State of Hawaii Department of Land and Natural Resources: Project Engineer for the design of a new secondary treatment system. Responsibilities included secondary biological process calculations for tank and equipment sizing, hydraulic calculations for plant hydraulics, mechanical process design including equipment selection, design and layout of new site piping, and development of process control strategies. Process units that Mr. Yamauchi was responsible for included the new anoxic/aerobic tanks, the new equalization basin, the new equalization flow splitter box, the additional effluent sand filters, the new injection wells, and the new dissolved air floatation thickener. Process equipment that Mr. Yamauchi was responsible for included fine air bubble diffusers, coarse air bubble diffusers, process air blowers, mixed liquor internal recycle pumps, return activated sludge pumps, thickened sludge transfer pumps, dissolved air floatation recirculation pumps and pressurization tanks, magnetic flow meters, and ultrasonic flow measuring devices. Prepared plans and specifications for construction, and assisted with the construction cost estimate and construction phasing schedule.

Moanalua and Kalihi Stream Dredging, State of Hawaii Department of Land and Natural Resources: Project Manager for the maintenance dredging sediment sampling and design project. Responsibilities included overall project management including coordinating subconsultants, development and execution of the sediment sampling plans, preparation of the sediment sampling results and alternatives analysis report, and management and coordination of the environmental assessment (EA) and hydrographic survey. As part of the sediment sampling and analysis report, Mr. Yamauchi researched the alternatives for disposal of the sediment.

Inflow and Infiltration Study at Schofield Barracks, Wheeler Army Airfield, and Helemano Military Reservation: Project Manager for this inflow and infiltration (I&I) study. Responsibilities included overall project management; coordination of subconsultants, preparation of the work plan and site safety and health plan, supervision and coordination of the smoke testing, CCTV inspections, manhole inspections, and minor construction repairs, and preparation of the preliminary engineering analysis of the recommended I&I construction repairs, including analysis of repair alternatives and development of construction cost estimates.

Saipan Lagoon Aquatic Ecosystem Restoration Study, Saipan, U.S. Army Corps of Engineers – Honolulu Engineering District: Project Engineer for this study to identify potential restoration alternatives for the nearshore lagoon environment. Responsibilities included calculation of stormwater runoff volumes using rainfall frequency intensity curves and preliminary engineering design of two stormwater conveyance and treatment system alternatives. Completed preliminary engineering design, including sizing and layout of conveyance structures and infiltration basins, and cost estimates for construction.

RCRA Corrective Action of Solid Waste Management Units, Areas of Interest, and Various Bunkers on Johnston Atoll, U.S. Army Corps of Engineers – Honolulu Engineering District: Project Engineer for the excavation and removal of contaminated soils from a number of former SWMU and AOI on Johnston Island. Assisted with preparation of the remediation work plan and site safety and health plan. Performed confirmation sample management and coordinated shipment of confirmation samples from Hawaii to the mainland laboratory. Assisted in the preparation of post-remediation excavation and sampling drawings.

Jonathan Springs Well Granulated Activated Carbon Treatment Unit Design, Honolulu Board of Water Supply: Project Manager for the preliminary sizing and design of the new granular activated carbon (GAC) treatment facility. This was the first project within Hawaii to utilize GAC technology for the removal of dieldrin and chlordane. Responsibilities included overall project management, coordination of subconsultants, and preparation of the preliminary design. Performed preliminary sizing calculations for the GAC unit, and the backwash settling tank and filter units. Prepared the preliminary layout of the GAC facilities and the construction cost estimate.

Collection System Maintenance Spill Response Procedures Manual, City and County of Honolulu: Project Engineer for the development of standardized spill response procedures for the City. Wrote a Spill Response Procedures Manual for the handling of wastewater spills in the collection system.

<u>PUBLICATIONS:</u>

S.R. Spengler, W. Freeman, D.W. Schlack, and R.S. Yamauchi. 1997. Exploring Electronic Project Data Management Alternatives for Environmental Projects. Paper presented at 1998 Pacific Basin Conference on Hazardous Waste, East-West Center, Program on Environment.

S.R. Spengler, R.S.W. Yamauchi, B.M.B. Pabingwit, and R. Babcock. 1999. Evaluating the Environmental Impact from Injection of Treated Wastewater in a Coastal Aquifer. Paper presented at ModelCARE'99 Conference, Zurich, Switzerland, September 20-23, 1999.

APPENDIX D-1.

Phase II Environmental Site Assessment Report

Phase II Environmental Site Assessment Screening Report

Maalaea Mauka
TMK (2) 3-6-001:018
Maalaea, Maui, Hawaii

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Executive Summary

Element Environmental, LLC completed a Screening Phase II Environmental Site Assessment (ESA) of the Maalaea Mauka property identified as TMK: (2) 3-6-001: parcel 018 located in Maui, Hawaii. A Phase I ESA prepared for the property in November 2006 identified historical agricultural use at the site. The purpose of this Screening Phase II ESA was to evaluate if residual levels of pesticides and herbicides resulting from historic agricultural use are present in surface soils. In addition, an area where fourteen 55-gallon unmarked drums were identified in the Phase I ESA was investigated to determine if a release from the drums had occurred. The results of this screening will be used to determine if additional characterization and remediation with regard to the planned future residential development is necessary to protect human health and the environment.

In line with current State of Hawaii Department of Health (HDOH) published guidance documents, the Screening Phase II ESA was completed on "neighborhood-size" decision units utilizing a multi-increment sampling approach. The 260-acre site was divided into eight decision units approximately 32.5 acres in size with one multi-increment surface soil sample collected from each unit. The multi-increment samples were analyzed for pesticide and herbicide constituents that may have been applied to the property.

The results of the multi-increment sampling analyses indicate that residual pesticides and herbicides are not present at significant levels in the surface soils at the site. The majority of the pesticide and herbicide analytes were not detected in the multi-increment samples. The heavy metal arsenic was detected in all of the multi-increment samples. The arsenic levels detected were within range of natural occurring levels (i.e. background levels) found in soils throughout Hawaii. According to HDOH guidance, residential sites that contain arsenic within background levels do not require further action or restrictions on land use.

Two discrete samples were also collected from beneath the area where fourteen 55-gallon drums were observed during the Phase I ESA. The two samples were analyzed for a full suite of analytes to determine if a significant release had occurred in the area. The analytical results did not indicate that a significant release had occurred from the drums. One of the two samples contained a low level of total petroleum hydrocarbons-residual range organics. The level detected was well below the HDOH Environmental Action Level (EAL). The majority of the remaining analytes were not detected with the exception of metals, which were detected at levels below the HDOH EALs and U.S. Environmental Protection Agency (EPA) Region 9 Preliminary Remediation Goals or within naturally occurring background levels. Based on these sample results and the fact that the drums were removed and disposed, no further action is recommended for the drum area at this time.

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FIGURES

TABLES

APPENDICES

List of Acronyms

AL	Anatek Labs
AR	applicable requirements
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
C	Celsius
COC	Chain-of-Custody
COPC	Contaminants of Potential Concern
DQO	data quality objectives
E2	Element Environmental, LLC
EAL	Environmental Action Level
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
GPS	global positioning system
HDOH	State of Hawaii Department of Health
HDPE	High Density Polyethylene
HEER	Office of Hazard Evaluation and Emergency Response
LCS	laboratory control sample
MDL	method detection limit
mg/kg	milligrams per kilogram
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PQL	practical quantitation limit
PRG	Preliminary Remediation Goal
QA	quality assurance
QA/QC	quality assurance/quality control
RPD	relative percent difference
RSD	relative standard deviation
SOW	scope of work

STL	Severn Trent Laboratories
SVOC	semi-volatile organic compound
TA-Honolulu	Test America-Honolulu
TPH-diesel	total petroleum hydrocarbons-diesel range
TPH-gas	total petroleum hydrocarbons-gasoline range
TPR-rro	total petroleum hydrocarbons-residual range organics
USGS	U.S. Geological Survey
VOC	volatile organic compound

Section 1 Introduction

This Phase II Environmental Site Assessment (ESA) Screening Report presents the work procedures, methods, and results from the Screening Phase II ESA conducted by Element Environmental, LLC (E2) for the Maalaea Mauka property located in Maui, Hawaii. A Phase I ESA prepared for the property in November 2006 identified historical agricultural use at the site. This Screening Phase II ESA was conducted to determine if residual levels of pesticides and herbicides are present in surface soils at the site.

This Phase II ESA Screening Report has been prepared for M&E Pacific, Inc. in accordance with E2's fee proposal dated February 20, 2007.

1.1 Purpose and Objectives

The purpose of this Screening Phase II ESA was to evaluate if residual levels of pesticides and herbicides resulting from historic agricultural use at the site are present in surface soils. In addition, an area where fourteen 55-gallon unmarked drums were identified in the Phase I ESA was investigated to determine if a release from the drums had occurred. The results of this screening will be used to determine if additional characterization and remediation with regard to the planned future development is necessary to protect human health and the environment.

1.2 Report Organization

Details of the investigation are presented in the following sections of this Phase II ESA Screening Report. The report is organized as follows:

Section 1:	Introduction
Section 2:	Site Description and Background
Section 3:	Field Investigation and Sample Collection
Section 4:	Sample Analytical Results
Section 5:	Summary and Recommendations
Appendix A:	Potentially Applied Pesticides and Herbicides
Appendix B:	Laboratory Analytical Results
Appendix C:	Project Photographs

Section 2 Site Background

2.1 Site Location and Description

The project site consists of one parcel of developed land located in West Maui between Waikapu and Maalaea along the western side of Honoapiilani Highway (Figure 2-1). The property consists of approximately 259.885 acres of land designated as Tax Map Key (TMK): (2) 3-6-001: parcel 018.

Honoapiilani Highway runs along the eastern and southern boundary of the site. A dirt road off of Honoapiilani Highway runs along the northern and western perimeter of the site. A weather station is also present along the southwestern perimeter; however, it could not be determined if the station is located within or outside of the property boundary.

The site is currently occupied by the Maui Cattle Company, which utilizes the site for cattle pastures. Maui Cattle Company has installed wire fences throughout the property to control grazing patterns of the cattle. Maui Cattle Company also has a cattle pen and storage area near the center of the property. Entrance to the cattle pen can be made via a dirt road and locked gate located along Honoapiilani Highway.

The state land use designation for the property is Agricultural (County of Maui, 2007). The southern end of the property is located in a State Special Management Area (County of Maui, 2007). A portion of the southern end of the property is also located within the Federal Emergency Management Agency 500 year flood plain (County of Maui, 2007).

2.2 Physiography

2.2.1 Climate

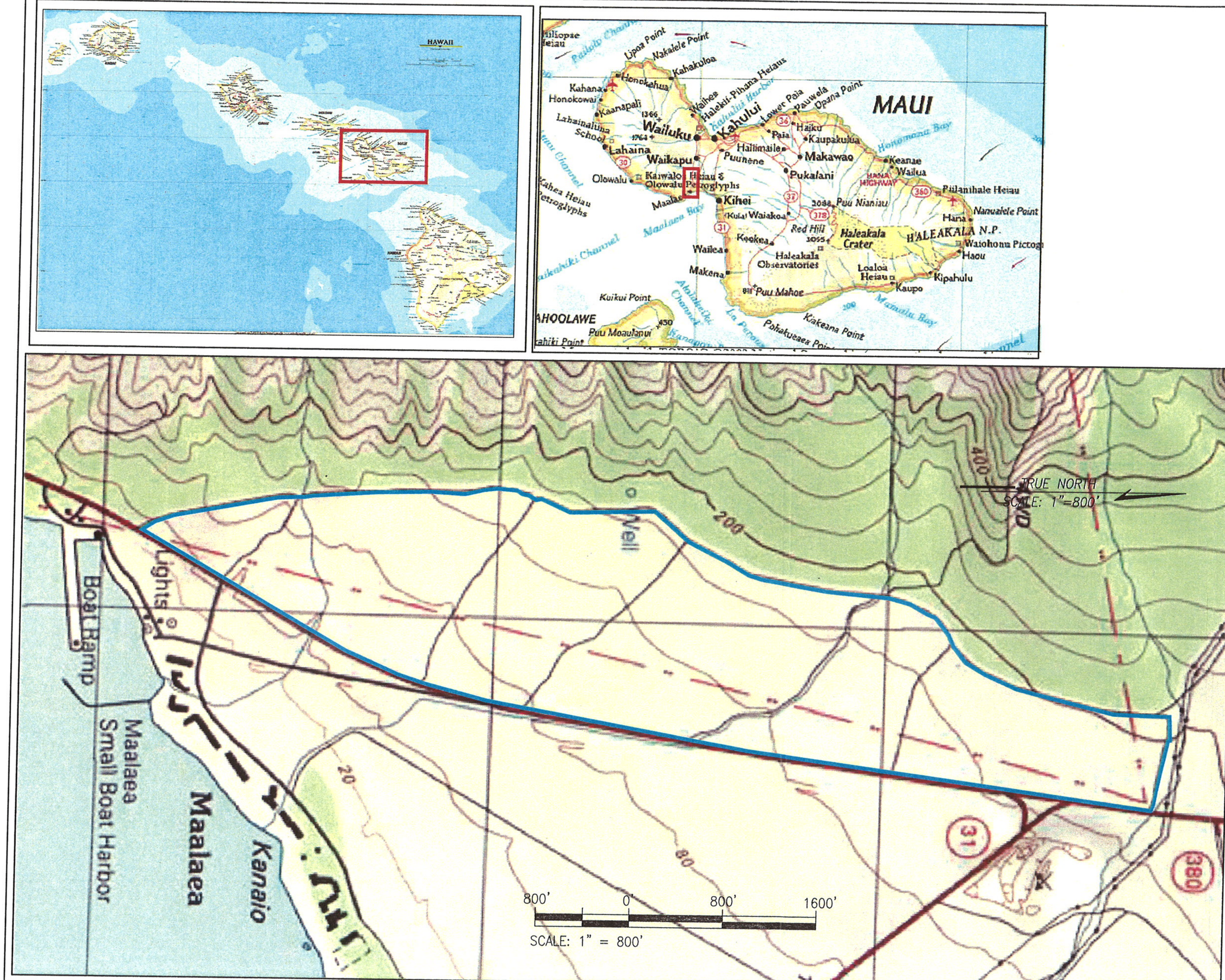
According to Giambelluca et al. (1986), the mean monthly temperatures in Maui range from 70° to 84° Fahrenheit. The average annual rainfall at the site is approximately 20 inches per year (Giambelluca et al., 1986).

2.2.2 Geology

The project site is located along the eastern base of the West Maui Mountains.

According to the U. S. Soil Conservation Service (Foote et al., 1972), the predominant soil types located in the site vicinity are:

> Puleiu cobbly loam – well drained and excessively drained, medium textured, moderately textured, and coarse-textured soils on alluvial fans and in basins on the island of Maui.
>
> Stony alluvial land – moderately well drained, moderately coarse textured soils with moderate infiltration rates.



LEGEND:

SITE BOUNDARY

element environmental llc
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PROJECT TITLE:

MAALAEA MAUKA PHASE II ESA SCREENING
MAALAEA , MAUI, HAWAII

FIGURE TITLE:

MAALAEA MAUKA
PROJECT LOCATION MAP

DATE:	FIGURE NO.:
AUGUST 10, 2007	2-1

2.2.3 Hydrogeology

The project site is located within the Waikapu Aquifer System of the Wailuku Aquifer Sector (Mink and Lau, 1990). Two aquifers are located beneath the site, an upper aquifer that occurs in sedimentary (alluvial) deposits and a lower (deeper) aquifer that occurs in horizontally extensive lavas. Both aquifers are basal, where freshwater is in contact with seawater. The upper aquifer is unconfined, where the water table is the upper surface of the saturated aquifer; and the lower aquifer is confined by impermeable or poorly permeable formations (the sedimentary deposits) with the top of the saturated aquifer below the surface of the groundwater (Mink and Lau, 1990).

The upper aquifer has the potential to be used, is not a drinking water source or ecologically important, has a moderate salinity (1,000 to 5,000 milligrams per liter of chloride), is replaceable, and is moderately vulnerable to contamination. The lower aquifer has the potential to be used, is not a drinking water source or ecologically important, has a moderate salinity (1,000 to 5,000 milligrams per liter of chloride), is replaceable, and has a low vulnerability to contamination.

Based on regional topography, regional groundwater flow direction is expected to be south-southeast towards the ocean. The nearest drinking water supply wells are located over one mile from subject property to the northwest (Element, 2006). There are five wells registered with the State Department of Land and Natural Resources within a one mile radius of the property. Three wells are being used for irrigation, one well may be used for drinking water for future residential development, and one well does not have a listed use.

2.2.4 Surface Water

The closest surface water body to the site is the Maalaea Small Boat Harbor, which is approximately 500 feet south of the southern end of the site, and is contiguous with the Pacific Ocean. The location of the Maalaea Small Boat Harbor in relation to the site is shown on Figure 2-1. There is also an earthen reservoir located approximately 1,000 feet northwest of the site.

Storm water runoff appears that it would flow into swales and gullies to the south-southwest of the site towards Honoapiilani Highway and Maalaea Harbor.

2.3 Site History

The Phase I ESA completed in November 2006 identified that the property has been historically used for agricultural purposes, specifically sugarcane cultivation, from at least 1950 to the mid 1990s. In an interview conducted during the Phase I ESA, Mr. Avery Chumbley of Wailuku Agribusiness (former user of the property) indicated that pesticides and herbicides were applied to the property as part of the normal agricultural operations. A list of potential pesticides and herbicides that may have been applied to the site was provided by Mr. Chumbley and is included in Appendix A (Element, 2006).

The site is currently occupied by the Maui Cattle Company, which utilizes the site for cattle pastures. Maui Cattle Company has installed wire fences throughout the property to control grazing patterns of the cattle. Maui Cattle Company also has a cattle pen and storage area near the center of the property.

During the Phase I ESA site reconnaissance, fourteen unmarked 55-gallon High Density Polyethylene (HDPE) drums were observed along the dirt road bordering the southwestern

end of the property. Twelve (12) of the drums were partially full with an unknown liquid at the time of the field inspection. Two of the drums were damaged and empty, indicating a potential release. In an interview with Mr. Alex Franco, Manager of Maui Cattle Company, Mr. Franco noted that the drums were present prior to their use of the property over a year ago. Mr. Franco believes that the drums may have been left by one of the farmers that were previously utilizing the property. In a follow-up request for additional information, Mr. Chumbley of Wailuku Agribusiness, indicated that the drums must have been left by a former lessee. Mr. Chumbley planned to have the drums removed by November 17, 2006 (Element, 2006).

Section 3 Field Investigation and Sample Collection

3.1 Sampling Approach

3.1.1 Multi-Increment Sampling

The primary objective of this project was to resolve the following Decision Statement: Determine whether residual levels of pesticides and herbicides resulting from historic agricultural use at the site are present in surface soils, and if present, determine if additional characterization and remediation with regard to the planned future residential development is necessary to protect human health and the environment.

In order to resolve the Decision Statement, E2 determined that an appropriate amount of data would be required. Therefore, a multi-increment sampling strategy was designed to screen the entire 260 acre site. Multi-increment sampling is a method employed to obtain representative samples that exhibit average concentrations of the material being sampled and that account for the variability of concentrations within that particular material. Such a method was developed to provide accurate (closeness of the sample value to its actual value) and precise (closeness of repeated sample values, or repeatability) data.

The multi-increment sampling strategy follows the State of Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response Office (HEER) technical report, entitled "Pesticides in Former Agricultural Lands and Related Areas – Updates on Investigation and Assessment" dated May 11, 2007. The sampling strategy employed for this project follows the "neighborhood-size" decision unit approach as outlined in the "Initial Screening of Agricultural Lands" section of the technical report.

The neighborhood size approach breaks down the project site into neighborhood-size decision units on the order of ten acres. The technical report recommends that the size and shape of individual decision units should be determined with respect to soil type, topography, past crop use, proposed redevelopment, etc. Areas suspected of higher levels of contamination (e.g. former pesticide mixing areas, storage areas, plantation camps, rail lines, etc.) are recommended to be investigated separately (HDOH, 2007). For the Maalaea Mauka project site, the site soils and past crop use across the site is relatively uniform and no areas suspected of higher levels of contamination were identified in the Phase I ESA, with the exception of the area with the 14 drums. Therefore, the 260 acre site was divided into eight neighborhood-size decision units on the order of 32.5 acres in area.

Per the technical report, one multi-increment sample was collected from each decision unit. For quality assurance purposes, one decision unit was sampled in triplicate. The field sampling methodology is described in the sections to follow.

3.1.2 Multi-Increment Sample Analyses

The technical report recommends that each multi-increment sample be tested for the full suite of pesticides that may have been used in the past. Based on the list of pesticides and herbicides provided by Mr. Chumbley, the multi-increment samples were analyzed for the following constituents:

- Arsenic and Lead (Method: SW 846);

- Semi-volatile Organic Compounds (Method: GC/MS and 8270C);
- Chlorinated Herbicides (Method: EPA 8151A);
- Organochlorine Pesticides (Method: EPA 8081A);
- Carbamates (Method: EPA 8321A);
- Volatile Organic Compounds (i.e. Fumigants) (Method: EPA 8260B); and
- Polychlorinated Biphenyls (Method: EPA 8082).

The technical report also recommends sampling for dioxins, which may remain in soils even though the parent pesticide has degraded below levels of concern (HDOH, 2007). However, due to the expense of the analysis and the screening nature of this investigation, dioxins were not analyzed as part of this investigation.

3.1.3 Discrete Sampling

During the Phase I ESA site reconnaissance, fourteen unmarked 55-gallon HDPE drums were identified along the dirt road bordering the southwestern end of the property. Twelve (12) of the drums were partially full with an unknown liquid at the time of the field inspection. Two of the drums were damaged and empty, indicating a potential release. In an interview with Mr. Alex Franco, Manager of Maui Cattle Company, Mr. Franco noted that the drums were present prior to their use of the property over a year ago. Mr. Franco believes that the drums may have been left by one of the farmers that were previously utilizing the property. In a follow-up request for additional information, Mr. Chumbley of Wailuku Agribusiness, indicated that the drums must have been left by a former lessee (Element, 2006). Based on the potential for a release from the drums, the area surrounding the drums was separated from the multi-increment decision units and sampled discretely. Two discrete samples were collected from the surface soil directly beneath the drums.

3.1.4 Discrete Sample Analyses

Due to the unknown nature of the drum contents, the discrete surface soil samples collected from the drum area were analyzed for the following complete suite of analytes:

- Total Petroleum Hydrocarbons – gasoline range (Method: EPA 8015M/8260B)
- Total Petroleum Hydrocarbons – diesel range and residual range organics (Method: EPA 8015M)
- RCRA 8 Metals (Method: SW 846)
- Volatile Organic Compounds (Method: EPA 8260B)
- Semi-volatile Organic Compounds (Method: GC/MS)
- Chlorinated Herbicides (Method: EPA 8151A)
- Organochlorine Pesticides (Method: EPA 8081A)
- Polychlorinated Biphenyls (Method: EPA 8082)

3.2 Sample Collection

3.2.1 Decision Unit Establishment

The eight neighborhood size decision units were established at the site utilizing a hand held global positioning system (GPS) unit. Latitude and longitude coordinates of the decision unit boundary corners were obtained from the United States Geological Survey (USGS) Topographic Quadrangle mapping program. The hand held GPS unit was used to locate the boundary corners of the decision units in the field and survey flagging was used to mark these corners. The eight decision units were numbered from 1 to 8 from south to north (Figure 3-1).

3.2.2 Multi-Increment Sample Collection

One multi-increment sample was collected from each of the decision units with one decision unit sampled in triplicate. Per the HDOH technical report, each multi-increment sample consisted of 30 to 50 increments of soil. Each increment was collected approximately 6 inches below the ground surface using dedicated plastic scoop(s) and consisted of approximately 50 grams of soil. The increments were placed into Ziploc bags for shipment to the laboratory and the bags were labeled with the project name, sample identification, and the date/time of sample collection. Prior to handling any soil, E2 personnel donned a new pair of disposable nitrile gloves. New plastic scoops were used to collect each multi-increment sample. Sieving of the samples was not conducted in the field, but rather at the laboratory.

Per the HDOH technical report, the increments were collected in a stratified-random manner by sampling up and down adjacent rows. The increments within a decision unit were physically combined into one sample. The adjacent sampling rows were spaced approximately 160 to 175 feet apart to provide coverage across the entire decision unit. The increment sample locations across several rows in each decision unit were recorded using a hand held GPS unit such that the spatial coverage could be verified by mapping the coordinate locations (Figure 3-2). No suspect areas (i.e. dumping sites, waste pits, etc.) were observed during the multi-increment sampling across the decision units.

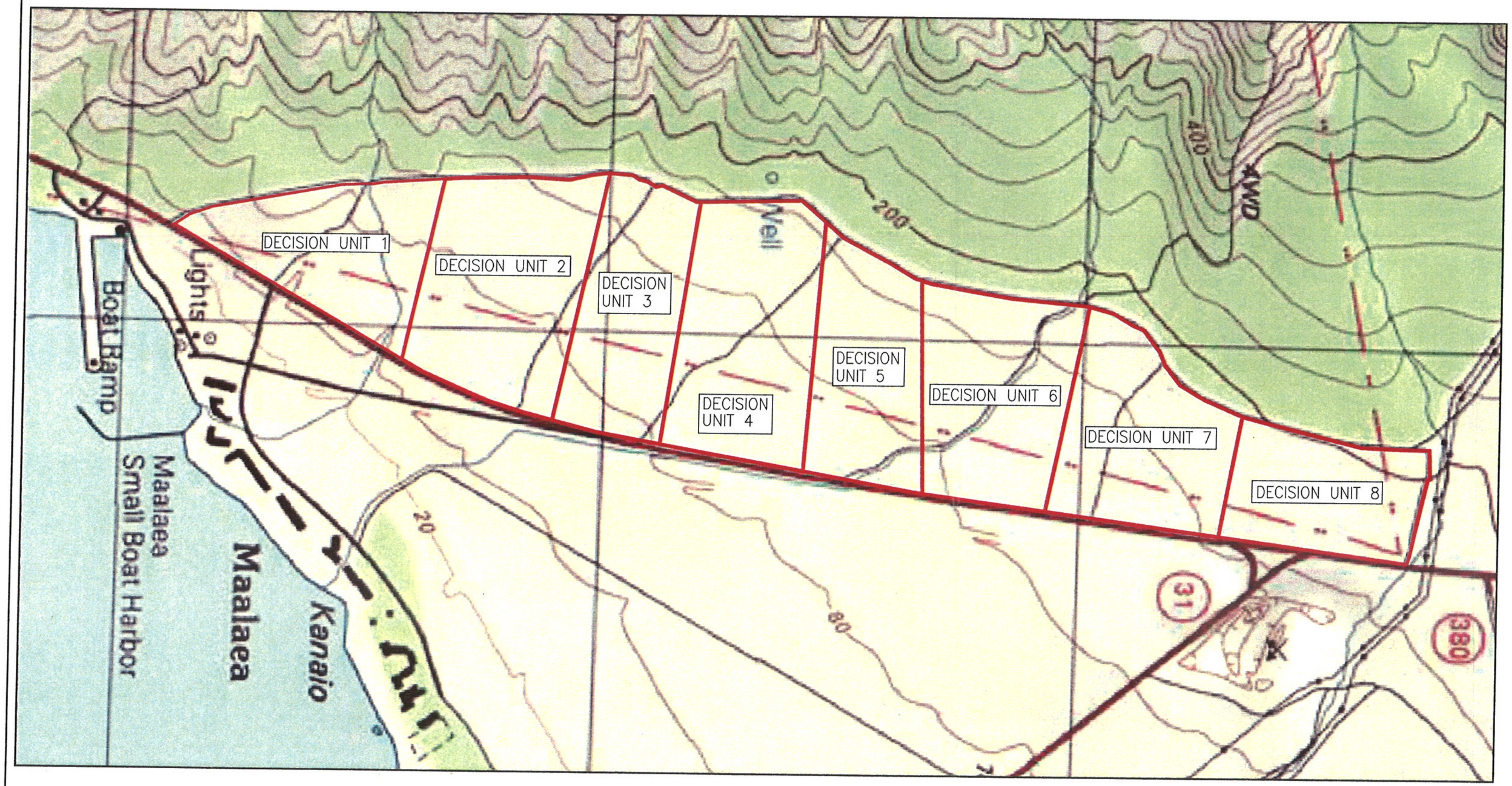
Based on consultation with HEER, discrete sampling for volatile organic compound (VOC) analysis was completed rather than utilizing multi-increment sampling techniques. Discrete VOC samples were collected in the middle of each decision unit at a depth of 18 inches below ground surface (bgs) (Figure 3-2).

A summary of the multi-increment samples collected is presented in Table 3-1 below.

TRUE NORTH
SCALE: 1"=800'

LEGEND:

DECISION UNIT BOUNDARY



800' 0' 800' 1600'

SCALE: 1" = 800'

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PROJECT TITLE:

MAALAEA MAUKA PHASE II ESA SCREENING
MAALAEA, MAUI, HAWAII

FIGURE TITLE:

MAALAEA MAUKA
DECISION UNITS

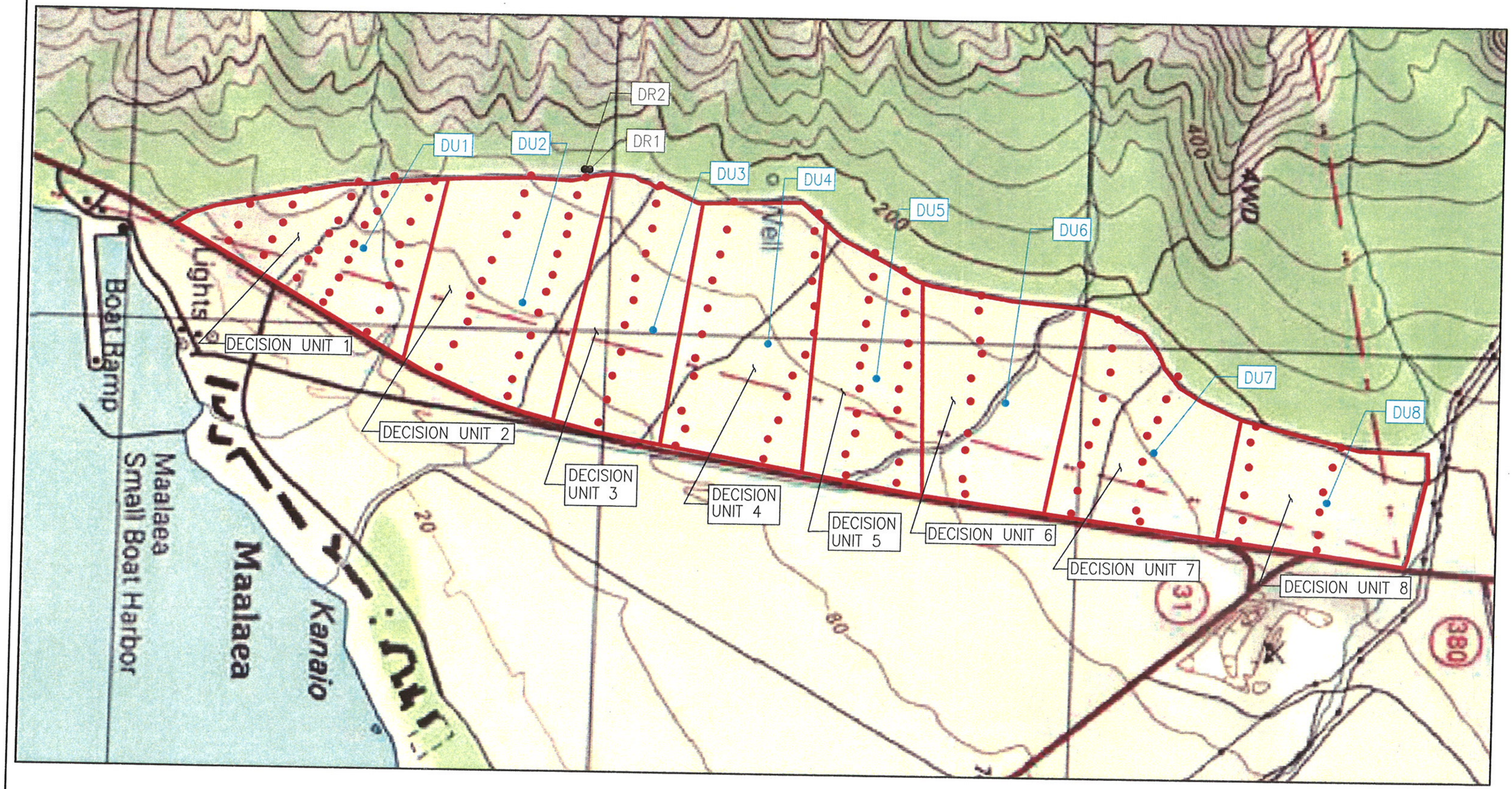
DATE:

AUGUST 10, 2007

FIGURE NO.:

3-1

TRUE NORTH
SCALE: 1"=800'



800' 0' 800' 1600'

SCALE: 1" = 800'

LEGEND:

DECISION UNIT BOUNDARY

GPS SAMPLE LOCATIONS

MULTI–INCREMENTAL GPS SAMPLE LOCATION

DU1 VOC GPS SAMPLE LOCATION

DR1 FORMER DRUM GPS SAMPLE LOCATION

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PROJECT TITLE:
MAALAEA MAUKA PHASE II ESA SCREENING
MAALAEA, MAUI, HAWAII

FIGURE TITLE:
MAALAEA MAUKA
GPS SAMPLE LOCATIONS

DATE: AUGUST 10, 2007

FIGURE NO.: 3-2

Table 3-1
Multi-Increment Sample Summary

Sample Identification	Decision Unit	Number of Increments
DU1	1	34
DU2	2	51
DU3	3	55
DU4	4	57
DU5	5	54
DU6	6	48
DU7	7	49
DU8	8	40
DU9	1	32
DU10	1	31

3.2.3 Discrete Sample Collection

The 14 drums observed during the Phase I ESA had been properly removed from the site by Wailuku Agribusiness prior to commencement of this field investigation. The area where the drums were observed was located by hand held GPS and verified against photos taken during the Phase I ESA (Figure 3-2). Stressed vegetation and staining was not observed in the area. Two surface soil samples were collected from beneath the former drum locations. The two samples were collected using dedicated plastic scoops and placed into pre-cleaned laboratory jars. The samples were collected approximately 6 inches bgs (18 inches for VOC analysis). The sample jars were labeled with the project name, sample identification, and the date/time of sample collection.

3.2.4 Sample Shipment

All soil samples were chilled immediately upon sample collection. The samples were hand delivered to the analytical laboratory, Test America (TA-Honolulu), on Oahu under proper Chain of Custody procedures. TA-Honolulu processed the samples and completed the majority of the analyses. Sub-samples were sent to their sister laboratories, Severn Trent Laboratories (STL) in Seattle and Anatek Labs (AL) in Idaho, for certain analyses (Chlorinated Herbicides and Organochlorine Pesticides at STL and Carbamates and subset Semi-volatile Organic Compounds at AL).

Section 4 Soil Sampling Results

4.1 Data Evaluation Criteria

The primary objective of this Screening Phase II ESA is to determine if residual levels of pesticides and herbicides are present in site surface soils, and if present, whether the levels warrant further characterization and remediation when considering the planned future land use change from agricultural to residential. Therefore, the soil sample analytical results for this Screening Phase II ESA are compared to the current HDOH Environmental Action Levels (EALs) for sites where groundwater is a current or potential source of drinking water and a surface water body is less than 150 meters from the site (HDOH, 2006) and the U.S. Environmental Protection Agency (EPA) Region 9 Residential Preliminary Remediation Goals (PRGs) (EPA, 2004). In addition, arsenic levels are also compared to the soil action levels presented in the HDOH HEER technical report entitled "Soil Action Levels and Categories for Bioaccessible Arsenic" dated August 7, 2006.

4.2 Sample Results

4.2.1 Multi-increment Sample Results

A total of ten multi-increment samples were collected during this investigation: one from Decision Units 2 through 7 and three from Decision Unit 1. The laboratory analytical results are presented in Table 4-1. Some analytical results within the table are reported as "ND", which indicates that a specific analyte was "not detected" at or above the method reporting limits as shown on the laboratory reports. Concentrations detected above the reporting limit are shown in "bold" font. Detected concentrations that are below the HDOH EALs and EPA Region 9 Residential PRGs are highlighted in light blue. Detected concentrations that are above either the HDOH EALs or EPA Region 9 Residential PRGs are highlighted in orange. Several analytes do not have established EALs or PRGs and are identified on the tables by "NS", which indicates that "no standard" has been established. The complete laboratory reports are provided in Appendix B.

The analytical results indicate that VOCs, semi-volatile organic compounds (SVOCs), chlorinated herbicides, organochlorine pesticides, carbamates, and polychlorinated biphenyls (PCBs) were not detected in any of the multi-increment samples. Lead was detected in two of the ten multi-increment samples at concentrations much lower than the HDOH EAL and EPA Region 9 PRG.

Arsenic was detected in all ten multi-increment samples. The range of concentrations detected was 2.82 mg/kg to 3.98 mg/kg. These arsenic levels are below the HDOH EAL of 20 mg/kg, but above the EPA Region 9 Residential PRG of 0.39 mg/kg. Based on the HDOH HEER technical report for bioaccessible arsenic, concentrations of total arsenic less than or equal to 20 mg/kg are within range of natural occurring levels (i.e. background levels) found in soils throughout Hawaii (HDOH, 2006b). According to Table 1 in the HDOH HEER technical report, residential sites with concentrations of arsenic less than or equal to 20 mg/kg do not require further action or restrictions on land use.

Table 4-1
Laboratory Analytical Results
Multi-increment Samples

Analyte	Sample Number																				HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
	DU1		DU2		DU3		DU4		DU5		DU6		DU7		DU8		DU9		DU10			
	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)		
TOTAL METALS (SW 846)																						
Arsenic	3.04	0.962	2.94	0.952	3.98	0.98	3.64	0.98	3.33	0.952	3.58	0.943	3.1	0.971	3.41	0.971	2.82	0.935	2.89	0.943	20	0.39
Lead	ND	1.92	5.19	1.9	1.97	1.96	ND	1.96	ND	1.9	ND	1.89	ND	1.94	ND	1.94	ND	1.87	ND	1.89	200	400
SEMIVOLATILE ORGANICS (GC/MS)																						
1,2,4,5-Tetrachlorobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	18
1,2,4-Trichlorobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	1.6	62
1,2-Dichlorobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	1.1	600
1,3-Dichlorobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	7.4	530
1,4-Dichlorobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.065	34
1-Chloronaphthalene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
1-Naphthylamine	ND	0.617	ND	0.658	ND	0.658	ND	0.641	ND	0.635	ND	0.658	ND	0.637	ND	0.633	ND	0.641	ND	0.633	NS	NS
2,3,4,6-Tetrachlorophenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.4	1,800
2,4,5-Trichlorophenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.18	6,100
2,4,6-Trichlorophenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	1.2	6.1
2,4-Dichlorophenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.3	180
2,4-Dimethylphenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.73	1,200
2,4-Dinitrophenol	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	0.21	120
2,4-Dinitrotoluene	ND	0.617	ND	0.658	ND	0.658	ND	0.641	ND	0.635	ND	0.658	ND	0.637	ND	0.633	ND	0.641	ND	0.633	0.25	NS
2,6-Dichlorophenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.3	NS
2,6-Dinitrotoluene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.42	120
2-Chloronaphthalene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
2-Chlorophenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.012	63
2-Methylnaphthalene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.25	NS
2-Methylphenol (o-Cresol)	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	3,100
2-Naphthylamine	ND	0.617	ND	0.658	ND	0.658	ND	0.641	ND	0.635	ND	0.658	ND	0.637	ND	0.633	ND	0.641	ND	0.633	NS	NS
2-Nitroaniline	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	NS	180
2-Nitrophenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
2-Picoline	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
3,3-Dichlorobenzidine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.04	1.1
3-Methylcholanthrene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
3-Nitroaniline	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	NS	18
4,6-Dinitro-2-methylphenol	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	NS	NS
4-Aminobiphenyl	ND	0.617	ND	0.658	ND	0.658	ND	0.641	ND	0.635	ND	0.658	ND	0.637	ND	0.633	ND	0.641	ND	0.633	NS	NS
4-Bromophenyl phenyl ether	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
4-Chloro-3-methylphenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
4-Chloroaniline	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.053	240
4-Chlorophenyl phenyl ether	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
4-Methylphenol (p-Cresol)	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	310
4-Nitroaniline	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	23
4-Nitrophenol	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	NS	NS
7,12-Dimethylbenz (a) anthracene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
a,a-Dimethylphenethylamine	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	0.035	61
Acenaphthene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	16	NS
Acenaphthylene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	13	NS
Acetophenone	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
Aniline	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	85
Anthracene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	2.8	22,000
Azobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	4.4
Benzidine	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	NS	0.0021
Benzo (a) anthracene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	6.2	NS
Benzo (a) pyrene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.62	0.062
Benzo (b) fluoranthene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	6.2	0.61
Benzo (g,h,i) perylene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	27	NS

Table 4-1
Laboratory Analytical Results
Multi-increment Samples

Analyte	DU1 Sample Result (mg/kg)	DU1 Reporting Limit (mg/kg)	DU2 Sample Result (mg/kg)	DU2 Reporting Limit (mg/kg)	DU3 Sample Result (mg/kg)	DU3 Reporting Limit (mg/kg)	DU4 Sample Result (mg/kg)	DU4 Reporting Limit (mg/kg)	DU5 Sample Result (mg/kg)	DU5 Reporting Limit (mg/kg)	DU6 Sample Result (mg/kg)	DU6 Reporting Limit (mg/kg)	DU7 Sample Result (mg/kg)	DU7 Reporting Limit (mg/kg)	DU8 Sample Result (mg/kg)	DU8 Reporting Limit (mg/kg)	DU9 Sample Result (mg/kg)	DU9 Reporting Limit (mg/kg)	DU10 Sample Result (mg/kg)	DU10 Reporting Limit (mg/kg)	HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
Benzo (k) fluoranthene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	37	6.2
Benzoic acid	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	NS	100,000
Benzyl alcohol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	18,000
Bis(2-chloroethoxy)methane	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
Bis(2-chloroethyl)ether	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.00012	0.22
Bis(2-chloroisopropyl) ether	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.003	2.9
Bis(2-ethylhexyl)phthalate (DEHP)	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	35	35
Butyl benzyl phthalate	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	12,000
Chrysene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	23	62
Dibenz (a,j) acridine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
Dibenzo (a,h) anthtracene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.62	0.062
Dibenzofuran	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	150
Diethylphthalate	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.035	49,000
Dimethylphthalate	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.035	100,000
Dimethylaminoazobenzene	ND	0.617	ND	0.658	ND	0.658	ND	0.641	ND	0.635	ND	0.658	ND	0.637	ND	0.633	ND	0.641	ND	0.633	NS	NS
Di-n-butyl phthalate	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
Di-n-octyl phthalate	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	2,400
Ethyl Methanesulfonate	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
Fluoranthene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	40	2,300
Fluorene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	8.9	2,700
Hexachlorobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.3	0.3
Hexachlorobutadiene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	4.3	6.2
Hexachlorocyclopentadiene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	370
Hexachloroethane	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	16	35
Indeno (1,2,3-cd) pyrene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	6.2	0.62
Isophorone	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.69	510
Methyl Methanesulfonate	ND	0.617	ND	0.658	ND	0.658	ND	0.641	ND	0.635	ND	0.658	ND	0.637	ND	0.633	ND	0.641	ND	0.633	NS	NS
Naphthalene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	1.2	56
Nitrobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.037	20
N-Nitrosodimethylamine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	0.022
N-Nitrosodi-n-butylamine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	0.024
N-Nitrosodi-n-propylamine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	0.069
N-Nitrosodiphenylamine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	99
N-Nitrosopiperidine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
Pentachloronitrobenzene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	1.9
Pentachlorophenol	ND	1.59	ND	1.69	ND	1.69	ND	1.65	ND	1.63	ND	1.69	ND	1.64	ND	1.63	ND	1.65	ND	1.63	3	NS
Phenacetin	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	NS
Phenanthrene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	11	NS
Phenol	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	0.076	18,000
Pronamide	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	4,600
Pyrene	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	85	2,300
Pyridine	ND	0.308	ND	0.329	ND	0.329	ND	0.320	ND	0.317	ND	0.329	ND	0.318	ND	0.316	ND	0.320	ND	0.316	NS	61
CHLORINATED HERBICIDES (EPA 8151A)																						
Dalapon	ND	0.0083	ND	0.0082	ND	0.0082	ND	0.0081	ND	0.0081	ND	0.0082	ND	0.0083	ND	0.0078	ND	0.0083	ND	0.0080	0.091	1,800
4-Nitrophenol	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	NS	NS
Dicamba	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	NS	1,800
MCPP	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	NS	NS
MCPA	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	NS	NS
Dichlorprop	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	NS	NS
2,4-D	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	2.7	690
Pentachlorophenol	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	3.0	3.0
Silvex (2,4,5-TP)	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	0.67	490
2,4,5-T	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	NS	610

Table 4-1
Laboratory Analytical Results
Multi-increment Samples

Analyte	DU1 Sample Result (mg/kg)	DU1 Reporting Limit (mg/kg)	DU2 Sample Result (mg/kg)	DU2 Reporting Limit (mg/kg)	DU3 Sample Result (mg/kg)	DU3 Reporting Limit (mg/kg)	DU4 Sample Result (mg/kg)	DU4 Reporting Limit (mg/kg)	DU5 Sample Result (mg/kg)	DU5 Reporting Limit (mg/kg)	DU6 Sample Result (mg/kg)	DU6 Reporting Limit (mg/kg)	DU7 Sample Result (mg/kg)	DU7 Reporting Limit (mg/kg)	DU8 Sample Result (mg/kg)	DU8 Reporting Limit (mg/kg)	DU9 Sample Result (mg/kg)	DU9 Reporting Limit (mg/kg)	DU10 Sample Result (mg/kg)	DU10 Reporting Limit (mg/kg)	HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
Dinoseb	ND	0.0083	ND	0.0082	ND	0.0082	ND	0.0081	ND	0.0081	ND	0.0082	ND	0.0083	ND	0.0078	ND	0.0083	ND	0.0080	NS	61
2,4-DB	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0033	ND	0.0032	ND	0.0033	ND	0.0033	ND	0.0031	ND	0.0033	ND	0.0032	NS	490
ORGANOCHLORINE PESTICIDES (EPA 8081A)																						
Aldrin	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	0.029	0.029
alpha-BHC	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	NS	0.09
beta-BHC	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	NS	0.32
delta-BHC	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	NS	NS
gamma-BHC (Lindane)	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	0.049	0.44
4,4'-DDD	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	2.4	2.4
4,4'-DDE	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	2.4	1.7
4,4'-DDT	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	1.7	1.7
Dieldrin	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	0.0023	0.03
Endosulfan I	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	0.0046	370
Endosulfan II	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	NS	NS
Endosulfan sulfate	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	NS	NS
Endrin	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	0.00065	18
Endrin aldehyde	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	NS	NS
Heptachlor	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	0.013	0.11
Heptachlor epoxide	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	0.014	0.053
Methoxychlor	ND	0.0065	ND	0.0065	ND	0.0065	ND	0.0065	ND	0.0065	ND	0.0064	ND	0.0067	ND	0.0065	ND	0.0065	ND	0.0066	19	310
Endrin ketone	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	ND	0.0013	NS	NS
Toxaphene	ND	0.065	ND	0.065	ND	0.065	ND	0.065	ND	0.065	ND	0.064	ND	0.067	ND	0.065	ND	0.065	ND	0.066	0.00042	0.44
alpha-Chlordane	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	1.6	1.6
gamma-Chlordane	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00065	ND	0.00064	ND	0.00067	ND	0.00065	ND	0.00065	ND	0.00066	1.6	1.6
POLYCHLORINATED BIPHENYLS (EPA 8082)																						
Aroclor 1016	ND	0.0321	ND	0.0322	ND	0.0315	ND	0.0331	ND	0.0323	ND	0.0326	ND	0.0330	ND	0.0318	ND	0.0310	ND	0.0324	1.1	3.9
Aroclor 1221	ND	0.0641	ND	0.0643	ND	0.0631	ND	0.0662	ND	0.0645	ND	0.0651	ND	0.0660	ND	0.0637	ND	0.0619	ND	0.0647	1.1	NS
Aroclor 1232	ND	0.0321	ND	0.0322	ND	0.0315	ND	0.0331	ND	0.0323	ND	0.0326	ND	0.0330	ND	0.0318	ND	0.0310	ND	0.0324	1.1	NS
Aroclor 1242	ND	0.0321	ND	0.0322	ND	0.0315	ND	0.0331	ND	0.0323	ND	0.0326	ND	0.0330	ND	0.0318	ND	0.0310	ND	0.0324	1.1	NS
Aroclor 1248	ND	0.0321	ND	0.0322	ND	0.0315	ND	0.0331	ND	0.0323	ND	0.0326	ND	0.0330	ND	0.0318	ND	0.0310	ND	0.0324	1.1	NS
Aroclor 1254	ND	0.0321	ND	0.0322	ND	0.0315	ND	0.0331	ND	0.0323	ND	0.0326	ND	0.0330	ND	0.0318	ND	0.0310	ND	0.0324	1.1	0.22
Aroclor 1260	ND	0.0321	ND	0.0322	ND	0.0315	ND	0.0331	ND	0.0323	ND	0.0326	ND	0.0330	ND	0.0318	ND	0.0310	ND	0.0324	1.1	NS
VOLATILE ORGANIC COMPOUNDS (EPA 8260B)																						
1,1,1-Trichloroethane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	7.8	1,200
1,1,2,2-Tetrachloroethane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.00099	0.41
1,1,2-Trichloroethane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.026	0.73
1,1-Dichloroethane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	1.9	510
1,1-Dichloroethylene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	1.2	120
1,2-Dibromo-3-chloropropane (DBCP)	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.0009	0.46
1,2-Dibromoethane (EDB)	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.000052	0.032
1,2-Dichlorobenzene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	1.1	600
1,2-Dichloroethane (EDC)	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.0011	0.28
1,2-Dichloropropane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.021	0.34
1,3-Dichlorobenzene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	7.4	530
1,4-Dichlorobenzene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.065	3.4
Bromodichloromethane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.0034	0.82
Bromoform (tribromomethane)	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	2.2	62
Bromomethane (methyl bromide)	ND	0.0988	ND	0.0977	ND	0.0998	ND	0.100	ND	0.0998	ND	0.0998	ND	0.0992	ND	0.100	NA	-	NA	-	0.34	3.9
Carbon Tetrachloride	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.027	0.25
Chlorobenzene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	1.5	150
Chlorodibromomethane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	NS	340

Table 4-1
Laboratory Analytical Results
Multi-increment Samples

Analyte	DU1 Sample Result (mg/kg)	DU1 Reporting Limit (mg/kg)	DU2 Sample Result (mg/kg)	DU2 Reporting Limit (mg/kg)	DU3 Sample Result (mg/kg)	DU3 Reporting Limit (mg/kg)	DU4 Sample Result (mg/kg)	DU4 Reporting Limit (mg/kg)	DU5 Sample Result (mg/kg)	DU5 Reporting Limit (mg/kg)	DU6 Sample Result (mg/kg)	DU6 Reporting Limit (mg/kg)	DU7 Sample Result (mg/kg)	DU7 Reporting Limit (mg/kg)	DU8 Sample Result (mg/kg)	DU8 Reporting Limit (mg/kg)	DU9 Sample Result (mg/kg)	DU9 Reporting Limit (mg/kg)	DU10 Sample Result (mg/kg)	DU10 Reporting Limit (mg/kg)	HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
Chloroethane	ND	0.0494	ND	0.0488	ND	0.0499	ND	0.0500	ND	0.0499	ND	0.0499	ND	0.0496	ND	0.0501	NA	-	NA	-	0.27	3.0
Chloroform	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.018	0.22
Chloromethane (methyl chloride)	ND	0.0494	ND	0.0488	ND	0.0499	ND	0.0500	ND	0.0499	ND	0.0499	ND	0.0496	ND	0.0501	NA	-	NA	-	16	47
cis-1,2-Dichloroethylene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	2.2	43
cis-1,3-Dichloropropene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	NS	NS
Dichlorodifluoromethane	ND	0.0494	ND	0.0488	ND	0.0499	ND	0.0500	ND	0.0499	ND	0.0499	ND	0.0496	ND	0.0501	NA	-	NA	-	NS	94
Methylene Chloride	ND	0.0494	ND	0.0488	ND	0.0499	ND	0.0500	ND	0.0499	ND	0.0499	ND	0.0496	ND	0.0501	NA	-	NA	-	0.067	9.1
Tetrachloroethylene (PCE)	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.069	0.48
trans-1,2-Dichloroethylene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	6.7	69
1,3-Dichloropropene	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.046	0.78
Trichloroethylene (TCE)	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	0.036	0.053
Trichlorofluoromethane	ND	0.00988	ND	0.00977	ND	0.00998	ND	0.0100	ND	0.00998	ND	0.00998	ND	0.00992	ND	0.0100	NA	-	NA	-	NS	390
Vinyl chloride	ND	0.0494	ND	0.0488	ND	0.0499	ND	0.0500	ND	0.0499	ND	0.0499	ND	0.0496	ND	0.0501	NA	-	NA	-	0.02	0.079
SEMI-VOLATILE ORGANIC COMPOUNDS (EPA 8270C)																						
Ametryne	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	1.1	550
Atrazine	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	0.11	2.2
Diazinon	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	NS	55
Fenamiphos	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	NS	15
Hexazinone	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	120	2,000
Metribuzin	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	NS	1,500
CARBAMATES (EPA 8321A)																						
Diuron	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	1.4	120
Oxamyl	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	NS	1,500

Notes:
ND - Sample not dectected above laboratory reporting limit.
NS - No standard set for analyte.
NA - Sample not analyzed for that analyte.
Detected concentrations below EALs and PRGs are indicated in **bold** and highlighted light blue.
Detected concentrations above either EALs or PRGs are indicated in **bold** and highlighted orange.

4.2.2 Discrete Sample Results

Two discrete surface soil samples were collected from the area where 14 drums were identified in the Phase I ESA. The laboratory analytical results for these two samples are summarized in Table 4-2. The complete laboratory analytical reports are provided in Appendix B.

The analytical results indicate that total petroleum hydrocarbons-gasoline range (TPH-gas); total petroleum hydrocarbons-diesel range (TPH-diesel); benzene, toluene, ethylbenzene, and xylene (BTEX); VOCs; SVOCs; chlorinated herbicides; organochlorine pesticides; and PCBs were not detected in either sample. One sample, Drum-2, did contain total petroleum hydrocarbons-residual range organics (TPH-rro) at a concentration of 21.9 mg/kg, well below the HDOH EAL of 500 mg/kg.

The metals barium, cadmium, chromium, and lead were detected in both samples. Mercury was also detected in sample Drum-2. The detected metal concentrations were all below the HDOH EALs and EPA Region 9 PRGs except for chromium in sample Drum-1. Chromium was detected at a concentration of 240 mg/kg in sample Drum-1, slightly above the EAL and PRG of 210 mg/kg. However, this concentration of chromium represents a human health cancer risk of 1.1×10^{-6}, which is within EPA's acceptable human health cancer risk range of 1×10^{-6} to 1×10^{-4}.

4.2.3 Quality Control Samples

Decision Unit 1 was sampled in triplicate for quality assurance / quality control (QA/QC) purposes. Arsenic was the only analyte detected in these three multi-increment samples. The arsenic concentrations in these three samples, DU1, DU9, and DU10 were 3.04 mg/kg, 2.82 mg/kg, and 2.89 mg/kg, respectively. The relative percent difference (RPD) of these samples ranges from 5 to 7.5 percent. This low RPD range represents a high precision in the field sampling methodology.

Laboratory QA/QC procedures employed for this project were standard laboratory QA/QC procedures which included using standard EPA test methods, and analyzing one or more of the following: method blanks, laboratory control spikes, matrix spikes, matrix spike duplicates, laboratory control samples and sample duplicates. QA/QC results and QA/QC case narratives are included in the attached laboratory reports. According to TA-Honolulu, the laboratory QA/QC analysis met quality assurance objectives with the exceptions noted in the case narratives. Due to logistical issues regarding sample preparation and shipment to the mainland, the organochlorine pesticide analyses were extracted outside of recommended hold times and were flagged as estimated. Considering that organochlorine pesticides are semi-volatile and very persistent in the environment, the organochlorine pesticide sample results are considered useable for screening purposes.

Table 4-2
Laboratory Analytical Results
Discrete Samples from Drum Area

Analyte	Sample Number				HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
	Drum 1		Drum 2			
	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)		
EXTRACTABLE PETROLEUM HYDROCARBONS (EPA 8015M)						
DRO	ND	6.55	ND	6.66	500	NS
RRO	ND	19.7	21.9	20.0	500	NS
GASOLINE RANGE ORGANICS / BTEX (EPA 8015M/8260B)						
GRO	ND	0.495	ND	0.488	100	NS
Benzene	ND	0.00198	ND	0.00195	0.22	0.64
Ethylbenzene	ND	0.00198	ND	0.00195	3.3	400
m,p-xylene	ND	0.00396	ND	0.00391	2.3 (total)	270 (total)
o-Xylene	ND	0.00198	ND	0.00195	2.3 (total)	270 (total)
Toluene	ND	0.00198	ND	0.00195	2.9	520
TOTAL METALS (SW 846)						
Arsenic	ND	4.50	ND	4.55	20	0.39
Barium	107	9.01	95.3	9.09	750	5,400
Cadmium	3.88	1.8	2.26	1.82	12	37
Chromium	240	4.5	171	4.55	210	210
Lead	60.8	9.01	124	9.09	200	400
Mercury	ND	0.0192	0.0511	0.0181	10	23
Selenium	ND	9.01	ND	9.09	10	390
Silver	ND	4.50	ND	4.55	20	390
SEMIVOLATILE ORGANICS (GC/MS)						
1,2,4,5-Tetrachlorobenzene	ND	0.320	ND	0.322	NS	18
1,2,4-Trichlorobenzene	ND	0.320	ND	0.322	1.6	62
1,2-Dichlorobenzene	ND	0.320	ND	0.322	1.1	600
1,3-Dichlorobenzene	ND	0.320	ND	0.322	7.4	530
1,4-Dichlorobenzene	ND	0.320	ND	0.322	0.065	34
1-Chloronaphthalene	ND	0.320	ND	0.322	NS	NS
1-Naphthylamine	ND	0.641	ND	0.645	NS	NS
2,3,4,6-Tetrachlorophenol	ND	0.320	ND	0.322	0.4	1,800
2,4,5-Trichlorophenol	ND	0.320	ND	0.322	0.18	6,100
2,4,6-Trichlorophenol	ND	0.320	ND	0.322	1.2	6.1
2,4-Dichlorophenol	ND	0.320	ND	0.322	0.3	180
2,4-Dimethylphenol	ND	0.320	ND	0.322	0.73	1,200
2,4-Dinitrophenol	ND	1.65	ND	1.66	0.21	120
2,4-Dinitrotoluene	ND	0.641	ND	0.645	0.25	NS
2,6-Dichlorophenol	ND	0.320	ND	0.322	0.3	NS
2,6-Dinitrotoluene	ND	0.320	ND	0.322	0.42	120
2-Chloronaphthalene	ND	0.320	ND	0.322	NS	NS
2-Chlorophenol	ND	0.320	ND	0.322	0.012	63
2-Methylnaphthalene	ND	0.320	ND	0.322	0.25	NS
2-Methylphenol (o-Cresol)	ND	0.320	ND	0.322	NS	3,100
2-Naphthylamine	ND	0.641	ND	0.645	NS	NS
2-Nitroaniline	ND	1.65	ND	1.66	NS	180
2-Nitrophenol	ND	0.320	ND	0.322	NS	NS
2-Picoline	ND	0.320	ND	0.322	NS	NS
3,3-Dichlorobenzidine	ND	0.320	ND	0.322	0.04	1.1
3-Methylcholanthrene	ND	0.320	ND	0.322	NS	NS
3-Nitroaniline	ND	1.65	ND	1.66	NS	18
4,6-Dinitro-2-methylphenol	ND	1.65	ND	1.66	NS	NS
4-Aminobiphenyl	ND	0.641	ND	0.645	NS	NS

Table 4-2
Laboratory Analytical Results
Discrete Samples from Drum Area

Analyte	Drum 1 Sample Result (mg/kg)	Drum 1 Reporting Limit (mg/kg)	Drum 2 Sample Result (mg/kg)	Drum 2 Reporting Limit (mg/kg)	HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
4-Bromophenyl phenyl ether	ND	0.320	ND	0.322	NS	NS
4-Chloro-3-methylphenol	ND	0.320	ND	0.322	NS	NS
4-Chloroaniline	ND	0.320	ND	0.322	0.053	240
4-Chlorophenyl phenyl ether	ND	0.320	ND	0.322	NS	NS
4-Methylphenol (p-Cresol)	ND	0.320	ND	0.322	NS	310
4-Nitroaniline	ND	0.320	ND	0.322	NS	23
4-Nitrophenol	ND	1.65	ND	1.66	NS	NS
7,12-Dimethylbenz (a) anthracene	ND	0.320	ND	0.322	NS	NS
a,a-Dimethylphenethylamine	ND	1.65	ND	1.66	0.035	61
Acenaphthene	ND	0.320	ND	0.322	16	NS
Acenaphthylene	ND	0.320	ND	0.322	13	NS
Acetophenone	ND	0.320	ND	0.322	NS	NS
Aniline	ND	0.320	ND	0.322	NS	85
Anthracene	ND	0.320	ND	0.322	2.8	22,000
Azobenzene	ND	0.320	ND	0.322	NS	4.4
Benzidine	ND	1.65	ND	1.66	NS	0.0021
Benzo (a) anthracene	ND	0.320	ND	0.322	6.2	NS
Benzo (a) pyrene	ND	0.320	ND	0.322	0.62	0.062
Benzo (b) fluoranthene	ND	0.320	ND	0.322	6.2	0.61
Benzo (g,h,i) perylene	ND	0.320	ND	0.322	27	NS
Benzo (k) fluoranthene	ND	0.320	ND	0.322	37	6.2
Benzoic acid	ND	1.65	ND	1.66	NS	100,000
Benzyl alcohol	ND	0.320	ND	0.322	NS	18,000
Bis(2-chloroethoxy)methane	ND	0.320	ND	0.322	NS	NS
Bis(2-chloroethyl)ether	ND	0.320	ND	0.322	0.00012	0.22
Bis(2-chloroisopropyl) ether	ND	0.320	ND	0.322	0.003	2.9
Bis(2-ethylhexyl)phthalate (DEHP)	ND	0.320	ND	0.322	35	35
Butyl benzyl phthalate	ND	0.320	ND	0.322	NS	12,000
Chrysene	ND	0.320	ND	0.322	23	62
Dibenz (a,j) acridine	ND	0.320	ND	0.322	NS	NS
Dibenzo (a,h) anthtracene	ND	0.320	ND	0.322	0.62	0.062
Dibenzofuran	ND	0.320	ND	0.322	NS	150
Diethylphthalate	ND	0.320	ND	0.322	0.035	49,000
Dimethylphthalate	ND	0.320	ND	0.322	0.035	100,000
Dimethylaminoazobenzene	ND	0.641	ND	0.645	NS	NS
Di-n-butyl phthalate	ND	0.320	ND	0.322	NS	NS
Di-n-octyl phthalate	ND	0.320	ND	0.322	NS	2,400
Ethyl Methanesulfonate	ND	0.320	ND	0.322	NS	NS
Fluoranthene	ND	0.320	ND	0.322	40	2,300
Fluorene	ND	0.320	ND	0.322	8.9	2,700
Hexachlorobenzene	ND	0.320	ND	0.322	0.3	0.3
Hexachlorobutadiene	ND	0.320	ND	0.322	4.3	6.2
Hexachlorocyclopentadiene	ND	0.320	ND	0.322	NS	370
Hexachloroethane	ND	0.320	ND	0.322	16	35
Indeno (1,2,3-cd) pyrene	ND	0.320	ND	0.322	6.2	0.62
Isophorone	ND	0.320	ND	0.322	0.69	510
Methyl Methanesulfonate	ND	0.641	ND	0.645	NS	NS
Naphthalene	ND	0.320	ND	0.322	1.2	56
Nitrobenzene	ND	0.320	ND	0.322	0.037	20
N-Nitrosodimethylamine	ND	0.320	ND	0.322	NS	0.022
N-Nitrosodi-n-butylamine	ND	0.320	ND	0.322	NS	0.024
N-Nitrosodi-n-propylamine	ND	0.320	ND	0.322	NS	0.069

Table 4-2
Laboratory Analytical Results
Discrete Samples from Drum Area

Analyte	Drum 1 Sample Result (mg/kg)	Drum 1 Reporting Limit (mg/kg)	Drum 2 Sample Result (mg/kg)	Drum 2 Reporting Limit (mg/kg)	HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
N-Nitrosodiphenylamine	ND	0.320	ND	0.322	NS	99
N-Nitrosopiperidine	ND	0.320	ND	0.322	NS	NS
Pentachloronitrobenzene	ND	0.320	ND	0.322	NS	1.9
Pentachlorophenol	ND	1.65	ND	1.66	3	NS
Phenacetin	ND	0.320	ND	0.322	NS	NS
Phenanthrene	ND	0.320	ND	0.322	11	NS
Phenol	ND	0.320	ND	0.322	0.076	18,000
Pronamide	ND	0.320	ND	0.322	NS	4,600
Pyrene	ND	0.320	ND	0.322	85	2,300
Pyridine	ND	0.320	ND	0.322	NS	61
CHLORINATED HERBICIDES (EPA 8151A)						
Dalapon	ND	0.0083	ND	0.0083	0.091	1,800
4-Nitrophenol	ND	0.0033	ND	0.0033	NS	NS
Dicamba	ND	0.0033	ND	0.0033	NS	1,800
MCPP	ND	0.0033	ND	0.0033	NS	NS
MCPA	ND	0.0033	ND	0.0033	NS	NS
Dichlorprop	ND	0.0033	ND	0.0033	NS	NS
2,4-D	ND	0.0033	ND	0.0033	2.7	690
Pentachlorophenol	ND	0.0033	ND	0.0033	3.0	3.0
Silvex (2,4,5-TP)	ND	0.0033	ND	0.0033	0.67	490
2,4,5-T	ND	0.0033	ND	0.0033	NS	610
Dinoseb	ND	0.0083	ND	0.0083	NS	61
2,4-DB	ND	0.0033	ND	0.0033	NS	490
ORGANOCHLORINE PESTICIDES (EPA 8081A)						
Aldrin	ND	0.00066	ND	0.00064	0.029	0.029
alpha-BHC	ND	0.00066	ND	0.00064	NS	0.09
beta-BHC	ND	0.00066	ND	0.00064	NS	0.32
delta-BHC	ND	0.00066	ND	0.00064	NS	NS
gamma-BHC (Lindane)	ND	0.00066	ND	0.00064	0.049	0.44
4,4'-DDD	ND	0.0013	ND	0.0013	2.4	2.4
4,4'-DDE	ND	0.0013	ND	0.0013	2.4	1.7
4,4'-DDT	ND	0.0013	ND	0.0013	1.7	1.7
Dieldrin	ND	0.0013	ND	0.0013	0.0023	0.03
Endosulfan I	ND	0.00066	ND	0.00064	0.0046	370
Endosulfan II	ND	0.0013	ND	0.0013	NS	NS
Endosulfan sulfate	ND	0.0013	ND	0.0013	NS	NS
Endrin	ND	0.0013	ND	0.0013	0.00065	18
Endrin aldehyde	ND	0.0013	ND	0.0013	NS	NS
Heptachlor	ND	0.00066	ND	0.00064	0.013	0.11
Heptachlor epoxide	ND	0.00066	ND	0.00064	0.014	0.053
Methoxychlor	ND	0.0066	ND	0.0064	19	310
Endrin ketone	ND	0.0013	ND	0.0013	NS	NS
Toxaphene	ND	0.066	ND	0.064	0.00042	0.44
alpha-Chlordane	ND	0.00066	ND	0.00064	1.6	1.6
gamma-Chlordane	ND	0.00066	ND	0.00064	1.6	1.6

Table 4-2
Laboratory Analytical Results
Discrete Samples from Drum Area

Analyte	Sample Number				HDOH Residential EAL (mg/kg)	EPA Region 9 Residential PRG (mg/kg)
	Drum 1		Drum 2			
	Sample Result (mg/kg)	Reporting Limit (mg/kg)	Sample Result (mg/kg)	Reporting Limit (mg/kg)		
POLYCHLORINATED BIPHENYLS (EPA 8082)						
Aroclor 1016	ND	0.0330	ND	0.0333	1.1	3.9
Aroclor 1221	ND	0.0660	ND	0.0667	1.1	NS
Aroclor 1232	ND	0.0330	ND	0.0333	1.1	NS
Aroclor 1242	ND	0.0330	ND	0.0333	1.1	NS
Aroclor 1248	ND	0.0330	ND	0.0333	1.1	NS
Aroclor 1254	ND	0.0330	ND	0.0333	1.1	0.22
Aroclor 1260	ND	0.0330	ND	0.0333	1.1	NS
VOLATILE ORGANIC COMPOUNDS (EPA 8260B)						
1,1,1-Trichloroethane	ND	0.00990	ND	0.00977	7.8	1,200
1,1,2,2-Tetrachloroethane	ND	0.00990	ND	0.00977	0.00099	0.41
1,1,2-Trichloroethane	ND	0.00990	ND	0.00977	0.026	0.73
1,1-Dichloroethane	ND	0.00990	ND	0.00977	1.9	510
1,1-Dichloroethylene	ND	0.00990	ND	0.00977	1.2	120
1,2-Dibromo-3-chloropropane (DBCP)	ND	0.00990	ND	0.00977	0.0009	0.46
1,2-Dibromoethane (EDB)	ND	0.00990	ND	0.00977	0.000052	0.032
1,2-Dichlorobenzene	ND	0.00990	ND	0.00977	1.1	600
1,2-Dichloroethane (EDC)	ND	0.00990	ND	0.00977	0.0011	0.28
1,2-Dichloropropane	ND	0.00990	ND	0.00977	0.021	0.34
1,3-Dichlorobenzene	ND	0.00990	ND	0.00977	7.4	530
1,4-Dichlorobenzene	ND	0.00990	ND	0.00977	0.065	3.4
Bromodichloromethane	ND	0.00990	ND	0.00977	0.0034	0.82
Bromoform (tribromomethane)	ND	0.00990	ND	0.00977	2.2	62
Bromomethane (methyl bromide)	ND	0.0990	ND	0.0977	0.34	3.9
Carbon Tetrachloride	ND	0.00990	ND	0.00977	0.027	0.25
Chlorobenzene	ND	0.00990	ND	0.00977	1.5	150
Chlorodibromomethane	ND	0.00990	ND	0.00977	NS	340
Chloroethane	ND	0.0495	ND	0.0488	0.27	3.0
Chloroform	ND	0.00990	ND	0.00977	0.018	0.22
Chloromethane (methyl chloride)	ND	0.0495	ND	0.0488	16	47
cis-1,2-Dichloroethylene	ND	0.00990	ND	0.00977	2.2	43
cis-1,3-Dichloropropene	ND	0.00990	ND	0.00977	NS	NS
Dichlorodifluoromethane	ND	0.0495	ND	0.0488	NS	94
Methylene Chloride	ND	0.0495	ND	0.0488	0.067	9.1
Tetrachloroethylene (PCE)	ND	0.00990	ND	0.00977	0.069	0.48
trans-1,2-Dichloroethylene	ND	0.00990	ND	0.00977	6.7	69
1,3-Dichloropropene	ND	0.00990	ND	0.00977	0.046	0.78
Trichloroethylene (TCE)	ND	0.00990	ND	0.00977	0.036	0.053
Trichlorofluoromethane	ND	0.00990	ND	0.00977	NS	390
Vinyl chloride	ND	0.0495	ND	0.0488	0.02	0.079

Notes:
ND - Sample not dectected above laboratory reporting limit.
NS - No standard set for analyte.
NA - Sample not analyzed for that analyte.
Detected concentrations below EALs and PRGs are indicated in **bold** and highlighted light blue.
Detected concentrations above either EALs or PRGs are indicated in **bold** and highlighted orange.

Section 5 Summary of Findings

E2 completed a Screening Phase II ESA of the Maalaea Mauka property identified as TMK: (2) 3-6-001: parcel 018 located in Maui, Hawaii. The purpose of this Screening Phase II ESA was to evaluate if residual levels of pesticides and herbicides resulting from historic agricultural use at the site are present in surface soils. In addition, an area where fourteen 55-gallon unmarked drums were identified in the Phase I ESA was investigated to determine if a release from the drums had occurred.

Per the HDOH HEER technical report for investigation and assessment of former agricultural lands, the screening was completed on "neighborhood-size" decision units utilizing a multi-increment sampling approach. The 260-acre site was divided into eight decision units approximately 32.5 acres in size with one multi-increment surface soil sample collected from each unit. The multi-increment samples were analyzed for pesticide and herbicide constituents that may have been applied to the property.

The results of the multi-increment sampling analyses indicate that residual pesticides and herbicides are not present at significant levels in the surface soils at the site. Arsenic was detected in all of the multi-increment samples. The levels detected were within range of natural occurring levels (i.e. background levels) found in soils throughout Hawaii. According to HDOH guidance, residential sites that contain arsenic within background levels do not require further action or restrictions on land use.

Two discrete samples were also collected from beneath the area where fourteen 55-gallon drums were observed during the Phase I ESA. The two samples were analyzed for a full suite of analytes to determine if a significant release had occurred in the area. The analytical results did not indicate that a significant release had occurred from the drums. One of the two samples contained a low level of TPH-rro. The level detected was well below the HDOH EAL. The majority of the remaining analytes were not detected with the exception of metals, which were detected below the HDOH EALs and EPA Region 9 PRGs or within naturally occurring background levels. Based on these sample results and the fact that the drums were removed and disposed, no further action is recommended for the drum area at this time.

Section 6 References

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Mink, J. F. and Lau, S., 1990. *Aquifer Identification and Classification for Maui Groundwater Protection Strategy for Hawaii.* Water Resources Research Center, University of Hawaii, Technical Report 185, February 1990.

WAILUKU WATER CO.

Na Wai Eha

November 1, 2006

To: Avery Chumbley
From: Clayton Suzuki

Subject: Waikapu to Maalaea Fields

The following chemicals may have been used during the cultivation of sugarcane in the Waikapu to Maalaea Fields.

Active Ingredient:	Brand Name:
Atrazine	Aatrex Nine-O
Ametryn	Evik 80W
2, 4-D	Formula 40
Diuron	Karmex DF
Glyphosate	Roundup
Metribuzin	Sinbar
Hexazinone	Velpar
Glyphosate	Polado

The following fertilizers were used in the cultivation of sugarcane.

Nitrogen
Potassium
Phosphorus
Calcium carbonate

The following chemicals may have been used during the cultivation of pineapple in the Waikapu to Maalaea fields.

Aliette	Ethrel
Amdro	Evik
Diazinon	Hyvar X
Karmex (Diuron)	Velpar DF
Roundup (non crop area)	Atrazine
Fruitone	Nemcur 3

The following fertilizers were used in the cultivation of pineapple.

Nitrogen	Sulfate of Potash
Iron Sulfate	Magnesium Sulfate
Zinc Sulfate	Sulfate of Amonia
Phosic Acid	

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August 08, 2007

LABORATORY REPORT

Client:
Element Environmental LLC
62-180 Emerson Rd.
Haleiwa, HI 96712
Attn: Matt Neal

Work Order: HQG0016
Project Name: Maalea
Project Number: Maalaea Phase II ESA
Date Received: 07/02/07

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica.

Reproduction of this analytical report is permitted only in its entirety. This report shall not be reproduced except in full without the written approval of the laboratory.

TestAmerica Analytical Testing Corporation certifies that the analytical results contained herein apply only to the specific sample(s) analyzed.

The Chain(s) of Custody, 2 pages, are included and are an integral part of this report. This entire report was reviewed and approved for release.

If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-(808)486-5227

CASE NARRATIVE:
This report has been revised to include BTEX for sample IDs Drum 1 and Drum 2.

Client Samples IDs DU1 through DU10 contained in this report were prepared by incremental subsampling in accordance with the EPA/600/R-03/027 Guidance Document.

8270C (Modified) and 8321A analyses were performed by Anatek Labs, Inc. Please find Anatek Labs, Inc. report attached.

8081A and 8151A analyses were performed by STL-Seattle. Please find STL-Seattle report attached.

Samples were received into laboratory at a temperature of 0 °C.

NELAC states that samples which require thermal preservation shall be considered acceptable if the arrival temperature is within 2 degrees C of the required temperature or the method specified range. For samples with a temperature requirement of 4 degrees C, an arrival temperature from 0 degrees C to 6 degrees C meets specifications. Samples that are delivered to the laboratory on the same day that they are collected may not meet these criteria. In these cases, the samples are considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

The reported results were obtained in compliance with the 2003 NELAC standards unless otherwise noted.

Approved By:

Jamie L Slade
Project Manager

NELAC Certification # E87907

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Element Environmental LLC
62-180 Emerson Rd.
Haleiwa, HI 96712
Matt Neal

Work Order: HQG0016
Project: Maalea
Project Number: Maalaea Phase II ESA

Received: 07/02/07
Reported: 08/08/07 09:34

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
DU1	HQG0016-01	06/29/07 16:45
DU2	HQG0016-02	06/28/07 13:30
DU3	HQG0016-03	06/28/07 15:51
DU4	HQG0016-04	06/28/07 16:30
DU5	HQG0016-05	06/28/07 16:50
DU6	HQG0016-06	06/29/07 10:10
DU7	HQG0016-07	06/29/07 11:10
DU8	HQG0016-08	06/29/07 12:10
DU9	HQG0016-09	06/29/07 14:10
DU10	HQG0016-10	06/29/07 15:10
DU1-VOC	HQG0016-11	06/29/07 16:30
DU2-VOC	HQG0016-12	06/29/07 15:55
DU3-VOC	HQG0016-13	06/29/07 15:23
DU4-VOC	HQG0016-14	06/29/07 14:53
DU5-VOC	HQG0016-15	06/29/07 14:26
DU6-VOC	HQG0016-16	06/29/07 13:53
DU7-VOC	HQG0016-17	06/29/07 13:25
DU8-VOC	HQG0016-18	06/29/07 12:33
Drum1	HQG0016-19	06/29/07 19:07
Drum2	HQG0016-20	06/29/07 19:07

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-01 (DU1 - Solid/Soil)						Sampled: 06/29/07 16:45		Recvd: 07/02/07 12:35	
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0321	1	07/07/07 02:22	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	-	0.0641	-	-	-	-	-
Aroclor 1232	ND	C-01	-	0.0321	-	-	-	-	-
Aroclor 1242	ND	C-01	-	0.0321	-	-	-	-	-
Aroclor 1248	ND	C-01	-	0.0321	-	-	-	-	-
Aroclor 1254	ND	C-01	-	0.0321	-	-	-	-	-
Aroclor 1260	ND	C-01	-	0.0321	-	-	-	-	-
Surr: Decachlorobiphenyl (24-154%)	*110 %*	*C-01*				-	-	-	-
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.308	1	07/27/07 01:00	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		-	0.308	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.308	-	-	-	-	-
1,3-Dichlorobenzene	ND		-	0.308	-	-	-	-	-
1,4-Dichlorobenzene	ND		-	0.308	-	-	-	-	-
1-Chloronaphthalene	ND		-	0.308	-	-	-	-	-
1-Naphthylamine	ND		-	0.617	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	ND		-	0.308	-	-	-	-	-
2,4,5-Trichlorophenol	ND		-	0.308	-	-	-	-	-
2,4,6-Trichlorophenol	ND		-	0.308	-	-	-	-	-
2,4-Dichlorophenol	ND		-	0.308	-	-	-	-	-
2,4-Dimethylphenol	ND		-	0.308	-	-	-	-	-
2,4-Dinitrophenol	ND		-	1.59	-	-	-	-	-
2,4-Dinitrotoluene	ND		-	0.617	-	-	-	-	-
2,6-Dichlorophenol	ND		-	0.308	-	-	-	-	-
2,6-Dinitrotoluene	ND		-	0.308	-	-	-	-	-
2-Chloronaphthalene	ND		-	0.308	-	-	-	-	-
2-Chlorophenol	ND		-	0.308	-	-	-	-	-
2-Methylnaphthalene	ND		-	0.308	-	-	-	-	-
2-Methylphenol (o-Cresol)	ND		-	0.308	-	-	-	-	-
2-Naphthylamine	ND		-	0.617	-	-	-	-	-
2-Nitroaniline	ND		-	1.59	-	-	-	-	-
2-Nitrophenol	ND		-	0.308	-	-	-	-	-
2-Picoline	ND		-	0.308	-	-	-	-	-
3,3'-Dichlorobenzidine	ND		-	0.308	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.308	-	-	-	-	-
3-Nitroaniline	ND		-	1.59	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.59	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.617	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.308	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.308	-	-	-	-	-
4-Chloroaniline	ND		-	0.308	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.308	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.308	-	-	-	-	-
4-Nitroaniline	ND		-	0.308	-	-	-	-	-
4-Nitrophenol	ND		-	1.59	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.308	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.59	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-01 (DU1 - Solid/Soil) - cont.						Sampled: 06/29/07 16:45		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
Acenaphthene	ND		-	0.308	-	-	-	-	-
Acenaphthylene	ND		-	0.308	-	-	-	-	-
Acetophenone	ND		-	0.308	-	-	-	-	-
Aniline	ND		-	0.308	-	-	-	-	-
Anthracene	ND		-	0.308	-	-	-	-	-
Azobenzene	ND		-	0.308	-	-	-	-	-
Benzidine	ND		-	1.59	-	-	-	-	-
Benzo (a) anthracene	ND		-	0.308	-	-	-	-	-
Benzo (a) pyrene	ND		-	0.308	-	-	-	-	-
Benzo (b) fluoranthene	ND		-	0.308	-	-	-	-	-
Benzo (g,h,i) perylene	ND		-	0.308	-	-	-	-	-
Benzo (k) fluoranthene	ND		-	0.308	-	-	-	-	-
Benzoic acid	ND		-	1.59	-	-	-	-	-
Benzyl alcohol	ND		-	0.308	-	-	-	-	-
Bis(2-chloroethoxy)methane	ND		-	0.308	-	-	-	-	-
Bis(2-chloroethyl)ether	ND		-	0.308	-	-	-	-	-
Bis(2-chloroisopropyl) ether	ND		-	0.308	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	ND		-	0.308	-	-	-	-	-
Butyl benzyl phthalate	ND		-	0.308	-	-	-	-	-
Chrysene	ND		-	0.308	-	-	-	-	-
Dibenz (a,j) acridine	ND		-	0.308	-	-	-	-	-
Dibenzo (a,h) anthracene	ND		-	0.308	-	-	-	-	-
Dibenzofuran	ND		-	0.308	-	-	-	-	-
Diethyl phthalate	ND		-	0.308	-	-	-	-	-
Dimethyl phthalate	ND		-	0.308	-	-	-	-	-
Dimethylaminoazobenzene	ND		-	0.617	-	-	-	-	-
Di-n-butyl phthalate	ND		-	0.308	-	-	-	-	-
Di-n-octyl phthalate	ND		-	0.308	-	-	-	-	-
Ethyl Methanesulfonate	ND		-	0.308	-	-	-	-	-
Fluoranthene	ND		-	0.308	-	-	-	-	-
Fluorene	ND		-	0.308	-	-	-	-	-
Hexachlorobenzene	ND		-	0.308	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.308	-	-	-	-	-
Hexachlorocyclopentadiene	ND		-	0.308	-	-	-	-	-
Hexachloroethane	ND		-	0.308	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.308	-	-	-	-	-
Isophorone	ND		-	0.308	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.617	-	-	-	-	-
Naphthalene	ND		-	0.308	-	-	-	-	-
Nitrobenzene	ND		-	0.308	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.308	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.308	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.308	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.308	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.308	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.308	-	-	-	-	-
Pentachlorophenol	ND		-	1.59	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-01 (DU1 - Solid/Soil) - cont.					Sampled: 06/29/07 16:45		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Phenacetin	ND		-	0.308	-	-	-	-	-
Phenanthrene	ND		-	0.308	-	-	-	-	-
Phenol	ND		-	0.308	-	-	-	-	-
Pronamide	ND		-	0.308	-	-	-	-	-
Pyrene	ND		-	0.308	-	-	-	-	-
Pyridine	ND		-	0.308	-	-	-	-	-
Surr: 2,4,6-Tribromophenol (52.6-114%)	*66 %*					-	-	-	-
Surr: 2-Fluorobiphenyl (45.9-108%)	*65 %*					-	-	-	-
Surr: 2-Fluorophenol (39.4-103%)	*44 %*					-	-	-	-
Surr: Nitrobenzene-d5 (37.2-107%)	*60 %*					-	-	-	-
Surr: Phenol-d6 (49.6-105%)	*47 %*	Z				-	-	-	-
Surr: Terphenyl-d14 (45.7-133%)	*85 %*					-	-	-	-
Total Metals by SW 846 Series Methods									
Arsenic	3.04		mg/kg	0.962	1	07/20/07 12:54	07/10/07	7G10005	SW6010B
Lead	ND		-	1.92	-	-	-	-	-
Sample ID: HQG0016-02 (DU2 - Solid/Soil)					Sampled: 06/28/07 13:30		Recvd: 07/02/07 12:35		
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0322	1	07/07/07 02:49	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	-	0.0643	-	-	-	-	-
Aroclor 1232	ND	C-01	-	0.0322	-	-	-	-	-
Aroclor 1242	ND	C-01	-	0.0322	-	-	-	-	-
Aroclor 1248	ND	C-01	-	0.0322	-	-	-	-	-
Aroclor 1254	ND	C-01	-	0.0322	-	-	-	-	-
Aroclor 1260	ND	C-01	-	0.0322	-	-	-	-	-
Surr: Decachlorobiphenyl (24-154%)	*106 %*	*C-01*				-	-	-	-
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.329	1	07/27/07 01:47	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		-	0.329	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.329	-	-	-	-	-
1,3-Dichlorobenzene	ND		-	0.329	-	-	-	-	-
1,4-Dichlorobenzene	ND		-	0.329	-	-	-	-	-
1-Chloronaphthalene	ND		-	0.329	-	-	-	-	-
1-Naphthylamine	ND		-	0.658	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	ND		-	0.329	-	-	-	-	-
2,4,5-Trichlorophenol	ND		-	0.329	-	-	-	-	-
2,4,6-Trichlorophenol	ND		-	0.329	-	-	-	-	-
2,4-Dichlorophenol	ND		-	0.329	-	-	-	-	-
2,4-Dimethylphenol	ND		-	0.329	-	-	-	-	-
2,4-Dinitrophenol	ND		-	1.69	-	-	-	-	-
2,4-Dinitrotoluene	ND		-	0.658	-	-	-	-	-
2,6-Dichlorophenol	ND		-	0.329	-	-	-	-	-
2,6-Dinitrotoluene	ND		-	0.329	-	-	-	-	-
2-Chloronaphthalene	ND		-	0.329	-	-	-	-	-
2-Chlorophenol	ND		-	0.329	-	-	-	-	-
2-Methylnaphthalene	ND		-	0.329	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-02 (DU2 - Solid/Soil) - cont.					Sampled: 06/28/07 13:30		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
2-Methylphenol (o-Cresol)	ND		-	0.329	-	-	-	-	-
2-Naphthylamine	ND		-	0.658	-	-	-	-	-
2-Nitroaniline	ND		-	1.69	-	-	-	-	-
2-Nitrophenol	ND		-	0.329	-	-	-	-	-
2-Picoline	ND		-	0.329	-	-	-	-	-
3,3'-Dichlorobenzidine	ND		-	0.329	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.329	-	-	-	-	-
3-Nitroaniline	ND		-	1.69	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.69	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.658	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.329	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.329	-	-	-	-	-
4-Chloroaniline	ND		-	0.329	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.329	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.329	-	-	-	-	-
4-Nitroaniline	ND		-	0.329	-	-	-	-	-
4-Nitrophenol	ND		-	1.69	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.329	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.69	-	-	-	-	-
Acenaphthene	ND		-	0.329	-	-	-	-	-
Acenaphthylene	ND		-	0.329	-	-	-	-	-
Acetophenone	ND		-	0.329	-	-	-	-	-
Aniline	ND		-	0.329	-	-	-	-	-
Anthracene	ND		-	0.329	-	-	-	-	-
Azobenzene	ND		-	0.329	-	-	-	-	-
Benzidine	ND		-	1.69	-	-	-	-	-
Benzo (a) anthracene	ND		-	0.329	-	-	-	-	-
Benzo (a) pyrene	ND		-	0.329	-	-	-	-	-
Benzo (b) fluoranthene	ND		-	0.329	-	-	-	-	-
Benzo (g,h,i) perylene	ND		-	0.329	-	-	-	-	-
Benzo (k) fluoranthene	ND		-	0.329	-	-	-	-	-
Benzoic acid	ND		-	1.69	-	-	-	-	-
Benzyl alcohol	ND		-	0.329	-	-	-	-	-
Bis(2-chloroethoxy)methane	ND		-	0.329	-	-	-	-	-
Bis(2-chloroethyl)ether	ND		-	0.329	-	-	-	-	-
Bis(2-chloroisopropyl) ether	ND		-	0.329	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	ND		-	0.329	-	-	-	-	-
Butyl benzyl phthalate	ND		-	0.329	-	-	-	-	-
Chrysene	ND		-	0.329	-	-	-	-	-
Dibenz (a,j) acridine	ND		-	0.329	-	-	-	-	-
Dibenzo (a,h) anthracene	ND		-	0.329	-	-	-	-	-
Dibenzofuran	ND		-	0.329	-	-	-	-	-
Diethyl phthalate	ND		-	0.329	-	-	-	-	-
Dimethyl phthalate	ND		-	0.329	-	-	-	-	-
Dimethylaminoazobenzene	ND		-	0.658	-	-	-	-	-
Di-n-butyl phthalate	ND		-	0.329	-	-	-	-	-
Di-n-octyl phthalate	ND		-	0.329	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order:	HQG0016	Received:	07/02/07
	Project:	Maalea	Reported:	08/08/07 09:34
	Project Number:	Maalaea Phase II ESA		

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-02 (DU2 - Solid/Soil) - cont.					Sampled: 06/28/07 13:30		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Ethyl Methanesulfonate	ND		-	0.329	-	-	-	-	-
Fluoranthene	ND		-	0.329	-	-	-	-	-
Fluorene	ND		-	0.329	-	-	-	-	-
Hexachlorobenzene	ND		-	0.329	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.329	-	-	-	-	-
Hexachlorocyclopentadiene	ND		-	0.329	-	-	-	-	-
Hexachloroethane	ND		-	0.329	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.329	-	-	-	-	-
Isophorone	ND		-	0.329	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.658	-	-	-	-	-
Naphthalene	ND		-	0.329	-	-	-	-	-
Nitrobenzene	ND		-	0.329	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.329	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.329	-	-	-	-	-
Pentachlorophenol	ND		-	1.69	-	-	-	-	-
Phenacetin	ND		-	0.329	-	-	-	-	-
Phenanthrene	ND		-	0.329	-	-	-	-	-
Phenol	ND		-	0.329	-	-	-	-	-
Pronamide	ND		-	0.329	-	-	-	-	-
Pyrene	ND		-	0.329	-	-	-	-	-
Pyridine	ND		-	0.329	-	-	-	-	-
Surr: 2,4,6-Tribromophenol (52.6-114%)	*74 %*					-	-	-	-
Surr: 2-Fluorobiphenyl (45.9-108%)	*74 %*					-	-	-	-
Surr: 2-Fluorophenol (39.4-103%)	*56 %*					-	-	-	-
Surr: Nitrobenzene-d5 (37.2-107%)	*71 %*					-	-	-	-
Surr: Phenol-d6 (49.6-105%)	*55 %*					-	-	-	-
Surr: Terphenyl-d14 (45.7-133%)	*92 %*					-	-	-	-
Total Metals by SW 846 Series Methods									
Arsenic	1.94		mg/kg	0.952	1	07/20/07 12:58	07/10/07	7G10005	SW6010B
Lead	5.19		-	1.90	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order:	HQG0016	Received:	07/02/07
	Project:	Maalea	Reported:	08/08/07 09:34
	Project Number:	Maalaea Phase II ESA		

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-03 (DU3 - Solid/Soil)					Sampled: 06/28/07 15:51		Recvd: 07/02/07 12:35		
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0315	1	07/07/07 03:17	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	-	0.0631	-	-	-	-	-
Aroclor 1232	ND	C-01	-	0.0315	-	-	-	-	-
Aroclor 1242	ND	C-01	-	0.0315	-	-	-	-	-
Aroclor 1248	ND	C-01	-	0.0315	-	-	-	-	-
Aroclor 1254	ND	C-01	-	0.0315	-	-	-	-	-
Aroclor 1260	ND	C-01	-	0.0315	-	-	-	-	-
Surr: Decachlorobiphenyl (24-154%)	*111 %*	*C-01*				-	-	-	-
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.329	1	07/27/07 02:33	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		-	0.329	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.329	-	-	-	-	-
1,3-Dichlorobenzene	ND		-	0.329	-	-	-	-	-
1,4-Dichlorobenzene	ND		-	0.329	-	-	-	-	-
1-Chloronaphthalene	ND		-	0.329	-	-	-	-	-
1-Naphthylamine	ND		-	0.658	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	ND		-	0.329	-	-	-	-	-
2,4,5-Trichlorophenol	ND		-	0.329	-	-	-	-	-
2,4,6-Trichlorophenol	ND		-	0.329	-	-	-	-	-
2,4-Dichlorophenol	ND		-	0.329	-	-	-	-	-
2,4-Dimethylphenol	ND		-	0.329	-	-	-	-	-
2,4-Dinitrophenol	ND		-	1.69	-	-	-	-	-
2,4-Dinitrotoluene	ND		-	0.658	-	-	-	-	-
2,6-Dichlorophenol	ND		-	0.329	-	-	-	-	-
2,6-Dinitrotoluene	ND		-	0.329	-	-	-	-	-
2-Chloronaphthalene	ND		-	0.329	-	-	-	-	-
2-Chlorophenol	ND		-	0.329	-	-	-	-	-
2-Methylnaphthalene	ND		-	0.329	-	-	-	-	-
2-Methylphenol (o-Cresol)	ND		-	0.329	-	-	-	-	-
2-Naphthylamine	ND		-	0.658	-	-	-	-	-
2-Nitroaniline	ND		-	1.69	-	-	-	-	-
2-Nitrophenol	ND		-	0.329	-	-	-	-	-
2-Picoline	ND		-	0.329	-	-	-	-	-
3,3'-Dichlorobenzidine	ND		-	0.329	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.329	-	-	-	-	-
3-Nitroaniline	ND		-	1.69	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.69	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.658	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.329	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.329	-	-	-	-	-
4-Chloroaniline	ND		-	0.329	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.329	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.329	-	-	-	-	-
4-Nitroaniline	ND		-	0.329	-	-	-	-	-
4-Nitrophenol	ND		-	1.69	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.329	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.69	-	-	-	-	-

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-03 (DU3 - Solid/Soil) - cont.					**Sampled: 06/28/07 15:51**		**Recvd: 07/02/07 12:35**		
Semivolatile Organics by GC/MS - cont.									
Acenaphthene	ND		"	0.329	"	"	"	"	"
Acenaphthylene	ND		"	0.329	"	"	"	"	"
Acetophenone	ND		"	0.329	"	"	"	"	"
Aniline	ND		"	0.329	"	"	"	"	"
Anthracene	ND		"	0.329	"	"	"	"	"
Azobenzene	ND		"	0.329	"	"	"	"	"
Benzidine	ND		"	1.69	"	"	"	"	"
Benzo (a) anthracene	ND		"	0.329	"	"	"	"	"
Benzo (a) pyrene	ND		"	0.329	"	"	"	"	"
Benzo (b) fluoranthene	ND		"	0.329	"	"	"	"	"
Benzo (g,h,i) perylene	ND		"	0.329	"	"	"	"	"
Benzo (k) fluoranthene	ND		"	0.329	"	"	"	"	"
Benzoic acid	ND		"	1.69	"	"	"	"	"
Benzyl alcohol	ND		"	0.329	"	"	"	"	"
Bis(2-chloroethoxy)methane	ND		"	0.329	"	"	"	"	"
Bis(2-chloroethyl)ether	ND		"	0.329	"	"	"	"	"
Bis(2-chloroisopropyl) ether	ND		"	0.329	"	"	"	"	"
Bis(2-ethylhexyl)phthalate	ND		"	0.329	"	"	"	"	"
Butyl benzyl phthalate	ND		"	0.329	"	"	"	"	"
Chrysene	ND		"	0.329	"	"	"	"	"
Dibenz (a,j) acridine	ND		"	0.329	"	"	"	"	"
Dibenzo (a,h) anthracene	ND		"	0.329	"	"	"	"	"
Dibenzofuran	ND		"	0.329	"	"	"	"	"
Diethyl phthalate	ND		"	0.329	"	"	"	"	"
Dimethyl phthalate	ND		"	0.329	"	"	"	"	"
Dimethylaminoazobenzene	ND		"	0.658	"	"	"	"	"
Di-n-butyl phthalate	ND		"	0.329	"	"	"	"	"
Di-n-octyl phthalate	ND		"	0.329	"	"	"	"	"
Ethyl Methanesulfonate	ND		"	0.329	"	"	"	"	"
Fluoranthene	ND		"	0.329	"	"	"	"	"
Fluorene	ND		"	0.329	"	"	"	"	"
Hexachlorobenzene	ND		"	0.329	"	"	"	"	"
Hexachlorobutadiene	ND		"	0.329	"	"	"	"	"
Hexachlorocyclopentadiene	ND		"	0.329	"	"	"	"	"
Hexachloroethane	ND		"	0.329	"	"	"	"	"
Indeno (1,2,3-cd) pyrene	ND		"	0.329	"	"	"	"	"
Isophorone	ND		"	0.329	"	"	"	"	"
Methyl Methanesulfonate	ND		"	0.658	"	"	"	"	"
Naphthalene	ND		"	0.329	"	"	"	"	"
Nitrobenzene	ND		"	0.329	"	"	"	"	"
N-Nitrosodimethylamine	ND		"	0.329	"	"	"	"	"
N-Nitrosodi-n-butylamine	ND		"	0.329	"	"	"	"	"
N-Nitrosodi-n-propylamine	ND		"	0.329	"	"	"	"	"
N-Nitrosodiphenylamine	ND		"	0.329	"	"	"	"	"
N-Nitrosopiperidine	ND		"	0.329	"	"	"	"	"
Pentachloronitrobenzene	ND		"	0.329	"	"	"	"	"
Pentachlorophenol	ND		"	1.69	"	"	"	"	"

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-03 (DU3 - Solid/Soil) - cont.					**Sampled: 06/28/07 15:51**		**Recvd: 07/02/07 12:35**		
Semivolatile Organics by GC/MS - cont.									
Phenacetin	ND		"	0.329	"	"	"	"	"
Phenanthrene	ND		"	0.329	"	"	"	"	"
Phenol	ND		"	0.329	"	"	"	"	"
Pronamide	ND		"	0.329	"	"	"	"	"
Pyrene	ND		"	0.329	"	"	"	"	"
Pyridine	ND		"	0.329	"	"	"	"	"
Surr: 2,4,6-Tribromophenol (52.6-114%)	*67 %*					"	"	"	"
Surr: 2-Fluorobiphenyl (45.9-108%)	*78 %*					"	"	"	"
Surr: 2-Fluorophenol (39.4-103%)	*50 %*					"	"	"	"
Surr: Nitrobenzene-d5 (37.2-107%)	*74 %*					"	"	"	"
Surr: Phenol-d6 (49.6-105%)	*58 %*					"	"	"	"
Surr: Terphenyl-d14 (45.7-133%)	*92 %*					"	"	"	"
Total Metals by SW 846 Series Methods									
Arsenic	3.98		mg/kg	0.980	1	07/20/07 13:02	07/10/07	7G10005	SW6010B
Lead	1.97		"	1.96	"	"	"	"	"
Sample ID: HQG0016-04 (DU4 - Solid/Soil)					**Sampled: 06/28/07 16:30**		**Recvd: 07/02/07 12:35**		
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0331	1	07/07/07 04:13	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	"	0.0662	"	"	"	"	"
Aroclor 1232	ND	C-01	"	0.0331	"	"	"	"	"
Aroclor 1242	ND	C-01	"	0.0331	"	"	"	"	"
Aroclor 1248	ND	C-01	"	0.0331	"	"	"	"	"
Aroclor 1254	ND	C-01	"	0.0331	"	"	"	"	"
Aroclor 1260	ND	C-01	"	0.0331	"	"	"	"	"
Surr: Decachlorobiphenyl (24-154%)	*113 %*	*C-01*				"	"	"	"
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.320	1	07/27/07 03:19	07/13/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		"	0.320	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.320	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.320	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.320	"	"	"	"	"
1-Chloronaphthalene	ND		"	0.320	"	"	"	"	"
1-Naphthylamine	ND		"	0.641	"	"	"	"	"
2,3,4,6-Tetrachlorophenol	ND		"	0.320	"	"	"	"	"
2,4,5-Trichlorophenol	ND		"	0.320	"	"	"	"	"
2,4,6-Trichlorophenol	ND		"	0.320	"	"	"	"	"
2,4-Dichlorophenol	ND		"	0.320	"	"	"	"	"
2,4-Dimethylphenol	ND		"	0.320	"	"	"	"	"
2,4-Dinitrophenol	ND		"	1.65	"	"	"	"	"
2,4-Dinitrotoluene	ND		"	0.641	"	"	"	"	"
2,6-Dichlorophenol	ND		"	0.320	"	"	"	"	"
2,6-Dinitrotoluene	ND		"	0.320	"	"	"	"	"
2-Chloronaphthalene	ND		"	0.320	"	"	"	"	"
2-Chlorophenol	ND		"	0.320	"	"	"	"	"
2-Methylnaphthalene	ND		"	0.320	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-04 (DU4 - Solid/Soil) - cont.					Sampled: 06/28/07 16:30		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
2-Methylphenol (o-Cresol)	ND		"	0.320	"	"	"	"	"
2-Naphthylamine	ND		"	0.641	"	"	"	"	"
2-Nitroaniline	ND		"	1.65	"	"	"	"	"
2-Nitrophenol	ND		"	0.320	"	"	"	"	"
2-Picoline	ND		"	0.320	"	"	"	"	"
3,3'-Dichlorobenzidine	ND		"	0.320	"	"	"	"	"
3-Methylcholanthrene	ND		"	0.320	"	"	"	"	"
3-Nitroaniline	ND		"	1.65	"	"	"	"	"
4,6-Dinitro-2-methylphenol	ND		"	1.65	"	"	"	"	"
4-Aminobiphenyl	ND		"	0.641	"	"	"	"	"
4-Bromophenyl phenyl ether	ND		"	0.320	"	"	"	"	"
4-Chloro-3-methylphenol	ND		"	0.320	"	"	"	"	"
4-Chloroaniline	ND		"	0.320	"	"	"	"	"
4-Chlorophenyl phenyl ether	ND		"	0.320	"	"	"	"	"
4-Methylphenol (p-Cresol)	ND		"	0.320	"	"	"	"	"
4-Nitroaniline	ND		"	0.320	"	"	"	"	"
4-Nitrophenol	ND		"	1.65	"	"	"	"	"
7,12-Dimethylbenz (a) anthracene	ND		"	0.320	"	"	"	"	"
a,a-Dimethylphenethylamine	ND		"	1.65	"	"	"	"	"
Acenaphthene	ND		"	0.320	"	"	"	"	"
Acenaphthylene	ND		"	0.320	"	"	"	"	"
Acetophenone	ND		"	0.320	"	"	"	"	"
Aniline	ND		"	0.320	"	"	"	"	"
Anthracene	ND		"	0.320	"	"	"	"	"
Azobenzene	ND		"	0.320	"	"	"	"	"
Benzidine	ND		"	1.65	"	"	"	"	"
Benzo (a) anthracene	ND		"	0.320	"	"	"	"	"
Benzo (a) pyrene	ND		"	0.320	"	"	"	"	"
Benzo (b) fluoranthene	ND		"	0.320	"	"	"	"	"
Benzo (g,h,i) perylene	ND		"	0.320	"	"	"	"	"
Benzo (k) fluoranthene	ND		"	0.320	"	"	"	"	"
Benzoic acid	ND		"	1.65	"	"	"	"	"
Benzyl alcohol	ND		"	0.320	"	"	"	"	"
Bis(2-chloroethoxy)methane	ND		"	0.320	"	"	"	"	"
Bis(2-chloroethyl)ether	ND		"	0.320	"	"	"	"	"
Bis(2-chloroisopropyl) ether	ND		"	0.320	"	"	"	"	"
Bis(2-ethylhexyl)phthalate	ND		"	0.320	"	"	"	"	"
Butyl benzyl phthalate	ND		"	0.320	"	"	"	"	"
Chrysene	ND		"	0.320	"	"	"	"	"
Dibenz (a,j) acridine	ND		"	0.320	"	"	"	"	"
Dibenzo (a,h) anthracene	ND		"	0.320	"	"	"	"	"
Dibenzofuran	ND		"	0.320	"	"	"	"	"
Diethyl phthalate	ND		"	0.320	"	"	"	"	"
Dimethyl phthalate	ND		"	0.320	"	"	"	"	"
Dimethylaminoazobenzene	ND		"	0.641	"	"	"	"	"
Di-n-butyl phthalate	ND		"	0.320	"	"	"	"	"
Di-n-octyl phthalate	ND		"	0.320	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-04 (DU4 - Solid/Soil) - cont.					Sampled: 06/28/07 16:30		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Ethyl Methanesulfonate	ND		"	0.320	"	"	"	"	"
Fluoranthene	ND		"	0.320	"	"	"	"	"
Fluorene	ND		"	0.320	"	"	"	"	"
Hexachlorobenzene	ND		"	0.320	"	"	"	"	"
Hexachlorobutadiene	ND		"	0.320	"	"	"	"	"
Hexachlorocyclopentadiene	ND		"	0.320	"	"	"	"	"
Hexachloroethane	ND		"	0.320	"	"	"	"	"
Indeno (1,2,3-cd) pyrene	ND		"	0.320	"	"	"	"	"
Isophorone	ND		"	0.320	"	"	"	"	"
Methyl Methanesulfonate	ND		"	0.641	"	"	"	"	"
Naphthalene	ND		"	0.320	"	"	"	"	"
Nitrobenzene	ND		"	0.320	"	"	"	"	"
N-Nitrosodimethylamine	ND		"	0.320	"	"	"	"	"
N-Nitrosodi-n-butylamine	ND		"	0.320	"	"	"	"	"
N-Nitrosodi-n-propylamine	ND		"	0.320	"	"	"	"	"
N-Nitrosodiphenylamine	ND		"	0.320	"	"	"	"	"
N-Nitrosopiperidine	ND		"	0.320	"	"	"	"	"
Pentachloronitrobenzene	ND		"	0.320	"	"	"	"	"
Pentachlorophenol	ND		"	1.65	"	"	"	"	"
Phenacetin	ND		"	0.320	"	"	"	"	"
Phenanthrene	ND		"	0.320	"	"	"	"	"
Phenol	ND		"	0.320	"	"	"	"	"
Pronamide	ND		"	0.320	"	"	"	"	"
Pyrene	ND		"	0.320	"	"	"	"	"
Pyridine	ND		"	0.320	"	"	"	"	"
Surr: 2,4,6-Tribromophenol (52.6-114%)	63 %					"	"	"	"
Surr: 2-Fluorobiphenyl (45.9-108%)	70 %					"	"	"	"
Surr: 2-Fluorophenol (39.4-103%)	43 %					"	"	"	"
Surr: Nitrobenzene-d5 (37.2-107%)	63 %					"	"	"	"
Surr: Phenol-d6 (49.6-105%)	46 %	Z				"	"	"	"
Surr: Terphenyl-d14 (45.7-133%)	89 %					"	"	"	"
Total Metals by SW 846 Series Methods									
Arsenic	3.64		mg/kg	0.980	1	07/20/07 13:06	07/10/07	7G10005	SW6010B
Lead	ND		"	1.96	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-05 (DU5 - Solid/Soil)						Sampled: 06/28/07 16:50		Recvd: 07/02/07 12:35	
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0323	1	07/07/07 04:41	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	-	0.0645	-	-	-	-	-
Aroclor 1232	ND	C-01	-	0.0323	-	-	-	-	-
Aroclor 1242	ND	C-01	-	0.0323	-	-	-	-	-
Aroclor 1248	ND	C-01	-	0.0323	-	-	-	-	-
Aroclor 1254	ND	C-01	-	0.0323	-	-	-	-	-
Aroclor 1260	ND	C-01	-	0.0323	-	-	-	-	-
Surr: Decachlorobiphenyl (24-154%)	*114 %*	*C-01*				-	-	-	-
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.317	1	07/27/07 04:05	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		-	0.317	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.317	-	-	-	-	-
1,3-Dichlorobenzene	ND		-	0.317	-	-	-	-	-
1,4-Dichlorobenzene	ND		-	0.317	-	-	-	-	-
1-Chloronaphthalene	ND		-	0.317	-	-	-	-	-
1-Naphthylamine	ND		-	0.635	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	ND		-	0.317	-	-	-	-	-
2,4,5-Trichlorophenol	ND		-	0.317	-	-	-	-	-
2,4,6-Trichlorophenol	ND		-	0.317	-	-	-	-	-
2,4-Dichlorophenol	ND		-	0.317	-	-	-	-	-
2,4-Dimethylphenol	ND		-	0.317	-	-	-	-	-
2,4-Dinitrophenol	ND		-	1.63	-	-	-	-	-
2,4-Dinitrotoluene	ND		-	0.635	-	-	-	-	-
2,6-Dichlorophenol	ND		-	0.317	-	-	-	-	-
2,6-Dinitrotoluene	ND		-	0.317	-	-	-	-	-
2-Chloronaphthalene	ND		-	0.317	-	-	-	-	-
2-Chlorophenol	ND		-	0.317	-	-	-	-	-
2-Methylnaphthalene	ND		-	0.317	-	-	-	-	-
2-Methylphenol (o-Cresol)	ND		-	0.317	-	-	-	-	-
2-Naphthylamine	ND		-	0.635	-	-	-	-	-
2-Nitroaniline	ND		-	1.63	-	-	-	-	-
2-Nitrophenol	ND		-	0.317	-	-	-	-	-
2-Picoline	ND		-	0.317	-	-	-	-	-
3,3'-Dichlorobenzidine	ND		-	0.317	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.317	-	-	-	-	-
3-Nitroaniline	ND		-	1.63	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.63	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.635	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.317	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.317	-	-	-	-	-
4-Chloroaniline	ND		-	0.317	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.317	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.317	-	-	-	-	-
4-Nitroaniline	ND		-	0.317	-	-	-	-	-
4-Nitrophenol	ND		-	1.63	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.317	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.63	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-05 (DU5 - Solid/Soil) - cont.						Sampled: 06/28/07 16:50		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
Acenaphthene	ND		-	0.317	-	-	-	-	-
Acenaphthylene	ND		-	0.317	-	-	-	-	-
Acetophenone	ND		-	0.317	-	-	-	-	-
Aniline	ND		-	0.317	-	-	-	-	-
Anthracene	ND		-	0.317	-	-	-	-	-
Azobenzene	ND		-	0.317	-	-	-	-	-
Benzidine	ND		-	1.63	-	-	-	-	-
Benzo (a) anthracene	ND		-	0.317	-	-	-	-	-
Benzo (a) pyrene	ND		-	0.317	-	-	-	-	-
Benzo (b) fluoranthene	ND		-	0.317	-	-	-	-	-
Benzo (g,h,i) perylene	ND		-	0.317	-	-	-	-	-
Benzo (k) fluoranthene	ND		-	0.317	-	-	-	-	-
Benzoic acid	ND		-	1.63	-	-	-	-	-
Benzyl alcohol	ND		-	0.317	-	-	-	-	-
Bis(2-chloroethoxy)methane	ND		-	0.317	-	-	-	-	-
Bis(2-chloroethyl)ether	ND		-	0.317	-	-	-	-	-
Bis(2-chloroisopropyl) ether	ND		-	0.317	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	ND		-	0.317	-	-	-	-	-
Butyl benzyl phthalate	ND		-	0.317	-	-	-	-	-
Chrysene	ND		-	0.317	-	-	-	-	-
Dibenz (a,j) acridine	ND		-	0.317	-	-	-	-	-
Dibenzo (a,h) anthracene	ND		-	0.317	-	-	-	-	-
Dibenzofuran	ND		-	0.317	-	-	-	-	-
Diethyl phthalate	ND		-	0.317	-	-	-	-	-
Dimethyl phthalate	ND		-	0.317	-	-	-	-	-
Dimethylaminoazobenzene	ND		-	0.635	-	-	-	-	-
Di-n-butyl phthalate	ND		-	0.317	-	-	-	-	-
Di-n-octyl phthalate	ND		-	0.317	-	-	-	-	-
Ethyl Methanesulfonate	ND		-	0.317	-	-	-	-	-
Fluoranthene	ND		-	0.317	-	-	-	-	-
Fluorene	ND		-	0.317	-	-	-	-	-
Hexachlorobenzene	ND		-	0.317	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.317	-	-	-	-	-
Hexachlorocyclopentadiene	ND		-	0.317	-	-	-	-	-
Hexachloroethane	ND		-	0.317	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.317	-	-	-	-	-
Isophorone	ND		-	0.317	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.635	-	-	-	-	-
Naphthalene	ND		-	0.317	-	-	-	-	-
Nitrobenzene	ND		-	0.317	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.317	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.317	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.317	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.317	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.317	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.317	-	-	-	-	-
Pentachlorophenol	ND		-	1.63	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-05 (DU5 - Solid/Soil) - cont.						Sampled: 06/28/07 16:50		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
Phenacetin	ND		"	0.317	"	"	"	"	"
Phenanthrene	ND		"	0.317	"	"	"	"	"
Phenol	ND		"	0.317	"	"	"	"	"
Pronamide	ND		"	0.317	"	"	"	"	"
Pyrene	ND		"	0.317	"	"	"	"	"
Pyridine	ND		"	0.317	"	"	"	"	"
Surr: 2,4,6-Tribromophenol (32.6-114%)	*70 %*					"	"	"	"
Surr: 2-Fluorobiphenyl (45.9-108%)	*69 %*					"	"	"	"
Surr: 2-Fluorophenol (39.4-103%)	*48 %*					"	"	"	"
Surr: Nitrobenzene-d5 (37.2-107%)	*65 %*					"	"	"	"
Surr: Phenol-d6 (49.6-105%)	*48 %*	Z				"	"	"	"
Surr: Terphenyl-d14 (45.7-133%)	*93 %*					"	"	"	"
Total Metals by SW 846 Series Methods									
Arsenic	3.33		mg/kg	0.952	1	07/20/07 13:10	07/10/07	7G10005	SW6010B
Lead	ND		"	1.90	"	"	"	"	"
Sample ID: HQG0016-06 (DU6 - Solid/Soil)						Sampled: 06/29/07 10:10		Recvd: 07/02/07 12:35	
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0326	1	07/07/07 05:08	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	"	0.0651	"	"	"	"	"
Aroclor 1232	ND	C-01	"	0.0326	"	"	"	"	"
Aroclor 1242	ND	C-01	"	0.0326	"	"	"	"	"
Aroclor 1248	ND	C-01	"	0.0326	"	"	"	"	"
Aroclor 1254	ND	C-01	"	0.0326	"	"	"	"	"
Aroclor 1260	ND	C-01	"	0.0326	"	"	"	"	"
Surr: Decachlorobiphenyl (24-154%)	*111 %*	*C-01*				"	"	"	"
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.329	1	07/27/07 09:24	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		"	0.329	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.329	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.329	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.329	"	"	"	"	"
1-Chloronaphthalene	ND		"	0.329	"	"	"	"	"
1-Naphthylamine	ND		"	0.658	"	"	"	"	"
2,3,4,6-Tetrachlorophenol	ND		"	0.329	"	"	"	"	"
2,4,5-Trichlorophenol	ND		"	0.329	"	"	"	"	"
2,4,6-Trichlorophenol	ND		"	0.329	"	"	"	"	"
2,4-Dichlorophenol	ND		"	0.329	"	"	"	"	"
2,4-Dimethylphenol	ND		"	0.329	"	"	"	"	"
2,4-Dinitrophenol	ND		"	1.69	"	"	"	"	"
2,4-Dinitrotoluene	ND		"	0.658	"	"	"	"	"
2,6-Dichlorophenol	ND		"	0.329	"	"	"	"	"
2,6-Dinitrotoluene	ND		"	0.329	"	"	"	"	"
2-Chloronaphthalene	ND		"	0.329	"	"	"	"	"
2-Chlorophenol	ND		"	0.329	"	"	"	"	"
2-Methylnaphthalene	ND		"	0.329	"	"	"	"	"

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99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-06 (DU6 - Solid/Soil) - cont.						Sampled: 06/29/07 10:10		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
2-Methylphenol (o-Cresol)	ND		"	0.329	"	"	"	"	"
2-Naphthylamine	ND		"	0.658	"	"	"	"	"
2-Nitroaniline	ND		"	1.69	"	"	"	"	"
2-Nitrophenol	ND		"	0.329	"	"	"	"	"
2-Picoline	ND		"	0.329	"	"	"	"	"
3,3'-Dichlorobenzidine	ND		"	0.329	"	"	"	"	"
3-Methylcholanthrene	ND		"	0.329	"	"	"	"	"
3-Nitroaniline	ND		"	1.69	"	"	"	"	"
4,6-Dinitro-2-methylphenol	ND		"	1.69	"	"	"	"	"
4-Aminobiphenyl	ND		"	0.658	"	"	"	"	"
4-Bromophenyl phenyl ether	ND		"	0.329	"	"	"	"	"
4-Chloro-3-methylphenol	ND		"	0.329	"	"	"	"	"
4-Chloroaniline	ND		"	0.329	"	"	"	"	"
4-Chlorophenyl phenyl ether	ND		"	0.329	"	"	"	"	"
4-Methylphenol (p-Cresol)	ND		"	0.329	"	"	"	"	"
4-Nitroaniline	ND		"	0.329	"	"	"	"	"
4-Nitrophenol	ND		"	1.69	"	"	"	"	"
7,12-Dimethylbenz (a) anthracene	ND		"	0.329	"	"	"	"	"
a,a-Dimethylphenethylamine	ND		"	1.69	"	"	"	"	"
Acenaphthene	ND		"	0.329	"	"	"	"	"
Acenaphthylene	ND		"	0.329	"	"	"	"	"
Acetophenone	ND		"	0.329	"	"	"	"	"
Aniline	ND		"	0.329	"	"	"	"	"
Anthracene	ND		"	0.329	"	"	"	"	"
Azobenzene	ND		"	0.329	"	"	"	"	"
Benzidine	ND		"	1.69	"	"	"	"	"
Benzo (a) anthracene	ND		"	0.329	"	"	"	"	"
Benzo (a) pyrene	ND		"	0.329	"	"	"	"	"
Benzo (b) fluoranthene	ND		"	0.329	"	"	"	"	"
Benzo (g,h,i) perylene	ND		"	0.329	"	"	"	"	"
Benzo (k) fluoranthene	ND		"	0.329	"	"	"	"	"
Benzoic acid	ND		"	1.69	"	"	"	"	"
Benzyl alcohol	ND		"	0.329	"	"	"	"	"
Bis(2-chloroethoxy)methane	ND		"	0.329	"	"	"	"	"
Bis(2-chloroethyl)ether	ND		"	0.329	"	"	"	"	"
Bis(2-chloroisopropyl) ether	ND		"	0.329	"	"	"	"	"
Bis(2-ethylhexyl)phthalate	ND		"	0.329	"	"	"	"	"
Butyl benzyl phthalate	ND		"	0.329	"	"	"	"	"
Chrysene	ND		"	0.329	"	"	"	"	"
Dibenz (a,j) acridine	ND		"	0.329	"	"	"	"	"
Dibenzo (a,h) anthracene	ND		"	0.329	"	"	"	"	"
Dibenzofuran	ND		"	0.329	"	"	"	"	"
Diethyl phthalate	ND		"	0.329	"	"	"	"	"
Dimethyl phthalate	ND		"	0.329	"	"	"	"	"
Dimethylaminoazobenzene	ND		"	0.658	"	"	"	"	"
Di-n-butyl phthalate	ND		"	0.329	"	"	"	"	"
Di-n-octyl phthalate	ND		"	0.329	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-06 (DU6 - Solid/Soil) - cont.						Sampled: 06/29/07 10:10		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
Ethyl Methanesulfonate	ND		-	0.329	-	-	-	-	-
Fluoranthene	ND		-	0.329	-	-	-	-	-
Fluorene	ND		-	0.329	-	-	-	-	-
Hexachlorobenzene	ND		-	0.329	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.329	-	-	-	-	-
Hexachlorocyclopentadiene	ND		-	0.329	-	-	-	-	-
Hexachloroethane	ND		-	0.329	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.329	-	-	-	-	-
Isophorone	ND		-	0.329	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.658	-	-	-	-	-
Naphthalene	ND		-	0.329	-	-	-	-	-
Nitrobenzene	ND		-	0.329	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.329	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.329	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.329	-	-	-	-	-
Pentachlorophenol	ND		-	1.69	-	-	-	-	-
Phenacetin	ND		-	0.329	-	-	-	-	-
Phenanthrene	ND		-	0.329	-	-	-	-	-
Phenol	ND		-	0.329	-	-	-	-	-
Pronamide	ND		-	0.329	-	-	-	-	-
Pyrene	ND		-	0.329	-	-	-	-	-
Pyridine	ND		-	0.329	-	-	-	-	-
Surr: 2,4,6-Tribromophenol (32.6-114%)	*65 %*					-	-	-	-
Surr: 2-Fluorobiphenyl (45.9-108%)	*73 %*					-	-	-	-
Surr: 2-Fluorophenol (39.4-103%)	*49 %*					-	-	-	-
Surr: Nitrobenzene-d5 (37.2-107%)	*69 %*					-	-	-	-
Surr: Phenol-d6 (49.6-105%)	*53 %*					-	-	-	-
Surr: Terphenyl-d14 (45.7-133%)	*91 %*					-	-	-	-
Total Metals by SW 846 Series Methods									
Arsenic	3.58		mg/kg	0.943	1	07/20/07 13:14	07/10/07	7G10005	SW6010B
Lead	ND		-	1.89	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-07 (DU7 - Solid/Soil)					Sampled: 06/29/07 11:10			Recvd: 07/02/07 12:35	
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0330	1	07/07/07 05:36	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	-	0.0660	-	-	-	-	-
Aroclor 1232	ND	C-01	-	0.0330	-	-	-	-	-
Aroclor 1242	ND	C-01	-	0.0330	-	-	-	-	-
Aroclor 1248	ND	C-01	-	0.0330	-	-	-	-	-
Aroclor 1254	ND	C-01	-	0.0330	-	-	-	-	-
Aroclor 1260	ND	C-01	-	0.0330	-	-	-	-	-
Surr: Decachlorobiphenyl (24-154%)	*113 %*	*C-01*				-	-	-	-
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.318	1	07/27/07 10:10	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		-	0.318	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.318	-	-	-	-	-
1,3-Dichlorobenzene	ND		-	0.318	-	-	-	-	-
1,4-Dichlorobenzene	ND		-	0.318	-	-	-	-	-
1-Chloronaphthalene	ND		-	0.318	-	-	-	-	-
1-Naphthylamine	ND		-	0.637	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	ND		-	0.318	-	-	-	-	-
2,4,5-Trichlorophenol	ND		-	0.318	-	-	-	-	-
2,4,6-Trichlorophenol	ND		-	0.318	-	-	-	-	-
2,4-Dichlorophenol	ND		-	0.318	-	-	-	-	-
2,4-Dimethylphenol	ND		-	0.318	-	-	-	-	-
2,4-Dinitrophenol	ND		-	1.64	-	-	-	-	-
2,4-Dinitrotoluene	ND		-	0.637	-	-	-	-	-
2,6-Dichlorophenol	ND		-	0.318	-	-	-	-	-
2,6-Dinitrotoluene	ND		-	0.318	-	-	-	-	-
2-Chloronaphthalene	ND		-	0.318	-	-	-	-	-
2-Chlorophenol	ND		-	0.318	-	-	-	-	-
2-Methylnaphthalene	ND		-	0.318	-	-	-	-	-
2-Methylphenol (o-Cresol)	ND		-	0.318	-	-	-	-	-
2-Naphthylamine	ND		-	0.637	-	-	-	-	-
2-Nitroaniline	ND		-	1.64	-	-	-	-	-
2-Nitrophenol	ND		-	0.318	-	-	-	-	-
2-Picoline	ND		-	0.318	-	-	-	-	-
3,3'-Dichlorobenzidine	ND		-	0.318	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.318	-	-	-	-	-
3-Nitroaniline	ND		-	1.64	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.64	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.637	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.318	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.318	-	-	-	-	-
4-Chloroaniline	ND		-	0.318	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.318	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.318	-	-	-	-	-
4-Nitroaniline	ND		-	0.318	-	-	-	-	-
4-Nitrophenol	ND		-	1.64	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.318	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.64	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-07 (DU7 - Solid/Soil) - cont.					Sampled: 06/29/07 11:10		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Acenaphthene	ND		"	0.318	"	"	"	"	"
Acenaphthylene	ND		"	0.318	"	"	"	"	"
Acetophenone	ND		"	0.318	"	"	"	"	"
Aniline	ND		"	0.318	"	"	"	"	"
Anthracene	ND		"	0.318	"	"	"	"	"
Azobenzene	ND		"	0.318	"	"	"	"	"
Benzidine	ND		"	1.64	"	"	"	"	"
Benzo (a) anthracene	ND		"	0.318	"	"	"	"	"
Benzo (a) pyrene	ND		"	0.318	"	"	"	"	"
Benzo (b) fluoranthene	ND		"	0.318	"	"	"	"	"
Benzo (g,h,i) perylene	ND		"	0.318	"	"	"	"	"
Benzo (k) fluoranthene	ND		"	0.318	"	"	"	"	"
Benzoic acid	ND		"	1.64	"	"	"	"	"
Benzyl alcohol	ND		"	0.318	"	"	"	"	"
Bis(2-chloroethoxy)methane	ND		"	0.318	"	"	"	"	"
Bis(2-chloroethyl)ether	ND		"	0.318	"	"	"	"	"
Bis(2-chloroisopropyl) ether	ND		"	0.318	"	"	"	"	"
Bis(2-ethylhexyl)phthalate	ND		"	0.318	"	"	"	"	"
Butyl benzyl phthalate	ND		"	0.318	"	"	"	"	"
Chrysene	ND		"	0.318	"	"	"	"	"
Dibenz (a,j) acridine	ND		"	0.318	"	"	"	"	"
Dibenzo (a,h) anthracene	ND		"	0.318	"	"	"	"	"
Dibenzofuran	ND		"	0.318	"	"	"	"	"
Diethyl phthalate	ND		"	0.318	"	"	"	"	"
Dimethyl phthalate	ND		"	0.318	"	"	"	"	"
Dimethylaminoazobenzene	ND		"	0.637	"	"	"	"	"
Di-n-butyl phthalate	ND		"	0.318	"	"	"	"	"
Di-n-octyl phthalate	ND		"	0.318	"	"	"	"	"
Ethyl Methanesulfonate	ND		"	0.318	"	"	"	"	"
Fluoranthene	ND		"	0.318	"	"	"	"	"
Fluorene	ND		"	0.318	"	"	"	"	"
Hexachlorobenzene	ND		"	0.318	"	"	"	"	"
Hexachlorobutadiene	ND		"	0.318	"	"	"	"	"
Hexachlorocyclopentadiene	ND		"	0.318	"	"	"	"	"
Hexachloroethane	ND		"	0.318	"	"	"	"	"
Indeno (1,2,3-cd) pyrene	ND		"	0.318	"	"	"	"	"
Isophorone	ND		"	0.318	"	"	"	"	"
Methyl Methanesulfonate	ND		"	0.637	"	"	"	"	"
Naphthalene	ND		"	0.318	"	"	"	"	"
Nitrobenzene	ND		"	0.318	"	"	"	"	"
N-Nitrosodimethylamine	ND		"	0.318	"	"	"	"	"
N-Nitrosodi-n-butylamine	ND		"	0.318	"	"	"	"	"
N-Nitrosodi-n-propylamine	ND		"	0.318	"	"	"	"	"
N-Nitrosodiphenylamine	ND		"	0.318	"	"	"	"	"
N-Nitrosopiperidine	ND		"	0.318	"	"	"	"	"
Pentachloronitrobenzene	ND		"	0.318	"	"	"	"	"
Pentachlorophenol	ND		"	1.64	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-07 (DU7 - Solid/Soil) - cont.					Sampled: 06/29/07 11:10		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Phenacetin	ND		"	0.318	"	"	"	"	"
Phenanthrene	ND		"	0.318	"	"	"	"	"
Phenol	ND		"	0.318	"	"	"	"	"
Pronamide	ND		"	0.318	"	"	"	"	"
Pyrene	ND		"	0.318	"	"	"	"	"
Pyridine	ND		"	0.318	"	"	"	"	"
Surr: 2,4,6-Tribromophenol (52.6-114%)	*75 %*					"	"	"	"
Surr: 2-Fluorobiphenyl (43.9-108%)	*72 %*					"	"	"	"
Surr: 2-Fluorophenol (39.4-103%)	*50 %*					"	"	"	"
Surr: Nitrobenzene-d5 (37.2-107%)	*61 %*					"	"	"	"
Surr: Phenol-d6 (49.6-105%)	*62 %*					"	"	"	"
Surr: Terphenyl-d14 (45.7-133%)	*87 %*					"	"	"	"
Total Metals by SW 846 Series Methods									
Arsenic	3.10		mg/kg	0.971	1	07/20/07 13:18	07/10/07	7G10005	SW6010B
Lead	ND		"	1.94	"	"	"	"	"
Sample ID: HQG0016-08 (DU8 - Solid/Soil)					Sampled: 06/29/07 12:10		Recvd: 07/02/07 12:35		
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0318	1	07/07/07 06:04	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	"	0.0637	"	"	"	"	"
Aroclor 1232	ND	C-01	"	0.0318	"	"	"	"	"
Aroclor 1242	ND	C-01	"	0.0318	"	"	"	"	"
Aroclor 1248	ND	C-01	"	0.0318	"	"	"	"	"
Aroclor 1254	ND	C-01	"	0.0318	"	"	"	"	"
Aroclor 1260	ND	C-01	"	0.0318	"	"	"	"	"
Surr: Decachlorobiphenyl (24-154%)	*116 %*	*C-01*				"	"	"	"
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.316	1	07/27/07 10:55	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		"	0.316	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.316	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.316	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.316	"	"	"	"	"
1-Chloronaphthalene	ND		"	0.316	"	"	"	"	"
1-Naphthylamine	ND		"	0.653	"	"	"	"	"
2,3,4,6-Tetrachlorophenol	ND		"	0.316	"	"	"	"	"
2,4,5-Trichlorophenol	ND		"	0.316	"	"	"	"	"
2,4,6-Trichlorophenol	ND		"	0.316	"	"	"	"	"
2,4-Dichlorophenol	ND		"	0.316	"	"	"	"	"
2,4-Dimethylphenol	ND		"	0.316	"	"	"	"	"
2,4-Dinitrophenol	ND		"	1.63	"	"	"	"	"
2,4-Dinitrotoluene	ND		"	0.633	"	"	"	"	"
2,6-Dichlorophenol	ND		"	0.316	"	"	"	"	"
2,6-Dinitrotoluene	ND		"	0.316	"	"	"	"	"
2-Chloronaphthalene	ND		"	0.316	"	"	"	"	"
2-Chlorophenol	ND		"	0.316	"	"	"	"	"
2-Methylnaphthalene	ND		"	0.316	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-08 (DU8 - Solid/Soil) - cont.					Sampled: 06/29/07 12:10		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
2-Methylphenol (o-Cresol)	ND		-	0.316	-	-	-	-	-
2-Naphthylamine	ND		-	0.633	-	-	-	-	-
2-Nitroaniline	ND		-	1.63	-	-	-	-	-
2-Nitrophenol	ND		-	0.316	-	-	-	-	-
2-Picoline	ND		-	0.316	-	-	-	-	-
3,3'-Dichlorobenzidine	ND		-	0.316	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.316	-	-	-	-	-
3-Nitroaniline	ND		-	1.63	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.63	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.633	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.316	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.316	-	-	-	-	-
4-Chloroaniline	ND		-	0.316	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.316	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.316	-	-	-	-	-
4-Nitroaniline	ND		-	0.316	-	-	-	-	-
4-Nitrophenol	ND		-	1.63	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.316	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.63	-	-	-	-	-
Acenaphthene	ND		-	0.316	-	-	-	-	-
Acenaphthylene	ND		-	0.316	-	-	-	-	-
Acetophenone	ND		-	0.316	-	-	-	-	-
Aniline	ND		-	0.316	-	-	-	-	-
Anthracene	ND		-	0.316	-	-	-	-	-
Azobenzene	ND		-	0.316	-	-	-	-	-
Benzidine	ND		-	1.63	-	-	-	-	-
Benzo (a) anthracene	ND		-	0.316	-	-	-	-	-
Benzo (a) pyrene	ND		-	0.316	-	-	-	-	-
Benzo (b) fluoranthene	ND		-	0.316	-	-	-	-	-
Benzo (g,h,i) perylene	ND		-	0.316	-	-	-	-	-
Benzo (k) fluoranthene	ND		-	0.316	-	-	-	-	-
Benzoic acid	ND		-	1.63	-	-	-	-	-
Benzyl alcohol	ND		-	0.316	-	-	-	-	-
Bis(2-chloroethoxy)methane	ND		-	0.316	-	-	-	-	-
Bis(2-chloroethyl)ether	ND		-	0.316	-	-	-	-	-
Bis(2-chloroisopropyl) ether	ND		-	0.316	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	ND		-	0.316	-	-	-	-	-
Butyl benzyl phthalate	ND		-	0.316	-	-	-	-	-
Chrysene	ND		-	0.316	-	-	-	-	-
Dibenz (a,j) acridine	ND		-	0.316	-	-	-	-	-
Dibenzo (a,h) anthracene	ND		-	0.316	-	-	-	-	-
Dibenzofuran	ND		-	0.316	-	-	-	-	-
Diethyl phthalate	ND		-	0.316	-	-	-	-	-
Dimethyl phthalate	ND		-	0.316	-	-	-	-	-
Dimethylaminoazobenzene	ND		-	0.633	-	-	-	-	-
Di-n-butyl phthalate	ND		-	0.316	-	-	-	-	-
Di-n-octyl phthalate	ND		-	0.316	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-08 (DU8 - Solid/Soil) - cont.					Sampled: 06/29/07 12:10		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Ethyl Methanesulfonate	ND		-	0.316	-	-	-	-	-
Fluoranthene	ND		-	0.316	-	-	-	-	-
Fluorene	ND		-	0.316	-	-	-	-	-
Hexachlorobenzene	ND		-	0.316	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.316	-	-	-	-	-
Hexachlorocyclopentadiene	ND		-	0.316	-	-	-	-	-
Hexachloroethane	ND		-	0.316	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.316	-	-	-	-	-
Isophorone	ND		-	0.316	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.633	-	-	-	-	-
Naphthalene	ND		-	0.316	-	-	-	-	-
Nitrobenzene	ND		-	0.316	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.316	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.316	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.316	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.316	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.316	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.316	-	-	-	-	-
Pentachlorophenol	ND		-	1.63	-	-	-	-	-
Phenacetin	ND		-	0.316	-	-	-	-	-
Phenanthrene	ND		-	0.316	-	-	-	-	-
Phenol	ND		-	0.316	-	-	-	-	-
Pronamide	ND		-	0.316	-	-	-	-	-
Pyrene	ND		-	0.316	-	-	-	-	-
Pyridine	ND		-	0.316	-	-	-	-	-
Surr: 2,4,6-Tribromophenol (32.6-114%)	70 %					-	-	-	-
Surr: 2-Fluorobiphenyl (45.9-108%)	63 %					-	-	-	-
Surr: 2-Fluorophenol (39.4-103%)	42 %					-	-	-	-
Surr: Nitrobenzene-d5 (37.2-107%)	57 %					-	-	-	-
Surr: Phenol-d6 (49.6-105%)	46 %	Z				-	-	-	-
Surr: Terphenyl-d14 (45.7-133%)	86 %					-	-	-	-
Total Metals by SW 846 Series Methods									
Arsenic	3.41		mg/kg	0.971	1	07/20/07 13:21	07/10/07	7G10005	SW6010B
Lead	ND		-	1.94	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-09 (DU9 - Solid/Soil)						Sampled: 06/29/07 14:10		Recvd: 07/02/07 12:35	
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0310	1	07/07/07 06:32	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	-	0.0619	-	-	-	-	-
Aroclor 1232	ND	C-01	-	0.0310	-	-	-	-	-
Aroclor 1242	ND	C-01	-	0.0310	-	-	-	-	-
Aroclor 1248	ND	C-01	-	0.0310	-	-	-	-	-
Aroclor 1254	ND	C-01	-	0.0310	-	-	-	-	-
Aroclor 1260	ND	C-01	-	0.0310	-	-	-	-	-
Surr: Decachlorobiphenyl (24-154%)	*109 %*	*C-01*				-	-	-	-
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.320	1	07/27/07 11:41	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		-	0.320	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.320	-	-	-	-	-
1,3-Dichlorobenzene	ND		-	0.320	-	-	-	-	-
1,4-Dichlorobenzene	ND		-	0.320	-	-	-	-	-
1-Chloronaphthalene	ND		-	0.320	-	-	-	-	-
1-Naphthylamine	ND		-	0.641	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	ND		-	0.320	-	-	-	-	-
2,4,5-Trichlorophenol	ND		-	0.320	-	-	-	-	-
2,4,6-Trichlorophenol	ND		-	0.320	-	-	-	-	-
2,4-Dichlorophenol	ND		-	0.320	-	-	-	-	-
2,4-Dimethylphenol	ND		-	0.320	-	-	-	-	-
2,4-Dinitrophenol	ND		-	1.65	-	-	-	-	-
2,4-Dinitrotoluene	ND		-	0.641	-	-	-	-	-
2,6-Dichlorophenol	ND		-	0.320	-	-	-	-	-
2,6-Dinitrotoluene	ND		-	0.320	-	-	-	-	-
2-Chloronaphthalene	ND		-	0.320	-	-	-	-	-
2-Chlorophenol	ND		-	0.320	-	-	-	-	-
2-Methylnaphthalene	ND		-	0.320	-	-	-	-	-
2-Methylphenol (o-Cresol)	ND		-	0.320	-	-	-	-	-
2-Naphthylamine	ND		-	0.641	-	-	-	-	-
2-Nitroaniline	ND		-	1.65	-	-	-	-	-
2-Nitrophenol	ND		-	0.320	-	-	-	-	-
2-Picoline	ND		-	0.320	-	-	-	-	-
3,3'-Dichlorobenzidine	ND		-	0.320	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.320	-	-	-	-	-
3-Nitroaniline	ND		-	1.65	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.65	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.641	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.320	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.320	-	-	-	-	-
4-Chloroaniline	ND		-	0.320	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.320	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.320	-	-	-	-	-
4-Nitroaniline	ND		-	0.320	-	-	-	-	-
4-Nitrophenol	ND		-	1.65	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.320	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.65	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-09 (DU9 - Solid/Soil) - cont.						Sampled: 06/29/07 14:10		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
Acenaphthene	ND		-	0.320	-	-	-	-	-
Acenaphthylene	ND		-	0.320	-	-	-	-	-
Acetophenone	ND		-	0.320	-	-	-	-	-
Aniline	ND		-	0.320	-	-	-	-	-
Anthracene	ND		-	0.320	-	-	-	-	-
Azobenzene	ND		-	0.320	-	-	-	-	-
Benzidine	ND		-	1.65	-	-	-	-	-
Benzo (a) anthracene	ND		-	0.320	-	-	-	-	-
Benzo (a) pyrene	ND		-	0.320	-	-	-	-	-
Benzo (b) fluoranthene	ND		-	0.320	-	-	-	-	-
Benzo (g,h,i) perylene	ND		-	0.320	-	-	-	-	-
Benzo (k) fluoranthene	ND		-	0.320	-	-	-	-	-
Benzoic acid	ND		-	1.65	-	-	-	-	-
Benzyl alcohol	ND		-	0.320	-	-	-	-	-
Bis(2-chloroethoxy)methane	ND		-	0.320	-	-	-	-	-
Bis(2-chloroethyl)ether	ND		-	0.320	-	-	-	-	-
Bis(2-chloroisopropyl) ether	ND		-	0.320	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	ND		-	0.320	-	-	-	-	-
Butyl benzyl phthalate	ND		-	0.320	-	-	-	-	-
Chrysene	ND		-	0.320	-	-	-	-	-
Dibenz (a,j) acridine	ND		-	0.320	-	-	-	-	-
Dibenzo (a,h) anthracene	ND		-	0.320	-	-	-	-	-
Dibenzofuran	ND		-	0.320	-	-	-	-	-
Diethyl phthalate	ND		-	0.320	-	-	-	-	-
Dimethyl phthalate	ND		-	0.320	-	-	-	-	-
Dimethylaminoazobenzene	ND		-	0.641	-	-	-	-	-
Di-n-butyl phthalate	ND		-	0.320	-	-	-	-	-
Di-n-octyl phthalate	ND		-	0.320	-	-	-	-	-
Ethyl Methanesulfonate	ND		-	0.320	-	-	-	-	-
Fluoranthene	ND		-	0.320	-	-	-	-	-
Fluorene	ND		-	0.320	-	-	-	-	-
Hexachlorobenzene	ND		-	0.320	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.320	-	-	-	-	-
Hexachlorocyclopentadiene	ND		-	0.320	-	-	-	-	-
Hexachloroethane	ND		-	0.320	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.320	-	-	-	-	-
Isophorone	ND		-	0.320	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.641	-	-	-	-	-
Naphthalene	ND		-	0.320	-	-	-	-	-
Nitrobenzene	ND		-	0.320	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.320	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.320	-	-	-	-	-
Pentachlorophenol	ND		-	1.65	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-09 (DU9 - Solid/Soil) - cont.						Sampled: 06/29/07 14:10		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
Phenacetin	ND		"	0.320	"	"	"	"	"
Phenanthrene	ND		"	0.320	"	"	"	"	"
Phenol	ND		"	0.320	"	"	"	"	"
Pronamide	ND		"	0.320	"	"	"	"	"
Pyrene	ND		"	0.320	"	"	"	"	"
Pyridine	ND		"	0.320	"	"	"	"	"
Surr: 2,4,6-Tribromophenol (52.6-114%)	*67 %*					"	"	"	"
Surr: 2-Fluorobiphenyl (45.9-108%)	*81 %*					"	"	"	"
Surr: 2-Fluorophenol (39.4-103%)	*51 %*					"	"	"	"
Surr: Nitrobenzene-d5 (37.2-107%)	*78 %*					"	"	"	"
Surr: Phenol-d6 (49.6-105%)	*53 %*					"	"	"	"
Surr: Terphenyl-d14 (45.7-133%)	*99 %*					"	"	"	"
Total Metals by SW 846 Series Methods									
Arsenic	2.82		mg/kg	0.935	1	07/20/07 13:25	07/10/07	7G10005	SW6010B
Lead	ND		"	1.87	"	"	"	"	"
Sample ID: HQG0016-10 (DU10 - Solid/Soil)						Sampled: 06/29/07 15:10		Recvd: 07/02/07 12:35	
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0324	1	07/07/07 00:30	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	"	0.0647	"	"	"	"	"
Aroclor 1232	ND	C-01	"	0.0324	"	"	"	"	"
Aroclor 1242	ND	C-01	"	0.0324	"	"	"	"	"
Aroclor 1248	ND	C-01	"	0.0324	"	"	"	"	"
Aroclor 1254	ND	C-01	"	0.0324	"	"	"	"	"
Aroclor 1260	ND	C-01	"	0.0324	"	"	"	"	"
Surr: Decachlorobiphenyl (24-154%)	*111 %*	*C-01*				"	"	"	"
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.316	1	07/27/07 12:27	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		"	0.316	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.316	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.316	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.316	"	"	"	"	"
1-Chloronaphthalene	ND		"	0.316	"	"	"	"	"
1-Naphthylamine	ND		"	0.633	"	"	"	"	"
2,3,4,6-Tetrachlorophenol	ND		"	0.316	"	"	"	"	"
2,4,5-Trichlorophenol	ND		"	0.316	"	"	"	"	"
2,4,6-Trichlorophenol	ND		"	0.316	"	"	"	"	"
2,4-Dichlorophenol	ND		"	0.316	"	"	"	"	"
2,4-Dimethylphenol	ND		"	0.316	"	"	"	"	"
2,4-Dinitrophenol	ND		"	1.63	"	"	"	"	"
2,4-Dinitrotoluene	ND		"	0.633	"	"	"	"	"
2,6-Dichlorophenol	ND		"	0.316	"	"	"	"	"
2,6-Dinitrotoluene	ND		"	0.316	"	"	"	"	"
2-Chloronaphthalene	ND		"	0.316	"	"	"	"	"
2-Chlorophenol	ND		"	0.316	"	"	"	"	"
2-Methylnaphthalene	ND		"	0.316	"	"	"	"	"

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THE LEADER IN ENVIRONMENTAL TESTING

99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-10 (DU10 - Solid/Soil) - cont.						Sampled: 06/29/07 15:10		Recvd: 07/02/07 12:35	
Semivolatile Organics by GC/MS - cont.									
2-Methylphenol (o-Cresol)	ND		"	0.316	"	"	"	"	"
2-Naphthylamine	ND		"	0.633	"	"	"	"	"
2-Nitroaniline	ND		"	1.63	"	"	"	"	"
2-Nitrophenol	ND		"	0.316	"	"	"	"	"
2-Picoline	ND		"	0.316	"	"	"	"	"
3,3'-Dichlorobenzidine	ND		"	0.316	"	"	"	"	"
3-Methylcholanthrene	ND		"	0.316	"	"	"	"	"
3-Nitroaniline	ND		"	1.63	"	"	"	"	"
4,6-Dinitro-2-methylphenol	ND		"	1.63	"	"	"	"	"
4-Aminobiphenyl	ND		"	0.633	"	"	"	"	"
4-Bromophenyl phenyl ether	ND		"	0.316	"	"	"	"	"
4-Chloro-3-methylphenol	ND		"	0.316	"	"	"	"	"
4-Chloroaniline	ND		"	0.316	"	"	"	"	"
4-Chlorophenyl phenyl ether	ND		"	0.316	"	"	"	"	"
4-Methylphenol (p-Cresol)	ND		"	0.316	"	"	"	"	"
4-Nitroaniline	ND		"	0.316	"	"	"	"	"
4-Nitrophenol	ND		"	1.63	"	"	"	"	"
7,12-Dimethylbenz (a) anthracene	ND		"	0.316	"	"	"	"	"
a,a-Dimethylphenethylamine	ND		"	1.63	"	"	"	"	"
Acenaphthene	ND		"	0.316	"	"	"	"	"
Acenaphthylene	ND		"	0.316	"	"	"	"	"
Acetophenone	ND		"	0.316	"	"	"	"	"
Aniline	ND		"	0.316	"	"	"	"	"
Anthracene	ND		"	0.316	"	"	"	"	"
Azobenzene	ND		"	0.316	"	"	"	"	"
Benzidine	ND		"	1.63	"	"	"	"	"
Benzo (a) anthracene	ND		"	0.316	"	"	"	"	"
Benzo (a) pyrene	ND		"	0.316	"	"	"	"	"
Benzo (b) fluoranthene	ND		"	0.316	"	"	"	"	"
Benzo (g,h,i) perylene	ND		"	0.316	"	"	"	"	"
Benzo (k) fluoranthene	ND		"	0.316	"	"	"	"	"
Benzoic acid	ND		"	1.63	"	"	"	"	"
Benzyl alcohol	ND		"	0.316	"	"	"	"	"
Bis(2-chloroethoxy)methane	ND		"	0.316	"	"	"	"	"
Bis(2-chloroethyl)ether	ND		"	0.316	"	"	"	"	"
Bis(2-chloroisopropyl) ether	ND		"	0.316	"	"	"	"	"
Bis(2-ethylhexyl)phthalate	ND		"	0.316	"	"	"	"	"
Butyl benzyl phthalate	ND		"	0.316	"	"	"	"	"
Chrysene	ND		"	0.316	"	"	"	"	"
Dibenz (a,j) acridine	ND		"	0.316	"	"	"	"	"
Dibenzo (a,h) anthracene	ND		"	0.316	"	"	"	"	"
Dibenzofuran	ND		"	0.316	"	"	"	"	"
Diethyl phthalate	ND		"	0.316	"	"	"	"	"
Dimethyl phthalate	ND		"	0.316	"	"	"	"	"
Dimethylaminoazobenzene	ND		"	0.633	"	"	"	"	"
Di-n-butyl phthalate	ND		"	0.316	"	"	"	"	"
Di-n-octyl phthalate	ND		"	0.316	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34	

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-10 (DU10 - Solid/Soil) - cont.					Sampled: 06/29/07 15:10		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Ethyl Methanesulfonate	ND		"	0.316	"	"	"	"	"
Fluoranthene	ND		"	0.316	"	"	"	"	"
Fluorene	ND		"	0.316	"	"	"	"	"
Hexachlorobenzene	ND		"	0.316	"	"	"	"	"
Hexachlorobutadiene	ND		"	0.316	"	"	"	"	"
Hexachlorocyclopentadiene	ND		"	0.316	"	"	"	"	"
Hexachloroethane	ND		"	0.316	"	"	"	"	"
Indeno (1,2,3-cd) pyrene	ND		"	0.316	"	"	"	"	"
Isophorone	ND		"	0.316	"	"	"	"	"
Methyl Methanesulfonate	ND		"	0.633	"	"	"	"	"
Naphthalene	ND		"	0.316	"	"	"	"	"
Nitrobenzene	ND		"	0.316	"	"	"	"	"
N-Nitrosodimethylamine	ND		"	0.316	"	"	"	"	"
N-Nitrosodi-n-butylamine	ND		"	0.316	"	"	"	"	"
N-Nitrosodi-n-propylamine	ND		"	0.316	"	"	"	"	"
N-Nitrosodiphenylamine	ND		"	0.316	"	"	"	"	"
N-Nitrosopiperidine	ND		"	0.316	"	"	"	"	"
Pentachloronitrobenzene	ND		"	0.316	"	"	"	"	"
Pentachlorophenol	ND		"	1.63	"	"	"	"	"
Phenacetin	ND		"	0.316	"	"	"	"	"
Phenanthrene	ND		"	0.316	"	"	"	"	"
Phenol	ND		"	0.316	"	"	"	"	"
Pronamide	ND		"	0.316	"	"	"	"	"
Pyrene	ND		"	0.316	"	"	"	"	"
Pyridine	ND		"	0.316	"	"	"	"	"
Surr: 2,4,6-Tribromophenol (52.6-114%)	*70 %*					"	"	"	"
Surr: 2-Fluorobiphenyl (45.9-108%)	*73 %*					"	"	"	"
Surr: 2-Fluorophenol (39.4-103%)	*46 %*					"	"	"	"
Surr: Nitrobenzene-d5 (37.2-107%)	*71 %*					"	"	"	"
Surr: Phenol-d6 (49.6-105%)	*53 %*					"	"	"	"
Surr: Terphenyl-d14 (45.7-133%)	*97 %*					"	"	"	"
Total Metals by SW 846 Series Methods									
Arsenic	2.89		mg/kg	0.943	1	07/20/07 13:41	07/10/07	7G10005	SW6010B
Lead	ND		"	1.89	"	"	"	"	"

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ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-11 (DU1-VOC - Solid/Soil)					Sampled: 06/29/07 16:30		Recvd: 07/02/07 12:35		
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.00988	1	07/12/07 00:42	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.00988	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.00988	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.00988	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.00988	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.00988	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.00988	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.00988	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.00988	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.00988	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.00988	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.00988	"	"	"	"	"
Bromodichloromethane	ND		"	0.00988	"	"	"	"	"
Bromoform	ND		"	0.00988	"	"	"	"	"
Bromomethane	ND		"	0.0988	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.00988	"	"	"	"	"
Chlorobenzene	ND		"	0.00988	"	"	"	"	"
Chlorodibromomethane	ND		"	0.00988	"	"	"	"	"
Chloroethane	ND		"	0.0494	"	"	"	"	"
Chloroform	ND		"	0.00988	"	"	"	"	"
Chloromethane	ND		"	0.0494	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.00988	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.00988	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0494	"	"	"	"	"
Methylene Chloride	ND		"	0.0494	"	"	"	"	"
Tetrachloroethene	ND		"	0.00988	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.00988	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.00988	"	"	"	"	"
Trichloroethene	ND		"	0.00988	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.00988	"	"	"	"	"
Vinyl chloride	ND		"	0.0494	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*109 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*133 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*104 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*122 %*					"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Sample ID: HQG0016-12 (DU2-VOC - Solid/Soil) Sampled: 06/29/07 15:55 Recvd: 07/02/07 12:35

Volatile Organic Compounds by EPA 8260B

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
1,1,1-Trichloroethane	ND		mg/kg	0.00977	1	07/12/07 01:09	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.00977	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.00977	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.00977	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.00977	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.00977	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.00977	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.00977	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.00977	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.00977	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.00977	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.00977	"	"	"	"	"
Bromodichloromethane	ND		"	0.00977	"	"	"	"	"
Bromoform	ND		"	0.00977	"	"	"	"	"
Bromomethane	ND		"	0.0977	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.00977	"	"	"	"	"
Chlorobenzene	ND		"	0.00977	"	"	"	"	"
Chlorodibromomethane	ND		"	0.00977	"	"	"	"	"
Chloroethane	ND		"	0.0488	"	"	"	"	"
Chloroform	ND		"	0.00977	"	"	"	"	"
Chloromethane	ND		"	0.0488	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.00977	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.00977	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0488	"	"	"	"	"
Methylene Chloride	ND		"	0.0488	"	"	"	"	"
Tetrachloroethene	ND		"	0.00977	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.00977	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.00977	"	"	"	"	"
Trichloroethene	ND		"	0.00977	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.00977	"	"	"	"	"
Vinyl chloride	ND		"	0.0488	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*113 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*149 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*109 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*132 %*					"	"	"	"

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ANALYTICAL REPORT

Sample ID: HQG0016-13 (DU3-VOC - Solid/Soil) Sampled: 06/29/07 15:23 Recvd: 07/02/07 12:35

Volatile Organic Compounds by EPA 8260B

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
1,1,1-Trichloroethane	ND		mg/kg	0.00998	1	07/12/07 02:02	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.00998	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.00998	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.00998	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.00998	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.00998	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.00998	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.00998	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.00998	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
Bromodichloromethane	ND		"	0.00998	"	"	"	"	"
Bromoform	ND		"	0.00998	"	"	"	"	"
Bromomethane	ND		"	0.0998	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.00998	"	"	"	"	"
Chlorobenzene	ND		"	0.00998	"	"	"	"	"
Chlorodibromomethane	ND		"	0.00998	"	"	"	"	"
Chloroethane	ND		"	0.0499	"	"	"	"	"
Chloroform	ND		"	0.00998	"	"	"	"	"
Chloromethane	ND		"	0.0499	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.00998	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.00998	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0499	"	"	"	"	"
Methylene Chloride	ND		"	0.0499	"	"	"	"	"
Tetrachloroethene	ND		"	0.00998	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.00998	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.00998	"	"	"	"	"
Trichloroethene	ND		"	0.00998	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.00998	"	"	"	"	"
Vinyl chloride	ND		"	0.0499	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*114 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*145 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*109 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*123 %*					"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA		Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-14 (DU4-VOC - Solid/Soil)						**Sampled: 06/29/07 14:53**		**Recvd: 07/02/07 12:35**	
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.0100	1	07/12/07 02:29	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.0100	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.0100	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.0100	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.0100	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.0100	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.0100	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.0100	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.0100	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.0100	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.0100	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.0100	"	"	"	"	"
Bromodichloromethane	ND		"	0.0100	"	"	"	"	"
Bromoform	ND		"	0.0100	"	"	"	"	"
Bromomethane	ND		"	0.100	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.0100	"	"	"	"	"
Chlorobenzene	ND		"	0.0100	"	"	"	"	"
Chlorodibromomethane	ND		"	0.0100	"	"	"	"	"
Chloroethane	ND		"	0.0500	"	"	"	"	"
Chloroform	ND		"	0.0100	"	"	"	"	"
Chloromethane	ND		"	0.0500	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.0100	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.0100	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0500	"	"	"	"	"
Methylene Chloride	ND		"	0.0500	"	"	"	"	"
Tetrachloroethene	ND		"	0.0100	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.0100	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.0100	"	"	"	"	"
Trichloroethene	ND		"	0.0100	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.0100	"	"	"	"	"
Vinyl chloride	ND		"	0.0500	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*113 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*134 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*110 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*125 %*					"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA		Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-15 (DU5-VOC - Solid/Soil)						**Sampled: 06/29/07 14:26**		**Recvd: 07/02/07 12:35**	
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.00998	1	07/12/07 04:16	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.00998	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.00998	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.00998	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.00998	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.00998	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.00998	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.00998	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.00998	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
Bromodichloromethane	ND		"	0.00998	"	"	"	"	"
Bromoform	ND		"	0.00998	"	"	"	"	"
Bromomethane	ND		"	0.0998	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.00998	"	"	"	"	"
Chlorobenzene	ND		"	0.00998	"	"	"	"	"
Chlorodibromomethane	ND		"	0.00998	"	"	"	"	"
Chloroethane	ND		"	0.0499	"	"	"	"	"
Chloroform	ND		"	0.00998	"	"	"	"	"
Chloromethane	ND		"	0.0499	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.00998	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.00998	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0499	"	"	"	"	"
Methylene Chloride	ND		"	0.0499	"	"	"	"	"
Tetrachloroethene	ND		"	0.00998	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.00998	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.00998	"	"	"	"	"
Trichloroethene	ND		"	0.00998	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.00998	"	"	"	"	"
Vinyl chloride	ND		"	0.0499	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*125 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*139 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*112 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*142 %*					"	"	"	"

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THE LEADER IN ENVIRONMENTAL TESTING

99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-16 (DU6-VOC - Solid/Soil)					Sampled: 06/29/07 13:53		Recvd: 07/02/07 12:35		
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.00998	1	07/12/07 04:42	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.00998	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.00998	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.00998	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.00998	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.00998	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.00998	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.00998	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.00998	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.00998	"	"	"	"	"
Bromodichloromethane	ND		"	0.00998	"	"	"	"	"
Bromoform	ND		"	0.00998	"	"	"	"	"
Bromomethane	ND		"	0.0998	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.00998	"	"	"	"	"
Chlorobenzene	ND		"	0.00998	"	"	"	"	"
Chlorodibromomethane	ND		"	0.00998	"	"	"	"	"
Chloroethane	ND		"	0.0499	"	"	"	"	"
Chloroform	ND		"	0.00998	"	"	"	"	"
Chloromethane	ND		"	0.0499	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.00998	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.00998	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0499	"	"	"	"	"
Methylene Chloride	ND		"	0.0499	"	"	"	"	"
Tetrachloroethene	ND		"	0.00998	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.00998	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.00998	"	"	"	"	"
Trichloroethene	ND		"	0.00998	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.00998	"	"	"	"	"
Vinyl chloride	ND		"	0.0499	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*113 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*138 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*104 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*118 %*					"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-17 (DU7-VOC - Solid/Soil)					Sampled: 06/29/07 13:25		Recvd: 07/02/07 12:35		
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.00992	1	07/12/07 05:09	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.00992	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.00992	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.00992	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.00992	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.00992	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.00992	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.00992	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.00992	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.00992	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.00992	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.00992	"	"	"	"	"
Bromodichloromethane	ND		"	0.00992	"	"	"	"	"
Bromoform	ND		"	0.00992	"	"	"	"	"
Bromomethane	ND		"	0.0992	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.00992	"	"	"	"	"
Chlorobenzene	ND		"	0.00992	"	"	"	"	"
Chlorodibromomethane	ND		"	0.00992	"	"	"	"	"
Chloroethane	ND		"	0.0496	"	"	"	"	"
Chloroform	ND		"	0.00992	"	"	"	"	"
Chloromethane	ND		"	0.0496	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.00992	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.00992	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0496	"	"	"	"	"
Methylene Chloride	ND		"	0.0496	"	"	"	"	"
Tetrachloroethene	ND		"	0.00992	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.00992	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.00992	"	"	"	"	"
Trichloroethene	ND		"	0.00992	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.00992	"	"	"	"	"
Vinyl chloride	ND		"	0.0496	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*118 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*132 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*111 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*128 %*					"	"	"	"

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99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-18 (DU8-VOC - Solid/Soil)					**Sampled:**	**06/29/07 12:33**		**Recvd: 07/02/07 12:35**	
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.0100	1	07/12/07 05:36	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		"	0.0100	"	"	"	"	"
1,1,2-Trichloroethane	ND		"	0.0100	"	"	"	"	"
1,1-Dichloroethane	ND		"	0.0100	"	"	"	"	"
1,1-Dichloroethene	ND		"	0.0100	"	"	"	"	"
1,2-Dibromo-3-chloropropane	ND		"	0.0100	"	"	"	"	"
1,2-Dibromoethane (EDB)	ND		"	0.0100	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.0100	"	"	"	"	"
1,2-Dichloroethane	ND		"	0.0100	"	"	"	"	"
1,2-Dichloropropane	ND		"	0.0100	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.0100	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.0100	"	"	"	"	"
Bromodichloromethane	ND		"	0.0100	"	"	"	"	"
Bromoform	ND		"	0.0100	"	"	"	"	"
Bromomethane	ND		"	0.100	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.0100	"	"	"	"	"
Chlorobenzene	ND		"	0.0100	"	"	"	"	"
Chlorodibromomethane	ND		"	0.0100	"	"	"	"	"
Chloroethane	ND		"	0.0501	"	"	"	"	"
Chloroform	ND		"	0.0100	"	"	"	"	"
Chloromethane	ND		"	0.0501	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.0100	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.0100	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0501	"	"	"	"	"
Methylene Chloride	ND		"	0.0501	"	"	"	"	"
Tetrachloroethene	ND		"	0.0100	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.0100	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.0100	"	"	"	"	"
Trichloroethene	ND		"	0.0100	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.0100	"	"	"	"	"
Vinyl chloride	ND		"	0.0501	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (58.3-155%)	*113 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*130 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*108 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*117 %*					"	"	"	"

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99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-19 (Drum1 - Solid/Soil)					**Sampled:**	**06/29/07 19:07**		**Recvd: 07/02/07 12:35**	
Extractable Petroleum Hydrocarbons by 8015M									
DRO	ND		mg/kg	6.55	1	07/10/07 11:41	07/06/07	7G06006	SW8015M
RRO	ND		"	19.7	"	"	"	"	"
Surr: o-Terphenyl (34.7-135%)	*74 %*					"	"	"	"
Gasoline Range Organics/BTEX/MTBE by EPA 8015M/8260B									
Benzene	ND		mg/kg	0.00198	1	07/12/07 06:03	07/11/07	7G12011	SW8015B/8260B
Ethylbenzene	ND		"	0.00198	"	"	"	"	"
GRO	ND		"	0.495	"	"	"	"	"
m,p-Xylene	ND		"	0.00396	"	"	"	"	"
o-Xylene	ND		"	0.00198	"	"	"	"	"
Toluene	ND		"	0.00198	"	"	"	"	"
Surr: Toluene-d8 (88.2-117%)	*120 %*	Z5				"	"	"	"
Surr: Toluene-d8 (88.2-117%)	*120 %*	Z5				"	"	"	"
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0330	1	07/07/07 07:00	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	"	0.0660	"	"	"	"	"
Aroclor 1232	ND	C-01	"	0.0330	"	"	"	"	"
Aroclor 1242	ND	C-01	"	0.0330	"	"	"	"	"
Aroclor 1248	ND	C-01	"	0.0330	"	"	"	"	"
Aroclor 1254	ND	C-01	"	0.0330	"	"	"	"	"
Aroclor 1260	ND	C-01	"	0.0330	"	"	"	"	"
Surr: Decachlorobiphenyl (24-154%)	*113 %*	*C-01*				"	"	"	"
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.320	1	07/27/07 13:25	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		"	0.320	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.320	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.320	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.320	"	"	"	"	"
1-Chloronaphthalene	ND		"	0.320	"	"	"	"	"
1-Naphthylamine	ND		"	0.641	"	"	"	"	"
2,3,4,6-Tetrachlorophenol	ND		"	0.320	"	"	"	"	"
2,4,5-Trichlorophenol	ND		"	0.320	"	"	"	"	"
2,4,6-Trichlorophenol	ND		"	0.320	"	"	"	"	"
2,4-Dichlorophenol	ND		"	0.320	"	"	"	"	"
2,4-Dimethylphenol	ND		"	0.320	"	"	"	"	"
2,4-Dinitrophenol	ND		"	1.65	"	"	"	"	"
2,4-Dinitrotoluene	ND		"	0.641	"	"	"	"	"
2,6-Dichlorophenol	ND		"	0.320	"	"	"	"	"
2,6-Dinitrotoluene	ND		"	0.320	"	"	"	"	"
2-Chloronaphthalene	ND		"	0.320	"	"	"	"	"
2-Chlorophenol	ND		"	0.320	"	"	"	"	"
2-Methylnaphthalene	ND		"	0.320	"	"	"	"	"
2-Methylphenol (o-Cresol)	ND		"	0.320	"	"	"	"	"
2-Naphthylamine	ND		"	0.641	"	"	"	"	"
2-Nitroaniline	ND		"	1.65	"	"	"	"	"
2-Nitrophenol	ND		"	0.320	"	"	"	"	"
2-Picoline	ND		"	0.320	"	"	"	"	"

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99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-19 (Drum1 - Solid/Soil) - cont.					Sampled: 06/29/07 19:07		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
3,3'-Dichlorobenzidine	ND		-	0.320	-	-	-	-	-
3-Methylcholanthrene	ND		-	0.320	-	-	-	-	-
3-Nitroaniline	ND		-	1.65	-	-	-	-	-
4,6-Dinitro-2-methylphenol	ND		-	1.65	-	-	-	-	-
4-Aminobiphenyl	ND		-	0.641	-	-	-	-	-
4-Bromophenyl phenyl ether	ND		-	0.320	-	-	-	-	-
4-Chloro-3-methylphenol	ND		-	0.320	-	-	-	-	-
4-Chloroaniline	ND		-	0.320	-	-	-	-	-
4-Chlorophenyl phenyl ether	ND		-	0.320	-	-	-	-	-
4-Methylphenol (p-Cresol)	ND		-	0.320	-	-	-	-	-
4-Nitroaniline	ND		-	0.320	-	-	-	-	-
4-Nitrophenol	ND		-	1.65	-	-	-	-	-
7,12-Dimethylbenz (a) anthracene	ND		-	0.320	-	-	-	-	-
a,a-Dimethylphenethylamine	ND		-	1.65	-	-	-	-	-
Acenaphthene	ND		-	0.320	-	-	-	-	-
Acenaphthylene	ND		-	0.320	-	-	-	-	-
Acetophenone	ND		-	0.320	-	-	-	-	-
Aniline	ND		-	0.320	-	-	-	-	-
Anthracene	ND		-	0.320	-	-	-	-	-
Azobenzene	ND		-	0.320	-	-	-	-	-
Benzidine	ND		-	1.65	-	-	-	-	-
Benzo (a) anthracene	ND		-	0.320	-	-	-	-	-
Benzo (a) pyrene	ND		-	0.320	-	-	-	-	-
Benzo (b) fluoranthene	ND		-	0.320	-	-	-	-	-
Benzo (g,h,i) perylene	ND		-	0.320	-	-	-	-	-
Benzo (k) fluoranthene	ND		-	0.320	-	-	-	-	-
Benzoic acid	ND		-	1.65	-	-	-	-	-
Benzyl alcohol	ND		-	0.320	-	-	-	-	-
Bis(2-chloroethoxy)methane	ND		-	0.320	-	-	-	-	-
Bis(2-chloroethyl)ether	ND		-	0.320	-	-	-	-	-
Bis(2-chloroisopropyl) ether	ND		-	0.320	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	ND		-	0.320	-	-	-	-	-
Butyl benzyl phthalate	ND		-	0.320	-	-	-	-	-
Chrysene	ND		-	0.320	-	-	-	-	-
Dibenz (a,j) acridine	ND		-	0.320	-	-	-	-	-
Dibenzo (a,h) anthracene	ND		-	0.320	-	-	-	-	-
Dibenzofuran	ND		-	0.320	-	-	-	-	-
Diethyl phthalate	ND		-	0.320	-	-	-	-	-
Dimethyl phthalate	ND		-	0.320	-	-	-	-	-
Dimethylaminoazobenzene	ND		-	0.641	-	-	-	-	-
Di-n-butyl phthalate	ND		-	0.320	-	-	-	-	-
Di-n-octyl phthalate	ND		-	0.320	-	-	-	-	-
Ethyl Methanesulfonate	ND		-	0.320	-	-	-	-	-
Fluoranthene	ND		-	0.320	-	-	-	-	-
Fluorene	ND		-	0.320	-	-	-	-	-
Hexachlorobenzene	ND		-	0.320	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.320	-	-	-	-	-

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99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-19 (Drum1 - Solid/Soil) - cont.					Sampled: 06/29/07 19:07		Recvd: 07/02/07 12:35		
Semivolatile Organics by GC/MS - cont.									
Hexachlorocyclopentadiene	ND		-	0.320	-	-	-	-	-
Hexachloroethane	ND		-	0.320	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.320	-	-	-	-	-
Isophorone	ND		-	0.320	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.641	-	-	-	-	-
Naphthalene	ND		-	0.320	-	-	-	-	-
Nitrobenzene	ND		-	0.320	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.320	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.320	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.320	-	-	-	-	-
Pentachlorophenol	ND		-	1.65	-	-	-	-	-
Phenacetin	ND		-	0.320	-	-	-	-	-
Phenanthrene	ND		-	0.320	-	-	-	-	-
Phenol	ND		-	0.320	-	-	-	-	-
Pronamide	ND		-	0.320	-	-	-	-	-
Pyrene	ND		-	0.320	-	-	-	-	-
Pyridine	ND		-	0.320	-	-	-	-	-
Surr: 2,4,6-Tribromophenol (52.6-114%)	*88 %*					-	-	-	-
Surr: 2-Fluorobiphenyl (45.9-108%)	*84 %*					-	-	-	-
Surr: 2-Fluorophenol (39.4-103%)	*73 %*					-	-	-	-
Surr: Nitrobenzene-d5 (37.2-107%)	*58 %*					-	-	-	-
Surr: Phenol-d6 (49.6-105%)	*70 %*					-	-	-	-
Surr: Terphenyl-d14 (45.7-133%)	*107 %*					-	-	-	-
Total Metals by SW 846 Series Methods									
Arsenic	ND		mg/kg	4.50	1	07/17/07 14:43	07/16/07	7G16005	SW6010B
Barium	107		-	9.01	-	-	-	-	-
Cadmium	3.88		-	1.80	-	-	-	-	-
Chromium	240		-	4.50	-	-	-	-	-
Lead	60.8		-	9.01	-	-	-	-	-
Mercury	ND		-	0.0192	-	07/11/07 19:04	07/11/07	7G11013	SW7471
Selenium	ND		-	9.01	-	07/17/07 14:43	07/16/07	7G16005	SW6010B
Silver	ND		-	4.50	-	-	-	-	-
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.00990	1	07/12/07 06:03	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		-	0.00990	-	-	-	-	-
1,1,2-Trichloroethane	ND		-	0.00990	-	-	-	-	-
1,1-Dichloroethane	ND		-	0.00990	-	-	-	-	-
1,1-Dichloroethene	ND		-	0.00990	-	-	-	-	-
1,2-Dibromo-3-chloropropane	ND		-	0.00990	-	-	-	-	-
1,2-Dibromoethane (EDB)	ND		-	0.00990	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.00990	-	-	-	-	-
1,2-Dichloroethane	ND		-	0.00990	-	-	-	-	-
1,2-Dichloropropane	ND		-	0.00990	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-19 (Drum1 - Solid/Soil) - cont.						Sampled: 06/29/07 19:07		Recvd: 07/02/07 12:35	
Volatile Organic Compounds by EPA 8260B - cont.									
1,3-Dichlorobenzene	ND		"	0.00990	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.00990	"	"	"	"	"
Bromodichloromethane	ND		"	0.00990	"	"	"	"	"
Bromoform	ND		"	0.00990	"	"	"	"	"
Bromomethane	ND		"	0.0990	"	"	"	"	"
Carbon Tetrachloride	ND		"	0.00990	"	"	"	"	"
Chlorobenzene	ND		"	0.00990	"	"	"	"	"
Chlorodibromomethane	ND		"	0.00990	"	"	"	"	"
Chloroethane	ND		"	0.0495	"	"	"	"	"
Chloroform	ND		"	0.00990	"	"	"	"	"
Chloromethane	ND		"	0.0495	"	"	"	"	"
cis-1,2-Dichloroethene	ND		"	0.00990	"	"	"	"	"
cis-1,3-Dichloropropene	ND		"	0.00990	"	"	"	"	"
Dichlorodifluoromethane	ND		"	0.0495	"	"	"	"	"
Methylene Chloride	ND		"	0.0495	"	"	"	"	"
Tetrachloroethene	ND		"	0.00990	"	"	"	"	"
trans-1,2-Dichloroethene	ND		"	0.00990	"	"	"	"	"
trans-1,3-Dichloropropene	ND		"	0.00990	"	"	"	"	"
Trichloroethene	ND		"	0.00990	"	"	"	"	"
Trichlorofluoromethane	ND		"	0.00990	"	"	"	"	"
Vinyl chloride	ND		"	0.0495	"	"	"	"	"
Surr: 1,2-Dichloroethane-d4 (55.3-156%)	*107 %*					"	"	"	"
Surr: 4-Bromofluorobenzene (72.1-156%)	*129 %*					"	"	"	"
Surr: Dibromofluoromethane (63.2-149%)	*103 %*					"	"	"	"
Surr: Toluene-d8 (70.5-145%)	*120 %*					"	"	"	"
Sample ID: HQG0016-20 (Drum2 - Solid/Soil)						Sampled: 06/29/07 19:07		Recvd: 07/02/07 12:35	
Extractable Petroleum Hydrocarbons by 8015M									
DRO	ND		mg/kg	6.66	1	07/10/07 12:00	07/06/07	7G06006	SW8015M
RRO	21.9		"	20.0	"	"	"	"	"
Surr: o-Terphenyl (34.7-135%)	*88 %*					"	"	"	"
Gasoline Range Organics/BTEX/MTBE by EPA 8015M/8260B									
Benzene	ND		mg/kg	0.00195	1	07/12/07 06:29	07/11/07	7G12011	SW8015B/8260B
Ethylbenzene	ND		"	0.00195	"	"	"	"	"
GRO	ND		"	0.488	"	"	"	"	"
m,p-Xylene	ND		"	0.00391	"	"	"	"	"
o-Xylene	ND		"	0.00195	"	"	"	"	"
Toluene	ND		"	0.00195	"	"	"	"	"
Surr: Toluene-d8 (58.2-117%)	*132 %*	Z5				"	"	"	"
Surr: Toluene-d8 (88.2-117%)	*132 %*	Z5				"	"	"	"
Polychlorinated Biphenyls by EPA Method 8082									
Aroclor 1016	ND	C-01	mg/kg	0.0333	1	07/07/07 07:27	07/05/07	7G05005	SW8082
Aroclor 1221	ND	C-01	"	0.0667	"	"	"	"	"
Aroclor 1232	ND	C-01	"	0.0333	"	"	"	"	"
Aroclor 1242	ND	C-01	"	0.0333	"	"	"	"	"
Aroclor 1248	ND	C-01	"	0.0333	"	"	"	"	"

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-20 (Drum2 - Solid/Soil) - cont.						Sampled: 06/29/07 19:07		Recvd: 07/02/07 12:35	
Polychlorinated Biphenyls by EPA Method 8082 - cont.									
Aroclor 1254	ND	C-01	"	0.0333	"	"	"	"	"
Aroclor 1260	ND	C-01	"	0.0333	"	"	"	"	"
Surr: Decachlorobiphenyl (24-154%)	*109 %*	*C-01*				"	"	"	"
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	0.322	1	07/30/07 09:48	07/11/07	7G11004	SW8270C
1,2,4-Trichlorobenzene	ND		"	0.322	"	"	"	"	"
1,2-Dichlorobenzene	ND		"	0.322	"	"	"	"	"
1,3-Dichlorobenzene	ND		"	0.322	"	"	"	"	"
1,4-Dichlorobenzene	ND		"	0.322	"	"	"	"	"
1-Chloronaphthalene	ND		"	0.322	"	"	"	"	"
1-Naphthylamine	ND		"	0.645	"	"	"	"	"
2,3,4,6-Tetrachlorophenol	ND		"	0.322	"	"	"	"	"
2,4,5-Trichlorophenol	ND		"	0.322	"	"	"	"	"
2,4,6-Trichlorophenol	ND		"	0.322	"	"	"	"	"
2,4-Dichlorophenol	ND		"	0.322	"	"	"	"	"
2,4-Dimethylphenol	ND		"	0.322	"	"	"	"	"
2,4-Dinitrophenol	ND		"	1.66	"	"	"	"	"
2,4-Dinitrotoluene	ND		"	0.645	"	"	"	"	"
2,6-Dichlorophenol	ND		"	0.322	"	"	"	"	"
2,6-Dinitrotoluene	ND		"	0.322	"	"	"	"	"
2-Chloronaphthalene	ND		"	0.322	"	"	"	"	"
2-Chlorophenol	ND		"	0.322	"	"	"	"	"
2-Methylnaphthalene	ND		"	0.322	"	"	"	"	"
2-Methylphenol (o-Cresol)	ND		"	0.322	"	"	"	"	"
2-Naphthylamine	ND		"	0.645	"	"	"	"	"
2-Nitroaniline	ND		"	1.66	"	"	"	"	"
2-Nitrophenol	ND		"	0.322	"	"	"	"	"
2-Picoline	ND		"	0.322	"	"	"	"	"
3,3'-Dichlorobenzidine	ND		"	0.322	"	"	"	"	"
3-Methylcholanthrene	ND		"	0.322	"	"	"	"	"
3-Nitroaniline	ND		"	1.66	"	"	"	"	"
4,6-Dinitro-2-methylphenol	ND		"	1.66	"	"	"	"	"
4-Aminobiphenyl	ND		"	0.645	"	"	"	"	"
4-Bromophenyl phenyl ether	ND		"	0.322	"	"	"	"	"
4-Chloro-3-methylphenol	ND		"	0.322	"	"	"	"	"
4-Chloroaniline	ND		"	0.322	"	"	"	"	"
4-Chlorophenyl phenyl ether	ND		"	0.322	"	"	"	"	"
4-Methylphenol (p-Cresol)	ND		"	0.322	"	"	"	"	"
4-Nitroaniline	ND		"	0.322	"	"	"	"	"
4-Nitrophenol	ND		"	1.66	"	"	"	"	"
7,12-Dimethylbenz (a) anthracene	ND		"	0.322	"	"	"	"	"
a,a-Dimethylphenethylamine	ND		"	1.66	"	"	"	"	"
Acenaphthene	ND		"	0.322	"	"	"	"	"
Acenaphthylene	ND		"	0.322	"	"	"	"	"
Acetophenone	ND		"	0.322	"	"	"	"	"
Aniline	ND		"	0.322	"	"	"	"	"
Anthracene	ND		"	0.322	"	"	"	"	"

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Sample ID: HQG0016-20 (Drum2 - Solid/Soil) - cont. Sampled: 06/29/07 19:07 Recvd: 07/02/07 12:35

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Semivolatile Organics by GC/MS - cont.									
Azobenzene	ND		-	0.322	-	-	-	-	-
Benzidine	ND		-	1.66	-	-	-	-	-
Benzo (a) anthracene	ND		-	0.322	-	-	-	-	-
Benzo (a) pyrene	ND		-	0.322	-	-	-	-	-
Benzo (b) fluoranthene	ND		-	0.322	-	-	-	-	-
Benzo (g,h,i) perylene	ND		-	0.322	-	-	-	-	-
Benzo (k) fluoranthene	ND		-	0.322	-	-	-	-	-
Benzoic acid	ND		-	1.66	-	-	-	-	-
Benzyl alcohol	ND		-	0.322	-	-	-	-	-
Bis(2-chloroethoxy)methane	ND		-	0.322	-	-	-	-	-
Bis(2-chloroethyl)ether	ND		-	0.322	-	-	-	-	-
Bis(2-chloroisopropyl) ether	ND		-	0.322	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	ND		-	0.322	-	-	-	-	-
Butyl benzyl phthalate	ND		-	0.322	-	-	-	-	-
Chrysene	ND		-	0.322	-	-	-	-	-
Dibenz (a,j) acridine	ND		-	0.322	-	-	-	-	-
Dibenzo (a,h) anthracene	ND		-	0.322	-	-	-	-	-
Dibenzofuran	ND		-	0.322	-	-	-	-	-
Diethyl phthalate	ND		-	0.322	-	-	-	-	-
Dimethyl phthalate	ND		-	0.322	-	-	-	-	-
Dimethylaminoazobenzene	ND		-	0.645	-	-	-	-	-
Di-n-butyl phthalate	ND		-	0.322	-	-	-	-	-
Di-n-octyl phthalate	ND		-	0.322	-	-	-	-	-
Ethyl Methanesulfonate	ND		-	0.322	-	-	-	-	-
Fluoranthene	ND		-	0.322	-	-	-	-	-
Fluorene	ND		-	0.322	-	-	-	-	-
Hexachlorobenzene	ND		-	0.322	-	-	-	-	-
Hexachlorobutadiene	ND		-	0.322	-	-	-	-	-
Hexachlorocyclopentadiene	ND		-	0.322	-	-	-	-	-
Hexachloroethane	ND		-	0.322	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND		-	0.322	-	-	-	-	-
Isophorone	ND		-	0.322	-	-	-	-	-
Methyl Methanesulfonate	ND		-	0.645	-	-	-	-	-
Naphthalene	ND		-	0.322	-	-	-	-	-
Nitrobenzene	ND		-	0.322	-	-	-	-	-
N-Nitrosodimethylamine	ND		-	0.322	-	-	-	-	-
N-Nitrosodi-n-butylamine	ND		-	0.322	-	-	-	-	-
N-Nitrosodi-n-propylamine	ND		-	0.322	-	-	-	-	-
N-Nitrosodiphenylamine	ND		-	0.322	-	-	-	-	-
N-Nitrosopiperidine	ND		-	0.322	-	-	-	-	-
Pentachloronitrobenzene	ND		-	0.322	-	-	-	-	-
Pentachlorophenol	ND		-	1.66	-	-	-	-	-
Phenacetin	ND		-	0.322	-	-	-	-	-
Phenanthrene	ND		-	0.322	-	-	-	-	-
Phenol	ND		-	0.322	-	-	-	-	-
Pronamide	ND		-	0.322	-	-	-	-	-
Pyrene	ND		-	0.322	-	-	-	-	-

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

ANALYTICAL REPORT

Sample ID: HQG0016-20 (Drum2 - Solid/Soil) - cont. Sampled: 06/29/07 19:07 Recvd: 07/02/07 12:35

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Semivolatile Organics by GC/MS - cont.									
Pyridine	ND		-	0.322	-	-	-	-	-
Surr: 2,4,6-Tribromophenol (52.6-114%)	*58 %*					-	-	-	-
Surr: 2-Fluorobiphenyl (45.9-108%)	*72 %*					-	-	-	-
Surr: 2-Fluorophenol (39.4-103%)	*54 %*					-	-	-	-
Surr: Nitrobenzene-d5 (37.2-107%)	*74 %*					-	-	-	-
Surr: Phenol-d6 (49.6-105%)	*42 %*	Z				-	-	-	-
Surr: Terphenyl-d14 (45.7-133%)	*107 %*					-	-	-	-
Total Metals by SW 846 Series Methods									
Arsenic	ND		mg/kg	4.55	1	07/17/07 14:47	07/16/07	7G16005	SW6010B
Barium	95.3		-	9.09	-	-	-	-	-
Cadmium	2.26		-	1.82	-	-	-	-	-
Chromium	171		-	4.55	-	-	-	-	-
Lead	124		-	9.09	-	-	-	-	-
Mercury	0.0511		-	0.0181	-	07/11/07 19:06	07/11/07	7G11013	SW7471
Selenium	ND		-	9.09	-	07/17/07 14:47	07/16/07	7G16005	SW6010B
Silver	ND		-	4.55	-	-	-	-	-
Volatile Organic Compounds by EPA 8260B									
1,1,1-Trichloroethane	ND		mg/kg	0.00977	1	07/12/07 06:29	07/11/07	7G12011	SW8260B
1,1,2,2-Tetrachloroethane	ND		-	0.00977	-	-	-	-	-
1,1,2-Trichloroethane	ND		-	0.00977	-	-	-	-	-
1,1-Dichloroethane	ND		-	0.00977	-	-	-	-	-
1,1-Dichloroethene	ND		-	0.00977	-	-	-	-	-
1,2-Dibromo-3-chloropropane	ND		-	0.00977	-	-	-	-	-
1,2-Dibromoethane (EDB)	ND		-	0.00977	-	-	-	-	-
1,2-Dichlorobenzene	ND		-	0.00977	-	-	-	-	-
1,2-Dichloroethane	ND		-	0.00977	-	-	-	-	-
1,2-Dichloropropane	ND		-	0.00977	-	-	-	-	-
1,3-Dichlorobenzene	ND		-	0.00977	-	-	-	-	-
1,4-Dichlorobenzene	ND		-	0.00977	-	-	-	-	-
Bromodichloromethane	ND		-	0.00977	-	-	-	-	-
Bromoform	ND		-	0.00977	-	-	-	-	-
Bromomethane	ND		-	0.0977	-	-	-	-	-
Carbon Tetrachloride	ND		-	0.00977	-	-	-	-	-
Chlorobenzene	ND		-	0.00977	-	-	-	-	-
Chlorodibromomethane	ND		-	0.00977	-	-	-	-	-
Chloroethane	ND		-	0.0488	-	-	-	-	-
Chloroform	ND		-	0.00977	-	-	-	-	-
Chloromethane	ND		-	0.0488	-	-	-	-	-
cis-1,2-Dichloroethene	ND		-	0.00977	-	-	-	-	-
cis-1,3-Dichloropropene	ND		-	0.00977	-	-	-	-	-
Dichlorodifluoromethane	ND		-	0.0488	-	-	-	-	-
Methylene Chloride	ND		-	0.0488	-	-	-	-	-
Tetrachloroethene	ND		-	0.00977	-	-	-	-	-
trans-1,2-Dichloroethene	ND		-	0.00977	-	-	-	-	-
trans-1,3-Dichloropropene	ND		-	0.00977	-	-	-	-	-
Trichloroethene	ND		-	0.00977	-	-	-	-	-

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA		Received: 07/02/07 Reported: 08/08/07 09:34

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Rpt Limit	Dilution	Date Analyzed	Prep Date	Seq/ Batch	Method
Sample ID: HQG0016-20 (Drum2 - Solid/Soil) - cont.					Sampled: 06/29/07 19:07		Recvd: 07/02/07 12:35		
Volatile Organic Compounds by EPA 8260B - cont.									
Trichlorofluoromethane	ND		-	0.00977	-	-	-	-	-
Vinyl chloride	ND		-	0.0488	-	-	-	-	-
Surr: 1,2-Dichloroethane-d4 (58.3-156%)	*114 %*					-	-	-	-
Surr: 4-Bromofluorobenzene (72.1-156%)	*151 %*					-	-	-	-
Surr: Dibromofluoromethane (63.2-149%)	*107 %*					-	-	-	-
Surr: Toluene-d8 (70.5-145%)	*132 %*					-	-	-	-

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THE LEADER IN ENVIRONMENTAL TESTING

99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA		Received: 07/02/07 Reported: 08/08/07 09:34

LABORATORY BLANK QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Extractable Petroleum Hydrocarbons by 8015M													
Batch\Seq: 7G06006 Extracted: 07/06/07													
Blank Analyzed: 07/10/2007 (7G06006-BLK1)													
DRO			mg/kg	N/A	6.66	ND							
RRO			mg/kg	N/A	20.0	ND							
Surrogate: o-Terphenyl			mg/kg					*72*		*34.7-135*			
Gasoline Range Organics/BTEX/MTBE by EPA 8015M/8260B													
Batch\Seq: 7G12011 Extracted: 07/11/07													
Blank Analyzed: 07/11/2007 (7G12011-BLK1)													
Benzene			mg/kg	N/A	0.00200	ND							
Ethylbenzene			mg/kg	N/A	0.00200	ND							
GRO			mg/kg	N/A	0.500	ND							
m,p-Xylene			mg/kg	N/A	0.00400	ND							
o-Xylene			mg/kg	N/A	0.00200	ND							
Toluene			mg/kg	N/A	0.00200	ND							
Surrogate: Toluene-d8			mg/kg					*107*		*88.2-117*			
Surrogate: Toluene-d8			mg/kg					*107*		*88.2-117*			
Polychlorinated Biphenyls by EPA Method 8082													
Batch\Seq: 7G05005 Extracted: 07/05/07													
Blank Analyzed: 07/06/2007 (7G05005-BLK1)													
Aroclor 1016			mg/kg	N/A	0.0333	ND							C-01
Aroclor 1221			mg/kg	N/A	0.0667	ND							C-01
Aroclor 1232			mg/kg	N/A	0.0333	ND							C-01
Aroclor 1242			mg/kg	N/A	0.0333	ND							C-01
Aroclor 1248			mg/kg	N/A	0.0333	ND							C-01
Aroclor 1254			mg/kg	N/A	0.0333	ND							C-01
Aroclor 1260			mg/kg	N/A	0.0333	ND							C-01
Aroclor 1262			mg/kg	N/A	0.0333	ND							C-01
Aroclor 1268			mg/kg	N/A	0.0333	ND							C-01
Surrogate: Decachlorobiphenyl			mg/kg					*103*		*24-154*			C-01
Blank Analyzed: 07/09/2007 (7G05005-BLK2)													
Aroclor 1016			mg/kg	N/A	0.0333	ND							C-02,C-01
Aroclor 1221			mg/kg	N/A	0.0667	ND							C-02,C-01
Aroclor 1232			mg/kg	N/A	0.0333	ND							C-02,C-01
Aroclor 1242			mg/kg	N/A	0.0333	ND							C-02,C-01
Aroclor 1248			mg/kg	N/A	0.0333	ND							C-02,C-01
Aroclor 1254			mg/kg	N/A	0.0333	ND							C-02,C-01
Aroclor 1260			mg/kg	N/A	0.0333	ND							C-02,C-01
Aroclor 1262			mg/kg	N/A	0.0333	ND							C-02,C-01
Surrogate: Decachlorobiphenyl			mg/kg					*87*		*24-154*			C-02,C-01
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
Blank Analyzed: 07/26/2007 (7G11004-BLK1)													
1,2,4,5-Tetrachlorobenzene			mg/kg	N/A	0.330	ND							
1,2,4-Trichlorobenzene			mg/kg	N/A	0.330	ND							
1,2-Dichlorobenzene			mg/kg	N/A	0.330	ND							

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

LABORATORY BLANK QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
Blank Analyzed: 07/26/2007 (7G11004-BLK1)													
1,3-Dichlorobenzene			mg/kg	N/A	0.330	ND							
1,4-Dichlorobenzene			mg/kg	N/A	0.330	ND							
1-Chloronaphthalene			mg/kg	N/A	0.330	ND							
1-Naphthylamine			mg/kg	N/A	0.660	ND							
2,3,4,6-Tetrachlorophenol			mg/kg	N/A	0.330	ND							
2,4,5-Trichlorophenol			mg/kg	N/A	0.330	ND							
2,4,6-Trichlorophenol			mg/kg	N/A	0.330	ND							
2,4-Dichlorophenol			mg/kg	N/A	0.330	ND							
2,4-Dimethylphenol			mg/kg	N/A	0.330	ND							
2,4-Dinitrophenol			mg/kg	N/A	1.70	ND							
2,4-Dinitrotoluene			mg/kg	N/A	0.660	ND							
2,6-Dichlorophenol			mg/kg	N/A	0.330	ND							
2,6-Dinitrotoluene			mg/kg	N/A	0.330	ND							
2-Chloronaphthalene			mg/kg	N/A	0.330	ND							
2-Chlorophenol			mg/kg	N/A	0.330	ND							
2-Methylnaphthalene			mg/kg	N/A	0.330	ND							
2-Methylphenol (o-Cresol)			mg/kg	N/A	0.330	ND							
2-Naphthylamine			mg/kg	N/A	0.660	ND							
2-Nitroaniline			mg/kg	N/A	1.70	ND							
2-Nitrophenol			mg/kg	N/A	0.330	ND							
2-Picoline			mg/kg	N/A	0.330	ND							
3,3'-Dichlorobenzidine			mg/kg	N/A	0.330	ND							
3-Methylcholanthrene			mg/kg	N/A	0.330	ND							
3-Nitroaniline			mg/kg	N/A	1.70	ND							
4,6-Dinitro-2-methylphenol			mg/kg	N/A	1.70	ND							
4-Aminobiphenyl			mg/kg	N/A	0.660	ND							
4-Bromophenyl phenyl ether			mg/kg	N/A	0.330	ND							
4-Chloro-3-methylphenol			mg/kg	N/A	0.330	ND							
4-Chloroaniline			mg/kg	N/A	0.330	ND							
4-Chlorophenyl phenyl ether			mg/kg	N/A	0.330	ND							
4-Methylphenol (p-Cresol)			mg/kg	N/A	0.330	ND							
4-Nitroaniline			mg/kg	N/A	0.330	ND							
4-Nitrophenol			mg/kg	N/A	1.70	ND							
7,12-Dimethylbenz (a) anthracene			mg/kg	N/A	0.330	ND							
a,a-Dimethylphenethylamine			mg/kg	N/A	1.70	ND							
Acenaphthene			mg/kg	N/A	0.330	ND							
Acenaphthylene			mg/kg	N/A	0.330	ND							
Acetophenone			mg/kg	N/A	0.330	ND							
Aniline			mg/kg	N/A	0.330	ND							
Anthracene			mg/kg	N/A	0.330	ND							
Azobenzene			mg/kg	N/A	0.330	ND							
Benzidine			mg/kg	N/A	1.70	ND							
Benzo (a) anthracene			mg/kg	N/A	0.330	ND							
Benzo (a) pyrene			mg/kg	N/A	0.330	ND							
Benzo (b) fluoranthene			mg/kg	N/A	0.330	ND							
Benzo (g,h,i) perylene			mg/kg	N/A	0.330	ND							

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

LABORATORY BLANK QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
Blank Analyzed: 07/26/2007 (7G11004-BLK1)													
Benzo (k) fluoranthene			mg/kg	N/A	0.330	ND							
Benzoic acid			mg/kg	N/A	1.70	ND							
Benzyl alcohol			mg/kg	N/A	0.330	ND							
Bis(2-chloroethoxy)methane			mg/kg	N/A	0.330	ND							
Bis(2-chloroethyl)ether			mg/kg	N/A	0.330	ND							
Bis(2-chloroisopropyl) ether			mg/kg	N/A	0.330	ND							
Bis(2-ethylhexyl)phthalate			mg/kg	N/A	0.330	ND							
Butyl benzyl phthalate			mg/kg	N/A	0.330	ND							
Chrysene			mg/kg	N/A	0.330	ND							
Dibenz (a,j) acridine			mg/kg	N/A	0.330	ND							
Dibenzo (a,h) anthracene			mg/kg	N/A	0.330	ND							
Dibenzofuran			mg/kg	N/A	0.330	ND							
Diethyl phthalate			mg/kg	N/A	0.330	ND							
Dimethyl phthalate			mg/kg	N/A	0.330	ND							
Dimethylaminoazobenzene			mg/kg	N/A	0.660	ND							
Di-n-butyl phthalate			mg/kg	N/A	0.330	ND							
Di-n-octyl phthalate			mg/kg	N/A	0.330	ND							
Ethyl Methanesulfonate			mg/kg	N/A	0.330	ND							
Fluoranthene			mg/kg	N/A	0.330	ND							
Fluorene			mg/kg	N/A	0.330	ND							
Hexachlorobenzene			mg/kg	N/A	0.330	ND							
Hexachlorobutadiene			mg/kg	N/A	0.330	ND							
Hexachlorocyclopentadiene			mg/kg	N/A	0.330	ND							
Hexachloroethane			mg/kg	N/A	0.330	ND							
Indeno (1,2,3-cd) pyrene			mg/kg	N/A	0.330	ND							
Isophorone			mg/kg	N/A	0.330	ND							
Methyl Methanesulfonate			mg/kg	N/A	0.660	ND							
Naphthalene			mg/kg	N/A	0.330	ND							
Nitrobenzene			mg/kg	N/A	0.330	ND							
N-Nitrosodimethylamine			mg/kg	N/A	0.330	ND							
N-Nitrosodi-n-butylamine			mg/kg	N/A	0.330	ND							
N-Nitrosodi-n-propylamine			mg/kg	N/A	0.330	ND							
N-Nitrosodiphenylamine			mg/kg	N/A	0.330	ND							
N-Nitrosopiperidine			mg/kg	N/A	0.330	ND							
Pentachloronitrobenzene			mg/kg	N/A	0.330	ND							
Pentachlorophenol			mg/kg	N/A	1.70	ND							
Phenacetin			mg/kg	N/A	0.330	ND							
Phenanthrene			mg/kg	N/A	0.330	ND							
Phenol			mg/kg	N/A	0.330	ND							
Pronamide			mg/kg	N/A	0.330	ND							
Pyrene			mg/kg	N/A	0.330	ND							
Pyridine			mg/kg	N/A	0.330	ND							
Surrogate: 2,4,6-Tribromophenol			*mg/kg*					*60*		*52.6-114*			
Surrogate: 2-Fluorobiphenyl			*mg/kg*					*71*		*45.9-105*			
Surrogate: 2-Fluorophenol			*mg/kg*					*63*		*39.4-103*			
Surrogate: Nitrobenzene-d5			*mg/kg*					*73*		*37.2-107*			

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Element Environmental LLC	Work Order:	HQG0016		Received:	07/02/07
62-180 Emerson Rd.				Reported:	08/08/07 09:34
Haleiwa, HI 96712	Project:	Maalea			
Matt Neal	Project Number:	Maalaea Phase II ESA			

LABORATORY BLANK QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
Blank Analyzed: 07/26/2007 (7G11004-BLK1)													
Surrogate: Phenol-d6			mg/kg					*63*		*49.6-105*			
Surrogate: Terphenyl-d14			mg/kg					*94*		*45.7-133*			
Total Metals by SW 846 Series Methods													
Batch\Seq: 7G10005 Extracted: 07/10/07													
Blank Analyzed: 07/20/2007 (7G10005-BLK1)													
Arsenic			mg/kg	N/A	1.00	ND							
Lead			mg/kg	N/A	2.00	ND							
Batch\Seq: 7G11013 Extracted: 07/11/07													
Blank Analyzed: 07/11/2007 (7G11013-BLK1)													
Mercury			mg/kg	N/A	0.0200	ND							
Batch\Seq: 7G16005 Extracted: 07/16/07													
Blank Analyzed: 07/17/2007 (7G16005-BLK1)													
Arsenic			mg/kg	N/A	5.00	ND							
Barium			mg/kg	N/A	10.0	ND							
Cadmium			mg/kg	N/A	2.00	ND							
Chromium			mg/kg	N/A	5.00	ND							
Lead			mg/kg	N/A	10.0	ND							
Selenium			mg/kg	N/A	10.0	ND							
Silver			mg/kg	N/A	5.00	ND							
Volatile Organic Compounds by EPA 8260B													
Batch\Seq: 7G12011 Extracted: 07/11/07													
Blank Analyzed: 07/11/2007 (7G12011-BLK1)													
1,1,1-Trichloroethane			mg/kg	N/A	0.0100	ND							
1,1,2,2-Tetrachloroethane			mg/kg	N/A	0.0100	ND							
1,1,2-Trichloroethane			mg/kg	N/A	0.0100	ND							
1,1-Dichloroethane			mg/kg	N/A	0.0100	ND							
1,1-Dichloroethene			mg/kg	N/A	0.0100	ND							
1,2-Dibromo-3-chloropropane			mg/kg	N/A	0.0100	ND							
1,2-Dibromoethane (EDB)			mg/kg	N/A	0.0100	ND							
1,2-Dichlorobenzene			mg/kg	N/A	0.0100	ND							
1,2-Dichloroethane			mg/kg	N/A	0.0100	ND							
1,2-Dichloropropane			mg/kg	N/A	0.0100	ND							
1,3-Dichlorobenzene			mg/kg	N/A	0.0100	ND							
1,4-Dichlorobenzene			mg/kg	N/A	0.0100	ND							
Bromodichloromethane			mg/kg	N/A	0.0100	ND							
Bromoform			mg/kg	N/A	0.0100	ND							
Bromomethane			mg/kg	N/A	0.100	ND							
Carbon Tetrachloride			mg/kg	N/A	0.0100	ND							
Chlorobenzene			mg/kg	N/A	0.0100	ND							
Chlorodibromomethane			mg/kg	N/A	0.0100	ND							
Chloroethane			mg/kg	N/A	0.0500	ND							
Chloroform			mg/kg	N/A	0.0100	ND							
Chloromethane			mg/kg	N/A	0.0500	ND							

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Element Environmental LLC	Work Order:	HQG0016		Received:	07/02/07
62-180 Emerson Rd.				Reported:	08/08/07 09:34
Haleiwa, HI 96712	Project:	Maalea			
Matt Neal	Project Number:	Maalaea Phase II ESA			

LABORATORY BLANK QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Volatile Organic Compounds by EPA 8260B													
Batch\Seq: 7G12011 Extracted: 07/11/07													
Blank Analyzed: 07/11/2007 (7G12011-BLK1)													
cis-1,2-Dichloroethene			mg/kg	N/A	0.0100	ND							
cis-1,3-Dichloropropene			mg/kg	N/A	0.0100	ND							
Dichlorodifluoromethane			mg/kg	N/A	0.0500	ND							
Methylene Chloride			mg/kg	N/A	0.0500	ND							
Tetrachloroethene			mg/kg	N/A	0.0100	ND							
trans-1,2-Dichloroethene			mg/kg	N/A	0.0100	ND							
trans-1,3-Dichloropropene			mg/kg	N/A	0.0100	ND							
Trichloroethene			mg/kg	N/A	0.0100	ND							
Trichlorofluoromethane			mg/kg	N/A	0.0100	ND							
Vinyl chloride			mg/kg	N/A	0.0500	ND							
Surrogate: 1,2-Dichloroethane-d4			mg/kg					*97*		*58.3-156*			
Surrogate: 4-Bromofluorobenzene			mg/kg					*106*		*72.1-156*			
Surrogate: Dibromofluoromethane			mg/kg					*96*		*63.2-140*			
Surrogate: Toluene-d8			mg/kg					*107*		*70.5-145*			

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

LABORATORY DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Polychlorinated Biphenyls by EPA Method 8082												
Batch\Seq: 7G05005 Extracted: 07/05/07												
Duplicate Analyzed: 07/06/2007 (7G05005-DUP1)				QC Source Sample: HQG0016-01								
Aroclor 1016	ND		mg/kg	N/A	0.0319	ND					30	C-01
Aroclor 1221	ND		mg/kg	N/A	0.0639	ND					30	C-01
Aroclor 1232	ND		mg/kg	N/A	0.0319	ND					30	C-01
Aroclor 1242	ND		mg/kg	N/A	0.0319	ND					30	C-01
Aroclor 1248	ND		mg/kg	N/A	0.0319	ND					30	C-01
Aroclor 1254	ND		mg/kg	N/A	0.0319	ND					30	C-01
Aroclor 1260	ND		mg/kg	N/A	0.0319	ND					30	C-01
Aroclor 1262	ND		mg/kg	N/A	0.0319	ND					0	C-01
Aroclor 1268	ND		mg/kg	N/A	0.0319	ND					0	C-01
Surrogate: Decachlorobiphenyl			mg/kg				*111*		*24-154*			C-01
Duplicate Analyzed: 07/06/2007-07/09/2007 (7G05005-DUP1)				QC Source Sample: HQG0009-01								
Aroclor 1016	3.25		mg/kg	N/A	0.645	2.79				15	30	C-01
Aroclor 1221	ND		mg/kg	N/A	1.29	ND					30	C-01
Aroclor 1232	ND		mg/kg	N/A	0.645	ND					30	C-01
Aroclor 1242	ND		mg/kg	N/A	0.645	ND					30	C-01
Aroclor 1248	4.55		mg/kg	N/A	0.645	3.41				29	30	C-01
Aroclor 1254	7.05		mg/kg	N/A	0.645	1.84				117	30	C-01
Aroclor 1260	4.08		mg/kg	N/A	0.645	3.11				27	30	C-01
Aroclor 1262	ND		mg/kg	N/A	0.645	ND					0	C-01
Aroclor 1268	ND		mg/kg	N/A	0.645	ND					0	C-01
Surrogate: Decachlorobiphenyl			mg/kg				*196*		*24-154*			Z3,C-01
Duplicate Analyzed: 07/06/2007-07/09/2007 (7G05005-DUP3)				QC Source Sample: HQG0009-01								
Aroclor 1016	3.25		mg/kg	N/A	0.654	3.32				2	30	C-01
Aroclor 1221	ND		mg/kg	N/A	1.31	ND					30	C-01
Aroclor 1232	ND		mg/kg	N/A	0.654	ND					30	C-01
Aroclor 1242	ND		mg/kg	N/A	0.654	ND					30	C-01
Aroclor 1248	4.55		mg/kg	N/A	0.654	4.58				1	30	C-01
Aroclor 1254	7.05		mg/kg	N/A	0.654	2.78				87	30	C-01
Aroclor 1260	4.08		mg/kg	N/A	0.654	4.01				2	30	C-01
Aroclor 1262	ND		mg/kg	N/A	0.654	ND					0	C-01
Aroclor 1268	ND		mg/kg	N/A	0.654	ND					0	C-01
Surrogate: Decachlorobiphenyl			mg/kg				*271*		*24-154*			C-01,Z3
Semivolatile Organics by GC/MS												
Batch\Seq: 7G11004 Extracted: 07/11/07												
Duplicate Analyzed: 07/26/2007 (7G11004-DUP1)				QC Source Sample: HQG0016-03								
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	N/A	0.308	ND					30	
1,2,4-Trichlorobenzene	ND		mg/kg	N/A	0.308	ND					30	
1,2-Dichlorobenzene	ND		mg/kg	N/A	0.308	ND					30	
1,3-Dichlorobenzene	ND		mg/kg	N/A	0.308	ND					30	
1,4-Dichlorobenzene	ND		mg/kg	N/A	0.308	ND					30	
1-Chloronaphthalene	ND		mg/kg	N/A	0.308	ND					30	
1-Naphthylamine	ND		mg/kg	N/A	0.617	ND					30	
2,3,4,6-Tetrachlorophenol	ND		mg/kg	N/A	0.308	ND					30	
2,4,5-Trichlorophenol	ND		mg/kg	N/A	0.308	ND					30	
2,4,6-Trichlorophenol	ND		mg/kg	N/A	0.308	ND					30	

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

LABORATORY DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS												
Batch\Seq: 7G11004 Extracted: 07/11/07												
Duplicate Analyzed: 07/26/2007 (7G11004-DUP1)				QC Source Sample: HQG0016-03								
2,4-Dichlorophenol	ND		mg/kg	N/A	0.308	ND					30	
2,4-Dimethylphenol	ND		mg/kg	N/A	0.308	ND					30	
2,4-Dinitrophenol	ND		mg/kg	N/A	1.59	ND					30	
2,4-Dinitrotoluene	ND		mg/kg	N/A	0.617	ND					30	
2,6-Dichlorophenol	ND		mg/kg	N/A	0.308	ND					30	
2,6-Dinitrotoluene	ND		mg/kg	N/A	0.308	ND					30	
2-Chloronaphthalene	ND		mg/kg	N/A	0.308	ND					30	
2-Chlorophenol	ND		mg/kg	N/A	0.308	ND					30	
2-Methylnaphthalene	ND		mg/kg	N/A	0.308	ND					30	
2-Methylphenol (o-Cresol)	ND		mg/kg	N/A	0.308	ND					30	
2-Naphthylamine	ND		mg/kg	N/A	0.617	ND					30	
2-Nitroaniline	ND		mg/kg	N/A	1.59	ND					30	
2-Nitrophenol	ND		mg/kg	N/A	0.308	ND					30	
2-Picoline	ND		mg/kg	N/A	0.308	ND					30	
3,3'-Dichlorobenzidine	ND		mg/kg	N/A	0.308	ND					30	
3-Methylcholanthrene	ND		mg/kg	N/A	0.308	ND					30	
3-Nitroaniline	ND		mg/kg	N/A	1.59	ND					30	
4,6-Dinitro-2-methylphenol	ND		mg/kg	N/A	1.59	ND					30	
4-Aminobiphenyl	ND		mg/kg	N/A	0.617	ND					30	
4-Bromophenyl phenyl ether	ND		mg/kg	N/A	0.308	ND					30	
4-Chloro-3-methylphenol	ND		mg/kg	N/A	0.308	ND					30	
4-Chloroaniline	ND		mg/kg	N/A	0.308	ND					30	
4-Chlorophenyl phenyl ether	ND		mg/kg	N/A	0.308	ND					30	
4-Methylphenol (p-Cresol)	ND		mg/kg	N/A	0.308	ND					30	
4-Nitroaniline	ND		mg/kg	N/A	0.308	ND					30	
4-Nitrophenol	ND		mg/kg	N/A	1.59	ND					30	
7,12-Dimethylbenz (a) anthracene	ND		mg/kg	N/A	0.308	ND					30	
a,a-Dimethylphenethylamine	0.00233		mg/kg	N/A	1.59	ND					30	
Acenaphthene	ND		mg/kg	N/A	0.308	ND					30	
Acenaphthylene	ND		mg/kg	N/A	0.308	ND					30	
Acetophenone	ND		mg/kg	N/A	0.308	ND					30	
Aniline	ND		mg/kg	N/A	0.308	ND					30	
Anthracene	ND		mg/kg	N/A	0.308	ND					30	
Azobenzene	ND		mg/kg	N/A	0.308	ND					30	
Benzidine	ND		mg/kg	N/A	1.59	ND					30	
Benzo (a) anthracene	ND		mg/kg	N/A	0.308	ND					30	
Benzo (a) pyrene	ND		mg/kg	N/A	0.308	ND					30	
Benzo (b) fluoranthene	ND		mg/kg	N/A	0.308	ND					30	
Benzo (g,h,i) perylene	ND		mg/kg	N/A	0.308	ND					30	
Benzo (k) fluoranthene	ND		mg/kg	N/A	0.308	ND					30	
Benzoic acid	ND		mg/kg	N/A	1.59	ND					30	
Benzyl alcohol	ND		mg/kg	N/A	0.308	ND					30	
Bis(2-chloroethoxy)methane	ND		mg/kg	N/A	0.308	ND					30	
Bis(2-chloroethyl)ether	ND		mg/kg	N/A	0.308	ND					30	
Bis(2-chloroisopropyl) ether	ND		mg/kg	N/A	0.308	ND					30	
Bis(2-ethylhexyl)phthalate	ND		mg/kg	N/A	0.308	ND					30	

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: Reported:	07/02/07 08/08/07 09:34

LABORATORY DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS												
Batch\Seq: 7G11004 Extracted: 07/11/07												
Duplicate Analyzed: 07/26/2007 (7G11004-DUP1)				QC Source Sample: HQG0016-03								
Butyl benzyl phthalate	ND		mg/kg	N/A	0.308	ND					30	
Chrysene	ND		mg/kg	N/A	0.308	ND					30	
Dibenz (a,j) acridine	ND		mg/kg	N/A	0.308	ND					30	
Dibenzo (a,h) anthracene	ND		mg/kg	N/A	0.308	ND					30	
Dibenzofuran	ND		mg/kg	N/A	0.308	ND					30	
Diethyl phthalate	ND		mg/kg	N/A	0.308	ND					30	
Dimethyl phthalate	ND		mg/kg	N/A	0.308	ND					30	
Dimethylaminoazobenzene	ND		mg/kg	N/A	0.617	ND					30	
Di-n-butyl phthalate	ND		mg/kg	N/A	0.308	ND					30	
Di-n-octyl phthalate	ND		mg/kg	N/A	0.308	ND					30	
Ethyl Methanesulfonate	ND		mg/kg	N/A	0.308	ND					30	
Fluoranthene	ND		mg/kg	N/A	0.308	ND					30	
Fluorene	ND		mg/kg	N/A	0.308	ND					30	
Hexachlorobenzene	ND		mg/kg	N/A	0.308	ND					30	
Hexachlorobutadiene	ND		mg/kg	N/A	0.308	ND					30	
Hexachlorocyclopentadiene	ND		mg/kg	N/A	0.308	ND					30	
Hexachloroethane	ND		mg/kg	N/A	0.308	ND					30	
Indeno (1,2,3-cd) pyrene	ND		mg/kg	N/A	0.308	ND					30	
Isophorone	ND		mg/kg	N/A	0.308	ND					30	
Methyl Methanesulfonate	ND		mg/kg	N/A	0.617	ND					30	
Naphthalene	ND		mg/kg	N/A	0.308	ND					30	
Nitrobenzene	ND		mg/kg	N/A	0.308	ND					30	
N-Nitrosodimethylamine	ND		mg/kg	N/A	0.308	ND					30	
N-Nitrosodi-n-butylamine	ND		mg/kg	N/A	0.308	0.120					30	
N-Nitrosodi-n-propylamine	0.224		mg/kg	N/A	0.308	0.237				5	30	
N-Nitrosodiphenylamine	ND		mg/kg	N/A	0.308	ND					30	
N-Nitrosopiperidine	ND		mg/kg	N/A	0.308	ND					30	
Pentachloronitrobenzene	ND		mg/kg	N/A	0.308	ND					30	
Pentachlorophenol	ND		mg/kg	N/A	1.59	ND					30	
Phenacetin	ND		mg/kg	N/A	0.308	ND					30	
Phenanthrene	ND		mg/kg	N/A	0.308	ND					30	
Phenol	ND		mg/kg	N/A	0.308	ND					30	
Pronamide	ND		mg/kg	N/A	0.308	ND					30	
Pyrene	ND		mg/kg	N/A	0.308	ND					30	
Pyridine	ND		mg/kg	N/A	0.308	ND					30	
Surrogate: 2,4,6-Tribromophenol			mg/kg				*82*		*32.6-114*			
Surrogate: 2-Fluorobiphenyl			mg/kg				*97*		*45.9-108*			
Surrogate: 2-Fluorophenol			mg/kg				*55*		*39.4-103*			
Surrogate: Nitrobenzene-d5			mg/kg				*88*		*37.2-107*			
Surrogate: Phenol-d6			mg/kg				*59*		*49.6-105*			
Surrogate: Terphenyl-d14			mg/kg				*110*		*45.7-133*			

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LCS/LCS DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Extractable Petroleum Hydrocarbons by 8015M													
Batch\Seq: 7G06006 Extracted: 07/06/07													
LCS Analyzed: 07/10/2007 (7G06006-BS1)													
DRO		167	mg/kg	N/A	6.66	145		87		50-107			
Surrogate: o-Terphenyl			mg/kg					*83*		*34.7-135*			
Gasoline Range Organics/BTEX/MTBE by EPA 8015M/8260B													
Batch\Seq: 7G12011 Extracted: 07/11/07													
LCS Analyzed: 07/11/2007 (7G12011-BS1)													
Benzene		0.100	mg/kg	N/A	0.00200	0.108	0.106	108	106	77.9-124	1	30	
Ethylbenzene		0.100	mg/kg	N/A	0.00200	0.106	0.104	106	104	77.1-129	2	30	
m,p-Xylene		0.200	mg/kg	N/A	0.00400	0.209	0.213	105	107	69.7-126	2	30	
o-Xylene		0.100	mg/kg	N/A	0.00200	0.0969	0.0999	97	100	70.3-124	3	30	
Toluene		0.100	mg/kg	N/A	0.00200	0.103	0.102	103	102	77.6-125	1	30	
Surrogate: Toluene-d8			mg/kg					*100*	*99*	*88.2-117*			
LCS Analyzed: 07/11/2007 (7G12011-BS2)													
GRO		4.40	mg/kg	N/A	0.500	4.88	5.19	111	118	70-130	6	30	
Surrogate: Toluene-d8			mg/kg					*103*	*96*	*88.2-117*			
Polychlorinated Biphenyls by EPA Method 8082													
Batch\Seq: 7G05005 Extracted: 07/05/07													
LCS Analyzed: 07/06/2007 (7G05005-BS1)													
Aroclor 1016		0.167	mg/kg	N/A	0.0333	0.171		102		65-128			C-01
Aroclor 1260		0.167	mg/kg	N/A	0.0333	0.176		106		63-130			C-01
Surrogate: Decachlorobiphenyl			mg/kg					*117*		*24-154*			C-01
LCS Analyzed: 07/09/2007 (7G05005-BS2)													
Aroclor 1016		0.167	mg/kg	N/A	0.0333	0.151		90		65-128			C-01,C-02
Aroclor 1260		0.167	mg/kg	N/A	0.0333	0.158		95		63-130			C-01,C-02
Surrogate: Decachlorobiphenyl			mg/kg					*89*		*24-154*			C-01,C-02
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
LCS Analyzed: 07/26/2007 (7G11004-BS1)													
1,2,4,5-Tetrachlorobenzene			mg/kg	N/A	0.330	ND				64.4-103			
1,2,4-Trichlorobenzene		1.67	mg/kg	N/A	0.330	1.25		75		47.9-94.6			
1,2-Dichlorobenzene		1.67	mg/kg	N/A	0.330	1.20		72		48.8-91			
1,3-Dichlorobenzene		1.67	mg/kg	N/A	0.330	1.20		72		49.6-90.1			
1,4-Dichlorobenzene		1.67	mg/kg	N/A	0.330	1.22		73		51.7-88			
1-Naphthylamine			mg/kg	N/A	0.660	ND				26-94.6			
2,3,4,6-Tetrachlorophenol			mg/kg	N/A	0.330	ND				61.1-112			
2,4,5-Trichlorophenol		1.67	mg/kg	N/A	0.330	1.33		80		66.1-108			
2,4,6-Trichlorophenol		1.67	mg/kg	N/A	0.330	1.28		77		59.4-105			
2,4-Dichlorophenol		1.67	mg/kg	N/A	0.330	1.24		75		53.8-98			
2,4-Dimethylphenol		1.67	mg/kg	N/A	0.330	1.07		64		52.6-103			
2,4-Dinitrophenol		1.67	mg/kg	N/A	1.70	1.54		92		36-155			
2,4-Dinitrotoluene		1.67	mg/kg	N/A	0.660	1.42		85		55.5-118			
2,6-Dichlorophenol			mg/kg	N/A	0.330	ND				55.7-98.6			
2,6-Dinitrotoluene		1.67	mg/kg	N/A	0.330	1.41		84		60.9-111			
2-Chloronaphthalene		1.67	mg/kg	N/A	0.330	1.16		70		57.8-98			

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LCS/LCS DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
LCS Analyzed: 07/26/2007 (7G11004-BS1)													
2-Chlorophenol		1.67	mg/kg	N/A	0.330	1.19		72		54-92.5			
2-Methylnaphthalene		1.67	mg/kg	N/A	0.330	1.27		76		55.9-95.5			
2-Methylphenol (o-Cresol)			mg/kg	N/A	0.330	1.22				59.3-95.2			
2-Naphthylamine			mg/kg	N/A	0.660	ND				1.16-97.7			
2-Nitroaniline		1.67	mg/kg	N/A	1.70	1.43		86		62.5-109			
2-Nitrophenol		1.67	mg/kg	N/A	0.330	1.24		74		54.6-94.9			
2-Picoline			mg/kg	N/A	0.330	ND				4.88-65.6			
3,3'-Dichlorobenzidine			mg/kg	N/A	0.330	ND				51.4-92.7			
3-Methylcholanthrene			mg/kg	N/A	0.330	ND				59.1-108			
3-Nitroaniline		1.67	mg/kg	N/A	1.70	1.26		75		58.9-109			
4,6-Dinitro-2-methylphenol		1.67	mg/kg	N/A	1.70	1.62		97		57.6-125			
4-Aminobiphenyl			mg/kg	N/A	0.660	ND				29.5-85.1			
4-Bromophenyl phenyl ether		1.67	mg/kg	N/A	0.330	1.30		78		64.1-104			
4-Chloro-3-methylphenol		1.67	mg/kg	N/A	0.330	1.41		84		58.8-110			
4-Chloroaniline		1.67	mg/kg	N/A	0.330	0.469		28		49.6-89			L2
4-Chlorophenyl phenyl ether		1.67	mg/kg	N/A	0.330	1.42		85		56-109			
4-Methylphenol (p-Cresol)			mg/kg	N/A	0.330	1.28				38.7-110			
4-Nitroaniline		1.67	mg/kg	N/A	0.330	1.26		75		71.2-113			
4-Nitrophenol		1.67	mg/kg	N/A	1.70	1.46		87		39.7-138			
7,12-Dimethylbenz (a) anthracene			mg/kg	N/A	0.330	ND				55.8-152			
a,a-Dimethylphenethylamine			mg/kg	N/A	1.70	0.0820				-7.04-12.2			
Acenaphthene		1.67	mg/kg	N/A	0.330	1.37		82		64.6-99.2			
Acenaphthylene		1.67	mg/kg	N/A	0.330	1.21		73		58.6-103			
Acetophenone			mg/kg	N/A	0.330	ND				48.8-96.1			
Aniline			mg/kg	N/A	0.330	ND				29.7-92.8			
Anthracene		1.67	mg/kg	N/A	0.330	1.33		80		68.6-104			
Azobenzene		1.67	mg/kg	N/A	0.330	1.32		79		69.5-104			
Benzidine			mg/kg	N/A	1.70	ND				-42.6-66.5			
Benzo (a) anthracene		1.67	mg/kg	N/A	0.330	1.43		86		64.2-107			
Benzo (a) pyrene		1.67	mg/kg	N/A	0.330	2.42		145		61.4-111			L1
Benzo (b) fluoranthene		1.67	mg/kg	N/A	0.330	2.59		156		58.3-119			L1
Benzo (g,h,i) perylene		1.67	mg/kg	N/A	0.330	2.12		127		57.6-102			L1
Benzo (k) fluoranthene		1.67	mg/kg	N/A	0.330	2.97		178		66.3-114			L1
Bis(2-chloroethoxy)methane		1.67	mg/kg	N/A	0.330	1.26		75		60.3-107			
Bis(2-chloroethyl)ether		1.67	mg/kg	N/A	0.330	1.31		78		58.3-86.3			
Bis(2-chloroisopropyl) ether		1.67	mg/kg	N/A	0.330	1.31		79		58.7-89.3			
Bis(2-ethylhexyl)phthalate		1.67	mg/kg	N/A	0.330	1.46		88		56.5-126			
Butyl benzyl phthalate		1.67	mg/kg	N/A	0.330	1.41		85		60.2-120			
Chrysene		1.67	mg/kg	N/A	0.330	1.52		91		64.7-110			
Dibenz (a,j) acridine			mg/kg	N/A	0.330	ND				-2.91-24.8			
Dibenzo (a,h) anthracene		1.67	mg/kg	N/A	0.330	3.49		209		61.4-102			L1
Dibenzofuran		1.67	mg/kg	N/A	0.330	1.34		80		61-104			
Diethyl phthalate		1.67	mg/kg	N/A	0.330	1.44		86		60.2-113			
Dimethyl phthalate		1.67	mg/kg	N/A	0.330	1.40		84		59.6-110			
Dimethylaminoazobenzene			mg/kg	N/A	0.660	ND				59.8-112			
Di-n-butyl phthalate		1.67	mg/kg	N/A	0.330	1.40		84		63.8-117			

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LCS/LCS DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
LCS Analyzed: 07/26/2007 (7G11004-BS1)													
Di-n-octyl phthalate		1.67	mg/kg	N/A	0.330	1.30		78		55.6-120			
Ethyl Methanesulfonate			mg/kg	N/A	0.330	ND				59.5-91.8			
Fluoranthene		1.67	mg/kg	N/A	0.330	1.47		88		64.8-118			
Fluorene		1.67	mg/kg	N/A	0.330	1.42		85		61.4-105			
Hexachlorobenzene		1.67	mg/kg	N/A	0.330	1.44		86		62.9-108			
Hexachlorobutadiene		1.67	mg/kg	N/A	0.330	1.27		76		42.9-97.8			
Hexachlorocyclopentadiene		1.67	mg/kg	N/A	0.330	0.930		56		-14.3-125			
Hexachloroethane		1.67	mg/kg	N/A	0.330	1.24		74		52.2-88.8			
Indeno (1,2,3-cd) pyrene		1.67	mg/kg	N/A	0.330	2.27		136		61.2-102			L1
Isophorone		1.67	mg/kg	N/A	0.330	1.35		81		49.2-90.7			
Methyl Methanesulfonate			mg/kg	N/A	0.660	ND				27.1-140			
Naphthalene		1.67	mg/kg	N/A	0.330	1.20		72		52.4-91.9			
Nitrobenzene		1.67	mg/kg	N/A	0.330	1.31		78		53.2-89			
N-Nitrosodimethylamine		1.67	mg/kg	N/A	0.330	1.27		76		38.3-94.9			
N-Nitrosodi-n-butylamine			mg/kg	N/A	0.330	ND				55.7-104			
N-Nitrosodi-n-propylamine		1.67	mg/kg	N/A	0.330	1.45		87		40.4-119			
N-Nitrosodiphenylamine			mg/kg	N/A	0.330	ND				73.5-112			
N-Nitrosopiperidine			mg/kg	N/A	0.330	ND				53.5-96			
Pentachloronitrobenzene			mg/kg	N/A	0.330	ND				58.7-117			
Pentachlorophenol		1.67	mg/kg	N/A	1.70	1.33		80		63.3-124			
Phenacetin			mg/kg	N/A	0.330	0.0723				60.7-116			
Phenanthrene		1.67	mg/kg	N/A	0.330	1.43		86		75-104			
Phenol		1.67	mg/kg	N/A	0.330	1.14		69		56.5-93.6			
Pronamide			mg/kg	N/A	0.330	ND				67.3-121			
Pyrene		1.67	mg/kg	N/A	0.330	1.39		83		61.2-114			
Pyridine			mg/kg	N/A	0.330	ND				-18-106			
Surrogate: 2,4,6-Tribromophenol			mg/kg					*83*		*57.7-121*			
Surrogate: 2-Fluorobiphenyl			mg/kg					*79*		*51.3-99.2*			
Surrogate: 2-Fluorophenol			mg/kg					*67*		*45.1-92.5*			
Surrogate: Nitrobenzene-d5			mg/kg					*77*		*43.5-94.6*			
Surrogate: Phenol-d6			mg/kg					*73*		*52.3-97*			
Surrogate: Terphenyl-d14			mg/kg					*90*		*58.1-112*			
Total Metals by SW 846 Series Methods													
Batch\Seq: 7G10005 Extracted: 07/10/07													
LCS Analyzed: 07/20/2007 (7G10005-BS1)													
Arsenic		20.0	mg/kg	N/A	1.00	19.5		98		80-120			
Lead		20.0	mg/kg	N/A	2.00	18.5		92		80-120			
Batch\Seq: 7G11013 Extracted: 07/11/07													
LCS Analyzed: 07/11/2007 (7G11013-BS1)													
Mercury		0.333	mg/kg	N/A	0.0200	0.375		112		80-120			
Batch\Seq: 7G16005 Extracted: 07/16/07													
LCS Analyzed: 07/17/2007 (7G16005-BS1)													
Arsenic		100	mg/kg	N/A	5.00	94.1		94		80-120			
Barium		100	mg/kg	N/A	10.0	94.7		95		80-120			
Cadmium		100	mg/kg	N/A	2.00	92.0		92		80-120			

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Element Environmental LLC
62-180 Emerson Rd.
Haleiwa, HI 96712
Matt Neal

Work Order: HQG0016
Project: Maalea
Project Number: Maalaea Phase II ESA

Received: 07/02/07
Reported: 08/08/07 09:34

LCS/LCS DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Total Metals by SW 846 Series Methods													
Batch\Seq: 7G16005 Extracted: 07/16/07													
LCS Analyzed: 07/17/2007 (7G16005-BS1)													
Chromium		100	mg/kg	N/A	5.00	88.8		89		80-120			
Lead		100	mg/kg	N/A	10.0	89.5		89		80-120			
Selenium		100	mg/kg	N/A	10.0	95.2		95		80-120			
Silver		10.0	mg/kg	N/A	5.00	8.52		85		80-120			C2
Volatile Organic Compounds by EPA 8260B													
Batch\Seq: 7G12011 Extracted: 07/11/07													
LCS Analyzed: 07/11/2007 (7G12011-BS1)													
1,1-Dichloroethene		0.100	mg/kg	N/A	0.0100	0.103	0.103	103	103	65.1-127	0	30	
Chlorobenzene		0.100	mg/kg	N/A	0.0100	0.105	0.106	105	106	74.4-119	0	30	
Trichloroethene		0.100	mg/kg	N/A	0.0100	0.106	0.108	106	108	72.9-119	2	30	
Surrogate: 1,2-Dichloroethane-d4			mg/kg					*102*	*104*	*58.3-156*			
Surrogate: 4-Bromofluorobenzene			mg/kg					*100*	*99*	*72.1-156*			
Surrogate: Dibromofluoromethane			mg/kg					*99*	*99*	*63.2-149*			
Surrogate: Toluene-d8			mg/kg					*100*	*99*	*70.5-145*			

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Element Environmental LLC
62-180 Emerson Rd.
Haleiwa, HI 96712
Matt Neal

Work Order: HQG0016
Project: Maalea
Project Number: Maalaea Phase II ESA

Received: 07/02/07
Reported: 08/08/07 09:34

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Extractable Petroleum Hydrocarbons by 8015M													
Batch\Seq: 7G06006 Extracted: 07/06/07													
Matrix Spike Analyzed: 07/10/2007 (7G06006-MS1)				QC Source Sample: HQG0016-19									
DRO	ND	164	mg/kg	N/A	6.55	137	144	83	88	50-107	5	30	
Surrogate: o-Terphenyl			mg/kg					*77*	*62*	*34.7-135*			
Gasoline Range Organics/BTEX/MTBE by EPA 8015M/8260B													
Batch\Seq: 7G12011 Extracted: 07/11/07													
Matrix Spike Analyzed: 07/12/2007 (7G12011-MS1)				QC Source Sample: HQG0016-12									
Benzene	ND	0.0998	mg/kg	N/A	0.00200	0.109		109		77.9-124			
Ethylbenzene	ND	0.0998	mg/kg	N/A	0.00200	0.105		106		77.1-129			
m,p-Xylene	ND	0.200	mg/kg	N/A	0.00399	0.198		99		69.7-126			
o-Xylene	ND	0.0998	mg/kg	N/A	0.00200	0.107		107		70.3-124			
Toluene	ND	0.0998	mg/kg	N/A	0.00200	0.122		122		77.8-125			
Surrogate: Toluene-d8			mg/kg					*118*		*88.2-117*			ZS
Polychlorinated Biphenyls by EPA Method 8082													
Batch\Seq: 7G05005 Extracted: 07/05/07													
Matrix Spike Analyzed: 07/06/2007 (7G05005-MS1)				QC Source Sample: HQG0016-10									
Aroclor 1016	ND	0.164	mg/kg	N/A	0.0329	0.172	0.164	105	100	65-128	5	50	C-01
Aroclor 1260	ND	0.164	mg/kg	N/A	0.0329	0.173	0.166	105	101	63-139	4	50	C-01
Surrogate: Decachlorobiphenyl			mg/kg					*110*	*103*	*24-154*			C-01
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
Matrix Spike Analyzed: 07/26/2007 (7G11004-MS1)				QC Source Sample: HQG0016-02									
1,2,4,5-Tetrachlorobenzene	ND		mg/kg	N/A	0.319	ND	ND			64.4-103		30	
1,2,4-Trichlorobenzene	ND	1.61	mg/kg	N/A	0.319	1.19	0.868	74	56	47.9-94.6	31	30	M1
1,2-Dichlorobenzene	ND	1.61	mg/kg	N/A	0.319	1.10	0.800	68	51	48.8-91	31	30	M1
1,3-Dichlorobenzene	ND	1.61	mg/kg	N/A	0.319	1.07	0.772	66	50	49.6-90.1	32	30	M1
1,4-Dichlorobenzene	ND	1.61	mg/kg	N/A	0.319	1.09	0.787	68	51	51.7-88	32	30	M1
1-Chloronaphthalene	ND		mg/kg	N/A	0.319	1.61	1.30			54.6-103	22	30	
1-Naphthylamine	ND		mg/kg	N/A	0.639	ND	ND			26-94.6		30	
2,3,4,6-Tetrachlorophenol	ND		mg/kg	N/A	0.319	ND	ND			61.1-112		30	
2,4,5-Trichlorophenol	ND	1.61	mg/kg	N/A	0.319	1.37	1.22	85	78	66.1-108	12	30	
2,4,6-Trichlorophenol	ND	1.61	mg/kg	N/A	0.319	1.25	1.08	78	69	59.4-105	15	30	
2,4-Dichlorophenol	ND	1.61	mg/kg	N/A	0.319	1.27	0.973	79	62	53.8-98	27	30	
2,4-Dimethylphenol	ND	1.61	mg/kg	N/A	0.319	0.326	0.215	20	14	52.6-103	41	30	M1
2,4-Dinitrophenol	ND	1.61	mg/kg	N/A	1.65	0.691	0.566	43	36	36-155	20	30	
2,4-Dinitrotoluene	ND	1.61	mg/kg	N/A	0.639	1.46	1.34	91	86	55.5-118	9	30	
2,6-Dichlorophenol	ND		mg/kg	N/A	0.319	ND	ND			55.7-98.6		30	
2,6-Dinitrotoluene	ND	1.61	mg/kg	N/A	0.319	1.48	1.35	92	86	60.9-111	10	30	
2-Chloronaphthalene	ND	1.61	mg/kg	N/A	0.319	1.27	1.02	79	65	57.8-98	22	30	
2-Chlorophenol	ND	1.61	mg/kg	N/A	0.319	1.06	0.772	66	50	54-92.5	31	30	M1
2-Methylnaphthalene	ND	1.61	mg/kg	N/A	0.319	1.33	1.02	82	65	55.9-95.5	26	30	
2-Methylphenol (o-Cresol)	ND		mg/kg	N/A	0.319	0.827	0.551			59.3-95.2	40	30	M1
2-Naphthylamine	ND		mg/kg	N/A	0.639	ND	ND			1.16-97.7		30	
2-Nitroaniline	ND	1.61	mg/kg	N/A	1.65	1.49	1.34	93	86	62.5-109	11	30	
2-Nitrophenol	ND	1.61	mg/kg	N/A	0.319	1.20	0.865	75	56	54.6-94.9	33	30	M1

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
Matrix Spike Analyzed: 07/26/2007 (7G11004-MS1)				QC Source Sample: HQG0016-02									
2-Picoline	ND		mg/kg	N/A	0.319	ND	ND			4.88-65.6		30	
3,3'-Dichlorobenzidine	ND		mg/kg	N/A	0.319	ND	ND			51.4-92.7		30	
3-Methylcholanthrene	ND		mg/kg	N/A	0.319	ND	ND			59.1-108		30	
3-Nitroaniline	ND	1.61	mg/kg	N/A	1.65	1.27	1.14	79	73	58.9-109	11	30	
4,6-Dinitro-2-methylphenol	ND	1.61	mg/kg	N/A	1.65	1.36	1.21	84	78	57.6-125	11	30	
4-Aminobiphenyl	ND		mg/kg	N/A	0.639	ND	ND			29.5-85.1		30	
4-Bromophenyl phenyl ether	ND	1.61	mg/kg	N/A	0.319	1.39	1.26	86	81	64.1-104	10	30	
4-Chloro-3-methylphenol	ND	1.61	mg/kg	N/A	0.319	1.32	1.15	82	74	58.8-110	14	30	
4-Chloroaniline	ND	1.61	mg/kg	N/A	0.319	0.731	0.549	45	35	49.6-89	28	30	M1
4-Chlorophenyl phenyl ether	ND	1.61	mg/kg	N/A	0.319	1.49	1.34	92	86	56-109	11	30	
4-Methylphenol (p-Cresol)	ND		mg/kg	N/A	0.319	0.749	0.500			38.7-110	40	30	M1
4-Nitroaniline	ND	1.61	mg/kg	N/A	0.319	1.27	1.14	79	71	71.2-113	11	30	
4-Nitrophenol	ND	1.61	mg/kg	N/A	1.65	1.18	1.05	73	68	39.7-138	11	30	
7,12-Dimethylbenz (a) anthracene	ND		mg/kg	N/A	0.319	ND	ND			55.8-152		30	
a,a-Dimethylphenethylamine	0.00233		mg/kg	N/A	1.65	0.0800	0.0586			-7.04-12.2	31	30	M1
Acenaphthene	ND	1.61	mg/kg	N/A	0.319	1.44	1.25	89	80	64.6-99.2	14	30	
Acenaphthylene	ND	1.61	mg/kg	N/A	0.319	1.33	1.12	82	72	58.6-103	17	30	
Acetophenone	ND		mg/kg	N/A	0.319	ND	ND			48.8-96.1		30	
Aniline	ND		mg/kg	N/A	0.319	ND	ND			29.7-92.8		30	
Anthracene	ND	1.61	mg/kg	N/A	0.319	1.51	1.32	94	85	68.6-104	14	30	
Azobenzene	ND	1.61	mg/kg	N/A	0.319	1.40	1.26	87	81	69.5-104	11	30	
Benzidine	ND		mg/kg	N/A	1.65	ND	ND			-42.6-66.5		30	
Benzo (a) anthracene	ND	1.61	mg/kg	N/A	0.319	1.44	1.39	89	89	64.2-107	4	30	
Benzo (a) pyrene	ND	1.61	mg/kg	N/A	0.319	2.46	2.35	152	151	61.4-111	4	30	M1
Benzo (b) fluoranthene	ND	1.61	mg/kg	N/A	0.319	2.36	2.34	146	150	58.3-119	1	30	M1
Benzo (g,h,i) perylene	ND	1.61	mg/kg	N/A	0.319	2.01	1.79	125	115	57.6-102	12	30	M1
Benzo (k) fluoranthene	ND	1.61	mg/kg	N/A	0.319	2.93	2.82	182	181	66.3-114	4	30	M1
Bis(2-chloroethoxy)methane	ND	1.61	mg/kg	N/A	0.319	1.26	0.918	78	59	60.3-107	31	30	M1
Bis(2-chloroethyl)ether	ND	1.61	mg/kg	N/A	0.319	1.19	0.872	74	56	58.3-86.3	31	30	M1
Bis(2-chloroisopropyl) ether	ND	1.61	mg/kg	N/A	0.319	1.17	0.863	72	55	58.7-89.3	30	30	M1
Bis(2-ethylhexyl)phthalate	ND	1.61	mg/kg	N/A	0.319	1.44	1.40	89	90	56.5-126	3	30	
Butyl benzyl phthalate	ND	1.61	mg/kg	N/A	0.319	1.39	1.35	86	87	60.2-120	3	30	
Chrysene	ND	1.61	mg/kg	N/A	0.319	1.51	1.48	93	95	64.7-110	2	30	
Dibenz (a,j) acridine	ND		mg/kg	N/A	0.319	ND	ND			-2.91-24.8		30	
Dibenzo (a,h) anthracene	ND	1.61	mg/kg	N/A	0.319	3.35	3.05	208	196	61.4-102	9	30	M1
Dibenzofuran	ND	1.61	mg/kg	N/A	0.319	1.44	1.27	89	82	61-104	13	30	
Diethyl phthalate	ND	1.61	mg/kg	N/A	0.319	1.49	1.36	92	87	60.2-113	9	30	
Dimethyl phthalate	ND	1.61	mg/kg	N/A	0.319	1.44	1.31	89	84	59.6-110	10	30	
Dimethylaminoazobenzene	ND		mg/kg	N/A	0.639	ND	ND			59.8-112		30	
Di-n-butyl phthalate	ND	1.61	mg/kg	N/A	0.319	1.55	1.38	96	89	63.8-117	11	30	
Di-n-octyl phthalate	ND	1.61	mg/kg	N/A	0.319	1.33	1.29	83	83	55.6-120	3	30	
Ethyl Methanesulfonate	ND		mg/kg	N/A	0.319	ND	ND			59.5-91.8		30	
Fluoranthene	ND	1.61	mg/kg	N/A	0.319	1.63	1.40	101	90	64.8-118	15	30	
Fluorene	ND	1.61	mg/kg	N/A	0.319	1.49	1.37	93	88	61.4-105	9	30	
Hexachlorobenzene	ND	1.61	mg/kg	N/A	0.319	1.53	1.38	95	88	62.9-108	11	30	
Hexachlorobutadiene	ND	1.61	mg/kg	N/A	0.319	1.19	0.855	74	55	42.9-97.8	32	30	M1

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Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS													
Batch\Seq: 7G11004 Extracted: 07/11/07													
Matrix Spike Analyzed: 07/26/2007 (7G11004-MS1)				QC Source Sample: HQG0016-02									
Hexachlorocyclopentadiene	ND	1.61	mg/kg	N/A	0.319	1.06	0.714	66	46	-14.3-125	39	30	M1
Hexachloroethane	ND	1.61	mg/kg	N/A	0.319	1.09	0.777	68	50	52.2-88.8	34	30	M1
Indeno (1,2,3-cd) pyrene	ND	1.61	mg/kg	N/A	0.319	2.17	1.97	135	126	61.2-102	10	30	M1
Isophorone	ND	1.61	mg/kg	N/A	0.319	1.34	1.02	83	66	49.2-90.7	27	30	
Methyl Methanesulfonate	ND		mg/kg	N/A	0.639	ND	ND			27.1-140		30	
Naphthalene	ND	1.61	mg/kg	N/A	0.319	1.16	0.864	72	55	52.4-91.9	30	30	
Nitrobenzene	ND	1.61	mg/kg	N/A	0.319	1.21	0.895	75	57	53.2-89	30	30	
N-Nitrosodimethylamine	ND	1.61	mg/kg	N/A	0.319	1.07	0.783	67	50	38.3-94.9	31	30	M1
N-Nitrosodi-n-butylamine	ND		mg/kg	N/A	0.319	ND	ND			55.7-104		30	
N-Nitrosodi-n-propylamine	0.212	1.61	mg/kg	N/A	0.319	1.41	1.06	75	54	40.4-119	29	30	
N-Nitrosodiphenylamine	ND		mg/kg	N/A	0.319	ND	ND			73.5-112		30	
N-Nitrosopiperidine	ND		mg/kg	N/A	0.319	ND	ND			53.5-96		30	
Pentachloronitrobenzene	ND		mg/kg	N/A	0.319	ND	ND			58.7-117		30	
Pentachlorophenol	ND	1.61	mg/kg	N/A	1.65	0.871	0.714	54	46	63.3-124	20	30	M1
Phenacetin	ND		mg/kg	N/A	0.319	0.0768	0.0701			60.7-116	9	30	
Phenanthrene	ND	1.61	mg/kg	N/A	0.319	1.50	1.35	93	86	75-104	11	30	
Phenol	ND	1.61	mg/kg	N/A	0.319	1.02	0.751	63	48	56.5-93.6	30	30	M1
Pronamide	ND		mg/kg	N/A	0.319	ND	ND			67.3-121		30	
Pyrene	ND	1.61	mg/kg	N/A	0.319	1.34	1.29	83	83	61.2-114	4	30	
Pyridine	ND		mg/kg	N/A	0.319	ND	ND			-18-106		30	
Surrogate: 2,4,6-Tribromophenol			mg/kg					*84*	*77*	*57.7-121*			
Surrogate: 2-Fluorobiphenyl			mg/kg					*89*	*73*	*31.2-99.7*			
Surrogate: 2-Fluorophenol			mg/kg					*57*	*41*	*45.1-92.5*			Z
Surrogate: Nitrobenzene-d5			mg/kg					*76*	*59*	*43.5-94.6*			
Surrogate: Phenol-d6			mg/kg					*67*	*52*	*52.3-97*			Z
Surrogate: Terphenyl-d14			mg/kg					*69*	*69*	*58.1-112*			
Total Metals by SW 846 Series Methods													
Batch\Seq: 7G10005 Extracted: 07/10/07													
Matrix Spike Analyzed: 07/10/2007 (7G10005-MS1)				QC Source Sample: HQG0016-10									
Arsenic	2.89	18.7	mg/kg	N/A	0.935	3.25	4.24	2	7	80-120	26	20	M1
Lead	ND	18.7	mg/kg	N/A	1.87	9.62	12.3	51	62	80-120	25	20	M1,R3
Batch\Seq: 7G11013 Extracted: 07/11/07													
Matrix Spike Analyzed: 07/11/2007 (7G11013-MS1)				QC Source Sample: HQG0033-01									
Mercury	76.4	0.241	mg/kg	N/A	7.22	66.8	85.8	-3970	3100	75-125	26	20	MHA
Batch\Seq: 7G16005 Extracted: 07/16/07													
Matrix Spike Analyzed: 07/17/2007 (7G16005-MS1)				QC Source Sample: HQG0007-07									
Arsenic	6.71	93.5	mg/kg	N/A	4.67	88.8	83.3	88	83	80-120	6	20	
Barium	23.2	93.5	mg/kg	N/A	9.35	105	95.5	87	83	80-120	9	20	
Cadmium	ND	93.5	mg/kg	N/A	1.87	66.4	61.1	71	70	80-120	8	20	M1
Chromium	13.6	93.5	mg/kg	N/A	4.67	97.1	92.2	89	90	80-120	5	20	
Lead	1.68	93.5	mg/kg	N/A	9.35	75.4	69.8	79	78	80-120	8	20	M1
Selenium	0.771	93.5	mg/kg	N/A	9.35	78.5	71.6	83	81	80-120	9	20	
Silver	ND	9.35	mg/kg	N/A	4.67	7.33	6.61	78	76	80-120	10	20	M1

Volatile Organic Compounds by EPA 8260B

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Volatile Organic Compounds by EPA 8260B													
Batch\Seq: 7G12011 Extracted: 07/11/07													
Matrix Spike Analyzed: 07/12/2007 (7G12011-MS1)				QC Source Sample: HQG0016-12									
1,1-Dichloroethene	ND	0.0998	mg/kg	N/A	0.00998	0.0861		86		65.1-127			
Chlorobenzene	ND	0.0998	mg/kg	N/A	0.00998	0.110		110		74.4-119			
Trichloroethene	ND	0.0998	mg/kg	N/A	0.00998	0.0920		92		72.9-119			
Surrogate: 1,2-Dichloroethane-d4			mg/kg					*136*		*58.3-156*			
Surrogate: 4-Bromofluorobenzene			mg/kg					*130*		*72.1-156*			
Surrogate: Dibromofluoromethane			mg/kg					*115*		*63.2-149*			
Surrogate: Toluene-d8			mg/kg					*118*		*70.5-145*			

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

CERTIFICATION SUMMARY

Subcontracted Laboratories

Anatek Labs.

1282 Alturas Dr. - Moscow, ID 83843

Analysis Performed: 8270Modified Pest. Screen
Samples: HQG0016-01, HQG0016-02, HQG0016-03, HQG0016-04, HQG0016-05, HQG0016-06, HQG0016-07, HQG0016-08, HQG0016-09, HQG0016-10

Analysis Performed: 8321 Carbamate Herbicides
Samples: HQG0016-01, HQG0016-02, HQG0016-03, HQG0016-04, HQG0016-05, HQG0016-06, HQG0016-07, HQG0016-08, HQG0016-09, HQG0016-10

STL - Seattle, WA

5755 8th Street East - Tacoma., WA 98424

Analysis Performed: 8081A Pesticides
Samples: HQG0016-01, HQG0016-02, HQG0016-03, HQG0016-04, HQG0016-05, HQG0016-06, HQG0016-07, HQG0016-08, HQG0016-09, HQG0016-10, HQG0016-19, HQG0016-20

Analysis Performed: 8151 Herbicides
Samples: HQG0016-01, HQG0016-02, HQG0016-03, HQG0016-04, HQG0016-05, HQG0016-06, HQG0016-07, HQG0016-08, HQG0016-09, HQG0016-10, HQG0016-19, HQG0016-20

Any abnormalities or departures from sample acceptance policy shall be documented on the 'Sample Receipt and Temperature Log Form' and 'Sample Non-conformance Form' (if applicable) included with this report.

For information concerning certifications of this facility or another TestAmerica facility, please visit our website at www.TestAmericaInc.com

Samples collected by TestAmerica Field Services personnel are noted on the Chain of Custody (COC) and are sampled in accordance with TA-CF SOP CF09-01.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

99-193 Aiea Heights Drive, Suite 121 Aiea, HI 96701 * 808-486-5227 * Fax 808-486-2456

Element Environmental LLC 62-180 Emerson Rd. Haleiwa, HI 96712 Matt Neal	Work Order: HQG0016 Project: Maalea Project Number: Maalaea Phase II ESA	Received: 07/02/07 Reported: 08/08/07 09:34

DATA QUALIFIERS AND DEFINITIONS

C-01	To reduce matrix interference, the sample extract has undergone sulfuric acid clean-up, method 3665A, which is specific to hydrocarbon contamination.
C-02	To reduce matrix interference, the sample extract has undergone copper clean-up, method 3660, which is specific to sulfur contamination.
C2	Calibration Verification recovery was below the method control limit for this analyte, however the average % difference for all analytes met method criteria. See Calibration Summary form. 91.15%
L1	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was above acceptance limits.
L2	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was below acceptance limits.
M1	The MS and/or MSD were outside the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).
R3	The RPD exceeded the acceptance limit due to sample matrix effects.
Z	Due to sample matrix effects, the surrogate recovery was below the acceptance limits.
Z3	The sample required a dilution due to the nature of the sample matrix. Because of this dilution, the surrogate spike concentration in the sample was reduced to a level where the recovery calculation does not provide useful information.
Z5	Due to sample matrix effects, the surrogate recovery was outside acceptance limits. Secondary surrogate recovery was within the acceptance limits.

ADDITIONAL COMMENTS

Oceanic Analytical Laboratory, Inc.

99-193 Aiea Heights Drive, Suite 121 Aiea, Hawaii 96701-3900
Telephone: (808)486-LABS (5227) Fax: (808)486-2456 E-mail: Info@oceanic-labs.com

LABORATORY USE ONLY
LAB JOB NO. HQG0016
LOCATION
CONTAINERS

Chain of Custody / Analysis Request Form

Report To: Matt Neal
Company Name: Element Environmental LLC
Address: 62-180 Emerson Road
City: Haleiwa State: HI Zip: 96712
Phone: 637-1200 Fax: 637-0001
Sampler: MN # of Samples in Shipment: ~~10~~ 20 PM

Project Identification
Job Name: Maalaea Phase II ESA
Job Number: ~~X~~ PM
P.O. Number:
Date of Sample Shipment: 7/2/07
Date Results Needed: Standard TAT

Indicate Analysis Requested: ICP Metals (Arsenic & Lead); SVOCs; Chlorinated Herbicides; Organochlorine Pesticides; PCBs

Item No.	Client Sample I.D.	Multi-Increment	COMP	GRAB	Matrix	Preservation Method	Sampling Date	Sampling Time	Number of Containers	ICP Metals (Arsenic & Lead)	SVOCs	Chlorinated Herbicides	Organochlorine Pesticides	PCBs	Laboratory No.
1	DU1	X			Soil X	—	4/29/07	16.45	1	X	X	X	X	X	HQF0016-01
2	DU2	X					4/28/07	13:30	2						-02
3	DU3	X					4/20/07	15:51	2						-03
4	DU4	X					4/20/07	16:30	2						-04
5	DU5	X					4/28/07	16:50	2						-05
6	DU6	X					4/29/07	10:10	2						-06
7	DU7	X					4/29/07	11:10	2						-07
8	DU8	X					4/29/07	12:10	1						-08
9	DU9	X					4/29/07	14.10	1						-09
10	DU10	X					4/29/07	15:10	1						-10

Released by (Print/Signature)	Date / Time Released	Delivery Method	Received by (Print/Signature)	Company / Agency Affiliation	Date / Time Received	Condition Noted
Matt Neal / [signature]	7/2/07 / 1235	Hand	Yvonne Parry / YVONNE PARRY	TA HON	7/2/07 / 1235	wet ice intact 0-3°C
	/				/	
	/				/	

Comments: Samples DU1 – DU10 are Multi Increment Samples

Please Check Box
☐ Dispose by Lab
☐ Return to Client
☐ Archive

White - Oceanic Analytical Yellow - Oceanic Analytical Pink - Client

SGS

CHAIN OF CUSTODY RECORD
CT&E Enviromental Services Inc.
Laboratory Division

Locations Nationwide
- Alaska
- Maryland
- New Jersey
- Hawaii
- Louisiana
- Michigan
- West Virginia

www.sgsenvironmental.com 035795

CLIENT: Element Environmental LLC
CONTACT: Matt Neal PHONE NO: (808) 637-1200
PROJECT: Maalaea Phase II ESA SITE/PWSID#:
REPORTS TO: Matt Neal FAX NO.: (673) -0001
INVOICE TO: QUOTE #
P.O. NUMBER

CT&E Reference:

PAGE 2 OF 2

Analysis Required: HVOC (1,3-dichloropropene); Fuel Fingerprint/Gas, diesel...; RCRA 8 Total Metals; Chlorinated herbicides; Organochlorine pesticides; PCBs; HVOCs; SVOCs

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	SAMPLE TYPE (C=COMP, G=GRAB)	HVOC (1,3-dichloropropene)	Fuel Fingerprint/Gas, diesel	RCRA 8 Total Metals	Chlorinated herbicides	Organochlorine pesticides	PCBs	HVOCs	SVOCs	REMARKS
HQG0016-11	DU1-VOC	6/29/07	16:30	Soil	2	G	X								HQG0016
-12	DU2-VOC	↓	15:55	↓	2	↓	X								
-13	DU3-VOC		15:23		2		X								
-14	DU4-VOC		14:53		2		X								
-15	DU5-VOC		14:26		2		X								
-16	DU6-VOC		13:53		1		X								
-17	DU7-VOC		13:25		2		X								
-18	DU8-VOC		12:33		2		X								
-19	DRUM 1		19:07		4			X	X	X	X	X	X	X	
-20	DRUM 2	↓	19:17	↓	4	↓		X	X	X	X	X	X	X	

Collected/Relinquished By: (1)	Date	Time	Received By:
Matt Neal / Meg Neal	7/2/07	1235	Yvonne Vati-Ray
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received By:

Shipping Carrier:
Shipping Ticket No:
Samples Received Cold? (Circle) YES NO
Temperature °C: 0 . 3°C
Special Deliverable Requirements:
Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT
Requested Turnaround Time and Special Instructions:

STL

ANALYTICAL REPORT

Job Number: 580-6454-1

Job Description: HQG0016

For:
TestAmerica Analytical Testing Corp.
99-193 Aiea Heights Drive
Suite 121
Aiea, HI 96701

Attention: Yvonne Parry

Tiffany Ryan
Project Mgmt. Assistant
tiffany.ryan@testamericainc.com
07/23/2007

Project Manager: Terri L Torres

STL Seattle is a part of Severn Trent Laboratories, Inc.

Severn Trent Laboratories, Inc.
STL Seattle 5755 8th Street East, Tacoma, WA 98424
Tel (253) 922-2310 Fax (253) 922-5047 www.stl-inc.com

Job Narrative
580-J6454-1

GC Semi VOA - Method 8081A
The matrix spike / matrix spike duplicate (MS/MSD) recoveries for batch 580-20818 were outside control limits for delta-BHC, Endosulfan II, Endosulfan sulfate, Endrin aldehyde, Endrin ketone, and Methoxychlor. It is believed that this is due to matrix interference. The associated laboratory control standard (LCS) met acceptance criteria. The data has been reported as is.

The surrogate recovery of Tetrachloro-m-xylene (126%) in sample 580-6454-4 associated with batch 580-20899 exceeded QC limits (49-123%). All other surrogates were within control limits. No further action was taken on this outlier.

No other analytical or quality issues were noted.

METHOD SUMMARY

Client: TestAmerica Analytical Testing Corp. Job Number: 580-6454-1

Description	Lab Location	Method	Preparation Method
Matrix: Solid			
Chlorinated Herbicides by GC-MS	STL SEA	SW846 8151A	
Chlorinated Herbicides by GC - Solids Prep	STL SEA		SW846 8151A
Organochlorine Pesticides by Gas Chromatography	STL SEA	SW846 8081A	
Ultrasonic Extraction (Low Level)	STL SEA		SW846 3550B

LAB REFERENCES:

STL SEA = STL Seattle

METHOD REFERENCES:

SW846 - "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

SAMPLE SUMMARY

Client: TestAmerica Analytical Testing Corp. Job Number: 580-6454-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
580-6454-1	HQG0016-01	Solid	06/29/2007 1645	07/09/2007 1150
580-6454-2	HQG0016-02	Solid	06/28/2007 1330	07/09/2007 1150
580-6454-3	HQG0016-03	Solid	06/28/2007 1551	07/09/2007 1150
580-6454-4	HQG0016-04	Solid	06/28/2007 1630	07/09/2007 1150
580-6454-5	HQG0016-05	Solid	06/28/2007 1650	07/09/2007 1150
580-6454-6	HQG0016-06	Solid	06/29/2007 1010	07/09/2007 1150
580-6454-7	HQG0016-07	Solid	06/29/2007 1110	07/09/2007 1150
580-6454-8	HQG0016-08	Solid	06/29/2007 1210	07/09/2007 1150
580-6454-9	HQG0016-09	Solid	06/29/2007 1410	07/09/2007 1150
580-6454-10	HQG0016-10	Solid	06/29/2007 1510	07/09/2007 1150
580-6454-11	HQG0016-19	Solid	06/29/2007 1907	07/09/2007 1150
580-6454-12	HQG0016-20	Solid	06/29/2007 1907	07/09/2007 1150

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-01

Lab Sample ID: 580-6454-1
Client Matrix: Solid

Date Sampled: 06/29/2007 1645
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23796.D
Dilution:	1.0			Initial Weight/Volume:	30.0012 g
Date Analyzed:	07/13/2007 0727			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.3
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.3
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	99	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-02

Lab Sample ID: 580-6454-2
Client Matrix: Solid

Date Sampled: 06/28/2007 1330
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23797.D
Dilution:	1.0			Initial Weight/Volume:	30.4377 g
Date Analyzed:	07/13/2007 0750			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.2
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.2
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	97	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-03

Lab Sample ID: 580-6454-3
Client Matrix: Solid

Date Sampled: 06/28/2007 1551
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23798.D
Dilution:	1.0			Initial Weight/Volume:	30.5788 g
Date Analyzed:	07/13/2007 0812			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.2
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.2
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	100	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-04

Lab Sample ID: 580-6454-4
Client Matrix: Solid

Date Sampled: 06/28/2007 1630
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23799.D
Dilution:	1.0			Initial Weight/Volume:	30.6799 g
Date Analyzed:	07/13/2007 0835			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.1
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.1
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	98	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-05

Lab Sample ID: 580-6454-5
Client Matrix: Solid

Date Sampled: 06/28/2007 1650
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method: 8151A
Preparation: 8151A
Dilution: 1.0
Date Analyzed: 07/13/2007 1106
Date Prepared: 07/11/2007 1401

Analysis Batch: 580-20656
Prep Batch: 580-20441

Instrument ID: SEA008
Lab File ID: L23800.D
Initial Weight/Volume: 31.0234 g
Final Weight/Volume: 10 mL
Injection Volume:

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.1
4-Nitrophenol		ND		3.2
Dicamba		ND		3.2
MCPP		ND		3.2
MCPA		ND		3.2
Dichlorprop		ND		3.2
2,4-D		ND		3.2
Pentachlorophenol		ND		3.2
Silvex (2,4,5-TP)		ND		3.2
2,4,5-T		ND		3.2
Dinoseb		ND		8.1
2,4-DB		ND		3.2

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	101	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-06

Lab Sample ID: 580-6454-6
Client Matrix: Solid

Date Sampled: 06/29/2007 1010
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method: 8151A
Preparation: 8151A
Dilution: 1.0
Date Analyzed: 07/13/2007 1129
Date Prepared: 07/11/2007 1401

Analysis Batch: 580-20656
Prep Batch: 580-20441

Instrument ID: SEA008
Lab File ID: L23801.D
Initial Weight/Volume: 30.4567 g
Final Weight/Volume: 10 mL
Injection Volume:

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.2
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.2
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	99	51 - 129

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-07

Lab Sample ID: 580-6454-7
Client Matrix: Solid

Date Sampled: 06/29/2007 1110
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method: 8151A
Preparation: 8151A
Dilution: 1.0
Date Analyzed: 07/13/2007 1151
Date Prepared: 07/11/2007 1401

Analysis Batch: 580-20656
Prep Batch: 580-20441

Instrument ID: SEA008
Lab File ID: L23802.D
Initial Weight/Volume: 30.0123 g
Final Weight/Volume: 10 mL
Injection Volume:

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.3
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.3
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	105	51 - 129

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-08

Lab Sample ID: 580-6454-8
Client Matrix: Solid

Date Sampled: 06/29/2007 1210
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method: 8151A
Preparation: 8151A
Dilution: 1.0
Date Analyzed: 07/13/2007 1214
Date Prepared: 07/11/2007 1401

Analysis Batch: 580-20656
Prep Batch: 580-20441

Instrument ID: SEA008
Lab File ID: L23803.D
Initial Weight/Volume: 31.9987 g
Final Weight/Volume: 10 mL
Injection Volume:

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		7.8
4-Nitrophenol		ND		3.1
Dicamba		ND		3.1
MCPP		ND		3.1
MCPA		ND		3.1
Dichlorprop		ND		3.1
2,4-D		ND		3.1
Pentachlorophenol		ND		3.1
Silvex (2,4,5-TP)		ND		3.1
2,4,5-T		ND		3.1
Dinoseb		ND		7.8
2,4-DB		ND		3.1

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	89	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-09

Lab Sample ID: 580-6454-9
Client Matrix: Solid

Date Sampled: 06/29/2007 1410
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23804.D
Dilution:	1.0			Initial Weight/Volume:	30.0123 g
Date Analyzed:	07/13/2007 1236			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.3
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.3
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	90	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-10

Lab Sample ID: 580-6454-10
Client Matrix: Solid

Date Sampled: 06/29/2007 1510
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23805.D
Dilution:	1.0			Initial Weight/Volume:	31.3457 g
Date Analyzed:	07/13/2007 1259			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.0
4-Nitrophenol		ND		3.2
Dicamba		ND		3.2
MCPP		ND		3.2
MCPA		ND		3.2
Dichlorprop		ND		3.2
2,4-D		ND		3.2
Pentachlorophenol		ND		3.2
Silvex (2,4,5-TP)		ND		3.2
2,4,5-T		ND		3.2
Dinoseb		ND		8.0
2,4-DB		ND		3.2

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	82	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-19

Lab Sample ID: 580-6454-11
Client Matrix: Solid

Date Sampled: 06/29/2007 1907
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23806.D
Dilution:	1.0			Initial Weight/Volume:	30.1255 g
Date Analyzed:	07/13/2007 1321			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.3
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.3
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	85	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-20

Lab Sample ID: 580-6454-12
Client Matrix: Solid

Date Sampled: 06/29/2007 1907
Date Received: 07/09/2007 1150

8151A Chlorinated Herbicides by GC-MS

Method:	8151A	Analysis Batch: 580-20656		Instrument ID:	SEA008
Preparation:	8151A	Prep Batch: 580-20441		Lab File ID:	L23807.D
Dilution:	1.0			Initial Weight/Volume:	30.1447 g
Date Analyzed:	07/13/2007 1344			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Dalapon		ND		8.3
4-Nitrophenol		ND		3.3
Dicamba		ND		3.3
MCPP		ND		3.3
MCPA		ND		3.3
Dichlorprop		ND		3.3
2,4-D		ND		3.3
Pentachlorophenol		ND		3.3
Silvex (2,4,5-TP)		ND		3.3
2,4,5-T		ND		3.3
Dinoseb		ND		8.3
2,4-DB		ND		3.3

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	79	51 - 129

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-01

Lab Sample ID: 580-6454-1
Client Matrix: Solid

Date Sampled: 06/29/2007 1645
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method:	8081A	Analysis Batch: 580-20899	Instrument ID: SEA035
Preparation:	3550B	Prep Batch: 580-20818	Lab File ID: ECD26325.D
Dilution:	1.0		Initial Weight/Volume: 30.5684 g
Date Analyzed:	07/20/2007 1749		Final Weight/Volume: 20 mL
Date Prepared:	07/20/2007 0855		Injection Volume:
			Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.65
alpha-BHC		ND	H	0.65
beta-BHC		ND	H	0.65
delta-BHC		ND	H	0.65
gamma-BHC (Lindane)		ND	H	0.65
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.65
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.65
Heptachlor epoxide		ND	H	0.65
Methoxychlor		ND	H	6.5
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	65
alpha-Chlordane		ND	H	0.65
gamma-Chlordane		ND	H	0.65

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	103	49 - 123
DCB Decachlorobiphenyl	95	40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-02

Lab Sample ID: 580-6454-2
Client Matrix: Solid

Date Sampled: 06/28/2007 1330
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method:	8081A	Analysis Batch: 580-20899	Instrument ID: SEA035
Preparation:	3550B	Prep Batch: 580-20818	Lab File ID: ECD26326.D
Dilution:	1.0		Initial Weight/Volume: 30.6645 g
Date Analyzed:	07/20/2007 1808		Final Weight/Volume: 20 mL
Date Prepared:	07/20/2007 0855		Injection Volume:
			Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.65
alpha-BHC		ND	H	0.65
beta-BHC		ND	H	0.65
delta-BHC		ND	H	0.65
gamma-BHC (Lindane)		ND	H	0.65
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.65
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.65
Heptachlor epoxide		ND	H	0.65
Methoxychlor		ND	H	6.5
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	65
alpha-Chlordane		ND	H	0.65
gamma-Chlordane		ND	H	0.65

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	101	49 - 123
DCB Decachlorobiphenyl	85	40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: **HQG0016-03**

Lab Sample ID: 580-6454-3
Client Matrix: Solid

Date Sampled: 06/28/2007 1551
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A
Preparation: 3550B
Dilution: 1.0
Date Analyzed: 07/20/2007 1828
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26327.D
Initial Weight/Volume: 30.8802 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N Result (ug/Kg)	Qualifier	RL
Aldrin	ND	H	0.65
alpha-BHC	ND	H	0.65
beta-BHC	ND	H	0.65
delta-BHC	ND	H	0.65
gamma-BHC (Lindane)	ND	H	0.65
4,4'-DDD	ND	H	1.3
4,4'-DDE	ND	H	1.3
4,4'-DDT	ND	H	1.3
Dieldrin	ND	H	1.3
Endosulfan I	ND	H	0.65
Endosulfan II	ND	H	1.3
Endosulfan sulfate	ND	H	1.3
Endrin	ND	H	1.3
Endrin aldehyde	ND	H	1.3
Heptachlor	ND	H	0.65
Heptachlor epoxide	ND	H	0.65
Methoxychlor	ND	H	6.5
Endrin ketone	ND	H	1.3
Toxaphene	ND	H	65
alpha-Chlordane	ND	H	0.65
gamma-Chlordane	ND	H	0.65

Surrogate	%Rec	Qualifier	Acceptance Limits
Tetrachloro-m-xylene	105		49 - 123
DCB Decachlorobiphenyl	97		40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: **HQG0016-04**

Lab Sample ID: 580-6454-4
Client Matrix: Solid

Date Sampled: 06/28/2007 1630
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A
Preparation: 3550B
Dilution: 1.0
Date Analyzed: 07/20/2007 1847
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26328.D
Initial Weight/Volume: 30.7934 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N Result (ug/Kg)	Qualifier	RL
Aldrin	ND	H	0.65
alpha-BHC	ND	H	0.65
beta-BHC	ND	H	0.65
delta-BHC	ND	H	0.65
gamma-BHC (Lindane)	ND	H	0.65
4,4'-DDD	ND	H	1.3
4,4'-DDE	ND	H	1.3
4,4'-DDT	ND	H	1.3
Dieldrin	ND	H	1.3
Endosulfan I	ND	H	0.65
Endosulfan II	ND	H	1.3
Endosulfan sulfate	ND	H	1.3
Endrin	ND	H	1.3
Endrin aldehyde	ND	H	1.3
Heptachlor	ND	H	0.65
Heptachlor epoxide	ND	H	0.65
Methoxychlor	ND	H	6.5
Endrin ketone	ND	H	1.3
Toxaphene	ND	H	65
alpha-Chlordane	ND	H	0.65
gamma-Chlordane	ND	H	0.65

Surrogate	%Rec	Qualifier	Acceptance Limits
Tetrachloro-m-xylene	126	X	49 - 123
DCB Decachlorobiphenyl	112		40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp. Job Number: 580-6454-1

Client Sample ID: HQG0016-05

Lab Sample ID: 580-6454-5 Date Sampled: 06/28/2007 1650
Client Matrix: Solid Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A Analysis Batch: 580-20899 Instrument ID: SEA035
Preparation: 3550B Prep Batch: 580-20818 Lab File ID: ECD26329.D
Dilution: 1.0 Initial Weight/Volume: 30.9321 g
Date Analyzed: 07/20/2007 1907 Final Weight/Volume: 20 mL
Date Prepared: 07/20/2007 0855 Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.65
alpha-BHC		ND	H	0.65
beta-BHC		ND	H	0.65
delta-BHC		ND	H	0.65
gamma-BHC (Lindane)		ND	H	0.65
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.65
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.65
Heptachlor epoxide		ND	H	0.65
Methoxychlor		ND	H	6.5
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	65
alpha-Chlordane		ND	H	0.65
gamma-Chlordane		ND	H	0.65

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	57	49 - 123
DCB Decachlorobiphenyl	51	40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp. Job Number: 580-6454-1

Client Sample ID: HQG0016-06

Lab Sample ID: 580-6454-6 Date Sampled: 06/29/2007 1010
Client Matrix: Solid Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A Analysis Batch: 580-20899 Instrument ID: SEA035
Preparation: 3550B Prep Batch: 580-20818 Lab File ID: ECD26330.D
Dilution: 1.0 Initial Weight/Volume: 31.1468 g
Date Analyzed: 07/20/2007 1926 Final Weight/Volume: 20 mL
Date Prepared: 07/20/2007 0855 Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.64
alpha-BHC		ND	H	0.64
beta-BHC		ND	H	0.64
delta-BHC		ND	H	0.64
gamma-BHC (Lindane)		ND	H	0.64
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.64
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.64
Heptachlor epoxide		ND	H	0.64
Methoxychlor		ND	H	6.4
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	64
alpha-Chlordane		ND	H	0.64
gamma-Chlordane		ND	H	0.64

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	67	49 - 123
DCB Decachlorobiphenyl	59	40 - 158

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-07

Lab Sample ID: 580-6454-7
Client Matrix: Solid

Date Sampled: 06/29/2007 1110
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A
Preparation: 3550B
Dilution: 1.0
Date Analyzed: 07/20/2007 1946
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26331.D
Initial Weight/Volume: 29.8976 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.67
alpha-BHC		ND	H	0.67
beta-BHC		ND	H	0.67
delta-BHC		ND	H	0.67
gamma-BHC (Lindane)		ND	H	0.67
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.67
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.67
Heptachlor epoxide		ND	H	0.67
Methoxychlor		ND	H	6.7
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	67
alpha-Chlordane		ND	H	0.67
gamma-Chlordane		ND	H	0.67

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	91	49 - 123
DCB Decachlorobiphenyl	83	40 - 158

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-08

Lab Sample ID: 580-6454-8
Client Matrix: Solid

Date Sampled: 06/29/2007 1210
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A
Preparation: 3550B
Dilution: 1.0
Date Analyzed: 07/20/2007 2045
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26334.D
Initial Weight/Volume: 30.6358 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.65
alpha-BHC		ND	H	0.65
beta-BHC		ND	H	0.65
delta-BHC		ND	H	0.65
gamma-BHC (Lindane)		ND	H	0.65
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.65
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.65
Heptachlor epoxide		ND	H	0.65
Methoxychlor		ND	H	6.5
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	65
alpha-Chlordane		ND	H	0.65
gamma-Chlordane		ND	H	0.65

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	85	49 - 123
DCB Decachlorobiphenyl	74	40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-09

Lab Sample ID: 580-6454-9
Client Matrix: Solid

Date Sampled: 06/29/2007 1410
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method:	8081A	Analysis Batch: 580-20899		Instrument ID:	SEA035
Preparation:	3550B	Prep Batch: 580-20818		Lab File ID:	ECD26335.D
Dilution:	1.0			Initial Weight/Volume:	30.9676 g
Date Analyzed:	07/20/2007 2104			Final Weight/Volume:	20 mL
Date Prepared:	07/20/2007 0855			Injection Volume:	
				Column ID:	PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.65
alpha-BHC		ND	H	0.65
beta-BHC		ND	H	0.65
delta-BHC		ND	H	0.65
gamma-BHC (Lindane)		ND	H	0.65
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.65
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.65
Heptachlor epoxide		ND	H	0.65
Methoxychlor		ND	H	6.5
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	65
alpha-Chlordane		ND	H	0.65
gamma-Chlordane		ND	H	0.65

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	97	49 - 123
DCB Decachlorobiphenyl	89	40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-10

Lab Sample ID: 580-6454-10
Client Matrix: Solid

Date Sampled: 06/29/2007 1510
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method:	8081A	Analysis Batch: 580-20899		Instrument ID:	SEA035
Preparation:	3550B	Prep Batch: 580-20818		Lab File ID:	ECD26336.D
Dilution:	1.0			Initial Weight/Volume:	30.1861 g
Date Analyzed:	07/20/2007 2124			Final Weight/Volume:	20 mL
Date Prepared:	07/20/2007 0855			Injection Volume:	
				Column ID:	PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.66
alpha-BHC		ND	H	0.66
beta-BHC		ND	H	0.66
delta-BHC		ND	H	0.66
gamma-BHC (Lindane)		ND	H	0.66
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.66
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.66
Heptachlor epoxide		ND	H	0.66
Methoxychlor		ND	H	6.6
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	66
alpha-Chlordane		ND	H	0.66
gamma-Chlordane		ND	H	0.66

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	95	49 - 123
DCB Decachlorobiphenyl	94	40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-19

Lab Sample ID: 580-6454-11
Client Matrix: Solid

Date Sampled: 06/29/2007 1907
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A
Preparation: 3550B
Dilution: 1.0
Date Analyzed: 07/20/2007 2223
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26339.D
Initial Weight/Volume: 30.4557 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.66
alpha-BHC		ND	H	0.66
beta-BHC		ND	H	0.66
delta-BHC		ND	H	0.66
gamma-BHC (Lindane)		ND	H	0.66
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.66
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.66
Heptachlor epoxide		ND	H	0.66
Methoxychlor		ND	H	6.6
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	66
alpha-Chlordane		ND	H	0.66
gamma-Chlordane		ND	H	0.66

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	97	49 - 123
DCB Decachlorobiphenyl	79	40 - 158

Analytical Data

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Client Sample ID: HQG0016-20

Lab Sample ID: 580-6454-12
Client Matrix: Solid

Date Sampled: 06/29/2007 1907
Date Received: 07/09/2007 1150

8081A Organochlorine Pesticides by Gas Chromatography

Method: 8081A
Preparation: 3550B
Dilution: 1.0
Date Analyzed: 07/20/2007 2242
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26340.D
Initial Weight/Volume: 31.3384 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	DryWt Corrected: N	Result (ug/Kg)	Qualifier	RL
Aldrin		ND	H	0.64
alpha-BHC		ND	H	0.64
beta-BHC		ND	H	0.64
delta-BHC		ND	H	0.64
gamma-BHC (Lindane)		ND	H	0.64
4,4'-DDD		ND	H	1.3
4,4'-DDE		ND	H	1.3
4,4'-DDT		ND	H	1.3
Dieldrin		ND	H	1.3
Endosulfan I		ND	H	0.64
Endosulfan II		ND	H	1.3
Endosulfan sulfate		ND	H	1.3
Endrin		ND	H	1.3
Endrin aldehyde		ND	H	1.3
Heptachlor		ND	H	0.64
Heptachlor epoxide		ND	H	0.64
Methoxychlor		ND	H	6.4
Endrin ketone		ND	H	1.3
Toxaphene		ND	H	64
alpha-Chlordane		ND	H	0.64
gamma-Chlordane		ND	H	0.64

Surrogate	%Rec	Acceptance Limits
Tetrachloro-m-xylene	88	49 - 123
DCB Decachlorobiphenyl	67	40 - 158

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Method Blank - Batch: 580-20441

Method: 8151A
Preparation: 8151A

Lab Sample ID: MB 580-20441/1-A
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/13/2007 0534
Date Prepared: 07/11/2007 1401

Analysis Batch: 580-20656
Prep Batch: 580-20441
Units: ug/Kg

Instrument ID: SEA008
Lab File ID: L23791.D
Initial Weight/Volume: 30.0000 g
Final Weight/Volume: 10 mL
Injection Volume:

Analyte	Result	Qual	RL
Dalapon	ND		8.3
4-Nitrophenol	ND		3.3
Dicamba	ND		3.3
MCPP	ND		3.3
MCPA	ND		3.3
Dichlorprop	ND		3.3
2,4-D	ND		3.3
Pentachlorophenol	ND		3.3
Silvex (2,4,5-TP)	ND		3.3
2,4,5-T	ND		3.3
Dinoseb	ND		8.3
2,4-DB	ND		3.3

Surrogate	% Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	100	51 - 129

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Lab Control Spike/
Lab Control Spike Duplicate Recovery Report - Batch: 580-20441

Method: 8151A
Preparation: 8151A

LCS Lab Sample ID: LCS 580-20441/2-A
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/13/2007 0557
Date Prepared: 07/11/2007 1401

Analysis Batch: 580-20656
Prep Batch: 580-20441
Units: ug/Kg

Instrument ID: SEA008
Lab File ID: L23792.D
Initial Weight/Volume: 30.0000 g
Final Weight/Volume: 10 mL
Injection Volume:

LCSD Lab Sample ID: LCSD 580-20441/3-A
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/13/2007 0620
Date Prepared: 07/11/2007 1401

Analysis Batch: 580-20656
Prep Batch: 580-20441
Units: ug/Kg

Instrument ID: SEA008
Lab File ID: L23793.D
Initial Weight/Volume: 30.0000 g
Final Weight/Volume: 10 mL
Injection Volume:

Analyte	% Rec. LCS	% Rec. LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
Dalapon	57	59	16 - 74	4	30		
4-Nitrophenol	68	73	50 - 150	7	30		
Dicamba	94	90	48 - 123	4	30		
MCPP	105	111	53 - 154	5	30		
MCPA	107	106	50 - 150	1	30		
Dichlorprop	114	121	75 - 140	6	30		
2,4-D	86	92	46 - 136	6	30		
Pentachlorophenol	107	100	50 - 150	6	30		
Silvex (2,4,5-TP)	99	99	52 - 137	0	30		
2,4,5-T	99	104	45 - 135	4	30		
Dinoseb	68	80	18 - 157	15	30		
2,4-DB	107	113	50 - 155	5	30		

Surrogate	LCS % Rec	LCSD % Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	104	99	51 - 129

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: TestAmerica Analytical Testing Corp. Job Number: 580-6454-1

Matrix Spike/
Matrix Spike Duplicate Recovery Report - Batch: 580-20441

Method: 8151A
Preparation: 8151A

MS Lab Sample ID:	580-6454-12	Analysis Batch:	580-20656	Instrument ID:	SEA008
Client Matrix:	Solid	Prep Batch:	580-20441	Lab File ID:	L23794.D
Dilution:	1.0			Initial Weight/Volume:	15.0126 g
Date Analyzed:	07/13/2007 0642			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

MSD Lab Sample ID:	580-6454-12	Analysis Batch:	580-20656	Instrument ID:	SEA008
Client Matrix:	Solid	Prep Batch:	580-20441	Lab File ID:	L23795.D
Dilution:	1.0			Initial Weight/Volume:	15.1266 g
Date Analyzed:	07/13/2007 0704			Final Weight/Volume:	10 mL
Date Prepared:	07/11/2007 1401			Injection Volume:	

Analyte	% Rec. MS	MSD	Limit	RPD	RPD Limit	MS Qual	MSD Qual
Dalapon	23	23	16 - 74	1	30		
4-Nitrophenol	55	57	50 - 150	2	30		
Dicamba	65	71	48 - 123	8	30		
MCPP	78	86	53 - 154	9	30		
MCPA	69	75	50 - 150	7	30		
Dichlorprop	76	81	75 - 140	6	30		
2,4-D	55	62	46 - 136	11	30		
Pentachlorophenol	120	137	50 - 150	12	30		
Silvex (2,4,5-TP)	80	90	52 - 137	11	30		
2,4,5-T	66	73	45 - 135	9	30		
Dinoseb	104	105	18 - 157	0	30		
2,4-DB	122	130	50 - 155	6	30		

Surrogate	MS % Rec	MSD % Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	80	80	51 - 129

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: TestAmerica Analytical Testing Corp. Job Number: 580-6454-1

Method Blank - Batch: 580-20818

Method: 8081A
Preparation: 3550B

Lab Sample ID:	MB 580-20818/1-A	Analysis Batch:	580-20899	Instrument ID:	SEA035
Client Matrix:	Solid	Prep Batch:	580-20818	Lab File ID:	ECD26322.D
Dilution:	1.0	Units:	ug/Kg	Initial Weight/Volume:	30 g
Date Analyzed:	07/20/2007 1650			Final Weight/Volume:	20 mL
Date Prepared:	07/20/2007 0855			Injection Volume:	
				Column ID:	PRIMARY

Analyte	Result	Qual	RL
Aldrin	ND		0.67
alpha-BHC	ND		0.67
beta-BHC	ND		0.67
delta-BHC	ND		0.67
gamma-BHC (Lindane)	ND		0.67
4,4'-DDD	ND		1.3
4,4'-DDE	ND		1.3
4,4'-DDT	ND		1.3
Dieldrin	ND		1.3
Endosulfan I	ND		0.67
Endosulfan II	ND		1.3
Endosulfan sulfate	ND		1.3
Endrin	ND		1.3
Endrin aldehyde	ND		1.3
Heptachlor	ND		0.67
Heptachlor epoxide	ND		0.67
Methoxychlor	ND		6.7
Endrin ketone	ND		1.3
Toxaphene	ND		67
alpha-Chlordane	ND		0.67
gamma-Chlordane	ND		0.67

Surrogate	% Rec	Acceptance Limits
Tetrachloro-m-xylene	111	49 - 123
DCB Decachlorobiphenyl	111	40 - 158

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Lab Control Spike/
Lab Control Spike Duplicate Recovery Report - Batch: 580-20818

Method: 8081A
Preparation: 3550B

LCS Lab Sample ID: LCS 580-20818/2-A
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/20/2007 1709
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818
Units: ug/Kg

Instrument ID: SEA035
Lab File ID: ECD26323.D
Initial Weight/Volume: 30 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

LCSD Lab Sample ID: LCSD 580-20818/3-A
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/20/2007 1729
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818
Units: ug/Kg

Instrument ID: SEA035
Lab File ID: ECD26324.D
Initial Weight/Volume: 30 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	% Rec. LCS	% Rec. LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
Aldrin	108	108	53 - 126	1	24		
alpha-BHC	99	101	41 - 128	1	28		
beta-BHC	99	98	48 - 121	1	32		
delta-BHC	43	43	22 - 153	1	36		
gamma-BHC (Lindane)	98	99	50 - 127	1	29		
4,4'-DDD	104	97	44 - 141	6	41		
4,4'-DDE	104	100	47 - 140	4	40		
4,4'-DDT	96	90	34 - 159	6	47		
Dieldrin	101	98	53 - 134	3	32		
Endosulfan I	105	103	52 - 122	2	31		
Endosulfan II	105	100	53 - 132	5	36		
Endosulfan sulfate	85	81	42 - 128	6	43		
Endrin	100	96	46 - 138	4	36		
Endrin aldehyde	96	92	12 - 179	4	47		
Heptachlor	102	105	50 - 130	2	31		
Heptachlor epoxide	105	104	49 - 123	2	31		
Methoxychlor	100	94	46 - 154	7	46		
Endrin ketone	99	93	45 - 127	7	45		
alpha-Chlordane	101	98	46 - 118	3	33		
gamma-Chlordane	103	100	49 - 122	3	32		

Surrogate	LCS % Rec	LCSD % Rec	Acceptance Limits
Tetrachloro-m-xylene	106	108	49 - 123
DCB Decachlorobiphenyl	96	89	40 - 158

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Matrix Spike/
Matrix Spike Duplicate Recovery Report - Batch: 580-20818

Method: 8081A
Preparation: 3550B

MS Lab Sample ID: 580-6454-10
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/20/2007 2143
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26337.D
Initial Weight/Volume: 30.2004 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

MSD Lab Sample ID: 580-6454-10
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/20/2007 2203
Date Prepared: 07/20/2007 0855

Analysis Batch: 580-20899
Prep Batch: 580-20818

Instrument ID: SEA035
Lab File ID: ECD26338.D
Initial Weight/Volume: 30.2453 g
Final Weight/Volume: 20 mL
Injection Volume:
Column ID: PRIMARY

Analyte	% Rec. MS	% Rec. MSD	Limit	RPD	RPD Limit	MS Qual	MSD Qual
Aldrin	107	100	53 - 126	7	24		
alpha-BHC	82	74	41 - 128	10	28		
beta-BHC	62	54	48 - 121	14	32		
delta-BHC	12	10	22 - 153	22	36	F	F
gamma-BHC (Lindane)	75	70	50 - 127	8	29		
4,4'-DDD	87	72	44 - 141	18	41		
4,4'-DDE	107	98	47 - 140	9	40		
4,4'-DDT	81	69	34 - 159	16	47		
Dieldrin	72	63	53 - 134	14	32		
Endosulfan I	88	75	52 - 122	16	31		
Endosulfan II	14	12	53 - 132	17	36	F	F
Endosulfan sulfate	5	4	42 - 128	14	43	F	F
Endrin	75	61	46 - 138	20	36		
Endrin aldehyde	4	6	12 - 179	22	47	F	F
Heptachlor	96	90	50 - 130	6	31		
Heptachlor epoxide	85	76	49 - 123	11	31		
Methoxychlor	42	34	46 - 154	21	46	F	F
Endrin ketone	16	14	45 - 127	10	45	F	F
alpha-Chlordane	89	80	46 - 118	10	33		
gamma-Chlordane	84	76	49 - 122	10	32		

Surrogate	MS % Rec	MSD % Rec	Acceptance Limits
Tetrachloro-m-xylene	93	87	49 - 123
DCB Decachlorobiphenyl	98	88	40 - 158

Calculations are performed before rounding to avoid round-off errors in calculated results.

DATA REPORTING QUALIFIERS

Client: TestAmerica Analytical Testing Corp.

Job Number: 580-6454-1

Lab Section	Qualifier	Description
GC Semi VOA		
	F	MS or MSD exceeds the control limits
	H	Sample was prepped or analyzed beyond the specified holding time
	X	Surrogate exceeds the control limits

SUBCONTRACT ORDER

TestAmerica - Honolulu, HI

HQG0016

STD TAT
7 days

6454

SENDING LABORATORY:

TestAmerica - Honolulu, HI
99-193 Aiea Heights Drive, Suite 121
Aiea, HI 96701
Phone: 808-486-5227
Fax: 808-486-2456
Project Manager: Yvonne K. Parry
Client: Element Environmental LLC

RECEIVING LABORATORY:

STL - Seattle, WA
5755 8th Street East
Tacoma,, WA 98424
Phone :(253) 922-2310
Fax: 253
Project Location: Hawaii
Receipt Temperature: 20.5 °C

Ice: Y / N

Analysis	Due	Expires	Interlab	Surch	Comments
Sample ID: HQG0016-01	**Solid/Soil**	Sampled: 06/29/07 16:45			
8081A Pesticides	07/13/07 12:00	07/13/07 16:45	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 16:45	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-02	**Solid/Soil**	Sampled: 06/28/07 13:30			
8081A Pesticides	07/13/07 12:00	07/12/07 13:30	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/05/07 13:30	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-03	**Solid/Soil**	Sampled: 06/28/07 15:51			
8081A Pesticides	07/13/07 12:00	07/12/07 15:51	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/05/07 15:51	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-04	**Solid/Soil**	Sampled: 06/28/07 16:30			
8081A Pesticides	07/13/07 12:00	07/12/07 16:30	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/05/07 16:30	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-05	**Solid/Soil**	Sampled: 06/28/07 16:50			
8081A Pesticides	07/13/07 12:00	07/12/07 16:50	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/05/07 16:50	$195.00	0%	
Containers Supplied:					

Samples 1-10 are multiincremental, please extract entire jar provided (~30g)

Released By	Date/Time	Received By	Date/Time
Yvonne Parry PCP	7/5/07 13:45	K[illegible]	7/9/07 1150A

SUBCONTRACT ORDER

TestAmerica - Honolulu, HI

HQG0016

Analysis	Due	Expires	Interlab	Surch	Comments
Sample ID: HQG0016-06	Solid/Soil	Sampled: 06/29/07 10:10			
8081A Pesticides	07/13/07 12:00	07/13/07 10:10	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 10:10	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-07	Solid/Soil	Sampled: 06/29/07 11:10			
8081A Pesticides	07/13/07 12:00	07/13/07 11:10	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 11:10	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-08	Solid/Soil	Sampled: 06/29/07 12:10			
8081A Pesticides	07/13/07 12:00	07/13/07 12:10	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 12:10	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-09	Solid/Soil	Sampled: 06/29/07 14:10			
8081A Pesticides	07/13/07 12:00	07/13/07 14:10	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 14:10	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-10	Solid/Soil	Sampled: 06/29/07 15:10			
8081A Pesticides	07/13/07 12:00	07/13/07 15:10	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 15:10	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-19	Solid/Soil	Sampled: 06/29/07 19:07			
8081A Pesticides	07/13/07 12:00	07/13/07 19:07	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 19:07	$195.00	0%	
Containers Supplied:					
Sample ID: HQG0016-20	Solid/Soil	Sampled: 06/29/07 19:07			
8081A Pesticides	07/13/07 12:00	07/13/07 19:07	$135.00	0%	
8151 Herbicides	07/13/07 12:00	07/06/07 19:07	$195.00	0%	
Containers Supplied:					

LOGIN SAMPLE RECEIPT CHECK LIST

Client: TestAmerica Analytical Testing Corp. Job Number: 580-6454-1

Login Number: 6454

Question	T/F/NA	Comment
Radioactivity either was not measured or, if measured, is at or below background		
The cooler's custody seal, if present, is intact.		
The cooler or samples do not appear to have been compromised or tampered with.		
Samples were received on ice.		
Cooler Temperature is acceptable.		
Cooler Temperature is recorded.		
COC is present.		
COC is filled out in ink and legible.		
COC is filled out with all pertinent information.		
There are no discrepancies between the sample IDs on the containers and the COC.		
Samples are received within Holding Time.		
Sample containers have legible labels.		
Containers are not broken or leaking.		
Sample collection date/times are provided.		
Appropriate sample containers are used.		
Sample bottles are completely filled.		
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs		
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.		
If necessary, staff have been informed of any short hold time or quick TAT needs		
Multiphasic samples are not present.		
Samples do not require splitting or compositing.		

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client: TEST AMERICA - HONOLULU, HI
Address: 99-193 AIEA HEIGHTS DRIVE
AIEA, HI 96701-3900
Attn: YVONNE PARRY

Batch #: 070712032
Project Name: HQG0016

Analytical Results Report

Sample Number 070712032-001 | Sampling Date 6/29/2007 | Date/Time Received 7/12/2007 11:00 AM
Client Sample ID HQG0016-01 | Sampling Time 4:45 PM | Extraction Date 7/12/2007
Matrix: Soil

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	5.2	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number 070712032-001

Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	99.4	30-140

Comments:

Anatek Labs, Inc.

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504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client: TEST AMERICA - HONOLULU, HI
Address: 99-193 AIEA HEIGHTS DRIVE
AIEA, HI 96701-3900
Attn: YVONNE PARRY

Batch #: 070712032
Project Name: HQG0016

Analytical Results Report

Sample Number 070712032-002 | Sampling Date 6/28/2007 | Date/Time Received 7/12/2007 11:00 AM
Client Sample ID HQG0016-02 | Sampling Time 1:30 PM | Extraction Date 7/12/2007
Matrix: Soil

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	5.6	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number 070712032-002

Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	128.4	30-140

Comments:

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	TEST AMERICA - HONOLULU, HI	**Batch #:**	070712032
Address:	99-193 AIEA HEIGHTS DRIVE	**Project Name:**	HQG0016
	AIEA, HI 96701-3900		
Attn:	YVONNE PARRY		

Analytical Results Report

Sample Number	070712032-003	**Sampling Date**	6/28/2007	**Date/Time Received**	7/12/2007	11:00 AM
Client Sample ID	HQG0016-03	**Sampling Time**	3:51 PM	**Extraction Date**	7/12/2007	
Matrix:	Soil					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	6.1	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number	070712032-003			
	Surrogate Standard	Method	Percent Recovery	Control Limits
	Terphenyl-d14	EPA 8270C	137.2	30-140

Comments:

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Client:	TEST AMERICA - HONOLULU, HI	**Batch #:**	070712032
Address:	99-193 AIEA HEIGHTS DRIVE	**Project Name:**	HQG0016
	AIEA, HI 96701-3900		
Attn:	YVONNE PARRY		

Analytical Results Report

Sample Number	070712032-004	**Sampling Date**	6/28/2007	**Date/Time Received**	7/12/2007	11:00 AM
Client Sample ID	HQG0016-04	**Sampling Time**	4:30 PM	**Extraction Date**	7/12/2007	
Matrix:	Soil					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	5.9	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number	070712032-004			
	Surrogate Standard	Method	Percent Recovery	Control Limits
	Terphenyl-d14	EPA 8270C	120.6	30-140

Comments:

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Client:	TEST AMERICA - HONOLULU, HI	Batch #:	070712032
Address:	99-193 AIEA HEIGHTS DRIVE	Project Name:	HQG0016
	AIEA, HI 96701-3900		
Attn:	YVONNE PARRY		

Analytical Results Report

Sample Number	070712032-005	Sampling Date	6/28/2007	Date/Time Received	7/12/2007	11:00 AM
Client Sample ID	HQG0016-05	Sampling Time	4:50 PM	Extraction Date	7/12/2007	
Matrix:	Soil					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	5.9	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number	070712032-005		
Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	125.8	30-140

Comments:

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Client:	TEST AMERICA - HONOLULU, HI	Batch #:	070712032
Address:	99-193 AIEA HEIGHTS DRIVE	Project Name:	HQG0016
	AIEA, HI 96701-3900		
Attn:	YVONNE PARRY		

Analytical Results Report

Sample Number	070712032-006	Sampling Date	6/29/2007	Date/Time Received	7/12/2007	11:00 AM
Client Sample ID	HQG0016-06	Sampling Time	10:10 AM	Extraction Date	7/12/2007	
Matrix:	Soil					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	5.9	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number	070712032-006		
Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	105.0	30-140

Comments:

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Client: TEST AMERICA - HONOLULU, HI
Address: 99-193 AIEA HEIGHTS DRIVE
AIEA, HI 96701-3900
Attn: YVONNE PARRY

Batch #: 070712032
Project Name: HQG0016

Analytical Results Report

Sample Number 070712032-007
Client Sample ID HQG0016-07
Matrix: Soil
Sampling Date 6/29/2007
Sampling Time 11:10 AM
Date/Time Received 7/12/2007 11:00 AM
Extraction Date 7/12/2007

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	5.6	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number 070712032-007

Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	117.8	30-140

Comments:

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Client: TEST AMERICA - HONOLULU, HI
Address: 99-193 AIEA HEIGHTS DRIVE
AIEA, HI 96701-3900
Attn: YVONNE PARRY

Batch #: 070712032
Project Name: HQG0016

Analytical Results Report

Sample Number 070712032-008
Client Sample ID HQG0016-08
Matrix: Soil
Sampling Date 6/29/2007
Sampling Time 12:10 PM
Date/Time Received 7/12/2007 11:00 AM
Extraction Date 7/12/2007

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	4.8	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number 070712032-008

Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	128.4	30-140

Comments:

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AIEA, HI 96701-3900
Attn: YVONNE PARRY

Batch #: 070712032
Project Name: HQG0016

Analytical Results Report

Sample Number: 070712032-009
Client Sample ID: HQG0016-09
Matrix: Soil
Sampling Date: 6/29/2007
Sampling Time: 2:10 PM
Date/Time Received: 7/12/2007 11:00 AM
Extraction Date: 7/12/2007

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	6	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number: 070712032-009

Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	125.0	30-140

Comments:

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Client: TEST AMERICA - HONOLULU, HI
Address: 99-193 AIEA HEIGHTS DRIVE
AIEA, HI 96701-3900
Attn: YVONNE PARRY

Batch #: 070712032
Project Name: HQG0016

Analytical Results Report

Sample Number: 070712032-010
Client Sample ID: HQG0016-10
Matrix: Soil
Sampling Date: 6/29/2007
Sampling Time: 3:10 PM
Date/Time Received: 7/12/2007 11:00 AM
Extraction Date: 7/12/2007

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Ametryne	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Atrazine	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Diazinon	ND	mg/Kg	0.05	7/26/2007	EMP	EPA 8270C	
Fenamiphos	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Hexazinone	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Metribuzin	ND	mg/kg	0.05	7/26/2007	EMP	EPA 8270C	
Diuron	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
Oxamyl	ND	mg/kg	0.02	7/25/2007	TGT	EPA 8321A	
%moisture	5.6	Percent		7/16/2007	CH	%moisture	

Surrogate Data

Sample Number: 070712032-010

Surrogate Standard	Method	Percent Recovery	Control Limits
Terphenyl-d14	EPA 8270C	112.6	30-140

Authorized Signature John Coll

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

Comments:

Anatek Labs, Inc.

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Pesticide Screen EPA 8270C-MOD - Quality Control Report

Lab #	070712032-010
Blank	MB 7/12
Units	mg/Kg
Sample	
Extract date	7/12/2007
Analysis date	7/26/2007

Analyte	BLANK	Spike	LCS	%R	%R AR	LCS %R Failure
Diazinon	0.00	1.00	0.94	93.9	50-150	
Atrazine	0.00	1.00	0.62	61.8	50-150	

Analyte	Sample	Spike	MS	%R	MSD	%R	RPD	RPD AR	%R AR	MS %R Failure	MSD %R Failure	RPD Failure
Diazinon	0.00	1.00	1.01	100.7	1.01	101.0	0.3	25	50-150			
Atrazine	0.00	1.00	0.62	62.3	0.58	57.5	7.9	25	50-150			

R>2S = Result is more then 2X the spike added

Anatek Labs, Inc.

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EPA 8321MOD - MS/LFB Report

Lab #	070712032-010
Units	mg/Kg
Extraction date	7/13/2007
Analysis date	7/25/2007

Analyte	Sample	Spike	MS	%R	MS %R Failure
Diuron	0.00	0.1	0.0865	86.5	
Bromacil	0.00	0.1	0.106	106	
Oxamyl	0.00	1.0	0.556	55.6	

Lab #	070712032-010
Units	mg/Kg
Extraction date	7/13/2007
Analysis date	7/25/2007

Analyte	Sample	Spike	MS	%R	MS %R Failure
Diuron	0.00	0.1	0.0745	74.5	
Bromacil	0.00	0.1	0.104	104	
Oxamyl	0.00	1.0	0.774	77.4	

Lab #	LCS
Units	mg/Kg

Analyte	BLANK	Spike	LFB	%R	%R AR	LCS %R Failure
Diuron	0.00	0.1	0.0776	77.6	25-150	
Bromacil	0.00	0.1	0.0664	66.4	25-150	
Oxamyl	0.00	1	0.624	62.4	25-150	

Photo 1: Layout of Decision Units

Photo 2: Typical multi-increment sample.

Photo 3: Boring for volatile sample collection.

Photo 4: Sampling row for multi-increment sampling.

Photo 5: Drum area sample collection.

APPENDIX E.

Biological Resources Surveys

BIOLOGICAL RESOURCES SURVEY

for the

MAALAEA MAUKA PROJECT DISTRICT 12

MAALAEA, MAUI, HAWAII

by

ROBERT W. HOBDY
ENVIRONMENTAL CONSULTANT
Kokomo, Maui
January 2005

Prepared for: Ma'alaea Properties, LLC.

BIOLOGICAL RESOURCES SURVEY
MAALAEA MAUKA PROJECT DISTRICT 12
MAALAEA , MAUI

INTRODUCTION

The Maalaea Mauka Project District 12 lies on approximately 260 acres of land northwest of Ma'alaea. It is bounded on the east by 1.5 miles of Honoapi'ilani Highway extending from Ma'alaea to the Kihei Road Junction, and on the west by a similar distance along the base of the foothills of the West Maui Mountains. Of the 260 acres, 184 acres lie in the ahupua'a of Ukumehame and 76 acres lie within the ahupua'a of Waikapu.

SITE DESCRIPTION

The entire project area is gently sloping grassland through which run four small unnamed gullys that drain toward Ma'alaea and Ma'alaea Mud Flats. Elevations range from about 200 feet above mean sea level (amsl) at the top at the northwest corner down to about 35 feet amsl at the southern tip above Ma'alaea. Annual rainfall averages 14-16 inches with the bulk occurring between the months of November and April (Armstrong 1983). Soils are of the Pulehu Cobbly Clay Loam, Ewa Cobbly Silty Clay and Ewa Silty Clay series all of which have developed from igneous alluvium, are neutral, dark brown in color and at least 60 inches deep (Foote et al, 1972).

BIOLOGICAL HISTORY

The entire project area was once a dry native shrubland with scattered trees such as wiliwili (*Erythrina sandwicensis*). It was cleared for agricultural use in the late 1800's and was cultivated for sugar cane for over 100 years. During the 1990's pineapple was cultivated for a few years, after which the area was leased out for small scale agriculture until 2003. For the past year the land has lain fallow. Little of the original vegetation remains except in the some of the small gullies.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the proposed Maalaea Mauka Project District 12 which was conducted during January 2005. The objectives of the survey were to:

1. Document what plant, bird and mammal species occur on the property or may likely occur in the existing habitat.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.
5. Note which aspects of the proposed development pose significant concerns for plants or for wildlife and recommend measures that would mitigate or avoid these problems.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following a route to ensure complete coverage of the area. Areas most likely to harbor native or rare plants such as gullies were more intensively examined. Notes were made on plant species, distribution and abundance as well as terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation throughout the 260 acre project area is an open grassland consisting primarily of Guinea grass (*Panicum maximum*) and buffelgrass (*Cenchrus ciliaris*), with a variety of other grass and weed species. The four unnamed gullies also contain grass and weed species but also have a few scattered kiawe (*Prosopis pallida*) trees and one gully contains about 20 small native wiliwili trees. The vegetation also contains widespread remnants of the crop species that were cultivated during recent small scale agriculture period. Twenty one such species were recorded.

A total of 95 plant species were identified. Of this total two were endemic species, wiliwili and nehe (*Melanthera lavarum*), four were indigenous species ‘a’ali’i (*Dodonaea viscosa*), ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*) and ‘ilie’e (*Plumbago zeylanica*) and two were Polynesian introductions, ki (*Cordylene fruticosa*) and ko (*Saccharum officinarum*).

DISCUSSION

The vegetation throughout the project area is dominated by non-native species. This is a result of over a century of intensive agricultural activity. Only six widespread and common native species occur here. No officially listed Threatened or Endangered plants (U.S. Fish and Wildlife Service 1999) are found on the site, nor do any plants proposed as candidate for such status occur on the property.

No wetlands occur on the site. Nothing remotely approaching the three essential criteria that define a Federally recognized wetland, namely 1) hydrophytic vegetation 2) hydric soils and 3) wetland hydrology occur within this dry project area.

Because the vegetation on the site is dominated primarily by non-native plants and because there are no rare or protected native species within the project area, there is little of botanical concern and the proposed project is not expected to have a significant negative impact on the botanical resources.

RECOMMENDATIONS

It is recommended that the native wiliwili trees growing in one of the gullies be left to provide a native accent to the project development. These hardy trees are a signature species of Hawaii’s dryland forests and flourish in this habitat with no care required.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999).

For each species, the following information is provided:
1. Scientific name with author citation
2. Common English or Hawaiian name.
3. Bio-geographic status. The following symbols are used:
   - endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   - indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   - non-native = all those plants brought to the islands intentionally or accidentally after western contact.
4. Abundance of each species within the project area:
   - abundant = forming a major part of the vegetation within the project area.
   - common = widely scattered throughout the area or locally abundant within a portion of it.
   - uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   - rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MONOCOTS			
AGAVACEAE (Agave Family)			
Asparagus officinalis L.	asparagus	non-native	common
Cordylene fruticosa (L.) A. Chev.	*ki*	polynesian	rare
CYPERACEAE (Sedge Family)			
Cyperus rotundus L.	nut grass	non-native	rare
MUSACEAE (Banana Family)			
Musa x paradisiaca L.	banana	non-native	uncommon
POACEAE (Grass Family)			
Bambusa vulgaris Schrad.ex Wendl.	feathery bamboo	non-native	rare
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	non-native	rare
Brachiaria subquadripara (Trin.) Hitch.	--------------	non-native	rare
Cenchrus ciliaris L.	buffelgrass	non-native	abundant
Cenchrus echinatus L.	sandbur	non-native	rare
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	common
Chloris virgata Sw.	feather fingergrass	non-native	rare
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	uncommon
Digitaria insularis (L.) Mex ex Ekman	sourgrass	non-native	common
Digitaria violascens Link	*kukae pua'a*	non-native	uncommon
Echinochloa colona (L.) Link	jungle rice	non-native	rare
Eleusine indica (L.) Gaertn.	wiregrass	non-native	rare
Eragrostis tenella (L.) P. Beauv.Ex Roem. & Schult.	--------------	non-native	uncommon
Panicum maximum Jacq.	Guinea grass	non-native	abundant
Pennisetum purpureum Schumach.	Napier grass	non-native	uncommon
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Saccharum officinarum L.	sugar cane	polynesian	rare
Setaria verticillata (L.) P.Beauv.	bristly foxtail	non-native	rare
Sorghum bicolor (L.) Moench	sorghum	non-native	rare
Tragus berteronianus Schult.	goatgrass	non-native	uncommon
Zea mays L.	corn	non-native	rare
DICOTS			
ACANTHACEAE (Acanthus Family)			
Asystasia gangetica (L.) T. Anderson	Chinese violet	non-native	rare
AMARANTHACEAE (Amaranth Family)			
Amaranthus spinosus L.	spiny amaranth	non-native	uncommon
Amaranthus viridis L.	spleen amaranth	non-native	rare
ANACARDIACEAE (Mango Family)			
Mangifera indica L.	mango	non-native	rare
ASTERACEAE (Sunflower Family)			
Bidens pilosa L.	Spanish needle	non-native	rare
Calyptocarpus vialis Less	-----------------	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	rare
Emilia fosbergii Nicolson	red pualele	non-native	rare
Melanthera lavarum (Gaud.)W.L.Wagner&H.Rob.	*nehe*	endemic	rare
Pluchea carolinensis (Jacq.) G. Don	sourbush	non-native	uncommon
Sonchus oleraceus L.	*pualele*	non-native	rare
Synedrella nodiflora (L.) Gaertn.	nodeweed	non-native	rare
Tridax procumbens L.	coat buttons	non-native	rare
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown beard	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Xanthium strumarium L.	*kikania*	non-native	rare
BRASSICACEAE (Mustard Family)			
Brassica oleracea L.	cabbage	non-native	rare
CAPPARACEAE (Caper Family)			
Cleome gynandra L.	wild spider flower	non-native	rare
CARICACEAE (Papaya Family)			
Carica papaya L.	papaya	non-native	rare
CHENOPODIACEAE (Goosefoot Family)			
Chenopodium murale L.	*aheahea*	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea batatas (L.) Lam.	sweet potato	non-native	rare
Ipomoea obscura (L.) Ker-Gawl.	--------------	non-native	rare
Ipomoea triloba L.	little bell	non-native	rare
Merremia aegyptia (L.) Urb.	hairy merremia	non-native	uncommon
CUCURBITACEAE (Gourd Family)			
Momordica charantia L.	balsam pear	non-native	rare
EUPHORBIACEAE (Spurge Family)			
Chamaecyce hirta (L.) Millsp.	hairy spurge	non-native	uncommon
Chamaecyce hypericifolia (L.) Millsp.	graceful spurge	non-native	uncommon
Manihot dulcis (J.F.Gmel.) Pax	manioc	non-native	uncommon
Ricinus communis L.	castor bean	non-native	rare
Euphorbia cyathophora J.A.Murray	Mexican fire plant	non-native	rare
Euphorbia heterophylla L.	kaliko	non-native	rare
FABACEAE (Pea Family)			
Acacia farnesiana (L.) Willd.	klu	non-native	rare
Cajanus cajan (L.) Millsp.	pigeon pea	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Chamaechrista nictitans (L.) Moench	partridge pea	non-native	common
Crotalaria incana L.	fuzzy rattlepod	non-native	rare
Crotalaria pallida Aiton	smooth rattlepod	non-native	uncommon
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	uncommon
Desmodium tortuosum (Sw.) DC	Florida beggarweed	non-native	rare
Erythrina sandwicensis Degener	*wiliwili*	endemic	uncommon
Erythrina variegata L.	fastigiate wiliwili	non-native	rare
Indigofera hendecaphylla Jacq.	creeping indigo	non-native	rare
Indigofera suffruticosa Mill.	*'iniko*	non-native	rare
Leucaena leucocephala (Lam.) deWit	*koa haole*	non-native	uncommon
Macroptilium atropurpureum (DC) Urb.	------------------------	non-native	uncommon
Macroptilium lathyroides (L.) Urb.	wild bean	non-native	rare
Phaseolus vulgaris L.	string bean	non-native	rare
Prosopis pallida (Humb.&Bonpl.Ex.Willd.) Kunth	*kiawe*	non-native	uncommon
Sesbania grandiflora (L.)Kunth Poir.	katurai	non-native	rare
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R.Br.	lion's ear	non-native	uncommon
LAURACEAE (Laurel Family)			
Persea americana Mill.	avocado	non-native	rare
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.)Sweet	hairy abutilon	non-native	uncommon
Hisbiscus esculentus L.	okra	non-native	rare
Malva parviflora L.	cheese weed	non-native	rare
Malvastrum coromandelianum (L.) Garcke	false mallow	non-native	uncommon
Sida fallax Walp.	*'ilima*	indigenous	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Sida rhombifolia L.	----------------------	non-native	uncommon
MORACEAE (Mulberry Family)			
Allaeanthus glaber Warb.	alokon	non-native	rare
Ficus microcarpa L. fil.	Chinese banyan	non-native	rare
MORINGACEAE (Moringa Family)			
Moringa oleifera Lam.	horseradish tree	non-native	rare
MYRTACEAE (Myrtle Family)			
Syzygium cumini (L.) Skeels	Java plum	non-native	rare
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia coccinea Mill.	---------------	non-native	rare
OXALIDACEAE (Wood Sorrel Family)			
Oxalis corniculata L.	yellow wood sorrel	non-native	rare
PLUMBAGINACEAE (Leadwort Family)			
Plumbago zeylanica L.	*'ilie'e*	indigenous	rare
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pigweed	non-native	rare
SAPINDACEAE (Soapberry Family)			
Dodonaea viscosa Jacq.	*'a'ali'i*	indigenous	rare
SOLANACEAE (Nightshade Family)			
Nicandra physalodes (L.) Gaertn.	apple of Peru	non-native	rare
Solanum melongena L.	eggplant	non-native	rare
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	*'uhaloa*	indigenous	common
VERBENACEAE (Verbena Family)			
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Verbena littoralis Kunth	*ha'u owi*	non-native	rare
ZYGOPHYLLACEAE (Creosote Bush Family)			
Tribulus terrestris L.	puncture vine	non-native	rare

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species abundance, activities and location as well as observations of trails, tracks scat and signs of feeding. In addition an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

RESULTS

MAMMALS

No mammals were observed anywhere in the project area during two site visits. Tracks of a feral cat (*Felis domestica*), however, were noted within one of the small abandoned agricultural plantings. Taxonomy and nomenclature follow Tomich (1986). Dense vegetation prevented good visibility of ground dwelling animals, but a significant population of cats, mongoose (*Herpestes auropunctatus*), rats (*Rattus rattus*) and mice (*Mus musculus*) would be expected. Cats and mongoose feed on rats and mice. While rats and mice were not seen, their presence is virtually guaranteed by an abundant food supply in the form of grass seed and herbaceous vegetation. Another mammal one might possibly see in this area would be axis deer (*axis axis*). No sign of axis deer was observed on the property during either the daytime survey or the evening survey.

A special effort was made to look for the native Hawaiian hoary bat by making an evening survey of the area. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No evidence of such activity was observed though visibility was excellent and plenty of flying insects were seen. This area does not represent ideal bat habitat and there have been no reports of bat sightings in the vicinity.

BIRDS

There was moderate birdlife diversity in this normally dry area. An ample supply of grass and herbaceous plant seeds were available following a good winter wet season. Twelve species of non-native birds, one endemic species and one migratory species were seen, most taking advantage of this seasonal food supply. Taxonomy and nomenclature follow American Ornithologist's Union (1988), Berger (1981), Pratt et al.(1987) and Hawaii Audubon Society (1989).

Nutmeg mannikin (*Lonchura puntulata*) – Several large flocks were seen feeding on seeds in the extensive grasslands.

Barred dove (*Geopelia striata*) – Many barred doves were seen and heard in the kiawe trees and in the agricultural planting remnants. Their smaller size, striated body and white flashing tails feathers when taking flight distinguish this species from the spotted dove.

Common mynah (*Acridotheres tristis*) – A few pairs of mynahs were seen throughout the area, feeding in grassy openings or transiting the area high above the trees. They are confident and assertive birds.

Gray francolin (*Francolinus pondicerianus*) – A few gray francolins were seen in ground openings and in kiawe trees, but their loud and distinctive calls were heard frequently throughout the area indicating a larger population than seen.

Spotted dove (*Streptopelia chinensis*) – Several of these large doves were seen in trees and in the small agricultural planting remnants.

Java sparrow (*Padda oryzivora*) – One large flock of these distinctively colored birds was seen feeding on grass seeds.

Black francolin (*Francolinus francolinus*) – Scattered individuals were seen but their distinctive calls were heard throughout the project area.

Cattle egret (*Bubulcus ibis*) – A few egrets were seen feeding in grassy openings during the day and a few were seen transiting over the property to their roosting areas at Kealia Pond for the night.

House sparrow (*Passer domesticus*) A few sparrows were seen in and around trees in the gullies.

Japanese white-eye (*Zosterops japonica*) – A few white-eyes were seen feeding in the kiawe where their high pitched calls were frequently heard.

House finch (*Carpodacus mexicanus*) – A few pairs of these moderately-sized, light brown finches were seen in the kiawe trees and flying between them.

Kolea or golden plover (*Pluvialis fulva*) – A few plover were seen feeding in grassy openings during the late afternoon. These migratory birds are widespread and common in Hawaii during the fall and winter months.

Skylark (*Alauda arvensis*) – A single skylark was seen in a clearing alongside an old field road.

Nene (*Nesochen sanvicensis*) – Three endemic and Endangered nene were seen feeding on herbaceous vegetation in the agricultural planting remnants. Two of these birds had leg bands indicating that they had been reared as part of an endangered species recovery program at Haleakala National Park. A fourth nene was seen during the evening survey transiting the area heading toward the southern West Maui uplands for the night.

INSECTS

While insects in general were not tallied, they were abundant throughout the area and fueled the elevated bird activity observed. Although not found on the project site one native Sphingid moth, Blackburn's sphinx moth (*Manduca blackburni*), has been put on the Federal Endangered species list and this designation requires special focus (USFWS 2000). Blackburn's sphinx moth occurs on Maui although it has not been found in this area. Its native host plants are species of 'Aiea (*Nothocestrum*) and a non-native alternative host plant is tree tobacco (*Nicotiana glauca*). There are no 'aiea on or near the project area and no tree tobacco plants were observed during the survey. No Blackburn's sphinx moth or their larvae were observed.

CONCLUSIONS

Fauna surveys are seldom comprehensive due to the short window of observation, the seasonal nature of animal activities and the unpredictable nature of their daily movements. This survey, however, should be considered fairly representative due to the abundance of food resources present throughout the area and the resulting level of animal use. All twelve non-native bird species, as well as the indigenous migratory golden plover, are widespread and common on Maui and require no special consideration. While ideal for many types of non-native animals the habitat is not suitable in its present state for most native animals, and is far removed from remnant populations. Three Endangered nene (USFWS, 1999), however, were seen feeding on herbaceous vegetation within the project area and a fourth was seen flying over during the evening. Nene are strong fliers and wide ranging in their search for food. They seem to prefer open areas with lush grasses and herbs. They often utilize pastures, golf courses, large lawns and reservoir margins. While reared in the wild, these birds can become accustomed to people and their irrigated landscapes. These birds showed no sign of nesting behavior and appeared to be using these open fields for incidental feeding activity. This habitat, while useful to nene for such feeding, is not substantially different from thousands of acres of similar pastures and fields in southern West Maui, and should not be considered critical for their survival and well being. In fact if the proposed development contains substantial irrigated open space as indicated in preliminary plans, the habitat will continue to be suitable for incidental nene use and such use will no doubt continue. No unique or special habitats were found on the property.

The proposed changes in land use should have no significant impact on the fauna in this part of Maui.

RECOMMENDATIONS

Some seabirds such as the Endangered dark rumped petrel (*Pterodroma phaeopygia sandwichensis*) and the commoner wedge-tailed shearwater (*Puffinus pacificus chlororhynchus*), nesting on the summit of Haleakala and the coastal sites of Wailea Point and Molokini respectively, leave their burrows before dawn and return after sunset. These birds can become attracted to and confused by bright lights, crash and be killed by vehicles or cats and dogs that find them. Young birds are especially vulnerable when they fledge in late fall and take their first tentative flights. It is recommended that all significant outdoor lighting in the development be hooded to direct the light downward.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within two groups: Mammals and Birds. For each species the following information is provided:

1. Common name
2. Scientific name
3. Bio-geographical status. The following symbols are used:
   - endemic = native only to Hawaii; not naturally occurring anywhere else in the world.
   - indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   - non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.
   - migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.
4. Abundance of each species within the project area:
   - abundant = many flocks or individuals seen throughout the area at all times of day.
   - common = a few flocks or well scattered individuals throughout the area.
   - uncommon = only one flock or several individuals seen within the project area.
   - rare = only one or two seen within the project area.

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
BIRDS			
Nutmeg mannikin	*Lonchura puntulata*	non-native	common
Barred dove	*Geopelia striata*	non-native	common
Common mynah	*Acridotheres tristis*	non-native	common
Gray francolin	*Francolinus pondicerianus*	non-native	uncommon
Spotted dove	*Streptopelia chinensis*	non-native	uncommon
Java Sparrow	*Padda oryzivora*	non-native	uncommon
Black francolin	*Francolinus francolinus*	non-native	uncommon
Cattle egret	*Bubulcus ibis*	non-native	rare
House sparrow	*Passer domesticus*	non-native	rare
Japanese white-eye	*Zosterops japonica*	non-native	rare
House finch	*Carpodacus mexicana*	non-native	rare
Golden plover	*Pluvialis fulva*	indigenous/migratory	rare
Skylark	*Alauda arvensis*	non-native	rare
Nene	*Nesochen sanvicensis*	endemic	rare

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BIOLOGICAL RESOURCES SURVEY

for the

MA'ALAEA MAUKA PROPOSED
WASTEWATER TREATMENT PROJECT

MA'ALAEA, MAUI, HAWAII

by

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Kokomo, Maui
September 2006

Prepared for: Ma'alaea Properties, LLC.

BIOLOGICAL RESOURCES SURVEY
MAALAEA MAUKA PROPOSED
WASTEWATER TREATMENT PROJECT
MA'ALAEA , MAUI

INTRODUCTION

The Maalaea Mauka Proposed Wastewater Treatment Project lies on 120 acres of land north of Ma'alaea within TMK (2) 3-6-02:02 (por.). It is bounded on the east by 0.6 miles of the Honoapi'ilani Highway running north from the Kuihelani junction and on the west by a similar distance along the base of the foothills of the West Maui Mountains. This property lies entirely within the ahupua'a lands of Waikapu.

SITE DESCRIPTION

The entire project area is gently sloping agricultural land between Pohakea and Palea'ahu Streams that drain toward the Ma'alaea Mudflats and Keāli'a Pond. Elevations range from 180 ft. above sea level along Honoapi'ilani Highway at the bottom up to 360 ft. above sea level at the top of the proposed water tank site. Annual rainfall averages between 16 and 20 inches per year with the bulk falling between November and March (Armstrong, 1983). Soils are of the Pulehu Cobbly Clay Loam, Ewa Silty Clay and Stony Alluvial Land series that are all deep, dark brown, neutral to slightly alkaline soils developed from igneous alluvium washed down from the West Maui Mountains (Foote et al, 1972).

BIOLOGICAL HISTORY

In ancient times the entire project area was a dry native shrubland with scattered trees such as wiliwili (*Erythrina sandwicensis*) and 'ohe (*Reynoldsia sandwicensis*) and a variety of native shrubs, vines and grasses. It was cleared for agricultural use in the late 1800's and was cultivated for sugar cane for over 100 years. Since the 1990's part of it was cultivated for pineapple but these lands are now fallow. The remainder is still in sugar cane production. Almost none of the original native vegetation remains. The area is now covered by agricultural crop plants and field weeds.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the proposed Maalaea Mauka Wastewater Treatment Project which was conducted during September, 2006.

The objectives of the survey were to:

1. Document what plant, bird and mammal species occur on the property or may likely occur in the existing habitat.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.
5. Note which aspects of the proposed development pose significant concerns for plants or for wildlife and recommend measures that would mitigate or avoid these problems.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following multiple routes to ensure complete coverage of the area. Areas most likely to harbor native plants such as gullies or rock outcrops were more intensively examined. Notes were made on plant species, distribution and abundance as well as terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation on the largest part of this project consists of old abandoned pineapple (*Ananas comosus*) fields with a large assortment of agricultural weeds such as bitter melon (*Momordica charantia*), little bell (*Ipomoea triloba*) and swollen fingergrass (*Chloris barbata*). The active sugar cane (*Saccharum officinarum*) fields are a dense montypic growth with only a few weed species along the roads. The proposed water tank site is primarily kiawe (*Prosopis pallida*), koa haole (*Leucaena leucocephala*) and buffelgrass (*Cenchrus ciliaris*).

A total of 79 plant species were recorded. Of this total, 5 were common indigenous species: koali awahia (*Ipomoea indica*), ʻilima (*Sida fallax*), ilie'e (*Plumbago zeylanica*), popolo (*Solanum americanum*) and ʻuhaloa (*Waltheria indica*) all of which are widespread in Hawaii and other countries. One, sugar cane, is a Polynesian introduction. The remaining 73 species were agricultural weeds or escaped ornamental or landscape plants.

DISCUSSION AND RECOMMENDATIONS

The vegetation throughout the project area is dominated by agricultural and non-native weeds. This is the result of over a hundred years of intensive cultivation, burning, harvesting and plowing. Only five common indigenous plants were found scattered sparsely within the area. No officially listed Threatened or Endangered Plants Species (USFWS, 1999) were found on the property, nor were any plants proposed for such status found. No special habitats were identified.

No wetlands occur on this dry property. The ditch and reservoir adjacent to this project are by Federal definition not wetlands.

Because the vegetation is dominated by non-native species and because there are no rare, protected species or special habitats, there is little of botanical concern and the proposed project is not expected to have a significant negative impact on the botanical resources in this part of Maui.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999) and Staples and Herbst, 2005).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:
   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:
   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MONOCOTS			
AGAVACEAE			
Furcraea foetida (L.) Haworth	Mauritius hemp	non-native	rare
BROMELIACEAE (Bromeliad Family)			
Ananas comosus (L.) Merrill	pineapple	non-native	abundant
CYPERACEAE (Sedge Family)			
Cyperus rotundus L.	nut sedge	non-native	rare
POACEAE (Grass Family)			
Brachiaria subquadripara (Trin.) Hitchc.	-------------------	non-native	uncommon
Cenchrus ciliaris L.	buffelgrass	non-native	uncommon
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	common
Coix lacryma-jobi L.	Job's tears	non-native	rare
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	rare
Echinochloa crus-galli (L.) P. Beauv.	barnyard grass	non-native	rare
Eleusine indica (L.) Gaertn.	wiregrass	non-native	rare
Melinis minutiflora P. Beauv.	molasses grass	non-native	rare
Melinis repens (Willd.) Zizka	Natal redtop	non-native	uncommon
Panicum maximum Jacq.	Guinea grass	non-native	common
Saccharum officinarum L.	sugar cane	Polynesian	abundant
DICOTS			
ACANTHACEAE (Acanthus Family)			
Asystasia gangetica (L.) T. Anderson	Chinese violet	non-native	rare
Thunbergia fragrans Roxb.	sweet clock-vine	non-native	rare
AMARANTHACEAE (Amaranth Family)			
Amaranthus spinosus L.	spiny amaranth	non-native	uncommon
Amaranthus viridis L.	slender amaranth	non-native	rare
ANACARDIACEAE (Mango Family)			
Schinus terebinthifolius Raddi	Christmas berry	non-native	rare
APOCYNACEAE (Dogbane Family)			
Thevetia peruviana (Pers.) K. Schumann	be-still tree	non-native	rare
ASCLEPIADACEAE (Milkweed Family)			
Asclepias physocarpa (E. Mey.) Schlecter	baloon plant	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Calotropis procera (W.Aiton) W. Aiton	small crownflower	non-native	rare
ASTERACEAE (Sunflower Family)			
Ageratum conyzoides L.	*maile hohono*	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	uncommon
Crassocephalum crepidioides (Benth.) S. Moore	-----------------	non-native	rare
Emilia fosbergii Nicolson	red pualele	non-native	uncommon
Emilia sonchifolia (L.) DC.	violet pualele	non-native	rare
Flaveria trivervia (Spreng.) C. Mohr	-----------------	non-native	rare
Lactuca sativa L.	prickly lettuce	non-native	rare
Pluchea carolinensis (Jacq.) G. Don	sourbush	non-native	rare
Pluchea indica (L.) Less.	Indian fleabane	non-native	rare
Senecio madagascariensis Poir.	fireweed	non-native	rare
Synedrella nodiflora (L.) Gaertn.	nodeweed	non-native	rare
Tridax procumbens L.	coat buttons	non-native	uncommon
BIGNONIACEAE (Catalpa Family)			
Spathodea campanulata P. Beauv.	African-tulip tree	non-native	uncommon
BUDDLEIACAE (Butterfly Bush Family)			
Buddleia asiatica Lour.	dog tail	non-native	uncommon
CAPPARACEAE (Caper Family)			
Cleome gynandra L.	wild spider flower	non-native	rare
CHENOPODIACEAE (Goosefoot Family)			
Atriplex suberecta verd.	---------------	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea alba L.	moon flower	non-native	uncommon
Ipomoea indica (J. Burm.) Merr.	*koali awahia*	indigenous	rare
Ipomoea obscura (L.) Ker-Gawl.	-----------------	non-native	rare
Ipomoea triloba L.	little bell	non-native	common
CURCURBITACEAE (Gourd Family)			
Curcurbita pepo L.	pumpkin	non-native	rare
Momordica charantia L.	bitter melon	non-native	common
EUPHORBIACAE (Spurge Family)			
Chamaesyce hirta (L.) Millsp.	hairy spurge	non-native	uncommon
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Ricinus communis L.	Castor bean	non-native	rare
FABACEAE (Pea Family)			
Acacia farnesiana (L.) Willd.	klu	non-native	rare
Canavalia cathartica Thouars	*maunaloa*	non-native	uncommon
Crotalaria incana L.	fuzzy rattlepod	non-native	uncommon
Crotalaria pallida Aiton	smooth rattlepod	non-native	rare
Crotalaria retusa L.	-----------------	non-native	rare
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	non-native	rare
Indogofera hendecaphylla Jacq.	creeping indigo	non-native	rare
Indigofera suffruticosa Mill.	*iniko*	non-native	rare
Leucaena leucocephala (Lam.) de Wit	*koa haole*	non-native	uncommon
Macroptilium atropurpureum (DC.) Urb.	-----------------	non-native	uncommon
Neonotonia wightii (Wight & Arnott) Lackey	tineroo	non-native	rare
Prosopis pallida (Humb.& Bonpl. ex Willd) Kunth	*kiawe*	non-native	rare
Senna occidentalis (L.) Link	coffee senna	non-native	rare
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R. Br.	Lion's ear	non-native	rare
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	non-native	rare
Malvastrum coromandelianum (L.) Garcke	false mallow	non-native	uncommon
Sida fallax Walp.	*'ilima*	indigenous	rare
Sida rhombifolia L.	Cuban jute	non-native	rare
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia coccinea Mill.	-----------------	non-native	common
Bougainvillea spectabilis Willd.	bougainvillea	non-native	rare
Mirabilis jalapa L.	four-o'clock	non-native	rare
ONAGRACEAE (Evening Primrose Family)			
Ludwigia octovalvis (Jacq.) Raven	primrose willow	non-native	rare
PASSIFLORACEAE (Passion Flower Family)			
Passiflora edulis Sims	passion fruit	non-native	rare
PLUMBAGINACEAE (Plumbago Family)			
Plumbago zeylanica L.	*'ili'e'e*	indigenous	rare
SOLANACEAE (Nightshade Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Nicotiana glauca R.C. Graham	tree tobacco	non-native	rare
Solanum americanum Mill.	*popolo*	indigenous	rare
Solanum lycopersicum L.	cherry tomato	non-native	uncommon
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	*'uhaloa*	indigenous	uncommon
TILIACEAE (Linden Family)			
Triumfetta semitriloba Jacq.	Sacramento bur	non-native	rare
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	rare
ZYGOPHYLLACEAE (Creosote Bush Family)			
Tribulus terrestris L.	puncture vine	non-native	rare

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species abundance, activities and location as well as observations of trails, tracks scat and signs of feeding. In addition an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

RESULTS

MAMMALS

Just one mammal was observed in the project area during two site visits. Taxonomy and nomenclature follow Tomich (1986).

Feral cat (*Felis catus*) – One feral cat was seen along an old pineapple field road hunting for birds and rodents.

Dense vegetation prevented good visibility of other ground dwelling mammals, but a significant population of rats (*Rattus rattus*) and mice (*Mus domesticus*) would be expected. Rats and mice were not seen but they are known to frequent this type of habitat. Mongoose (*Herpestes auropunctatus*) are also known to frequent such habitat where they and cats feed on rodents and birds. Axis deer (*Axis axis*) are also known to occur in nearby gulches and might occasionally visit this property during night forays although no such activity or signs were observed.

A special effort was made to look for the native Hawaiian hoary bat by making an evening survey of the area. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No evidence of such activity was observed though visibility was excellent and plenty of flying insects were seen. This area does not represent ideal bat habitat and there have been no reports of bat sightings in the vicinity.

BIRDS

There was moderate birdlife diversity observed within the project area feeding on an ample supply of seeds, insects and herbaceous vegetation. Eleven species of birds were recorded; 9 non-native species, 1 indigenous waterbird and 1 endemic goose. Taxonomy and nomenclature follow American Ornithologists' Union (2005).

Zebra dove (*Geopelia striata*) – Large flocks of these small doves were seen throughout the project area feeding on seeds along roads and in grassy clearings.

Gray francolin (*Francolinus pondicerianus*) – Families of these francolins were seen along plantation roads and on the margins of grass clearings throughout the project area.

Nutmeg mannikin (*Lonchura punctulata*) – A few flocks of these tiny brown birds were seen feeding on grass seeds in deeper grass.

Black francolin (*Francolinus francolinus*) – A few solitary black francolins were seen along field margins and calling with their distinctive buzzing voice. They are secretive and wary birds.

House sparrow (*Passer domesticus*) A couple pairs of sparrows were seen flying between bushes.

Cattle egret (*Bubulcus ibis*) – Two individual egrets were seen hunting for insects in the fallow pineapple fields.

Common myna (*Acridotheres tristis*) – A few myna were seen in the upper part of the property.

'Auku'u, Black-crowned night-heron (*Nycticorax nycticorax hoactli*) – Three herons were seen along the fringes of the adjacent reservoir at the top of the property. These are strictly waterbirds and the dry open property contains no habitat for these large birds. 'Auku'u are widespread and fairly common in Hawai'i.

Spotted dove (*Streptopelia chinensis*) – Just one of these large doves was seen within the fallow pineapple fields.

Red-creasted cardinal (Paroaria coronata) – One of these cardinals was heard calling in the kiawe trees at the top of the property during the evening survey.

Nēnē (*Branta sandvicensis*) – A flock of about 10 of these endemic nene were seen circling overhead during the evening survey. They had taken flight from the adjacent golf course and were heading up to the West Maui Mountains where they spend the night. They are attracted to the lush grasses on the golf course fairways where they feed. The subject property is too dry at this time of year to provide habitat for these birds and is less than preferred habitat at any time of year.

INSECTS

While insects in general were not tallied, they were common throughout the property. Although not found on the property, one native sphingid moth, Blackburn's sphinx moth (*Manduca blackburni*), has been put on the Federal Endangered species list and this designation requires special focus (USFWS, 2000). Blackburn's sphinx moth occurs on Maui although it has not been found in this area. Its native host plants are species of 'aiea (*Nothocestrum spp.*) and alternative host plants are tobacco (*Nicotiana tabacum*) and tree tobacco (*Nicotiana glauca*). There are no 'aiea on or near the property but a few tree tobacco were found near the top of the property. Each of these was carefully examined and no Blackburns' sphinx moth or their lavae were found.

DISCUSSION AND RECOMMENDATIONS

Fauna surveys are seldom comprehensive due to the short window of observations, the seasonal nature of animal activities and the usually unpredictable nature of their daily movements. This survey, however, should be considered fairly representative. More lengthy surveys and at different times of the year might turn up a few additional animal species but it is unlikely that any species of environmental concern would be found. While ideal for many types of non-native mammals and birds, it is not suitable in its present state for most native animals and it is far removed from remnant populations.

The flock of nēnē, while not seen using the property, deserves comment. Nēnē are strong fliers and range widely looking for suitable feeding area. They feed on grasses and small fruits and seem to be attracted to lush golf courses, parks, lawns and the margins of reservoirs. Other open field and agricultural lands may also be occasionally used but less frequently. Thus they may occasionally use the subject property but it is not preferred habitat. Nēnē are an Endangered species and this status is in effect where ever they may be. If found on the property people should be careful not to injure or harass them.

No other Threatened or Endangered mammal, bird or insect was seen on the property. No special habitats were found either. The proposed changes in land use are thus not expected to have a significant negative impact on the fauna resources in this part of Maui.

No specific recommendations other than the general caution regarding nēnē are deemed appropriate for the fauna resources.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within two groups: Mammals and Birds. For each species the following information is provided:

1. Common name
2. Scientific name
3. Bio-geographical status. The following symbols are used:
    - endemic = native only to Hawaii; not naturally occurring anywhere else in the world.
    - indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
    - non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.
    - migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.
4. Abundance of each species within the project area:
    - abundant = many flocks or individuals seen throughout the area at all times of day.
    - common = a few flocks or well scattered individuals throughout the area.
    - uncommon = only one flock or several individuals seen within the project area.
    - rare = only one or two seen within the project area.

MAMMALS

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
Feral cat	*Felis catus*	non-native	rare

BIRDS

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
Zebra dove	*Geopelia striata*	non-native	abundant
Gray francolin	*Francolinus pondicerianus*	non-native	common
Nutmeg mannikin	*Lonchura punctulata*	non-native	uncommon
Black francolin	*Francolinus francolinus*	non-native	rare
House sparrow	*Passer domesticus*	non-native	rare
Cattle egret	*Bubulcus ibis*	non-native	rare
Common myna	*Acridotheres tristis*	non-native	rare
'Auku'u, Black-crowned night-heron	*Nycticorax nycticorax hoactli*	indigenous	rare
Spotted dove	*Streptopelia chinensis*	non-native	rare
Red-crested cardinal	*Paroaria coronata*	non-native	rare
Nene	*Branta sandwicensis*	Endemic	rare

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APPENDIX F.

Water Quality and Marine Biological Resources Survey

AECOS No. 1094

Maalaea Mauka Development: Water Quality and Marine Biology of Ma'alaea Harbor and Nearby Ma'alaea Bay

Ma'alaea aerial view from the south Photo credit: NOAA/NOS

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September 5, 2006

Maalaea Properties is proposing to develop a residential community on a 260 acre parcel on the central Maui plain above Ma'alaea Small Boat Harbor. In 2005, *AECOS* undertook surveys of the water quality and biota of the adjacent marine area to assess "baseline" conditions. Overall, waters adjacent to the shore at Ma'alaea are generally murky with re-suspended sediments, have high nutrient levels, have most hard surfaces covered by seaweed, and support almost no live coral. Conversely, just offshore (at and exceeding about 6 ft depth), waters are generally clear, nutrient levels are lower, seaweed cover is less, and live coral cover ranges from 5% to over 50% of available hard bottom.

The water quality of northwest Ma'alaea Bay is degraded and does not meet the Water Quality Standards set by the Hawaii Department of Health for most nutrients (nitrate + nitrite, total nitrogen, and total phosphorus), chlorophyll α (an indicator of phytoplankton growth), and turbidity (an indicator of suspended sediments). These waters appear to be largely affected by groundwater inputs and not surface water run-off. However, during infrequent major storm events, surface water runoff is significant and is the primary source of particulates to nearshore waters.

New buildings, roads, and sidewalks to be built as part of this project will increase the amount of impervious surfaces in the watershed, leading to a reduction in rainfall infiltration into the ground and an increase in peak runoff. The runoff from the development project may reach the nearshore community via existing drainage systems and affect Kapoli Beach Park, Ma'alaea Small Boat Harbor, and Kanaio Beach.

The nearshore marine community of northwest Ma'alaea Bay is quite variable, ranging from the sand and mud bottom within Ma'alaea Small Boat Harbor to a reef supporting in excess of 50% coral cover found off Kanaio. The nearshore marine community is adapted to elevated levels of silt and sediment associated with runoff, especially along the shoreline and in the Harbor where many silt-tolerant species occur. However, of particular concern are the impacts on algal and coral communities that could be subjected to project associated runoff.

During the construction phase, it will be necessary to: (1) employ Best Management Practices (BMPs) to prevent soil erosion and surface runoff from getting into the Bay; (2) have detention basins in place and functional prior to other land grubbing and grading; and (3) develop a water quality monitoring program to ensure the short and long-term effectiveness of the BMPs. Limiting early site grading work to the dry season on Maui can reduce runoff impacts. If proper BMPs are employed during construction and runoff into the nearshore waters minimized, the proposed development should have minimal long-term adverse effects on the nearby marine communities.

Maalaea Mauka Development: Water Quality and Marine Biology of Maʻalaea Harbor and Nearby Maʻalaea Bay[1]

September 5, 2006 *AECOS* No. 1094

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Introduction

Maʻalaea Properties, LLC is proposing the development of a 260 acre parcel on the central Maui plain above Maʻalaea Small Boat Harbor, Wailuku District, Island of Maui, Hawaiʻi (Fig. 1). The now vacant agricultural lands proposed for development are on the mauka side of Honoapiilani Highway, beginning near the intersection of Honoapiilani and Kuihelani highways and extending southwest nearly to the west intersection of Honoapiilani Highway and Maʻalaea Road (Fig. 2).

The proposed project includes construction of a residential development with approximately 950 single family and multi-family dwelling units and some 27 acres set aside for open space. The creation of buildings, roads, and sidewalks will increase the impervious surfaces and lead to a reduction in rainfall infiltrated into the ground. Increased peak runoff flow from the development is to be addressed by a series of drainage detention basins on the mauka (mountain) side of Honoapiilani Highway (M & E Pacific, 2005).

The purpose of this report is to identify sensitive biological resources in the nearby marine environment that may be potentially impacted by runoff associated with the proposed development. This report includes results from a marine biological survey and water quality sampling in nearshore waters of Maʻalaea Bay and Maʻalaea Small Boat Harbor into which drainage from the project area may flow. The survey

[1] This document has been prepared for Ma`alaea Properties, LLC for inclusion in an Environmental Assessment entitled "Environmental Impact Statement for Proposed Maalaea Mauka Residential Subdivision" and will therefore become part of the public record.

area spans the coastline from Kapoli Park, west of the Boat Harbor, to Kanaio drainage ditch and includes the Boat Harbor itself.

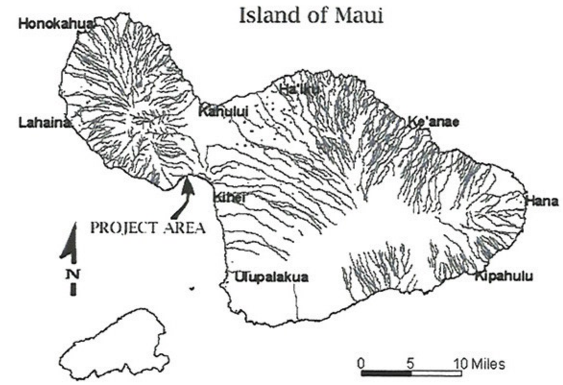

Figure 1. Project location at Maʻalaea on the Island of Maui.

Figure 2. Maʻalaea Mauka development would be located in the area of agricultural lots across Honoapiilani Highway from Maʻalaea (upslope, behind the harbor in this aerial photograph from NOAA/NOS, 2003).

Methods

Water Quality Survey

Water quality samples were collected for this survey on three different occasions (September 9, 2005; January 12, 2006; and June 2, 2006) on four nearshore transects in the vicinity of potential drainage discharges from the Maalaea Mauka Project area. Each transect included a shoreline station and a station at or close to the 6 ft (2 m) depth contour directly offshore from the shoreline station (Fig. 3). These water samples were collected to update an existing data base on water quality conditions in and near Ma'alaea Small Boat Harbor where potential drainage discharges from the project would go.

Water samples were analyzed for physical parameters (salinity, temperature, pH, dissolved oxygen, turbidity, and total suspended solids), for nutrients (ammonia, nitrate+nitrite, total nitrogen and total phosphorus), and for chlorophyll α. Temperature, pH, salinity, and dissolved oxygen (DO) were measured in the field. Samples for turbidity, salinity, total suspended solids (TSS), nutrients and chlorophyll were collected in appropriate containers, placed on ice, and taken to *AECOS*, Inc. laboratory on O'ahu for analyses. The analytical methods and instruments used on these samples are presented in Table 1.

Table 1. Analytical methods used in the water quality sampling program for the Ma`alaea Mauka Project.

Analysis	Method	Reference	Instrument
Ammonia	alkaline phenol	Karoleff in Grasshoff et al. (1986)	Technicon AutoAnalyzer II
Chlorophyll α	10200 H	Standard Methods, 18th Edition (1992)	Turner Model 112 fluorometer
Dissolved Oxygen	EPA 360.1	EPA (1979)	YSI Model 550 DO meter
Nitrate + Nitrite	EPA 353.2	EPA (1993)	Technicon AutoAnalyzer II
pH	EPA 150.1	EPA (1993)	SA 250
Salinity	bench salinometer	Grasshoff in Grasshoff et al. (1986)	AGE Model 2100 salinometer
Temperature	Thermister calibrated to NBS cert. thermometer (EPA 170.1)	EPA (1979)	YSI Model 550 DO meter
Total Nitrogen	persulfate digestion/EPA 353.2	D'Elia et al. (1977) / EPA (1993)	Technicon AutoAnalyzer II

Table 1 (continued).

Analysis	Method	Reference	Instrument
Total Phosphorus	persulfate digestion/EPA 365.1	Karoleff in Grasshoff et al. (1986)/EPA (1993)	Technicon AutoAnalyzer II
Total Suspended Solids	Method 2540D (EPA 160.2)	Standard Methods 18th Edition (1992); EPA (1979)	Mettler H31 balance
Turbidity	Method 2130B (EPA 180.1)	Standard Methods 18th Edition (1992); EPA (1993)	Hach 2100P Turbidimeter

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Marine Biological Survey

On September 30, 2005 a marine reconnaissance survey was undertaken by AECOS biologists snorkeling three areas likely to be impacted by storm water runoff originating from the project area. These survey areas are shown in Fig. 3 and, from west to east, are referred to as south breakwater, east of east breakwater, and Kanaio drainage. Species of macroalgae and marine animals observed in each of the three areas were recorded and estimates of relative abundances noted. The faunal survey included species of fishes, coral, and other macro-invertebrates. Cryptic and nocturnal species were likely not encountered or noted during this daytime survey.

To survey the south breakwater area, biologists snorkeled from Kapoli Beach Park parallel to the breakwater and out to the 6 ft (2 m) depth contour. To survey the east of east breakwater area, biologists started adjacent to the Maalaea Kai condominium and swam perpendicular to shore out to the 6 ft (2 m) depth contour. To survey the Kanaio drainage ditch area, biologists swam perpendicular to the shoreline beginning on either side of a shallow shoal between Island Sands and Banyans condominiums and out to the 6 ft (2 m) depth contour.

Most specimens encountered were identified in the field based on the experience of the biologists and various published texts: algae were identified using Magruder and Hunt (1979), Abbott (1999), and Abbott and Huisman (2004); coral species were identified using Fenner (2005), macroinvertebrates were identified using Hoover (1998); and fish species were identified using Randall (1996) and Hoover (1993).

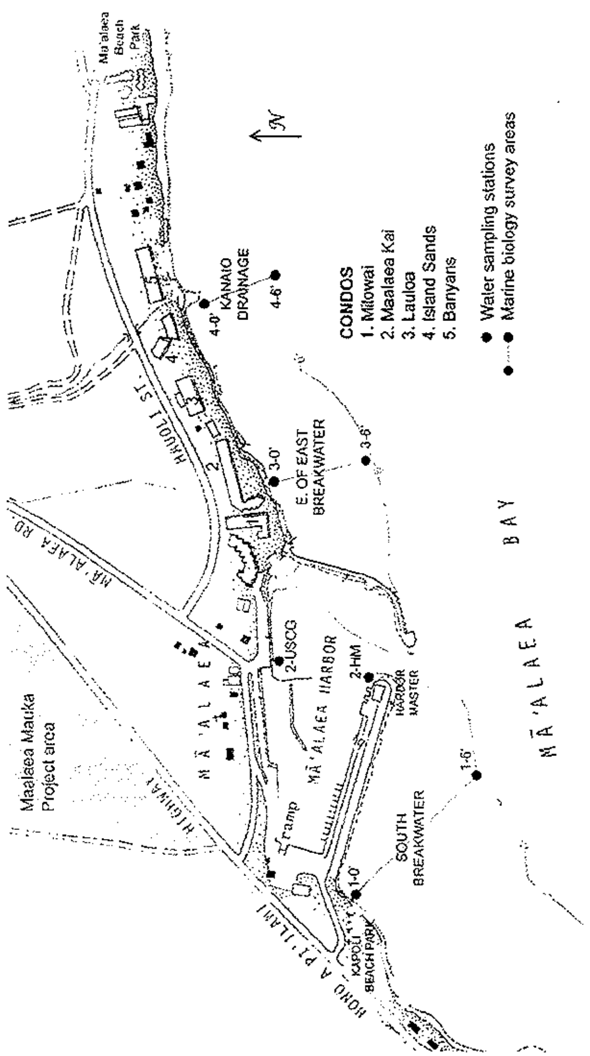

Figure 3. Location of the September 30, 2005 marine biological survey areas and water quality sample stations for the Maalaea Mauka Project (base map from *AECOS*, 1980).

Water Quality

Ma'alaea Bay is a large open bight on the southern coast of Maui. Bay waters are subject to the water quality standards and criteria of Hawaii Administrative Rules Title 11, Department of Health Chapter 54, Water Quality Standards (HDOH, 2004) and classified as Class A open coastal waters. Ma'alaea Boat Harbor is classified by these State regulations as a Class A embayment. The objective of Class A waters is that their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters (HDOH, 2004).

Historical Review

Department of Health monitoring

The Hawaii Department of Health (HDOH) maintains a coastal water quality monitoring program that includes Ma'alaea Boat Harbor and several beaches along the east side of Ma'alaea Bay between Kihei and Makena. Water quality data for these sites were obtained from the EPA STORET database (USEPA, 2005) and are described herein based on sampling off four beaches along the Kihei-Wailea coastline of Ma'alaea Bay and southward. These beach locations are indicated in Figure 4. The data are summarized in Table 2 and represent samples collected between 1990 and 2005.

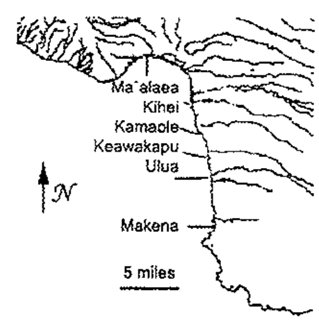

Figure 4. The four beach (Kihei, Kamaole, Keawakapu, and Ulua) and Ma'alaea Boat Harbor locations where water quality data were collected by HDOH in Ma'alaea Bay on the Island of Maui.

Table 2. Historic water quality data from selected nearshore areas along the Ma'alaea-Kihei-Makena coast (after USEPA, 2005).

Location (Collection Period)		Salinity (ppt)	Temp. (°C)	DO sat. (ppt)	pH	Turbidity (ntu)	NO_3+NO_2 (µg N/l)	Total N (µg N/l)	Total P (µg P/l)	Chl. α (µg/l)
Ma'alaea Boat Harbor (9/90 - 01/06)	mean	34.00	25.0	96	8.2	3.80	33.4	218	21.8	0.77
	range	31.0 - 35.4	18.7 - 28.2	55 - 134	7.6 - 8.8	0.6 - 142	0.5 - 200	100 - 530	11.0 - 100	0.10 - 19.4
	n	*403*	*328*	*289*	*181*	*308*	*51*	*26*	*41*	*50*
Kihei Beach Park (09/89 - 08/90)	mean	28.63	22.3	80	8.1	2.30	82	402	55.0	64.50
	range	21.90 - 31.50	19.0 - 26.8	45 - 130	8.0 - 8.1	0.48 - 5.09	10 - 560	100 - 860	31 - 96	4.40 - 417
	n	*12*	*12*	*12*	*10*	*10*	*12*	*9.0*	*12*	*12*
Kamaole Beach (09/90 - 12/98)	mean	34.08	24.7	72	8.2	0.66	44	147	10.2	0.52
	range	32.00 - 35.00	19.0 - 28.6	72 - 86	7.2 - 8.9	0.05 - 4.2	2.7 - 232	71 - 316	5.0 - 24	0.07 - 10.3
	n	*113*	*62*	*51*	*53*	*38*	*41*	*41*	*25*	*50*
Keawakapu Beach (09/90 - 12/98)	mean	34.57	24.6	87	8.2	0.92	28	126	9.7	0.91
	range	33.00 - 35.20	19.3 - 28.8	71 - 112	7.7 - 8.9	0.15 - 3.0	1.6 - 105	71 - 360	3.7 - 22	0.08 - 11.1
	n	*106*	*55*	*43*	*47*	*31*	*41*	*41*	*41*	*41*
Ulua Beach (09/90 - 12/98)	mean	34.44	25.0	108	8.2	0.87	45	142	9.4	0.66
	range	32.73 - 35.20	19.20 - 29.3	89 - 134	7.2 - 8.9	0.22 - 6.00	4.6 - 351	15.9 - 460	2.5 - 112	0.04 - 0.66
	n	*110*	*61*	*49*	*52*	*37*	*40*	*49*	*40*	*48*

Average salinity levels and temperature values were quite similar at all of the monitored stations with the exception of Kihei Beach Park where both salinity and temperature means were notably lower. Salinity was consistently low at Kihei Beach Park as indicated by the range of salinities over the monitoring period (21.9 - 31.5 ppt) and indicates that there is a more or less continuous input of fresh water at this location. The average pH at Kihei Beach Park was also slightly lower than the other three locations. Mean dissolved oxygen (DO) saturation levels were quite variable between the four stations. Geometric mean values for turbidity ranged from a low of 0.66 ntu at Kama'ole Beach to a high of 3.80 ntu in Ma'alaea Boat Harbor. The lowest geometric mean nutrient levels occurred at Kama'ole Beach and the highest at Kihei Beach Park, while the lowest chlorophyll levels were noted at Ulua Beach and the highest at Kihei Beach Park.

Table 3. A summary of the physical water quality parameters measured in the nearshore waters of Ma'alaea Bay and Ma'alaea Small Boat Harbor (*AECOS*, 1994).

Station		Salinity (ppt)	Temp. (°C)	DO sat. (%)	pH	Turbidity (ntu)	TSS (mg/l)
1 - 0	mean	33.63	25.5	112	8.43	2.48	5.2
	range	33.34 - 33.88	24.2 - 26.5	103 - 122	8.42 - 8.44	1.65 - 3.21	4.2 - 7.4
	n	*3*	*3*	*2*	*3*	*3*	*3*
1 - 6	mean	34.40	25.3	95	8.29	0.77	2
	range	34.27 - 34.57	---	---	8.20 - 8.41	0.68 - 1.01	1.5 - 3.4
	n	*5*	*1*	*1*	*3*	*6*	*5*
2 - USGS	mean	32.43	25.5	87	8.22	3.11	5.7
	range	32.15 - 32.63	25.3 - 25.8	83 - 90	8.20 - 8.24	2.02 - 4.85	5.5 - 6.0
	n	*3*	*3*	*2*	*3*	*3*	*3*
2 - HM	mean	33.54	25.8	94	8.28	1.46	2.9
	range	33.41 - 33.77	25.6 - 26.0	91 - 98	8.26 - 8.30	1.24 - 1.64	2.6 - 3.3
	n	*3*	*3*	*2*	*3*	*3*	*3*
3 - 0	mean	29.59	26.7	189	8.59	2.67	6.4
	range	27.45 - 33.79	26.5 - 27.0	173 - 205	8.50 - 8.70	1.40 - 5.08	4.1 - 10.1
	n	*3*	*3*	*2*	*3*	*2*	*2*
4 - 0	mean	33.5	25.7	105	8.33	3.58	12.1
	range	---	---	---	---	---	---
	n	*1*	*1*	*1*	*1*	*1*	*1*

Maui Ocean Center

AECOS prepared an Environmental Assessment for Maalaea Triangle and Maui Ocean Center (*AECOS*, 1994) and collected samples from several of the same stations that were sampled during the present survey. The water quality results from this earlier survey are presented in Tables 3 (above) and 4. Note that in these tables station designations from the earlier survey have been changed to correspond to station naming convention used in the present survey.

Table 4. A summary of the nutrient and chlorophyll water quality parameters measured in the nearshore waters of Ma'alaea Bay (*AECOS*, 1994).

Station	NH_3 (µg N/l)	NO_3+NO_2 (µg N/l)	TN (µg N/l)	TP (µg P/l)	Chl. α (µg/l)
1 - 0					
mean	7	24	168	14	1.00
range	5 - 9	12 - 51	137 - 201	11 - 15	0.84 - 1.12
n	3	3	3	3	3
1 - 6					
mean	2	22	137	15	0.39
range	2 - 3	16-26	128 - 153	10 - 21	0.24 - 0.52
n	3	3	3	3	3
2 - USGS					
mean	19	217	342	39	1.08
range	15 - 22	192 - 264	315 - 399	34 - 44	0.91 - 1.35
n	3	3	3	3	3
2 - HM					
mean	12	82	219	21	0.83
range	10 - 13	69 - 98	205 - 226	20 - 21	0.61 - 1.35
n	3	3	3	3	3
3 - 0					
mean	6	171	446	35	2.45
range	<1 - 24	61 - 320	361 - 511	28 - 48	2.04 - 2.94
n	3	3	3	3	2
4 - 0					
mean	5.5	88	232	32	3.7
range	5 - 6	70 - 111	196 - 275	21 - 48	---
n	2	2	2	2	1

Salinity levels in the, 1994, study ranged from a low of 27.45 ppt at Sta. 3-0 to a high of 34.57 ppt at Sta. 1-6, while mean temperature varied from 24.2 °C at Sta. 1-0 to 27.0 °C at Sta. 2-USGS (Table 2). pH ranged from a low of 8.20 at Sta. 1-6 and Sta. 2-USGS to a high of 8.70 at Sta. 3-0. Dissolved oxygen (DO) saturation levels were quite variable with a range from 83% of saturation at Sta. 2-USGS to 205% at Sta. 3-0. Turbidity values ranged from 0.68 ntu at Sta. 1-6 to 5.08 ntu at Sta. 3-0, while total suspended solids (TSS) varied from 1.5 mg/l at Sta. 1-6 to 12.1 mg/l at Sta.4-0.

Ammonia concentrations ranged from undetectable at Sta. 3-0 to 24 µg/l at the same station. Nitrate + nitrite concentrations were variable, ranging from 12 µg N/l at Sta. 1-0 to 320 µg N/l at Sta. 3-0. Total nitrogen (TN) varied from 137 µg N/l at Sta. 1-0 to 511 µg N/l at Sta. 3-0, while total phosphorus (TP) varied from 10 µg P/l

at Sta. 1-6 to 48 µg P/l at Sta. 3-0 and Sta. 4-0. Chlorophyll ranged from 0.24 µg/l at Sta. 1-6 to 3.7 µg/l at Sta. 4-0.

Maui and Molokai TMDL

A DOH project entitled "Maui and Molokai TMDL" (TMDL = Total Maximum Daily Load) included (in addition to other locations on Maui and Moloka'i) a series of sampling events at stations scattered along the shoreline of Ma'alaea Bay from Ma'alaea Boat Harbor in the northwest to Keawakapu (see Fig. 4) in the south (Laws, 2001). These samples were collected mostly at the mouths of drainage discharge points between December 2000 and March 2001. The results from these sampling events are presented in Table 5.

Table 5. Geometric mean concentrations of water quality parameters at nearshore stations in the Ma'alaea/Kihei area (after Laws, 2001).

Station	Salinity (ppt)	Tubidity (ntu)	TSS (mg/L)	TDP† (µg P/L)	NO_3+NO_2 (µg N/L)	NH_3 (µg N/L)	TDN† (µg N/L)	Chl. α (µg/L)
Ma'alaea harbor	31.3	9.7	35.1	17.98	208.6	5.2	402	5.1
Kealia Pond	35.4	1.4	20.3	6.51	2.8	1.0	113	0.5
Mokulele	34	3.4	33.1	9.92	56	1.3	234	1.5
Kaunoulu	30.9	9.6	47.9	8.99	247.8	1.5	389	1.8
Kalepolepo Pond	32.6	5.2	29.9	7.13	75.6	2.8	234	1.4
Kulanihakoi	32.3	23.7	64.9	9.3	100.8	5.2	281	3.3
Luana Kai	33.1	16.1	45.7	6.82	29.4	8.7	218	1.4
South Lipoa	32.8	8.8	35.6	7.13	8.4	1.5	147	0.9
Kalama Park	34	20.7	57.7	8.68	8.4	6.0	182	3.2
Cove Park	32.7	6.5	33.6	18.6	134.4	1.1	295	2.3
Maui Coast	34.9	1.8	22.3	8.37	15.4	1.3	125	0.7
South Kamaole II	35.1	1.1	21.4	9.92	18.2	1.5	123	0.6
Kihei Boat Ramp	28.2	3.3	22.8	8.99	291.2	1.4	759	1.4
Keawakapu	35.3	1.2	21.5	7.13	19.6	1.4	140	0.8

† TDP and TDN represent total dissolved phosphorus and nitrogen respectively as opposed to total phosphorus and total nitrogen and therefore are not directly comparable with State water quality criteria or other nitrogen and phosphorus values presented in this report.

In general, the values reported by Laws fall within the ranges reported elsewhere in this document with several exceptions. The TSS results are unrealistically high and likely caused by some procedural or analytical error. Typically such values suggest that the filters were not well washed with distilled water prior to drying, so the weight of the salt on the filter is included in the suspended solids weight. Another common source of deviation from typical values comes from sampling in the surf zone, which causes fine sand to be incorporated in the TSS sample (not an error, but results in elevated TSS and poor correspondence between TSS and turbidity). The mean nitrate + nitrite concentration in Ma'alaea Boat Harbor is high compared with other studies at this location. This result might be from the specific sampling site; i.e., samples collected closer to the actual land discharge site compared with the other surveys. The values reported for total dissolved phosphorus and nitrogen are expectedly low compared with other surveys which measured total phosphorus and total nitrogen levels (i.e., both dissolved and particulate fractions) as required by HDOH protocols. Based on the results of his study, Laws (2001) concluded that much of the nutrient enrichment occurring in the coastal waters of Ma'alaea Bay was related to groundwater inputs.

2005-2006 (Present) Survey

The results from the 2005-06 sampling events are presented in Table 6. Salinity was consistently lower at the shoreline stations (Sta. 1-0, Sta. 2-USCG, Sta. 3-0 and Sta. 4-0) compared with those stations along the 6 ft (2 m) depth contour (Table 6). Also, at the shoreline stations, average salinity tended to decrease from west to east; i.e., from Sta. 1-0 to Sta. 4-0, except at Station 3-0 which had the lowest mean salinity. Average salinity at the 6 ft (2 m) contour stations did not show such a trend. Temperature values did not show any trends moving away from the shoreline, but average temperature values did increase from west to east at the shoreline stations.

Dissolved oxygen (DO) saturation levels were generally higher at the shoreline stations when compared with stations further out, except within Ma'alaea Boat Harbor where the average DO saturation level was higher at Sta. 2-HM nearer the harbor mouth. pH did not demonstrate any particular trends, ranging from a low of 7.81 at Sta.3-0 to a high of 8.42 at Sta. 4-0. Particulate levels (turbidity and TSS) were consistently higher at the shoreline stations when compared with the 6 ft (2 m) depth contour stations.

Table 6. Physical water quality characteristics in Ma'alaea Bay and Harbor from the 2005-06 survey.

Station Date	Salinity (ppt)	Temp (°C)	DO sat. (%)	pH	Turbidity (ntu)	TSS (mg/l)
1 - 0						
9-Sep-05	35	26.7	101	8.26	2.76	8.8
12-Jan-06	33.1	23.2	93	8.11	1.70	7.6
2-Jun-06	33.95	24.8	99	8.07	4.38	11.3
Mean	**34.0**	**24.9**	**98**	**8.15**	**2.74**	**9.1**
1 - 6						
9-Sep-05	35	26.5	90	8.15	0.74	5.6
12-Jan-06	34.5	23.6	91	8.14	1.04	2.5
2-Jun-06	34.40	24.7	95	8.04	2.38	11.4
Mean	**34.6**	**24.9**	**92**	**8.11**	**1.22**	**5.4**

Table 6 (continued).

Station Date	Salinity (ppt)	Temp (°C)	DO sat. (%)	pH	Turbidity (ntu)	TSS (mg/l)
2 - USCG						
9-Sep-05	35	27.0	89	8.13	1.42	5.3
12-Jan-06	34.0	23.5	85	8.12	0.84	4.9
2-Jun-06	32.57	25.2	92	8.02	4.24	14.7
Mean	**33.7**	**25.2**	**89**	**8.09**	**1.72**	**7.3**
2 - HM						
9-Sep-05	35	26.6	90	8.15	0.88	5.1
12-Jan-06	34.3	23.5	92	8.16	0.82	2.8
2-Jun-06	33.80	25.0	92	8.02	3.60	14.2
Mean	**34.4**	**25.0**	**91**	**8.11**	**1.37**	**5.9**
3 - 0						
9-Sep-05	34	27.9	147	8.34	1.40	9.1
12-Jan-06	30.3	24.3	71	7.81	3.72	13.6
2-Jun-06	32.12	25.5	117	8.18	3.07	13.7
Mean	**32.1**	**25.9**	**112**	**8.11**	**2.52**	**11.9**
3 - 6						
9-Sep-05	35	27.6	84	8.20	0.65	3.9
12-Jan-06	33.6	23.5	96	8.18	0.92	5.2
2-Jun-06	34.66	25.1	99	8.13	1.19	5.7
Mean	**34.4**	**25.4**	**93**	**8.17**	**0.89**	**4.9**
4 - 0						
9-Sep-05	34	27.7	145	8.42	2.53	11.1
12-Jan-06	30.1	25.5	96	8.05	3.58	31.8
2-Jun-06	32.83	26.8	105	8.16	2.95	14.8
Mean	**32.3**	**26.7**	**115**	**8.21**	**2.99**	**17.4**
4 - 6						
9-Sep-05	35	27.6	93	8.22	0.67	6.3
12-Jan-06	32.9	24.1	104	8.16	1.11	5.0
2-Jun-06	34.58	25.7	96	8.11	1.50	8.8
Mean	**34.2**	**25.8**	**98**	**8.16**	**1.04**	**6.5**

The results of nutrient and chlorophyll α analyses are presented in Table 7. Ammonia nitrogen, an intermediate breakdown product of organic nitrogen, was not present in detectable amounts except at Sta. 3-0 and Sta. 4-0 and then only when salinity levels were <32 ppt (see Table 6), indicating an ammonia source either from groundwater inputs or surface water runoff to these nearshore waters. Shoreline station means for nitrate+nitrite, total nitrogen (TN) and total phosphorus (TP) were greater when compared with the 6 ft (2 m) depth contour stations, except in Ma'alaea Harbor (i.e., Sta. 2-USCG & Sta. 2-HM), demonstrating an influence of terrestrial inputs on these nutrients. Similarly, there was an increase in mean concentration for these nutrients from west to east at the shoreline stations.

Table 7. Nutrient and chlorophyll *a* water quality characteristics in Ma'alaea Bay and Harbor for 2005-2006.

Station	Date	NH_3 (µg N/l)	NO_3+NO_2 (µg N/l)	TN (µg N/l)	TP (µg P/l)	Chl. *a* (µg/l)
Sta. 1 - 0						
	9-Sep-05	<1	52	202	17	1.72
	12-Jan-06	<1	46	179	18	3.38
	2-Jun-06	<1	21	175	22	2.50
	Mean	**<1**	**37**	**185**	**19**	**2.44**
Sta. 1 - 6						
	9-Sep-05	<1	16	138	12	0.41
	12-Jan-06	<1	17	161	15	1.04
	2-Jun-06	<1	5	163	21	1.93
	Mean	**<1**	**11**	**154**	**16**	**0.94**
Sta. 2 - USCG						
	9-Sep-05	<1	97	247	21	0.53
	12-Jan-06	<1	61	173	17	0.64
	2-Jun-06	<1	71	250	30	4.00
	Mean	**<1**	**75**	**220**	**22**	**1.11**
Sta. 2 - HM						
	9-Sep-05	<1	221	403	36	0.56
	12-Jan-06	<1	72	199	16	0.69
	2-Jun-06	<1	274	429	55	2.84
	Mean	**<1**	**163**	**325**	**32**	**1.03**
Sta. 3 - 0						
	9-Sep-05	<1	64	230	17	3.62
	12-Jan-06	130	252	835	73	21.1
	2-Jun-06	<1	186	440	55	5.05
	Mean	**3.2**	**144**	**439**	**41**	**7.28**
Sta. 3 - 6						
	9-Sep-05	<1	14	146	12	0.37
	12-Jan-06	<1	84	188	11	1.80
	2-Jun-06	<1	3	137	19	0.84
	Mean		**15**	**156**	**14**	**0.82**

Table 7 (continued).

Station	Date	NH3 (µg N/l)	NO3+NO2 (µg N/l)	TN (µg N/l)	TP (µg P/l)	Chl. *a* (µg/l)
Sta. 4 - 0						
	9-Sep-05	11	292	524	36	5.40
	12-Jan-06	10	412	692	71	27.10
	2-Jun-06	<1	161	374	35	6.45
	Mean	**3.8**	**269**	**514**	**45**	**9.81**
Sta. 4 - 6						
	9-Sep-05	<1	13	156	12	0.80
	12-Jan-06	<1	161	266	16	2.54
	2-Jun-06	<1	5	153	17	1.02
	Mean	**<1**	**22**	**185**	**15**	**1.27**

Chlorophyll *a* distribution was similar to that for nitrate + nitrite, TN and TP with higher concentrations close to the shore and a trend of increasing concentration in the nearshore waters from west to east, exceptions being the Ma'alaea Harbor stations.

To determine if a correlation between salinity and the other water quality parameters exists, a coefficient of determination (the square of the correlation coefficient) was calculated for salinity with each of the other measured water quality parameters (Table 8). The coefficient of determination estimates the amount of variation that can be attributed to the causative parameter—in this case salinity. Thus, while salinity had little effect on the physical parameters measured (i.e., temperature, DO, pH and particulates), it accounted for at least 70 percent of the variation in nitrate+nitrite, TN, TP, and chlorophyll concentrations thus demonstrating the influence of salinity—in this case, terrestrial freshwater inputs—on these particular water quality parameters.

Table 8. A comparison of the correlation coefficient (r) and coefficient of determination (r^2) between salinity and the other water quality parameters.

Coefficient	Temp	DO	DO sat.	pH	Turbidity	TSS
R	0.254	-0.166	-0.094	0.353	-0.655	-0.730
r^2	0.06	0.03	0.01	0.12	0.43	0.53

Coefficient	NH_4	NO_3+NO_2	TN	TP	Chl. *a*
R	-0.551	-0.836	-0.879	-0.852	-0.836
r^2	0.30	0.70	0.77	0.73	0.70

Marine Biology

Ma'alaea Bay

Ma'alaea Bay is used extensively for public recreation and offers easily accessible reef and offshore areas for pleasure divers and fisherman alike. Ma'alaea Small Boat Harbor is one of only two berthing areas for small craft on Maui. The harbor is the home port of a sport charter fishing fleet, a small commercial fishing fleet, whale watching tour boats, as well as Maui headquarters of the U. S. Coast Guard. The harbor also has a launch ramp which is heavily used by Maui's trailer-boat fishermen (*AECOS*, 1980; 1994).

Historically, the shallow water fauna of western Ma'alaea Bay was considered unusual in several respects. A large number of species uncommon elsewhere were found to be relatively common in Ma'alaea Bay. The variety of sponges and bryozoans, and the highly diverse assemblage of gastropod mollusks historically made Ma'alaea Bay an area of special interest for nature study, photography, and scientific research (Maciolek, 1971). Degraded in recent decades, the current status of these special biological resources in is largely unknown (see Butler, 1975).

The long, continuous sand beach east from Kanaio is readily accessible to the public. The small shore break allows easy entry along its entire length. The ocean is relatively calm, and currents are relatively weak, allowing easy access into the water and safe swimming. The shallow waters, less than 30 ft (10 m) deep, between Kanaio and Palalau (by Kealia Pond) are considered best for snorkeling and diving because of the highly diverse flora and fauna and seasonally clear waters (Clark, 1980). The waters off Kapoli Park (west of the boat harbor) are also used by snorkelers.

At least two reef flat areas near the harbor are popular with *limu* (edible seaweed) gatherers: the shallows off and south of Kapoli Park and the reef flat off Ma'alaea Beach Park (Figure 3). Several popular seaweeds such as *limu manauea* (*Gracilaria coronopifolia*) and *limu huluhuluwaena* (*Grateloupia filicina*) are sought in these areas (McDermid, 1990).

Ma'alaea Bay is within the boundaries of the Hawaiian Islands Humpback Whale National Marine Sanctuary. The sanctuary was established in 1992 to protect endangered humpback whales (*Megaptera novaengliae*) and their habitat (HIHWNMSA, 2005).

Waters off Kapoli Beach Park

The marine reef environment found off of Kapoli Beach Park and Ma'alaea Boat Harbor's south breakwater (essentially southwest of the harbor) have been surveyed

by *AECOS* (2005a, 2005b, 1994), USFWS (1993), McDermid (1990), Brewer (1987), Kinzie (1972), and Maciolek (1971). Images representative of the area in 2005 are provided below as Fig. 5 and biological data are presented in the appendix.

The shoreline at Kapoli Beach Park is a mixed sand and basalt boulder beach, with intertidal boulders near the water line supporting the algae, *Ahnfeltia concinna* and *Chaetomorpha antennina* (present survey; *AECOS*, 1994). Subtidally, the same algal grouping exists with the exception of *C. antennina* which drops out and is replaced by *Ulva fasciata* and *Sargassum echinocarpum* (Fig. 5b). In 1994, *Pterocladia capillacea* was prominent with some *Ulva* (*AECOS*, 1994). Supralittoral invertebrates found here and on the south breakwater include the false limpet (*Siphonaria normalis*), the black nerite (*Nerita picea*), the dotted periwinkle (*Littoraria pintado*), the helmet urchin (*Colobocentrotus atratus*), and grapsid crabs (present survey; Brewer, 1987). Brewer (1987) noted unattached algal mats, mostly of *Hypnea musciformis*.

The bottom grades from smooth rounded boulders and cobbles to a wide flat limestone reef or shelf (*AECOS*, 1994) occurring 8-10 m (26 to 33 ft) offshore of the beach, beyond which (20 m/66 ft offshore) an "undulating surface of limestone ..... slopes gently, forming a reef flat of sorts." Algal coverage is substantial, nearly 100% over large areas close to shore and thinning gradually away from shore (Brewer, 1987; *AECOS*, 1994). Brewer (1987) commented on the "...unusually high diversity and abundance of algal macrophytes" and McDermid's (1990) survey of the algal community off of the south breakwater documented 25 species. Especially notable was an extensive growth of *Grateloupia filicina*, considered a culturally important Hawaiian food resource (Abbott, 1999). In 2005, the area was dominated by lush growths of *Ulva reticulata* and *Acanthophora spicifera* (Fig. 5d). Of the twenty-five species recorded by McDermid and the twenty-eight species recorded by *AECOS* in 2005, eight (*Pterocladia capillacea*, *Melanamansia glomerata*, *Acanthophora spicifera*, *Codium edule*, *Ulva fasciata*, *Ulva reticulata*, *Ahnfeltia concinna*, and *Hypnea musciformis*) are considered to be potential food resources for Green sea turtle (*Chelonia mydas*; Forsyth and Balazs, 1989; Russel and Balazs, 2000).

Macro-invertebrates of the reef platform include sea urchins and sea cucumbers, including: blue-black urchin (*Echinothrix diadema*), slate-pencil urchin (*Heterocentrotus mammilatus*), rock-boring urchin (*Echinometra mathaei*), collector urchin (*Tripneustes gratilla*), black sea cucumber (*Holothuria atra*), and white-spotted sea cucumber (*Actinopyga mauritiana*; present survey, 2005; *AECOS*, 1994; USFWS, 1993; Brewer, 1987). Scattered coral colonies (*Porites lobata*, *Poc. meandrina*, and *Poc. damicornis*) in this area often appeared stunted in their growth form likely due to the shallow, wave-swept conditions.

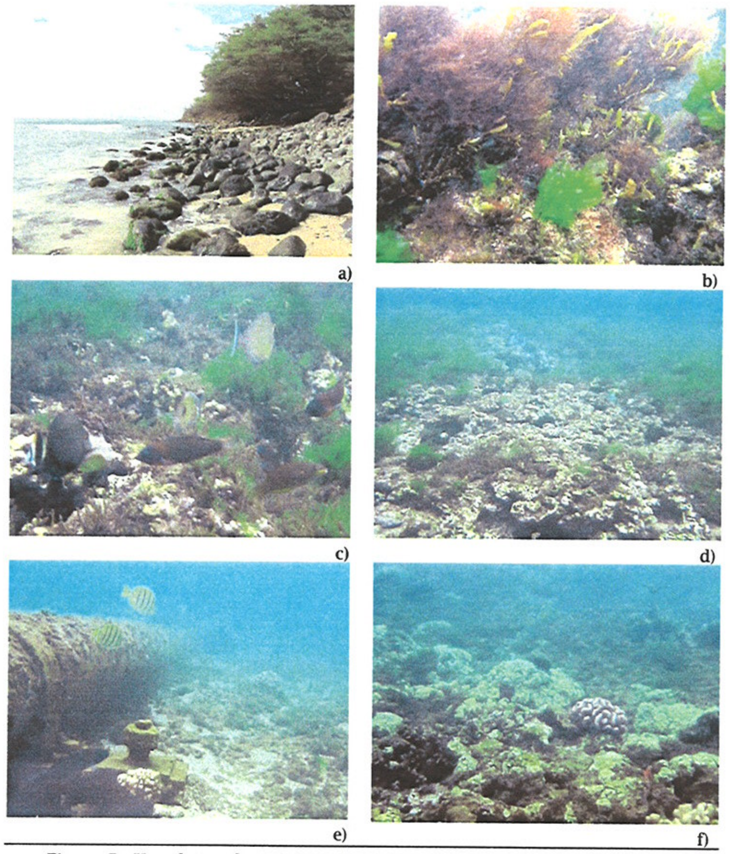

Figure 5. Kapoli Beach Park marine biological survey area, nearshore to offshore. a) Kapoli Park shoreline; b) alga rich shallows (*Hypnea musciformis, Sargassum,* and *Ulva fasciata);* c) diverse fish life (*Acanthophora spicifera*, and an abundance of *Ulva reticulata);* d) coralline algal consolidated bench; e) pipeline with corals f) low profile corals (*Porites lobata, Montiora capitata, Pocillopora meandrina*, and *Porites compressa*).

USFWS (1993) reported a diverse assemblage of fishes on the reef flat including: butterflyfish (*Chaetodon lunula, C. miliaris, C. ornatisssimus, and C. unimaculatus*), damselfish (*Abudefduf abdominalis* and *Stegastes fasciolatus*), goatfish (*Mulloides flavolineolatus, M. vanicolensis, and Parupeneus multifasciatus*), surgeonfish (*Acanthurus triostegus),* wrasse (*Stethojoulis balteata*), and triggerfish (*Rhinecanthus rectangulus*). Likewise, our 2005 survey revealed a diverse assemblage of fishes (Fig. 5c) on the reef flat with many juveniles present, including juvenile *kala* or unicornfish (*Naso unicornis*) and threadfin butterflyfish (*Chaetodon auriga*). Herbivorous surgeonfish (Acanthuridae) and wrasses (Labridae) made up the majority of fishes at this site with the most abundant being *manini* (*Acanthurus triostegus*), as well as the endemic wrasses, saddle wrasse (*Thalassoma duperrey*) and belted wrasse (*Stethojulis balteata*). Other common fishes include raccoon butterflyfish (*Chaetodon lunula*), brighteye damsel (*Plectroglyphidodon johnstonianus*), reef triggerfish (*Rhinecanthus rectangulus*), black surgeon (*Ctenochaetus strigosus*) and unicornfish (*N. unicornis).*

AECOS (1994) and Brewer (1987) recorded low fish abundances on this reef flat, but found a distinct increase in numbers roughly 90 m (300 ft) south of the breakwater where an increase in vertical relief occurs. The present survey did not survey the benthos this far offshore. Acanthurids were again common including: *A. nigroris, A. achilles, A. glaucopareius, A. olivaceous,* and *Manini* (*Acanthurus triostegus*) (Brewer, 1987). *AECOS* (1994) also mentioned the saddle wrasse (*Thalassoma duperrey*) and Moorish idol (*Zanclus cornutus*). Brewer (1987) noted a "conspicuous" absence of butterflyfishes and goatfishes and suggested a possible link between their absence and heavy sport-fishing and aquarium-fish collecting in the area.

Roughly half way down the length of the south breakwater the limestone bench flattens for a short distance and is covered by a layer of sand. In this area a pair of pipelines (Maui Ocean Center seawater intake lines) cross perpendicular from shore (Fig. 5e) and these now host slightly larger coral colonies of the same species (*Porites lobata, Poc. meandrina,* and *Poc. damicornis*) as observed in closer to shore. A large school of adult unicornfish or *kala* (*Naso unicornis*) was observed here in 2005. Beyond this section, the reef topography becomes increasingly diverse, with crevices and small overhangs. This area had the greatest coral cover observed off Kapoli Beach, roughly 10%, with, in order of abundance, scattered small colonies of *P. lobata, Poc. meandrina,* and *Poc. damicornis* (Fig. 5f).

The reef beyond the bench where the reef slope begins is described as having an increase in coral cover (*AECOS*, 1994; USFWS, 1993; Brewer, 1987). This area was not surveyed by the 2005 survey. The following description of this area is from *AECOS* (1994, p. 64 and 65):

At depths of 5 to 6 m (16 to 20 ft), the bottom remains low relief limestone, but with a silty sand veneer. Corals and other large benthic invertebrates are rare, as are fishes due to a lack of vertical relief or cover.

Kinzie (1972) conducted nine transects from the shore out to depths of -20 m (65 ft) to quantify the benthic biota in Ma'alaea Bay. Two transects were located south of Ma'alaea Harbor, the remainder were to the east. The transect closest to Kapoli Park (No. 2) was laid in an ESE direction from the shoreline about 450 ft SW from the base of the south breakwater. No corals were reported on any of the five 20 meter sections sampled along the No. 2 transect. Coral abundance increased further southward and off McGregor Point [a headland southwest of Ma'alaea Harbor] and Manuohule is luxuriant on the reef front (Kinzie, 1972; *AECOS*, 1980).

Likewise, Brewer (1987) and USFWS (1993) noted a near absence of corals fronting the south breakwater. But further out on the reef slope, Brewer (1987) observed approximately 50% coral cover with *Porites lobata* and *Montipora flabellata* most common and *Porites compressa, Poc. Meandrina, and Poc. damicornis* also present. *AECOS* (1994) also notes a sharp increase in coral cover "... perhaps to 15 to 20 % of the bottom over small areas" on the reef front.

Waters East of East Breakwater

USFWS (1993) surveyed the east breakwater and the "fringing reef flat" off the east breakwater; Brewer (1987) surveyed the base of the east breakwater, but not the adjacent reef flat, and *AECOS* (1994) surveyed the "beachrock shelf" east of the harbor including the waters off Kanaio. Images representative of this area in 2005 are presented in Fig. 6 and biological data are presented in the appendix.

In 1987, Brewer described the rocky intertidal of the east breakwater as having a "prominent yellowish-green band in the upper intertidal zone along the entire length of the breakwater" due to thick growth of *Ahnfeltia concinna*. In 1993, thick stands of *Ahnfeltia concinna* were still seen, as well as *Pterocladia capillacea* attached to the wave-washed boulders (USFWS, 1993). The east breakwater also provided habitat for common intertidal mollusks such as *Nerita picea* and the false limpet (*Siphonaria normalis*) [referred to as *Cellana exarata* by USFWS], as well as rock crab (*Grapsus tenuicrustatus*) and helmet urchin (*Colobocentrotus atratus*; Brewer, 1987; USFWS, 1993). Collector urchins (*Tripneustes gratilla*) were common subtidally. Also noted were small colonies of cauliflower coral (*Poc. meandrina*) and *Poc. damicornis* (referred to as *Poc. cespitosa*) subtidally on the breakwater (Brewer, 1987). Fishes at the breakwater were relatively sparse with the Hawaiian flagtail or *aholehole* (*Kuhlia sandvicensis*) most common, followed in abundance by juvenile wrasses, *manini*, Hawaiian sergeant (*Abudefduf abdominalis*), and *Stegastes faciolatus*, and *Monotaxis grandoculis* (Brewer, 1987).

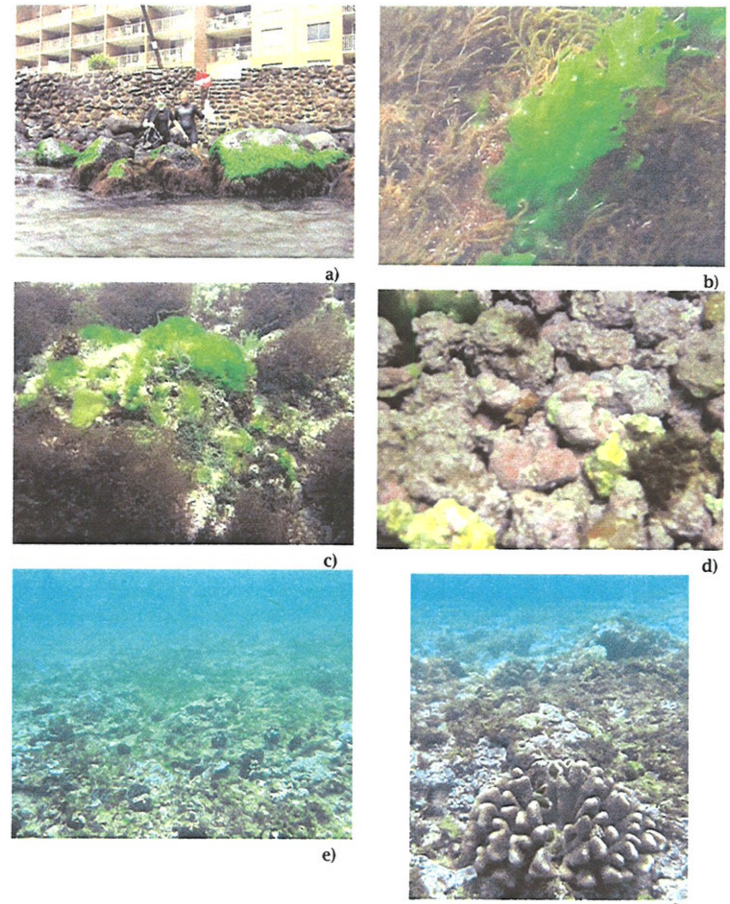
a) b) c) d) e) f)

Figure 6. East of east breakwater marine biological survey area; images presented nearshore to offshore: a) algae dominated shoreline; b) boulder with *U. fasciata, Hypnea musciformes* , and *Pterocladiella capillaceae;* c) algal community; d) coralline algal rubble field; e) urchin barren with sparse coral cover; f) corals (*Pocillopora meandrina* and *Montipora flabellata*).

A similar flora and fauna was observed in 2005 close by in the intertidal zone east of the east breakwater. Adjacent to the Maalaea Kai condominium the rocky intertidal is bordered landward by a vertical 2 m (6 ft) rock wall with a section of steps providing access to the water at the shoreline (Fig. 6a, above). The rock and boulder zone that fronts the access point forms a somewhat protected tide pool. The splash zone hosted the thin-shelled rock crab (*Grapsus tenuicrustatus*) and several mollusk species (brown purse shell, black nerite, and dotted periwinkle). The intertidal flora of the wave-washed rocks was similar to that found at the east breakwater and Kapoli Beach except a lush growth of *Ulva fasciata* replaced *Chaetomorpha antennina* alongside *Grateloupia filicina* and *Ahnfeltia concinna* (Fig. 6b). The nearshore waters are murky and heavily littered with drift algae. Due to low visibility conditions, fish observations could not be made here.

Subtidally, the rock and boulder shore gives way to a sand bottom (likely shallow sand over limestone reef) littered with rubble patches and attached algal colonies of *G. filicina* and/or *Hypnea musciformis* (the authors possibly mistook *G. filicina* for *H. musciformis* at times in the field) and the false limpet (*Siphonaria normalis*; Fig. 6c).

Roughly, 10 m (33 ft) from shore the bottom transitions to a rubble field with sparse coral colonies (*Montipora capitata* and *Pocillopora meandrina*) followed by a consolidated reef zone of greater complexity with crevices and small pockets of sand and rubble, previously described as a "beachrock shelf" (*AECOS*, 1994). The reef flat or "beachrock shelf" located east of the east breakwater was found in 1994 to generally not support an abundance of algae (*AECOS*, 1994). Conversely, the 2005 survey found a diverse assemblage of algal species which almost completely covered the bottom. *Ulva fasciata* was again present but greatly reduced in biomass with a cropped back appearance. Prominent were *Melanamansia glomerata* (previously recorded as *Amansia glomerata*) and *Acanthophora spicifera*. Scattered grazing scars, encrusting coralline algae, and live coral colonies (*Montipora flabellata*) were common amongst the algal laden seascape (Fig. 6e).

In 2005, dozens of *Tripneustes gratilla* were observed foraging in the open while rock-boring urchins (*E. mathaei*) lined crevices and blue-black urchins (*Echinothrix diadema*) and slate urchins (*Heterocentrotus mammilatus*) found cover under small overhangs. In 1993 and 1994, the same urchin species were observed as well as Christmas tree worms and spiny lobster (USFWS, 1993; *AECOS*, 1994). Other macro-invertebrates found in 2005 include an unidentified smooth black sponge, sea cucumbers, black-lipped pearl oyster (*Pinctada margaritifera*), snakehead cowry (*Cypraea caputserpentis*), blue swallow tail slug (*Chelidonura hirundina*), and day octopus (*Octopus cyanea*).

Adjacent to the east breakwater coral cover increased with distance from shore with 10% at the east breakwater and 50-75% at approximately 8 m (25 ft) depth where coverage then declined abruptly (USFWS, 1993). Common species were *Porites lobata, Poc. meandrina, Poc. damicornis, Poc. eydouxi, and Montipora flabellata.* In the present survey, coral cover became more substantial around the 6 ft (2 m) depth contour on the reef flat with nearly 40% cover by blue rice coral (*M. flabellata*) and cauliflower coral (*Poc. meandrina*) (Fig. 6f). This area also had two species of corals not recorded at the other 2005 survey areas: crust coral (*Leptastrea purpurea*) and ocellated coral (*Cyphastrea ocellina*), whereas absent was lace coral (*Poc. damicornis*).

The USFWS (1993) noted large feeding aggregations of herbivorous surgeonfishes (Acanthuridae), including *Acanthurus blochii, A. olivaceaus, A. xanthopterus, Naso literatus*, and *N. unicornis* foraging the reef slope off the east breakwater. In 2005, large schools of surgeonfish were not observed. Most common in this area were wrasses (Labridae) followed by butterflyfishes (Chaetodontidae) and damselfishes (Pomacentridae). *AECOS* (1994) found the labrids, *Stethojulis balteata* and *Stegastes fasciolatus*, most common between the harbor and Kanaio, while *Acanthurus nigroris* and *Mulloidichthys flavolineolatus* were most common off of Palalau (an area east of Kanaio).

The area was found to be quite depauperate of fishes in 2005, hosting only 26 species as compared to Kanaio with 49 species. Not previously mentioned by other reports were the many sedentary fishes common during the 2005 study, including the bullethead rock skipper (*Blenniella gibbifrons*), the scarface blenny (*Cirripectes vanderbilti*), the speckled scorpionfish (*Sebastapistes coniorta*), and the triple fin blenny (*Enneapterygius atriceps*). The saddle (*Thalassoma duperrey*) and belted wrasses (*Stethojulis balteata*) were abundant and the reef triggerfish (*Rhinecanthus rectangulus*) common.

Kanaio Drainage

The present (2005) survey was undertaken off a concrete box culvert (Fig. 7a) that passes beneath Hauoli St. between Island Sands and Banyans condominiums in an area known as Kanaio. The concrete drainage structure ends short of a sand beach, but water flow scars were evident out to the upper reach of the beach. The sand beach allows easy access to the nearshore environment (Fig. 7b). The shoreline was littered with algal debris which was also suspended in the first few meters of murky nearshore waters. A sand spit exists seaward of the drainage ditch which was completely littered with small boulders. These intertidal boulders hosted a community dominated by hookweed (*Hypnea musciformis*), *Pterocladiella capillacea*, and *Ulva fasciata* with the false limpet (*Siphonaria normalis*) occurring as well. Submerged boulders had roughly 100% algal cover with nearly equal coverage by *U.*

fasciata and *H. musciformis*. Images representative of this area in 2005 are presented in Fig. 7 and biological data are presented in the appendix.

The sand spit boulder field grades into a coralline algae-encrusted rubble field, which grades to rubble and sand, and eventually becomes a consolidated limestone reef with increasing topographic diversity (Fig. 7c,d). Unlike the reef flat off of the east breakwater, the shallows off Kanaio were found in 1994 to have an abundance of algae (*AECOS*, 1994). Common off Kanaio were, *Ulva reticulata, Grateloupia hawaiiana, Amansia glomerata, and Acanthophora spicifera.* Also noted were sediment resistant species such as *Halimeda discoidea* and *Codium edule* east of Kanaio, close to Kealia Pond. Most of these same species were observed in 2005. *AECOS* (1994) also noted an abundance of urchins (*Tripneustes gratilla* and *Heterocentrotus mammilatus*) amongst their survey areas with the greatest abundance of various urchins occurring off of Kanaio. During the present study, the collector urchin, slate pencil urchin, and rock-boring urchin were all prevalent on the reef flat.

An abundance of fishes with moderate species diversity (37 species) was found during the 2005 survey (Fig. 7d). The most abundant species were belted wrasse and saddle wrasse. Also common were the threadfin butterflyfish (*Chaetodon auriga*), racoon butterflyfish (*Chaetodon lunula*), Hawaiian sergeant (*Abudefduf abdominalis*), brighteye damsel (*Plectroglyphidodon johnstonianus*), lavender tang (*Acanthurus nigrofuscus*), blue lined surgeon (*Acanthurus nigroris*), palenose parrotfish (*Scarus psittacus*), and the reef trigger (*Rhinecanthus rectangulus*), as well as a fair number of juveniles, like the elegant coris (*Coris ventusta*) and the threadfin butterflyfish. Numerous juvenile wrasses were also seen throughout the surveyed areas. In 1994, the belted wrasse (*Stethojulis balteata*), Pacific gregory (*Stegastes fasciolatus*), and bluelined surgeonfish were considered some of the most common fishes off of Palalau (an area east of Kanaio). Also, in 1994, yellowstripe goatfish (*Mulloidichthys flavolineolatus*) were found as common (east of Kanaio) while the present study found them to be rare. A sand channel exists at the east end of the 2005 Kanaio Drainage survey area. A leatherback or *lai* (*Scomberoides lysan*) was sighted at the edge of this channel.

Kinzie (1972) surveyed 9 transects throughout Ma`alaea Bay and reported the greatest coral cover (average of 15%) at Kanaio with the most common species being *Montipora capitata, Poc. meandrina,* and *Montipora patula* (referred to as *Montipora verrucosa, Pocillopora ligulata, and Montipora verrilli,* respectively). In 2005, the coral community was found to be dominated by *Porites lobata, Montipora capitata,* and *Pocillopora meandrina* with scattered colonies of finger coral (*Porites compressa*) and spreading rice coral (*Montipora patula*; Fig. 7e). Coral cover was

Figure 7. Kanaio Drainage marine biological survey area, images ordered from nearshore to offshore: a) Kanaio drainage ditch; b) sandy shoreline of Kanaio; c) turbid water, coralline algal encrusted gravel bottom with *U. fasciata* and *Arothron hispidus*; d) small boulders, *Chaetodon lunula*, other fish, and algae; e) *Porites compressa, Pocillopora meandrina, Montipora capitata,* and *Tripneustes gratilla* (collector urchin); f) high coral cover and high topographic diversity.

upwards of 60% on portions of the reef and was the greatest of any area visited during the present survey (Fig. 7f). A species not recorded in the other 2005 survey areas, but recorded here, is the antler coral, *Pocillopora eydouxi*.

Ma'alaea Small Boat Harbor

Much of Ma'alaea Small Boat Harbor is soft bottom and supports a variety of infaunal invertebrates typical of this substratum type. Boulder revetments line the margin of the harbor basin and provide surfaces for attachment of intertidal and subtidal forms. A small, dark sand beach occurs in the northeast corner of the harbor. Remnants of the former reef flat remain within the harbor where dredging has not been undertaken.

Below is a description of the harbor and its marine floral and faunal inhabitants compiled from several surveys of the area (*AECOS*, 2005a, 2005b, 1994; USFWS, 1993; McDermid, 1990; Brewer, 1987; USFWS, 1980;). A species listing from the surveys conducted by *AECOS* in 2004 and 2005 are presented in the appendix.

The intertidal habitat within the harbor is predominantly basalt revetment stones and concrete surfaces which host a wide variety of intertidal creatures. Brewer (1987) lists thin-shelled rock crab or *'a'ama* crab (*Grapsus tenuicrustatus*) and common supratidal snails (*Nerita picea, Littorina pintado* and *L. scabra*) as conspicuous inhabitants by the USCG station. Near the low tide line the fleshy green algae, *Ulva fasciata* and *U. reticulata* were occasionally found along with filamentous blue-green algae. Surveys in May and April 1994 found essentially the same species with some additional forms seen further inside the harbor (*AECOS*, 1994). Along the shore west from the USCG station a small species of oyster (*Ostrea* sp.) was common, and in the vicinity of the boat ramp, clusters of mussels (*Brachidontes crebristriatus*) were present near the water line. The *'alamihi* crab (*Metopograpsus thukuhar*) was conspicuous everywhere on rocks just above and below the water line, replacing the *'a'ama* crab which was present, but only common in the eastern part of the harbor. Algae were mostly limited to scattered, large growths of *Ulva reticulata* and some *U. lactuca*, but encrusting, pink *Porolithon onkoides* could be found on boulders. USFWS (1980, 1993) reports of *opihi* (*Cellana exarata*) as being abundant in the harbor may refer to the false limpet (*Siphonaria normalis*). In 2005, dozens of limpet, the thin-shelled rock crab (*Grapsus tenuicrustatus*) and flat crab (*Percnon planissimum*) were observed on the rocks above the water line (*AECOS*, 2005b). Burrowing sentinel crabs (*Macrophthalmus* sp.) were abundant in the mud bottom basin adjacent to the USCG station (*AECOS*, 2005b).

Brewer (1987) noted lace coral (*Pocillopora damicornis*) (reported as *P. cespitosa*) as the "...only significant (and somewhat surprising) benthic organism observed in the

harbor ...attached to the concrete sea wall ...west of the Coast Guard station." Observations made in 1994 along the shore west from the USCG station, noted that coral cover declines further into the harbor, with only small, scattered heads of lace coral present (*AECOS*, 1994). A 1980 USFWS survey, although possibly impaired by low visibility (reported at 3 ft), reported no corals and no macroalgae anywhere along the northern edge of the harbor between the boat ramp (furthest point inside) and the east breakwater.

In the vicinity of the U.S. Coast Guard station dock occurs a mud bottom basin with a small area (less than 10 m^2) of boulders and undredged reef with growth of at least two coral species: rice coral (*Montipora capitata*) and lace coral (*P. damicornis; AECOS*, 1994, 2005b). Rice coral colonies were observed in 1994 and 2005 at sizes of over 10 inches (25 cm) across. In 2005, scattered coral colonies covered up to 30% of the hard surfaces, which was higher than the 10% reported by *AECOS* in 1994 for the same area (*AECOS*, 1994). In addition to rice and lace coral, lobe coral (*Porites lobata*) and sandpaper coral (*Montipora patula*) were also present (*AECOS*, 2005b). Other benthic invertebrates observed were hydroid (?*Halocordyle disticha*), burrowing urchin (*Echinometra mathaei*), and spaghetti worm (*Loimia medusa*). Algal growth was limited to sparse turf with silt and scattered large fronds of *Ulva reticulata*. Hawaiian flagtail fish (*Kuhlia sandvicensis*) were found under sheltered overhangs (*AECOS*, 2005b).

In October 2005, the concrete seawall immediately east of the USCG station was surveyed by *AECOS* (2005b). At about 1 m (3 ft) depth the seawall was densely covered by rice coral colonies (*Montipora capitata*). Roughly 70% of the surface was covered with coral, but in some places the coverage exceeded 100% with colonies overlapping each other on the vertical surface. The Moorish idol (*Zanculus cornutus*) and surgeonfishes (Acanthuridae), and a variety of planktivorous fishes were common in this area.

The trapezoidal shaped reef remnant in the middle of the harbor adjacent to the USCG station was visited by USFWS biologists in 1993. The shoal was covered by sand and silt. The introduced red alga, hookweed (*Hypnea musciformis*), covered much of the shallow bottom. A few small colonies of the corals, *Porites rus* and *Pocillopora damicornis*, and two species of sea urchins, *Diadema paucispinum* and *Echinometra mathaei*, were observed in this area. In 2005, surprisingly nearly 30%, cover of *Montipora capitata* and a fair number of small *Pocillopora damicornis* colonies were noted. A variety of urchins were observed on the reef and a large school of the yellow-stripe goatfish (*Mulloidichthys flavolineatus*) stayed near the eastern edge of the reef.

A shallow flat occurs inside the harbor along the east breakwater. This shallow water area of some 2 acres was surveyed by Brewer (1987) and USFWS (1993). The biota in 1987 was dominated by "dense, tangled stands of .....*Ulva fasciata, Ulva reticulata, Hypnea chordacea, Amansia glomerata, Gracilaria* cf. *bursapastoris*, and *Grateloupia filicina*, with 100% cover in some patches. USFWS (1993) found the reef flat to be heavily infested by the red alga, *Hypnea musciformis*, but *Bryopsis pinnata, Codium reediae, C. reticulata, Ulva fasciata*, and *Sargassum echinocarpum* occurred as well. Large amounts of hookweed could be seen on the small beach inside the harbor, indicating that this species remained abundant on the reef flat. Between 1999 and 2000, Smith (2000) also found an abundance of hookweed with 80% coverage in northwest Ma'alaea Bay. Two species of fishes, *manini* and *aholehole*, were numerically dominant, but numerous juvenile wrasses and a moray eel were noted by Brewer (1987). No live coral was seen in the area, noted as silted over close to the harbor channel, in contrast to that section of the same reef flat lying outside of the east breakwater (*AECOS*, 1994).

Fishes are certainly not abundant, but the harbor fauna includes more than the anchovy or *nehu* (*Stolephorus purpureus*) listed by Brewer (1987). *AECOS* (1994) observed the following species near the sampan wharf (roughly in order of abundance observed): Hawaiian flagtail or *aholehole* (*Kuhlia sandvicensis*), convict tang or *manini* (*Acanthurus sandvicensis*), Hawaiian sergeant or *mamo* (*Abudefduf abdominalis*), moorish idol (*Zanclus cornutus*), box fish (*Ostracion meleagris*), belted wrasse (*Stethojulis balteata*), pearl wrasse or *'opule* (*Anampses cuvier*), Hawaiian white-spotted toby (*Canthigaster jactator*), Hawaiian dascyllus or *alo'ilo'i* (*Dascyllus albisella*), raccoon butterflyfish or *lau hau* (*Chaetodon lunula*), lizardfish (*Synodus* cf. *variegatus*), blacktail snapper or *to'au* (*Lutjanus fulvus*), pualu (*Acanthurus* cf. *xanthopterus*), weke (*Mulloidichthyes vanicolensis*), juvenile sidespot goatfish or *malu* (*Parupeneus pleurostigma*), Jenkin's damsel (*Stegastes fasciolatus*), parrotfish (*Scarus* sp.), and cornetfish (*Fistularia commersoni*). Barracuda (*Sphyraena barracuda*), *aholehole*, and schools of mullet (*Mugil cephalus*) and small silverside (?*Spratelloides delicatulus*) occur throughout the inner harbor. The paucity of fishes recorded from the harbor in 1987 may be attributed to the poor underwater visibility at the time of the survey (Brewer, 1987). USFWS (1980) listed *manini* and *nehu* as abundant, and *aholehole* and barracuda as found in "occasional numbers". The report further mentions that Ma'alaea Harbor supports a "short, but intense seasonal, recreational fishery of bigeye scad or *hahalalu* (*Selar crumenophthalmus*)."

In 2004 and 2005, *AECOS* (2005a, b) observed 57 fish species within the harbor and at the harbor mouth. Twenty-one of these were observed only in the harbor and not in surrounding reef areas. Most notable were observations of eleven species of surgeonfish, eight species of wrasse, six species of goatfish, and spotted eagle ray (*Aetobatis narinari*). At the harbor mouth surgeonfish were represented by eyestripe surgeonfish (*Acanthurus dussumieri*), lavender tang (*Acanthurus*

nigrofuscus), with convict surgeonfish or *manini* (*Acanthurus triostegus*) being most abundant. Two large schools of yellowstripe goatfish were noted here as well.

In 2005, the present survey observed an extensive coral community that extends from the breakwater boulders shoreward inside the east breakwater. Coral coverage approached 90% in the limited space around the tip of the east breakwater with rice coral (*Montipora capitata*), cauliflower coral (*Pocillopora meandrina*), lobe coral (*Porites lobata*), and finger coral (*Porites compressa*) predominating. Commensal snapping shrimp (*Alphaeus deuteropus*) were abundant in surface grooves of lobe coral. The most conspicuous fishes were the large and abundant eyestripe surgeonfish (*Acanthurus dussumierei*). The red reef lobster (*Enoplometopus occidentalis*), usually only seen at night, was recorded from the finding of a detached pincer. The area immediately outside of the channel, fronting the tip of the east breakwater hosts numerous small colonies of blue rice coral (*Montipora flabellata*), cauliflower coral, lobe coral, and finger coral. Urchins and juvenile palenose parrotfish (*Scarus psittacus*) are also very common amongst the many small coral colonies of this high wave energy platform.

Ma'alaea Boat Harbor provides a wide array of habitats and thus supports a high diversity of marine biota. Of the 80 fish species observed in the 2004 and 2005 surveys of NW Ma'alaea Bay (present survey; *AECOS*, 2005a and 2005b), more than 70% (57 species) were observed inside the harbor. Likewise, 70% (32 species) of the macro-invertebrate species were found inside the harbor. The same did not apply to algae and corals with the algal community being the least diverse and the coral community no more diverse than the other areas surveyed.

Discussion

Water Quality

Water quality conditions in the nearshore coastal waters of Hawai'i are determined to a large degree by prevailing salinity regimes. Because of its open configuration, much of Ma'alaea Bay is regularly flushed by open ocean water of oceanic salinity and excellent water quality. At the same time, nearshore waters of the Bay are influenced by both surface water runoff and groundwater inputs from the adjacent land that not only lower salinity levels, but also introduce particulate matter, nutrients and other chemicals which degrade the quality of these coastal waters. Thus, separate State water quality criteria have been developed for "wet" and "dry" conditions in Hawaiian coastal waters (Table 9) based upon the amount of freshwater discharging into the coastal waters (HDOH, 2004). Specifically, the regulations state that "wet" criteria apply when open coastal waters receive more than three million gallons per day of fresh water discharge per mile of shoreline. Conversely, "dry" criteria apply when fresh water discharge per mile is less than three million gallons per day. The open coast water quality criteria pertain to Sta.s 1-0, 1-6, 3-0, 3-6, 4-0 and 4-6 (all but the Ma'alaea Harbor stations). Since it is difficult to practically make an accurate determination of freshwater discharge, it is assumed herein that "dry" criteria apply since annual rainfall in this region of Maui is typically low: only about 15 inches (M&E Pacific, 2005).

Table 9. State of Hawaii water quality criteria for open coastal waters (after HDOH, 2004).

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

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

Other "standards":

- pH units shall not deviate more than 0.5 units from a value of 8.1.
- Dissolved oxygen shall not decrease below 75% of saturation.
- Temperature shall not vary more than 1 C° from ambient conditions.
- Salinity shall not vary more than 10% from natural or seasonal changes.

Sta. 2-USGS & Sta. 2-MH are located within Ma'alaea Boat Harbor and fall under the State water quality standards applicable to embayments (Table 10). As with open coastal waters, HDOH water quality criteria incorporate "wet" and "dry" components, depending upon the amount of fresh water entering the bay on a daily basis. It is assumed that "dry" criteria apply in Ma'alaea Boat Harbor due to the low annual rainfall conditions in this region of Maui.

The water quality data from the shoreline and 6 ft (2 m) contour stations have been combined and are presented in Tables 11 and 12 as transects (e.g., Sta. 1-0 & Sta. 1-6 have been combined as Transect 1 and so forth) for comparison with the State water quality criteria. Since the water quality data collected for this study represent baseline conditions, salinity and temperature at all stations would be considered to be "ambient" as specified above in the footnotes to Table 9 and Table 10 above.

Table 10. State of Hawaii water quality criteria for embayments. (after HDOH, 2004).

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Total Nitrogen (μg N/l)	150.00 *200.00*	250.00 *350.00*	350.00 *500.00*
Ammonia Nitrogen (μg N/l)	3.50 *6.00*	8.50 *13.00*	1500 *20.00*
Nitrate+Nitrite (μg N/l)	5.00 *8.00*	14.00 *20.00*	25 00 *35.00*
Total Phosphorus (μg P/l)	20.00 *25.00*	40.00 *50.00*	60.00 *75.00*
Chlorophyll α, (μg/l)	0. 50 *1.50*	1.50 *4.50*	3.00 *8.50*
Turbidity (NTU)	0.40 *1.50*	1.00 *3.00*	1.50 *5.00*

Two values upper, "dry" criteria apply when average fresh water inflow is less than one percent of the embayment volume per day; lower, "wet" (italicized) criteria apply when average fresh water inflow equals or exceeds one percent of the embayment volume per day

Other "standards":

- pH units shall not deviate more than 0.5 units from a value of 8.1.
- Dissolved oxygen shall not decrease below 75% of saturation.
- Temperature shall not vary more than 1 C° from ambient conditions.
- Salinity shall not vary more than 10% from natural or seasonal changes.

Dissolved oxygen (DO) saturation levels were within the "...shall be greater than or equal to 75 percent saturation criterion, except at Transect 3 during the January 12, 2006 sampling event (see Table 6). pH levels were consistently within the State criterion range of 7.6 - 8.6 and represent ambient conditions. Turbidity consistently exceeded State criteria for both "wet" and "dry" conditions.

Ammonia concentrations met State criteria (both "wet" and "dry") at all stations, being undetectable most of the time (Table 12). However, ammonia concentration at Transect 3 did reach a high level (130 µg N/l) during the January 12, 2006 sampling event. Since salinity was also quite low at this transect on this date (30.3 ppt), it is likely that the high ammonia concentration was associated with surface runoff from a storm event.

Table 11. Summary statistics for the physical water quality data combining shoreline and 6 ft (2 m) depth contour stations for the Ma`alaea Mauka Project.

Location		Salinity (ppt)	Temp (°C)	DO sat. (%)	pH	Turbidity (NTU)
Transect 1						
	mean	34.3	24.9	95	8.13	1.83
	range	33.1 - 35	23.2 - 26.7	90 - 101	8.04 - 8.30	0.74 - 4.38
	n	6	6	6	6	6
Transect 2						
	mean	34.1	25.1	90	8.10	1.54
	range	32.57 - 35	23.5 - 27.0	85 - 92	8.02 - 8.16	0.82 - 4.24
	n	6	6	6	6	6
Transect 3						
	mean	33.3	25.7	102	8.14	1.50
	range	30.3 - 35	23.5 - 27.9	71 - 147	7.8 - 8.34	0.65 - 3.72
	n	6	6	6	6	6
Transect 4						
	mean	33.2	26.2	106.5	8.19	1.76
	range	30.1 - 35	24.1 - 27.7	93 - 145	8.05 - 8.42	0.67 - 3.58
	n	6	6	6	6	6

State "dry" criteria were exceeded at all four transects for nitrate + nitrite, total nitrogen, total phosphorus and chlorophyll α geometric means; although total phosphorus just exceeded the geometric mean criterion at Transect 1.

The historic HDOH physical water quality data from Ma'alaea Boat Harbor (Table 2, above) are in reasonable agreement with the results from the Harbor samples collected in the present survey (Sta. 2-USGS and Sta. 2-HM in Table 6 and 7 above). Thus, salinity, temperature and pH means are nearly identical, while DO saturation levels in the present study were somewhat lower as were turbidity levels when compared with the long-term HDOH means. There was less agreement with the nutrient data between the two data sets with nitrate + nitrite means being notably higher in the present study. Total nitrogen, total phosphorus and chlorophyll α levels were also elevated compared with the HDOH data, but all measurements in the 2005 survey fell within the range of the HDOH data.

Mean salinity levels (33.2 - 34.3 ppt) at the three coastal sites in the present survey (Transects 1, 3, and 4) were lower compared with the means for the HDOH surveys, except for the Kihei Beach Park location (28.63 ppt), while mean temperatures in the present survey tended to be somewhat higher. Both DO saturation levels and pH values were comparable for both data sets, while geometric mean values for turbidity in the present survey were higher, except when compared with Kihei Beach Park.

Table 12. Summary statistics for the nutrient and chlorophyll α water quality data collected from the combined shoreline and 6' stations for the Ma`alaea Mauka Project.

Location		NH_4 (µg N/l)	NO_3+NO_2 (µg N/l)	TN (µg N/l)	TP (µg P/l)	Chl. α (µg/l)
Transect 1						
	mean	<1	20	169	17	1.51
	range	---	5.0 - 52	138 - 202	12 -22	0.41 - 3.38
	n	6	6	6	6	6
Transect 2						
	mean	<1	111	268	26	1.07
	range	---	61 - 274	173 - 429	16 - 55	0.53 - 4.00
	n	6	6	6	6	6
Transect 3						
	Mean	1.3	47	261	24	2.45
	Range	<1-130	3.0 - 252	137 - 835	11 - 73	0.37 - 21.1
	n	6	6	6	6	6
Transect 4						
	mean	1.4	77	308	26	3.54
	range	<1 - 11	5.0 - 77	153 - 692	12 - 71	0.80 - 27.1
	n	6	6	6	6	6

Nitrate+nitrite mean concentrations at the three coastal sites (Transects 1, 3, and 4) in the 2005-06 survey were comparable with those of the HDOH monitoring program. Total nitrogen means, on the other hand, were somewhat elevated compared with the HDOH data, except at the Kihei Beach Park station. Similarly, total phosphorus and chlorophyll means in the 2005-06 survey were higher than those in the HDOH data, except for the Kihei Beach Park station.

Salinity levels were typically lower during the 1994 *AECOS* study (Table 4) as compared with the 2005-06 survey, but there were distinct trends between the two data sets. Thus, there was an increase in salinity between Sta. 1-0 and Sta. 1-6 and Sta. 2-USGS and Sta. 2-HM. Also, the lowest mean salinity occurred at Station 3-0 in both studies. Temperatures tended to be slightly higher in the 1994 study, except at Sta. 4-0 but were generally within the same range for both studies. Dissolved oxygen saturation levels were fairly similar at Sta. 2-USGS and Sta. 2-HM and the highest levels in both surveys were recorded at Sta. 1-0, Sta. 3-0 and Sta. 4-0.

Particulate concentrations were somewhat variable between the survey efforts as is to be expected, since these parameters are influenced by runoff and both wind and wave action. Nevertheless, TSS levels were high in the present study by something on the order of double, except at Sta. 2-USGS. The reason for this difference is not clear, although it does not appear to be due to runoff as higher salinities were recorded in the most recent survey as compared with the 1994 results.

There was considerable variation between the nutrient and chlorophyll α concentrations between the two surveys (Tables 4 and 7) and no distinct trends were apparent between the two data sets.

Marine Biology

Summary of 2004 and 2005 Surveys

Each of the four areas of NW Ma'alaea Bay discussed above differs in topographic complexity, coral cover, algal cover, and species diversity. However, the three nearshore areas surveyed, with the exception of the Harbor, exhibit a similar nearshore to offshore zonation, grading from an algal-rich nearshore swash zone out to a consolidated coralline reef and then to a zone of increased topographical relief and coral cover yet further off the shore.

The summary presented below reflects data collected during our three recent surveys of NW Ma'alaea Bay and Ma'alaea Boat Harbor conducted in September 2005 (present survey), October 2005 (*AECOS*, 2005b), and November 2004 (*AECOS*, 2005a). Data are compiled in table format as an appendix.

The algal community of northwestern Ma'alaea Bay is diverse and dominates much of the intertidal and subtidal benthos. In general, a swath of immense algal biomass exists within roughly the first 3 m (9 ft) from shore which is eventually replaced by an urchin dominated zone. Thirty-four algal species were recorded with nearly all of those recorded at the South Breakwater. On the other hand, the Harbor itself hosts less than half that number. Many species found throughout the survey area are food resources for humans as well as sea turtles.

A total of eleven coral species were recorded with the following four occurring throughout the survey area including inside the Harbor; in order of abundance these four are *Montipora capitata*, *Porites lobata*, *M. flabellata*, *Pocillopora*

meandrina, and *Porites compressa*. Elevated coral cover occurs around the west tip of the east breakwater, on the reef flat of Kanaio, and surprisingly the inner Harbor east of the USCG station on a concrete wall (*M. capitata*). The southeast portion of the Harbor receives sufficient influx of ocean water through the harbor channel to support an extensive coral community with up to 90 percent cover. The most common corals are rice coral (*Montipora capitata*) and lobe coral (*Porites lobata*). The offshore area east of the east breakwater has nearly 40% cover of *M. flabellata*. Kanaio Drainage was the only area with antler coral.

A total of 45 invertebrate species, other than corals, were recorded, with between 21 and 32 species recorded from each survey area. Urchins are some of the most conspicuous members of the marine community in shallow water here, with rock-boring urchin, *Tripneustes gratilla*, and the collector urchin, *Echinometra methaei*, dominating the seascape. It is worth noting that urchins feed on algae, and their large numbers may well account for a sharp decline in algal abundance offshore.

A total of eighty fish species were recorded during the three recent surveys (present survey; *AECOS*, 2005a; *AECOS*, 2005b). Data presented for south breakwater and the harbor area are from at least two survey dates and resulted in roughly twice the number of fish species recorded as compared to the other two survey areas. Therefore, the number of species reported is likely skewed by the number of site visits. The most common fishes are the saddle wrasse (*Thallasoma duperrey*) and the belted wrasse (*Stethojulis balteata*), both endemic to Hawaiian waters. Butterflyfishes were recorded throughout the study area with the raccoon (*Chaetodon lunula*) and threadfin butterflyfish (*Chaetodon auriga*) most common. The area of greatest fish diversity appears to be along the surge dominated reef flat off of the south breakwater. Of the 62 marine fish species recorded during the present survey, 12 species or 20% are endemic, meaning they are found only in the Hawaiian Islands and no other geographic region. Very few pelagic fishes were recorded; only the bluefin trevally (*Caranx melampygus*) at South Breakwater and the Harbor, the mackerel scad or *opelu* (*Decapterus macarellus*) also at South Breakwater, and the leatherback or *lai* (*Scomberoides lysan*) at the two eastern sites.

No sea turtles or other endangered or threatened species were observed during our survey. However, three species—the humpback whale (*Megaptera novaeangliae*), the hawksbill sea turtle (*Eretmochelys imbricata*), and the green sea turtle (*Chelonia mydas*)—are protected under the Endangered Species Act of 1973 (Federal Register, 1999a, 1999b, and 2001) and Hawaii Administrative Rule (DLNR, 1998) and are reported from Ma'alaea Bay.

Ma`alaea Bay is an important calving, breeding, and nursing area for the endangered humpback whale between December and May each year (Forestell and Brown, 1991). When not migrating, the humpback whales come very close to shore and Maui offers great opportunities to view the whales from shore or by boat. The threatened green sea turtle (*Chelonia mydas*) and the endangered hawksbill sea turtle (*Eretmochelys imbricata*) are known to frequent Ma'alaea Bay (SRGII, 2004) and USFWS reported a large green sea turtle in the harbor in 1994 (USFWS, 1993).

Assessment

The nearshore marine community of northwest Ma'alaea Bay is quite variable ranging from the mud-lined bottom of Ma'alaea Boat Harbor to the reef supporting in excess of 50% coral cover found off Kanaio. The nearshore marine community is somewhat adapted to elevated levels of silt and sediment associated with runoff, especially along the shoreline and in the Harbor where many silt-tolerant species are found. However, of particular concern are the algal and coral communities which may be most likely impacted by project associated run-off.

There are several sites where run-off may be expected to impact the neashore community via existing drainage systems along northwest Ma'alaea Bay including: Ma'alaea Boat Harbor, Kapoli Beach, and Kanaio drainage ditch. Each of these areas hosts an important marine community. Ma'alaea Boat Harbor serves as a protected area for many juvenile fish and invertebrates and hosts a variety of corals both in the interior of the Harbor, but especially near the mouth of the Harbor. The waters off Kapoli Beach, west of the Boat Harbor, support a species-rich algal community that is important for human consumption and sea turtle consumption. The Kapoli Beach area also boasts a wide variety of fishes, many being juveniles. Land run-off via concrete-lined drainage ditch emptying at the Kanaio shore has the greatest potential for impacting an area of live coral. This ditch could carry run-off from the Maalaea Mauka Development Project not retained by the upslope basins.

It is often difficult to pinpoint the causes of water quality degradation in nearshore coastal waters. In northwest Ma'alaea Bay, 70% of variation in nutrients (except ammonia) and chlorophyll α concentrations can be attributed to variations in salinity, i.e. freshwater inputs or lack thereof. The source of freshwater input at the coastline can be from groundwater or surface water runoff. Based upon the paucity of rainfall in the Ma'alaea area—about 15 inches annually (M&E Pacific, 2005)—it can be concluded that much of the variation in salinity and nutrients in these nearshore coastal waters is the result of groundwater inputs.

Changes in particulate (turbidity and TSS) concentrations, on the other hand, are not necessarily associated with changes in salinity, or any other water quality parameter. In this case, much of the variation in particulates may be associated with turbulence caused by wind and waves stirring up bottom sediments in the shallow coastal water. Certainly, surface runoff is significant during major storm

events and such events are likely the primary source of particulates to these nearshore waters.

Conclusions

The proposed construction of a residential development on a 260-acre parcel on the central Maui plain above Ma'alaea Small Boat Harbor will include the construction of buildings, roads, parking lots, and sidewalks. The construction of these will increase coverage by impervious surfaces and will lead to a reduction in rainfall infiltration into the ground. Because the development is located some distance from the shore, construction will not directly impact the nearshore reef community of northwestern Ma'alaea Bay or Ma'alaea Boat Harbor. However, indirect impacts could occur if care is not taken to control storm water runoff from the project site, most particularly during land grading and early construction phases. In order to reduce the release of fine sediments or other pollutants into the marine environment, suitable BMPs (Best Management Practices) need to be implemented during construction and post-construction phases.

During rain events, water collects from impervious surfaces (roads, roofs, sidewalks, etc.) and follows a downhill path of least resistance. Unimpeded, this run-off continues on its course to the nearshore environment where it introduces an array of land-based pollutants. Drainage pathways for run-off should be directed into percolation areas rather than directly into existing drainage ways which lead to the ocean. In order to reduce the amount of polluted run-off it is recommended to use a) unlined ditches leading to unlined percolation basins and b) to establish planted percolation areas to act as a natural buffer surrounding the planned flood basins along their drainage pathways to the ocean. Vegetation surrounding these surfaces will act as a natural buffer to reduce pollutant levels in run-off and drought-tolerant native plant species should be considered. This approach will also minimize post-construction contributions of pollutants such as pesticides and herbicides, as well as oil and gasoline spills from vehicles.

Overall, if BMPs are followed and if special care is given to reduce silt-laden runoff the Maalaea Mauka development project has the potential to improve rather than degrade the nearby marine environment compared with existing land use practices at the project site. According to aerial photographs taken in 2003, the 960-acre project area has little groundcover in place to reduce surface run-off. Also, the Maalaea Waterfront Plaza which lies downstream from the project site has experienced flooding during large storms under existing drainage conditions (M&E Pacific, 2005).

M&E Pacific (2005) proposes a series of detention basins be developed for the proposed Maalaea Mauka development which should minimize particulates in storm water runoff into the bay. These detention basins would be located on the mauka side of Honoapiilani Highway and correspond to existing detention basins. Plans include considerations for drainage ways down to the proposed detention basins, but not beyond towards the ocean. The basins should be in place and functional prior to general site grading.

During the construction phase, it will be necessary to: (1) employ Best Management Practices (BMPs) to prevent soil erosion and surface runoff into the bay; and (2) develop a water quality monitoring program to ensure the long-term effectiveness of the BMPs. Since there are no perennial water flows through or near the project site, monitoring should generally duplicate the coastal water quality stations utilized in our survey. Monitoring the water quality of intermittent storm run-off may provide some useful information (and will likely be required under grading regulations), but can be very difficult to interpret in terms of compliance of construction-related BMPs. Visual observations are typically more instructive. Limiting early site grading work to the dry season on Maui can reduce runoff impacts at the time when storm runoff would have the potential to carry the most particulates to coastal waters. If proper BMPs are employed during construction and runoff into the nearshore waters minimized, the proposed development should have minimal long-term adverse effects on the nearby marine communities.

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APPENDIX TABLE

2004-2005 marine species list for the waters off Ma'alaea, Maui

Checklist and abundance of aquatic biota observed in nearshore waters of Ma`alaea Bay (present study & 2005a[1]) and Ma`alaea Small Boat Harbor (AECOS, 2005a[1] & b[2]).

PHYLUM, CLASS, ORDER, FAMILY		Location			
Genus species	Common name	South Breakwater 1	Ma`alaea Harbor 2	East of East Breakwater 3	Kanaio Drainage 4
	ALGAE				
CHLOROPHYTA	GREEN ALGAE				
Bryopsis pennata		O[1]			
Chaetomorpha antennina		A			
Cladophora sp.		P, O[1]	P[1]	P	P
Cladophora fascicularis				P	
Codium edule		P		P	
Halimeda opuntia		P, R[1]	P[1]		
Halimeda discoidea		P			
Ulva fasciata	sea lettuce	A, A[1]	P[1,2]	A	A
Ulva reticulata		A, R[1]	P[1,2]	P	A
Valonia aegagrophila			P[2]		
PHAEOPHYTA	BROWN ALGAE				
Dictyota acutiloba					P
Dictyota bartayresiana	*alani*	P, O[1]		P	P
Giffordia breviarticulata	*hulu`ilio*	U[1]			
Ralfsia pangoensis		P	P[1]		
Sargassum echinocarpum		C			
RHODOPHYTA	RED ALGAE				
Acanthophora spicifera	spiny seaweed	A, C[1]	P[1]	A	A
Ahnfeltia concinna (F)	*`aki`aki*	C[1]			
Coelothrix irregularis				P	
Desmia hornemannii		P		P	
Gracillaria parvispora (F)	*ogo*	P			P
Grateloupia hawaiiana (F)	*huluhuluwaena*	P	P[2]		
Grateloupia filicina (F)		A		A	
Gymnogongrus sp.		P			
Hydrolithon reinboldii		U[1]			
Hypnea musciformis	hookweed	A, O[1]	P[1]	A	A
Jania sp.		P		P	
Laurencia nidifica (F)	*mane`one`o*	P			
Laurencia parvipapillata (F)	*lipe`epe`e*			P	
Melanamansia glomerata		P, C[1]		P	P
Peyssonnelia sp.		P	P[2]	P	P
Peyssonnelia rubra			P[2]		
Porolithon onkodes		P, A[1]	P[2]	P	P
Pterocladiella capillacea		A, O[1]			P
Pterocladiella caerulescens		P		P	
HETEROKONTOPHYTA, BACILLARIOPHYCEAE	BLUE-GREEN ALGAE				
Indet.	pseudofilamentous diatom		P[1]		

PHYLUM, CLASS, ORDER, FAMILY Genus species	Common name	Location South Breakwater 1	 Ma`alaea Harbor 2	 East of East Breakwater 3	 Kanaio Drainage 4
	INVERTEBRATES				
PORIFERA					
indet.	smooth black sponge			R	
CNIDARIA, HYDROZOA					
HYDROIDA					
Pennaria cf. *disticha*	Christmas tree hydroid		P[1]		
CNIDARIA, ANTHOZOA					
CUBOZOA					
Carybdea sp.	box jellyfish	R[1]	P[2]		
SCLERACTINIA, POCILLOPORIDAE					
Pocillopora eydouxi	antler coral				R
Pocillopora damicornis	lace coral	O, R[1]	P[1,2]		R
Pocillopora meandrina	cauliflower coral	C, O[1]	P[1]	A	A
ACROPORIDAE					
Montipora capitata	rice coral	C, O[1]	P[1,2]	C	A
Montipora patula	spreading coral	O	P[1,2]		C
Montipora flabellata	blue rice coral	U, R[1]	P[1]	A	U
PORITIDAE					
Porites lobata	lobe coral	C, C[1]	P[1,2]	C	A
Porites compressa	finger coral	U, R[1]	P[1,2]	U	U
AGARICIIDAE					
Pavona varians	corrugated coral			U	
FAVIIDAE					
Leptastrea purpurea	crust coral			U	
Cyphastrea ocellina	ocellated coral	U	P[1,2]	U	
ZOANTHIDEA, ZOANTHIDAE					
Palythoa caesia	blue-gray zoanthid	R, O[1]	P[1]		
ALCYONACEA, ALCYONIIDAE					
Carijoa riisei	snowflake coral		P[1]		
ANELLIDA, POLYCHAETA, ACICULATA	WORMS				
AMPHINOMIDAE					
Pherecardia striata	lined fireworm		P[2]		
CANALIPALAPATA					
SABELLIDAE					
indet.	tube worm		P[2]		
SERPULIDAE					
Sabellastarte sanctijosephi	feather duster worm		P[1,2]		
Spirobranchus giganteus	Christmas-tree worm	U	P[1]		U
TEREBELLIDAE					
Loimia medusa	medusa spaghetti worm	R	P[1,2]	R	R
indet.	unknown pink spaghetti worm		P[2]		

PHYLUM, CLASS, ORDER, FAMILY Genus species	Common name	Location South Breakwater 1	 Ma`alaea Harbor 2	 East of East Breakwater 3	 Kanaio Drainage 4
MOLLUSCA, GASTROPODA	MOLLUSKS				
PATELLIDAE					
Cellana sandwicensis	yellow-foot `opihi	R[1]	P[2]		
Siphonaria normalis	false `opihi	C[1]	P[1,2]		C
TROCHIDAE					
Trochus intextus	woven top		P[2]	U	
NERITIDAE					
Nerita picea	black nerite	C, O[1]	P[1,2]	C	C
LITTORINIDAE					
Littoraria pintado	dotted periwinkle	C	P[1,2]	C	C
VERMETIDAE					
Serpulorbis variabilis	variable worm snail	O	P[1,2]	O	O
CYPRAEIDAE					
Cypraea caputserpentis	snakehead cowry			R	
CONIDAE					
Conus marmoreus	marbled cone	R			
MOLLUSCA, GASTROPODA, CEPHALASPIDEA					
AGLAJIDAE					
Chelidonura hirundina	blue swallowtail slug			R	
MOLLUSCA, BIVALVIA					
ARCIDAE					
Arca ventricosa	ventricose ark shell		P[2]		C
PTERIIDAE					
Pinctada margaritifera	black-lipped pearl oyster	U, R[1]	P[2]	O	U
ISOGNOMONIDAE					
Isognomon perna	brown purse shell	U		C	C
OSTREIDAE					
Ostrea sandvicensis	Hawaiian oyster		P[1,2]		
MOLLUSCA, CEPHALOPODA, OCTOPODA					
OCTOPODIDAE					
Octopus cyanea	day octopus	R[1]			R
MOLLUSCA, CEPHALOPODA, TEUTHOIDEA					
SEPIOLIDAE					
Sepioteuthis lessoniana	oval squid	R[1]			
ARTHOPODA, CRUSTACEA, DECAPODA					
ALPHEIDAE					
Alpheus deuteropus	snapping shrimp	C	P[1]	C	C
TRAPEZIIDAE					
Trapezia flavopunctata	yellow-spotted guard crab				R
Trapezia intermedia	common guard crab			R	
GRAPSIDAE					
Grapsus tenuicrustatus	thin-shelled rock crab	C, C[1]	P[1,2]	C	C
Percnon planissimum	flat rock crab		P[2]		

PHYLUM, CLASS, ORDER, FAMILY		Location			
Genus species	Common name	South Breakwater 1	Ma`alaea Harbor 2	East of East Breakwater 3	Kanaio Drainage 4
OCYPODIDAE					
Macrophthalmus sp.	sentinel crab		P[2]		
ENOPLOMETOPIDAE					
Enoplometopus occidentalis	red reef lobster †		P[1]		
ECHINODERMATA, OPHIUROIDEA	BRITTLE STARS				
OPHIOCOMIDAE					
Ophiocoma erinaceus	spiny brittle star	U		U	U
ECHINODERMATA, ECHINOIDAE	SEA URCHINS				
DIADEMATIDAE					
Diadema paucispinum	long-spined urchin	O, O[1]	P[1,2]	O	O
Echinothrix calamaris	banded urchin	R[1]	P[2]		U
Echinothrix diadema	blue-black urchin	U[1]	P[1]		O
ECHINOMETRIDAE					
Colobocentrotus atratus	helmet urchin	R[1]			
Echinometra mathaei	rock-boring urchin	C, A[1]	P[1,2]	A	A
Echinometra oblonga	oblong urchin	A[1]			
Heterocentrotus mammillatus	slate-pencil urchin	O, C[1]	P[1,2]	C	C
TOXOPNEUSTIDAE					
Tripneustes gratilla	collector urchin	A,C[1]	P[1,2]	A	A
ECHINODERMATA, HOLOTHUROIDAE	SEA CUCUMBERS				
HOLOTHURIIDAE					
Actinopyga mauritiana	white-spotted sea cucumber	U, O[1]	P[1]	U	U
Holothuria sp.	sea cucumber	C		C	
Holothuria atra	black sea cucumber	U[1]	P[2]	U	
	VERTEBRATES				
VERTEBRATA, CHONDRICHTHYES	SHARKS & RAYS				
MYLIOBATIDAE					
Aetobatis narinari	spotted eagle-ray		P[1]		
VERTEBRATA, PICES	FISHES				
MURAENIDAE					
Echidna nebulosa	snowflake moray	R[1]	P[2]		
Gymnomuraena zebra	zebra moray				R
Scuticaria tigrina	tiger moray			R	R
ENGRAULIDAE					
Encrasicholina purpurea	Hawaiian anchovy		P[2]		
AULOSTOMIDAE					
Aulostomus chinensis	trumpetfish	R, R[1]	P[1,2]		
FISTULARIIDAE					
Fistularia commersonii	cornetfish	A, U[1]	P[1,2]		U
SERRANIDAE					
Cephalopholis argus	peacock grouper, *roi*	R			U

PHYLUM, CLASS, ORDER, FAMILY		Location			
Genus species	Common name	South Breakwater 1	Ma`alaea Harbor 2	East of East Breakwater 3	Kanaio Drainage 4
SYNODONTIDAE					
Saurida sp.	lizardfish		P[1]		
Synodus ulae	*`ulae*		P[2]		
SCORPAENIDAE					
Sebastapistes coniorta (E)	speckled scorpionfish			U	U
Scorpaenopsis diabolus	devil scorpionfish	R[1]			
KUHLIIDAE					
Kuhlia sandvicensis (E)	Hawaiian flagtail		P[1,2]		
CIRRHITIDAE					
Cirrhitops fasciatus	redbarred hawkfish	R			
CARANGIDAE					
Caranx melampygus	bluefin trevally	R[1]	P[1]		
Decapterus macarellus	mackerel scad, *`opelu*	U			
Scomberoides lysan	leatherback, *lai*			R	R
LUTJANIDAE					
Lutjanus fulvus	blacktail snapper		P[2]		
MUGILIDAE					
Mugil cephalus	striped mullet, *`ama`ama*		P[2]		
MULLIDAE					
Mulloidichthys flavolineatus	yellowstripe goatfish	R,R[1]	P[1,2]		R
Mulloidichthys vanicolensis	yellowfin goatfish		P[1,2]		
Parupeneus cyclostomus	blue goatfish		P[1]		
Parupeneus multifasciatus	manybar goatfish	R,R[1]	P[1]	R	R
Parupeneus porphyreus (E)	whitesaddle goatfish	R,R[1]	P[1]		R
Upeneus arge	bandtail goatfish		P[2]		
KYPHOSIDAE					
Kyphosus bigibbus	brown chub		P[1]		
CHAETODONTIDAE					
Chaetodon auriga	threadfin butterflyfish	O	P[1,2]	O	C
Chaetodon lunula	raccoon butterflyfish	C, O[1]	P[1,2]	O	O
Chaetodon miliaris (E)	milletseed butterflyfish		P[1,2]		
Chaetodon unimaculatus	one-spot butterflyfish	R[1]			
POMOCENTRIDAE					
Abudefduf abdominalis (E)	Hawaiian sargeant	U,C[1]	P[1,1]	O	O
Abudefduf sordidus	blackspot sergeant		P[2]		
Chromis vanderbelti	blackfin chromis	U			U
Dascyllus albisella (E)	Hawaiian dascyllus		P[1,2]		R
Plectroglyphidodon imparipennis	brighteye damselfish	C	P[2]	O	C
Plectroglyphidodon johnstonianus	blue-eye damselfish	U			R
Stegastes fasciolatus	Pacific gregory	U,C[1]	P[1,2]		

PHYLUM, CLASS, ORDER, FAMILY		Location			
Genus species	Common name	South Breakwater	Ma`alaea Harbor	East of East Breakwater	Kanaio Drainage
		1	2	3	4
LABRIDAE					
indet.	juveniles	A		A	A
Anampses cuvier (E)	pearl wrasse	R[1]			
Bodianus bilunulatus (E)	Hawaiian hogfish	R[1]			
Cheilio inermis	cigar wrasse	R[1]	P[1]		
Coris gaimard	yellowtail coris	R,R[1]	P[1]		R
Coris venusta (E)	elegant coris				R
Gomphosus varius	bird wrasse	R,U[1]	P[1]	R	R
Labroides phthirophagus (E)	Hawaiian cleaner wrasse	U[1]	P[1]		R
Macropharyngodon geoffrey (E)	shortnose wrasse	R[1]			
Novaculichthys taeniourus	rockmover wrasse	R,R[1]			
Stethojulis balteata (E)	belted wrasse	A	P[1,2]	A	A
Thalassoma ballieui (E)	old woman wrasse		P[2]		
Thalassoma duperrey (E)	saddle wrasse	A, C[1]	P[1,2]	A	A
Thalassoma trilobatum	Christmas wrasse	O,O[1]	P[2]	O	O
SCARIDAE					
indet.	juveniles			O	O
Scarus psittacus	pale nose parrotfish	U	P[2]		C
Scarus rubroviolaceus	red-lip parrotfish		P[2]		
BLENNIIDAE					
Blenniella gibbifrons	bullethead rockskipper		P[2]	R	
Cirripectes vanderbilti (E)	scarface blenny	R		R	
Plagiotremus sp.	fang blenny			R	
TRIPTERYGIIDAE					
Enneapterygius atriceps	triple fin blenny		P[2]	R	
BLENNIDAE					
Blenniella gibbifrons	bullethead rockskipper		P[2]		
GOBIDAE					
Psilogobius mainlandi (E)	Hawaiian shrimp goby		P[2]		
ZANCLIDAE					
Zanculus cornutus	Moorish idol	R,U[1]	P[1,2]		U
ACANTHURIDAE					
Acanthurus blochii	ring-tail surgeonfish	U,O[1]	P[1,2]	U	O
Acanthurus dussumieri	eye-stripe surgeonfish		P[1]		
Acanthurus guttatus	white-bar surgeonfish	U,C[1]	P[1,2]		
Acanthurus leucopareius	whitespotted surgeonfish	R	P[1,2]		
Acanthurus nigrofuscus	lavender tang	U[1]	P[1,2]		C
Acanthurus nigroris	bluelined surgeonfish	C			U
Acanthurus olivaceus	orangeband surgeonfish	R			
Acanthurus triostegus	*manini*	A,A[1]	P[1,2]	U	U
Acanthurus xanthopterus	yellowfin surgeonfish	U	P[2]		
Ctenochaetus hawaiiensis	black surgeonfish		P[2]		
Ctenochaetus strigosus	goldring surgeon	R,U[1]	P[1,2]		

PHYLUM, CLASS, ORDER, FAMILY		Location			
Genus species	Common name	South Breakwater	Ma`alaea Harbor	East of East Breakwater	Kanaio Drainage
		1	2	3	4
ACANTHURIDAE (cont.)					
Naso lituratus	orangespine unicornfish	U,R[1]		R	U
Naso unicornis	unicornfish, *kala*	C,R[1]	P[1]	O	C
Zebrasoma flavescens	yellow tang		P[1,2]		
BALISTIDAE					
Rhinecanthus rectangulus	reef triggerfish	C,U[1]	P[1]	C	C
MONOCANTHIDAE					
Cantherhines dumerilii	barred filefish		P[2]	R	
OSTRACIIDAE					
Ostracion meleagris	spotted boxfish	U,C[1]	P[1,2]	U	R
TETRAODONTIDAE					
Arothron hispidus	stripebelly puffer	R		R	R
Canthigaster amboinensis	ambon toby	U	P[2]		U
Canthigaster jactator (E)	HI white spotted toby		P[2]		

KEY TO SYMBOLS USED IN TABLE 1:

Location:

1 - West Breakwater - west of west breakwater, outside harbor off Kapoli Beach.
2 - Maalaea Harbor - Ma`alaea Small Boat Harbor & channel (surveyed 2004 & 2005).
3 - East of East breakwater - adjacent to Ma`alaea Kai condominium.
4 - Kanaio Drainage - adjacent to Island Sands condominium.

Abundance categories:

P - Present
R - Rare - Only one or two individuals observed in area.
U - Uncommon - Three to no more than a dozen individuals seen in area.
O- Occasional - Seen irregularly and always in small numbers; more than a dozen individuals in area.
C - Common - Seen regularly, although generally in small numbers.
A - Abundant - Found in large numbers and widely distributed.

Other symbols and categories:

† - Shell, carapace, or test only (not seen alive).
E - Endemic - Found in Hawaii and nowhere else.
F - Food resource - Alga collected for consumption.

QC:

Animals were identified in the field on September 30, 2005 by S. Burr, K. Laing, and C. Linebaugh and algae were identified in the laboratory by C. Linebaugh.

[1] Reported in AECOS (2005a), Nov. 17, 2004, Ma`alaea ferry pier survey

[2] Reported in AECOS (2005b), Oct. 24, 2005, USCG harbor survey.

APPENDIX G.

Archaeological Inventory Survey Reports

SCS Project 534-1

AN ARCHAEOLOGICAL INVENTORY SURVEY REPORT ON 259.903 ACRES IN MA`ALAEA, UKUMEHAME AND WAIKAPU AHUPUA`A, WAILUKU DISTRICT, MAUI ISLAND, HAWAI`I [TMK: (2) 3-6-01:18]

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ABSTRACT

Scientific Consultant Services (SCS), Inc., conducted Archaeological Inventory Survey on a 259.903-acre land parcel in Ma`alaea, Ukumehame and Waikapu Ahupua'a, Wailuku District, Maui Island, Hawai`i [TMK: (2) 3-6-01:18]. The work consisted of historical background and archival research; pedestrian survey and inspection of the parcel; mapping and description of site features; subsurface testing (excavation by backhoe); consultation with state archaeologist Dr. Melissa Kirkendall; and, analysis, interpretation, and reporting of all relevant data. The main objectives of the project were to determine if significant cultural and/or historic resources occurred on the parcel; and, to provide significance assessments and recommendations.

The main results of this study were as follows: Three historic sites, all related to sugarcane agriculture, were identified, documented for the first time, and assigned SIHP numbers: Site 50-50-09-5657 (clearing mounds), Site 50-50-09-5658 (irrigation modifications), and Site 50-50-09-5659 (dirt road). These three sites were the only archaeological sites found within the project area, and all three are considered significant under Criterion D of the Hawaii State and National Register of Historic Places. A 100 percent pedestrian survey concluded that no prehistoric sites exist on the surface of the project area.

Subsurface testing was comprised of twenty backhoe trenches (a volume of approximately 292 cubic meters) which did not reveal any subsurface historic, or prehistoric, cultural material. Rather, excavation confirmed the extent, both in physical and temporal depth, of historic and modern agricultural activity within the project area. No burial features or human remains were observed during pedestrian survey or encountered during subsurface testing.

The following actions are recommended: No further archaeological work is necessary within the project area, with the exception of a period of observation during future earth-moving activity. An archaeologist must be on site during the leveling of a representative sample (a minimum of four) of the thirteen clearing mound features that comprise State Site 50-50-09-5657. This archaeological observation is necessitated by the possibility of historic and/or prehistoric features or artifacts having been buried under/within the large clearing mounds.

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LIST OF FIGURES

INTRODUCTION

Scientific Consultant Services (SCS), Inc., conducted Archaeological Inventory Survey (AIS) on a 259.903-acre land parcel in Ma`alaea, Ukumehame and Waikapu Ahupua'a, Wailuku District, Maui Island, Hawai`i [TMK: (2) 3-6-01:18] (Figures 1 and 2). The work consisted of historical background and archival research; pedestrian survey and inspection of the parcel; mapping and description of site features; subsurface testing (excavation by backhoe); consultation with state archaeologist Dr. Melissa Kirkendall; and, analysis, interpretation, and reporting of all relevant data. Fieldwork was conducted on January 31–February 11, 2005 by Jon Wilson, B.A. and Eric Pope, B.A. under the supervision of Principal Investigator Michael F. Dega, Ph.D.

Archaeological work in the project area was conducted to determine the presence/absence of archaeological features in surface and subsurface contexts through complete pedestrian survey and representative subsurface testing. The ultimate goals of the project were to determine if significant cultural and/or historic resources occurred on the parcel; and, to provide significance assessments and recommendations to the State Historic Preservation Division (SHPD). Plans for the "Ma`alaea Mauka" residential project by AFK Development utilize nearly the entire project area detailed within this AIS. Included in development plans are over one thousand residential units, a community center, a park and open areas, buffer zones, and roadways.

ENVIRONMENTAL SETTING

PROJECT AREA DESCRIPTION AND LOCATION

Maui's Wailuku District encompasses an area from the eastern half of the West Maui Mountains, north to Kahului Bay, south to Ma`alaea Bay, and includes the entire Kahului Isthmus (Figure 3). Near the southwestern corner of Wailuku District, the boundary separating Ukumehame Ahupua`a and Waikapu Ahupua`a runs from *mauka* to *makai* (roughly west to east). At an elevation of approximately 55 meters (180 feet) the *ahupua`a* boundary sharply angles south toward Ma`alaea Bay. This sharp angle between the two *ahupua`a* marks the northeastern boundary of the current project area. The *ahupua`a* boundary then divides the project area as it continues south, leaving roughly 65 percent of the parcel in Ukumehame Ahupua`a, and 35 percent of the parcel in Waikapu Ahupua`a (see Figure 1).

The "Ma`alaea Mauka" project area consists of one contiguous 259.903-acre parcel that uses the Honoapiilani Highway as its *makai* border. The three-sided project area's southern terminus is a triangular point *mauka* of Ma`alaea Small Boat Harbor. The northern boundary line

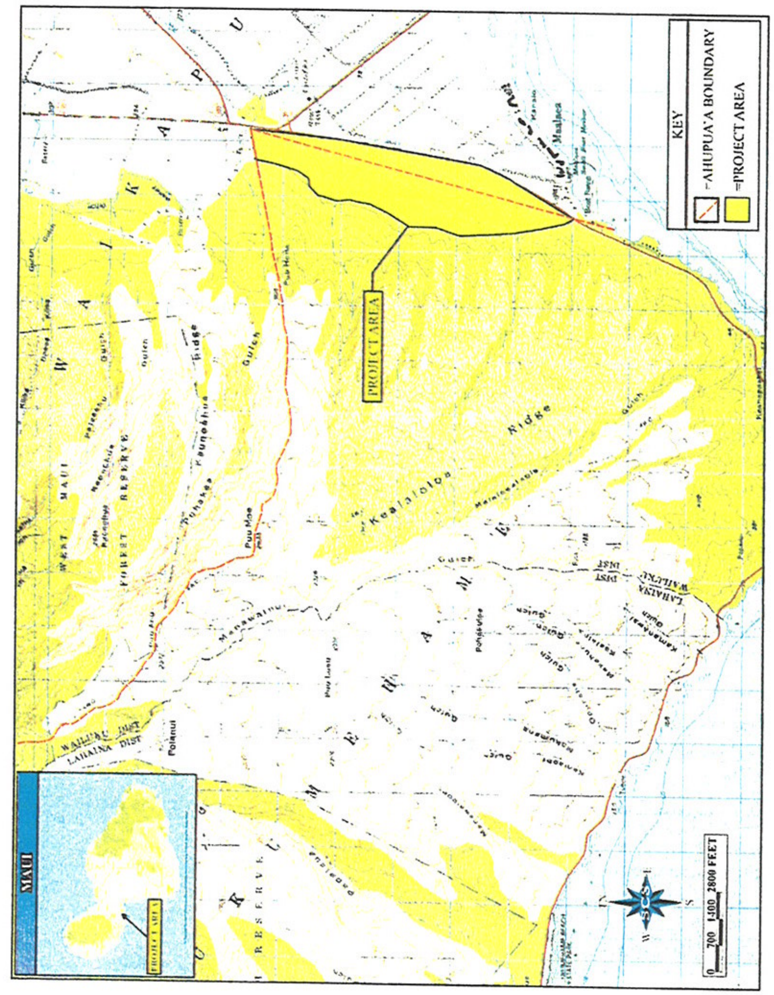

Figure 1: USGS Ma`alaea Quadrangle Showing Project Area Location.

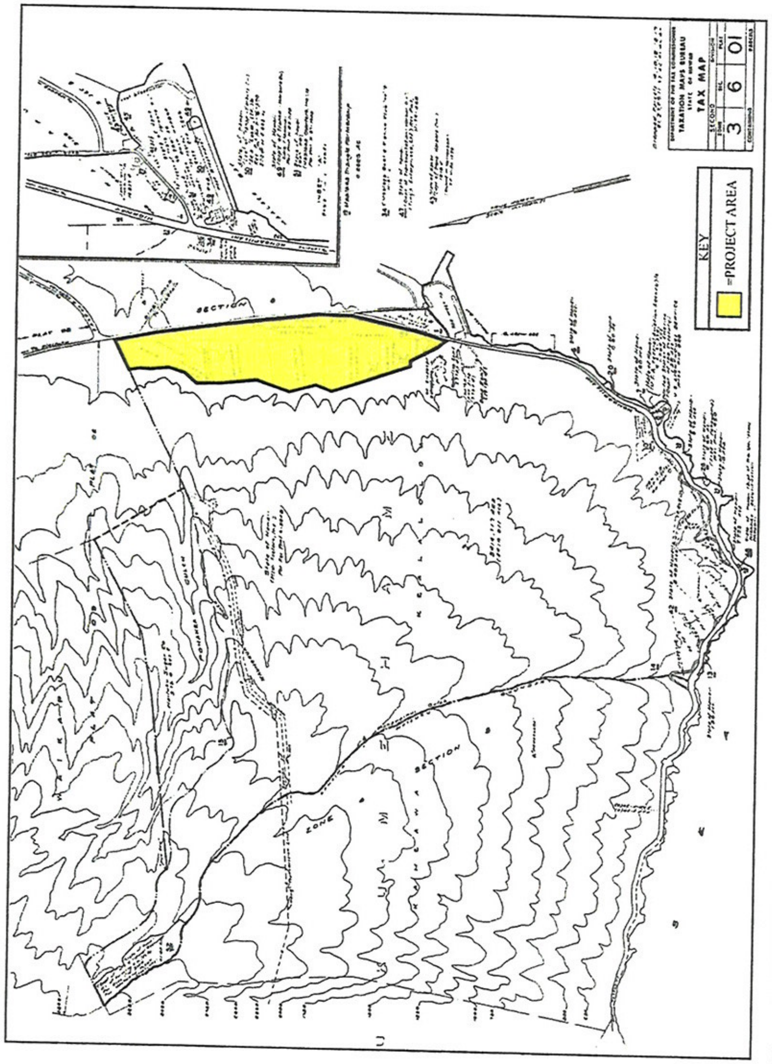

Figure 2: TMK [Tax Map Key] Showing Project Area Location.

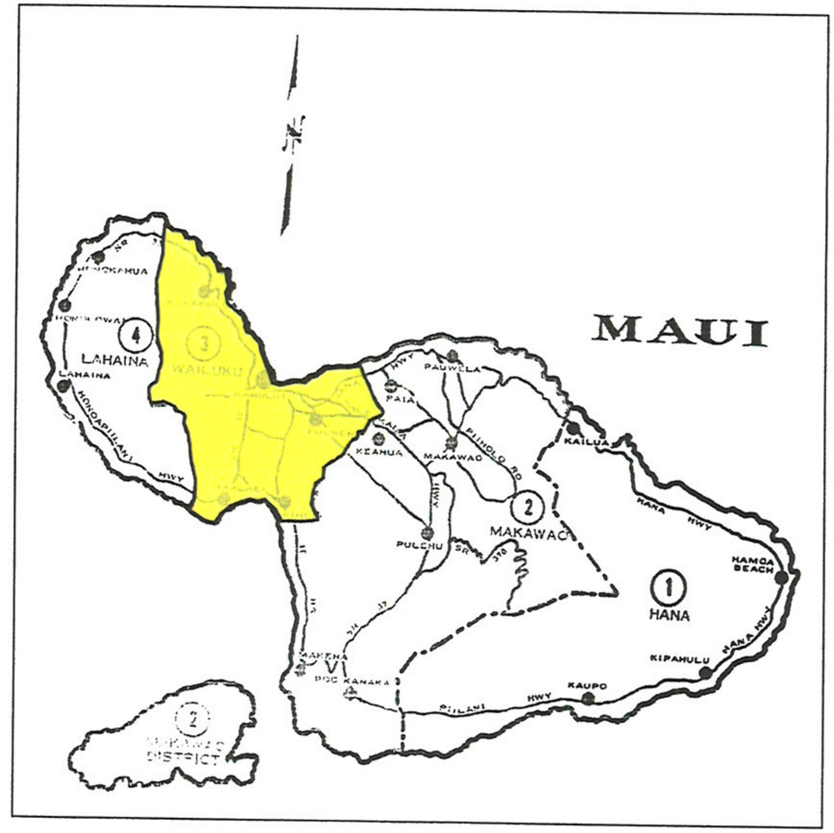

Figure 3: Wailuku District Boundaries.

extends *mauka* from a point 183 m (600 feet) south of the Kuihelani Highway's intersection with Honoapiilani Highway. The long, narrow project area runs 2.7 kilometers (1.7 miles) along the Honoapiilani Highway (Figure 4), and at it widest is 579 m (1900 feet).

PROJECT AREA LANDFORM

The sharp transition from valley floor to mountain slope is the most distinct visual feature of the nearby terrain. This dramatic elevation increase, however, occurs just *mauka* of the relatively flat project area (Figure 5). With the southeastern end of the project area having an elevation of 12 m (40 feet), and the northwestern perimeter high point of 61 m (200 feet), the maximum elevation difference throughout the project area is only 49 m (160 feet). The average *makai* to *mauka* elevation gained from walking the width of the project area (about half a kilometer) is only 24m (80 feet). The average elevation gained from climbing the next half kilometer beyond the project area's *mauka* border is 146 m (480 feet).

The gently-sloping terrain of the project area has been made more flatly uniform through decades of agricultural activity. Few distinct naturally-occurring landmarks remain within the project area's topography. Certain points within the project area afford an uninterrupted view of its entire expanse. The four perennial *mauka-makai* running drainages that cross the project area remained dry at the time of survey. It is likely that these narrow water courses that span the parcel's width only flow in times of heavy rains. Two of the four drainages are fairly shallow and narrow, and do not originate much farther upslope than the base of the mountains. The two more significant drainages appear on the USGS topographical map (see Figure 1), and are currently diverted under Honoapiilani Highway, eventually emptying into Ma`alaea Bay. Of these two, the southern drainage originates at an elevation of 335 m (1100 feet), and the northern drainage (Figure 6) originates near Puu Moe at 640 m (2100 feet). However, at a maximum width of less than four meters, it is likely that even these two more significant water sources served to irrigate the project area only in times of heavy rainfall.

CLIMATE AND VEGETATION

The project area receives 25 to 38 centimeters (10 to 15 inches) of rainfall annually (Armstrong 1983). This area is much drier than higher elevations to the west that receive as much as twenty times the level of precipitation. Air temperatures are consistently slightly warmer here than the Maui seasonal high and low averages, mostly due to the lower, coastal elevation.

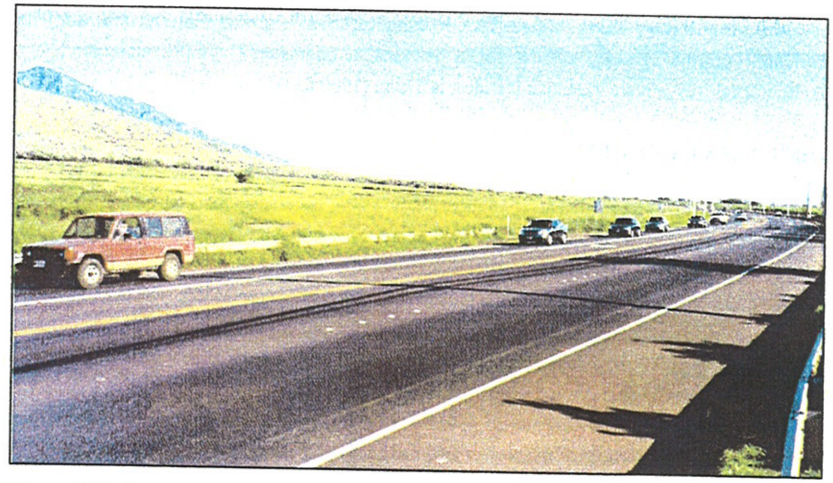

Figure 4: Project Area Overview. View to North, Across Honoapiilani Highway.

Figure 5: Project Area Overview. View to North, from Southern Quadrant.

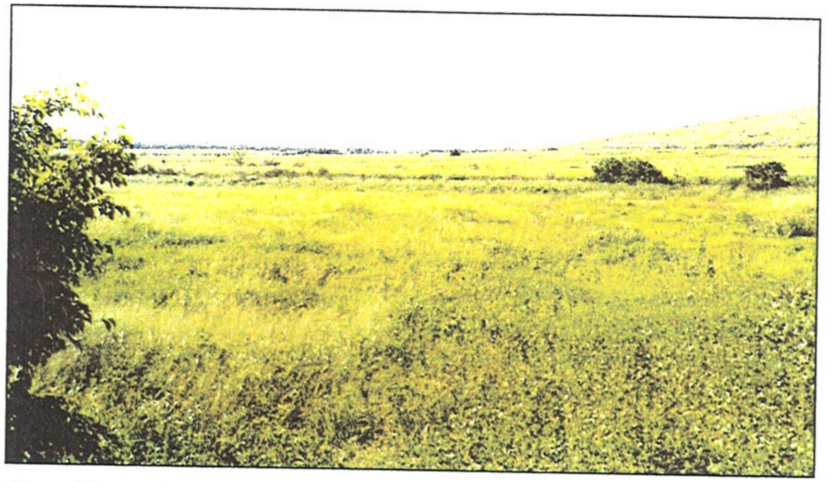

Figure 6: *Mauka-Makai* Vegetation Line Marks the Northern Drainage Appearing on the USGS Map. Northern Half of Project Area, View to South.

At the time of survey, project area vegetation consisted of a mix of introduced grasses and trees, few native species, and a variety of small garden plots with a mix of planted crop species. The only areas not covered by vegetation were the multiple dirt road segments that transect the property. Introduced grasses, ranging from 0.5 to 1.0 m tall, covered roughly 85 percent of the project area. Few *kiawe* trees (*Prosopis pallida*) were found outside of drainage perimeters, but along and within the drainages these introduced trees were abundant. *Kiawe* also lines the *mauka* side of the *mauka* perimeter road, and grows very dense within the State-owned lands at the base of the mountains. Overall, few trees exist within the former agriculture fields. Recent *koa haole* (*Leucaena leucocephala*) trees have grown to a height of no more than 1.5 m within the fields, but grow to a height of over 3.0 m along the *mauka* perimeter roads. Other species include lantana (*Lantana camarara*), sparse sisal (*Agave sisalana*), and the native *`ilima* (*Sida* sp.).

Over twenty different patches of recently abandoned garden crops are scattered throughout the southern 80 percent of the project area. None are larger than one acre, and none of these patches exist within the rockier northern soils. Two local informants spoke of "renting" land for small-scale farming within the "past couple of years," be it through a formal contract

with the previous land owner or not. Rows of banana trees occur in at least five different areas. One banana patch also includes gourds; papaya trees are interspersed throughout. At the center of the property, surface plastic irrigation pipes appear to be recently constructed and lead to a square sod field. The most elaborate small-scale farming remnant is what appears to be a *Ficus* sp. nursery at the center of the project area's northern half. Here, three rows of identically-sized trees are paralleled by what appear to be recently constructed concrete walkways and irrigation piping (Figure 7).

SOILS

As the project area extends north, its soils contain a greater concentration of basalt cobble and boulder. According to Foote *et al.* (1972:101), soils in the project area fall into mainly two categories: the Ewa Series (80 percent of the project area) and the Pulehu Series (most of the northern 20 percent). The Ewa Series consists of well-drained soils occurring on alluvial fans within Oahu and Maui. They are derived from igneous rock, moderately sloping, and best suited for sugar cane, truck crops, and pasture. The southern third of the project area consists entirely of Ewa Silty Clay (EsB), ideal for sugarcane. Bordering EsB soil to the north is a large contiguous section of Ewa Cobbly Silty Clay (EtB), covering roughly 50 percent of the project area. Foote *et al.* note that the removal of a surface layer of cobble renders this soil equally suitable to sugarcane cultivation as the less rocky soil to the south (1972:29–30, 115–116).

Figure 7: Possible Tree Nursery at Center of Project Area.

Roughly 20 percent of the project area, entirely concentrated at the northern end, consists of a Pulehu Series soil—specifically, Pulehu Cobbly Clay Loam (PtB). This soil is very similar to the Ewa Series in almost every aspect except its greater surface rock concentration. Thus, a direct correlation can be seen between the location of PtB soil and the 13 large, agricultural clearing mounds (State Site 50-50-09-5657) concentrated in the northern end of the project area (Figures 8 and 9). In an effort to create sugarcane fields equally productive as lands to the south, decades of tilling have deposited these enormous mounds of concentrated boulders. (See "RESULTS" section, below, for further discussion of the historic origin of the Site -5657 mounds).

TRADITIONAL AND HISTORIC SETTING

PRE-CONTACT TO EARLY HISTORIC ERA

Wailuku District, is frequently mentioned in historical texts and oral tradition as being politically, ceremonially, and geographically important during traditional times (Cordy 1981, 1996; Kirch 1985). Wailuku was considered a "chiefly center" (Sterling 1998:90) with many of the chiefs and much of the area's population residing near or within portions of `Īao Valley and lower Wailuku. The importance of the district is reflected by the relatively large number of *heiau* that were reportedly present in pre-Contact times. Oral tradition accounts surrounding these *heiau* provide examples of how religion tied into political power in the traditional Wailuku setting. Indeed, the period immediately preceding contact with the Europeans was one of considerable upheaval and conflict. *Wailuku*, meaning 'water of destruction,' succinctly describes the area in the late 1700s. Political power emanating from Moloka`i was an active element during the mid-eighteenth century. The resulting battle at Kalae`ili`ili (A.D. 1765) led to the expulsion of Keeaumoku and the Moloka`i *ali`i* and the beginning of Kahekili's reign (Kamakau 1992). Kahekili successfully defended his capital in Wailuku throughout the 1770s, until his defeat at the hands of Kamehameha's forces.

Closer to the current project area, in the southwest corner of Wailuku District, prehistoric settlement was not as dense as concentrations to the north. Climate had much to do with that trend, as the Ma`alaea area is a more arid environment than the rain-soaked fields to the north. According to Tomonari-Tuggle and Tuggle (1991), the majority of the pre-Contact population was located southwest of the project area, near what is now Ukumehame Beach State Park. Settlement was also probable north of Kealia Pond in Waikapu Ahupua`a. Handy and Handy report that before the historic sugarcane plantations in this region, water from Waikapu Stream ". . . was diverted into lo`i and its overflow was dissipated on the dry plains of the broad isthmus between West and East Maui" (1972:496).

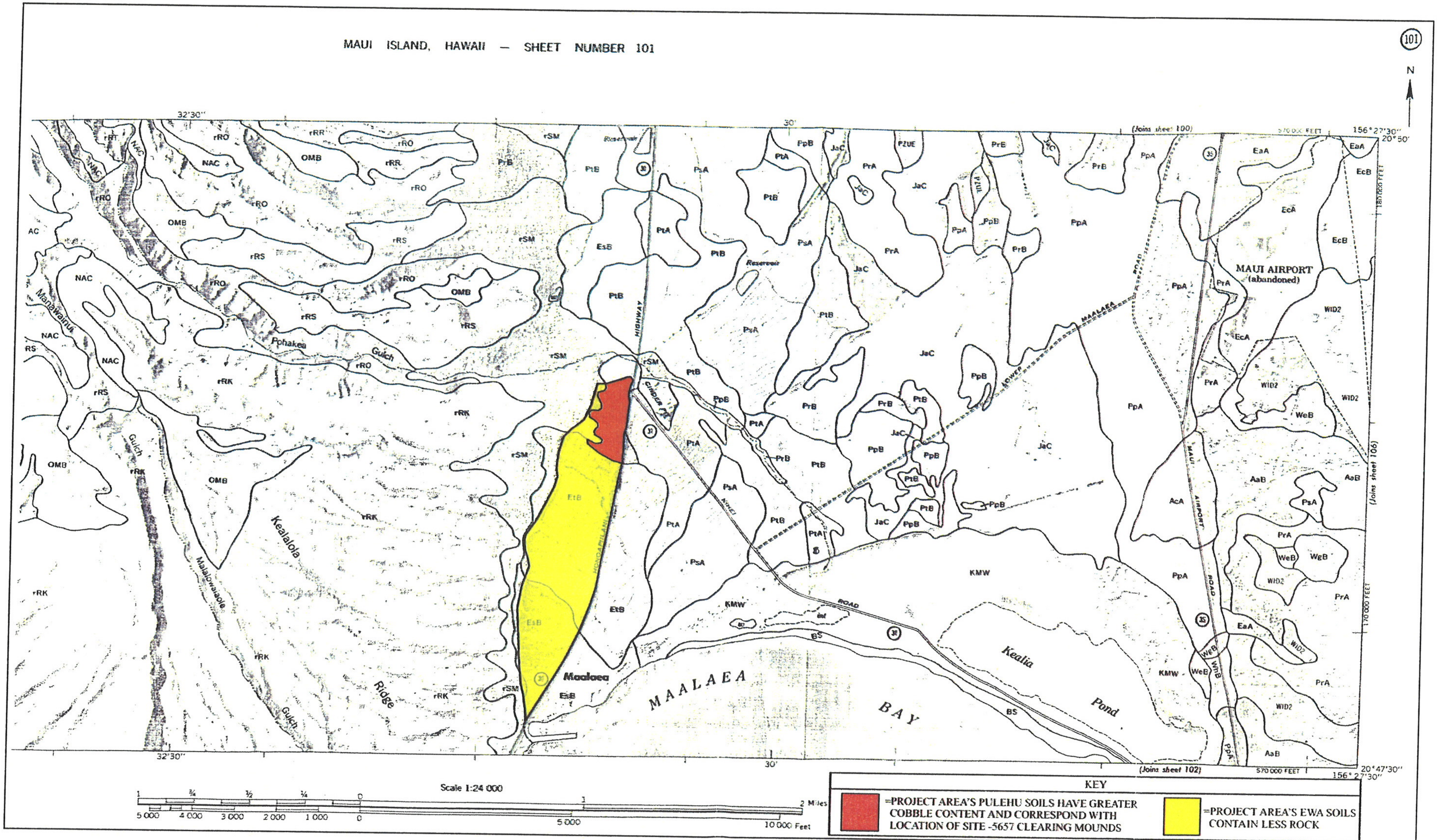

Figure 8: Project Area Soil Type Distribution (adapted from Foote *et al.* [1972:101]).

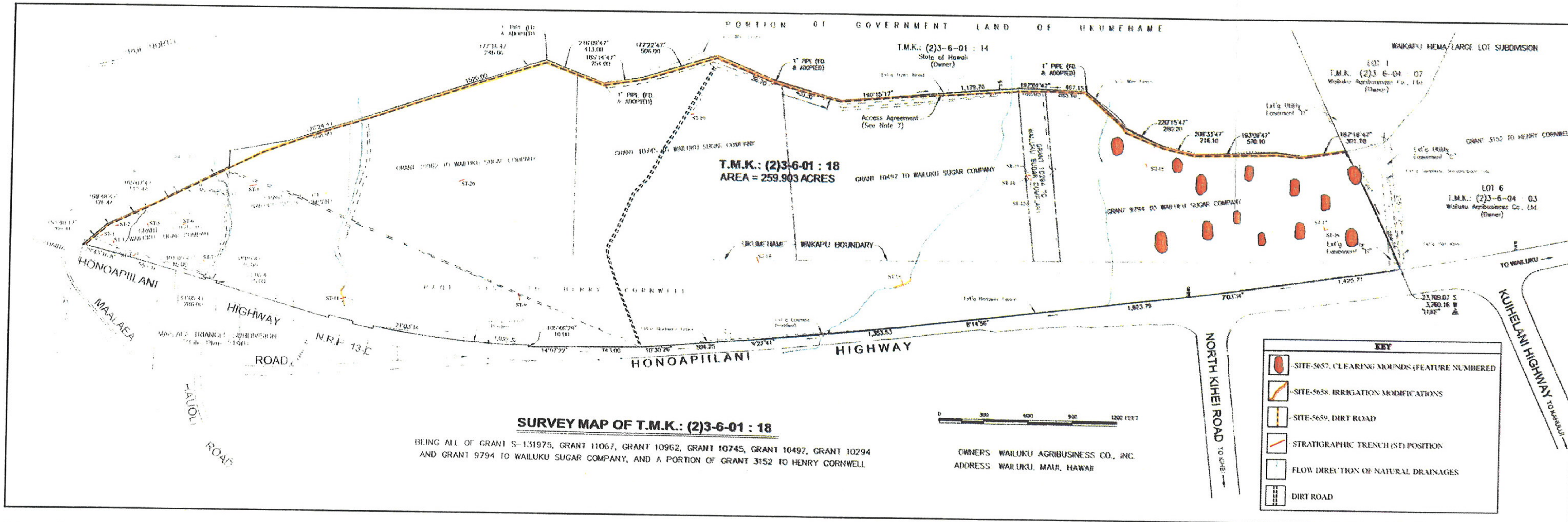

Figure 9: Project Area Site Map.

Wailuku District would see drastic change after Captain James Cook's 1778 arrival in Kahului Bay. The reign of Kamehameha I was intertwined with the increasing presence of Europeans within the Hawaiian Islands. By 1821, American missionaries had established a foothold in Lahaina and first arrived in Wailuku a year later. The religion of the Hawaiian people began to wane under the influence of Christianity. Fredericksen and Fredericksen (2002:4) point to a girls' seminary (Central Female Boarding School), established in Wailuku in 1836, as one of the initial steps in the conversion of Hawaiian language and customs in Maui.

THE GREAT MĀHELE

In 1848, commissioners of the Great Māhele instigated an extreme modification to traditional land tenure on all islands that resulted in a division of lands and a system of private ownership. The Māhele was based upon the principles of Western law. While 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 society into that of a market economy (Kuykendall Vol. I 1938:145, footnote 47, *et passim*; Daws 1968:111; Kame`eleihiwa 1992:169–170, 176). The dramatic shift from a redistributive economy to a market economy resulted in drastic changes to land tenure, among other things. As a result, foreigners demanded private ownership of land to ensure their investments (Kuykendall Vol. I, 1938:145, *et passim*; Kame`eleihiwa 1992:178; Kelly 1998:4).

Once lands were made available and private ownership was instituted, native Hawaiians, including the *maka`āinana* (commoners), were able to claim land plots upon which they had been cultivating and living. Oftentimes, foreigners were simply just given lands by the *ali`i*. However, commoners would often only make claims if they had first been made aware of the foreign procedures (*kuleana* lands, or land commission awards). These claims could not include any previously cultivated or currently fallow land, *okipu*, stream fisheries, or many other natural resources necessary for traditional survival (Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). Awarded parcels were labeled as Land Commission Awards (LCAs). If occupation could be established through the testimony of witnesses, the petitioners were issued a Royal Patent number and could then take possession of the property. Commoners claiming house lots in Honolulu, Hilo, and Lāhainā were required to pay commutation to the government before obtaining a Royal Patent for their awards (Chinen 1961:16).

During the Māhele, Wailuku District was declared Crown Land and numerous Land Commission Awards, approximately 180, were awarded within Wailuku Ahupua`a alone (Creed 1993). A handful of foreigners (*i.e.*, Anthony Catalena, James Louzada, E. Bailey) gained

control of large parcels of lands that would later be used for mass cultivation of sugar. Significantly, the majority of LCAs were awarded to Hawaiians, a gauge that can be used to measure pre-Contact settlement, since there was little overall change in traditional land use among Hawaiians prior to 1853 (Creed 1993:38).

During the Māhele, there were no land claims within the current project area. This fact may be attributed to the sparse pre-1848 Hawaiian population within the parcel, a result of settlement conditions within these *ahupua`a* favoring the coastal area.

THE LATE HISTORIC PERIOD AND GROWTH OF THE SUGAR INDUSTRY

Another influence that brought change to Maui was foreign commercialism. Two Chinese brothers, Ahung and Atai, of Honolulu's Hungtai Company arrived in Wailuku to explore the possibility of setting up one of its earliest sugar mills in 1828. Atai soon created a plant that processed sugar cane cultivated by Hawaiians, named the Hungtai Sugar Works (Dorrance and Morgan 2000:15–16). Ahung later joined Kamehameha III's sugar producing enterprise, although by 1844 both operations had ceased. The Wailuku Sugar Company was the next to follow, in 1862, and would expand sugar production over the next 126 years of its existence—4,450 acres by 1939, still more than three decades before its maximum production levels.

As it expanded its territory, the Wailuku Sugar Company first appeared on maps of the project area in the in the 1920s (Bureau of Conveyances, Grant 9794), although their acquisition of the project area land may have been as early as the turn of the century (Kennedy and Trimble 1992:4). Successive grants (Grant 10294 through to Grant S-13975) would follow in decades following and fully encompass the Ukumehame Ahupua`a side of the project area in Wailuku Sugar land. Kennedy and Trimble (1992:4) summarize the history of the Waikapu Ahupua`a (*makai*) portion of the project area by detailing its acquisition from the state government on November 18, 1875 by Henry Cornwell (Grant 3152). Cornwell subsequently sold to Claus Spreckels, and by the turn of the century the entire project area was under sugarcane cultivation.

Wailuku Sugar Company ended production in 1988, having averaged over 30,000 tons of sugar produced annually at its pinnacle in the 1970s (Dorrance and Morgan 2000:66). Owner C. Brewer & Company, Ltd. shut down sugar cultivation on the project area, which was then used almost entirely for pineapple cultivation starting no later than 1992 (Kennedy and Trimble 1992:1). The lands were under pineapple for at least the next three years (Tomonari-Tuggle 1995:11)—probably slightly longer—before transitioning to smaller-scale "garden" plots.

PREVIOUS ARCHAEOLOGY

Six studies on file within the SHPD-Kapolei archives summarize the most relevant previous archaeology within the vicinity of the current project area. Figure 10 exhibits the locations of these studies in relation to the current project area. Examination of the archaeological record helped to form the expected findings and, consequently, the subsurface testing pattern charted on Figure 9.

Most relevant to the current study is the only other previous archaeological study that took place within the current project area. Kennedy and Trimble (1992) surveyed an area that overlaps State Site 50-50-09-5659 (historic dirt road), first recorded in the present study (see Figure 10). While Kennedy and Trimble also note the lack of archaeological features in their project area due to the obvious history of intense agriculture, their 1992 report does not consider the road upon which their survey takes place to be a potential historic agricultural feature (as discussed below under "RESULTS"). The project area detailed in their study is no more than 5 meters wider than the dirt road itself, and concludes that "No artifacts, midden, or structures of historic or prehistoric significance were identified on the subject property" (1992:11).

An earlier Kennedy report (1986) entitled *Letter Report: Walk-Through Examination of the Proposed Maaļaea Triangle, Maui (TMK: 3-6-01:1)* also concluded with negative results. This project area is located on the *makai* side of Honoapiilani Highway and extends to the coastline (see Figure 10). This was the first archaeological study performed on this parcel and Kennedy does mention (1986:2) nearby sites that are detailed in later studies.

Monitoring within a smaller section of the same project area described by Kennedy (1986) resulted in a single site—a previously disturbed historic burial: State Site 50-50-09-4480 (McGerty, Burgett, and Spear 1998). McGerty *et. al*'s report, entitled *Draft: Monitoring Report on Earth Moving and Construction Excavations, Maui Ocean Center Site, Maui, Hawaii, (TMK: 3-6-01:001 and 019)* describes a pearl shell button found with the burial. The location of Site -4480 is of interest to the current study as its position is approximately 200 m *makai* of the current project area's southern corner. As subsequent subsurface testing would prove, however, the sandy matrix McGerty *et. al* experienced in the Maui Ocean Center monitoring contrasted the reddish clay of the current project area, rendering the likelihood of encountering burials much less. Nonetheless, the McGerty *et. al* (1998) study also mentions two more burials found not far to the north from Site -4480. While these (Sites -3553 and -3554) are even less spatially related

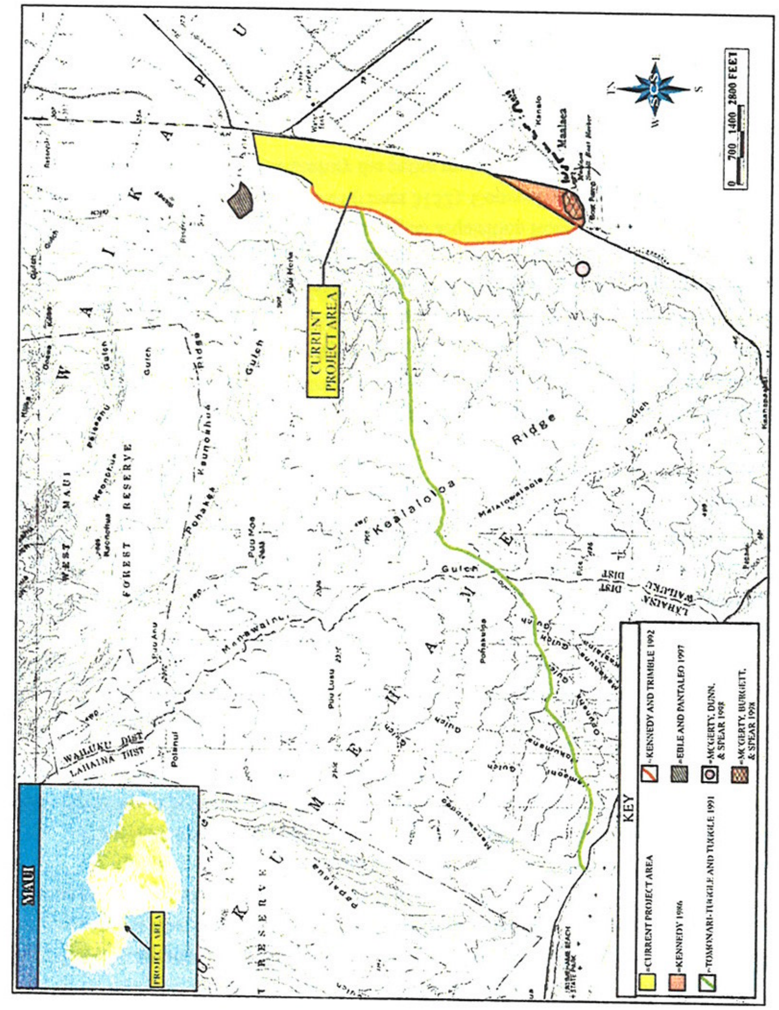

Figure 10: Locations of Selected Previous Archaeological Studies Near Current Project Area.

to the current project area, their presence will later call for increased testing in the southern portion of the current project area (closest to the sandy coastal matrices).

McGerty, Dunn, and Spear (1998) conducted Data Recovery in an area of five traditional sites documented by Moore and Kennedy (1995). These sites (50-50-09-3555, -4022, -4137, -4138, -4139) consisted of 28 features, including petroglyphs, subsurface firepits, agricultural terracing, rock mounds, and a C-shape. McGerty et. al's testing at Sites -4138, and -4139 did not produce any significant artifacts, however, radiocarbon analysis of a charcoal sample produced a date of A.D. 1390 to 1650. This sample was recovered from the C-shape (Site 4139, Feature C) which was determined to be a prehistoric temporary habitation. This site is less than 300 m *mauka* of the current project area's southern point.

There is no doubt that the current project area was utilized as a segment of an important trail system in the early 1800s, and probably prehistorically as well. The Lahaina Pali Trail is five miles long and crosses the southern slopes of the West Maui Mountains between Olowalu and Ma`alaea. The start of this trail, now a demonstration trail as part of the Na Ala Hele Trail System, borders the current project area near the center of the *mauka* border. By the historic period in which the trail's significance as a probable prehistoric route was realized, the portion *makai* of the current trail head (*i.e.* the portion transecting the width of the current project area) was already destroyed by sugarcane cultivation. Thus, the trail starts immediately outside the project area, within the State-owned lands. A 1991 study by Tomonari-Tuggle and Tuggle documented 18 sites upon the trail, the majority of historic origin (Figure 11).

SETTLEMENT PATTERN

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). Archaeological dates for initial occupation of the Hawaiian Islands far pre-date accepted ranges gathered from palynological data. A more conservative estimate for initial occupation of the islands is the A.D. 9th century (Athens 1997), if one is to lay more credibility with the pollen record than the archaeological record. In the Waihe`e and Wai`ehu areas of Wailuku, Kirch (1985:87) notes that "a number of coastal dune midden sites have been reported, and at least one of these contained pearl-shell fishhooks similar to those from the Bellows Site, eroding from the wave-cut midden." (The Bellows site, located on the windward coast of O`ahu, has yielded the controversial data of occupation dates from A.D. 300 to 600 [Pearson *et al.* 1971], one of the earliest dated sites in the

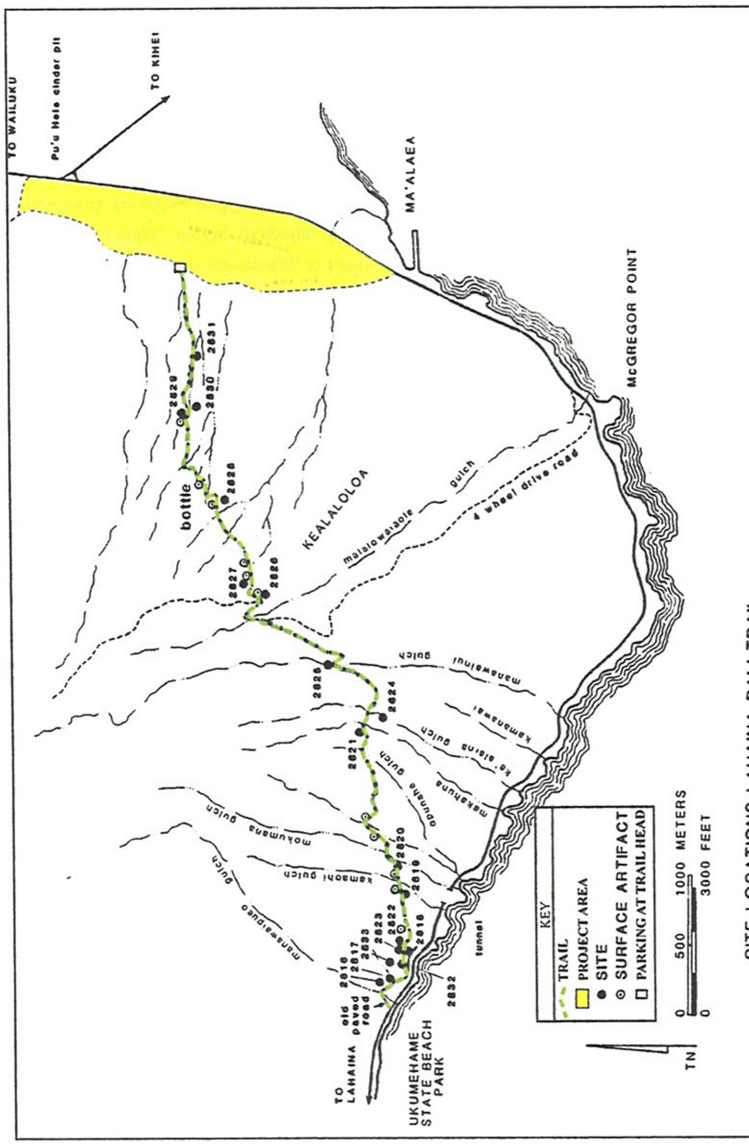

Figure 11: Project Area in Relation to Lahaina Pali Trail (Adapted from Tomonari-Tuggle and Tuggle 1991).

Hawaiian Islands. For the most part, these dates have now been diagnosed as problematic and are no longer considered valid.)

More recent research within Wailuku District indicates that Wailuku Ahupua`a was likely settled between *c.* A.D. 1100 (Kirch 1985:142) and A.D. 1200 (Fredericksen and Fredericksen 1996), whereas *ahupua`a* to the northeast have produced slightly earlier date ranges and *ahupua`a* to the southwest have later settlement dates. The earliest populations purportedly used local resources and seldom ventured into upland valleys. Cordy (in Creed 1993) suggests, however, that upper valley areas on windward coasts were likely populated before the A.D. 1100s. Coastal settlement was still dominant, but populations began exploiting and living in more upland *kula* zones. Population expansion to inland areas did not occur until the *c.* A.D. 12th century but continued through the 16th century. Large scale or intensive agricultural endeavors were implemented in association with habitation. Coastal lands were used for settlement and taro was cultivated in near-coastal reaches and in the uplands. Upland areas of Maui such as the Waiohuli-Kula area contained large garden enclosures, ceremonial structures, and permanent habitation sites by *c.* A.D. 1600.

Nearer the coast in lands like the current project area (*c.* 40–85 meters amsl), taro was cultivated along stream courses, dryland taro was grown on *kula* lands, and populations settled there as well. In the current parcel, however, no LCA records exist that might link prehistoric agriculture to historically documented practice.

EXPECTED FINDINGS

Based on all available physiographic, archaeological, and historical evidence, the following expectations guided this study:

- Historically-significant surface features were expected, particularly those pertaining to historic period sugarcane agriculture. SCS staff conducted a brief reconnaissance (prior to AIS) which reported the presence of the large clearing mounds. The reconnaissance did not report any other historic or prehistoric surface features, however, the probability of documenting additional historic agricultural features during AIS was considered high.

- A variety of traditional Hawaiian sites have been documented at locations within 500 meters outside of all three borders of the project area. While the probability of

encountering prehistoric archaeological surface features within the project area was considered low, there remained a moderate possibility of encountering subsurface cultural layers from a prehistoric period. The latter would depend largely on the existence of a previously undisturbed matrix stratigraphically lower (*i.e.*, older) than historically tilled soils.

- The probability of discovery of historic or prehistoric unmarked burials, or marked burials, was considered low. A slightly higher, yet still low, probability existed in regards to the discovery of scattered human remains during subsurface testing. While burials have been located within the sandy matrix of the adjacent parcels *makai* of Honoapiilani Highway (*i.e.*, during construction activities at the Maui Ocean Center; see McGerty, Burgett, and Spear 1998), SHPD records contain no documented burials *mauka* of Honoapiilani Highway (including on, or within a kilometer, of the current project area). The lack of burial sites immediately *mauka* of the highway can be attributed to two main factors: (1) the types of soils found here were generally less favored in prehistoric burial practices, and (2) the lands have been subject to continual agricultural activity for nearly a century, and in some cases, longer.

METHODOLOGY

In addition to analysis, interpretation, and preparation of this document, the work described in this Archaeological Inventory Survey report consisted of archival research, fieldwork, consultation (both professional and informal— *i.e.* talks with local residents and workers). No laboratory work was necessary. Specifics on all of these research activities are described in detail below.

ARCHIVAL RESEARCH

In addition to referencing available resources at SCS, archival research was conducted at the SHPD library facility (Kapolei, HI) and on the SHPD website before, during, and after the fieldwork described in this report. Archival work consisted of general research on the history and archaeology of the project area, as well as specific searches of previous archaeological studies in and around the subject parcel. Historic land use data, maps, and narrative information were obtained from the Hawaii Bureau of Conveyances as well as the Waihona `Aina Corporation.

FIELD METHODS

Fieldwork was conducted on January 31–February 11, 2005 by Jon Wilson, B.A. and Eric Pope, B.A. under the supervision of Principal Investigator Michael F. Dega, Ph.D. All aspects of the work were photographed and archived on the SCS computer database. Likewise, all fieldnotes, sketches, planviews, profiles, and maps are archived in SCS's Honolulu office.

Fieldwork resulted in a thorough, 100% pedestrian survey project area. The pedestrian survey was conducted via hundreds of east-west transects spanning the width of the project area, starting at the northern border and ending at the southern point. The method of pedestrian survey varied in relation to terrain. In areas of shorter grass and greater surface visibility (*i.e.*, among the Site -5657 clearing mounds) fieldworkers were spaced a maximum of 15 meters apart. In areas of denser vegetation and less surface visibility (*i.e.*, within and bordering the natural drainages) the distance between transect paths was reduced to 5 meters. A total of four temporary sites were plotted on a recently drafted (January 7, 2005) surveyor's map by calculating exact position via tape, compass, and pre-existing survey markers.

SUBSURFACE TESTING

Twenty stratigraphic trenches (ST-1 through ST-20) were excavated in the project area via backhoe, exposing a total of 293.4 linear meters (962.6 feet) of subsurface matrix. A standard 60-cm wide backhoe bucket was used, and the average width of trenches was 64 cm throughout the volume. Sixteen hours of intermittent excavation was conducted over the course of two days: February 9 and 10, 2005.

Methodology regarding excavation was as follows: first, the desired location was flagged by a field archaeologist. Excavation followed with an archaeologist monitoring at all times. Post excavation, three photographs were taken (overall position of the ST within the immediate vicinity of the project area, the length of the entire trench, and a close-up of the selected profiled wall). Also, a sketch stratigraphic profile was recorded on graph paper. All measurements, including detailed soil descriptions, were recorded in fieldnotes, and potential cultural material was screened from *in situ* matrix, or backfill, and thoroughly examined. Finally, the backhoe filled-in the trench.

Three main factors played a role in trench positioning: (1) the desire to excavate at the locations of the four temporary sites found during pedestrian survey, (2) the desire to gain an understanding of subsurface stratigraphy at locations evenly distributed throughout the project area, and (3) the desire to place a higher number of trenches in an area deemed slightly likelier to

contain subsurface prehistoric cultural material (the southern "triangle" *mauka* of the Ma`alaea Small Boat Harbor). This section of the project area lies in between multiple prehistoric sites already registered within the State Index of Historic Places (SIHP). Areas roughly 200 meters *mauka* and *makai* of the project area's southern point have contained traditional features. Therefore, 40 percent (8 STs) of the total individual excavations were placed within this triangle. Trench excavation locations were recorded using tape and compass, and were documented on a project area map (see Figure 9). Trench numbers indicate the chronological order in which they were excavated. Table 1 (in SUBSURFACE STRATIGRAPHY section) details the factors involved in trench positioning.

Maximum depth of individual trench excavation ranged from 96–247 centimeters below surface (cmbs), and averaged 156 cmbs. Bedrock (and/or extremely consolidated clays with decomposing gray basalt directly overlying bedrock) was reached in 16 of the 20 units. Of the units in which bedrock was reached, the shallowest depth was 72 cmbs and the deepest was 151 cmbs; average depth bedrock was first encountered was 114 cmbs. The four STs in which bedrock was not reached were either positioned in an area of convexed surface topography (*i.e.*, the surrounding field had been tilled so that it was higher at the center where the trench was located), or where extra soil had been likely imported for increased crop productivity. Total excavated area was roughly 187.8 square meters; total excavated volume was 292.9 cubic meters.

RESULTS

This section describes: (1) the three archaeological sites documented in the project area; and, (2) the subsurface testing, sediments, and stratigraphy throughout the project area. No significant artifacts or features were exposed in any the trenches. Excavation resulted in relatively homogenous soil stratification—what might be expected in an area subjected to decades of similar agricultural practice. The only relevant change in soil stratigraphy corresponded to the (previously discussed) shift in soil type from north to south. Some matrices had inclusions of modern debris, evidencing agricultural activity (likely small-scale) as recently as 2003.

SITE DESCRIPTION: 50-50-09-5657

Site 50-50-09-5657 consists of 13 historic clearing mounds located throughout the northern twenty percent of the project area (see Figure 9). The average feature measures approximately 40 by 30 m and is piled over 11 m high (Figure 12). Mega-boulders form at least

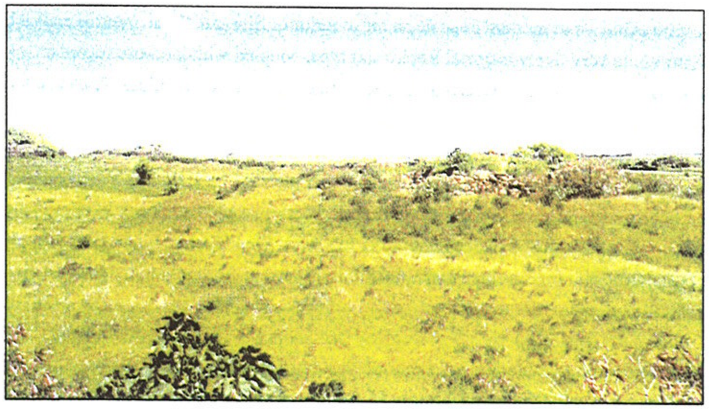

Figure 12: A Typical Boulder Mound Feature of Site -5657. View to Northeast.

the exterior layer of these features, with the average boulder measuring approximately 0.9 by 0.7 by 0.6 m. The majority of these features have a 4.0 m bulldozer blade track forming a ramp from the base to the summit (Figure 13). Heavy machinery scars are visible on the majority of surface boulders. Plastic irrigation tubing—both the ubiquitous black plastic (2 cm diameter) variety, and a larger-diameter white plastic tubing—can be found among surface crevices.

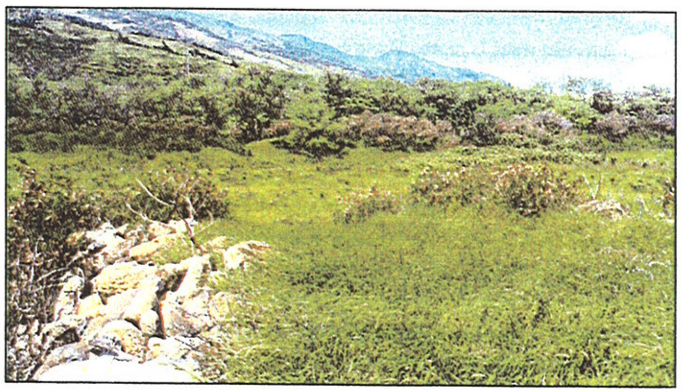

Figure 13: A Pushed "Ramp" on Top of a Site -5657 Mound Feature. Indicates Large Clearing Machinery in the Most Recent Layer of Mound Formation. View to Northwest.

Despite evidence of modern deposit on the exterior of Site -5657, the interior and/or base of these features are very likely historic. Rocky soil type, coupled with land-use records, indicates the necessity of boulder clearing prior to initial sugarcane cultivation. The even distribution of the clearing mounds within the northern portion of the project area may also point to historic agricultural technique. Whereas early 20th century clearing technology and methodology may have been limited to creating sporadic piles (to be gradually added on to throughout later decades), modern technology from the outset would have been likelier to clear the whole field level. Finally, enhancement of a 1965 aerial photo [Awai *et al.* (1967:map 30)] (Figure 14) shows the mounds in their same positions as present—a likely indicator of their locations at least a decade prior to 1965 as well.

While excavation or "testing" of Site -5657 clearing mounds could be accomplished only via highly specialized, very heavy machinery, SCS did perform representative subsurface testing in areas in between mounds (see "Subsurface Testing", below, specifically ST-15, ST-16, ST-17). Nothing of historic or prehistoric archaeological significance was found on the exterior of, or in between, the mounds. Confirmation of the historic origin of Site 50-50-09-5657 may be gained through archaeological observation of their deconstruction (see "RECOMMENDATIONS" section, below).

SITE DESCRIPTION: 50-50-09-5658

Site 50-50-09-5658 consists of dozens of likely historic sugarcane field irrigation modifications. All of these features are modifications within, or stemming out from, the two most significant perennial water courses. These drainages are the two interior drainages within the project area (see Figure 9). The northern of these drainages is approximately 730 m long, and the one directly south is approximately 460 m long. At intervals throughout their length, these two natural drainages have been widened by hand tools to increase and disperse water flow.

This widening modification involves two types: stream bank alterations (collectively recorded as Feature 1) and two narrow ditches (Feature 2 and Feature 3). Dozens of bank alterations are evidenced by shovel cuts and deposits. These modifications were not readily noticeable prior to pedestrian survey within the drainages themselves. When walking the two to four meter deep drainages, it becomes apparent that water flow was manipulated by removing parts of the soil stream bank in certain areas, and fortifying it by soil deposits in other areas. While this sort of alteration can be found within any 50 m stretch of these two drainages, only two isolated areas contain narrow channels extending from the streams. The southern interior stream has an 8 m shallow channel (Feature 2: 30 cm wide and 25 cm deep) that extends from

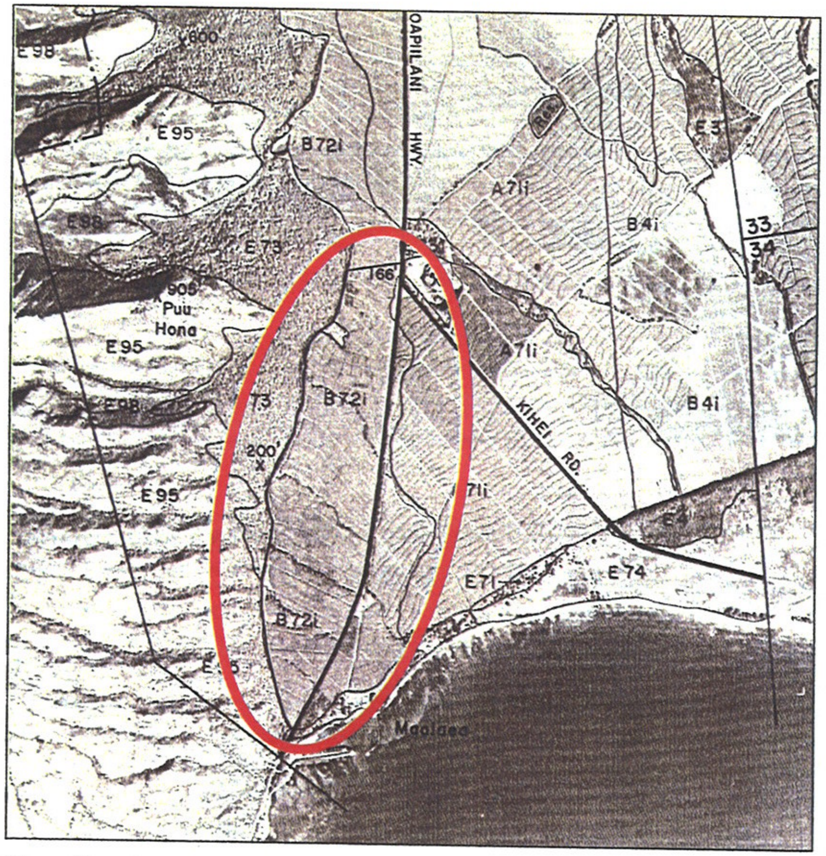

Figure 14: Aerial Photo of Project Area (Adapted from Awai *et al.* [1967:map 30]).

the southern bank to the southwest (see location of ST-11, Figure 9). The northern interior stream has an almost identical 7 m channel (Feature 3) extending eastward from its eastern bank (see location of ST-18, Figure 9).

It is likely that many more of these irrigation channels existed prior to the advent of more efficient irrigation methods (*i.e.*, imported water via tubing networks). Subsurface testing within and around these two channels produced none of the black irrigation tubing found at a depth of approximately 15 cmbs in the majority of all excavation. Surface observations also point to the historic origin of the subtle channel modifications. The channels extend outward from the stream and disappear under more recent deposits of tilled soil. This soil contains fragments of irrigation tubing (Figure 15), whereas no surface or subsurface matrix near the channel contains traces of modern disturbance. It is probable, that these two channels mark small areas that have remained undisturbed since historic use.

Nonetheless, ST-11 and ST-18, at a combined linear 19.1 m, excavated nearly 40 percent of this area. No historic material was observed, other than the depth of the soil-lined channels themselves.

SITE DESCRIPTION: 50-50-09-5659

Site 50-50-09-5659 consists of a historic dirt road that parallels the *mauka* perimeter of the entire project area (Figure 16). At some locations, the project area boundary extends several meters beyond (west of) this road—always including the entire width of the road within its boundaries. Thus, the length of the road is roughly equal to the length of the *mauka* perimeter of the project area (approximately three kilometers); the width of the road averages 4.0 m.

The Site -5659 road originates at the southern terminus of the project area and extends beyond the northern boundary where it forms a right angle with another dirt road segment that connects to Honoapiilani Highway. No less than seven other dirt road segments also connect Site -5659 to Honoapiilani Highway by transecting the width of the project area at various *mauka-makai* angles (see Figure 9). Site -5659's condition suggests that it is frequently traveled by Lahaina Pali trail hikers' vehicles. The parking area for the trail head is a turn out just two meters *mauka* of Site -5659, near the center of the project area's western border. The road is passable via car here. Other, less frequented sections of the road are only passable via four-wheel drive vehicles. One section near the southern point of the project area is washed out, and impassable.

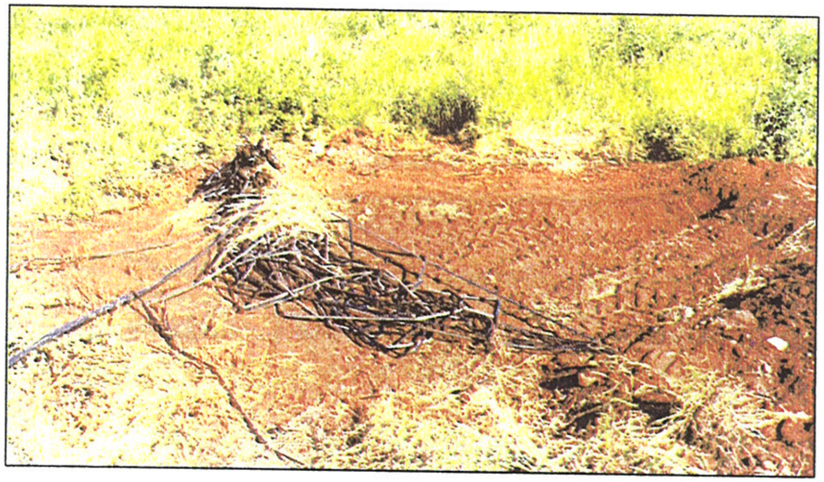

Figure 15: Example of Abundant Irrigation Tubing Found on Surface to 60 cmbs throughout Project Area.

Figure 16: A Segment of Site -5659, Historic Dirt Road.

It is highly probable that this road, along with others that no longer exist, was an original access and cane transport route within the project area. Whereas the predecessor to Honoapiilani Highway offered access along the *makai* border of the original cane fields, a similar *mauka* access (Site -5659) would have been required if the fields were to be worked at all. Awai *et al.*'s aerial photo (see Figure 14) proves that the project area's internal roads are modern (as locations have shifted since) but Site -5659 was in an identical position in 1965, and likely at least a decade earlier as well.

While modern trash was found throughout all sections of Site -5659, no cultural material of archaeological interest was found on the surface of the road. Likewise, the few stratigraphic trenches that were positioned near the road revealed no subsurface cultural material or differing soil stratigraphy (ST-1 and ST-2).

SUBSURFACE STRATIGRAPHY

As stated above, 20 stratigraphic trenches (ST-1 through ST-20) were excavated in the project area (see Table 1), exposing a total of 293.4 linear meters (962.6 ft.) of subsurface matrix. Total excavated area was roughly 187.8 square meters; total excavated volume was approximately 292.9 cubic meters. Depth of excavation ranged from 96–247 cmbs, and averaged 156cmbs. Bedrock, and/or extremely consolidated clays with decomposing gray basalt that directly overlying bedrock, was reached in 16 of the 20 units. Of the units in which bedrock was reached, the shallowest depth was 72 cmbs and the deepest was 151 cmbs; average depth bedrock was first encountered was 114 cmbs. The four STs in which bedrock was not reached were either positioned in an area of convexed surface topography (*i.e.*, the surrounding field had been tilled so that it was higher at the center where the trench was located), or where extra soil had been likely imported for increased crop productivity.

Table 1 presents a summary of all relevant quantitative and qualitative stratigraphic and cultural material observations for each trench. Following, each stratigraphic trench is documented with photograph(s) and post-excavation profile drawing. (Photos and profiles documenting trenches that are very similar to previously described trenches have not been included due to redundancy.) Indeed, the first stratigraphic trench excavated proved to be the standard for nearly every succeeding trench. Only slight variation followed, in both stratigraphy and cultural make-up.

Table 1: Summary of Stratigraphic Trenches within TMK: (2) 3-6-01:18.

Stratigraphic Trench Number	Reason for ST Position*	Trench Length (m)	Maximum Depth (in centimeters)	Average Bedrock Depth (in centimeters)	Cultual Material within ST	ST Orientation (Magnetic)
ST-1	HP*	7.0	154	116	Modern agriculture remnant	North / South
ST-2	HP	7.0	165	125	—	North / South
ST -3	HP	7.0	190	151	—	East / West
ST -4	HP	7.0	153	92	—	North / South
ST -5	HP	7.0	173	112	—	East / West
ST -6	HP, R*	7.0	242	Bedrock not reached	—	North / South
ST -7	HP	7.0	122	106	—	East / West
ST -8	HP	39.1	219	112	Modern agriculture remnant	North / South
ST -9	TS*	21.3	145	104	Modern agriculture remnant	East / West
ST-10	TS, R	17.7	142	112	Modern agriculture remnant	North / South
ST-11	TS	7.1	96	72	Historic agriculture feature (surface)	North / South
ST-12	TS	10.2	247	Bedrock not reached	Modern midden	310 degrees
ST-13	TS	13.7	141	Bedrock not reached	Modern agriculture remnant	240 degrees
ST-14	TS	32.0	153	Bedrock not reached	Modern agriculture remnant	290 degrees
ST-15	R, TS	21.4	110	103	Modern agriculture remnant	290 degrees
ST-16	R, TS	17.3	136	119	—	North / South
ST-17	R, TS	20.6	116	101	—	East / West
ST-18	TS	12.0	160	151	Historic agriculture feature (surface)	East / West
ST-19	R	17.0	125	118	—	East / West
ST-20	R	15.0	133	124	Modern agriculture remnant	North / South

Excavation Intent: (TS) = trenches tested a specific Temporary Site; (R) = trenches dispersed throughout project area for Representative testing of stratigraphy; (HP) = trenches tested the southern "triangle" of project area, which lies in an area between concentrated traditional sites, thus a slightly Higher Probability of encountering prehistoric subsurface features.

TRENCH SUMMARIES

STRATIGRAPHIC TRENCH 1 (ST-1)

ST-1 was positioned at the far southern corner of the project area (see Figure 9) with the intent to test the section of the parcel with the highest probability of containing traditional features. This probability was calculated based on the position of the "southern triangle" of the project area (Figure 17) in relation to previously documented traditional sites not far outside its *mauka* and *makai* borders. ST-1 measured 7.00 by 0.64 m (Figure 18).

Layer I was a 116 cm thick, dark reddish-brown (2.5YR 3/3) clay loam (Figure 19). The matrix was of a medium-sized, blocky ped structure, and was firm. Rock content was less than

Figure 17: Southern "Triangle" of Project Area, with Site -5659 (Road) at Right. View to Southeast.

Figure 18: ST-1, Post-excavation. View to North.

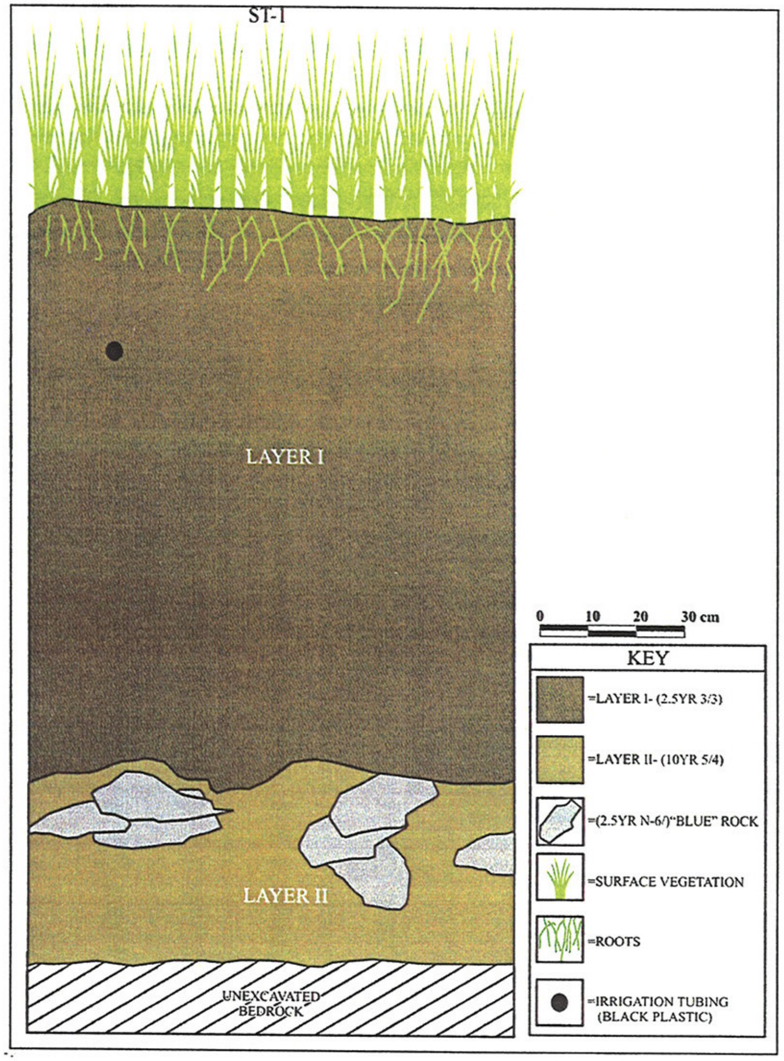

Figure 19: ST-1, Post-excavation. East Wall Stratigraphic Profile (Representative Section).

10 percent. Forty centimeter-tall grass grew dense on the surface and the fine roots extended over 15 cmbs. A 2-cm thick black plastic irrigation pipe had been severed by the backhoe bucket during excavation. The pipe was visible in the east wall profile at 27 cmbs (Figure 20). This was the only cultural material to be observed within ST-1. The base of Layer I likely indicates the subsurface extent of agricultural activity within the project area's southern triangle.

Layer II averaged 38 cm thick and was a yellowish-brown (10YR 5/4) culturally sterile matrix. The soil was a fine, granular ped structure, and was very hard. Twenty percent of Layer II was composed of "blue rock", and a harder, darker bedrock was exposed at the base. Excavation was then terminated at a maximum depth of 154 cmbs.

STRATIGRAPHIC TRENCH 2 (ST-2)

ST-2, like ST-1, intended to test the southern triangle for a cultural deposit. The stratigraphy of ST-2 was very similar to that of ST-1 in every respect, and the recorded profiles appeared nearly identical. No cultural material was observed within ST-2.

Figure 20: ST-1, Post-excavation. East Wall Photograph.

STRATIGRAPHIC TRENCH 3 (ST-3)

ST-3 was also placed in the "higher probability" zone of subsurface cultural deposit. This trench was the first that was oriented east-west, with the intent of possibly observing a change in the stratigraphy from ST-1 and ST-2. No change was observed and no cultural material was revealed.

STRATIGRAPHIC TRENCH 4 (ST-4)

ST-4 continued the trend of similar profiles (see Figure 19). However, this trench revealed bedrock at a slightly shallower depth (92 cmbs) than previously encountered. It is probable that ST-4's position near a graded, modern dirt road caused a portion of surface soil to erode downslope toward the highway. No cultural material observed.

STRATIGRAPHIC TRENCH 5 (ST-5)

ST-5 repeated the results of STs 2–4.

STRATIGRAPHIC TRENCH 6 (ST-6)

ST-6 was the first trench to be positioned farther north within the southern triangle. There remained the increased probability of encountering subsurface traditional features, however, the archaeological record shows that this chance would grow smaller as trench positions extended north. ST-6 also sought to gain a better understanding of overall project area stratigraphy outside of the southern triangle.

Excavation ceased after more than 200 cm of culturally sterile, homogenous soil. Bedrock was not encountered. This single, homogenous stratigraphic layer would also be observed in three more trenches to come. The likely explanation involves the subtle shape of the field immediately surrounding the trench. Tilling has left the surface within 75 m *mauka* and *makai* sloping down and away from the trench, which was positioned on a minor "crest." Thus, the piled soil here is not a true indicator of typical Layer I thickness. No cultural material was observed in this trench.

STRATIGRAPHIC TRENCH 7 (ST-7)

ST-7 resulted in a profile that matched the majority of previously excavated trenches. No cultural material was observed in this trench.

STRATIGRAPHIC TRENCH 8 (ST-8)

ST-8 resulted in a profile that matched the majority of previously excavated trenches. A black, plastic irrigation tube (identical to the one found in ST-1) extended from the east wall to

the west wall of the trench. This was the last trench to be positioned inside the southern triangle area—initially thought to have been a location of higher traditional site potential. However, no traditional subsurface features were observed within the southern triangle.

STRATIGRAPHIC TRENCH 9 (ST-9)

ST-9 was positioned with the intent to test an area near and within a Temporary Site. Pedestrian survey flagged the dirt road adjacent to ST-9's position as a possible historic road Figure 21). This trench revealed no difference in subsurface stratigraphy than previous excavation, nor did the trench produce any artifacts that may have been within the discard zone of historic traffic. The only cultural material observed was the usual irrigation tubing at 20 cmbs. Research unrelated to the subsurface testing later revealed this dirt road to be modern.

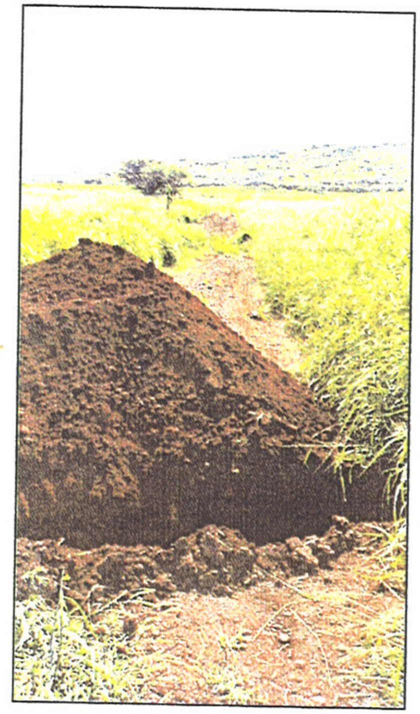

Figure 21: ST-9, Post-excavation. View to Southwest.

STRATIGRAPHIC TRENCH 10 (ST-10)

ST-10 also served to test a possible historic dirt road. The results were identical to ST-9, except that an *in situ* irrigation tube was observed at 58 cmbs. This depth increased known range of modern agricultural manipulation within the project area.

STRATIGRAPHIC TRENCH 11 (ST-11)

ST-11 was positioned to test a temporary site (ditch) that later became part of State Site 50-50-09-5658 (irrigation modification). Other than both the north and south wall profiles displaying the depth of the shallow ditch itself, no further cultural material was observed. (See ST-18 profile for a better subsurface representation of Site -5658.)

STRATIGRAPHIC TRENCH 12 (ST-12)

ST-12 also intended to test a temporary site, one which excavation proved to be modern. The "nursery" of Ficus sp. trees (Temporary Site 2) at the center of the project area was initially flagged as a temporary site. Although some surface features appeared modern (i.e., the relatively new appearance of the concrete walkways), the possibility existed that this temporary site could have been constructed at the location of historic cane workers' camp. A concrete building foundation was mapped in association with the tree rows (Figure 22).

ST-12 extended northwest from the foundation toward the concrete walkways of the nursery. A Coca Cola aluminum 12 ounce can was found *in situ* at a depth of 96 cmbs (Figure 23). The can's manufacture date was clearly decipherable: 2003. Other midden followed; a Dentine gum wrapper at 106 cmbs and a fragmented plastic fork head at 120 cmbs.

Excavation ceased after 247 cm of culturally sterile, homogenous soil. The matrix near the foundation pad had clearly been recently altered.

STRATIGRAPHIC TRENCH 13 (ST-13)

ST-13 sought to further explore what might lie beneath Temporary Site 2. The results of ST-13 also resulted in modern midden, and a single homogenous layer of "filled" soil. A 6-cm diameter, white PVC water pipe was uncovered 4 cmbs (Figure 24). The pipe ran perpendicular to the trench's length and was certainly part of a irrigation system involving the Ficus trees. The standard irrigation tubing appeared in the north wall profile at 19 cmbs. A shard of clear window glass was observed at 88 cmbs. Excavation ceased after 141 cm of culturally sterile, homogenous soil.

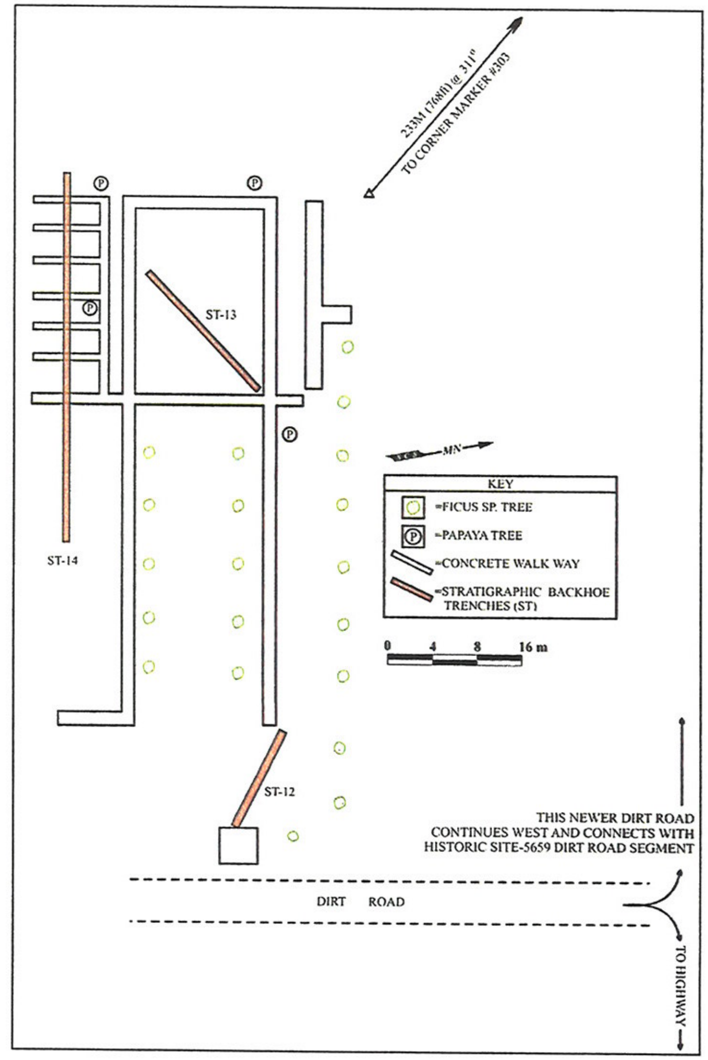

Figure 22: Plan View Map of Temporary Site 2, A Possible Modern *Ficus* sp. Nursery.

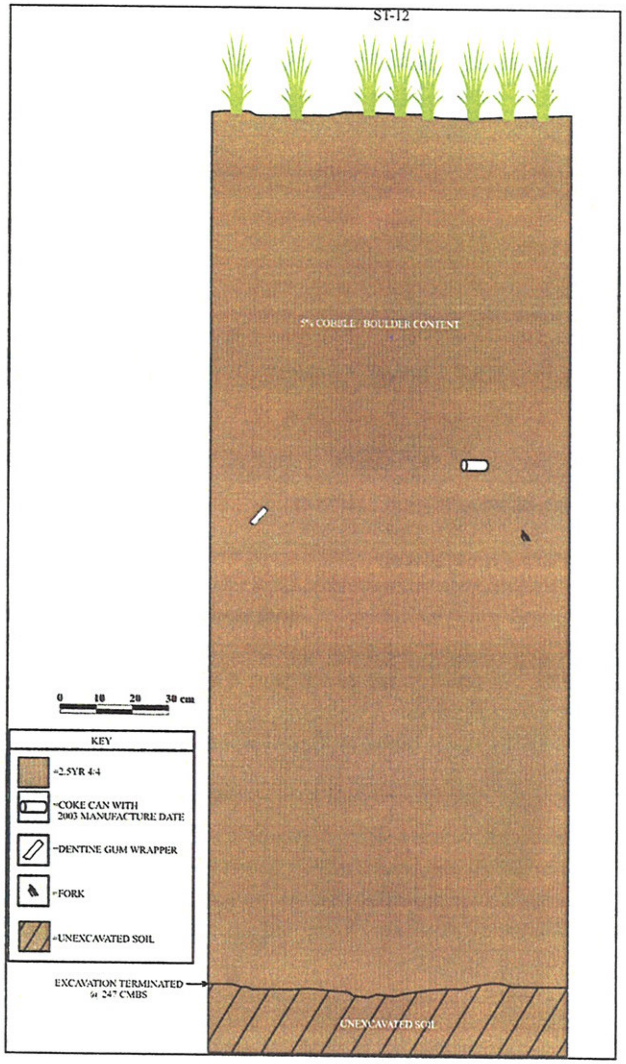

Figure 23: ST-12, Post-excavation. North Wall Stratigraphic Profile (Representative Section).

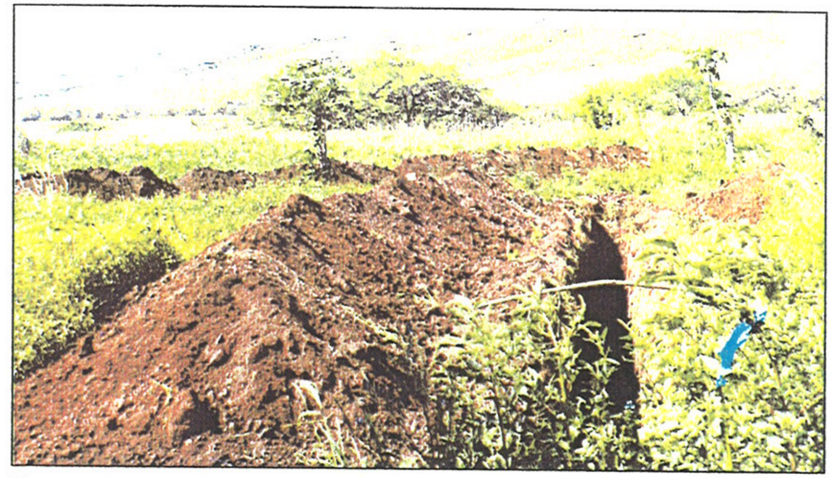

Figure 24: ST-13, Post-excavation. View to Southwest.

STRATIGRAPHIC TRENCH 14 (ST-14)

ST-14 provided another modern absolute date, albeit from a shallower provenience. A defunct electrical box (possibly used for lighting or irrigation system function) was attached to a series wires inside a PVC pipe at 39 cmbs (Figures 25 and 26). The manufacture date stamped on the pipe was "01/04/01". A section of the pipe was patched with an aluminum Coke can and adhesive. Once again, the manufacture date of the can was 2003. ST-14 also did not reach bedrock, although Layer I had a cobble content of 25 percent, higher than other areas tested previously (Figure 27).

No historic or traditional artifacts or features were observed at Temporary Site 2. Thus, the temporary designation was retracted, as this nursery is most likely a more elaborate example of the dozens of small-scale modern agriculture plots that are scattered throughout the project area. Extensive excavation did not reveal any evidence indication an older cultural layer beneath this area.

STRATIGRAPHIC TRENCH 15 (ST-15)

ST-15 sought to gain a representation of subsurface stratigraphy with the area of the (later-designated) Site -5657 clearing mounds. ST-15 was positioned in between two clearing mound features along the western border of the project area's north end (see Figure 9). Results

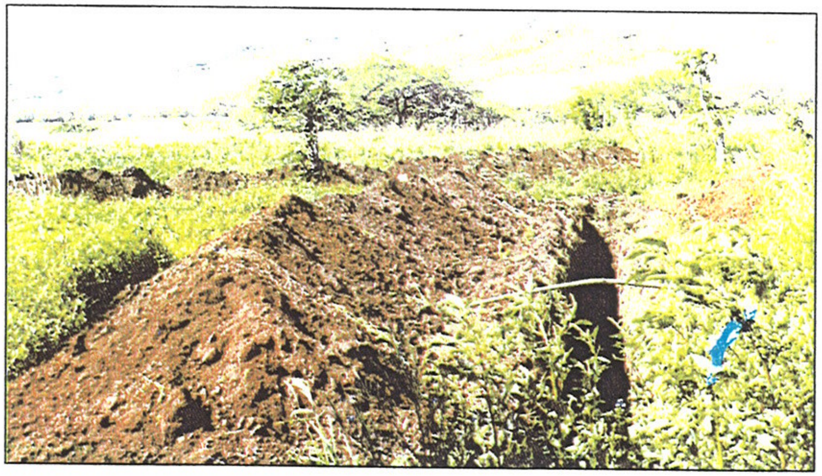

Figure 25: ST-14 Excavation. View to West.

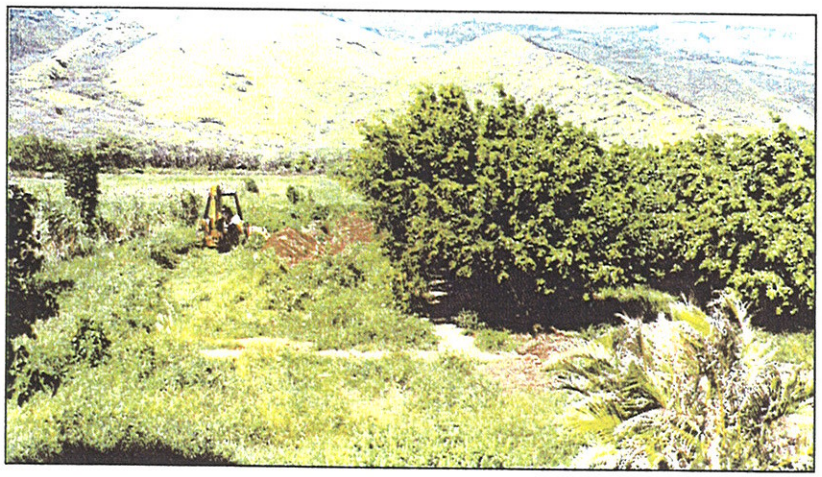

Figure 26: ST-14 Excavation. View to West.

Figure 27: ST-14, Post-excavation. North Wall Photograph.

matched soil records that showed the area to have a greater rock concentration than areas to the south. ST-15 exhibited the first truly significant stratigraphy variation from the previous 14 trenches (Figures 28, 29, and 30).

Layer I was a 20 cm thick, dark brown (7.5YR 3/2) clay loam. The matrix was of a medium-sized, blocky ped structure, and was firm. It had a rock content of approximately five percent. Fifteen centimeter-tall grass grew dense on the surface and the fine roots extended 5 cmbs). No cultural material was observed within Layer I.

Figure 28: ST-15, Post-excavation. View to East.

Figure 29: ST-15, Post-excavation. North Wall Photograph.

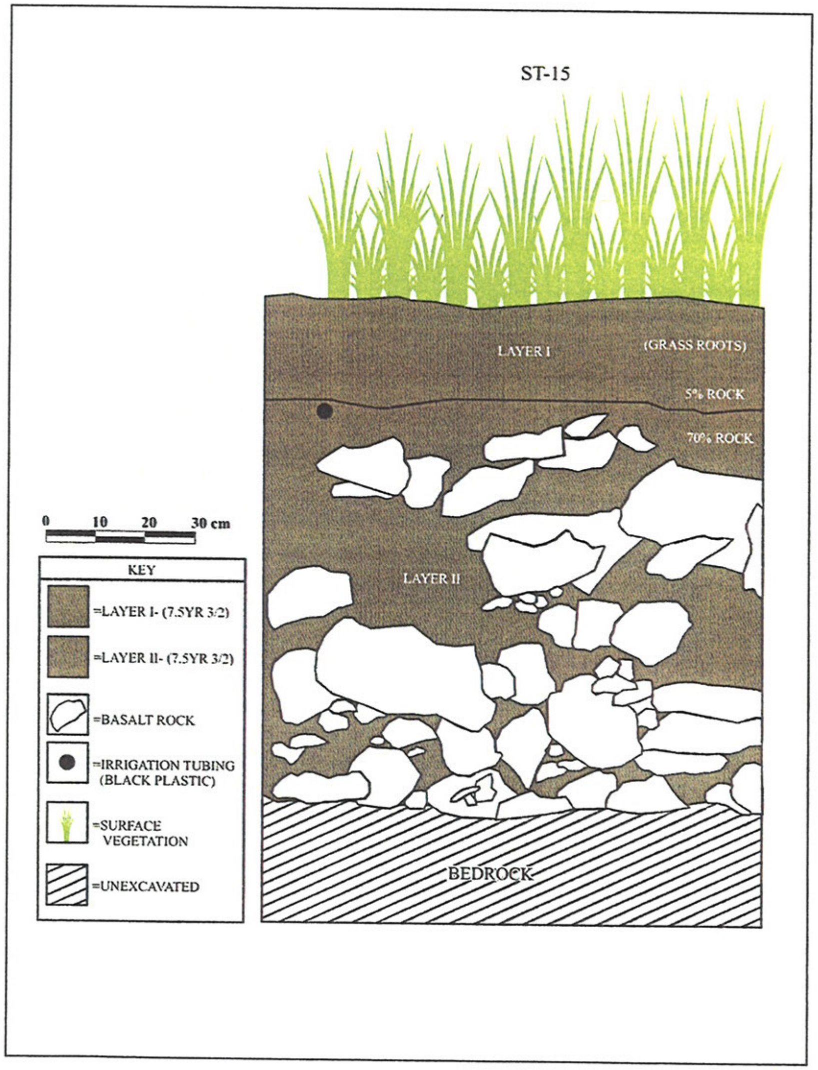

Figure 30: ST-15, Post-excavation. North Wall Stratigraphic Profile (Representative Section).

Layer II averaged 83 cm thick and was also a dark brown (7.5YR 3/2) clay loam. This matrix drastically changed in cobble and small boulder content—a concentration of 70 percent rock. Nonetheless, the common, black irrigation tubing was observed at 21 cmbs—the only cultural material. Whereas Layer I had been stripped of its rock (which then formed the piles of Site -5657), Layer II was beneath the planting soil.

STRATIGRAPHIC TRENCH 16 AND 17 (ST-16 AND ST-17)

ST-16 and ST-17 were excavated perpendicular to each other along the *makai* border of the project area's northern end (Figure 31). The trenches created an "L-shape" with the intention to expose stratigraphy both east-west and north-south in an immediate area. No notable variation was observed between ST-15, ST-16, or ST-17. The latter two trenches contained no cultural material.

STRATIGRAPHIC TRENCH 18 (ST-18)

ST-18, like ST-11, sought to expose the profile of a Site -5658 irrigation modification (shallow ditch). The trench was positioned perpendicular to ditch (which extended from a natural drainage). Aside from exposing the depth and width of the subtle feature, no change in stratigraphy was observed when compared to profiles of southern trenches (Figure 32).

Figure 31: ST-16 Excavation. View to East.

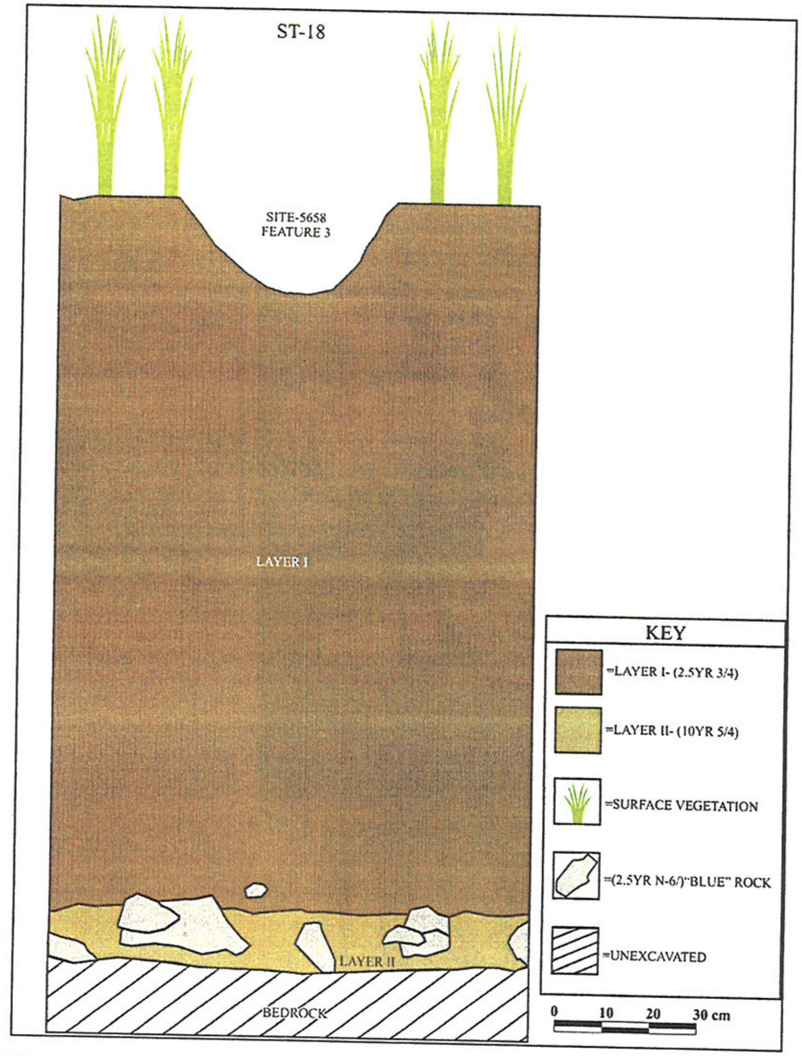

Figure 32: ST-18, Post-excavation. South Wall Stratigraphic Profile (Representative Section).

STRATIGRAPHIC TRENCH 19 (ST-19)

ST-19 sought to test a portion of the project area that remained relatively un-sampled toward the end of the subsurface testing period. Although this region was over 200 m away from any other trench, the stratigraphy was nearly identical to that of trenches to the south (Figure 33). No cultural material was observed within this trench.

STRATIGRAPHIC TRENCH 20 (ST-20)

ST-20 sought to test a portion of the project area that remained relatively un-sampled at the close of the subsurface testing period (Figure 34). Although this region was over 300 m away from any other trench, the stratigraphy was nearly identical to that of all trenches other than ST-14 through ST-17 (the higher rock concentrations). A west wall profile of ST-20 did reveal a black plastic "anti-weed" cover at 3 cmbs, along with irrigation tubing at 25 cmbs (Figure 35).

SUMMARY OF RESULTS

In summary, this Archaeological Inventory Survey resulted in the following findings:

- Three historic sites, all related to sugarcane agriculture, were identified, documented for the first time, and assigned SIHP numbers: Site 50-50-09-5657 (clearing mounds), Site 50-50-09-5658 (irrigation modifications), and Site 50-50-09-5659 (dirt road).

- A 100 percent pedestrian survey concluded that no prehistoric sites exist on the surface of the project area.

- Twently backhoe trenches (a volume of approximately 292 cubic meters) did not reveal any subsurface historic, or prehistoric, cultural material. Rather, excavation confirmed the extent, both in physical and temporal depth, of historic and modern agricultural activity within the project area.

- No burial features or human remains were observed during pedestrian survey or encountered during subsurface testing.

SIGNIFICANCE ASSESSMENTS

Three sites were documented in the project area [TMK: (2) 3-6-01:18] during Archaeological Inventory Survey. All three sites were of historic period construction and related to sugarcane agriculture. The sites have been evaluated for significance according to the criteria

Figure 33: Location of ST-19 within Central Project Area. View to East.

Figure 34: Location of ST-20 within Central Project Area. View to West.

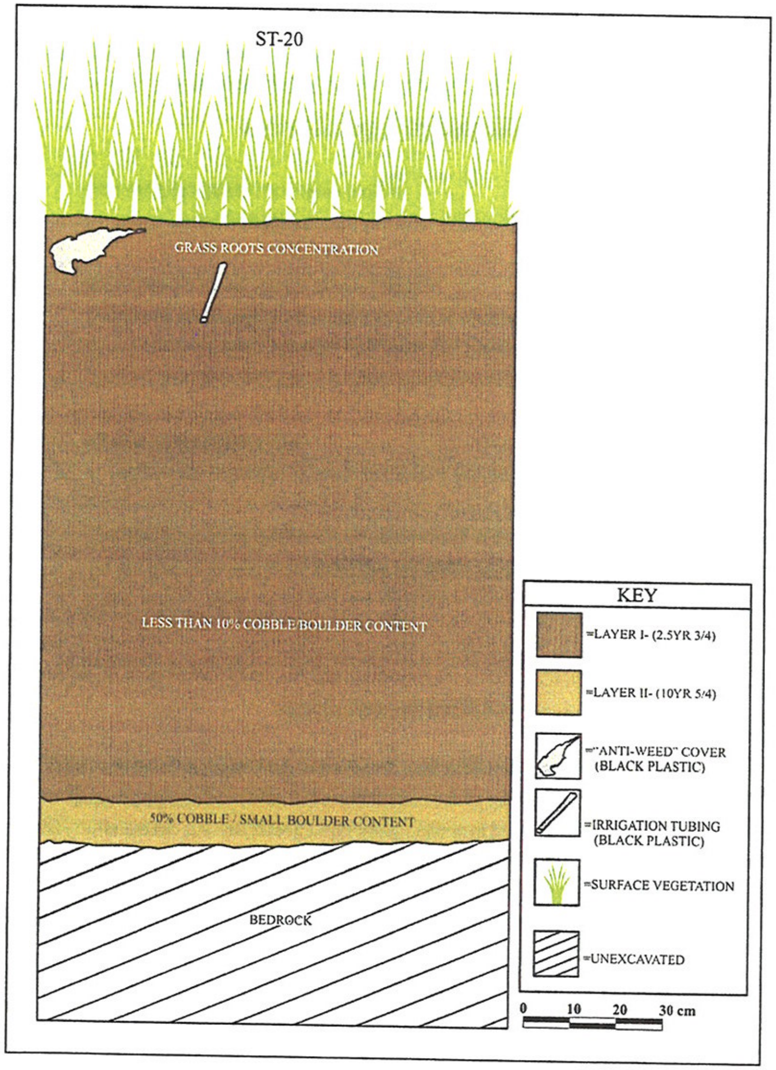

Figure 35: ST-20, Post-excavation. East Wall Stratigraphic Profile (Representative Section).

established for the State and National Register of Historic Places. Site 50-50-09-5657 (clearing mounds), Site 50-50-09-5658 (irrigation modifications), and Site 50-50-09-5659 (dirt road) are all considered significant under Criterion D. The five criteria are listed below:

Criterion A: Site is associated with events that have made a significant contribution to the broad patterns of our history;

Criterion B: Site is associated with the lives of persons significant to our past;

Criterion C: Site is an excellent site type; embodies distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual construction;

Criterion D: Site has yielded or has the potential to yield information important in prehistory or history;

Criterion E: Site has cultural significance; probable religious structures or burials present (State of Hawai`i criteria only).

RECOMMENDATIONS

Two of the three sites recorded during Inventory Survey require no further archaeological procedures. Criterion D sites 50-50-09-5658 (irrigation modifications) and 50-50-09-5659 (dirt road) have been listed in the SIHP. Identification, testing, analysis, and classification of the sites have been fully documented within this AIS report.

Site 50-50-09-5657 (clearing mounds), also classified under Criterion D, requires one additional archaeological procedure prior to the completion of its documentation (assuming no additional cultural material is located). Discussion between SCS and Dr. M. Kirkendall concluded that the internal construction of Site -5657's thirteen features is still unknown. It is possible that traditional Hawaiian features may be contained within these thirteen large piles of boulders.

Previous archaeological observations during construction activity on Maui have documented prehistoric architecture and artifacts under historic agriculture deposits. As sugarcane lands were originally cleared, it is possible that farmers deposited rubble on top of the nearest pre-existing "rock pile". As locally gathered rock was a staple for traditional Hawaiian architecture, the pre-existing "rock piles" may have been a variety unidentified traditional features—constructions ranging from simple temporary shelters to elaborate religious platforms.

Due to this possibility, SCS recommends that an archaeologist observes—and directs the method of—the leveling of a sample portion of Site -5657's thirteen mound features. Those responsible for scheduling initial earth-moving procedures at the Ma`alaea Mauka project area will be required to coordinate the presence of an archaeological observer during Site -5657 deconstruction. An archaeologist must be on site prior to any earth-moving activity within the northern 20 percent of the project area, that is, any operation of heavy machinery that occurs within a 15.0 meter (50 feet) radius of a Site -5657 mound.

Deconstruction should incorporate machinery that slowly removes Site -5657 surface boulders in stages, rather than pushes any intact section of mound to a different location. The exact number of mound deconstructions to be witnessed by the archaeologist on site may be determined based on the contents of the first four mounds selected for leveling. Should additional historic and/or prehistoric cultural material be observed during Site -5657 leveling, archaeological procedures will follow SHPD's guidelines for an inadvertent discovery.

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AN ARCHAEOLOGICAL INVENTORY SURVEY OF AN APPROXIMATELY 115 ACRE PROPERTY FOR THE PROPOSED MĀ`ALAEA WATER TREATMENT PLANT EFFLUENT REUSE AREA INCLUDING THE POTENTIAL WATER TANK LOCATION AND DETENTION PONDS A AND B WAIKAPŪ AHUPUA`A, WAILUKU DISTRICT, ISLAND OF MAUI, HAWAI`I [TMK: (2) 3-6-004:003 (por.)]

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ABSTRACT

At the request of Maalaea Properties, LLC., the current landowner, Scientific Consultant Services, Inc. (SCS) conducted an Archaeological Inventory Survey on approximately 115 acres of land located in Mā`alaea, Waikapū Ahupua`a, Wailuku District, Island of Maui, Hawai`i [TMK:(2)3-6-004:003 (por.)]. The project included archival research and involved a systematic pedestrian survey of the parcel, the mapping and recording of identified features, and the mechanical excavation of twenty-six stratigraphic trenches.

Seven sites were newly identified and documented during the survey. All of the identified sites (50-50-09-6251 through 50-50-09-6257 related to historic commercial agriculture. These sites consisted of three historic irrigation ditches (Sites 50-50-09-6251, T-1; 50-50-09-6254, T-4; and 50-50-09-6257, (-7), three clearing mounds (Sites 50-50-09-6252, T-2; 50-50-09-6253, T-3; and 50-50-09-6256, T-6), and one modified stream drainage (Site 50-50-09-6255, T-5). One additional clearing pile lies to the northwest of the project area; however, this feature was not recorded as it is located outside the project area boundaries.

As part of the survey, a total of twenty-six trenches were mechanically excavated by backhoe. Excavation did not reveal any significant cultural materials or features in the subsurface deposits of any of the trenches. All of the stratigraphic trenches were culturally sterile, except for modern debris and items associated with modern commercial agriculture. However, excavation did reveal a relatively homogenous soil stratification—what might be expected in an area subjected to decades of similar agricultural practice. Most of the matrices had inclusions of modern debris, evidencing recent agricultural activity. Portions of the project area are currently under commercially grown pineapple and sugarcane.

All of the sites in the project area have been assessed as significant under Criterion D, information content only.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

At the request of Maalaea Properties, LLC., the current landowner, Scientific Consultant Services, Inc. (SCS) conducted an Archaeological Inventory Survey on approximately 115 acres of land for the proposed Wastewater Treatment Facility, effluent reuse area, water tank site, and two detention basins. The project area is located in Mā`alaea, Waikapū Ahupua`a, Wailuku District, Maui Island, Hawai`i [TMK: (2) 3-6-0014:003 (por.)] at an elevation ranging from approximately 190 to 400 feet above mean sea level (amsl) (Figures 1, 2 and 3). This Inventory Survey included historic background research and settlement pattern analysis prior to fieldwork, a systematic pedestrian survey of the project area, the mapping and recording of newly identified features, and involved the mechanical excavation of 26 stratigraphic trenches. Fieldwork was conducted between September 14 and October 5, 2006 by SCS personnel Allison Chun, Ph.D., and D. Dillon, B.A. The Principle Investigator for this project was Michael Dega, Ph.D.

The Archaeological Inventory Survey of the project area was conducted to determine the presence/absence of archaeological sites and features in surface and subsurface contexts through complete systematic survey and representative subsurface testing, to provide adequate recordation and documentation of all historic sites present, to determine the significance of these sites, and to provide recommendations to the State Historic Preservation Division (SHPD) concerning site significance and mitigation in lieu of future land use in the project area.

A total of seven sites were newly identified and documented during the survey. All of the identified sites (50-50-09-6251 through 50-50-09-6257) related to historic commercial agriculture. These historic commercial agriculture sites consisted of three historic irrigation ditches (Sites 50-50-09-6251, T-1; 50-50-09-6254, T-4; and 50-50-09-6257, T-7), three clearing mounds (Sites 50-50-09-6252, T-2; 50-50-09-6253, T-3; and 50-50-09-6256, T-6), and a modified stream drainage (Site 50-50-09-6255, T-5). One additional clearing pile lies to the northwest of the project area; however, this feature was not recorded as it is outside the project area.

As part of the survey, 26 trenches were mechanically excavated by backhoe. Excavation did not reveal any significant cultural materials or features in the subsurface deposits of any of the trenches. All of the stratigraphic trenches were culturally sterile, except for modern debris and items associated with modern commercial agriculture. However, excavation did result in relatively homogenous soil stratification—what might be expected in an area subjected to decades of similar agricultural practice. Most of the matrices had inclusions of modern debris, evidence of agricultural activity.

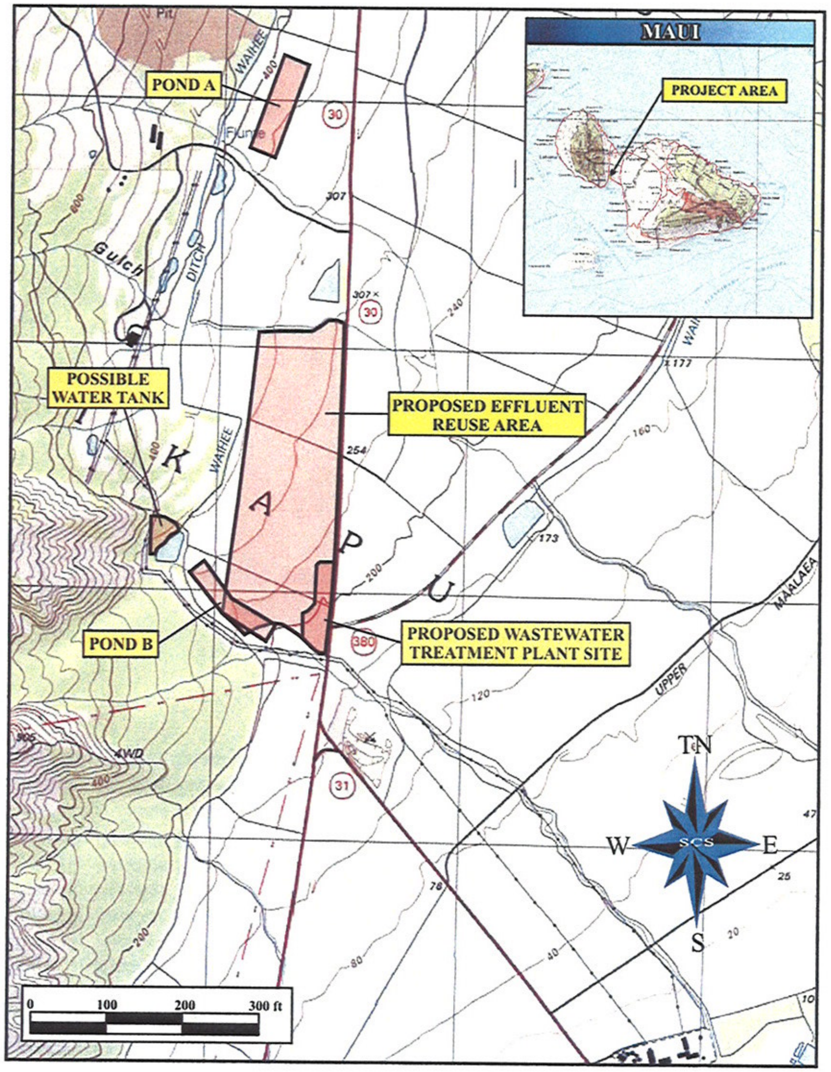

Figure 1: : USGS Quadrangle (Ma`alaea and Wailuku) Map Showing Project Areas.

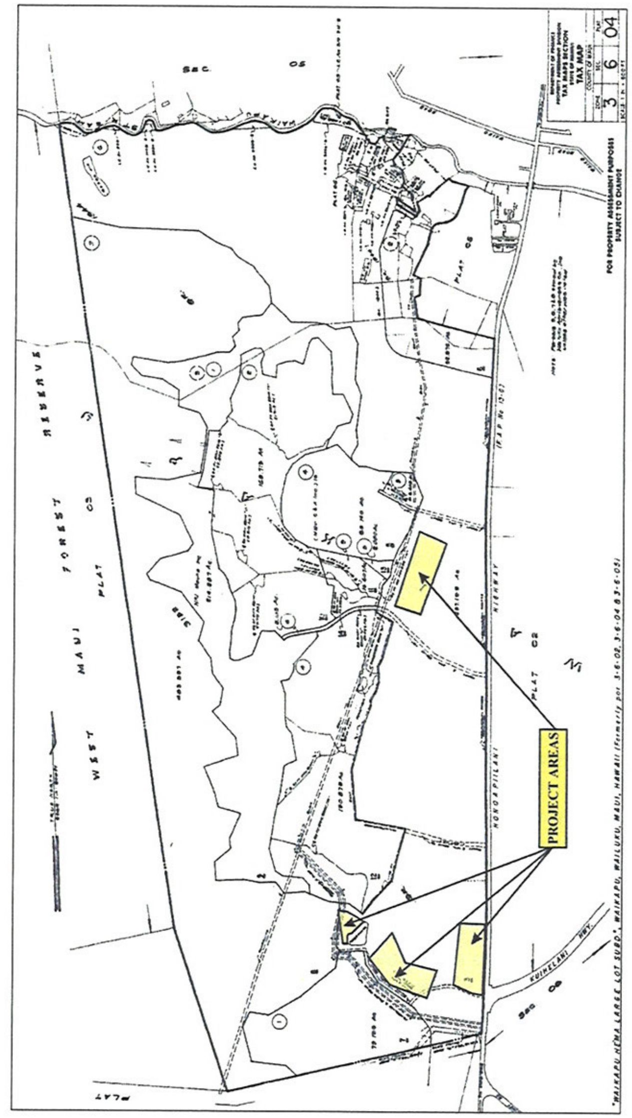

Figure 2: Tax Map Key [TMK] (2) 3-6-004:003 (por.) Showing Project Area

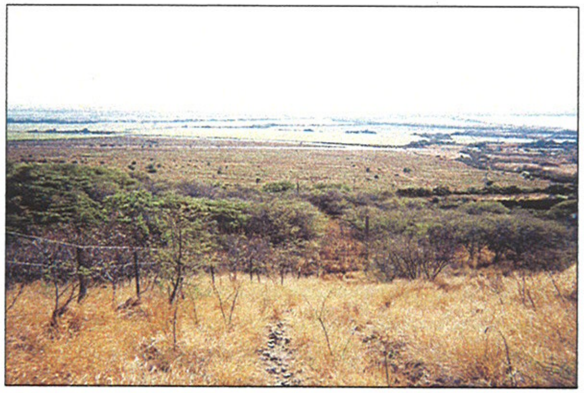

Figure 3: Project Area Overview Center of Effluent Re-Use Area (Pineapple Field) to East.

Please note that stratigraphic trench excavations were not conducted at several areas including: the irrigation ditches [Sites -6251 (T-1), 6254 (T-4), and -6255 (T-5)] as they are currently in use. In addition, excavations were not conducted at Site -6256 (T-6), the proposed water tank site, and Site -6257 (T-7), the junkyard and the borrow pit sites for Detention Pond B. All of these areas have all been subjected to extensive previous bulldozer disturbance, as evidenced by large displaced boulders and high berms, which has made these areas inaccessible to bulldozers.

ENVIRONMENTAL SETTTING

PROJECT AREA DESCRIPTION AND LOCATION

Maui's Wailuku District encompasses an area from the eastern half of the West Maui Mountains, north to Kahului Bay, south to Ma`alaea Bay, and includes the entire Kahului Isthmus (Figure 4). The current project area is located in Wailuku District immediately north of the boundary separating Ukumehame Ahupua`a and Waikapu Ahupua`a. The project consists of the construction of five separate areas: 1) a proposed wastewater treatment plant; 2) a proposed Effluent Reuse Area (ERA); 3) a possible water tank; 4) Detention Pond A; and 5) Detention Pond B (see Figure 1).

The proposed wastewater treatment plant site is located at the northeast corner of the intersection of Honoapiilani Highway and Kuihelani Highway. It is roughly rectangular with its long axis oriented North-South. Its eastern boundary is Honoapiilani Highway and its southern

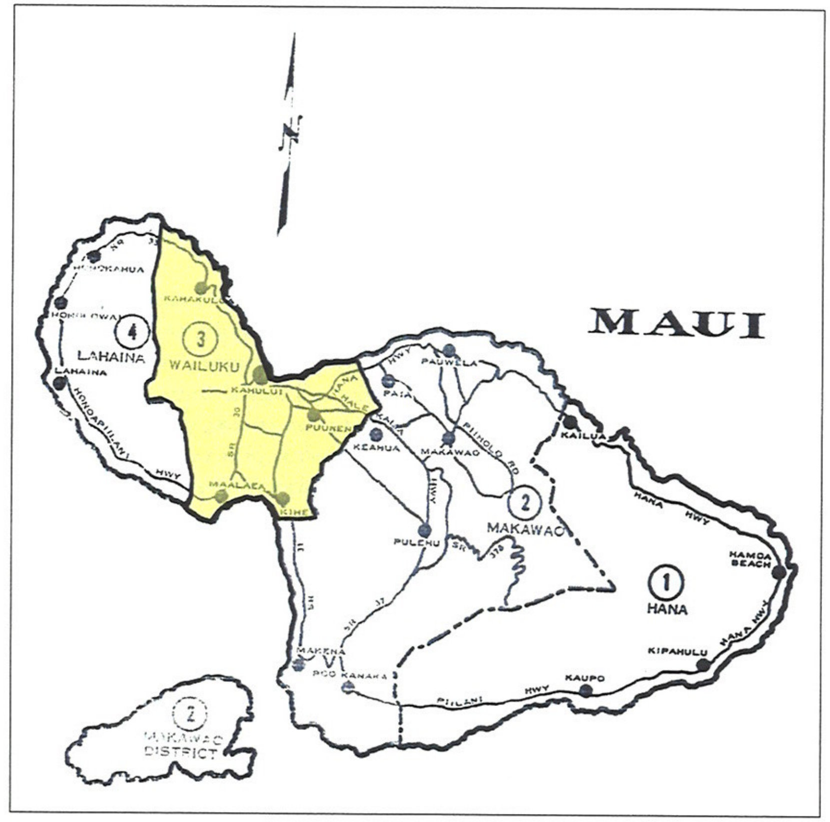

Figure 4: Map of the Island of Maui Showing Location of Wailuku District.

boundary is a paved road leading from Honoapiilani Highway to the Pohakea Quarry. The northern and western sides are bounded by fallow pineapple fields. The entire treatment plant site is located in the southeast corner of the effluent reuse area.

The majority of the project area consists of the ERA (approximately 85 acres), which is roughly rectangular in shape. Its long axis extends north-south. The boundaries of the ERA are as follows: its eastern boundary is the Honoapi`ilani Highway; its southern boundary is a paved road leading from Honoapi`ilani Highway up to the Pohakea Quarry; the northern boundary is a dirt cane haul road next to a ditch that crosses Honoapi`ilani Highway to the east; and the western boundary is an arbitrary line that runs approximately north-south, roughly paralleling the eastern boundary. Approximately 20 acres within the northernmost portion of the ERA are currently under cultivated commercial sugarcane which, according to an unidentified HC&S field worker, is due to be harvested sometime next year (2007). Most of the rest of the ERA is in fallow pineapple fields.

An approximately five acre portion of the southwest corner of the ERA is an uncultivated empty lot which probably was also used for commercial agriculture at one time, but more recently has been used as a cattle holding area; however, it does not appear to be in use at present. This area is rhomboidal in shape. Its southwestern side is bounded by a boulder wall which also serves as the boundary for the Pohakea Quarry. An historic water ditch (Site 50-50-09-6251, T-1) runs parallel to this rock wall. The southeastern boundary is the road leading up to the quarry. The northeastern side is a berm and ditch complex (Site 50-50-09-6257, T-7) which separates this empty lot from the pineapple field to the north and the northwest boundary is an unmarked line. Two large agricultural clearing piles (bulldozed and stacked boulders and soil), Sites -6252 (T-2) and -6253 (T-3), are in the surveyed portion of the empty lot. One additional clearing pile lies to the northwest of the project area; however, this feature was not recorded as it is outside the project area.

This part of the effluent reuse area also overlaps with the center portion of Detention Pond B. From this central portion, Pond B also extends about five acres northwest and another five acres southeast. The northwest portion of Pond B is a junkyard full of abandoned vehicles and heavy equipment, empty barrels, machine parts, and old construction supplies and equipment. This area is located just southeast of the existing reservoir and wellhead, and northwest of the Pohakea Quarry. The southeastern portion of Pond B is southeast of the road leading up to the quarry, just outside its main entrance. It has been heavily disturbed by bulldozer activity and appears to have been used as a borrow pit. Another large clearing pile (Site 50-50-09-6256, T-6) is located in this area.

The possible water tank site is located adjacent to the existing reservoir and slightly to its northwest. It is a roughly pork chop shaped area about five acres in area. It is bounded on the southeast by the reservoir, on its west side by an unimproved Maui Electric Company (MECO) road, and on its north side by the Waikapu golf course and an empty lot. A small natural drainage runs along the western edge of the pork chop. Portions of this drainage have been

modified along its eastern bank (Site 50-50-09-6255, T-5) to form a retaining wall for what appears to be an old water control or `*auwai* (ditch, canal) system. Another water transportation ditch, currently in use and leading up to the existing reservoir is located at the easternmost point of the pork chop (Site 50-50-09-6254, T-4). This possible water tank area has also been heavily impacted by previous bulldozer activity.

Detention basin A is located north of the road leading up to the Waikapu Golf Courses. It is rectangular in shape and is an estimated 15 acres in area. It is also currently under sugarcane cultivation.

CLIMATE AND SOILS

The project area receives 10 to 200 inches of rainfall annually (Foote 1972:115). This area is much drier than higher elevations to the west. Due to the lower, coastal elevation, air temperatures are consistently slightly warmer than Maui's seasonal averages.

According to Foote *et al.* (1972:100–101), soils in the project area fall into mainly two categories: the Pulehu Series (approximately 75 percent of the project area) and the Ewa Series (approximately 20 percent). The remaining portion (approximately 5 percent) of the project area is in Stony Alluvial Land (rSM) (Figure 5).

Roughly 75 percent of the project area consists of soils of the Pulehu Series. These soils are known to occur on four of the five major Hawaiian Islands (O`ahu, Maui, Lana`i, and Moloka`i). In general, these are well-drained soils are found on "alluvial fans, stream terraces, and basins" at elevations ranging from around sea level to 300 feet amsl. They are formed from alluvium eroded from basic igneous rock and are almost level to slightly sloping. Soils of the Pulehu Series are utilized for agricultural purposes such as growing sugarcane and truck crops, as well as for pasture lands, homes, and for wildlife habitation. (Foote *et al.*1972:115).

Pulehu Clay Loam (PsA) occurs on 0 to 3 percent slopes and is found on alluvial fans, stream terraces, and basins. This type of soil is characterized by slow runoff and a very slight erosional hazard. Pulehu Cobbly Clay Loam (PtA) is comparable to PsA, except that this soil contains cobbles. Pulehu Cobbly Clay Loam (PtB) is found throughout the project area (see Figure 5). The PtB soil, like PsA and PtA also exhibits slow runoff and a slight erosion hazard. However, unlike those soil types, PtB has a slope range of three to seven percent (Foote *et al.* 1972: 116).

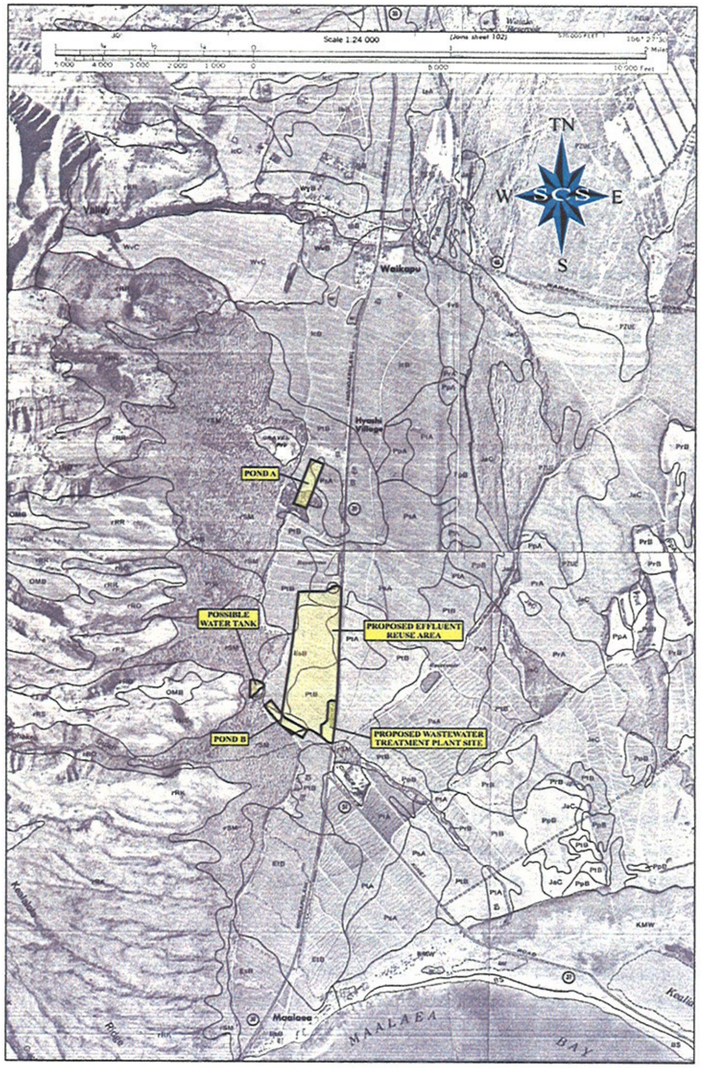

Figure 5: USDA Soil Survey Map Showing Soil Types within Project Area.

Approximately 20 percent of the project area lies in soils of the Ewa Series. The Ewa Series consists of well-drained soils that occur on alluvial fans located at elevations ranging from around sea level to 150 feet amsl within O`ahu and Maui. They are derived from igneous rock, are moderately sloping, and are best suited for sugarcane, truck crops, and pasture (Foote *et al.* 1972:29–30). Two soils of the Ewa Series are present in the project area: Ewa Silty Clay (EsA) has three to six percent slopes and exhibits slow runoff and s slight erosion hazard and Ewa Silty Clay (EsB) also has three to six percent slopes.

The rSM soils are comprised of boulders, stones, and soil which has been deposited by streams along the bottoms of gulches and alluvial fans with slopes ranging from 3 to 15 percent. Areas where this soil type is found have elevations ranging from around sea level to 1000 feet above mean sea level (amsl). Given the rocky nature of this soil, improvements to the land are difficult (Foote *et al* 1972:120).

PROJECT AREA LANDFORM AND VEGETATION

The wastewater treatment area, the ERA, and Detention Pond A are in a relatively level area covered with fallow pineapple and/or cultivated sugarcane. Dirt roads extend southwest-northeast between the pineapple rows and east-west through the sugarcane. Various weeds indicative of a highly disturbed ecosystem are growing throughout the fields. These include giant guinea grass (*Panicum maximum*), balsam pear (*Momordica charantia*), sourgrass (*Digitaria insularis*), swollen finger grass (*Chloris barbata*), hairy horseweed (*Conyza bonariensis*), coat buttons (*Tridax procumbens*), and the weedy natives *alena* (*Boerhavia repens*), and *`uhaloa* (*Waltheria indica*).

The proposed water tank site is also mostly level, but has undergone extensive ground alterations due to prior bulldozing. Large boulders have been displaced and bulldozer berms are scattered throughout the area, making the terrain very uneven, rocky, and extremely difficult to traverse. The vegetation is 100 percent coverage of moderate to dense kiawe (*Prosopis pallida*) woodland with bufflegrass (*Cenchrus ciliaris*) and giant guinea grass understory, scattered *koa haole* (*Leucanena leucocephala*), *klu* (*Acacia farnesiana*), and slender mimosa (*Desmanthus virgatus*). Several mature endemic *wiliwili* (*Erythrina sandwichensis*) trees are growing in a small drainage running North-South along the west side of the proposed water tank site, probably representing a remnant pocket of a once more widespread native ecosystem.

The center and southeast portions of Detention Pond B are level have been entirely razed by bulldozer activity. The presence of large agricultural clearing piles in both areas indicates the extent of clearing and earth moving activities. The southeast portion appears to have been heavily used as a borrow site, as well. Both areas are characterized by the presence of broken saprolitic rock on the surface as well as large boulders with bulldozer scars, broken rocks, and chunks of broken concrete throughout. Both areas are covered by bufflegrass grassland and *koa haole* shrub land and other invasive weedy species such as *klu*, slender mimosa, sticky foxtail grass (*Setaria verticillata*), giant guinea grass, sourgrass, lion's ear (*Leonotis nepetifolia*), indigo (*Indigofera suffruticosa*), hairy abutilon (*Abutilon grandifolium*), castor bean (*Ricinus communis*), glycine vine (*Glycine wightii*), and false mallow (*Malvastrum coromandelianum*). A few young endemic *wiliwili* saplings are located in the eastern corner of the central part of the pond area, but appear to have died. The entire center area has been burned in a previous brush fire. The grassland appears to have since grown back but dried up in this summer's drought, but the *koa haole* and other shrubs as well as the *wiliwili* saplings and nearby coconut trees, do not appear to have recovered. The southeast portion of Pond B does not have the same evidence of extensive damage from brush fire, but the vegetation is not as dense, probably due to the borrow activity.

The northwest portion of Pond B is currently being used as a junkyard. It is level and probably also has been bulldozed. The area is thickly overgrown by moderate *kiawe* woodland and a thick understory of bufflegrass and giant guinea grass, making it difficult to examine the terrain. It is highly unlikely that this area would have escaped the ubiquitous bulldozer activities prevalent in all areas immediately surrounding this one.

TRADITIONAL AND HISTORIC SETTING

Archaeological settlement pattern data indicates that the initial colonization and occupation of the Hawaiian Islands first occurred on the windward shoreline areas of the main islands between the A.D. 4th and 11th centuries, with populations eventually settling into drier leeward areas at later periods (Kirch 1985). Coastal settlement was still dominant, but populations began exploiting and living in the upland (*kula*) zones. Greater population expansion to inland areas did not occur until about the A.D. 12th century, but continued through the 16th century. Large scale or intensive agricultural endeavors were implemented in association with habitation. Coastal lands were used for settlement and taro was cultivated in near-coastal reaches and in the uplands.

TRADITIONAL SETTING OF WAILUKU DISTRICT

Wailuku District, is frequently mentioned in historical texts and oral tradition as being politically, ceremonially, and geographically important during traditional times (Cordy 1981,

1996; Kirch 1985). Wailuku was considered a "chiefly center" (Sterling 1998:90) with many of the chiefs and much of the area's population residing near or within portions of `Iao Valley and lower Wailuku. The importance of the district is reflected by the relatively large number of *heiau* that were reportedly present in pre-Contact times. Oral tradition accounts surrounding these *heiau* provide examples of how religion tied into political power in the traditional Wailuku setting. Indeed, the period immediately preceding contact with the Europeans was one of considerable upheaval and conflict. *Wailuku*, meaning 'water of destruction' (Pukui, *et al.* 1974), succinctly describes the area in the late 1700s. Political power emanating from Moloka`i was an active element during the mid-eighteenth century. The resulting battle at Kalae`ili`ili (A.D. 1765) led to the expulsion of Keeaumoku and the Moloka`i *ali`i* and the beginning of Kahekili's reign (Kamakau 1992). Kahekili successfully defended his capital in Wailuku throughout the 1770s, until his defeat at the hands of Kamehameha's forces.

Closer to the current project area, in the southwest corner of Wailuku District, pre-Contact settlement was not as dense as concentrations to the north. Climate had much to do with the trend, as the Ma`alaea area is a more arid environment than the rain-soaked fields to the north. According to Tomonari-Tuggle and Tuggle (1991), the majority of the pre-Contact population was located southwest of the project area, near what is now Ukumehame Beach State Park. Settlement was also probable north of Keālia Pond in Waikapū Ahupua`a. Handy and Handy report (1972: 496) that before the historic sugarcane plantations in this region, water from Waikapū Stream ". . . was diverted into lo`i and its overflow was dissipated on the dry plains of the broad isthmus between West and East Maui."

Wailuku District would see drastic change after Captain James Cook's 1778 arrival in Kahului Bay. The reign of Kamehameha I was intertwined with the increasing presence of Europeans within the Hawaiian Islands. By 1821, American missionaries had established a foothold in Lahaina and arrived in Wailuku the following year. The religion of the Hawaiian people began to wane under the influence of Christianity. Fredericksen and Fredericksen (2002:4) point to a girls' seminary school (Central Female Boarding School), established in Wailuku in 1836, as one of the initial steps in the conversion of Hawaiian language and customs in Maui.

TRADITIONAL SETTING OF WAIKAPŪ

Waikapū Ahupua`a is located in the land division (*`okana*) which was once known as "Nā Wai Eha" (The Four Streams). This area is "...comprised the four great valleys [Waihe`e, Waiehu, Wailuku, and Waikapū] which cut far back into the slopes of West Maui and drain the eastward watershed of Pu`u Kukui and the ridges radiating northeastward, eastward, and southeastward from it" (Handy and Handy 1972). This area once was renowned for "…its majesty and splendid living, whose native songs gather flowers in the dew and weave wreaths of ohelo berries" (S.W. Nailiili in Sterling 1998:93).

According to Handy and Handy (1972:497) and Pukui *et al.* (1976:223), the name "Waikapū" (Water of the Conch) refers to an ancient cave in the area where a famous conch shell (*pū*) was hidden until it was stolen by Puapua-lenalena (a supernatural dog). Sterling (1998) offers two alternative origins of the name "Waikapū." In one account, the area, known as "Nā Wai Eha," was renowned for the battles fought there; the name Waikapū (the water where the conch was blown) referred to a conch shell which was blown to announce the commencement of a battle (C. W. Stoddard 1894 in Sterling 1998). In another account (H. T Cheever 1851 in Sterling 1998:63), "Waikapū" (Forbidden Water) refers to the time Kamehameha I, the Conqueror, beached his canoes at Kalepolepo and placed a *kapu* (taboo, restriction) on the nearest stream (Stoddard in Sterling 1998:63). Although Waikapū Stream is not the closest stream to Kalepolepo, it does drain into Keālia Pond, and it may have been the closest stream with flowing water at the time of Kamehameha's landing (Sterling 1998:63).

W. D. Alexander (in Sterling 1998: 63) also states that "…the lands of Waikapū and Wailuku appropriated almost the whole of the isthmus so as to cut off half of the lands in the district of Kula from access to the sea. These two *ahupua`as,* together with Waiehu and Waihe`e, which were independent, belonging to no *Moku,* were called 'Na Poko,' and have been formed into a district in modern times."

Waikapū once was the setting of vast wet-land taro fields. Evidence of the widespread *lo`i* (irrigated terrace) planting is provided by the Land Commission Awards (LCA) which indicate there once were more than 1,300 wet-land taro patches extending along the boundaries of Waikapū Stream (Creed 1993). Handy and Handy (1972: 497) describe the general Waikapū area as follows:

> Spreading north and south from the base of Waikapu to a considerable distance below the below the valley are the vestiges of extensive wet-taro plantings, now almost obliterated by sugar-cane cultivation; a few here and there are preserved in plantation camps and under house and garden sites along the roads. Among these gardens there were, in 1934, a few patches of Japanese taro. Far on the north side, just above the main road and at least half a mile below the entrance to the canyon, an extensive truck garden on old terrace ground showed the large area and the distance below and away from the valley

> that was anciently developed in terraced taro culture. On the south side there are likewise several sizable *kuleana* where in 1934 old terraces were used for truck gardening. In the largest of these a few old patches were flooded and planted with Hawaiian wet taro. Several terraces were used as ponds planted with lotus for their edible seed. There were probably once a few small terraces on the narrow of valley bottom in the lower canyon.

TRADITIONAL SETTING OF UKUMEHAME

Ukumehame Ahupua`a is located immediately adjacent to and southeast of Waikapū Ahupua`a. It primarily lies within the boundaries of Lahaina District. However, a small portion of Ukumehame is located in Wailuku District. Handy and Handy (1972:492) suggest that at least portions of Ukumehame were wet enough to cultivate crops during traditional times:

> Southeast along the coast…were a number of areas where dispersed populations grew taro, sweet potato, breadfruit, and coconuts on slopes below and in the sides of valleys which had streams with constant flow. All this area like that around and above Lahaina is now sugar-cane land. Ukumehame had extensive terraces below its canyon, some of which were still planted in 1934; these terrace systems used to extend well down below the canyon.

Literature also indicates that Ukumehame supported a sizable population during the traditional period. During his survey of the island in the early 1930s, Walker (in Sterling 1998:21) noted at least 45 permanent and temporary house sites along a two mile stretch from Ma`alaea Village to McGregor Point. These house sites included low-walled semi-circular and/or oval enclosures, platforms, and sites that may have been used as *ko`as* (fishing shrines). Walker documented two unmanned *heiau* in Ukumehame. He describes one as "…a large walled heiau" located a quarter mile from Ma`alaea village at the base of the foothills of the West Maui Mountains (Walker 1931:105). The second unnamed *heiau is* located, "…on the west side of Ukumehame Gulch, just above the ditch at the edge of the cane lands (*ibid*: 107). Walker described this structure as an irregularly-shaped, walled *heiau* which was partially destroyed and used as a cattle pen. He also documented Hikii Heiau (*ibid*: 106), which he described as a "good sized heiau built of rough blocks of red basalt" located on the east side of Ukumehame Gulch. In addition to *heiau*, Walker also recorded a series of petroglyph panels located at the south end of the West Maui Mountains approximately one-quarter mile from Ma`alaea Bay (Walker in Sterling 1998:22).

Ukumehame is said to refer to using the wood of the *mehame* (*Antidesma bunius*) tree as payment. The wood was traditionally used for making anvils which were used to process *olonā* (*Touchardia latifolia*). The fruit of the *mehame* tree was used as a red dye for coloring kapa cloth

(Samuel Mookini in Sterling 1998:20). Ukumehame is mentioned in several legends including the Legend of the Battle of the Owls (W.H. Uaua in Sterling 1998:20). This legend mentions Manawaipueo (in Ukumehame), which is the place where the owls gathered with all of the owls of West Maui after flying from Molokai, Lanai, and Kaho`olawe. Another legend refers to Kaiaupe, the renowned female robber, who lived in Ukumehame and "...enticed men to lay with her at the edge of the pali then kick them over the edge with her foot..." (T. Kelsey Collection in Sterling 1998:20).

THE MĀHELE

In 1848, commissioners of the Māhele instigated an extreme modification to traditional land tenure on all islands that resulted in a division of lands and a system of private ownership. The Māhele was based upon the principles of Western law. While this land division 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 society into that of a market economy (Kuykendall Vol. I 1938:145, footnote 47, *et passim*; Daws 1968:111; Kame`eleihiwa 1992:169–170, 176). The dramatic shift from a redistributive economy to a market economy resulted in drastic changes to land tenure, among other things. As a result, foreigners demanded private ownership of land to ensure their investments (Kuykendall Vol. I, 1938:145, *et passim*; Kame`eleihiwa 1992:178).

Once lands were made available and private ownership was instituted, native Hawaiians, including the *maka`āinana* (commoners), were able to claim land plots upon which they had been cultivating and living. Oftentimes, foreigners were simply just given lands by the *ali`i* (chief, ruler). However, commoners would often only make claims if they had first been made aware of the foreign procedures (*kuleana* lands, or land commission awards). These claims could not include any previously cultivated or currently fallow land (*okipu*) stream fisheries, or many other natural resources necessary for traditional survival (Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). Awarded parcels were labeled as Land Commission Awards (LCAs). If occupation could be established through the testimony of witnesses, the petitioners were issued a Royal Patent (RP) number and could then take possession of the property. Commoners claiming house lots in Honolulu, Hilo, and Lahaina were required to pay commutation to the government before obtaining an RP number for their awards (Chinen 1961:16).

During the Māhele, Wailuku District was declared Crown Land and numerous Land Commission Awards; approximately 180 were awarded within Wailuku Ahupua`a alone (Creed 1993). A handful of foreigners (*i.e.*, Anthony Catalena, James Louzada, E. Bailey) gained

control of large parcels of lands that would later be used for mass cultivation of sugar. Significantly, the majority of LCAs were awarded to Hawaiians, a gauge that can be used to measure pre-Contact settlement, since there was little overall change in traditional land use among Hawaiians prior to 1853 (Creed 1993:38).

During the Māhele, 44 Land Court Awards were issued in Ukumehame Ahupua`a, Lahaina District and one was issued to a claimant in Ukumehame, Wailuku District. However, no land claims were awarded within the current project area. This fact may be attributed to the sparse pre-1848 Hawaiian population within the parcel, a result of settlement conditions within these *ahupua`a* favoring the coastal area.

THE LATE HISTORIC PERIOD AND GROWTH OF THE SUGAR INDUSTRY

Another influence that brought change to Maui was foreign commercialism. Two Chinese brothers, Ahung and Atai, of Honolulu's Hungtai Company arrived in Wailuku to explore the possibility of setting up one of its earliest sugar mills in 1828. Atai soon created a plant that processed sugarcane cultivated by Hawaiians, named the Hungtai Sugar Works (Dorrance and Morgan 2000:15–16). Ahung later joined Kamehameha III's sugar producing enterprise, although both operations had ceased by 1844. The Wailuku Sugar Company opened operations in 1862 and expanded sugar production over the next 126 years of its existence.

As it expanded its territory, the Wailuku Sugar Company first appeared on maps of the project area in the in the 1920s (Bureau of Conveyances, Grant 9794); however, their acquisition of the project area land may have been as early as the turn of the century (Kennedy and Trimble 1992:4). Successive grants (Grant 10294 through to Grant S-13975) would follow in decades following and fully encompass the Ukumehame Ahupua`a side of the project area in Wailuku Sugar land. Kennedy and Trimble (1992:4) summarize the history of the Waikapū Ahupua`a (*makai*) portion of the project area by detailing its acquisition from the state government on November 18, 1875 by Henry Cornwell (Grant 3152). Cornwell subsequently sold to Claus Spreckels, and by the turn of the century, the entire project area was under sugarcane cultivation.

Wailuku Sugar Company ended production in 1988, having averaged over 30,000 tons of sugar produced annually at its pinnacle in the 1970s (Dorrance and Morgan 2000:66). Owner C. Brewer & Company, Ltd. shut down sugar cultivation on the project area, which was then used almost entirely for pineapple cultivation starting no later than 1992 (Kennedy and Trimble 1992:1). The lands were under pineapple for at least the next three years (Tomonari-Tuggle 1994:11) (and probably slightly longer) before transitioning to smaller-scale "garden" plots.

RANCHING

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 as a result. In order to ensure that the cattle population would increase, a 10 year *kapu* was placed on slaughtering them. Eventually the cattle did increase. However, once the 10 year *kapu* on cattle slaughter had been lifted the number of cattle increased so dramatically they became 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).

Captain Richard Cleveland and his partner Captain William Shaler introduced horses to the Islands in 1803. Several horses, including a stallion and a mare with foal, were brought aboard their ship, the HMS *Lelia Byrd*, and 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.

Cattle were on the Island of Maui as early as 1806. Amaso Delano (in Brennan 1995:97) provides the following account of the effect cattle had on traditional life on Maui:

> They had recently brought to this island, one of the bulls the Captain Vancouver landed at Owhyee (Hawaii). He had made very great destruction amongst their sugarcane and gardens, breaking them and their cane patches and tearing them to pieces with his horns and tearing them with his feet. He would run after and frighten the natives and appeared to have the disposition to do all the mischief he could, so much so that he was an unwelcome guest among them.

As sandalwood and *koa* were diminishing, cattle became an important resource to the Hawaiian economy. By 1820, the number of cattle had increased to such a degree that they were aggressively being hunted for their hides. In addition, their tallow and meat became important commodities of local and international trade. Soon cattle and their importance in the trade industry flourished to such an extent that Hawai`i became a major supplier of beef to California during the Gold Rush and subsequently to the visiting whaling ships (Cowan-Smith and Stone 1988:6).

PREVIOUS ARCHAEOLOGY IN THE WAIKAPŪ AREA

A number of studies on file at the State Historic Preservation Division, Kapolei archives summarize the most relevant previous archaeology within the vicinity of the current project area. Figure 6 shows the locations of these studies in relation to the current project area.

In 1989, PHRI conducted an Archaeological Inventory Survey of over 600 acres within the Waikapū Mauka Partners Golf Resort located to the north of the current project area (Brisbin, *et al.*1991). The report documenting the findings of this survey (Haun 1989 in Brisbin, *et al.* 1991) does not appear to be available to the public at this time. Based on the findings and recommendations of Haun's Inventory Survey, Archaeological Data Recovery was subsequently conducted at the nine sites (comprised of over 46 features) newly identified during the initial survey report (Haun in Brisbin, *et al.* 1991) (see Figure 6). These nine sites indicated that this area was utilized for extensive traditional dryland agriculture with limited habitation and some historic ranching activities. The findings of this survey indicate that only a few habitation sites were located below 500 feet amsl and that the agricultural sites were "continuously distributed" throughout the project area.

Fifteen radiocarbon samples collected from data recovery excavations conducted at several of the features yielded sufficient amounts of charcoal suitable for providing reliable dates. The range of the radiocarbon dates suggests initial occupation of the project area occurred during the early 1500s and continued through the historic period (Brisbin *et al.* 1991).

During 1989 and 1990, Archaeological Consultants of Hawaii (ACH) conducted an Archaeological Inventory Survey of the lands immediately adjacent and *mauka* (west) of the above-mentioned PHRI project area (Kennedy 1994) (see Figure 6). During this survey a total of 18 sites, comprised of 74 features, were newly identified. These sites also indicated that the area was primarily utilized for traditional agriculture, although there was some evidence of limited habitation, including burials and ceremonial use. Kennedy (1994) concluded that these sites can

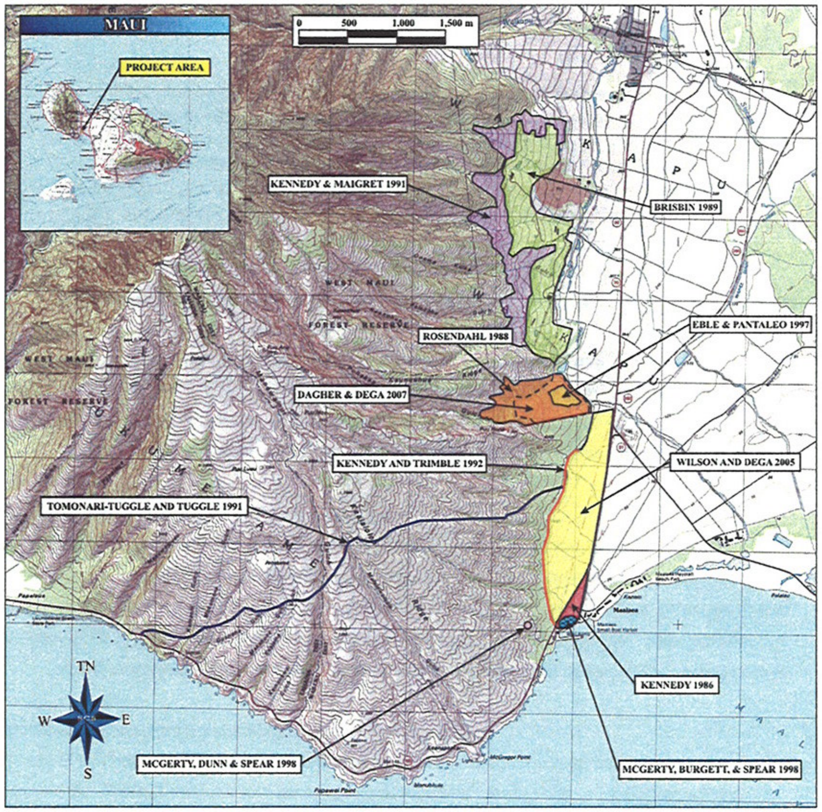

Figure 6: SGS Quadrangle (Ma`alaea and Wailuku) Map Showing Previous Archaeology.

only be a continuation of the occupation described by Brisbin *et al.* (1991). Five charcoal samples collected from test excavations of several of the features were submitted for radiocarbon dating. These samples yielded dates ranging from A.D. 1040 through 1950.

In 1997, Aki Sinoto Consulting (ASC), in association with Garcia and Associates (GANDA), conducted an Archaeological Inventory Survey of 15 acres of land north of Pōhākea Gulch. One structural feature was documented during this survey. Given the description of this feature and the site location map this may be in association with Site 50-50-09-6062 (PHRI T-6)

or 50-50-09-6063 (PHRI T-11) which were initially documented by PHRI in 1988 (Eble and Pantaleo 1997) (see Figure 6). This site is believed to have been subsequently destroyed during the construction of Pohakea Quarry (Dagher and Dega 2007).

Kennedy and Trimble (1992) surveyed an area to the south of the current project area. This survey overlaps State Site 50-50-09-5659 (historic dirt road), first recorded in the Wilson and Dega (2005) study (see Figure 6). While Kennedy and Trimble also note the lack of archaeological features in their project area due to the obvious history of intense agriculture, their 1992 report does not consider the road upon which their survey takes place to be a potential historic agricultural feature. The project area detailed in their study is no more than 5.0 meters wider than the dirt road itself, and concludes that "No artifacts, midden, or structures of historic or prehistoric significance were identified on the subject property" (1992:11).

An earlier Kennedy report entitled *Letter Report: Walk-Through Examination of the Proposed Ma`alaea Triangle, Maui (TMK: 3-6-01:1)* (1986) also concluded with negative results. This was the first archaeological study done on this parcel and Kennedy does mention (1986:2) nearby sites that are detailed in later studies. This project area is located on the *makai* (southeast) side of Honoapi`ilani Highway and extends to the coastline (see Figure 6).

Monitoring within a smaller section of the same project area described by Kennedy (1986) resulted in a single site (a previously disturbed historic burial: State Site 50-50-09-4480) (McGerty, Burgett, and Spear 1998). McGerty *et. al*'s report, entitled *Draft: Monitoring Report on Earth Moving and Construction Excavations, Maui Ocean Center Site, Maui, Hawaii, (TMK: 3-6-01:001 and 019)*, describes a pearl shell button found with the burial. As subsequent subsurface testing would prove, however, the sandy matrix McGerty, *et. al* experienced in the Maui Ocean Center monitoring contrasted the reddish clay of the Wilson and Dega (2005) project area, rendering the likelihood of encountering burials much less. Nonetheless, the McGerty *et. al* (1998) study also mentions two more burials found not far to the north from Site -4480.

McGerty, Dunn, and Spear (1998) conducted Data Recovery in an area of five traditional sites documented by Moore and Kennedy (1995). These sites (50-50-09-3555, -4022, -4137, -4138, -4139) consisted of 28 features, including petroglyphs, subsurface firepits, agricultural terracing, rock mounds, and a C-shape. McGerty *et. al*'s testing at Sites -4138, and -4139 did not produce any significant artifacts, however, radiocarbon analysis of a charcoal sample produced a date of A.D. 1390 to 1650. This sample was recovered from the C-shape (Site 4139, Feature C) which was determined to be a prehistoric temporary habitation.

In 2005, SCS (Wilson and Dega 2005) conducted an Archaeological Inventory Survey of the 259.903-acre property immediately adjacent to the south of the current project area (see Figure 6). Three historic sites, all related to sugarcane cultivation, were newly identified and documented: Site 50-50-09-5657 (clearing mounds), Site 50-50-09-5658 (irrigation modifications), and Site 50-50-09-5659 (dirt road). These three sites were the only archaeological sites found within the project area. Subsurface testing consisting of 20 stratigraphic trenches (a volume of approximately 292.0 cubic meters) was conducted, but did not reveal any subsurface historic, or prehistoric, cultural material. Rather, excavation confirmed the extent, both in physical and temporal depth, of historic and modern agricultural activity within the project area.

However, there is no doubt that the area discussed in Wilson and Dega (2005) was utilized as a segment of an important trail system in the early 1800s, and probably prehistorically as well. The Lahaina Pali Trail is five miles long and crosses the southern slopes of the West Maui Mountains between Olowalu and Ma`alaea. The start of this trail, now a demonstration trail as part of the Na Ala Hele Trail System, borders the Wilson and Dega 2005 project area near the center of the *mauka* border. By the Historic Period, in which the trail's significance as a probable prehistoric route was realized, the portion *makai* of the current trail head had already been destroyed by sugarcane cultivation. Thus, the trail starts immediately outside the project area, within the State-owned lands. A 1991 study by Tomonari-Tuggle and Tuggle documented 18 sites upon the trail, the majority of historic origin (see Figure 6).

In 2000, SCS (Dega and Dagher 2007) conducted an Archaeological Inventory Survey of approximately 60 acres of land for the proposed Pohakea Quarry expansion project. A total of seven sites comprised of 23 features were recorded and documented during this study. Five of these sites (Sites 50-50-09-6061 through 50-50-09-6065) were previously identified by PHRI in 1988, and two of these sites were newly identified (50-50-09-6066 and 50-50-09-6067). An additional segment of Site 50-50-09-6065 (PHRI T-13) was also identified and documented during the survey. All of these sites were interpreted as historic ranching sites.

SETTLEMENT PATTERN

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). Archaeological dates for initial occupation of the Hawaiian Islands far pre-date accepted ranges gathered from palynological data. A more conservative estimate for initial occupation of the islands is the A.D. 9th century (Athens 1997), if one is to lay more credibility with the pollen record than the archaeological record. In the Waihe`e and Wai`ehu areas of Wailuku, Kirch (1985:87) notes that "a number of coastal dune midden sites have been reported, and at least one of these contained pearl-shell fishhooks similar to those from the Bellows Site, eroding from the wave-cut midden." (The Bellows site, located on the windward coast of O`ahu, has yielded the controversial data of occupation dates from A.D. 300 to 600 [Pearson *et al.* 1971], one of the earliest dated sites in the Hawaiian Islands. For the most part, these dates have now been diagnosed as problematic and are no longer considered valid.)

More recent research within Wailuku District indicates that Wailuku Ahupua`a was likely settled between *c.* A.D. 1100 (Kirch 1985:142) and A.D. 1200 (Fredericksen and Fredericksen 1996), whereas *ahupua`a* to the northeast have produced slightly earlier date ranges and *ahupua`a* to the southwest have later settlement dates. The earliest populations purportedly used local resources and seldom ventured into upland valleys. Cordy (in Creed 1993) suggests, however, that upper valley areas on windward coasts were likely populated before the A.D. 1100s. Coastal settlement was still dominant, but populations began exploiting and living in more upland *kula* zones. Population expansion to inland areas did not occur until the *c.* A.D. 12th century but continued through the 16th century. Large scale or intensive agricultural endeavors were implemented in association with habitation. Coastal lands were used for settlement and taro was cultivated in near-coastal reaches and in the uplands. Upland areas of Maui such as the Waiohuli-Kula area contained large garden enclosures, ceremonial structures, and permanent habitation sites by *c.* A.D. 1600.

Nearer the coast in lands like the current project area (*c.* 40–85 meters amsl), taro was cultivated along stream courses, dryland taro was grown on *kula* lands, and populations settled there as well. In the current parcel, however, no LCA records exist that might link prehistoric agriculture to historically documented practice.

EXPECTED FINDINGS

Based on all available physiographic, archaeological, and historical evidence, the following expectations guided this study:

- Historically-significant surface features were expected, particularly those pertaining to historic period sugarcane agriculture. SCS staff conducted an Archaeological Inventory Survey of the property immediately adjacent and to the south of the current project area (Wilson and Dega 2005) which reported the presence of the large clearing mounds and other features related to historic sugarcane cultivation. Thus, the probability of documenting additional historic agricultural features during Archaeological Inventory Survey was considered high.

- A variety of traditional Hawaiian sites have been documented at locations within nearby studies. Although the probability of encountering prehistoric archaeological surface features within the project area was considered low, a moderate possibility of encountering subsurface cultural layers from a prehistoric period remained. The latter would depend largely on the existence of a previously undisturbed matrix stratigraphically lower (*i.e.*, older) than historically tilled soils.

- The probability of discovery of historic or prehistoric unmarked burials, or marked burials, was considered low. A slightly higher, yet still low, probability existed in regards to the discovery of scattered human remains during subsurface testing. While burials have been located within the sandy matrix of the adjacent parcels *makai* of Honoapi`ilani Highway (*i.e.*, during construction activities at the Maui Ocean Center; see McGerty, Burgett, and Spear 1998), SHPD records contain no documented burials *mauka* of Honoapi`ilani Highway (including on, or within a kilometer, of the current project area). The lack of burial sites immediately *mauka* of the highway can be attributed to two main factors: (1) the types of soils found here were generally less favored in prehistoric burial practices, and (2) the lands have been subject to continual agricultural activity for nearly a century, and in some cases, longer.

METHODOLOGY

FIELD METHODOLOGY

Fieldwork was conducted between September 14 and October 5, 2006 by Allison Chun, Ph.D. and D. Dillon, B.A. under the direct supervision of Principal Investigator Michael F. Dega, Ph.D. All aspects of the work were photographed and archived on the SCS computer database. Likewise, all field notes, sketches, plan views, profiles, and maps are archived in SCS's Honolulu office.

During the fieldwork, 100 percent of the project area was surveyed, with the exception of the portions currently under sugarcane cultivation. A 100 percent survey was not possible in the cane fields due to the thick cane growth and the fact that it was under current cultivation. Every effort was made to avoid disturbing the cane growth and that precluded machete-cutting swaths though the fields for transects. However, the roads within the sugarcane fields were walked

during the survey. Thus, examination of the areas within and alongside the roads was conducted as was a cursory survey inside some of the cultivated areas where it was easier to get inside the cane growth. Given the level of ground disturbance, it is highly unlikely that there are any significant surface features hiding inside the cane fields. However, in order to preclude that small possibility, it is recommended that the areas currently under cane cultivation should be re-examined after the cane is harvested next year.

STRATIGRAPHIC TRENCHING

A total of 26 stratigraphic trenches were excavated in the project area, with the exception of the areas currently under commercial sugarcane. These excavations were conducted over a period of three days between October 2 through 5, 2006.

Methodology regarding stratigraphic trench excavation and recordation are as follows: first, the selected trench location was flagged by a field archaeologist. All of the subsequent stratigraphic trench excavations were conducted with an archaeological monitor present. Post excavation, a 1.0 m wide column stratigraphic profile sketch was prepared for each trench and photographs were taken of a representative section of the selected profile wall of each trench. All measurements, including detailed soil descriptions, were recorded in field notes, and potential cultural material was screened from *in situ* matrix, or backfill, and thoroughly examined. Finally, the trenches were mechanically filled in by the backhoe.

Three factors played a role in trench positioning. First was the desire to excavate at the locations of the clearing mounds (Sites 50-50-09-6252, T-2; and 50-50-09-625, T-3) which were identified during the pedestrian survey. These areas have previously undergone extensive ground alterations making it inaccessible to the backhoe. Second was the desire to gain an understanding of subsurface stratigraphy at locations evenly distributed throughout the project area. The third reason for trench positioning was based on the desire to place a higher number of trenches in an area deemed slightly likelier to contain subsurface prehistoric cultural material. Trench excavation locations were recorded using tape and compass and were documented on a project area map (Figures 7 and 8). Trench numbers indicate the chronological order in which they were excavated.

Maximum depth of individual trench excavation ranged from 100 to 240 centimeters below surface (cmbs), and averaged 180 cmbs deep. Bedrock was reached in all of the 26 trenches. The shallowest depth at which bedrock was reached was at 100 cmbs in ST-15 and the deepest was at 280 cmbs in ST-20; average depth bedrock was first encountered was 190 cmbs.

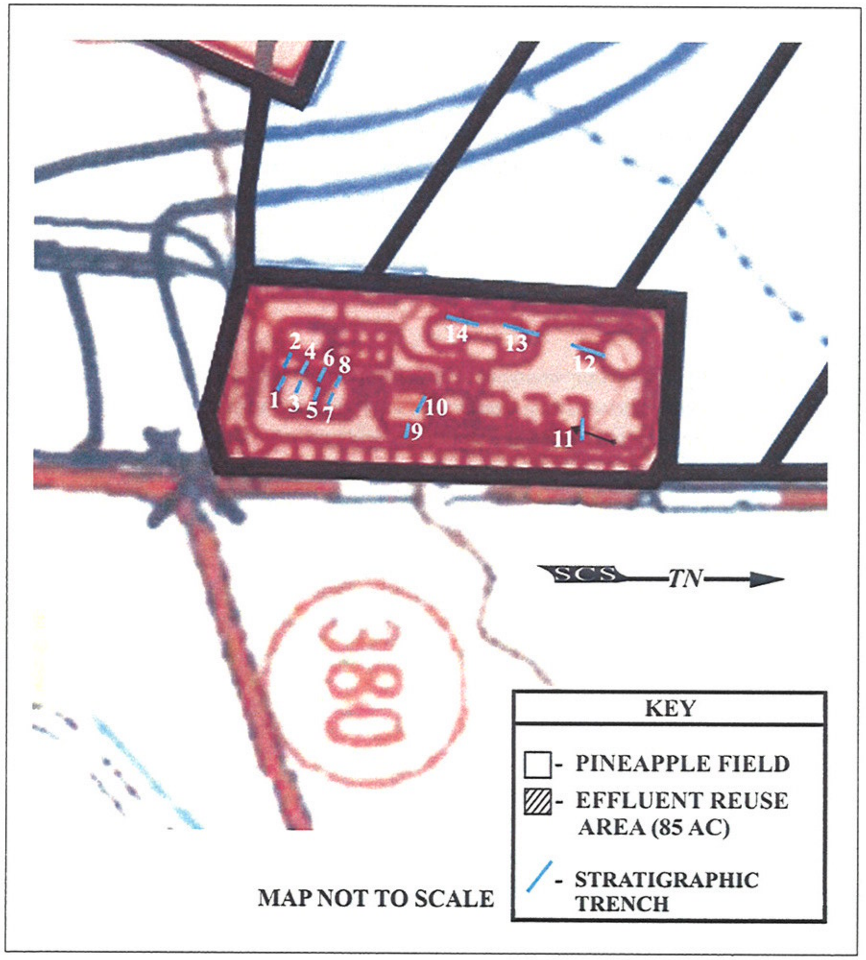

Figure 7: Detail Map of Wastewater Treatment Plant Area Showing Locations of BT 1 through 14.

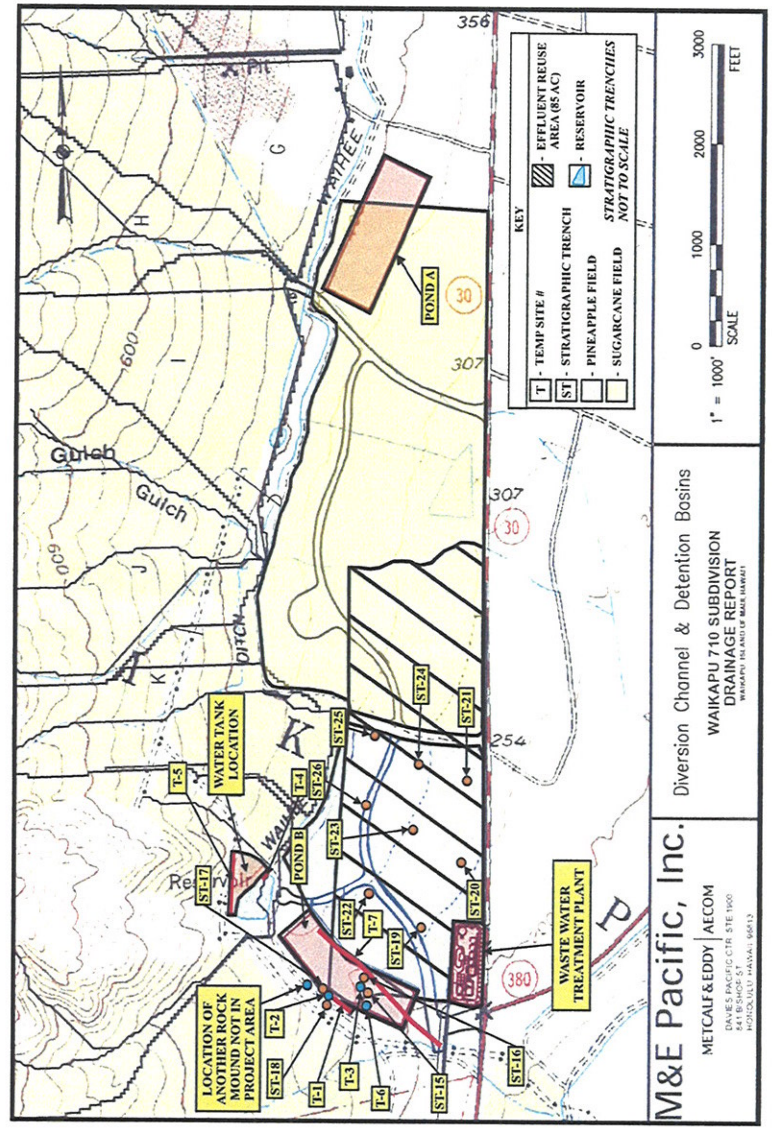

Figure 8: Project Area Map Showing Backhoe Trench and Site Locations.

ARCHAEOLOGICAL INVENTORY SURVEY RESULTS SUMMARY

During the survey a total of seven archaeological sites were newly identified and documented in the project area (see Figure 8). Based on the methods of construction and the type of features identified during the survey (large mounds and ditches), we believe that all of the identified sites (50-50-09-6251 through 50-50-09-6257) relate to the historic commercial agriculture. These historic commercial agriculture sites consist of three historic irrigation ditches (Sites 50-50-09-6251, T-1; 50-50-09-6254, T-4; and 50-50-09-6257, T-7) three clearing mounds (Sites 50-50-09-6252, T-2; 50-50-09-6253, T-3, and 50-50-09-6256, T-6), and a modified stream drainage (Site 50-50-09-6255, T-5). One additional clearing pile lies to the northwest of the project area; however, this feature was not recorded as it is outside the project area.

SITE DESCRIPTIONS

SITE 50-50-09-6251 (T-1)

Site 50-50-09-6251 (T-1) is located in a level bulldozed field (Figure 9) (see Figure 8). It consists of an excavated, concrete-lined ditch which runs along the entire length of, and parallel to, the modern Pohakea Quarry boundary wall. The concrete appears to have been poured over sub-angular and sub-rounded medium-sized boulders with large cobbles along the top. The ditch extends along a northwest-southeast axis with a bearing of 126/306° and measures 0.90 m wide at the top by 0.30 m deep. Wall thickness varies from 0.20 to 0.45 meters, with an average wall thickness of 0.20 m. The ditch has been filled with sand and PVC pipe (30.5 cm diameter) has been placed down the center. This site appears to be in fair to poor physical condition; modern trash litters the ground surface and the original ditch appears to have been repaired several times. Site 6251is currently in use and has been interpreted as an historic irrigation ditch associated with historic agriculture.

SITE 50-50-09-6252 (T-2)

Site 50-50-09-6252 (T-2) consists of an irregularly-shaped mound measuring 32.0 m east-west by 23.0 m north-south by 5.50 m high (Figure10) (see Figure 8). The mound appears to have been mechanically constructed of roughly piled sub-angular to sub-rounded cobbles and boulders and is situated along an east-west axis. This site appears to be good to fair physical condition and appears to be unaltered. Site 6252 has been interpreted as an historic agricultural clearing mound.

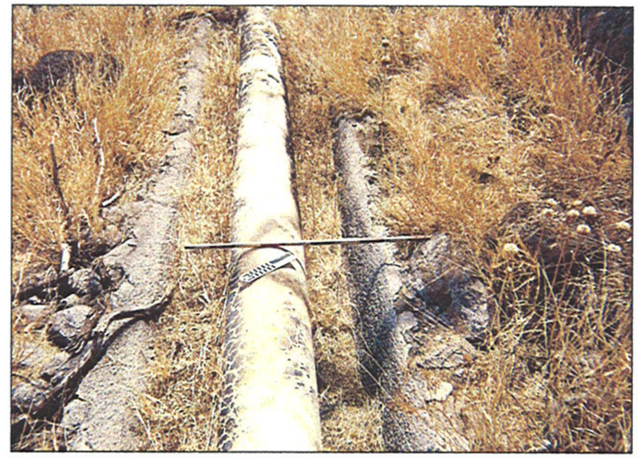

Figure 9: Photographic Detail of Site 50-50-09-6251 (T-1) View to Southeast.

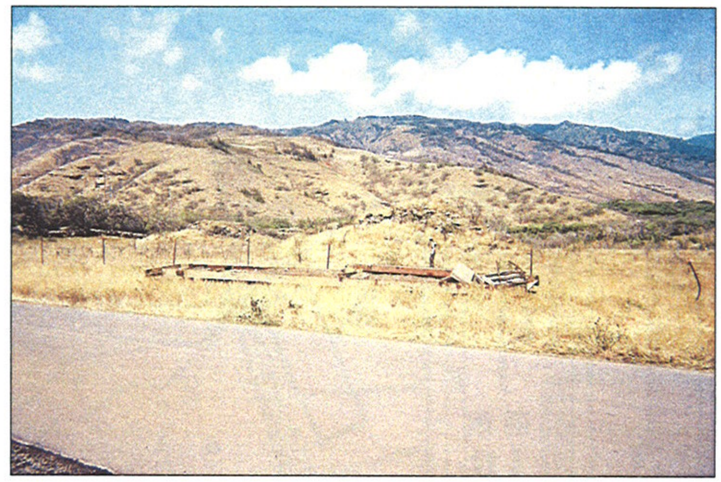

Figure 10: Sites 50-50-09-6252 (T-2) (left) and 50-50-09-6253 (T-3) (right) View to West.

SITE 50-50-09-6253 (T-3)

Site 50-50-09-6253 (T-3) is located in a level bulldozed field and modern trash litters the ground surface. This site consists of an irregularly shaped rock mound measuring approximately 20.0 by 20.0 by 5.0 m high (see Figures 8 and 10). The mound appears to have been mechanically constructed of roughly piled sub-angular to sub-rounded cobbles. The overall physical condition of the site is good to fair. Site 6253 has been interpreted as an historic agricultural clearing mound.

SITE 50-50-09-6254 (T-4)

Site 50-50-09-6254 (T-4) consists of a concrete lined ditch which is oriented on a 40/220° axis. This ditch is located at the boundary between the pineapple and sugarcane fields to the east and the golf course to the west and modern trash litters the ground surface (Figure 11). This ditch measures 2.08 m along the top and 1.17 m wide at the bottom. Unlike Site 6251 (T-1), boulders and cobbles were not utilized in construction of this ditch; instead, it was constructed of "formed" concrete. The length of this ditch was not provided as it extends well past the project area boundaries and is also visible on maps (see Figure 8). Exterior wall height is flush with the ground surface while the interior of the ditch is 0.88 m deep and the overall wall thickness is 0.15 m. The overall physical condition of this site is good. Site 6254 has been interpreted as an historic irrigation ditch associated with historic agriculture with use extending into modern times.

SITE 50-50-09-6255 (T-5)

Site 50-50-09-6255 (T-5) is located in a small natural drainage and consists of a modified stream drainage system which is oriented along a northwest/southeast axis (50/230°) (see Figure 8). The length of this site was not provided as it is at least as long as the western edge of the water tank site area. Site 6255 measures 0.60 to 0.80 m wide by 1.30 m in height (Figure 12). Modifications of stacked basalt boulders and cobbles have been constructed along its eastern bank to form a roughly faced retaining wall. Most of the modifications to the stream channel occur near the upper half along the side of the drainage, although there have been some modifications along the bottom next to the streambed. This site appears to have been altered by natural forces including, gravity, erosion, and vegetation. Site 6255 also exhibits evidence of mechanical alterations (*i.e.*, bulldozer activity). The overall site integrity of Site 6255 is fair to poor. Site 6255 has been interpreted as an old water control or `*auwai* system associated with historic agriculture.

Figure 11: Site50-50-09-6254 (T-4) View to Northeast.

Figure 12: Site 50-50-09-6255 (T-5) View to West.

SITE 50-50-09-6256 (T-6)

Site 50-50-09-6256 (T-6) consists of roughly piled basalt boulders and cobbles that form an irregularly-shaped mound that measures approximately 50.0 by 20.0 by 5.0 to 6.0 m (see Figure 8). Site 6256is oriented along an east-west axis (100/280°). The mound appears to have been mechanically constructed by bulldozer. The relatively flat top of the mound forms a ramp which slopes downward towards the east (Figure 13). This site, which appears to be unaltered and exhibits good to fair site integrity, has been interpreted as an historic agricultural clearing mound.

Figure 13: Site 50-50-09-6256 (T-6) View to West.

SITE 50-50-09-6257 (T-7)

Site 50-50-09-6257 (T-7) is located in a relatively level area near the southern boundary of a pineapple field (see Figure 8). Site 6257 consists of two mechanically (bulldozer) constructed rock and soil berms located on either side of an unlined drainage ditch (Figure 14). This ditch, which is currently not in use, is oriented along a southeast-northwest axis (10/290°). It extends along the entire southern boundary of the above-mentioned pineapple field. Given the extent of this drainage, only the portion of it extending through the southwest corner of the ERA was recorded as a representative section. The ditch measures approximately 5.0 m wide by approximately 2.50 m wide and the berms are approximately 4.0 m wide. The overall site integrity is fair to poor, as the site has been altered by natural forces including erosion, gravity, and vegetation. Site 625 has been interpreted as an irrigation ditch associated with historic agriculture.

Figure 14: Site 50-50-09-6257 (T-7) View to Southeast.

STRATIGRAPHIC TRENCH EXCAVATION SUMMARY

A total of twenty-six trenches (ST-1 through ST-26) were mechanically excavated by backhoe over the project area between October 2 through 5, 2006 (see Figures 7 and 8). Stratigraphic Trenches 1 through 14 were excavated within the proposed wastewater treatment area. These trenches were positioned on a west-northwest to east-southeast axis and were spaced 18.0 to 20.0 m apart. A higher density of stratigraphic trench excavations were concentrated in this area as it was thought that this portion of the project area would be the most heavily impacted by construction-related ground disturbance. ST-15 through ST-18 were excavated on either side of the large agricultural clearing piles (Sites 50-50-09-6252, T-2, and 50-50-09-6253, T-3) in the central portion of Pond B, as a representative sample of the subsurface deposits within this area. Stratigraphic Trenches 19 through 26 were positioned throughout the ERA to achieve a representative sample of the stratigraphic deposits of the area.

All the trenches in the pineapple field, both in the wastewater treatment area and in the ERA, exhibited similar stratigraphy. Two layers were revealed: a top plow zone layer of previously disturbed soil invariably with scattered debris from pineapple cultivation in the profiles (black plastic, black tube hosing used for irrigation), and a lower layer of supposedly intact soil. Two of the trenches in Detention Pond B (ST-15 and ST-17) had only one layer – an extremely rocky disturbed layer of very fine silty soil. The other two trenches (ST-16 and ST-

18) had another undisturbed layer underneath the top disturbed layer. None of these trenches were very deep and all terminated when reaching bedrock. All trenches were culturally sterile, save for modern debris and items associated with commercial agriculture. Given the similar stratigraphic deposits exhibited within the various areas of excavation, representative samples of each of the stratigraphic deposits have been selected and are presented below.

Please note that stratigraphic trench excavations were not conducted at several areas including: the irrigation ditches [Sites -6252 (T-1), 6254(T-4), and -6255 (T-5)] as they are currently in use. Detention Pond A and the surrounding area is currently in active sugarcane cultivation (see Figures 7 and 8). Thus, no excavation was conducted of Detention Pond A. In addition, excavations were not conducted at Site -6256 (T-6), the proposed water tank site, and Site -6257 (T-7), the junkyard and borrow pit sites for Detention Pond B. These areas have previously been subjected to extensive bulldozer disturbance, as evidenced by large displaced boulders and high berms, making them inaccessible to bulldozers at present. The northwestern portion of Detention Pond B is currently a junkyard and is covered with abandoned vehicles, heavy equipment, empty barrels, machine parts, and old construction materials and equipment. Thus, excavation was not conducted in this section of the pond, either.

STRATIGRAPHIC TRENCH 1 (ST-1)

Stratigraphic Trench 1 (ST-1) was positioned within the area proposed for the waste water treatment plant. This trench measured 5.0 m long by 0.75 m wide with a maximum depth of 1.60 m below surface. ST-1 was oriented along a northwest-southeast axis with a bearing of 115/295° (see Figure 7). ST-1 exhibited two stratigraphic layers. Layer I (0–150 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. Layer I contained several pieces of modern black plastic, evidence of the disturbed nature of the deposit. Layer II (150–160 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-1 was culturally sterile and terminated at 160 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 2 (ST-2)

Stratigraphic Trench 2 (ST-2) was positioned within the area proposed for the wastewater treatment plant. This trench measured 5.5 m long by 0.75 m wide with a maximum depth of 1.50 m below surface. ST-2 was oriented along a northwest-southeast axis with a bearing of 115/295° (see Figure 7) (Figure 15). This trench exhibited two stratigraphic layers. Layer I (0–130 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic and irrigation hose/tubing, evidence of the disturbed nature of the deposit. Layer II (130–

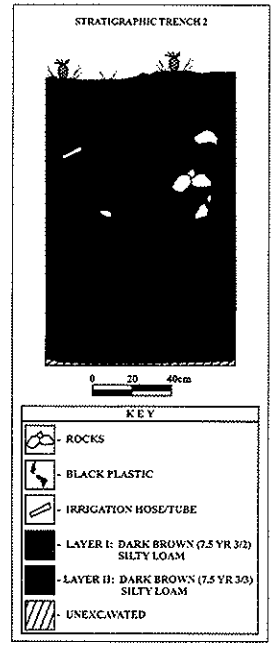

Figure 15: Backhoe Trench 2 Southwest Wall Profile.

150 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-2 was culturally sterile and terminated at 150 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 3 (ST-3)

Stratigraphic Trench 3 (ST-3) was positioned within the area proposed for the wastewater treatment plant. This trench measured 5.5 by 0.75 by 1.50 m and is oriented along a northwest-southeast axis with a bearing of 115/295° (see Figure 7). ST-3 exhibited two stratigraphic layers. Layer I (0-134 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of irrigation hose/tubing, evidence of the disturbed nature of the deposit. Layer II (134 - 150 cmbs) was composed of dark brown 7.5 YR 3/3) silty loam. ST-3 was culturally sterile and terminated at 150 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 4 (ST-4)

Stratigraphic Trench 4 (ST-4) was positioned within the area proposed for the waste water treatment plant. This trench measured 5.5 by 0.75 by 1.90 m and is oriented along a northwest/southeast axis with a bearing of 115/295° (see Figure 7). ST-4 exhibited two stratigraphic layers. Layer I (0-144 cmbs) consists of dark brown (7.5 YR 3/2) silty loam. Layer I contained several pieces of modern black plastic - evidence of the disturbed nature of the deposit. Layer II (144-190 cmbs) is composed of dark brown silty (7.5 YR 3/3) silty loam. ST-4 was culturally sterile and was terminated at 190 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 5 (ST-5)

Stratigraphic Trench 5 (ST-5) was positioned within the area proposed for the wastewater treatment plant. This trench measured 5.5 by 0.75 by 1.90 m and was oriented along a northwest-southeast axis with a bearing of 115/295° (see Figure 7). ST-5 exhibited two stratigraphic layers. Layer I (0–145 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic and several pieces of irrigation hose/tubing, evidence of the disturbed nature of the deposit. Layer II (145–190 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-5 was culturally sterile and terminated at 190 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 6 (ST-6)

Stratigraphic Trench 6 (ST-6) was positioned within the area proposed for the wastewater treatment plant. This trench measured 6.0 by 0.75 by 2.40 m and was oriented along a northwest-southeast axis with a bearing of 115/295° (Figure 16) (see Figure 7). ST-6 exhibited two stratigraphic layers. Layer I (0–124 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic and several pieces of irrigation hose/tubing, evidence of the disturbed nature of the deposit. Layer II (124–240 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-6 was culturally sterile and was terminated at 240 cmbs upon reaching the bedrock.

STRATIGRAPHIC TRENCH 7 (ST-7)

Stratigraphic Trench 7 (ST-7) was positioned within the area proposed for the wastewater treatment plant. This trench, which was oriented along a northwest-southeast axis with a bearing of 115/295°, measured 5.0 by 0.75 by 2.40 m (see Figure 7). ST-7 exhibited two stratigraphic layers. Layer I (0–118 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic and several pieces of irrigation hose/tubing, evidence of the disturbed nature of the deposit. Layer II (118–240 cmbs) was composed of dark brown (7.5

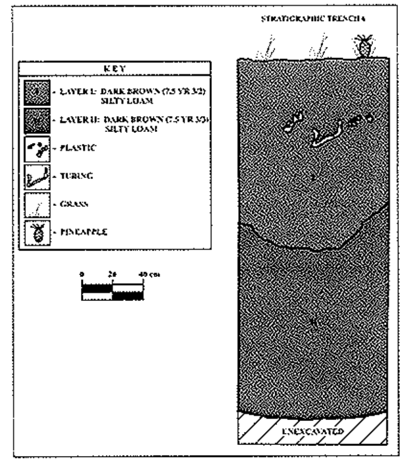

Figure 16: Backhoe Trench 6 Southwest Wall Profile.

YR 3/3) silty loam. ST-7 was culturally sterile and terminated at 240 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 8 (ST-8)

Stratigraphic Trench 8 (ST-8) was positioned within the area proposed for the wastewater treatment plant. This trench measured 6.0 by 0.75 by 2.10 m and was oriented along a northwest-southeast axis with a bearing of 115/295° (Figure 17) (see Figure 7). ST-8 exhibited two stratigraphic layers. Layer I (0–102 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic and several pieces of irrigation hose/tubing, evidence of the disturbed nature of the deposit. Layer II (102–210 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-8 was culturally sterile and terminated at 210 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 9 (ST-9)

Stratigraphic Trench 9 (ST-9) was positioned within the area proposed for the wastewater treatment plant, slightly more to the north than ST-1 through ST-8, and located adjacent to Honoapi`ilani Highway(Figure 18). The physical properties of ST-9 are slightly different than those

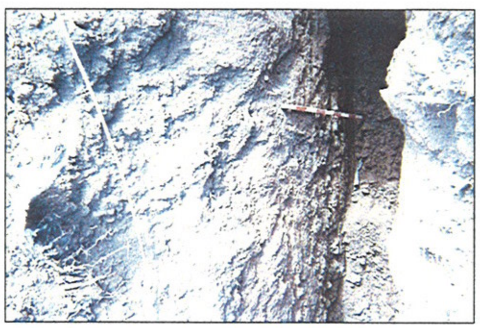

Figure 17: Backhoe Trench 8 Northwest Wall Profile View to Northwest.

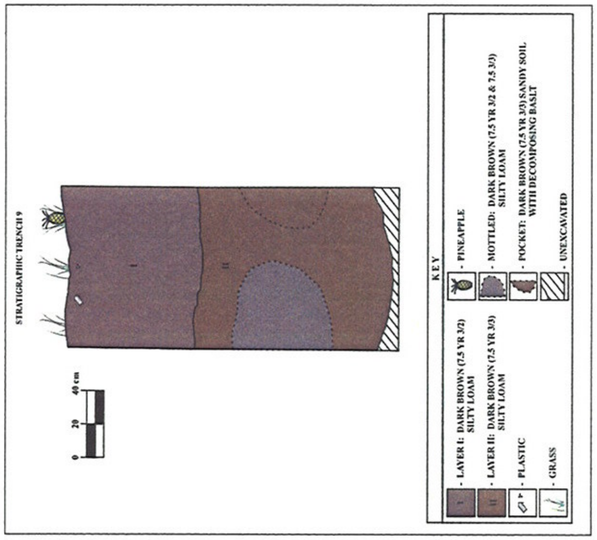

Figure 18: Backhoe Trench 9 Northwest Wall Profile.

apparent in ST-1 through ST-8 – the deposits and overall depth of the trench were shallower and large boulders were present on the ground surface. This trench measured 5.5 by 0.75 by 2.0 m and was oriented along a northwest-southeast axis with a bearing of 110/290° (see Figure 7). ST-9 exhibited two stratigraphic layers with the mottling of Layers I and II. Layer I (0–80 cmbs) consists of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic, evidence of the disturbed nature of the deposit. Layer II (80–200 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. A single large boulder was encountered at approximately 110 cmbs. When this boulder was removed a pocket of sandy soil and decomposing basalt remained. ST-9 was culturally sterile and terminated at 200 cmbs, when bedrock was encountered.

STRATIGRAPHIC TRENCH 10 (ST-10)

Stratigraphic Trench 10 (ST-10) was positioned within the area proposed for the wastewater treatment plant. ST-10 was located slightly northwest of ST-9 and north of ST-1 through ST-8. This trench measured 5.5 by 0.75 by 2.10 m and was oriented along a northwest-southeast axis with a bearing of 110/290° (see Figure 7). ST-10 exhibited two stratigraphic layers. Layer I (0–84 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. Layer I contained several pieces of irrigation hose/tubing, which is evidence of the disturbed nature of the deposit. Layer II (84–210 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-10 was culturally sterile and terminated at 210 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 11 (ST-11)

Stratigraphic Trench 11 (ST-11) was positioned within the area proposed for the wastewater treatment plant. ST-11 was positioned in the northeastern corner of the ERA adjacent to Honoapi`ilani Highway. This trench, which measured 9.0 by 0.75 by 2.40 m, was oriented along a northeast-southwest axis with a bearing of 15/195° (see Figure 7). ST-11 exhibited two stratigraphic layers. Layer I (0–88 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. This layer contained several pieces of modern black plastic, several pieces of irrigation hose/tubing, and some pieces of concrete, evidence of the disturbed nature of the deposit. Layer II (88–240 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-11 was culturally sterile and terminated at 240 cmbs upon reaching bedrock.

STRATIGRAPHIC TRENCH 12 (ST-12)

Stratigraphic Trench 12 (ST-12) was positioned within the area proposed for the wastewater treatment plant, and to the west of ST-11. ST-12 measured 10.0 by 0.75 by 2.40 m and was oriented along a northeast-southwest axis with a bearing of 20/200° (see Figure 7). ST-12 exhibited two stratigraphic layers. Layer I (0–80 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic, several pieces of irrigation hose/tubing, concrete chunks, and PVC pipe, evidence of the disturbed nature of the deposit. Layer II (80–240 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-12 was culturally sterile and terminated at 240 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 13 (ST-13)

Stratigraphic Trench 13 (ST-13) was positioned within the area proposed for the wastewater treatment plant and was located just southwest of ST-12. This trench measured 10.0 by 0.75 by 1.90 m and was oriented along a northeast-southwest axis with a bearing of 20/200° (see Figure 7). ST-13 exhibited two stratigraphic layers. Layer I (0– 68 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. Layer I contained several pieces of modern black plastic, several pieces of irrigation hose/tubing, and cement pieces, evidence of the disturbed nature of the deposit. Layer II (68–190 cmbs) is composed of dark brown (7.5 YR 3/3) silty loam. Also present within Layer II was a sandy lens which appeared at 124 cmbs and extended to 152 cmbs (Figure 19). ST-13 was culturally sterile and terminated at 190 cmbs when bedrock was encountered.

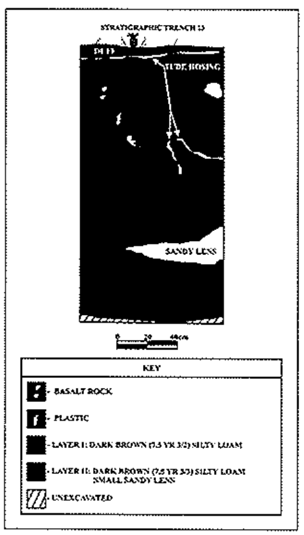

Figure 19: Backhoe Trench 13 Southeast Wall Profile.

STRATIGRAPHIC TRENCH 14 (ST-14)

Stratigraphic Trench 14 (ST-14) was positioned within the area proposed for the wastewater treatment plant, southwest of ST-13. This trench measured 9.0 by 0.75 by 1.90 m and was oriented along a northeast-southwest axis with a bearing of 20/200° (see Figure 7). ST-14 exhibited two stratigraphic layers. Layer I (0–73 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained several pieces of modern black plastic, several pieces of irrigation hose/tubing, concrete chunks, and a Bud Lite can, evidence of the disturbed nature of the deposit. Layer II (73–190 cmbs) was composed of dark brown (7.5 YR 3/3) silty loam. ST-14 was culturally sterile and terminated at 190 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 15 (ST-15)

Stratigraphic Trench 15 (ST-15) was positioned along the southeastern edge of Site – 6253 (T-3) in the central portion of the area proposed for Detention Pond B (see Figure 8). ST-15 was oriented along a 20/200° axis and measured 7.0 by 0.75 by 1.0 m. This trench exhibited one stratigraphic layer. Layer I (0–100 cmbs) consisted of an extremely rocky previously disturbed layer of very fine brown (7.5 YR 4/2) silt. Black tube hosing, which is used for irrigation, was present within then upper portion of Layer I (0–40 cmbs). ST-15 was culturally sterile and excavation terminated at 100 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 16 (ST-16)

Stratigraphic Trench 16 (ST-16) was located along the northeastern edge of Site -6253 (T-3) in the central portion of the area proposed for Detention Pond B (see Figure 8). ST-16 was oriented along a 110/290° axis and measured 6.5 by 0.75 by 1.7 m. This trench exhibited two stratigraphic layers. Layer I (0–90 cmbs) consisted of an extremely rocky previously disturbed layer of very fine brown (7.5 YR 4/2) silt. Layer II (90–170 cmbs) consisted of an undisturbed deposit of dark reddish brown (5 YR 3/3) silty loam which contained fewer rocks than Layer I (Figure 20). ST-16 was culturally sterile and excavation terminated at 170 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 17 (ST-17)

Stratigraphic Trench 17 (ST-17) was positioned along the western edge of Site – 6252 (T-2) within the central portion of the area proposed for Detention Pond B (see Figure 8). ST-17 was oriented along a 35/215° axis and measured 7.5 by 0.75 by 1.5 m. This trench exhibited one stratigraphic layer (Figure 21). Layer I (0–100 cmbs) consisted of an extremely rocky (50–60%) deposit comprised of medium- to large-sized cobbles and medium-sized boulders. This deposit was a previously disturbed layer of very fine brown (7.5 YR 4/2) silt. ST-17 was culturally sterile and excavation terminated at 150 cmbs when bedrock was encountered.

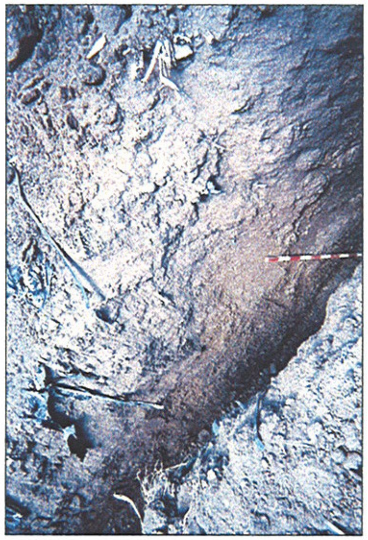

Figure 21: Backhoe Trench 17 West Wall Profile View to West.

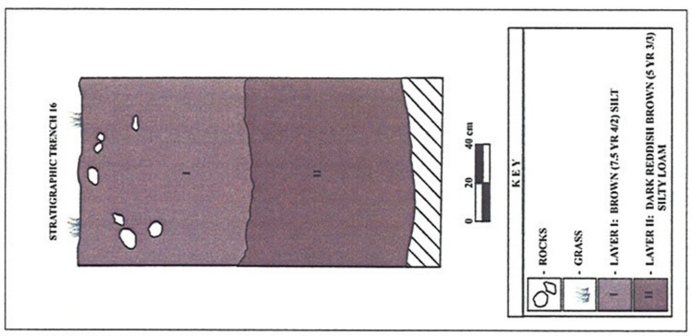

Figure 20: Backhoe Trench 16 South Wall Profile.

STRATIGRAPHIC TRENCH 18 (ST-18)

Stratigraphic Trench 18 (ST-18) was placed along the southern edge of Site -6252 (T-2), northeast of the Pohakea Quarry boundary wall (see Figure 8). ST-18 was oriented along a 100/280° axis and measured 10.0 by 0.75 by 1.2 m. This trench exhibited two stratigraphic layers. Layer I (0–46 cmbs) consisted of an extremely rocky previously disturbed layer of very fine brown (7.5 YR 4/2) silt. Layer II (46–120 cmbs) consisted of an undisturbed deposit of dark reddish brown (5 YR 3/3) silty loam which contained fewer rocks than Layer I (Figure 22). ST-18 was culturally sterile and excavation terminated at 120 cmbs when bedrock was encountered.

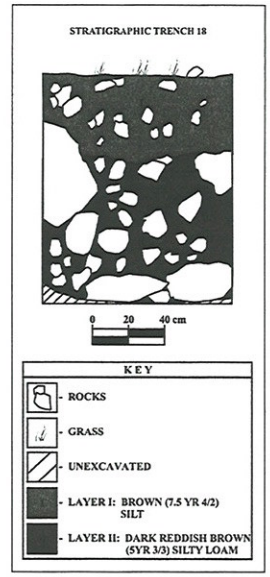

Figure 22: Backhoe Trench 18 North Wall Profile.

STRATIGRAPHIC TRENCH 19 (ST-19)

Stratigraphic Trench 19 (ST-19) was located to the west of the wastewater treatment plant in the pineapple field in the proposed ERA (see Figure 8). ST-19 was positioned at bearing of 115/295° and measured 8.5 by 0.75 by 2.0 m. This trench exhibited two stratigraphic layers. Layer I (0–95 cmbs) consists of dark brown (7.5 YR 3/2) silty loam and contained pieces of black plastic and irrigation tube/hose, indications of the disturbed nature of this deposit. Layer II (95– 200 cmbs) consisted of dark brown (7.5 YR 3/3) silty loam. Layer II contained a mottled grayish sandy pocket which extended from 128 to 148 cmbs. Few rocks were present within this trench. ST-19 was culturally sterile and terminated at 200 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 20 (ST-20)

Stratigraphic Trench 20 (ST-20) was located north of the of the wastewater treatment plant northeast of ST-19 in the pineapple field in the proposed ERA (see Figure 8)(Figure 23). This trench was oriented along a 110/290° axis and measured 6.5 by 0.75 by 2.8 m. This trench exhibited two stratigraphic layers. Layer I (0–100 cmbs) and was composed of dark brown (7.5 YR 3/2) silty loam. Layer I contained pieces of black plastic and irrigation tube/hose – demonstrating the disturbed nature of this deposit. Layer II (100– 280 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. ST-20 was culturally sterile and terminated at 280 cmbs when bedrock was encountered.

Figure 23: Backhoe Trench 20 West Wall Profile View to West.

STRATIGRAPHIC TRENCH 21 (ST-21)

Stratigraphic Trench 21 (ST-21) was located slightly northeast of ST-20 in the pineapple field in the proposed ERA (see Figure 8). This trench measured 6.0 by 0.75 by 2.0 m and was oriented along a 110/290° axis. ST-21 exhibited two stratigraphic layers. Layer I (0–88 cmbs) was composed of dark brown (7.5 YR 3/2) silty loam. Layer I contained chunks of concrete, pieces of black plastic, and irrigation hose/tubing and boulders, suggesting the disturbed nature of this deposit. Layer II (88–200 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. ST-21 was culturally sterile and terminated at 200 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 22 (ST-22)

Stratigraphic Trench 22 (ST-22) was located slightly northwest of ST-19 in the pineapple field in the proposed ERA (see Figure 8). This trench measured 6.0 by 0.75 by 2.1 m and was oriented along a 110/290° axis. ST-22 exhibited two stratigraphic layers. Layer I (0–70 cmbs) was composed of dark brown (7.5 YR 3/2) silty loam. Layer I contained pieces of black plastic and irrigation tubing/hose, indicators of the disturbed nature of this deposit. Layer II (70–210 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. Both Layer I and Layer II contained large cobbles and small boulders. ST-22 was culturally sterile and terminated at 210 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 23 (ST-23)

Stratigraphic Trench 23 (ST-23) was located slightly northwest of ST-20 in the pineapple field proposed for the ERA (see Figure 8). This trench measured 6.0 by 0.75 by 2.2 m and was oriented along a 105/285° axis. ST-23 exhibited two stratigraphic layers. Layer I (0–74 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. Layer I contained pieces of irrigation hose/tubing which indicates this layer has been previously disturbed. Layer II (74–220 cmbs) consisted of dark brown (7.5 YR 3/3) silty loam. ST-23 was culturally sterile and terminated at 220 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 24 (ST-24)

Stratigraphic Trench 24 (ST-24) was placed in the pineapple field proposed for the ERA, slightly northeast of ST-23 (see Figure 8). ST-24 measured 6.5 by 0.75 by 1.9 m and was positioned along a 120/300° axis. Two stratigraphic layers were revealed. Layer I (0–160 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam and contained pieces of black plastic and irrigation hose/tubing, which suggests the previously disturbed nature of this deposit. Layer I also contained a mottled grayish sandy deposit which extends from 104 to 160 cmbs. Layer II (160–190 cmbs) consisted of a dark brown (7.5 YR 3/3) silty loam. Both Layers I and II were rocky deposits (30–40%) containing small- to medium-sized cobbles. ST-24 was culturally sterile and terminated at 190 cmbs when bedrock was encountered (Figure 24).

STRATIGRAPHIC TRENCH 25 (ST-25)

Stratigraphic Trench 25 (ST-25) was placed along the western boundary of the pineapple field proposed for the ERA, slightly northwest of ST-24 (see Figure 8). ST-25 measured 6.0 by 0.75 by 1.5 m and was positioned along a 110/290° axis. This trench exhibited two stratigraphic layers. Layer I (0–70 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. Layer I contained pieces of black plastic and irrigation hose/tubing, suggesting the previously disturbed nature of

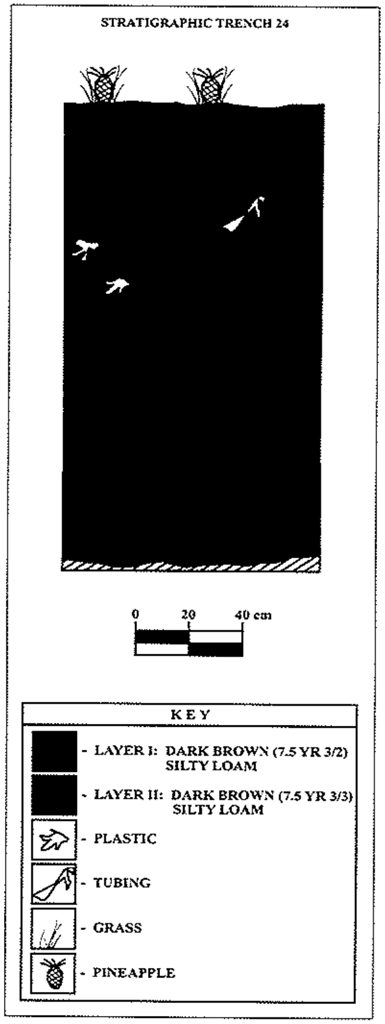

Figure 24: Backhoe Trench 24 North Wall Profile.

this deposit. Layer II (70–150 cmbs) consisted of a dark brown (7.5 YR 3/3) silty loam. ST-25 was culturally sterile and terminated at 150 cmbs when bedrock was encountered.

STRATIGRAPHIC TRENCH 26 (ST-26)

Stratigraphic Trench 26 (ST-26) was also located along the western boundary of the pineapple field, which is the proposed site of the ERA (see Figure 8). ST-26, which was situated south of ST-25 along an axis of 100/280°, measured 6.0 by 0.75 by 1.5 m. ST-26 contained two stratigraphic layers. Layer I (0–56 cmbs) consisted of dark brown (7.5 YR 3/2) silty loam. Layer I contained pieces of black plastic – suggesting the previously disturbed nature of this deposit. Layer II (56–150 cmbs) consisted of a dark brown (7.5 YR 3/3) silty loam. ST-26 was culturally sterile and terminated at 150 cmbs when bedrock was encountered.

DISCUSSION AND CONCLUSIONS

This survey resulted in the identification and documentation of seven newly identified sites. These sites consist of three historic irrigation ditches (Sites 50-50-09-6251, T-1; 50-50-09-6254, T-4; and 50-50-09-6257, T-7), three clearing mounds (Sites 50-50-09-6252, T-2; 50-50-09-6253, T-3; and 50-50-09-6256, T-6), and a modified stream drainage (Site 50-50-09-6255, T-5). Based on the method and style of construction and context, all of these sites appear to be associated with historic commercial agriculture. No historic sites and/or cultural materials were present in the subsurface deposits.

SITE SIGNIFICANCE ASSESSMENTS

The seven newly identified sites have been evaluated for significance according to the criteria established for the Hawai`i State Register of Historic Places §13-275-6. The five criteria are presented below:

Criterion A: Site is associated with events that have made a significant contribution to the broad patterns of our history

Criterion B: Site is associated with the lives of persons significant to our past

Criterion C: Site is an excellent site type; embodies distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual construction

Criterion D: Site has yielded or has the potential to yield information important in prehistory or history

Criterion E: Site has cultural significance to an ethnic group; examples include religious structures, burials, major traditional trails, and traditional cultural places

All of the sites identified during the Inventory Survey have been found to be significant for information content only (Criterion D) and have yielded adequate information. Based on the results of the Inventory Survey, it is unlikely that additional research would contribute significantly to furthering our understanding of Hawaiian prehistory or history (Table 1).

RECOMMENDATIONS

No further archaeological work is recommended in the project area and the planned undertaking may proceed within this parcel without endangering significant historic or cultural resources.

Due to the limited visibility resulting from extensive ground cover, however a program of limited Archaeological Monitoring is recommended as a precautionary measure during the initial construction phase (grading and grubbing), as it is possible additional sites may be present. Monitoring would only be limited to initially observing the surface of heavily vegetated areas to assess the presence/absence of archaeological sites. No Monitoring is warranted for any other ground altering activities or excavation in the project area, primarily due to the lack of soil in the area.

Table 1: Significance and Recommendations:

State Site 50-50-09-	Temp. Site Number	# of Fe.	Form	Function	Time Period	Sig.	Recommend
6251	T-1	1	Historic Water Ditch	Commercial Agriculture	Historic	D	No Further Work
6252	T-2	1	Large Clearing Pile	Commercial Agriculture	Historic	D	No Further Work
6253	T-3	1	Large Clearing Pile	Commercial Agriculture	Historic	D	No Further Work
6254	T-4	1	Historic Water Ditch	Commercial Agriculture	Historic	D	No Further Work
6255	T-5	1	Modified Stream Drainage	Commercial Agriculture	Historic	D	No Further Work
6256	T-6	1	Large Clearing Pile	Commercial Agriculture	Historic	D	No Further Work
6257	T-7	2	Berm and Historic Ditch	Commercial Agriculture	Historic	D	No Further Work

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APPENDIX H.

Cultural Impact Assessment Report

INTRODUCTION

Scientific Consultant Services (SCS), Inc. has been contracted by AKF Development to conduct a Cultural Impact Assessment on approximately 260 acres of land in Ukumehame and Waikapū Ahupua`a, Wailuku District, Maui Island, Hawai`i [TMK: 3-6-01:18] (Figure 1). According to information provided by the developers, a residential project that includes a mix of single-family and multi-family housing types. Amenities also include an open-space buffer along the highway and a 15-acre community oriented park connected to the neighborhoods by a pedestrian/bicycle path.

The Constitution of the State of Hawai`i clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of native Hawaiians. Article XII, Section 7 requires the State to "protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua`a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778" (2000). Beginning in 1850 with establishment of Hawai`i Revised Statutes (HRS) 7-1, native Hawaiians were given access rights to undeveloped private property and waterways in order to gather specific natural resources for customary uses. In 1992, the State of Hawai`i Supreme Court, reaffirmed HRS 7-1 and expanded it to include, "native Hawaiian rights…may extend beyond the ahupua`a in which a native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner" (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

Act 50, enacted by the Legislature of the State of Hawaii (2000) with House Bill 2895, relating to Environmental Impact Statements, proposes that:

> …there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights…[H.B. No. 2895].

Act 50 requires state agencies and other developers to assess the effects of proposed land use or shoreline developments on the "cultural practices of the community and State" as part of the HRS Chapter 343 environmental review process (2001). Its purpose has broadened, "to promote and protect cultural beliefs, practices and resources of native Hawaiians [and] other

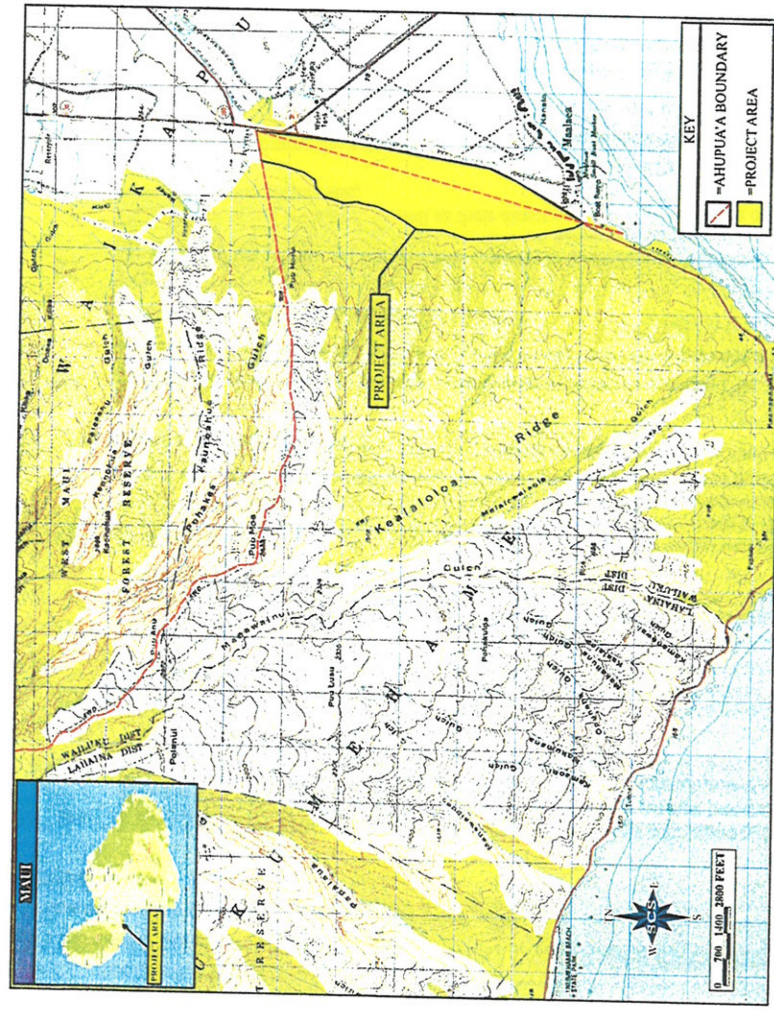

Figure 1: USGS Quadrangle Map Showing the Project Area.

ethnic groups, and it also amends the definition of 'significant effect' to be re-defined as "the sum of effects on the quality of the environment including actions that are...contrary to the State's environmental policies...or adversely affect the economic welfare, social welfare, or cultural practices of the community and State" (H.B. 2895, Act 50, 2000). Thus, not only are properties evaluated for impact to Native Hawaiians, but also for other ethnic groups as well.

Act 50 requires an assessment of cultural practices to be included in the Environmental Assessments and the Environmental Impact Statements, and to be taken into consideration during the planning process. The concept of geographical expansion is recognized by using, as an example, "the broad geographical area, e.g. district or *ahupua'a*" (OEQC 1997). It was decided that the process should identify 'anthropological' cultural practices, rather than 'social' cultural practices. For example, *limu* (edible seaweed) gathering would be considered an anthropological cultural practice, while a modern-day marathon would be considered a social cultural practice..

According to the Guidelines for Assessing Cultural Impacts established by the Hawaii State Office of Environmental Quality Control (OEQC 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both manmade and natural which support such cultural beliefs.

This Cultural Impact Assessment involves evaluating the probability of impacts on cultural values and rights within the project area and its vicinity.

METHODOLOGY

This Cultural Impact Assessment was prepared in accordance with the methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 1997). In outlining the "Cultural Impact Assessment Meodology", the OEQC state:

> ...information may be obtained through scooping, community meetings, ethnographic interviews and oral histories...[1997].

This report contains archival and documentary research, as well as communication with organizations having knowledge of the project area, its cultural resources, and its practices and beliefs. This Cultural Impact Assessment was prepared in accordance with the methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 1997). The assessment concerning cultural impacts should address, but not be limited to, the following matters:

(1) a discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints of limitations with might have affected the quality of the information obtained;

(2) a description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken;

(3) ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained;

(4) biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area;

(5) a discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken, as well as the particular perspective of the authors, if appropriate, any opposing views, and any other relevant constraints, limitations or biases;

(6) a discussion concerning the cultural resources, practices and beliefs identified, and for the resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site;

(7) a discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project;

(8) an explanation of confidential information that has been withheld from public disclosure in the assessment;

(9) a discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs;

(10) an analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place, and;

(11) the inclusion of bibliography of references, and attached records of interviews which were allowed to be disclosed.

Based on the inclusion of the above information, assessments of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

ARCHIVAL RESEARCH

Archival research focused on a historical documentary study involving both published and unpublished sources. These included legendary accounts of native and early foreign writers; early historical journals and narratives; historic maps and land records such as Land Commission Awards, Royal Patent Grants, and Boundary Commission records; historic accounts, and previous archaeological project reports.

INTERVIEW METHODOLOGY

When appropriate, interviews are conducted in accordance with Federal and State laws and guidelines. Individuals and/or groups who have knowledge of traditional practices and beliefs associated with a project area or who know of historical properties within a project area are sought for consultation. Individuals who have particular knowledge of traditions passed down from preceding generations and a personal familiarity with the project area are invited to share their relevant information. Often people are recommended for their expertise or can be located by visiting the area. Organizations, such as Hawaiian Civic Clubs, the Island Branch of Office of Hawaiian Affairs, historical societies, Island Trail clubs, and Planning Commissions are invited to contribute their input and suggest further avenues of inquiry, as well as specific individuals to interview.

When interviewees are identified, a standard procedure follows. Personal interviews are taped and then transcribed. These draft transcripts are returned to each of the participants for their review and comments. After corrections are made, each individual signs a release form, making the information available for this study. Key topics discussed with the interviewees vary from project to project, but usually include: personal association to the *ahupua`*a, land use in the project's vicinity; knowledge of traditional trails, gathering areas, water sources, religious sites;

place names and their meanings; stories that were handed down concerning special places or events in the vicinity of the project area; evidence of previous activities identified while in the project vicinity.

In this case, the project area had been used for ranching and agriculture for over 100 years. Letters, briefly outlining the development plans along with maps of the project area, were sent to organizations whose jurisdiction includes knowledge of the area with an invitation for consultation. Consultation was sought from the Maui Office of Hawaiian Affairs, Community Resource Coordinator, Maui; the Office of Hawaiian Affairs, O`ahu; Cultural Resource Planner for the Maui Planning Department; and the Central Maui Civic Club. Based on this research, an assessment of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

PROJECT AREA AND VICINITY

The project area comprises approximately 260 acres of land situated *mauka* of Honoapi`iland Highway from Ma`alaea Harbor to near the Kuihelani Highway on the lower eastern slope of Pu`ū Kukui in the *ahupua`a* of Ukumehame, with its eastern most section in the *ahupua`a* of Waikapū, West Maui (Figure 2). Ukumehame is bounded on the west by Olowalu Ahupua`a and on the east by Waikapū Ahupua`a. The *makai* portion of the project area is bounded on the east by Ma`alaea Harbor, on the west by rocky, uncultivated abandoned ranch land, and to the south by more abandoned ranch land.

CULTURAL HISTORICAL CONTEXT

The island of Maui ranks second in size of the eight main islands in the Hawaiian Archipelago. Pu`u Kukui, forming the west end of the island (1,215 m above mean sea level), is composed of large, heavily eroded amphitheater valleys that contain well-developed permanent stream systems that watered fertile agricultural lands extending to the coast. The deep valleys of West Maui and their associated coastal regions have been witness to many battles in ancient times and were coveted productive landscapes. Waikapū was the most southwestern valley of the Na Wai Eha (The Four Streams), a region that was famous as the largest continuous area of wet taro cultivation in the islands (Handy 1940:107).

PAST POLITICAL BOUNDARIES

Traditionally, the division of Maui's lands into districts (*moku*) and sub-districts was performed by a *kahuna* (priest, expert) named Kalaiha`ōhia, during the time of the *ali`i* Kaka`alaneo (Beckwith 1940:383; Fornander places Kaka`alaneo at the end of the 15th century or

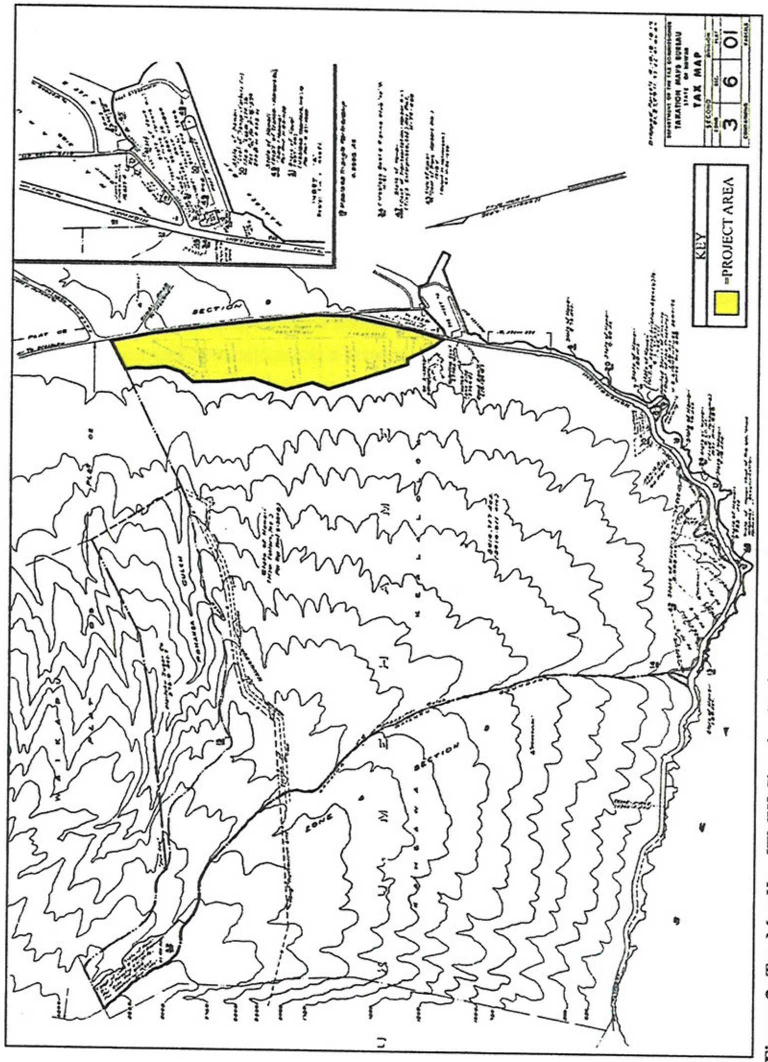

Figure 2: Tax Map Key [TMK] Showing Project Area Location.

the beginning of the 16th century [Fornander 1919–20, Vol. 6:248]). Land was considered the property of the king or *ali`i `ai moku* (the *ali`i* who eats the island/district), which he held in trust for the gods. The title of *ali`i `ai moku* ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted, his higher chiefs received large parcels from him and, in turn, they distributed smaller parcels to lesser chiefs. The *maka`āinana* (commoners) worked the individual plots of land.

In general, several terms, such as *moku, ahupua`a, `ili* or *`ili`* *āina* were used to delineate various land sections. A district (*moku*) contained smaller land divisions (*ahupua`a*) that customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the *ahupua`a* were therefore able to harvest from both the land and the sea. Ideally, this situation allowed each *ahupua`a* to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The *`ili `āina* or *`ili* were smaller land divisions next in importance to the *ahupua`a* and were administered by the chief who controlled the *ahupua`a* in which it was located (Lyons 1875:33; Lucas 1995:40). The *mo`o`āina* were narrow strips of land within an *`ili*. The land holding of a tenant or *hoa `āina* residing in an *ahupua`a* was called a *kuleana* (Lucas 1995:61). The project area is located in the *ahupua`a* of Ukumehame, meaning literally *paid mehame wood* (most likely referring to the prevalence of the *mehame* [*Antidesma Platyphyllum*] tree prized in ancient times for anvils on which to pound *olonā* [*Touchardia* sp.] and for the red dye made from its fruits), and Waikapū, or *water of the conch* (referring to a special conch shell in the legend of Puapua-lenalena; Pukui *et al*.:214, 223, Rock 1974).

TRADITIONAL SETTLEMENT PATTERNS

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various *ahupua`a*. During pre-Contact times, there were primarily two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys, like those present in the western portion of Ukumehame, provided ideal conditions for wetland *kalo* (*Colocasia esculenta*) agriculture, which included pond fields and irrigation canals. Other cultigens, such as *kō* (sugar cane, *Saccharum officinaruma*) and *mai`a* (banana, *Musa* sp.), were also grown and, where appropriate, such crops as *`uala* (sweet potato, *Ipomoea batatas*) were produced. This was the typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985). Agricultural development on the leeward side of Maui was likely to have begun early in what is known as the Expansion Period (A.D. 1200–1400 [Kirch 1985]).

WAHI PANI (LEGENDARY PLACES)

Scattered amongst the agricultural and habitation sites were other places of cultural significance to the *kama`āina* of the district. At least three *heiau* were recorded in Ukumehame Ahupua`a. Fishing *ko`a* (shrine) were present at Pā Ko`a beach (presently known as Ukumehame Beach Park) and petroglyphs were inscribed on mountain boulders, the meanings of which have yet to be fully understood (Thrum 1908, 1916, 1917; Walker 1930).

Trails extended from the coast to the mountains, linking the two for both economic and social reasons. A trail known as the *alanui* (or, *King's Trail*), which was built by Kihapi`ilani, extended along the coast passing through all the major communities between Lāhainā and Mākena. A path along Kealaloa ridge leads to the summit of Pu`u Kukui, the headwaters of the Pohakea and Ukumehame streams, and beyond. The Lahaina Pali Trail, constructed in 1841, provided access to other parts of the island.

Most of the *ahupua`a* on the coast have been overshadowed by the famous roadstead and village of Lāhainā, which served as the capitol of the Hawaiian Kingdom after the conquest of Kamehameha until 1855. The ethnographic and historic literature, often our only link to the past, reveals that the lands around Lāhainā were rich agricultural areas irrigated by aqueducts originating in well-watered valleys with permanent occupation predominately on the coast. Handy and Handy have stated the space cultivated by the natives of Lāhainā (district) at about "…three leagues [9 miles] in length, and one in its greatest breadth. Beyond this all is dry and barren; everything recalls the image of desolation" (1972:593). Crops cultivated included coconut, breadfruit, paper mulberry, banana, taro, sweet potato, sugar cane, and gourds.

Ukumehame Valley, with its permanent stream was one of the sources along with Olowalu, Launiupoko, and Kaua`ula, providing agricultural opportunities for the growing leeward population. Handy and Handy reported:

> Southeastward along the coast from the *ali`i* settlement were a number of areas where dispersed populations grew taro, sweet potato, breadfruit and coconut on the slopes below and in the sides of valleys which had streams with constant flow. All this area, like that around and above Lahaina, is now sugar-cane land. Ukumehame had extensive terraces below its canyon, some of which were still planted with taro in 1934; these terrace systems used to extend well down below the canyon…[1972].

The western portion of Ukumehame Ahupua`a offered beach and mountain habitation, as well as agricultural areas along the stream banks and in the southern marshy section close to the coast. Land was valuable in this section and 44 claims for land were made during the Great Māhele (Waihona `Aina 2004). Claimants for some parcels included several illustrious individuals who, although living in Lāhainā, claimed Ukumehame resources (David Malo, Charles Kanaina, etc.; McGerty and Spear 2005). Unlike the typical settlement, reflecting patterns of upland agriculture and coastal house sites, Ukumehame appears to have no distinct activity zones. House lots are found throughout the *ahupua`a* and *lo`i* are not only found along the stream, but continue into the plains fed by *`auwai* that is still extant (Devereux *et al* 1999).

However, the slope where the present project area is located faces east and is much drier than higher elevations to the west that receive as much as twenty times the level of precipitation. Air temperatures are consistently slightly warmer here than the Maui seasonal high and low averages, mostly due to the lower, coastal elevation. Four *mauka-makai* drainages cross the project area. In traditional times, it is likely that these narrow watercourses only flowed in times of heavy rains providing some moisture for marginal agriculture.

Closer to the current project area, in the southwest corner of Wailuku District, prehistoric settlement was not as dense as concentrations to the north. Climate had much to do with that trend, as the Ma`alaea area is a more arid environment than the rain-soaked fields to the north. According to Tomonari-Tuggle and Tuggle (1991), the majority of the pre-Contact population was located southwest of the project area, near what is now Ukumehame Beach State Park. Settlement was also probable north of Kealia Pond in Waikapu Ahupua`a. Handy and Handy report that before the historic sugar cane plantations were established in this region, water from Waikapu Stream "was diverted into lo`i and its overflow was dissipated on the dry plains of the broad isthmus between West and East Maui" (1972:496).

THE GREAT MĀHELE

In the 1840s, traditional land tenure shifted drastically with the introduction of private land ownership based on Western law. While it is 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 (Kame`eleihiwa 1992:169–70, 176; Kelly 1983:45, 1998:4; Daws 1962:111; Kuykendall 1938 Vol. I:145). The Great Māhele of 1848 divided Hawaiian lands between the king, the chiefs, the government, and began the process of private ownership of lands. The subsequently awarded parcels were called Land Commission Awards (LCAs). Once lands were thus made available and private ownership was instituted, the *maka`āinana* (commoners), if they had been made aware of the procedures, were able to claim the plots on which they had been cultivating and living. These claims did not include any previously cultivated but presently fallow land, *`okipū* (on O`ahu), 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 LCA and issued a Royal Patent, after which they could take possession of the property (Chinen 1961:16). There were 44 claims for land in Ukumehame during the Māhele, but none were in or near the project area (Waihona `Aina 2004). Seventeen *`ili* were also named and some of the *ahupua`a* became government land to sell as they saw fit.

Sugar was to be the economic future of Hawai`i and as early as 1828, two Chinese brothers, Ahung and Atai, of Honolulu's Hungtai Company, arrived in Wailuku to explore the possibility of setting up one of its earliest sugar mills. Atai soon created a plant that processed sugar cane cultivated by Hawaiians, named the Hungtai Sugar Works (Dorrance and Morgan 2000:15–16). Ahung then joined Kamehameha III's sugar producing enterprise, although by 1844 both operations had ceased. The Wailuku Sugar Company was the next to follow, in 1862, and would expand sugar production over the next 126 years of its existence—4,450 acres by 1939, still more than three decades before its maximum production levels.

As it expanded its territory, the Wailuku Sugar Company first appeared on maps of the project area in the in the 1920s (Bureau of Conveyances, Grant 9794), although their acquisition of the project area land may have been as early as the turn of the century (Kennedy and Trimble 1992:4). Successive grants (Grant 10294 through to Grant S-13975) would follow in decades following and fully encompass the Ukumehame Ahupua`a side of the project area to Wailuku sugar land. Kennedy and Trimble (1992:4) summarize the history of the Waikapu Ahupua`a (*makai*) portion of the project area by detailing its acquisition from the state government on November 18, 1875 by Henry Cornwell (Grant 3152). Cornwell subsequently sold to Claus Spreckels, and by the turn of the century, the entire project area was under sugar cane cultivation.

Wailuku Sugar Company ended production in 1988, having averaged over 30,000 tons of sugar produced annually at its pinnacle in the 1970s (Dorrance and Morgan 2000:66). Owner C. Brewer and Company, Ltd. shut down sugar cultivation on the project area, which was then used almost entirely for pineapple cultivation starting no later than 1992 (Kennedy and Trimble 1992:1). The lands were under pineapple for at least the next three years (Tomonari-Tuggle

1995:11)—probably slightly longer—before shifting to smaller-scale 'garden' plots. Recently, a few plots of land in the southern portion of the project area were leased. These agricultural ventures have included banana trees, gourds, and papaya. Portions of the upper valley of Ukumehame have been used for cattle grazing and, from the 1970s to the present time, there have been a number of families cultivating plants along the stream gulch. The traditional Hawaiian *`auwai* has been repaired and is now utilized for *lo`i kalo* irrigation. Now that sugar is longer an issue, the stream has found its way to the coast, reviving the stream's ecosystem.

The current project area was utilized as a segment of an important trail system in the early 1800s, and probably prehistorically as well. The Lahaina Pali Trail is five miles long and crosses the southern slopes of the West Maui Mountains between Olowalu and Ma`alaea. The start of this trail, now a demonstration trail as part of the Na Ala Hele Trail System, borders the current project area near the center of the *mauka* border. By the historic period in which the trail's significance as a probable prehistoric route was realized, the portion *makai* of the current trail head (*i.e.*, the portion transecting the width of the current project area) was already destroyed by sugarcane cultivation. Thus, the trail starts immediately outside the project area, within the state-owned lands. A 1991 study by Tomonari-Tuggle and Tuggle documented 18 archaeological sites upon the trail, the majority of historic origin (Figure 3).

SUMMARY ANDCULTURAL ASSESSMEMNT

As suggested in the "Guidelines for Accessing Cultural Impacts" (OEQC 1997), CIAs incorporating personal interviews should include ethnographic and oral history interview procedures, circumstances attending the interviews, as well as the results of this consultation. It is also permissible to include organizations with individuals familiar with cultural practices and features associated with the project area.

The "level of effort undertaken" (OEQC 1997) has not been officially defined and is left up to the investigator. To SCS, a good faith effort means contacting agencies by letter, interviewing people who may be affected by the project or who know its history, researching sensitive areas and previous land use, holding meetings in which the public is invited to testify, notifying the community through the media, and other appropriate strategies based on the type of project being proposed and its impact potential. In the case of the present parcel that has been agricultural for over 100 years, letters of inquiry were sent to organizations whose expertise would include the project area. Consultation was sought from the Maui Office of Hawaiian Affairs, Community Resource Coordinator, Maui; the Office of Hawaiian Affairs, O`ahu;

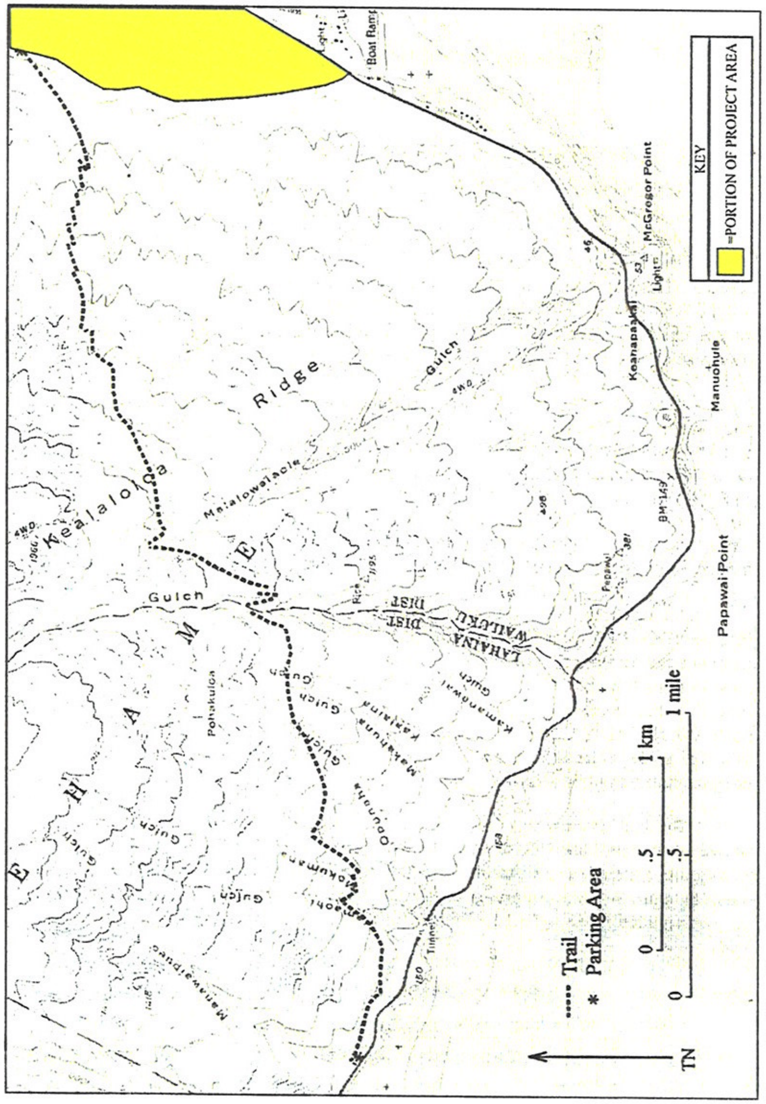

Figure 3: Map Showing Trail and Portion of Project Area.

Cultural Resource Planner for the Maui Planning Department; and the Central Maui Civic Club. Archival research included historical and cultural resources.

Additionally, historical and cultural source materials were also consulted were extensively used and can be found listed in the References Cited portion of the report. Such scholars as Thrum (1908, 1916 1917), Fornander (1919, 1969), Walker (1930), Kuykendall (1938), Beckwith (1940), Chinen (1961), Handy and Handy (1972), Puku`i *et al.* (1974), Kelly (1983, 1998), and Kame`eleihiwa (1992) have contributed, and continue to contribute, to our knowledge and understanding of Hawai`i, past and present. The works of these and other authors were consulted and incorporated in the report where appropriate. Land use document research was supplied by the Waihona `Aina Data base (2004).

Analysis of the potential effect of the project on cultural resources, practices or beliefs, the potential to isolate cultural resources, maintain practices or beliefs in their original setting, and the potential of the project to introduce elements that may alter the setting in which cultural practices take place is a requirement of the OEQC (No. 10, 1997). The project area has not been used for traditional cultural purposes within recent times. Based on historical research and the responses of the Maui Office of Hawaiian Affairs; Community Resource Coordinator, Maui; the Office of Hawaiian Affairs, O`ahu; the Cultural Resource Planner for the Maui Planning Department; and the Central Maui Civic Club, it is reasonable to conclude that Hawaiian rights related to gathering, access or other customary activities will not be affected and there will be no direct adverse effect upon cultural practices or beliefs.

However, the visual impact of the project from surrounding vantage points, for example, the highway, mountain trails, and the ocean is intrinsically more difficult to evaluate. Indirectly, each development may not seem to necessarily impose a negative cultural impact, especially when located on parcels that had been in agriculture for a century. But it is important to recognize that native Hawaiian cultural beliefs and practices are continually affected by the loss of land to development that intrudes into the natural setting and alters the landscape. These changes may affect certain cultural practices outside the project area. The custom of fishermen using certain landforms to triangulate secret, family fishing *ko`a* at sea, is an example of this affect. Maui has seen the development process intensify dramatically in the last 30 years, a trend that suggests the eventual permanent loss of traditional landscapes.

Documents submitted to SCS by AKF Development propose a residential project that will include a mix of single-family and multi-family housing types. Amenities also include an open-space buffer along the highway and a 15-acre community-oriented park linked to the neighborhoods with a pedestrian/bicycle path. Based on the response from various organizations and through archival research, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to gathering, access or other customary activities will not be affected by development activities on Parcel 18. It is recommended that Cultural Advisors be consulted during the planning process. In this way, appropriate mitigation measures, if needed, can be put in place before development occurs. However, because there were no activities identified, there are likely no adverse effects.

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APPENDIX I.

Economic Impact Assessment Report

MA'ALAEA MAUKA RESIDENTIAL SUBDIVISION: ECONOMIC AND FISCAL IMPACTS

DECISION ANALYSTS HAWAI'I, INC.

MA'ALAEA MAUKA RESIDENTIAL SUBDIVISION: ECONOMIC AND FISCAL IMPACTS

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EXECUTIVE SUMMARY

1. PROPOSED DEVELOPMENT

Ma'alaea Mauka, LLC proposes to develop Ma'alaea Mauka Residential Subdivision ("the Project"), a master-planned residential community on a 257-acre site located in the southeast corner of Central Maui. An additional 5 acres north of the Project will be used for a wastewater treatment plant. Some or all of the treated effluent will be dispersed on a nearby 85-acre site.

The Project will include about 949 homes, including: (1) about 144 custom homes built by buyers of lots, (2) about 355 4-bedroom conventional single-family homes, (3) about 164 4-bedroom patio homes, (4) about 100 3-bedroom townhouses, (5) about 126 2-bedroom apartments, and (6) about 60 senior-care 1-bedroom housing units. It is anticipated that a total of about 569 lots and homes (60% of the total) will be sold at prevailing market prices, including about 144 lots for custom homes, about 355 conventional single-family homes, and about 70 patio homes. The remaining 380 homes (40%) will be sold or rented at affordable prices and rents in compliance with the County's Residential Workforce Housing Policy.

The Project will also include a community center, a park, open space and buffer zones, a quasi-public facility, and interior roads.

Development is expected to occur over a 6-year period beginning in about 2010. However, development of the Project could require more or less time, depending on future market conditions and home sales.

2. MAJOR ECONOMIC AND FISCAL BENEFITS AND IMPACTS

a. Affordable Housing

Ma'alaea Mauka will contribute to more affordable home prices by supplying (1) about 380 homes (40% of the total) at affordable prices, and (2) about 569 homes at market prices in competition with other residential communities in Central Maui.

b. Employment, Development Activities

During the Project's 6-year development period, construction employment is expected to average about 280 jobs, resulting in about 2,680 man-years of effort to build the homes (280 jobs x 6 years). It is expected that the construction jobs for the Project will be filled by workers already living on Maui. As other construction projects are completed on the island, Maui construction workers will be hired to work on the various components of the Project, then move on to other projects. Thus, the Project will help keep Maui's existing construction workers employed.

Indirect employment related to Project development is expected to average about 270 jobs on Maui and 160 jobs on O'ahu. Thus, total direct-plus-indirect employment associated with Project development activities will average about 710 jobs, of which about 550 jobs will be on Maui. The actual job count will fluctuate over time, depending on the pace of construction.

c. Fiscal Impacts

<u>County</u>

Project development activity will result in a net expenditure by the County of about $2.1 million for park improvements. Assuming that this expenditure is financed with bonds, the debt service at full development will be about $160,000 per year.

At full development, net expenditures by the County to support the Project, including debt service on parks and general unspecified improvements, are expected to average about $399,000 per year. Such net expenditures are normal for a typical residential community that have a large number of lower-value affordable homes, a large number of owner-occupied homes (71% for the Project) that qualify for the County's $300,000 homeowner's exemption, and the County tax structure which taxes homeowners at a comparatively low rate. By design, services provided by the County to residents of typical communities are subsidized by tax revenues from resort, resort-residential, commercial, and industrial properties.

<u>State</u>

Unlike the County, the State derives substantial net revenues from development activity. Over the 6-year construction period, the State will net about $15.8 million from Project development activities, or an average of about $2.6 million per year. Net revenues are high because of the amount of economic activity associated with building and selling the homes.

At full development, net expenditures by the State to support the Project are expected to average about $1.3 million per year. Such net expenditures are normal for a typical residential community having a large number of lower-value affordable homes with families having lower incomes and lower expenditures on consumption, and who have school-age children. By design, services provided by the State to residents of typical communities are subsidized by tax revenues derived from property development, visitors, higher-income families, and commercial activities.

MA'ALAEA MAUKA RESIDENTIAL SUBDIVISION: ECONOMIC AND FISCAL IMPACTS

1. INTRODUCTION[1,2]

a. Content and Purpose

Ma'alaea Mauka, LLC proposes to develop Ma'alaea Mauka Residential Subdivision ("the Project"), a master-planned residential community on a 257-acre site located in the southeast corner of Central Maui—see Figures 1 and 2 for the location of the Project, and Figure 3 for the proposed development. An additional 5 acres north of the Project will be used for a wastewater treatment plant. Some or all of the treated effluent will be dispersed on a nearby 85-acre site.

The Project is within the State Agricultural District (Figure 4), and County of Maui ("County") zoning for the Project site is "Agricultural." However, the *Kihei-Makena Community Plan* designates the site as a residential Project District referred to as "Project District 12" (Figure 5). Development of the Project will require (1) a State Land Use Boundary Amendment to change the districting from Agricultural to Urban, (2) Project District Approval pursuant to Chapter 19.45 of the Maui County Code, and (3) changes in zoning to conform with the *Kihei-Makena Community Plan.*

This report addresses the economic and fiscal benefits and impacts of the Project. Its purpose is to provide State and County officials with information relevant to their decisions about State districting and County approvals and zoning.

The economic impacts cover sales and expenditures, profits, employment, and payroll related to the (1) development activities and (2) operations at full development of the Project.

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

b. Methodology

Multipliers

The proposed development is translated into economic and fiscal impacts based on a number of multipliers (for example, average price per home of a given type, indirect sales as a percentage of direct sales, jobs per $1 million in sales, indirect jobs per direct jobs, and tax rates).

The multipliers used reflect the professional judgment of the consultant, and were derived based on information from the following sources: Hawai'i projects similar to the proposed Project; U.S. Census data for Maui; the *State of Hawai'i Data Book;* the County's Workforce Housing Policy; *The 2002 Input-Output Study for Hawai'i; The Hawai'i Inter-County Input-Output Study: 2002 Benchmark Report;* employment and labor rates from the State Department of Labor and Industrial Relations (DLIR); County and State tax rates; and revenue and expenditure data from the County and the State.[3-8]

2007 Dollars

Throughout the report, dollar amounts are expressed in terms of 2007 purchasing power and market conditions. Values, prices, costs and dollar amounts for prior years are adjusted for inflation to 2007 dollars based on the Honolulu Consumer Price Index (CPI) for Urban Consumers.[4] Dollar amounts after 2007 are not increased to account for inflation, appreciation in property values, changes in labor rates, changes in building costs, or other changes in market conditions.

Accuracy of Estimates

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

c. Organization of the Report

The material below gives the following information about the Project and its economic and fiscal impacts: the location of the Project site, a summary of the economic impacts on current agricultural operations, a description of the

Project, the economic impacts of the Project's development activities, the economic impacts of the Project at full development, the impact on County revenues and expenditures, the impact on State revenues and expenditures, and a summary of major economic and fiscal benefits and impacts.

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

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

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

d. Economic Consultant

The analysis was conducted by Decision Analysts Hawai'i, Inc., a Hawai'i-based economic-consulting firm established in 1979, and specializing in economic development, land and housing economics, feasibility studies, valuations, market analysis, public policy analysis, and the economic and fiscal impacts of projects.

2. LOCATION OF THE PROJECT SITE[1]

As in Figure 1, the Project site is located in the southwestern portion of Central Maui near Ma'alaea Small Boat Harbor. Figure 2 shows a closer view of the site location and its Tax Map Key: (2) 3-6-01: 018.

The wastewater treatment plant for the Project will be located on a 5-acre site that is mauka and north of the intersection of Honoapi'ilani and Kuihelani Highways, and abutting Honoapi'ilani Highway. This treatment plant will be located over 600 feet north of the Project.

Also, the 85-acre effluent dispersal site is north of the treatment plant and mauka of Honoapi'ilani Highway. The site abuts both the treatment plant and the highway.

3. ECONOMIC IMPACTS ON CURRENT AGRICULTURAL OPERATIONS[9]

The Project site is currently leased to Maui Cattle Company for grazing cattle. This company is a partnership of seven ranches on Maui that, in combination, graze about 5,500 mother cows on about 60,000 acres, and employ about 60 ranch hands (about 1 job per 1,000 acres). Depending on rainfall, the Project site is used seasonally to grow out about 300 weaned calves to heavier weights. The Ma'alaea Mauka operation requires the part-time effort of a single land manager who makes sure that the cattle have water, fences have not been breached, etc.

Development of the Project will remove about 257 acres of Maui Cattle Company grazing land. However, the company anticipates no significant impact from this small reduction in their grazing land, including no significant impact on the size of their herd, production, revenues, employment or payroll.

4. PROJECT DESCRIPTION[1,2]

a. Overview

The Ma'alaea Mauka Residential Subdivision is a 257-acre master-planned residential development that will provide about 949 market and affordable residential units on about 166 acres (see Table 1 and Figure 3). The remainder of the parcel will include a community center, a park, open space and buffer zones, a quasi-public facility, and interior roads. As mentioned above, about 5 acres north of the Project site will be used for a wastewater treatment plant.

b. Homes, by Type[10,11]

The anticipated number of homes by type is summarized in Section 1.b. of Table 1. As indicated, the Project will include about 949 homes, including about 663 single-family (SF) homes, about 226 multi-family (MF) homes, and about 60 senior-care 1-bedroom housing units.

The single-family homes will include: (1) about 144 custom homes built by buyers of lots, (2) about 355 4-bedroom conventional single-family homes, and (3) about 164 4-bedroom patio homes. The patio homes will be single-family homes that share a common landscaped areas, and are legally defined as condominium units.

The multi-family homes will include: (1) about 100 3-bedroom townhouses and (2) about 126 2-bedroom apartments.

Depending on market conditions and County housing requirements, the mix and sizes of these units could change.

c. Market Homes

It is anticipated that a total of about 569 lots and homes (60% of the total) will be sold at prevailing market prices, including about 144 lots for custom homes, about 355 conventional single-family homes, and about 70 patio homes.

About 425 of these homes (45% of the total) will be sold at market prices above $600,000, including about 355 conventional single-family homes and 70 patio homes (see Table 2, Section 2.e for anticipated lot prices and home prices). The lots for custom homes will be sold for under $600,000.

d. Affordable Homes

Since fewer than than half of the total number of lots and homes in the Project will sell for under $600,000, the County's Residential Workforce Housing Policy requires that 40% of the units (380 homes) be sold or rented at affordable prices.

Affordable Homes Sold to Owner-Occupants

For the affordable homes that are sold, the Housing Policy requires the following allocation:

- 20% of the units shall be sold at prices affordable to families earning "gap incomes" (i.e., incomes from 140% to 160% of the median Maui family income).
- 20% of the units shall be sold at prices affordable to families earning "above moderate incomes" (i.e., incomes from 120% to 140% of the median Maui family income).
- 30% of the units shall be sold at prices affordable to families earning "moderate incomes" (i.e., incomes from 100% to 120% of the median Maui family income).
- 30% of the units shall be sold at prices affordable to families earning "below-moderate incomes" (i.e., incomes from 80% to 100% of the median Maui family income).

As shown in Table 1, Section 1.b, about 194 of the homes in the Project would be sold at affordable prices as follows:

- About 39 (20%) 4-bedroom patio homes will be priced for gap-income families.

— About 39 (20%) 4-bedroom patio homes will be priced for above-moderate-income families.

— About 16 (8%) 4-bedroom patio homes will be priced for moderate-income families.

— About 42 (22%) 3-bedroom town homes will be priced for moderate-income families.

— About 58 (30%) 3-bedroom town homes will be priced for below-moderate-income families.

Affordable Rentals

For the affordable homes that are rented, the Housing Policy requires the following allocation:

— 33.3% of the units shall be rented at rates affordable to families earning "moderate incomes" (i.e., incomes from 100% and 120% of the median Maui income).

— 33.3% of the units shall be rented at rates affordable to families earning "below-moderate incomes" (i.e., incomes from 80% and 100% of the median Maui income).

— 33.3% of the units shall be rented at rates affordable to families earning "very low incomes or low incomes" (i.e., incomes below 80% of the median Maui income).

As shown in Table 1, Section 1.b, about 186 of the homes in the Project will be rented at affordable rents as follows:

— About 62 (33.3%) 2-bedroom apartments will be rented to moderate-income families.

— About 62 (33.3%) 2-bedroom apartments will be rented to below-moderate-income families.

— About 2 (1.1%) 2-bedroom apartments will be rented to low-income families.

— About 60 (32.3%) 1-bedroom senior-care housing units will be rented to low-income families.

Most of the affordable homes will probably require developer subsidies derived from profits on the market-priced homes.

5. ECONOMIC IMPACTS OF DEVELOPMENT ACTIVITIES

The development of the Project will involve the following activities: (1) grading and other work to prepare the site for development; (2) construction of internal roads, water delivery systems, sewer systems, utilities systems, a wastewater treatment plant, etc.; (3) construction and sale of single-family and multi-family homes; (4) sale of improved lots for custom homes; (5) construction of custom homes; and (6) construction of rental apartments and senior care housing. Table 2 summarizes the direct and indirect economic impacts of these development activities. The material in the table gives the development period, construction expenditures, indirect sales generated by the construction activity, property sales and values, profits, employment and payroll, and the number of residents and homes supported by the development activities.

a. Development Period

As indicated in Table 2, Section 2.a, development is expected to occur over a 6-year period beginning in about 2010. However, development of the Project could require more or less time, depending on future market conditions and home sales.

b. Construction Expenditures

Over the 6-year development period, total construction expenditures for the Project are estimated at about $349 million based on the average cost for each type of home as shown in Table 2, Section 2.b. This translates into average construction expenditures of about $58.1 million per year. In practice, construction expenditures will vary from year to year.

Additional development costs not contained in the estimate include planning, permitting, design, financing, County and State exactions, marketing and sales commissions (see footnote for Table 2, Section 2.c).

c. Indirect Sales Generated by Construction Activity

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

Based on State economic multipliers, these indirect sales are expected to average about $47.6 million per year, of which about $26.7 million per year will be on Maui (see Table 2, Section 2.d.).

d. Home Prices and Property Sales

Home and lot sales are expected to reach about $490 million, or an average of about $81.6 million per year during the 6-year development period (Table 2, Section 2.e). As indicated in the table, average home prices are expected to range from about $325,000 for the affordable town homes to about $800,000 for the market-priced conventional single family homes.

Prices for market homes are based on similar products being sold in Central Maui.[10,12] Prices for the affordable homes are based on "Affordable Sales Price Guidelines" developed by the County of Maui.[13] These prices are based on the amount that is regarded as affordable taking into account the following: (1) Maui's estimated median family income of $69,900 per year in 2007, (2) adjustments for family incomes that are a given percentage higher or lower than the median, (3) the type of home (single-family homes can be priced higher than multi-family homes), (4) the number of bedrooms in a home (the homes with more bedrooms can be priced higher), and (5) the mortgage rate. For the prices shown in Table 2, Section 2.e, a Hula Mae mortgage rate of 4.5% was assumed.

e. Property Values at Full Development

At full development of the Project, the homes are expected to have a property value of about $607.5 million based on the average per-unit values shown in Table 2, Section 2.f. The values are the same as in Section 2.e except that the value of custom homes includes the value of both the lot and improvements. The value of rental units is based on the County's corresponding price for affordable homes that are sold instead of rented.

f. Summary of Expenditures and Sales

Section 2.g of Table 2 summarizes anticipated expenditures and sales. As indicated, combined home and lots sales, construction expenditures and indirect sales related to construction are expected to average about $187.3 million

per year during the 6-year development period. About $97.9 million per year will be subject to the 4% excise tax on final sales, while about $89.4 million per year will be subject to the 0.5% excise tax on intermediate sales. Development and sales in some years may be much higher or lower than the average, depending on market conditions.

g. Profits

Profits on these sales are estimated at about $21.6 million per year (Table 2, Section 2.h).

h. Employment

During the Project's 6-year development period, construction employment is expected to average about 280 jobs (Table 2, Section 2.i). Thus, the total effort to build the homes will require about 2,680 man-years of labor (280 jobs x 6 years).

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

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

Based on State employment multipliers, indirect employment related to Project development is expected to average about 270 jobs on Maui and 160 jobs on O'ahu. Thus, total direct-plus-indirect employment associated with Project development activities will average about 710 jobs, of which about 550 jobs will be on Maui. The actual job count will fluctuate over time, depending on the pace of construction.

i. Payroll

Development activities are expected to generate a total payroll of about $29.6 million per year, of which about $13 million will be for construction workers, about $9.9 million for indirect employment on Maui, and about $ 6.8 million for indirect employment on O'ahu (Table 2, Section 2.j). These estimates are based on the average number of direct and indirect jobs that will be supported and average wages as reported to the DLIR.

Wages will range from about $25,000 annually to over $100,000, and are expected to average about $45,800 per year for construction jobs, about $37,000 for indirect jobs on Maui, and about $41,500 for indirect jobs on O'ahu.

j. Supported Population and Housing

During the 6-year development period, direct and indirect jobs provided by Project construction will support about 1,510 residents housed in about 500 homes (Table 2, Sections 2.k and 2.l). About 590 residents and 200 homes will be supported by construction jobs, and the remainder will be supported by indirect jobs.

Most of the residents are expected to live on Maui: estimated at about 1,160 residents housed in about 390 homes. For the most part, development activities will support the families of many construction workers and other workers who already live on the island.

k. Sources of Construction Workers

As noted above, construction employment is expected to average about 280 jobs during the Project's 6-year development period. This is about 7% of the County's 3,770 construction jobs in 2005.[7] In view of this small percentage, it is expected that the construction jobs for the Project will be filled by workers already living on Maui. As other construction projects are completed on the island, Maui construction workers will be hired to work on the various components of the Project, then move on to other projects. Thus, the Project will help keep Maui's existing construction workers employed.

So long as the pace of Maui's economic and population growth, and its pace of development, does not accelerate, the number of construction jobs on Maui will not increase. In turn, few additional construction workers will be attracted to Maui.

l. Education, Job-Training and Placement Programs

Job training for construction workers and other workers who depend on development activity include the following: formal education and training programs, apprenticeship programs, and on-the-job training. High schools offer work-training programs for various trades, including trades related to construction and maintenance. At Maui Community College in Kahului, relevant courses include carpentry, electrical installation and maintenance, etc.[14]

Special programs to increase the number of construction workers appear to be unwarranted since (1) in terms of both number and type, these workers are already available on Maui; (2) existing programs are already in place to increase the number of these types of workers; and (3) a large increase in the number of these workers will not be needed inasmuch as the Project is not expected to accelerate the pace of development activity on Maui.

Job-placement programs for construction workers are offered by high schools, Maui Community College, and DLIR. Also, construction unions and informal networks already exist to inform available workers of employment opportunities. Thus, special job-placement programs are not warranted.

6. ECONOMIC IMPACTS OF AT FULL DEVELOPMENT

Table 3 summarizes the estimated number of people who will live or stay in homes in the Project at full development, and related economic activity at full development. As indicated above, full development is expected to occur about 6 years after construction starts.

a. Housing Uses and Characteristics, Assumptions

Section 3.a of Table 3 summarizes the assumptions that are used to estimate many of the impacts. For each type of home, the material covers:

— The percentage split between owner-occupied homes and rental homes.

- The average occupancy rate (i.e., the opposite of the vacancy rate).
- For occupied homes, the average number of occupants.
- For rented homes, the average monthly rent.
- The average household income.
- Anticipated consumption expenditures that are subject to the 4% excise tax.
- Average property values.

For market-priced owner-occupied homes, the family incomes shown in Section 3.a are sufficient to service a 30-year mortgage at a market rate of 5.9%, assuming a down payment of about 30% to 35% of the price of the home, and monthly mortgage payments that are about 28% of income. A high down payment is consistent with a family that is trading up from an existing home that has substantial equity due to past appreciation in the value of the home.

Market rents shown in Section 3.a are sufficient to service the mortgage of an investment owner. The corresponding family incomes are sufficient to pay rents that are slightly more than 30% of income.

For owner-occupied affordable homes, the family incomes shown in Section 3.a fall in ranges specified by the County based on each buyer's income group and the number of bedrooms.[13]

For rented affordable homes, the rents and family incomes shown in Section 3.a fall in ranges specified by the County based on each buyer's income group, family size, and the number of bedrooms.[15] These rents, which do not include utilities, are based on 30% of gross monthly income.

b. Housing Uses and Related Economic Activities

Section 3.b of Table 3 summarizes housing types and uses based on the given assumptions. The types of homes and the number of affordable homes are repeated from Table 1, Section 1.b.

As shown in Section 3.b, it is expected that, at full development, about 678 homes (71%) will be owned and occupied by residents, and about 271 homes (29%) will be rented.

These homes will house about 3,030 residents, including about 2,910 non-senior residents, about 120 senior residents, about 580 students enrolled in public schools, and about 1,520 workers.

Household income of residents living at Ma'alaea Mauka is projected to reach about $105.9 million per year at full development. Rents received on homes are expected to total about $6.7 million per year. Consumption expenditures are estimated at about $52.9 million per year. Corresponding profits on rents and consumption expenditures are estimated at about $6 million per year.

As previously mentioned, property values are estimated at about $607.5 million, of which about $491.3 million (81%) will be for owner-occupied homes and about $116.2 million (19%) for rented homes.

7. IMPACTS ON COUNTY REVENUES AND EXPENDITURES

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

a. Development Activities

Most of the County revenues derived from the Project development activities will come from impact fees and connect charges fees that will offset County expenditures on infrastructure and facilities. As with other major projects on Maui, the developer will provide or finance its fair shares of infrastructure and facilities to support the Project. This will include interior roads, water source development,, interior water distribution, drainage systems, sewer connections, collector sewers and trunks, a wastewater treatment plant, etc.

Regarding parks, the developer will comply with County requirements by providing about 15 acres of graded and landscaped land, along with a water system, a parking lot, and restrooms. This amounts to nearly 690 square feet of park space per home. It is expected that the County will provide remaining improvements, including playground equipment, a ball fields, tennis courts, etc. The Project's fair share of park improvement is estimated at about $2.1 million (Table 4, Section 4.b).

In addition, an allowance is made for general unspecified improvements that result in the same per-capita level of debt service as that carried by other Maui County residents. This debt service, which is shown in Table 4, Section 4.c., amounts to about $295,000 per year. Although not shown in Section 4.b, this level of debt service would support improvements costing about $3.9 million, assuming financing with a 20-year bond at an interest rate of about 4.25%.

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

As shown in Table 4, Section 4.b, Project development activity will result in a net expenditure by the County of about $2.1 million for park improvements. Assuming that this is financed with bonds, the debt service at full development will be about $160,000 per year. This expenditure is carried over to Section 4.c of Table 4 which addresses County revenues and expenditures derived from the Project at full development.

b. Full Development

At full development, the Project will generate increased revenues to the County of about $2.4 million per year (Table 4, Section 4.c). Most of this increase will come from property taxes: an increase of about $1.3 million per year above the $324 currently collected on the property.[16] An estimated $1.1 million per year in additional revenues will be derived from other taxes and user fees, which are assumed to be proportional to the number of residents in Ma'alaea Mauka. These taxes and fees include: fuel taxes, motor vehicle weight taxes, water fees, solid-waste disposal fees, other departmental earnings, other licenses and fees, etc.

County expenditures in support of operations are estimated at about $2.8 million per year. About $2.3 million of the expenditures will be on services, which are assumed to be proportional to the number of Ma'alaea Mauka residents. These services include: general government, police, fire, road maintenance, operations and maintenance (O&M) of water delivery, solid waste disposal, recreation, etc. And as previously mentioned, there will be debt service of about $160,000 per year for park improvements, and a debt-service allowance of about $295,000 per year for general unspecified improvements. The resulting debt service will result in about the same per-capita level of debt service as that carried by other residents of the County.

At full development, net expenditures by the County to support the Project are expected to average about $399,000 per year. Such net expenditures are normal for a typical residential community that have a large number of lower-value affordable homes (40% for the Project), a large number of owner-occupied homes (71% for the Project) that qualify for the County's $300,000 homeowner's exemption, and the County tax structure which taxes homeowners at the low rate of $2.50 per $1,000 of assessed value. Other property owners do not quality for a homeowner's exemption, and are taxed at far higher rates: $5 per $1,000 assessed value for apartments and rented homes, $8.20 for hotels and resorts,

$14 for time-shares, $6 for commercial property, and $6.50 for industrial property. By design, services provided by the County to residents of typical communities are subsidized by tax revenues from resort, resort-residential, commercial, and industrial properties.

8. IMPACTS ON STATE REVENUES AND EXPENDITURES

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

a. Development Activities

State revenues derived from Project development activities generate about $39.1 million over the 6-year development period (Table 5, Section 5.b). Most of the revenues will be derived from (1) school impact fees, (2) conveyance taxes, (3) excise taxes, and (4) corporate and personal income taxes.

State expenditures to support Project development activities are expected to total about $23.3 million over the 6-year development period. The major expenditures will be on schools. Other infrastructure and facilities to support the Project are primarily a County responsibility, with most of the fair share provided or financed by the developer.

In addition, an allowance is made for general unspecified improvements that result in the same per-capita level of debt service as carried by other residents in the State. This debt service, which is shown in Table 5, Section 5.c., amounts to about $667,000 per year. Although not shown in Section 5.b, this level of debt service would support improvements that cost about $8.9 million, assuming financing with a 20-year bond at an interest rate of about 4.25%.

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

Unlike the County, the State derives substantial net revenues from development activity. Over the 6-year construction period, the State will net about $15.8 million from Project development activities, or an average of about $2.6 million per year. Net revenues are high because of the amount of economic activity associated with building and selling the homes.

b. Full Development

At full development, the Project will generate revenues to the State of about $14 million per year (Table 5, Section 5.c). State revenues will include excise taxes, corporate and personal income taxes, and other revenues which are assumed to be proportional to the number of residents in the Project. Other revenues include: other sales taxes (cable television, telephone, etc.); fuel taxes; charges for various licenses, permits, and services; departmental earnings; etc.

State expenditures in support of the residents are estimated at $15.3 million per year, including about $6.7 million for education (K through 12), about $8 million for other services, and about $667,000 for debt services on general improvements. Other services include general government, university and adult education, health, highway maintenance, natural resources, parks and recreation, and miscellaneous expenditures. As previously mentioned, the debt service on general improvements will result in about the same per-capita level of debt service as carried by other residents in the State.

At full development, net expenditures by the State to support the Project are expected to average about $1.3 million per year. Such net expenditures are normal for a typical residential community having a large number of lower-value affordable homes (40% for the Project) with families having lower incomes and lower expenditures on consumption, and who have school-age children. By design, services provided by the State to residents of typical communities are subsidized by tax revenues derived from property development, visitors, higher-income families, and commercial activities.

9. SUMMARY OF MAJOR BENEFITS AND IMPACTS

Summarized below are the major economic and fiscal benefits and impacts that will be generated by Ma'alaea Mauka.

a. Affordable Housing

Ma'alaea Mauka will contribute to more affordable home prices by supplying (1) about 380 homes (40% of the total) at affordable prices, and (2) about 569 homes at market prices in competition with other residential communities in Central Maui.

b. Employment, Development Activities

During the Project's 6-year development period, construction employment is expected to average about 280 jobs, resulting in about 2,680 man-years of

effort to build the homes (280 jobs x 6 years). It is expected that the construction jobs for the Project will be filled by workers already living on Maui. As other construction projects are completed on the island, Maui construction workers will be hired to work on the various components of the Project, then move on to other projects. Thus, the Project will help keep Maui's existing construction workers employed.

Indirect employment related to Project development is expected to average about 270 jobs on Maui and 160 jobs on O'ahu. Thus, total direct-plus-indirect employment associated with Project development activities will average about 710 jobs, of which about 550 jobs will be on Maui. The actual job count will fluctuate over time, depending on the pace of construction.

c. Fiscal Impacts

<u>County</u>

Project development activity will result in a net expenditure by the County of about $2.1 million for park improvements. Assuming that this expenditure is financed with bonds, the debt service at full development will be about $160,000 per year.

At full development, net expenditures by the County to support the Project, including debt service on parks and general unspecified improvements, are expected to average about $399,000 per year. Such net expenditures are normal for a typical residential community that have a large number of lower-value affordable homes, a large number of owner-occupied homes (71% for the Project) that qualify for the County's $300,000 homeowner's exemption, and the County tax structure which taxes homeowners at a comparatively low rate. By design, services provided by the County to residents of typical communities are subsidized by tax revenues from resort, resort-residential, commercial, and industrial properties.

<u>State</u>

Unlike the County, the State derives substantial net revenues from development activity. Over the 6-year construction period, the State will net about $15.8 million from Project development activities, or an average of about $2.6 million per year. Net revenues are high because of the amount of economic activity associated with building and selling the homes.

At full development, net expenditures by the State to support the Project are expected to average about $1.3 million per year. Such net expenditures are normal for a typical residential community having a large number of lower-value affordable homes with families having lower incomes and lower expenditures on consumption, and who have school-age children. By design, services provided by the State to residents of typical communities are subsidized by tax revenues derived from property development, visitors, higher-income families, and commercial activities.

10. REFERENCES

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FIGURES

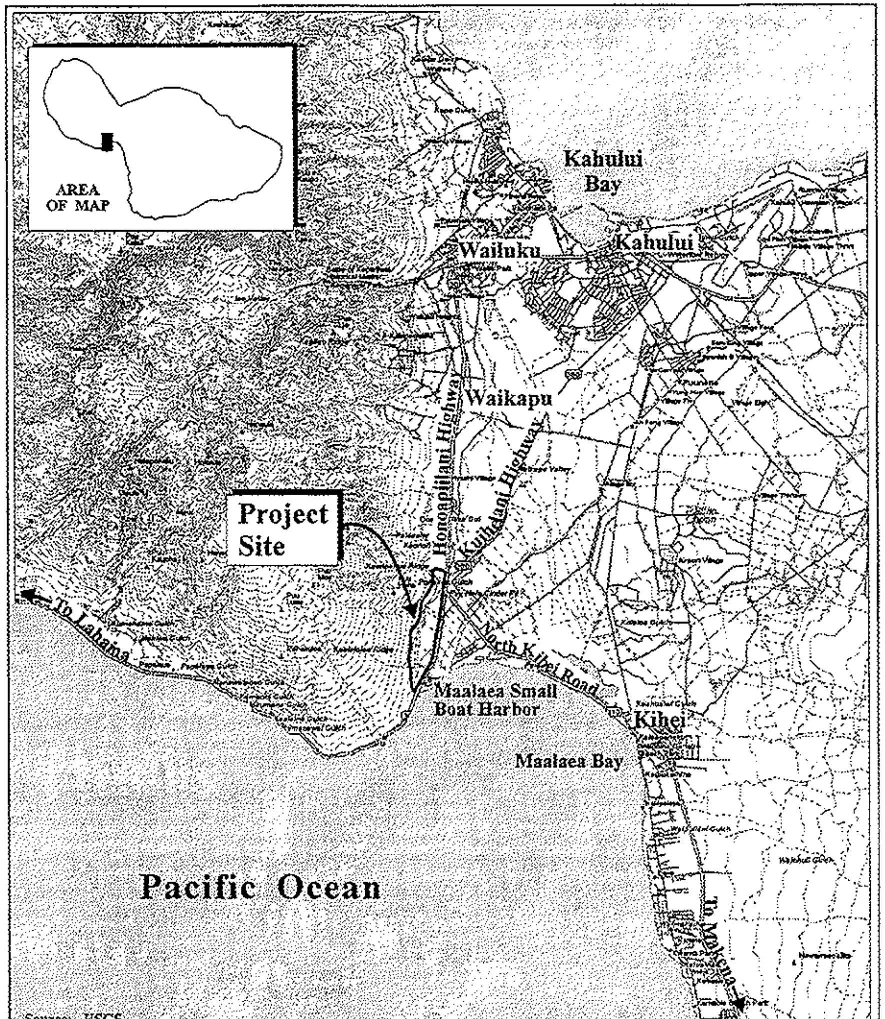


Figure 1 Proposed Ma`alaea Mauka Residential Subdivision
Regional Location Map
NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

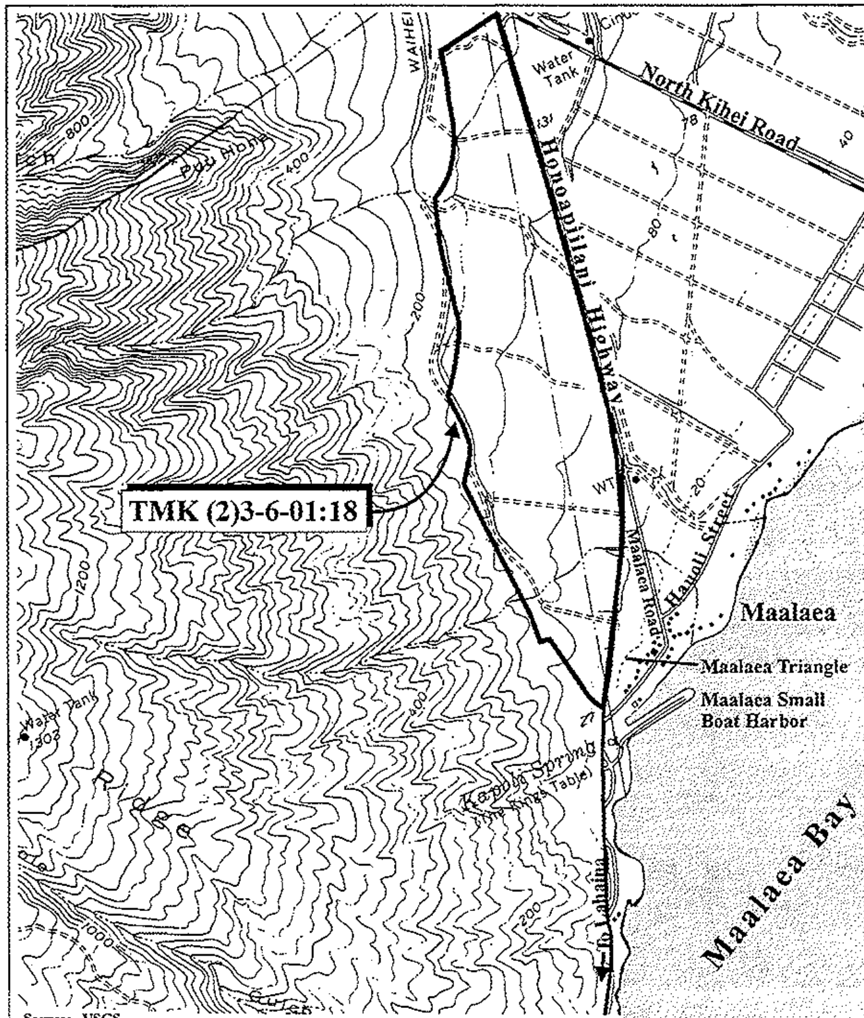
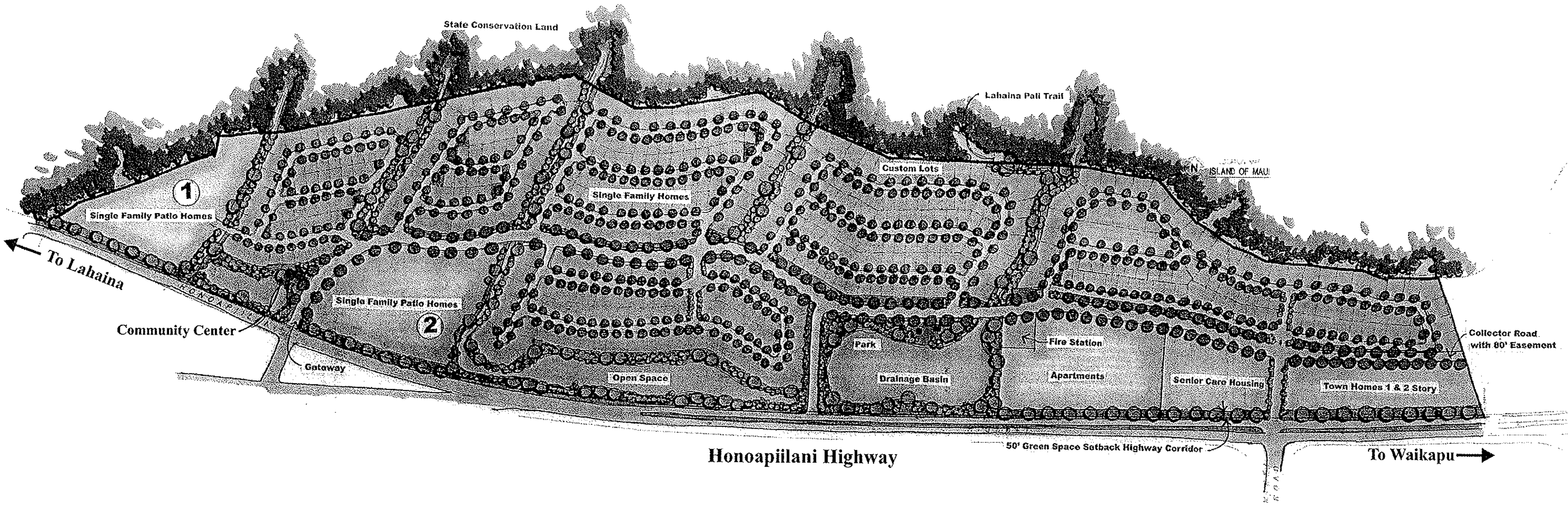


Figure 2 Proposed Ma`alaea Mauka Residential Subdivision
Site Location Map
NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.



Source: Maalaea Properties, LLC

Figure 3

Proposed Ma`alaea Mauka Residential Subdivision

Preliminary Subdivision Plan

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

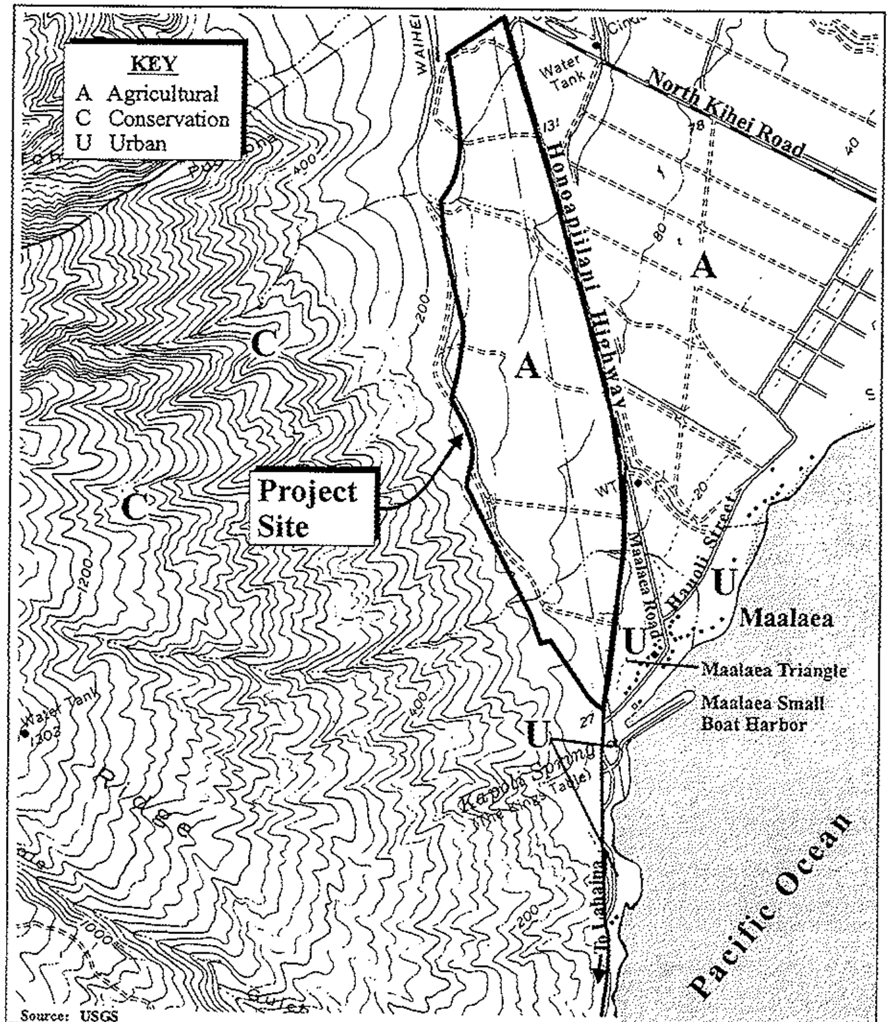


Figure 4

Proposed Ma`alaea Mauka Residential Subdivision
State Land Use Classification

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

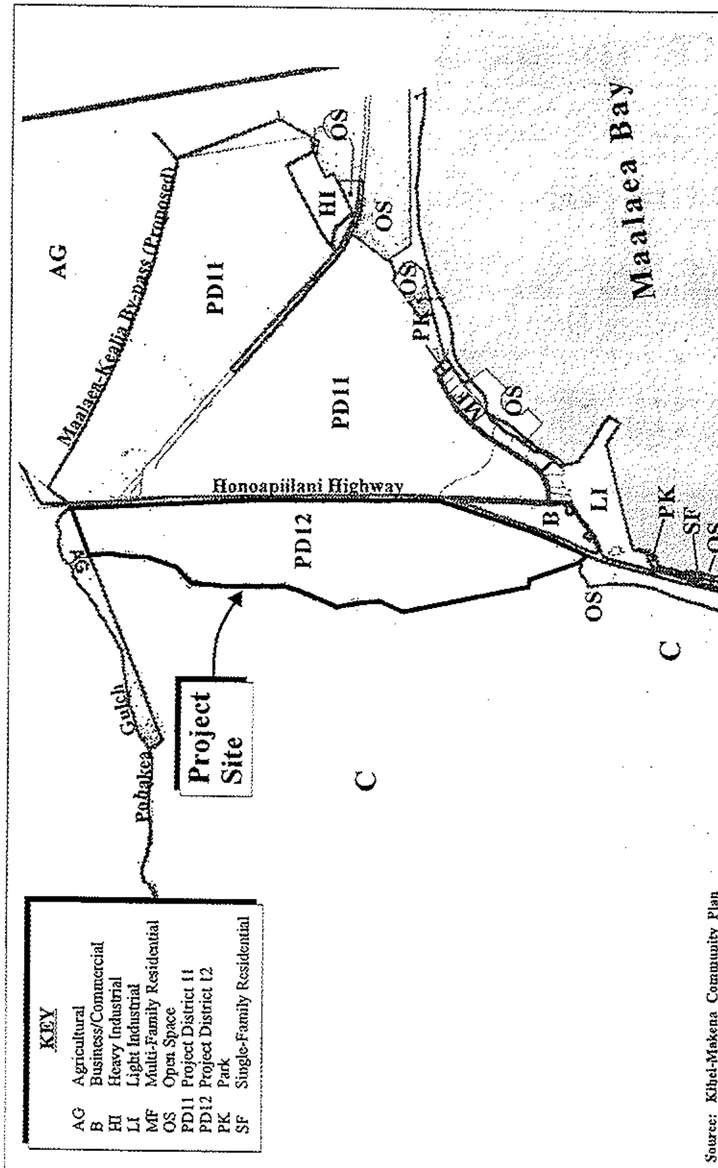


Figure 5

Proposed Ma`alaea Mauka Residential Subdivision
Kihei-Makena Community Plan Land Use Designations

NOT TO SCALE

Prepared for: Maalaea Properties, LLC

MUNEKIYO & HIRAGA, INC.

TABLES

Table 1. Proposed Development
(Values in 2007 dollars)

Item	Source or Multiplier	Amount at Full Development	Units
1.a. LAND AREA			
Single-family (SF) Homes			
Custom Lots	Munekiyo & Hiraga	38.0	acres
Conventional SF Homes	"	80.0	"
Patio homes	"	23.5	"
Multi-family (MF) Homes			
Town Homes	"	7.0	"
Apartments	"	11.5	"
Senior Care Housing	"	6.0	"
Community Center and Open Space	"	37.0	"
Park	"	15.0	"
Quasi-public Facility	"	3.0	"
Roads (including R-O-W)	"	36.0	"
Total Area Developed		257.0	acres
Offsite: Wastewater Treatment Plant	Munekiyo & Hiraga	5.0	"
1.b. HOMES			
SF Homes			
Custom Lots/Homes, at Market Prices	Munekiyo & Hiraga/DAHI	144	SF homes
Conventional SF Homes (4-bedroom), at Market Prices	"	355	"
Patio homes (4-bedroom)	"	164	"
At Market Prices	"	70	"
At Prices Affordable to:			
Gap-income Families	"	39	"
Above-moderate-income Families	"	39	"
Moderate-income Families	"	16	"
Subtotal, SF Homes		663	SF homes
MF Homes			
Town Homes (3-bedroom) at Prices Affordable to:	Munekiyo & Hiraga/DAHI	100	MF homes
Moderate-income Families	"	42	"
Below-moderate-income Families	"	58	"
Apartments (2-bedroom) at Rents Affordable to:	"	126	"
Moderate-income Families	"	62	"
Below-moderate-income Families	"	62	"
Low-income Families	"	2	"
Subtotal, MF Homes		226	MF homes
Senior-care Housing (1-bedroom) at Rents Affordable to Low-income Families	Munekiyo & Hiraga/DAHI	60	homes
Total Homes		949	homes
Affordable Homes	40%	380	"

Table 2. Economic Impacts of Development Activities

(Values in 2007 dollars)

Item	Source or Multiplier	Amount or Annual Average	Units
2.a. DEVELOPMENT PERIOD			
First Year of Construction	Munekiyo & Hiraga	2010	
Last Year of Construction	"	2016	
Duration of Construction	"	6	years
2.b. CONSTRUCTION EXPENDITURES			
Expenditures Over Development Period	(approximate costs, subject to change)		
SF Homes			
Custom Lots/Homes	$ 500,000 per home	$ 72,000,000	
Conventional SF Homes	$ 440,000 "	$ 156,200,000	
Patio homes, at Market Prices	$ 385,000 "	$ 26,950,000	
Patio Homes, at Affordable Prices	$ 375,000 "	$ 35,250,000	
MF Homes			
Town Homes	$ 240,000 "	$ 24,000,000	
Apartments	$ 190,000 "	$ 23,940,000	
Senior-care Housing	$ 170,000 "	$ 10,200,000	
Total Construction Expenditures		$ 348,540,000	
Annual Construction Expenditures (average)		$ 58,090,000	per year
2.c. OTHER DEVELOPMENT EXPENDITURES [1]		n.e.	
2.d. INDIRECT SALES GENERATED BY CONSTRUCTION ACTIVITY			
Statewide	82% of const. exp.	$ 47,633,800	per year
Maui	56%	$ 26,674,928	"
2.e. PROPERTY SALES	(approximate prices, subject to change)		
SF Homes			
Custom Lots, at Market Prices	$ 450,000 per home	$ 64,800,000	
Conventional SF Homes (4-bedroom), at Market Prices	$ 800,000 "	$ 284,000,000	
Patio homes (4 bedroom)			
At Market Prices	$ 700,000 "	$ 49,000,000	
At Prices Affordable to:			
Gap-income Families	$ 665,000 "	$ 25,935,000	
Above-moderate-income Families	$ 580,000 "	$ 22,620,000	
Moderate-income Families	$ 500,000 "	$ 8,000,000	
MF Homes			
Town Homes (3-bedroom) at Prices Affordable to:			
Moderate-income Families	$ 390,000 "	$ 16,380,000	
Below-moderate-income Families	$ 325,000 "	$ 18,850,000	
Total Home and Lot Sales		$ 489,585,000	
Annual Home and Lot Sales		$ 81,597,500	per year

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

Table 2. Economic Impacts of Development Activities

(Values in 2007 dollars)

(continued)

Item	Source or Multiplier	Amount or Annual Average	Units
2.f. PROPERTY VALUES AT FULL DEVELOPMENT	(approximate values, subject to change)		
SF Homes			
Custom Lots, at Market Prices	$ 950,000 per home	$ 136,800,000	
Conventional SF Homes (4-bedroom), at Market Prices	$ 800,000 "	$ 284,000,000	
Patio homes (4 bedroom)			
At Market Prices	$ 700,000 "	$ 49,000,000	
At Prices Affordable to:			
Gap-income Families	$ 665,000 "	$ 25,935,000	
Above-moderate-income Families	$ 580,000 "	$ 22,620,000	
Moderate-income Families	$ 500,000 "	$ 8,000,000	
MF Homes			
Town Homes (3-bedroom) at Prices Affordable to:			
Moderate-income Families	$ 390,000 "	$ 16,380,000	
Below-moderate-income Families	$ 325,000 "	$ 18,850,000	
Apartments (2-bedroom) at Rents Affordable to:			
Moderate-income Families	$ 310,000 "	$ 19,220,000	
Below-moderate-income Families	$ 250,000 "	$ 15,500,000	
Low-income Families	$ 200,000 "	$ 400,000	
Senior-care Housing (1-bedroom) at Rents Affordable to Low-income Families	$ 180,000 "	$ 10,800,000	
Total Value of Homes		$ 607,505,000	
2.g. SUMMARY OF EXPENDITURES & SALES			
Final Sales (taxed at 4%)			
Home and Lot Sales	Section 2.e	$ 81,597,500	per year
Consumption Expenditures	55% of payroll Section 2.j	$ 16,282,695	"
Total Sales at 4%		$ 97,880,195	per year
Intermediate Sales (taxed at 0.5%)			
Construction Expenditures	Section 2.b	$ 58,090,000	per year
Indirect Sales Related to Construction	Section 2.c	$ 47,633,800	"
Less Consumption	above	$ (16,282,695)	"
Total Sales at 0.5%		$ 89,441,105	per year
Total Sales		$ 187,321,300	per year
2.h. PROFITS			
Profits on Total Expenditures & Sales	10.0%	$ 18,732,130	per year
Risk Premium for Construction	5.0%	$ 2,904,500	"
Total Profit from Construction & Related Activity		$ 21,636,630	per year

Table 2. Economic Impacts of Development Activities

(Values in 2007 dollars)

(continued)

Item	Source or Multiplier	Amount or Annual Average	Units
2.i. EMPLOYMENT (on-site & off-site)			
Maui			
Construction Jobs	4.88 x sales/$1 mil	283	jobs
Indirect Employment Generated by Construction	1.52 x direct jobs 62%	267	"
Total Maui Employment		550	jobs
Oahu, Indirect Employment Generated by Construction	1.52 x direct jobs 38%	163	"
Total Employment		713	jobs
2.j. PAYROLL			
Maui			
Construction Payroll	$ 45,800 per job	$ 12,961,400	per year
Payroll for Indirect Employment	$ 37,000 "	$ 9,879,000	"
Total Maui Payroll		$ 22,840,400	per year
Oahu, Payroll for Indirect Employment	$ 41,500 per job	$ 6,764,500	"
Total Payroll		$ 29,604,900	per year
2.k. POPULATION SUPPORTED BY DEVELOPMENT ACTIVITIES			
Maui Residents			
Supported by Construction Jobs	2.1 per job	594	residents
Supported by Indirect Jobs	2.1 "	561	"
Total Maui Residents		1,155	residents
Oahu Residents Supported by Indirect Jobs	2.2 per job	359	"
Total Residents Supported		1,514	residents
2.l. HOUSING FOR SUPPORTED POPULATION			
Maui Homes			
Supported by Construction Jobs	0.34 per resident	202	homes
Supported by Indirect Jobs	0.34 "	191	"
Total Homes		393	homes
Oahu Homes Supported by Indirect Jobs	0.30 per resident	108	"
Total Homes Supported		501	homes

Table 3. Economic Impacts at Full Development

(Values in 2007 dollars)

Item	Source or Multiplier	Amount at Full Development	Units
3.a. HOUSING USES & CHARACTERISTICS, ASSUMPTIONS			
SF Custom Lots/Homes, at Market Prices		144	homes
Owner-occupied Homes	85%	122	"
Occupied Homes	98%	120	"
Residents	3.5 per household	420	residents
Household Income	$ 155,000 "	$ 18,600,000	per year
Consumption Expenditures	50% of income	$ 9,300,000	"
Property Value, Lot	$ 450,000 per lot	$ 54,900,000	
Property Value, Home and Lot	$ 950,000 per home	$ 115,900,000	
Rented Homes	15%	22	"
Occupied Homes	95%	21	"
Residents	3.50 per household	74	residents
Rent	$ 3,700 per month	$ 932,400	per year
Household Income	$ 140,000 per household	$ 2,940,000	"
Consumption Expenditures	50% of income	$ 1,470,000	"
Property Value, Lot	$ 450,000 per lot	$ 9,900,000	
Property Value, Home and Lot	$ 950,000 per home	$ 20,900,000	
SF Homes, at Market Prices		355	homes
Owner-occupied Homes	85%	302	homes
Occupied Homes	98%	296	"
Residents	3.50 per household	1,036	residents
Household Income	$ 140,000 "	$ 41,440,000	per year
Consumption Expenditures	50% of income	$ 20,720,000	"
Property Value	$ 800,000 per home	$ 241,600,000	
Rented Homes	15%	53	"
Occupied Homes	95%	50	"
Residents	3.50 per household	175	residents
Rent	$ 3,400 per month	$ 2,040,000	per year
Household Income	$ 125,000 per household	$ 6,250,000	"
Consumption Expenditures	50% of income	$ 3,125,000	"
Property Value	$ 800,000 per home	$ 42,400,000	
SF Patio Homes, at Market Prices		70	homes
Owner-occupied Homes	85%	60	homes
Occupied Homes	98%	59	"
Residents	3.25 per household	192	residents
Household Income	$ 125,000 "	$ 7,375,000	per year
Consumption Expenditures	50% of income	$ 3,687,500	"
Property Value	$ 700,000 per home	$ 42,000,000	

Table 3. Economic Impacts at Full Development
(Values in 2007 dollars)
(continued)

Item	Source or Multiplier	Amount at Full Development	Units
SF Patio Homes, at Market Prices (continued)		226	homes
Rented Homes	15%	10	"
Occupied Homes	95%	10	"
Residents	3.25 per household	33	residents
Rent	$ 3,000 per month	$ 360,000	per year
Household Income	$ 110,000 per household	$ 1,100,000	"
Consumption Expenditures	50% of income	$ 550,000	"
Property Value	$ 700,000 per home	$ 7,000,000	
SF Patio Homes, for Gap-income Families		39	homes
Owner-occupied Homes	100%	39	homes
Occupied Homes	100%	39	"
Residents	3.25 per household	127	residents
Household Income	$ 111,000 "	$ 4,329,000	per year
Consumption Expenditures	50% of income	$ 2,164,500	"
Property Value	$ 665,000 per home	$ 25,935,000	
SF Patio Homes, for Above-moderate-income Families		39	homes
Owner-occupied Homes	100%	39	"
Occupied Homes	100%	39	"
Residents	3.25 per household	127	residents
Household Income	$ 97,000 "	$ 3,783,000	per year
Consumption Expenditures	50% of income	$ 1,891,500	"
Property Value	$ 580,000 per home	$ 22,620,000	
SF Patio Homes, for Moderate-income Families		16	homes
Owner-occupied Homes	100%	16	"
Occupied Homes	100%	16	"
Residents	3.25 per household	52	residents
Household Income	$ 83,000 "	$ 1,328,000	per year
Consumption Expenditures	50% of income	$ 664,000	"
Property Value	$ 500,000 per home	$ 8,000,000	
MF Town Homes, for Moderate-income Families		42	homes
Owner-occupied Homes	100%	42	homes
Occupied Homes	100%	42	"
Residents	3.0 per household	126	residents
Household Income	$ 83,000 "	$ 3,486,000	per year
Consumption Expenditures	50% of income	$ 1,743,000	"
Property Value	$ 390,000 per home	$ 16,380,000	

Table 3. Economic Impacts at Full Development
(Values in 2007 dollars)
(continued)

Item	Source or Multiplier	Amount at Full Development	Units
MF Town Homes, for Below-moderate-income Families		58	homes
Owner-occupied Homes	100%	58	homes
Occupied Homes	100%	58	"
Residents	3.0 per household	174	residents
Household Income	$ 69,000 "	$ 4,002,000	per year
Consumption Expenditures	50% of income	$ 2,001,000	"
Property Value	$ 325,000 per home	$ 18,850,000	
MF Apartments, for Moderate-income Families		62	homes
Rented Homes	100%	62	"
Occupied Homes	100%	62	"
Residents	3.0 per household	186	residents
Rent	$ 1,880 per month	$ 1,398,720	per year
Household Income	$ 75,000 per household	$ 4,650,000	"
Consumption Expenditures	50% of income	$ 2,325,000	"
Property Value	$ 310,000 per home	$ 19,220,000	
MF Apartments, for Below-moderate-income Families		62	homes
Rented Homes	100%	62	"
Occupied Homes	100%	62	"
Residents	3.0 per household	186	residents
Rent	$ 1,560 per month	$ 1,160,640	per year
Household Income	$ 62,000 per household	$ 3,844,000	"
Consumption Expenditures	50% of income	$ 1,922,000	"
Property Value	$ 250,000 per home	$ 15,500,000	
MF Apartments, for Low-income Families		2	homes
Rented Homes	100%	2	"
Occupied Homes	100%	2	"
Residents	3.00 per household	6	residents
Rent	$ 1,250 per month	$ 30,000	per year
Household Income	$ 50,000 per household	$ 100,000	"
Consumption Expenditures	50% of income	$ 50,000	"
Property Value	$ 200,000 per home	$ 400,000	
MF Senior-care Housing, for Low-income Families		60	homes
Rented Homes	100%	60	"
Occupied Homes	100%	60	"
Senior Residents	2.0 per household	120	residents
Rent	$ 1,040 per month	$ 748,800	per year
Household Income	$ 44,000 per household	$ 2,640,000	"
Consumption Expenditures	50% of income	$ 1,320,000	"
Property Value	$ 180,000 per home	$ 10,800,000	

Table 3. Economic Impacts at Full Development

(Values in 2007 dollars)

(continued)

Item	Source or Multiplier	Amount at Full Development	Units
3.b. HOUSING USES & RELATED ECONOMIC ACTIVITIES			
Housing Units, by Type			
SF Homes	Section 1.b	663	homes
MF Homes	"	226	"
Senior-care Housing	"	60	"
Total Homes		949	homes
Affordable Homes	40%	380	"
Housing Units, by Use			
Owner-occupied Homes	Section 3.a	678	homes
Rented Homes	"	271	"
Total Homes		949	homes
Population (on-site)			
Residents (non-senior)	Section 3.a	2,914	residents
Senior Residents	"	120	"
Total Population		3,034	residents
Student Population, Public Schools	20% of residents	583	students
Workforce	52% of residents	1,515	workers
Household Income	Section 3.a	$ 105,867,000	per year
Sales Revenues			
Rental Income	Section 3.a	$ 6,670,560	per year
Consumption Expenditures	Section 3.a	$ 52,933,500	"
Total Sales Revenues		$ 59,604,060	per year
Profits Generated by:			
Rental Income	10% of rents	$ 667,056	per year
Consumption Expenditures	10% of expenditures	$ 5,293,350	"
Total Profits		$ 5,960,406	per year
Property Values			
Owner-occupied Homes	Section 3.a	$ 491,285,000	
Rented Homes	"	$ 116,220,000	
Total Home Value		$ 607,505,000	

Table 4. Impacts on County Revenues and Expenditures

(Values in 2007 dollars)

Item	Source or Multiplier	Amount or Annual Average	Units
4.a. TAX & EXPENDITURE BASE			
Development Activities			
Duration	Table 2, Section 2.a	6	years
Homes, by Type			
SF Homes	Table 1, Section 1.b	663	homes
MF Homes	"	226	"
Senior-care Housing	"	60	"
Total Homes		949	homes
Population (on site at full development)	Table 3, Section 3.b	3,034	people
Full Development			
Homes, by Use			
Owner-occupied Homes	Table 3, Section 3.b	678	homes
Rented Homes	"	271	"
Total Homes		949	homes
Population			
Residents (non-senior)	Table 3, Section 3.b	2,914	people
Senior Residents	"	120	"
Total Population		3,034	people
Taxable Values, Homes			
Owner-occupied Homes			
Gross Value	Table 3, Section 3.b	$ 491,285,000	
Less Exemptions	$ 300,000 per home	$ (203,400,000)	
Net Value, Owner-occupied Homes		287,885,000	
Rented Homes	Table 3, Section 3.b	$ 116,220,000	
Total Taxable Value, Homes		$ 404,105,000	

Table 4. Impacts on County Revenues and Expenditures

(Values in 2007 dollars)
(continued)

Item	Source or Multiplier	Amount or Annual Average	Units
4.b. DEVELOPMENT ACTIVITIES			
Revenues, Cumulative			
Total Revenues, Cumulative [1]		n.e.	
Expenditures, Cumulative			
Infrastructure and Facilities			
Infrastructure [1]			
Interior Roads		$ -	
Water Source Development		$ -	
Interior Water Distribution		$ -	
Drainage Systems		$ -	
Sewer Connections		$ -	
Collector Sewers & Trunks		$ -	
Wastewater Treatment Plant		$ -	
Parks			
Land, Graded and Landscaped [1]		$ -	
Water System, Parking Lot, and Restrooms [1]		$ -	
Other Improvements	$ 700 per person	$ (2,123,800)	
General Improvements		see text	
Services		$ -	
Total Expenditures		$ (2,123,800)	
Net Revenues, Cumulative		$ (2,123,800)	
Annual Debt Service at Full Development (4.25%, 20-year bond)	7.52% of net revenues	$ (159,710)	per year

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

Table 4. Impacts on County Revenues and Expenditures

(Values in 2007 dollars)
(continued)

Item	Source or Multiplier	Amount or Annual Average	Units
4.c. FULL DEVELOPMENT			
Revenues, Annual			
Property Taxes			
Homeowners	$ 2.50 per $1,000	$ 719,713	per year
Rented Homes	$ 5.00 "	$ 581,100	"
Less Current Taxes	County	$ (324)	"
Total Property Taxes		$ 1,300,489	per year
Other Revenues	$ 350 per person	$ 1,061,900	"
Total Revenues		**$ 2,362,389**	**per year**
Expenditures, Annual			
Services	$ 760 per person	$ (2,305,840)	per year
Debt Service			
Debt Service, Park	Section 4.b	$ (159,710)	"
General Improvements	derived	$ (295,390)	"
Total Debt Service	$ 150 per person	$ (455,100)	per year
Total Expenditures		**$ (2,760,940)**	**per year**
Net Revenues, Annual		**$ (398,551)**	**per year**

Table 5. Impacts on State Revenues and Expenditures
(Values in 2007 dollars)

Item	Source or Multiplier	Amount or Annual Average	Units
5.a. TAX & EXPENDITURE BASE			
Development Activities			
Duration	Table 2, Section 2.a	6	years
Homes, by Type			
SF Homes	Table 1, Section 1.b	663	homes
MF Homes	"	226	"
Senior Care Housing	"	60	"
Total Homes		949	homes
Final Sales (taxed at 4%)			
Annual Average	Table 2, Section 2.g	$ 97,880,195	per year
Cumulative		$ 587,281,170	
Intermediate Sales (taxed at 0.5%)			
Annual Average	Table 2, Section 2.g	$ 89,441,105	per year
Cumulative		$ 536,646,630	
Home and Lot Sales (for Conveyance Tax)			
Sales to Owner-occupants, at Prices:			
$600,000 to $1 million	Table 3, Section 3.a	$ 309,535,000	
Below $600,000	"	$ 120,750,000	
Sales to Other Buyers, at Prices:			
$600,000 to $1 million	"	$ 49,400,000	
Below $600,000	"	$ 9,900,000	
Total Home and Lot Sales		$ 489,585,000	
Profits			
Annual Average	Table 2, Section 2.h	$ 21,636,630	per year
Cumulative		$ 129,819,780	
Payroll			
Annual Average	Table 2, Section 2.j	$ 29,604,900	per year
Cumulative		$ 177,629,400	
Population (on site at full development)	Table 3, Section 3.b	3,034	residents
Students	"	583	students
Full Development			
Population			
Residents (non-senior)	Table 3, Section 3.b	2,914	residents
Senior Residents	"	120	"
Total Population		3,034	residents
Students	Table 3, Section 3.b	583	students
Household Income	Table 3, Section 3.b	$ 105,867,000	per year
Sales Revenues Generated by:			
Rental Income	Table 3, Section 3.c	$ 6,670,560	per year
Consumption Expenditures	"	$ 52,933,500	"
Profits on Rental Income	Table 3, Section 3.c	$ 667,056	per year

Table 5. Impacts on State Revenues and Expenditures
(Values in 2007 dollars)
(continued)

Item	Source or Multiplier	Amount or Annual Average	Units
5.b. DEVELOPMENT ACTIVITIES			
Revenues, Cumulative			
School Impact Fees			
SF Homes	$ 6,122 per home	$ 1,383,572	
MF Homes	$ 2,401 "	$ 1,591,863	
Senior Housing	$ - "	$ -	
Total School Impact Fees		$ 2,975,435	
Conveyance Tax			
Owner-occupied Homes at Prices:			
Below $600,000	0.10% of sales	$ 120,750	
$600,000 to $1 million	0.20% "	$ 619,070	
Sales to Other Buyers, at Prices:			
Below $600,000	0.15% "	$ 14,850	
$600,000 to $1 million	0.25% "	$ 123,500	
Total Conveyance Tax		$ 878,170	
Excise Tax			
Final Sales	4.0% of sales	$ 23,491,247	
Intermediate Sales	0.5% "	$ 2,683,233	
Total Excise Tax		$ 26,174,480	
Corporate Income Taxes	1.0% of profits	$ 1,298,198	
Personal Income Taxes	4.4% of income	$ 7,815,694	
Total State Tax Revenues		$ 39,141,977	
Expenditures, Cumulative			
Schools (K – 12)	$ 40,000 per student	$ (23,320,000)	
General Improvements		see text	
Services		$ -	
Total Expenditures		$ (23,320,000)	
Net Revenues			
Cumulative		$ 15,821,977	
Annual Average		$ 2,636,996	per year

Table 5. Impacts on State Revenues and Expenditures

(Values in 2007 dollars)

(continued)

Item	Source or Multiplier	Amount or Annual Average	Units
5.c. FULL DEVELOPMENT			
Revenues, Annual			
Personal Income Tax	4.80% income	$ 5,081,616	per year
Excise Tax Generated by:			
Rental Income	4.0% of rents	$ 266,822	"
Consumption Expenditures (consumer share)	3.5% of expenditures	$ 1,852,673	"
Corporate Income Tax on Rental Income	1.0% of profit	$ 6,671	"
Other Revenues	$ 2,230 per person	$ 6,765,820	"
Total Revenues		**$ 13,973,602**	**per year**
Expenditures, Annual			
Education	$ 11,460 per student	$ (6,681,180)	per year
Other Services			
Residents (non-senior)	$ 2,650 per person	$ (7,722,100)	per year
Senior Residents	$ 1,940 "	$ (232,800)	"
Total Other Services		$ (7,954,900)	per year
Debt Service, General Improvements	$ 220 "	$ (667,480)	"
Total Expenditures		**$ (15,303,560)**	**per year**
Net Revenues, Annual		**$ (1,329,958)**	**per year**

APPENDIX J.

Traffic Impact Analysis Report

Traffic Impact Analysis Report
Maalaea Mauka Subdivision

Maalaea, Island of Maui, Hawai'i

Tax Map Key Number (2)3-6-001: 018

OCTOBER 2005

Prepared for:
Maalaea Property, LLC
355 West Waiko Road
Wailuku, Hawaii 96793

Prepared by:

M&E Pacific, Inc.

METCALF & EDDY | AECOM

Davies Pacific Center, 841 Bishop Street
Suite 1900, Honolulu, Hawai'i 96813

Maalaea Mauka Subdivision
Maalaea, Island of Maui, Hawai'i

Traffic Impact Analysis Report

TMK (2)3-6-001: 018

October 2005

WARREN M. YAMAMOTO
LICENSED PROFESSIONAL ENGINEER
NO. 3893-C
HAWAII, U.S.A.

Expiration Date:
April 30, 2006

This work was prepared by me or under my direct supervision.

Signature
M & E Pacific, Inc.
METCALF & EDDY | AECOM

24 OCT 05
Date

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TRAFFIC IMPACT ANALYSIS
for the
MAALAEA MAUKA SUBDIVISION

A residential subdivision is being proposed in Maalaea, Hawaii. This report documents a study that was conducted to identify the traffic impacts of the proposed project and to recommend any mitigating measures.

PROJECT DESCRIPTION

Maalaea Property, LLC, proposes to develop the Maalaea Mauka subdivision, a residential project in Maalaea, Maui, Hawaii. The proposed project would consist of 239 affordable single family units, 427 standard single family units, 179 custom single family units and 105 multi-family units, for a total 950 residential units. The proposed project site is situated mauka of Honoapiilani Highway approximately between the Kuihelani Highway and the Maalaea Road (south) intersections, as shown on **Figure 1**. The project site is on a 260 acre parcel identified as TMK: (2)3-6-001:018.

Figure 1 shows the roadway network for the proposed project. Two access roads would connect into Honoapiilani Highway at the existing signalized intersections of North Kihei Road and Kapoli Street. A right-turn in, right-turn out access road would be built to the highway midway between the above two access roads. There would be a spine roadway running about north-south through the project that would connect these three access roads, and provide a secondary access to the existing roadway connecting to the highway at Kuihelani Highway. The intersections analyzed in the study included Kuihelani Highway, North Kihei Road, proposed access roadway, Maalaea Street (north), and Kapoli Street.

Construction on the proposed project is expected to begin in 2008 with initial occupancy in 2009. The project is anticipated to be fully occupied by 2013.

Other proposed projects in the vicinity of the project site include the 710 Waikapu Properties and the Maalaea Village. The Waikapu project would consist of 20 single family homes situated immediately north of the proposed project site. It would be built and occupied by 2008. The traffic that would be generated by this small project is not expected to have any impact on the proposed project. The proposed Maalaea Village project would be located makai of Honoapiilani Highway and the proposed project site. The project's developer, A&B Properties, Inc., does not expect to develop the Village within the next 20 years due to their other project commitments.

EXISTING CONDITIONS

A survey of the existing roadway and traffic conditions was made in September 2005.

Existing Roadways

The proposed project is at the juncture of several major roadways on Maui, including Honoapiilani Highway, Kuihelani Highway and North Kihei Road. These three highways are under the jurisdiction of the State of Hawaii Department of Transportation (State DOT). Other local roads in the area include Maalaea Road and Kapoli Street.

Honoapiilani Highway provides primary access between West Maui and Wailuku. It is a primary arterial and is designated as Route 30. Most of the intersections on the highway are channelized with separate turning lanes as discussed below. The posted speed limit is 45 miles per hour (mph) in the vicinity of the project site. Honoapiilani Highway is mainly a two-lane highway; however it was recently widened to four lanes in the vicinity of the project site. The highway widens from two to four lanes north of Kuihelani Highway. The southbound (toward Lahaina) approach of the highway transitions from two to one lane north of Maalaea Road (north). The northbound (toward Wailuku) approach incorporates the right-turn out lane from the south intersection of Maalaea Road as the second through lane.

Kuihelani Highway is a two-lane major collector (Route 380) that provides access between Kahului and Waikapu/Maalaea. The intersection with Honoapiilani Highway is signalized. The highway continues mauka of the highway as a two-lane local road. The Kuihelani Highway mauka bound approach has a left turn lane, a shared left turn/through lane and a separate right turn lane, while the makai bound approach has a shared left turn/through lane and a separate right turn lane. Both Honoapiilani Highway approaches have two through lanes and separate left turn and right turn lanes.

North Kihei Road is a two-lane major collector (Route 31) that connects Honoapiilani Highway to South Kihei Road and Piilani Highway. The intersection with Honoapiilani Highway is signalized, and there is a park-and-ride lot near the southwest corner. The North Kihei Road approach has two left turn lanes and a separate right turn lane. Both highway approaches have two through lanes and separate left turn (southbound) and right turn (northbound) lanes.

Maalaea Road is a two-lane local road that serves the Maalaea Harbor, Maalaea Triangle and adjoining land uses. It meets Honoapiilani Highway twice, north and south of the Maalaea Triangle, as unsignalized intersections. The north intersection approach meets the highway at an angle and is restricted to right-turns out and left turns in from the highway. The highway at this location has one southbound and two northbound lanes. The south intersection is restricted to right-turn in, right-turn out movements. The highway at this location has one southbound and one northbound lane approach.

Kapoli Street is a four-lane roadway that was improved to serve the visitor-oriented activities at the Maalaea Triangle. Its approach to Honoapiilani Highway is signalized and has a shared left turn/through lane and a separate right turn lane. The southbound approach of the highway has a single through lane and a separate left turn lane, while the northbound approach has two through lanes and a separate right turn lane.

Traffic Volumes

Traffic turning movement counts were taken at the four existing study intersections on Honoapiilani Highway: Kuihelani Highway, North Kihei Road, Maalaea Road (north) and Kapoli Street on Tuesday and Wednesday, September 27 and 28, 2005, during the morning and afternoon peak periods. Traffic turning movement counts require a traffic surveyor to observe traffic flow and record the movements of each vehicle crossing the intersection as through or turning movements by 15 minute intervals. The worksheets from these traffic counts are included in **Appendix A**. The peak hours at the two south intersections (Maalaea Road and Kapoli Street) were about 30 minutes earlier than at the north intersections (Kuihelani Highway and North Kihei Road).

The resultant morning and afternoon peak hour traffic volumes are shown on **Figure 2**. The volumes are rounded to the nearest five vehicles per hour (vph). The dominant direction of traffic flow is toward Lahaina in the AM peak hour with 1,485 vph at Kapoli Street. The PM peak hour volumes are about equal in both directions. There are significant levels of turning volumes at the two north intersections:

- Left turns from Kuihelani Highway to southbound Honoapiilani Highway
- Right turns from northbound Honoapiilani Highway to eastbound Kuihelani Highway
- Left turns from North Kihei Road to southbound Honoapiilani Highway
- Right turns from North Kihei Road to northbound Honoapiilani Highway
- Right turns from northbound Honoapiilani Highway to eastbound North Kihei Road, and
- Left turns from southbound Honoapiilani highway to eastbound North Kihei Road

The State Department of Transportation takes metered traffic counts at selected locations on Maui roadways in odd numbered years. Two stations are on Honoapiilani Highway at the North Kihei Road (Station 10) and Kuihelani Highway (Station 10B) intersections. The data from these counts provides the historic trend in daily traffic volumes on different legs of the intersections over a ten year period ending in 2001. Traffic counts were not taken in 2003, probably due to the roadway widening construction. The increases in daily traffic volumes on the three legs of the North Kihei Road intersection are shown in tabular and graph form on **Figure 3**.

The ten year increase and annual growth rate (compounded) in daily two-way daily traffic volumes on the different legs of the two intersections are as follows:

- Honoapiilani Highway, south of N. Kihei Road – 27.4% in 10 years, 2.45% annual growth rate.
- Honoapiilani Highway, between N. Kihei Road and Kuihelani Highway – 21.0% in 10 years, 1.92% annual growth rate.
- Honoapiilani Highway, north of Kuihelani Highway – 10.7% in 10 years, 1.02% annual growth rate.
- N. Kihei Road – 32.8% in 10 years, 2.88% annual growth rate.
- Kuihelani Highway – 19.4% in 10 years, 1.79% annual growth rate.

The daily traffic volumes show different rates of growth on each leg. The largest increases took place on the North Kihei Road and south leg of Honoapiilani Highway. The traffic growth on these roadways is associated with economic growth in the Kihei/Wailea and West Maui regions, respectively. The slowest growth occurred on the north leg of Honoapiilani Highway, which is associated with the Wailuku area that has experienced a slower economic growth.

The State DOT data also shows the hourly traffic volumes through the course of the day. **Figure 4** shows the hourly volumes in each direction of travel on the south leg of Honoapiilani Highway and North Kihei Road. Southbound traffic on Honoapiilani Highway peaked at 6:00 a.m., and then declined until rising to an afternoon high between 1:00 and 5:00 p.m. The peak volumes for northbound traffic were attained between 3:00 and 6:00 p.m. These trends correspond to commuter traffic traveling from East Maui to West Maui. The westbound traffic on North Kihei Road also peaked in the morning while eastbound traffic peaked in the afternoon. This pattern corresponds to commuter traffic leaving Kihei in the morning and traveling to West Maui and Wailuku, then returning in the afternoon.

TRAFFIC FORECASTS

The proposed project is expected to be fully occupied by 2013. During the eight year period from the traffic count date to proposed opening, ambient traffic on the area roadways can be expected to increase due to regional growth and new projects in the area. The traffic that would be generated from the proposed project was added to the ambient traffic forecast to obtain the total with project traffic forecast.

Ambient Traffic Forecast

There are no new major projects planned in the immediate vicinity of the proposed project. Regional growth is occurring due to growth in other areas whose traffic passes the project site. Therefore, the traffic growth indicated by the State Department of Transportation traffic volumes was used as the index of regional growth. Based on the traffic growth rate data previously discussed, the following growth rates for an eight year period were established:

- Honoapiilani Highway, south of N. Kihei Road - 21.4%
- Honoapiilani Highway, between N. Kihei Road and Kuihelani Highway -16.4%
- Honoapiilani Highway, north of Kuihelani Highway - 8.5%
- N. Kihei Road - 25.5%, and
- Kuihelani Highway - 15.2%

Traffic volumes at the two north intersections were increased using the above factors. Then the absolute increases in traffic volumes over existing traffic volumes on the north leg of Honoapiilani Highway at North Kihei Road were added to the existing through volumes at the two south intersections. The volumes turning into or out from the Maalaea Triangle were assumed to remain constant and were not adjusted. The results are summarized on **Figure 5**, with volumes rounded to the nearest five vph.

Project Generated Traffic

The traditional three step process of trip generation, trip distribution and trip assignment was used to forecast future traffic which would be generated by the proposed project. The trip generation step forecasts the number of new trips that would be produced in each of the two study periods. The trip distribution step allocates these new trips by direction of travel. Finally, the trip assignment step assigns the trips to the specific turning movements at the study intersections.

The trip generation and distribution analyses are summarized on **Table 1**. The trip generation step forecasts the volume of vehicle trips that would be generated by the proposed project during the morning and afternoon peak periods. The Institute of Transportation Engineers' Trip Generation (Seventh Edition, 2003) has trip generation equations or rates to calculate the number of morning and afternoon peak hour trips that would be generated by various land uses. The following trip generation equations for Single Family Dwelling (Land Use 210) were utilized:

AM Peak Hour - $T = 0.7(X) + 9.43$;
PM Peak Hour - $Ln(T) = 0.9Ln(X) + 0.53$;
Where, T = Trips generated by residential units, and
X = Number of residential units.

The equations were used to calculate the number of trips that would be generated by all 845 single family units. The equations do not account for differences in trip rates that could be caused by differences in income or family size, for instance. The single family homes are expected to generate 601 and 732 morning and afternoon peak hour trips, respectively.

The total number of trips was then allocated to the north, middle and south sections of the proposed project, which each would have their own access routes to the highway, based on the number of units in each section. The following numbers of units were assigned to each section: north-240 units, middle-355 units and south-250 units.

The average trip generation rates for Low-Rise Town House Dwellings (Land Use 231) of 0.67 and 0.78 for the morning and afternoon peak hours were also used. The multi-family units of the proposed project are expected to generate 70 trips in the morning peak and 82 trips in the afternoon peak. The trips generated from the multi-family units were allocated to the middle section of the project site.

The report also provides the percentage of inbound and outbound trips for each land use in each peak hour. The number of generated trips was divided into inbound and outbound trips based on the information from the report, as shown on **Table 1**. The proposed project would generate 503 outbound and 168 inbound trips in the morning peak hour and 508 inbound and 305 outbound trips in the afternoon peak hour.

The project generated trips were then distributed by direction of travel to and from the project site. A set of trip distribution factors was developed from socio-economic data from the Maui Long-Range Land Transportation Plan (February 1997) by Kaku Associates, Inc. The report showed current (1990) and forecast (2020) population and employment for several large area communities on Maui. 2013 forecast data for population and employment were extrapolated from the report data, as shown in the third column on **Table 2**. The 2013 data was then divided into smaller sub-communities assuming that Wailuku made up 40% of the Kahului-Wailuku community, and that Kihei made up 90% of the Kihei-Maalaea community. The data for the Makawao and Paia-Haiku communities were reduced by 40% to account for their distance from the project site. The Hana data was not included due to its remoteness. The results for the sub-communities are shown in the second to the last column of **Table 2**.

An "aggregate" growth factor was calculated for each sub-community using 30% of population and 70% of employment in that sub-community. The resultant factors are shown in the last column of **Table 2**. The data for the sub-communities was then assigned to the five highway paths/destinations from the project site as follows:

- Honoapiilani Highway (north to Wailuku) – Wailuku
- Kuihelani Highway - Kahului, Makawao, Paia
- N. Kihei Road - Kihei
- Maalaea – Maalaea, and
- Honoapiilani Highway (south to Lahaina) - Lahaina

The aggregate growth factors for the sub-communities do not add up to 100% as portions of two communities were used and one was not included. The aggregate growth factors were then normalized so that their sum equaled 100%. The derivation and results of the trip distribution factors are shown on **Table 2**.

The trip distribution factors were then used in the trip distribution analysis on **Table 1**. The same factors were used for single and multi-family homes, and for the AM and PM peak hours. During the morning peak hour, most of the trips leaving the project would be going to Kahului via Kuihelani Highway, with the second highest number going south on Honoapiilani Highway to Lahaina. The same pattern is repeated during the afternoon peak hour with returning trips.

The project generated traffic volumes were assigned to the study area network. The trips from the north section of the project were assigned to the access road leading to North Kihei Road. The trips from the south section of the project were assigned to the access road leading to Kapoli Street. Trips from the middle section of the project were assigned to the middle roadway only if the movement would comply with the right-turn in, right-turn out restriction. Outbound left turns were assigned to the roadway leading to North Kihei Road while inbound left turns were made at the Kapoli Street intersection. The results of the traffic assignment analysis are shown on **Figure 6** with the volumes not rounded.

Total Forecast Volumes

The project generated traffic assignment volumes from **Figure 6** were added to the ambient traffic forecasts from **Figure 5** to obtain the total with project traffic forecasts shown on **Figure 7**. The traffic volumes are rounded to the nearest five vehicles per hour except for volumes less than 5 vph.

LEVEL OF SERVICE ANALYSIS

The concept of level of service (LOS) is used to quantify the quality of traffic flow on roadway facilities. The Transportation Research Board (TRB) has developed procedures to calculate level of service value(s) by measuring traffic volumes against the capacities of different types of roadway facilities. Their Highway Capacity Manual 2000 (HCM2000) describes the various procedures developed for freeways, highways, signalized and unsignalized intersections, etc.

The study intersections are both signalized and unsignalized. The methodology for analyzing signalized intersections calculates the levels of service for individual movements, approaches and the intersection as a whole based on the average stopped delay per vehicle. The results range from level of service A (best with average delays less than ten seconds) to F (worst with average delays longer than 80 seconds), described as follows:

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (Seconds/Vehicle)
A	< 10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	> 80.1

Many jurisdictions consider levels of service A to D as acceptable for areas like Maui, with levels of service E and F indicating the need for mitigating measures. For signalized intersections, the major streets can be designed to have a higher level of service than the side streets or turning lanes.

The procedure used for analyzing unsignalized intersections calculates vehicle delays and levels of service based on the distribution of gaps in traffic on the major street and driver judgment in selecting gaps through which to execute turns. For two-way stop intersections where only the minor street traffic is controlled by a stop sign, levels of service are calculated for the critical turning movements including outbound movements from the stop-controlled approach and left turns from the major road to the minor road. The procedure does not calculate an overall intersection level of service.

The Highway Capacity Manual defines the relationship between level of service and delay (in seconds/vehicle) for unsignalized intersections as shown below:

LEVEL OF SERVICE	DELAY (Seconds/Vehicle)
A	< 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	> 50.1

Levels of service A to E are considered acceptable for unsignalized intersections. Level of service F (with average delays longer than 50 seconds) is considered undesirable for unsignalized intersections and would indicate the possible need for mitigation. Level of service F conditions could be tolerated if the delays are not much higher than 60 seconds, traffic queues are short and there are no reasonable mitigating measures available.

Table 3 summarizes the signalized intersection level of service analysis while **Table 4** summarizes the unsignalized intersection level of service analysis. A comparison of levels of service for the different forecast scenarios can give an indication of the traffic impacts of ambient traffic growth and the proposed project. For each of the two study periods, the existing, ambient forecast and total with project forecast levels of service are placed side by side to facilitate this comparison. There is also a fourth column indicating the results of adding mitigating measures to those intersections that show unacceptable levels of service.

Signalized Intersection Analysis

The three signalized intersections on Honoapiilani Highway include Kuihelani Highway, North Kihei Road and Kapoli Street. The results of the analysis of these intersections are shown on **Table 3**. The LOS calculations are provided in **Appendix B**.

The Kuihelani Highway intersection is currently operating at levels of service B and C in the morning and afternoon peak hours, respectively. With the increase in ambient traffic and traffic generated by the proposed project, the intersection would be operating at level of service C in the both morning and afternoon peak hours for the ambient and total with project forecasts. This result indicates that this intersection would not be adversely affected by the projected traffic increases.

The traffic assignment procedure did not assign any vehicles to the access road entering the Kuihelani Highway intersection. Project generated trips bound for Wailuku or Kuihelani Highway could use this route if traffic congestion became a problem at the North Kihei Road intersection in the morning peak. This would take away green time from the through traffic on Honoapiilani Highway but should not adversely affect the through movements, which are forecast to operate at levels of service B in the morning peak.

The North Kihei Road intersection is currently operating at levels of service C and D in the morning and afternoon peak hours, respectively. Despite these acceptable levels of service, the southbound left turn lane on Honoapiilani Highway is already operating at level F in both peak hours due to the high volumes of turns. This would require mitigation in the form of a second southbound left turn lane. The left turn lane level of service would improve from F to D in the morning peak and from F to E in the afternoon peak with mitigation. Level of service E could be considered acceptable for a left turn movement since if it would degrade a major through movement.

The proposed project would affect the traffic operations at the intersection when large volumes use both side street (North Kihei Road) approaches. These movements would require additional green time for the split phasing which was assumed. This green time would be taken away from the through traffic on Honoapiilani Highway. However, the analysis indicates that through traffic would not be adversely affected by these reductions in green time. The northbound levels of service would decrease from C to D for ambient to total with project forecasts in both peak periods. Similarly, the southbound levels of service would decrease from A to B for ambient to total with project forecasts in both peak periods. Despite these decreases in level of service, the resultant levels are at acceptable levels.

The Kapoli Street intersection is currently operating at levels of service D and B in the morning and afternoon peak hours, respectively. The intersection level of service would change to E for the ambient forecast and F for the total with project forecast in the morning peak. Similarly, the intersection level of service would change to C for the ambient forecast and F for the total with project forecast in the afternoon peak. The reason for the lower level of service in the morning peak is that there is only one southbound lane serving a very high volume of traffic. Adding a second through lane would mitigate the problem, as shown in the fourth and eighth columns of **Table 3**. The second lane would begin at the current lane drop and could be merged into the first lane about 1,000 feet south of the Kapoli Street intersection. One lane would be sufficient, as no other traffic signals to the south would affect the single through lane capacity. This proposed mitigation measure is shown on **Figure 8**.

The proposed project would affect the Kapoli Street intersection in two ways. First, the newly added makai bound approach would require a split phase that would take green time away from the main through phase. Second, a new northbound left turn lane would require a separate turn phase that would reduce the green time for the critical southbound through movement. However, these should not be a problem with the mitigation measure implemented, as indicated above.

<u>Unsignalized Intersection Analysis</u>

The two unsignalized intersections on Honoapiilani Highway are at Maalaea Street (north) and the new right-turn in, right-turn out project access roadway. The results of this analysis are shown on **Figure 4**, and the calculations are provided in **Appendix C**.

The only two movements at the Maalaea Street (north) intersection for which levels of service are calculated are the outbound right turn from Maalaea Road and the inbound left turn from the highway. The right turn movement is currently operating at level of service A in the morning peak and B in the afternoon peak. With the higher volumes of traffic on Honoapiilani Highway calculated for the ambient and total with project forecasts, the levels of service are forecast to change from A to B in the morning and from B to C in the afternoon. These levels are considered acceptable. The left turn movement is currently at level of service A in the morning peak and B in the afternoon peak. For both peak periods, the levels of service would remain unchanged for the ambient forecast but decrease one level for the total with project forecast. While levels B and C are considered acceptable, observation of traffic elsewhere indicates that left turns are difficult to make for levels of service B and C conditions. This would indicate the possible need to mitigate traffic safety problems forecast for the ambient traffic conditions. Possible mitigating measures include installing a traffic signal or prohibiting the left turn movement. The former measure would have to be coordinated with the traffic signal at Kapoli Street to avoid traffic operations problems, while the latter measure would affect the signal timing at Kapoli Street.

The right-turn in, right-turn out project access roadway would exist for only the total with project forecast. The level of service would be calculated for only the right-turn out movement. For both peak hours, this movement is forecast to operate at level of service C, indicating acceptable traffic operations.

CONCLUSIONS

The proposed project is not expected to have an adverse traffic impact on Honoapiilani Highway in the vicinity of the project site with adequate mitigation implemented. The additional traffic that would be generated by the proposed project would require resources that can be accommodated. Specifically, the new makai bound approaches to the signalized intersections would require more green time to meet split phase requirements. In addition, new northbound left turn lanes would take green time away from southbound through traffic. However, there should be sufficient surplus in the through traffic green times to accommodate these reductions if the previously identified mitigating measures are implemented.

The following measures are needed to alleviate existing and future problems due to increases in ambient traffic. A second left turn lane is needed on the southbound approach of Honoapiilani Highway at the North Kihei Road intersection to mitigate current traffic operations problems. In addition, a second southbound through lane on Honoapiilani Highway needs to be added at the Kapoli Street intersection to mitigate a future problem due to ambient traffic growth. To eliminate a foreseen traffic safety problem, the Maalaea Road (north) intersection needs to be signalized or the left turn from the highway should be prohibited.

References

References

1. *Highway Capacity Manual*, Transportation Research Board, National Research Council, Washington, D.C., 2000 Edition.

2. *Highway Capacity Analysis Program, Version 1*, Catalina Engineering, Inc., 2003.

3. *Maui Long-Range Land and Transportation Plan*, Kaku Associates, Inc., 1997.

4. *Trip Generation*, Institute of Transportation Engineers, Seventh Edition, 2003.

5. *Trip Generation Handbook*, Institute of Transportation Engineers, Second Edition, 2004.

Figures

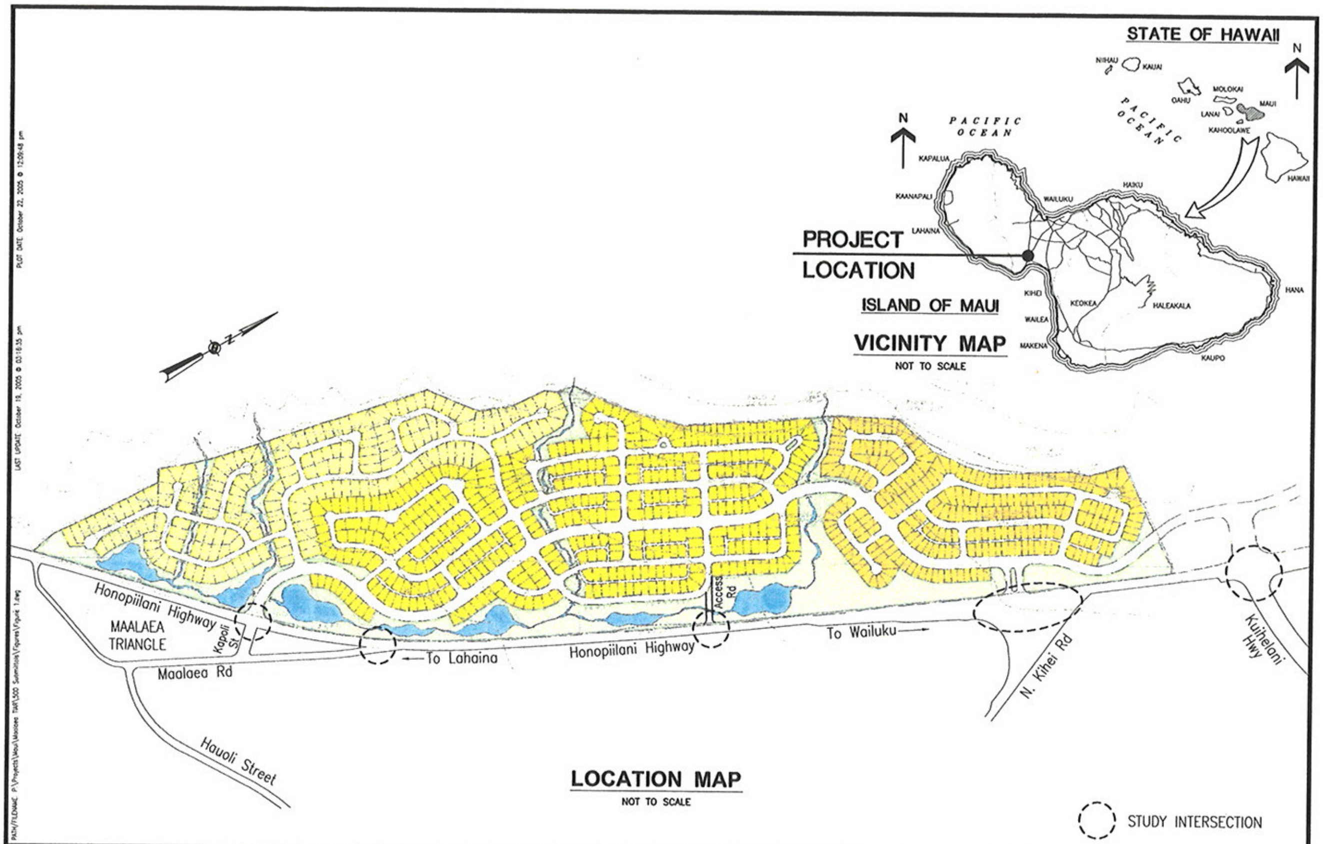

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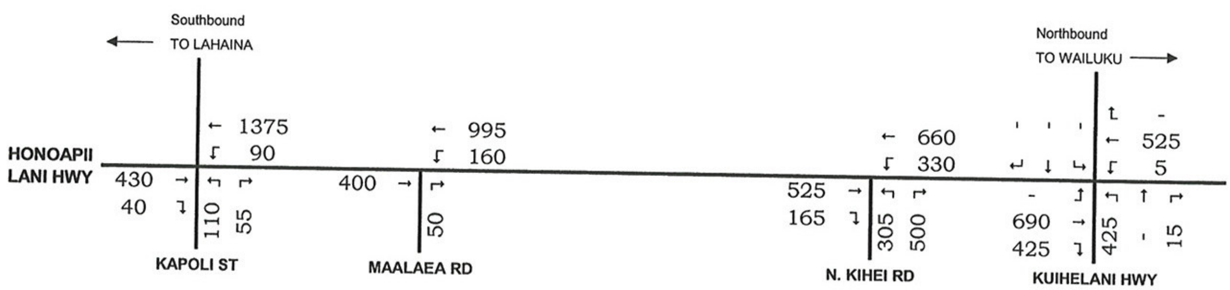
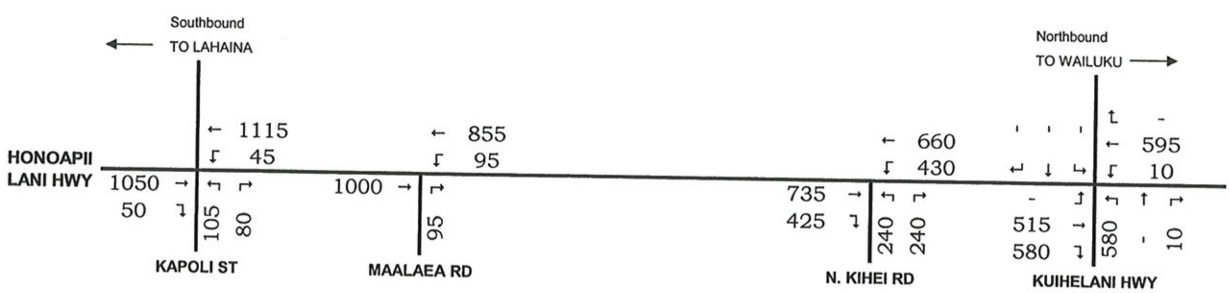
Figure 1
LOCATION MAP
TRAFFIC IMPACT ANALYSIS REPORT
MAALAEA MAUKA SUBDIVISION
MAALAEA, MAUI, HAWAII

OCTOBER 2005



AM PEAK HOUR



PM PEAK HOUR

Not to scale

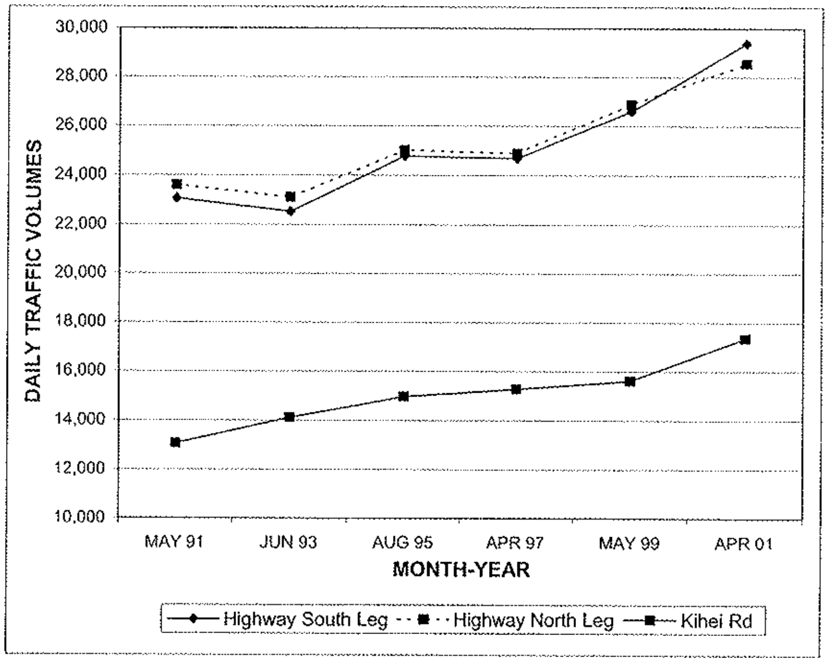
2005 EXISTING TRAFFIC VOLUMES

FIGURE 2

DAILY TRAFFIC VOLUMES AT STATION NO. 10
Honoapiilani Highway at North Kihei Road (April 9, 2001)

DATE OF COUNT	HONOAPIILANI HWY SOUTH LEG	HONOAPIILANI HWY NORTH LEG	N. KIHEI ROAD
MAY 91	23,061	23,594	13,060
JUN 93	22,520	23,099	14,112
AUG 95	24,767	25,010	14,964
APR 97	24,678	24,888	15,270
MAY 99	26,580	26,867	15,608
APR 01	29,375	28,546	17,348

Source:
State of Hawaii
Department of Transportation

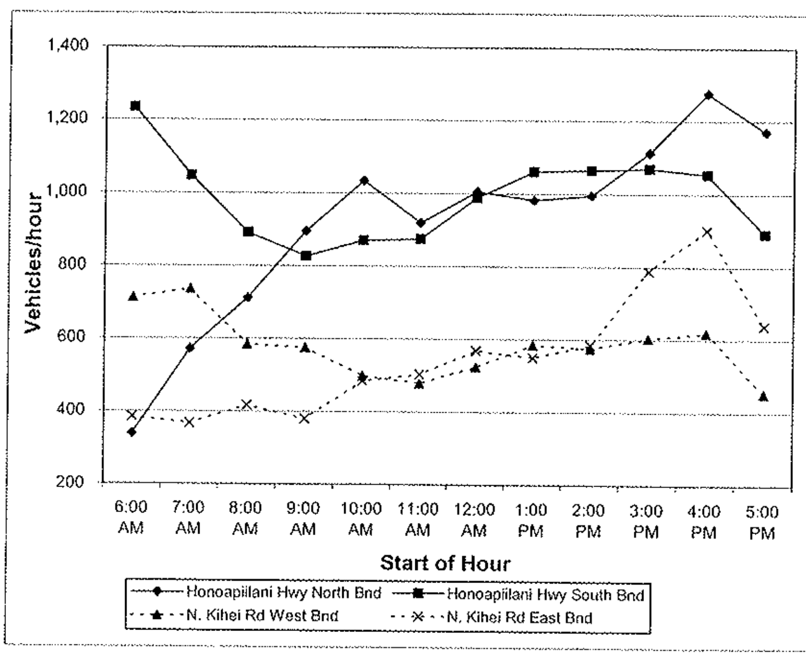


DAILY TRAFFIC VOLUMES ON HONOAPIILANI HIGHWAY AT NORTH KIHEI ROAD
FIGURE 3

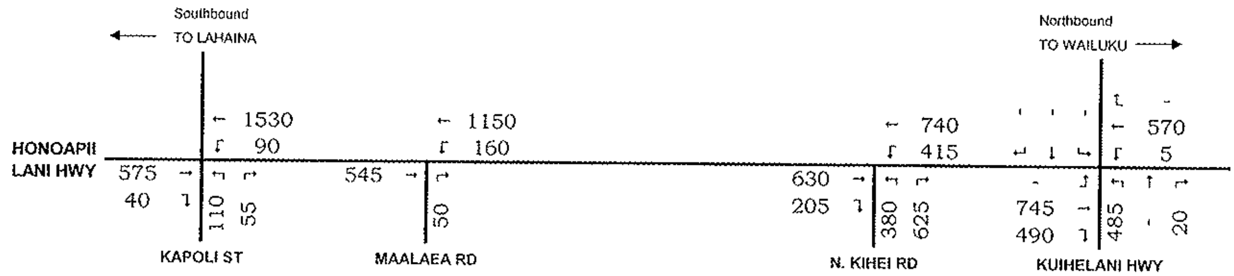
HOURLY TRAFFIC VOLUMES AT STATION NO. 10
Honoapiilani Highway at North Kihei Road (April 9, 2001)
Vehicles/Hour

Start of Hour	Honoapiilani Hwy North Bound	Honoapiilani Hwy South Bound	North Kihei Rd West Bound	North Kihei Rd East Bound
6:00 AM	339	1,233	712	385
7:00 AM	571	1,047	736	367
8:00 AM	711	891	583	417
9:00 AM	896	827	575	380
10:00 AM	1,034	871	498	484
11:00 AM	919	875	478	502
12:00 AM	1,005	988	523	568
1:00 PM	982	1,060	584	549
2:00 PM	995	1,064	574	584
3:00 PM	1,112	1,069	602	788
4:00 PM	1,275	1,054	618	901
5:00 PM	1,170	892	452	638

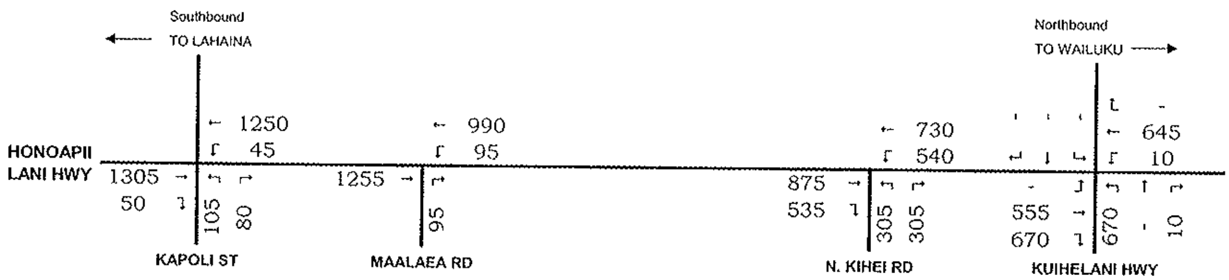
Source: State of Hawaii
Department of Transportation



HOURLY TRAFFIC VOLUMES ON HONOAPIILANI HIGHWAY AT NORTH KIHEI ROAD
FIGURE 4



AM PEAK HOUR

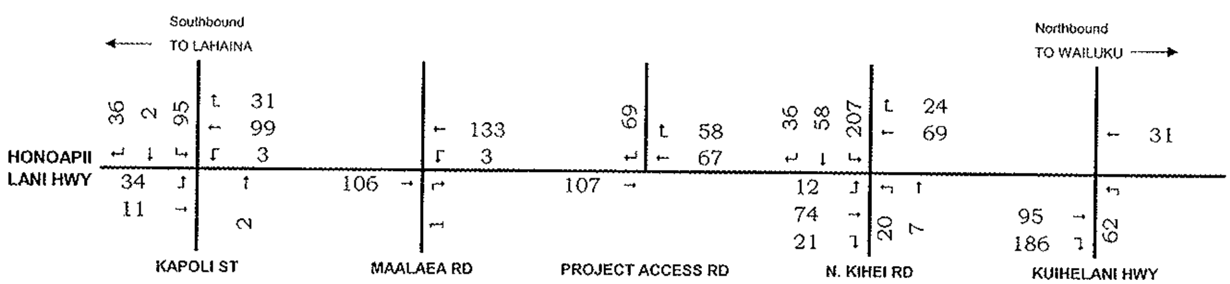


PM PEAK HOUR

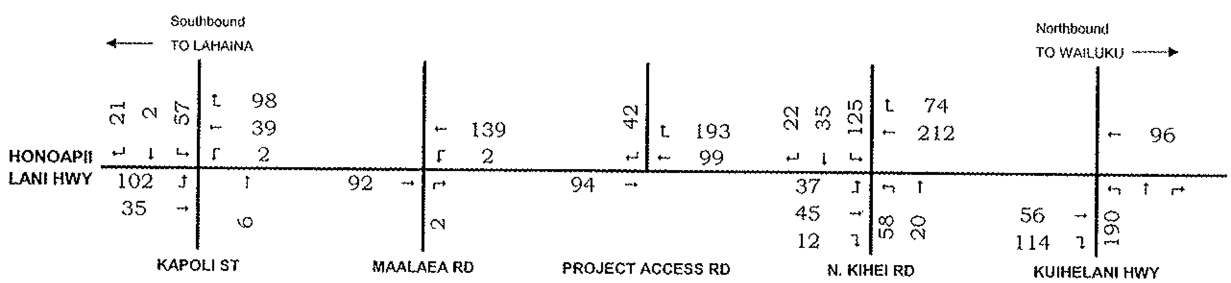
Not to scale

2013 AMBIENT TRAFFIC FORECAST

FIGURE 5



AM PEAK HOUR

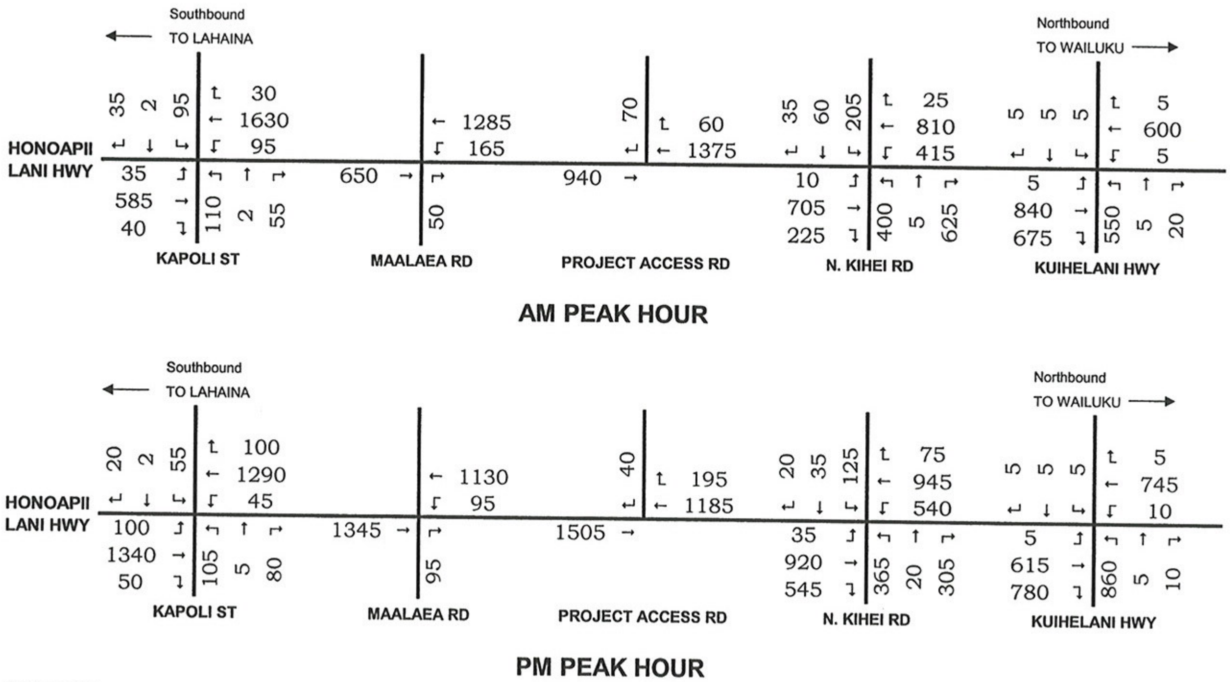


PM PEAK HOUR

Not to scale

PROJECT GENERATED TRAFFIC

FIGURE 6



Not to scale

2013 TOTAL WITH PROJECT FORECAST

FIGURE 7

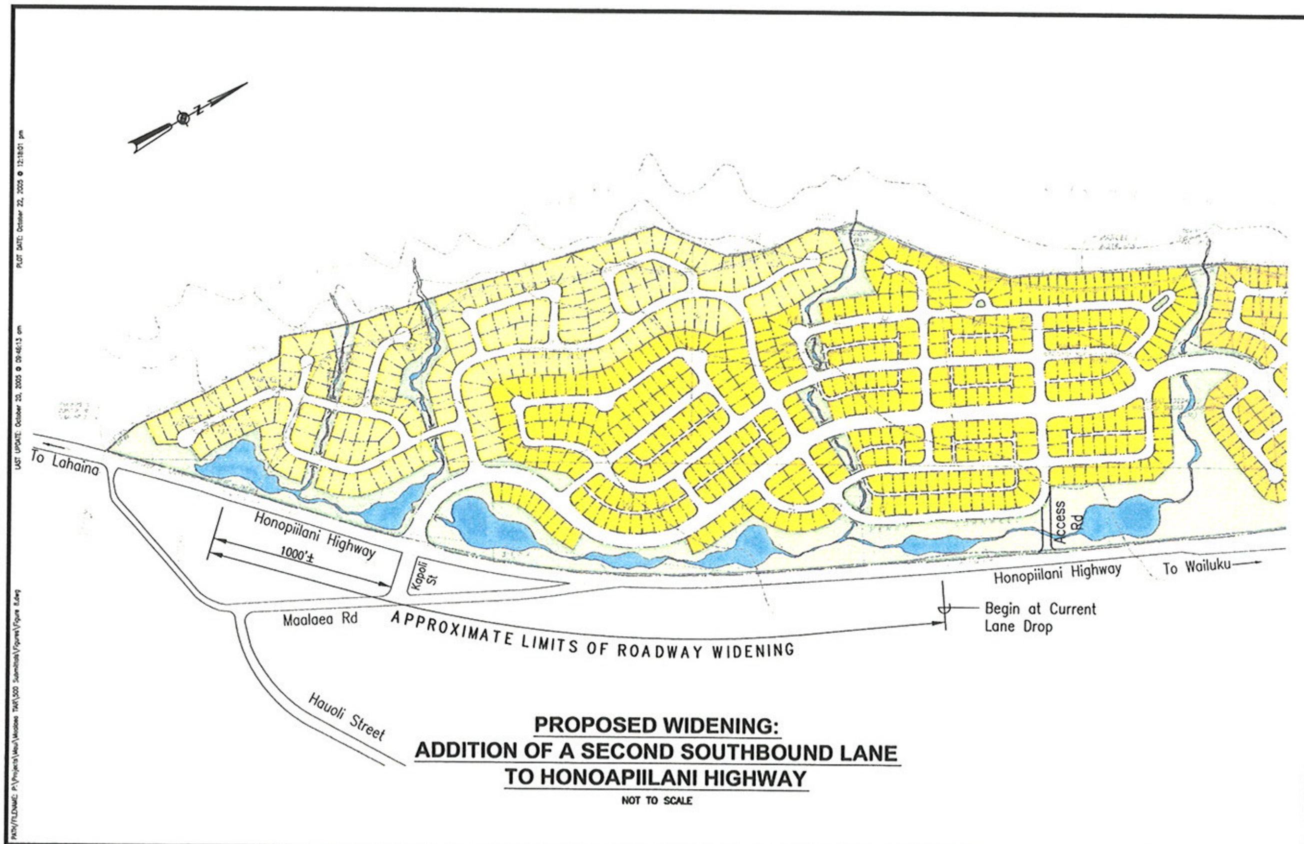


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Figure 8
PROPOSED WIDENING
TRAFFIC IMPACT ANALYSIS REPORT
MAALAEA MAUKA SUBDIVISION
MAALAEA, MAUI, HAWAII
OCTOBER 2005

Tables

TABLE 1
TRIP GENERATION AND DISTRIBUTION ANALYSIS

239	Affordable Single Family Units
427	Standard Single Family Units
179	Custom Single Family Units
845	Single Family Units
105	Multi-Family Units
950	**Total Residential Units**

AM TRIP GENERATION

845 Single Family Units (LU 210, SF DU)

	Trips	Entering	Exiting
T = 0.70(X) + 9.43		25%	75%
T =	601	150	451
for 240 North Section	171	43	128
355 Middle Section	252	63	189
250 South Section	178	44	133

105 Multi-Family Units (LU 231, low-rise townhouse)

	Trips	Entering	Exiting
T = 0.67(X)		25%	75%
T =	70	18	53
TOTAL TRIPS	671	168	503

AM TRIP DISTRIBUTION

Direction	Trips	North via H. Hwy	South via H. Hwy	via N. Kihei Rd	via Kuihelani	Maalaea
		18.8%	26.8%	15.6%	37.1%	1.7%
Entering	43	8	11	7	16	1
Exiting	128	24	34	20	47	2
Entering	63	12	17	10	23	1
Exiting	189	36	51	30	70	3
Entering	44	8	12	7	16	1
Exiting	133	25	36	21	49	2

Direction	Trips	North via H. Hwy	South via H. Hwy	via N. Kihei Rd	via Kuihelani	Maalaea
Entering	18	3	5	3	7	0
Exiting	53	10	14	8	20	1
Entering	168	32	45	26	62	3
Exiting	503	95	135	79	187	9

TABLE 1
TRIP GENERATION AND DISTRIBUTION ANALYSIS

PM TRIP GENERATION

845 Single Family Units (LU 210, SF DU)

		Trips	Entering	Exiting
Ln(T) = 0.90Ln(X) + 0.53			63%	37%
T = 6.60		732	461	271
for 240	North Section	208	131	77
355	Middle Section	307	194	114
250	South Section	216	136	80

105 Multi-Family Units (LU 231, low-rise townhouse)

	Trips	Entering	Exiting
T = 0.78(X)		58%	42%
T =	82	48	34
TOTAL TRIPS	814	508	305

PM TRIP DISTRIBUTION

Direction	Trips	North via H. Hwy	South via H. Hwy	via N. Kihei Rd	via Kuihelani	Maalaea
		18.8%	26.8%	15.6%	37.1%	1.7%
Entering	131	25	35	20	49	2
Exiting	77	14	21	12	29	1
Entering	194	36	52	30	72	3
Exiting	114	21	30	18	42	2
Entering	136	26	37	21	51	2
Exiting	80	15	21	12	30	1

Direction	Trips	North via H. Hwy	South via H. Hwy	via N. Kihei Rd	via Kuihelani	Maalaea
Entering	48	9	13	7	18	1
Exiting	34	6	9	5	13	1
Entering	508	96	136	79	189	9
Exiting	305	57	82	48	113	5

TABLE 2
ESTIMATED TRIP DISTRIBUTION BASED ON MAUI LRLTP FORECASTS

POPULATION

Community	1990	2013	2020	2013 (%)	Sub-Community Breakdown		30% pop+ 70% emp
Wailuku-Kahului	32,717	47,706	52,440	35.6%	Wailuku (0.4 of W-K)	14.2%	17.7%
Kihei-Makena	15,382	24,265	27,070	18.1%	Kahului (0.6 of W-K)	21.4%	26.5%
Lahaina	14,590	24,075	27,070	18.0%	Kihei (0.9 of K-M)	16.3%	14.7%
Hana	1,898	2,499	2,689	1.9%	Maalaea (0.1 of K-M)	1.8%	1.6%
Makawao	18,873	24,904	26,809	18.6%	Lahaina	18.0%	25.3%
Paia-Haiku	7,897	10,568	11,412	7.9%	60% of Makawao-Paia	18.5%	8.4%
	91,357	134,018	147,490	100.0%		90.2%	94.3%

EMPLOYMENT

Community	1990	2013	2020	2013 (%)	Sub-Community Breakdown	
Wailuku-Kahului	24,374	36,340	40,119	47.9%	Wailuku (0.4 of W-K)	19.2%
Kihei-Makena	7,575	11,837	13,183	15.6%	Kahului (0.6 of W-K)	28.8%
Lahaina	15,436	21,537	23,463	28.4%	Kihei (0.9 of K-M)	14.1%
Hana	851	941	970	1.2%	Maalaea (0.1 of K-M)	1.6%
Makawao	2,354	3,425	3,763	4.5%	Lahaina	28.4%
Paia-Haiku	1,178	1,728	1,902	2.3%	60% of Makawao-Paia	4.1%
	51,768	75,808	83,400	100.0%		96.0%

HIGHWAY BREAKDOWN	Sub-Communities	Highway Assignment Un-normalized	Highway Assignment Normalized
Honoapiilani Hwy (North)	Wailuku	17.7%	18.8%
Kuihelani Hwy	Kahului, Makawao, Paia	35.0%	37.1%
N. Kihei Rd	Kihei	14.7%	15.6%
Maalaea	Maalaea	1.6%	1.7%
Honoapiilani Hwy (South)	Lahaina	25.3%	26.8%
		94.3%	100.0%

Source of 1990 and 2020 data:
Kaku Associates, Inc., "Maui Long-Range Land Transportation Plan" (February 1997)

TABLE 3
SIGNALIZED INTERSECTION LEVEL OF SERVICE ANALYSIS ON HONOAPIILANI HIGHWAY

INTERSECTION APPROACH MOVEMENT	AM PEAK HOUR 2005 EXIST	AM PEAK HOUR 2013 AMB	AM PEAK HOUR 2013 TOTAL	AM PEAK HOUR 2013 W/MIT	PM PEAK HOUR 2005 EXIST	PM PEAK HOUR 2013 AMB	PM PEAK HOUR 2013 TOTAL	PM PEAK HOUR 2013 W/MIT
HWY @ KUIHELANI HWY	B	C	C		C	C	C	
Kuihelani Hwy ext EB	D	D	D		D	D	D	
Kuihelani Hwy WB	C	D	D		D	C	D	
Honoapiilani Hwy NB	B	B	B		B	B	B	
Left Turn Lane	D	D	D		D	D	D	
Through lanes	B	B	B		B	C	C	
Honoapiilani Hwy SB	B	B	B		B	C	C	
Left Turn Lane	D	D	D		D	D	D	
Through lanes	B	B	B		B	C	C	
HWY @ N. KIHEI RD	C	D	D	D	D	D	D	D
N. Kihei Rd ext EB			E	D			D	D
N. Kihei Rd WB	C	C	D	D	C	C	D	D
Honoapiilani Hwy NB	B	B	C	C	B	C	D	C
Left Turn Lane			E	E			E	E
Through Lanes	B	C	D	C	C	C	D	D
Honoapiilani Hwy SB	D	E	E	C	E	F	E	D
Left Turn Lane	F	F	F	D	F	F	F	E
Through Lanes	A	A	B	C	A	A	B	C
HWY @ KAPOLI ST	D	E	F	D	B	C	F	C
Kapoli St ext EB			D	D			D	D
Kapoli St WB	D	D	D	D	C	C	D	D
Honoapiilani Hwy NB	B	B	B	B	B	B	C	C
Left Turn Lane			D	D			E	E
Through Lanes	B	B	B	B	B	B	B	C
Honoapiilani Hwy SB	D	F	F	D	B	D	F	C
Left Turn Lane	D	D	E	E	D	D	D	D
Through Lane	D	F	F	D	B	D	F	C

LEGEND: NB - Northbound
SB - Southbound
EB - Eastbound
WB - Westbound

TABLE 4
UNSIGNALIZED INTERSECTION LEVEL OF SERVICE ANALYSIS ON HONOAPIILANI HIGHWAY

INTERSECTION APPROACH AND MOVEMENT	AM PEAK HOUR 2005 EXIST	AM PEAK HOUR 2013 AMB	AM PEAK HOUR 2013 TOTAL	AM PEAK HOUR 2013 W/MIT	PM PEAK HOUR 2005 EXIST	PM PEAK HOUR 2013 AMB	PM PEAK HOUR 2013 TOTAL	PM PEAK HOUR 2013 W/MIT
HWY @ MAALAEA RD								
Maalaea Rd WB RT	A	B	B		B	C	C	
Honoapiilani Hwy SB LT	A	A	B		B	B	C	
HWY @ PROJECT ACCESS								
Project Access EB RT			C				C	

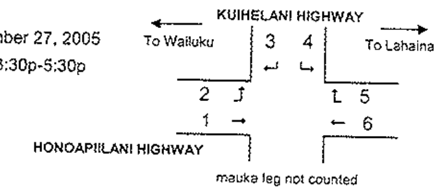
LEGEND: SB - Southbound RT - Right Turn
EB - Eastbound LT - Left Turn
WB - Westbound

Appendix A

Traffic Turning Movement Counts

TRAFFIC TURNING MOVEMENT COUNT
MAALAEA MAUKA SUBDIVISION

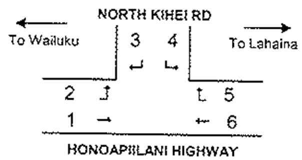
LOCATION: Honoapiilani Highway/ Kuihelani Hwy
DATE: TUES, September 27, 2005
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER:
RECORDER:



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
6:30-6:45a	102	0	1	90	32	63	288
6:45-7:00a	86	1	0	58	42	74	261
7:00-7:15a	157	0	0	131	60	115	463
7:15-7:30a	67	1	0	73	36	90	267
7:30-7:45a	157	0	6	115	93	199	570
7:45-8:00a	155	2	7	115	112	212	603
8:00-8:15a	113	4	3	100	117	145	482
8:15-8:30a	101	0	0	93	104	132	430
6:30-8:30a	938	8	17	775	596	1030	3364
6:30-7:30a	412	2	1	352	170	342	1279
7:00-8:00a	536	3	13	434	301	616	1903
7:30-8:30a	526	6	16	423	426	688	2085 *
PHF	0.85		0.91		0.86		
3:30-3:45p	132	3	7	174	121	137	574
3:45-4:00p	119	2	3	157	121	154	556
4:00-4:15p	118	4	5	129	148	136	540
4:15-4:30p	152	2	4	155	143	133	589
4:30-4:45p	152	1	1	141	159	123	577
4:45-5:00p	175	3	0	156	130	122	586
5:00-5:15p	138	2	3	102	125	129	499
5:15-5:30p	128	3	0	113	124	130	498
3:30-5:30p	1114	20	23	1127	1071	1064	4419
3:30-4:30p	521	11	19	615	533	560	2259
4:00-5:00p	597	10	10	581	580	514	2292 *
PHF	1.12				0.99		

TRAFFIC TURNING MOVEMENT COUNT
MAALAEA MAUKA SUBDIVISION

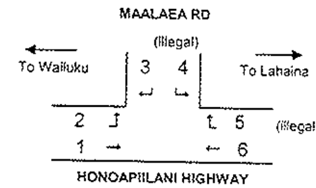
LOCATION: Honoapiilani Highway/ North Kihei Rd
DATE: TUES, September 27, 2005
TIME: 7:00a-8:30a / 3:30p-5:30p
WEATHER:
RECORDER:



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
6:30-6:45a							0
6:45-7:00a							0
7:00-7:15a							0
7:15-7:30a	108	81	111	66	44	95	505
7:30-7:45a	114	101	141	72	44	142	614
7:45-8:00a	257	93	152	86	49	132	769
8:00-8:15a	115	49	97	66	34	114	475
8:15-8:30a	175	87	109	80	37	136	624
6:30-8:30a	769	411	610	370	208	619	2987
7:15-8:15a	594	324	501	290	171	483	2363
7:30-8:30a	661	330	499	304	164	524	2482 *
PHF	0.71		0.84		0.95		
3:30-3:45p	150	96	68	59	80	164	617
3:45-4:00p	184	118	82	73	97	201	755
4:00-4:15p	168	84	67	60	103	160	642
4:15-4:30p	144	102	43	58	99	182	628
4:30-4:45p	166	127	50	51	127	192	713
4:45-5:00p	130	113	58	53	66	151	571
5:00-5:15p	121	131	50	73	97	166	638
5:15-5:30p	113	98	55	69	103	225	663
3:30-5:30p	1176	869	473	496	772	1441	5227
3:30-4:30p	646	400	260	250	379	707	2642
3:45-4:45p	662	431	242	242	426	735	2738 *
PHF	0.90		0.78		0.97		

TRAFFIC TURNING MOVEMENT COUNT
MAALAEA MAUKA SUBDIVISION

LOCATION: Honoapiilani Highway/ Maalaea Rd
DATE: WED, September 28, 2005
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER:
RECORDER:



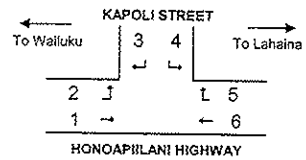
TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
6:30-6:45a	284	44	12	0	0	96	436
6:45-7:00a	237	49	12	0	0	68	366
7:00-7:15a	275	38	15	0	0	116	444
7:15-7:30a	198	28	13	0	0	120	359
7:30-7:45a	221	26	16	0	0	156	419
7:45-8:00a	234	30	9	0	0	162	435
8:00-8:15a	203	31	16	0	0	166	416
8:15-8:30a	169	22	12	0	0	154	357
6:30-8:30a	1821	268	105	0	0	1038	3232
6:30-7:30a	994	159	52	0	0	400	1605 *
7:00-8:00a	928	122	53	0	0	554	1657
7:30-8:30a	827	109	53	0	0	638	1627
PHF	0.84		0.88		0.85		
3:30-3:45p	265	26	20	0	0	278	589
3:45-4:00p	195	27	29	0	0	246	497
4:00-4:15p	223	23	25	0	0	253	524
4:15-4:30p	173	18	19	0	0	224	434
4:30-4:45p	212	29	40	0	0	290	571
4:45-5:00p	176	27	27	0	0	290	520
5:00-5:15p	174	21	26	0	0	251	472
5:15-5:30p	179	37	27	0	0	249	492
3:30-5:30p	1597	208	213	0	0	2081	4099
3:30-4:30p	856	94	93	0	0	1001	2044
4:00-5:00p	784	97	111	0	0	1057	2049 *
PHF	0.91		0.69		0.91		

Appendix B

Signalized Intersection Level of Service (LOS) Calculations

TRAFFIC TURNING MOVEMENT COUNT
MAALAEA MAUKA SUBDIVISION

LOCATION: Honoapiilani Highway/ Kapoli St
DATE: WED September 28, 2005
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER:
RECORDER:



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL	
6:30-6:45a	338	45	39	29	28	115	594	
6:45-7:00a	329	10	5	26	5	105	480	
7:00-7:15a	389	22	9	35	4	110	569	
7:15-7:30a	317	12	3	20	5	99	456	
7:30-7:45a	274	20	13	22	12	156	497	
7:45-8:00a	197	15	14	14	7	135	382	
8:00-8:15a	321	9	15	13	10	132	500	
8:15-8:30a	179	16	12	16	16	175	414	
6:30-8:30a	2344	149	110	175	87	1027	3892	
6:30-7:30a	1373	89	56	110	42	429	2099	*
7:00-8:00a	1177	69	39	91	28	500	1904	
7:30-8:30a	971	60	54	65	45	598	1793	
PHF	0.89		0.61		0.82			
3:30-3:45p	298	14	22	29	13	275	651	
3:45-4:00p	287	11	21	21	7	212	559	
4:00-4:15p	289	11	20	25	14	247	606	
4:15-4:30p	240	9	16	31	14	315	625	
4:30-4:45p	190	14	15	10	7	271	507	
4:45-5:00p	175	9	11	15	11	259	480	
5:00-5:15p	186	11	7	25	4	237	470	
5:15-5:30p	160	8	12	9	6	205	400	
3:30-5:30p	1825	87	124	165	76	2021	4298	
3:30-4:30p	1114	45	79	106	48	1049	2441	*
4:00-5:00p	894	43	62	81	46	1092	2218	
PHF	0.93		0.91		0.95			

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: EX AM 2005
Comment: 2005 EXISTING AM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: KUIHELANI
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	5	5	5	423	5	16	5	688	426	6	526	5
RTOR volume (veh/h)			5			10			150			5
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	0	0	0	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	0			0			0			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB		R	L	TR				
SB			L	TR				
Green (s)	5	25	5	46				
Yellow + All red (s)	5	5	4	5				

Cycle (s): 100 Lost time per cycle (s): 20 Critical v/c Ratio: .512

Intersection Performance

	EB		WB			NB			SB		
Lane group configuration	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	11	0	230	235	7	5	748	300	7	572	0
Capacity (veh/h)	93	81	442	444	396	88	1631	1124	88	1631	728
Adjusted saturation flow (veh/h)	1854	1615	1770	1776	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.117	0	.52	.53	.016	.061	.458	.267	.074	.35	0
g/C ratio	.05	.05	.25	.25	.25	.05	.46	.71	.05	.46	.46
Average back of queue (veh)	.3	0	6	6.2	.1	.2	8	3.3	.2	5.7	0
Uniform delay (s)	45.4	45.1	32.3	32.4	28.2	45.3	18.5	5.2	45.3	17.4	14.6
Incremental delay (s)	0	0	1.1	1.2	0	0	.1	0	0	0	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	45.4	45.1	33.4	33.6	28.2	45.3	18.6	5.2	45.3	17.4	14.6
LOS	D	D	C	C	C	D	B	A	D	B	B
Approach delay (s)/LOS	45.4 / D		33.5 / C			14.9 / B			17.7 / B		
Intersection delay (s)/ LOS	20 / B										

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AMB AM 2013
Comment: 2013 AMBIENT AM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: KUIHELANI
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	5	5	5	487	5	18	5	746	491	7	570	5
RTOR volume (veh/h)			5			10			200			5
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	0	0	0	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	0			0			0			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB		R	L	TR				
SB			L	TR				
Green (s)	5	25	5	46				
Yellow + All red (s)	5	5	4	5				

Cycle (s): 100 Lost time per cycle (s): 20 Critical v/c Ratio: .548

Intersection Performance

	EB		WB			NB			SB		
Lane group configuration	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	11	0	265	270	9	5	811	316	8	620	0
Capacity (veh/h)	93	81	442	444	396	88	1631	1124	88	1631	728
Adjusted saturation flow (veh/h)	1854	1615	1770	1776	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.117	0	.598	.608	.022	.061	.497	.281	.086	.38	0
g/C ratio	.05	.05	.25	.25	.25	.05	.46	.71	.05	.46	.46
Average back of queue (veh)	.3	0	7.1	7.3	.2	.2	8.9	3.5	.2	6.3	0
Uniform delay (s)	45.4	45.1	33.1	33.2	28.3	45.3	18.9	5.3	45.3	17.7	14.6
Incremental delay (s)	0	0	2.2	2.4	0	0	.2	0	0	0	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	45.4	45.1	35.3	35.6	28.3	45.3	19.1	5.3	45.3	17.7	14.6
LOS	D	D	D	D	C	D	B	A	D	B	B
Approach delay (s)/LOS	45.4 / D		35.3 / D			15.4 / B			18 / B		
Intersection delay (s)/ LOS	20.9 / C										

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOT AM 2013
Comment: 2013 TOTAL W/PROJ AM

Site Information

Jurisdiction/Date: 10/10/05
EB/WB Street: KUIHELANI
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	5	5	5	549	5	18	5	840	677	7	601	5
RTOR volume (veh/h)			5			10			200			5
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	0	0	0	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB		R	L	TR				
SB			L	TR				
Green (s)	5	25	5	46				
Yellow + All red (s)	5	5	4	5				

Cycle (s): 100 Lost time per cycle (s): 15 Critical v/c Ratio: .397

Intersection Performance

	EB		WB			NB			SB		
Lane group configuration	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	11	0	298	304	9	5	913	518	8	653	0
Capacity (veh/h)	93	81	442	444	396	88	1631	1124	88	1631	728
Adjusted saturation flow (veh/h)	1854	1615	1770	1776	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.117	0	.674	.684	.022	.061	.56	.461	.086	.4	0
g/C ratio	.05	.05	.25	.25	.25	.05	.46	.71	.05	.46	.46
Average back of queue (veh)	.3	0	8.4	8.6	.2	.2	10.5	6.9	.2	6.8	0
Uniform delay (s)	45.4	45.1	33.8	33.9	28.3	45.3	19.6	6.3	45.3	17.9	14.6
Incremental delay (s)	0	0	4	4.3	0	0	.4	.2	0	0	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	.0	0	0
Delay (s)	45.4	45.1	37.8	38.2	28.3	45.3	20	6.5	45.3	17.9	14.6
LOS	D	D	D	D	C	D	B	A	D	B	B
Approach delay (s)/LOS	45.4 / D		37.9 / D			15.2 / B			18.2 / B		
Intersection delay (s)/ LOS	21.2 / C										

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: EX PM 2005
Comment: 2005 EXISTING PM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: KUIHELANI
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	5	5	5	581	5	10	5	514	580	10	597	5
RTOR volume (veh/h)			5			10			200			5
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	0	0	0	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB		R	L	TR				
SB			L	TR				
Green (s)	5	25	5	46				
Yellow + All red (s)	5	5	4	5				

Cycle (s): 100 Lost time per cycle (s): 15 Critical v/c Ratio: .321

Intersection Performance

	EB		WB			NB			SB		
Lane group configuration	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	11	0	316	321	0	5	559	413	11	649	0
Capacity (veh/h)	93	81	442	444	396	88	1631	1124	88	1631	728
Adjusted saturation flow (veh/h)	1854	1615	1770	1775	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.117	0	.714	.724	0	.061	.342	.367	.123	.398	0
g/C ratio	.05	.05	.25	.25	.25	.05	.46	.71	.05	.46	.46
Average back of queue (veh)	.3	0	9.1	9.3	0	.2	5.6	5	.3	6.7	0
Uniform delay (s)	45.4	45.1	34.2	34.3	28.1	45.3	17.3	5.7	45.4	17.8	14.6
Incremental delay (s)	0	0	5.4	5.8	0	0	0	0	0	0	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	45.4	45.1	39.6	40.1	28.1	45.3	17.3	5.7	45.4	17.8	14.6
LOS	D	D	D	D	C	D	B	A	D	B	B
Approach delay (s)/LOS	45.4 / D		39.9 / D			12.6 / B			18.3 / B		
Intersection delay (s)/ LOS	22 / C										

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AMB PM 2013
Comment: 2013 AMBIENT PM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: KUIHELANI
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)	5	5	5	669	5	12	5	557	668	12	647	5
RTOR volume (veh/h)			5			10			260			5
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	0	0	0	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT   T: TH   R: RT   P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB		R	L	TR				
SB			L	TR				
Green (s)	5	31	5	40				
Yellow + All red (s)	5	5	4	5				

Cycle (s): 100   Lost time per cycle (s): 15   Critical v/c Ratio: .345

Intersection Performance

	EB		WB			NB			SB		
Lane group configuration	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	11	0	364	369	2	5	605	443	13	703	0
Capacity (veh/h)	93	81	549	550	491	88	1419	1124	88	1419	633
Adjusted saturation flow (veh/h)	1854	1615	1770	1775	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.117	0	.663	.671	.004	.061	.427	.394	.147	.496	0
g/C ratio	.05	.05	.31	.31	.31	.05	.4	.71	.05	.4	.4
Average back of queue (veh)	.3	0	9.7	9.9	0	.2	6.8	5.5	.4	8.3	0
Uniform delay (s)	45.4	45.1	30	30.1	23.8	45.3	21.7	5.8	45.5	22.5	18
Incremental delay (s)	0	0	3	3.2	0	0	.1	.1	0	.3	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	45.4	45.1	33	33.3	23.8	45.3	21.8	5.9	45.5	22.8	18
LOS	D	D	C	C	C	D	C	A	D	C	B
Approach delay (s)/LOS	45.4 / D		33.1 / C			15.3 / B			23.2 / C		
Intersection delay (s)/ LOS	22.8 / C										

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOT PM 2013
Comment: 2013 TOTAL W/PROJ PM

Site Information

Jurisdiction/Date: 10/10/05
EB/WB Street: KUIHELANI
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)	5	5	5	859	5	12	5	613	782	12	743	5
RTOR volume (veh/h)			5			10			260			5
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	0	0	0	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT   T: TH   R: RT   P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB		R	L	TR				
SB			L	TR				
Green (s)	5	31	5	40				
Yellow + All red (s)	5	5	4	5				

Cycle (s): 100   Lost time per cycle (s): 15   Critical v/c Ratio: .437

Intersection Performance

	EB		WB			NB			SB		
Lane group configuration	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	11	0	467	472	2	5	666	567	13	808	0
Capacity (veh/h)	93	81	549	550	491	88	1419	1124	88	1419	633
Adjusted saturation flow (veh/h)	1854	1615	1770	1775	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.117	0	.851	.858	.004	.061	.47	.505	.147	.569	0
g/C ratio	.05	.05	.31	.31	.31	.05	.4	.71	.05	.4	.4
Average back of queue (veh)	.3	0	14.5	14.8	0	.2	7.7	7.9	.4	10	0
Uniform delay (s)	45.4	45.1	32.3	32.4	23.8	45.3	22.2	6.6	45.5	23.3	18
Incremental delay (s)	0	0	12.2	12.8	0	0	.2	.4	0	.5	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	45.4	45.1	44.5	45.2	23.8	45.3	22.4	7	45.5	23.8	18
LOS	D	D	D	D	C	D	C	A	D	C	B
Approach delay (s)/LOS	45.4 / D		44.8 / D			15.4 / B			24.2 / C		
Intersection delay (s)/ LOS	27.1 / C										

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: EX AM 2005
Comment: 2005 EXISTING AM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: N. KIHEI R
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				304		499		524	164	330	661	
RTOR volume (veh/h)						300			75			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					0			0			0	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LR	R						
NB	R		TR					
SB		LT	T					
Green (s)	26	19	42.5					
Yellow + All red (s)	5	3	4.5					

Cycle (s): 100   Lost time per cycle (s): 4.5   Critical v/c Ratio: .481

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				2		1		2	1	1	2	
Flow rate (veh/h)				330		216		570	97	359	718	
Capacity (veh/h)				894		792		1507	1156	336	2288	
Adjusted saturation flow (veh/h)				3437		1583		3547	1583	1770	3547	
v/c ratio				.37		.273		.378	.084	1.067	.314	
g/C ratio				.26		.5		.425	.73	.19	.645	
Average back of queue (veh)				4.1		3.7		6.1	.8	15.7	5	
Uniform delay (s)				30.3		14.5		19.7	3.9	40.5	7.9	
Incremental delay (s)				0		0		0	0	67.9	0	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				30.3		14.5		19.7	3.9	108.4	7.9	
LOS				C		B		B	A	F	A	
Approach delay (s)/LOS		/		24	/	C	17.4	/	B	41.4	/	D
Intersection delay (s)/ LOS	30.3					/				C		

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AMB AM 2013
Comment: 2013 AMBIENT AM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: N. KIHEI R
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				381		626		629	206	414	740	
RTOR volume (veh/h)						425			110			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					0			0			0	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LR	R						
NB	R		TR					
SB		LT	T					
Green (s)	24	21	42.5					
Yellow + All red (s)	5	3	4.5					

Cycle (s): 100   Lost time per cycle (s): 4.5   Critical v/c Ratio: .594

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				2		1		2	1	1	2	
Flow rate (veh/h)				414		218		684	104	450	804	
Capacity (veh/h)				825		792		1507	1124	372	2359	
Adjusted saturation flow (veh/h)				3437		1583		3547	1583	1770	3547	
v/c ratio				.502		.276		.454	.093	1.211	.341	
g/C ratio				.24		.5		.425	.71	.21	.665	
Average back of queue (veh)				5.6		3.8		7.6	1	24.2	5.5	
Uniform delay (s)				32.8		14.5		20.5	4.5	39.5	7.3	
Incremental delay (s)				.5		0		.1	0	117.4	0	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				33.3		14.5		20.6	4.5	156.9	7.3	
LOS				C		B		C	A	F	A	
Approach delay (s)/LOS		/		26.8	/	C	18.5	/	B	60.9	/	E
Intersection delay (s)/ LOS	40.4					/				D		

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information | **Site Information**

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOT AM 2013
Comment: 2013 TOTAL W/PROJ AM
Jurisdiction/Date: 10/10/05
EB/WB Street: N. KIHEI R ·
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Actuated-Field | % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	207	58	36	400	7	626	12	703	226	414	809	24
RTOR volume (veh/h)			20			425			110			0
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		50			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB		LTR	R					
WB	LTR		R	R				
NB	R	R	L		TR			
SB			L	LTR	TR			
Green (s)	22	14	5	19	39.5			
Yellow + All red (s)	5	5	3	3	4.5			

Cycle (s): 120 | Lost time per cycle (s): 12.5 | Critical v/c Ratio: .771

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration	L	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	146	142	17	239	203	218	13	764	126	450	879	26
Capacity (veh/h)	206	211	274	324	271	647	74	1167	1122	398	1818	811
Adjusted saturation flow (veh/h)	1770	1812	1369	1770	1476	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.708	.671	.064	.737	.751	.338	.177	.655	.112	1.13	.484	.032
g/C ratio	.117	.117	.2	.183	.183	.408	.042	.329	.708	.225	.513	.513
Average back of queue (veh)	5.4	5.1	.5	8.6	7.4	5.3	.5	12.6	1.4	24.3	10.7	.5
Uniform delay (s)	51	50.8	38.9	46.3	46.4	24.4	55.5	34.4	5.5	46.5	19	14.5
Incremental delay (s)	10.7	8	0	8.6	11.2	0	0	1.3	0	85.5	.2	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	61.7	58.8	38.9	54.9	57.6	24.4	55.5	35.7	5.5	132	19.2	14.5
LOS	E	E	D	D	E	C	E	D	A	F	B	B
Approach delay (s)/LOS	59.1	/	E	45.6	/	D	31.8	/	C	56.5	/	E
Intersection delay (s)/ LOS				47.6			/			D		

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information | **Site Information**

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOAM MIT 2013
Comment: 2013 TOTAL AM W/MITIGATION
Jurisdiction/Date: 10/10/05
EB/WB Street: N. KIHEI R
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Actuated-Field | % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	207	58	36	400	7	626	12	703	226	414	809	24
RTOR volume (veh/h)			20			425			110			0
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		50			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB		LTR	R					
WB	LTR		R	R				
NB	R	R	L		TR			
SB			L	LTR	TR			
Green (s)	24	16	5	14	40.5			
Yellow + All red (s)	5	5	3	3	4.5			

Cycle (s): 120 | Lost time per cycle (s): 12.5 | Critical v/c Ratio: .487

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration	L	LT	R	L	LT	R	L	T	R	L	TR	
No. of lanes	1	1	1	1	1	1	1	2	1	2	2	
Flow rate (veh/h)	146	142	17	239	203	218	13	764	126	450	905	
Capacity (veh/h)	236	242	302	354	303	607	74	1197	1188	630	1692	
Adjusted saturation flow (veh/h)	1770	1812	1394	1770	1514	1583	1770	3547	1583	3437	3531	
v/c ratio	.62	.587	.058	.676	.671	.36	.177	.638	.106	.714	.535	
g/C ratio	.133	.133	.217	.2	.2	.383	.042	.338	.75	.183	.479	
Average back of queue (veh)	5.1	4.9	.5	8.2	7	5.5	.5	12.4	1.2	8.2	12	
Uniform delay (s)	49.1	48.9	37.3	44.4	44.4	26.5	55.5	33.6	4.1	46	21.9	
Incremental delay (s)	4.9	3.7	0	5.1	5.7	0	0	1.1	0	3.8	.3	
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	
Delay (s)	54	52.6	37.3	49.5	50.1	26.5	55.5	34.7	4.1	49.8	22.2	
LOS	D	D	D	D	D	C	E	C	A	D	C	
Approach delay (s)/LOS	52.4	/	D	42.1	/	D	30.7	/	C	31.4	/	C
Intersection delay (s)/ LOS				35.4			/			D		

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: EX PM 2005
Comment: 2005 EXISTING PM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: N. KIHEI R
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Actuated-Field | % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)				242		242		735	426	431	652	
RTOR volume (veh/h)						150			150			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					0			0			0	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LR	R						
NB	R		TR					
SB		LT	T					
Green (s)	24	21	42.5					
Yellow + All red (s)	5	3	4.5					

Cycle (s): 100 | Lost time per cycle (s): 9 | Critical v/c Ratio: .747

Intersection Performance

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane group configuration				L		R		T	R	L	T	
No. of lanes				2		1		2	1	1	2	
Flow rate (veh/h)				263		100		799	300	468	709	
Capacity (veh/h)				825		792		1507	1124	372	2359	
Adjusted saturation flow (veh/h)				3437		1583		3547	1583	1770	3547	
v/c ratio				.319		.126		.53	.267	1.261	.3	
g/C ratio				.24		.5		.425	.71	.21	.665	
Average back of queue (veh)				3.3		1.6		9.4	3.3	26.8	4.7	
Uniform delay (s)				31.3		13.3		21.3	5.2	39.5	7	
Incremental delay (s)				0		0		.4	0	137.3	0	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				31.3		13.3		21.7	5.2	176.8	7	
LOS				C		B		C	A	F	A	
Approach delay (s)/LOS		/		26.3	/	C	17.2	/	B	74.6	/	E
Intersection delay (s)/ LOS			44.1				/			D		

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AMB PM 2013
Comment: 2013 AMBIENT PM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: N. KIHEI R
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Actuated-Field | % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)				304		304		874	535	541	731	
RTOR volume (veh/h)						150			200			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					0			0			0	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LR	R						
NB	R		TR					
SB		LT	T					
Green (s)	23	25	39.5					
Yellow + All red (s)	5	3	4.5					

Cycle (s): 100 | Lost time per cycle (s): 9 | Critical v/c Ratio: .912

Intersection Performance

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane group configuration				L		R		T	R	L	T	
No. of lanes				2		1		2	1	1	2	
Flow rate (veh/h)				330		167		950	364	588	795	
Capacity (veh/h)				790		839		1401	1061	442	2394	
Adjusted saturation flow (veh/h)				3437		1583		3547	1583	1770	3547	
v/c ratio				.418		.199		.678	.343	1.329	.332	
g/C ratio				.23		.53		.395	.67	.25	.675	
Average back of queue (veh)				4.3		2.6		12.7	4.7	36.2	5.3	
Uniform delay (s)				32.8		12.4		25	7.1	37.5	6.8	
Incremental delay (s)				.2		0		1.3	0	163.1	0	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				33		12.4		26.3	7.1	200.6	6.8	
LOS				C		B		C	A	F	A	
Approach delay (s)/LOS		/		26.1	/	C	21	/	C	89.2	/	F
Intersection delay (s)/ LOS			51.3				/			D		

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOT PM 2013
Comment: 2013 TOTAL W/PROJ PM

Site Information

Jurisdiction/Date: 10/10/05
EB/WB Street: N. KIHEI R
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other; Analysis period: .25 h; Signal type: Actuated-Field; % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)	125	35	22	363	20	305	37	919	547	541	943	74
RTOR volume (veh/h)			20			100			200			0
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		50			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB		LTR	R					
WB	LTR		R	R				
NB	R	R	L		TR			
SB			L	LTR	TR			
Green (s)	19	12	5	24	39.5			
Yellow + All red (s)	5	5	3	3	4.5			

Cycle (s) 120; Lost time per cycle (s) 9; Critical v/c Ratio .921

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration	L	LT	R	L	LT	R	L	T	R	L	T	R
No. of lanes	1	1	1	1	1	1	1	2	1	1	2	1
Flow rate (veh/h)	82	92	2	217	199	223	40	999	377	588	1025	80
Capacity (veh/h)	177	181	245	280	227	673	74	1167	1056	472	1965	877
Adjusted saturation flow (veh/h)	1770	1810	1335	1770	1434	1583	1770	3547	1583	1770	3547	1583
v/c ratio	.461	.511	.009	.775	.878	.331	.545	.856	.357	1.246	.522	.092
g/C ratio	.1	.1	.183	.158	.158	.425	.042	.329	.667	.267	.554	.554
Average back of queue (veh)	2.8	3.2	.1	8.1	8.1	5.3	1.5	19.2	6	36.4	12.1	1.3
Uniform delay (s)	50.9	51.2	40.1	48.4	49.4	23.1	56.4	37.6	8.8	44	16.8	12.6
Incremental delay (s)	1.4	2.4	0	12.7	29.9	0	8.2	6.4	0	127.5	.3	0
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	52.3	53.6	40.1	61.1	79.3	23.1	64.6	44	8.8	171.5	17.1	12.6
LOS	D	D	D	E	E	C	E	D	A	F	B	B
Approach delay (s)/LOS	52.9	/	D	53.5	/	D	35.2	/	D	70.5	/	E
Intersection delay (s)/ LOS		54.2				/			D			

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOPM MIT 2013
Comment: 2013 TOTAL PM W/MITIGATION

Site Information

Jurisdiction/Date: 10/10/05
EB/WB Street: N. KIHEI R
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other; Analysis period: .25 h; Signal type: Actuated-Field; % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)	125	35	22	363	20	305	37	919	547	541	943	74
RTOR volume (veh/h)			10			100			200			0
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		50			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB		LTR	R					
WB	LTR		R	R				
NB	R	R	L		TR			
SB			L	LTR	TR			
Green (s)	24	16	5	14	40.5			
Yellow + All red (s)	5	5	3	3	4.5			

Cycle (s) 120; Lost time per cycle (s) 9; Critical v/c Ratio .747

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration	L	LT	R	L	LT	R	L	T	R	L	TR	
No. of lanes	1	1	1	1	1	1	1	2	1	2	2	
Flow rate (veh/h)	88	86	13	217	199	223	40	999	377	588	1105	
Capacity (veh/h)	236	242	302	354	304	607	74	1197	1188	630	1681	
Adjusted saturation flow (veh/h)	1770	1812	1394	1770	1519	1583	1770	3547	1583	3437	3508	
v/c ratio	.374	.354	.043	.613	.656	.367	.545	.835	.318	.933	.658	
g/C ratio	.133	.133	.217	.2	.2	.383	.042	.338	.75	.183	.479	
Average back of queue (veh)	2.9	2.8	.4	7.3	6.8	5.7	1.5	18.7	4.5	12.8	16.1	
Uniform delay (s)	47.4	47.3	37.2	43.8	44.2	26.6	56.4	36.7	4.9	48.3	23.8	
Incremental delay (s)	.1	0	0	3.1	5.1	0	8.2	5.3	0	21.1	1	
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	
Delay (s)	47.5	47.3	37.2	46.9	49.3	26.6	64.6	42	4.9	69.4	24.8	
LOS	D	D	D	D	D	C	E	D	A	E	C	
Approach delay (s)/LOS	46.7	/	D	40.5	/	D	32.7	/	C	40.3	/	D
Intersection delay (s)/ LOS		37.9				/			D			

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: EX AM 2005
Comment: 2005 EXISTING AM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				110		56		429	42	89	1373	
RTOR volume (veh/h)						0			0			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					50			50			50	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LR	R						
NB			T					
SB		LT	T					
Green (s)	11	15	58					
Yellow + All red (s)	5	5	6					

Cycle (s): 100 Lost time per cycle (s): 5 Critical v/c Ratio: .921

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	1	
Flow rate (veh/h)				120		61		466	46	97	1492	
Capacity (veh/h)				195		421		2057		265	1442	
Adjusted saturation flow (veh/h)				1770		1357		3547	1571	1770	1848	
v/c ratio				.614		.145		.227		.364	1.035	
g/C ratio				.11		.31		.58		.15	.78	
Average back of queue (veh)				3.6		1.3		3.5		2.6	58.1	
Uniform delay (s)				42.5		24.9		10.2		38.2	11	
Incremental delay (s)				5.7		0		0		0	33.3	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				48.2		24.9		10.2		38.2	44.3	
LOS				D		C		B		D	D	
Approach delay (s)/LOS		/		40.3	/	D	10.2	/	B	43.9	/	D
Intersection delay (s)/ LOS		36.1				/				D		

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AMB AM 2013
Comment: 2013 AMBIENT AM

Site Information

Jurisdiction/Date: 10/8/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				110		56		576	42	89	1529	
RTOR volume (veh/h)						0			0			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					50			50			50	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB				R				
WB	LR	R						
NB			T					
SB		LT	T					
Green (s)	11	15	58					
Yellow + All red (s)	5	5	6					

Cycle (s): 100 Lost time per cycle (s): 5 Critical v/c Ratio: 1.018

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	1	
Flow rate (veh/h)				120		61		626	46	97	1662	
Capacity (veh/h)				195		421		2057		265	1442	
Adjusted saturation flow (veh/h)				1770		1357		3547	1571	1770	1848	
v/c ratio				.614		.145		.304		.364	1.153	
g/C ratio				.11		.31		.58		.15	.78	
Average back of queue (veh)				3.6		1.3		5		2.6	79.4	
Uniform delay (s)				42.5		24.9		10.7		38.2	11	
Incremental delay (s)				5.7		0		0		0	77.2	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				48.2		24.9		10.7		38.2	88.2	
LOS				D		C		B		D	F	
Approach delay (s)/LOS		/		40.3	/	D	10.7	/	B	85.5	/	F
Intersection delay (s)/ LOS		63.1				/				E		

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOT AM 2013
Comment: 2013 TOTAL W/PROJ AM

Site Information

Jurisdiction/Date: 10/10/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)	95	2	36	110	2	56	34	586	42	93	1630	31
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR	R		R				
WB	LTR	R						
NB		L	T					
SB		L	T					
Green (s)	23	10	71					
Yellow + All red (s)	5	5	6					

Cycle (s): 120   Lost time per cycle (s): 11   Critical v/c Ratio: 1.253

Intersection Performance

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane group configuration		LT	R		LT	R	L	T	R	L	T	R
No. of lanes		1	1		1	1	1	2	1	1	1	1
Flow rate (veh/h)		105	39		122	61	37	637	46	101	1772	34
Capacity (veh/h)		165	497		180	497	147	2098		147	1102	
Adjusted saturation flow (veh/h)		862	1571		939	1571	1770	3547	1571	1770	1863	1571
v/c ratio		.638	.079		.677	.122	.251	.304		.685	1.608	
g/C ratio		.192	.317		.192	.317	.083	.592		.083	.592	
Average back of queue (veh)		3.7	1		4.3	1.5	1.2	5.9		3.8	145	
Uniform delay (s)		44.7	28.7		45	29.1	51.5	12.2		53.5	24.5	
Incremental delay (s)		8	0		9.7	0	0	0		12.5	277.7	
Initial queue delay (s)		0	0		0	0	0	0		0	0	
Delay (s)		52.7	28.7		54.7	29.1	51.5	12.2		66	302.2	
LOS		D	C		D	C	D	B		E	F	
Approach delay (s)/LOS	46.2	/	D	46.2	/	D	14.3	/	B	289.4	/	F
Intersection delay (s)/ LOS		195.5				/				F		

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOAM MIT 2013
Comment: 2013 TOTAL AM W/MITIGATION

Site Information

Jurisdiction/Date: 10/11/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (veh/h)	95	2	36	110	2	56	34	586	42	93	1630	31
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB			L	TR				
SB			L	TR				
Green (s)	13	15	10	61				
Yellow + All red (s)	5	5	5	6				

Cycle (s): 120   Lost time per cycle (s): 16   Critical v/c Ratio: .805

Intersection Performance

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane group configuration		LT	R		LT	R	L	T	R	L	TR	
No. of lanes		1	1		1	1	1	2	1	1	2	
Flow rate (veh/h)		105	39		122	61	37	637	46	101	1805	
Capacity (veh/h)		192	170		222	196	147	1803	799	147	1791	
Adjusted saturation flow (veh/h)		1776	1571		1776	1571	1770	3547	1571	1770	3523	
v/c ratio		.548	.23		.549	.31	.251	.353	.057	.685	1.008	
g/C ratio		.108	.108		.125	.125	.083	.508	.508	.083	.508	
Average back of queue (veh)		3.7	1.3		4.2	2	1.2	7.1	.8	3.8	41.8	
Uniform delay (s)		50.7	48.9		49.3	47.8	51.5	17.7	14.9	53.5	29.5	
Incremental delay (s)		3.3	0		2.9	0	0	0	0	12.5	23.3	
Initial queue delay (s)		0	0		0	0	0	0	0	0	0	
Delay (s)		54	48.9		52.2	47.8	51.5	17.7	14.9	66	52.8	
LOS		D	D		D	D	D	B	B	E	D	
Approach delay (s)/LOS	52.6	/	D	50.7	/	D	19.2	/	B	53.5	/	D
Intersection delay (s)/ LOS		44.9				/				D		

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: EX PM 2005
Comment: 2005 EXISTING PM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other — Analysis period: .25 h — Signal type: Actuated-Field — % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				106		79		1049	48	45	1114	
RTOR volume (veh/h)						0			0			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					0			0			0	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LR	R						
NB			T					
SB		LT	T					
Green (s)	15	15	54					
Yellow + All red (s)	5	5	6					

Cycle (s): 100 — Lost time per cycle (s): 5 — Critical v/c Ratio: .758

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	1	
Flow rate (veh/h)				115		86		1140	52	49	1211	
Capacity (veh/h)				265		550		1915		265	1368	
Adjusted saturation flow (veh/h)				1770		1571		3547	1571	1770	1848	
v/c ratio				.434		.156		.595		.184	.885	
g/C ratio				.15		.35		.54		.15	.74	
Average back of queue (veh)				3.2		1.7		12.3		1.3	30.7	
Uniform delay (s)				38.6		22.3		15.6		37.2	9.8	
Incremental delay (s)				.6		0		.5		0	7.3	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				39.2		22.3		16.1		37.2	17.1	
LOS				D		C		B		D	B	
Approach delay (s)/LOS		/		32	/	C	16.1	/	B	17.9	/	B
Intersection delay (s)/ LOS	18.1					/			B			

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AMB PM 2013
Comment: 2013 AMBIENT PM

Site Information

Jurisdiction/Date: 10/9/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other — Analysis period: .25 h — Signal type: Actuated-Field — % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				106		79		1303	48	45	1249	
RTOR volume (veh/h)						0			0			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				3		3		3	3	3	3	
Approach pedestrian volume (p/h)					0			0			0	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LR	R						
NB			T					
SB		LT	T					
Green (s)	15	15	54					
Yellow + All red (s)	5	5	6					

Cycle (s): 100 — Lost time per cycle (s): 5 — Critical v/c Ratio: .842

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	1	
Flow rate (veh/h)				115		86		1416	52	49	1358	
Capacity (veh/h)				265		550		1915		265	1368	
Adjusted saturation flow (veh/h)				1770		1571		3547	1571	1770	1848	
v/c ratio				.434		.156		.74		.184	.993	
g/C ratio				.15		.35		.54		.15	.74	
Average back of queue (veh)				3.2		1.7		17.8		1.3	48.6	
Uniform delay (s)				38.6		22.3		17.6		37.2	12.7	
Incremental delay (s)				.6		0		1.6		0	22.5	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				39.2		22.3		19.2		37.2	35.2	
LOS				D		C		B		D	D	
Approach delay (s)/LOS		/		32	/	C	19.2	/	B	35.3	/	D
Intersection delay (s)/ LOS	27.4					/			C			

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOT PM 2013
Comment: 2013 TOTAL W/PROJ PM

Site Information

Jurisdiction/Date: 10/10/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	57	2	21	105	6	80	102	1338	48	43	1288	98
RTOR volume (veh/h)			0			0			0			25
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR	R						
WB	LTR	R						
NB		L	T		0			
SB		L	T					
Green (s)	23	10	71					
Yellow + All red (s)	5	5	6					

Cycle (s): 120   Lost time per cycle (s): 11   Critical v/c Ratio: 1.01

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration		LT	R		LT	R	L	T	R	L	T	R
No. of lanes		1	1		1	1	1	2	1	1	1	1
Flow rate (veh/h)		64	23		121	87	111	1454	52	47	1400	79
Capacity (veh/h)		181	497		225	497	147	2098		147	1102	
Adjusted saturation flow (veh/h)		946	1571		1173	1571	1770	3547	1571	1770	1863	1571
v/c ratio		.354	.046		.537	.175	.752	.693		.317	1.27	
g/C ratio		.192	.317		.192	.317	.083	.592		.083	.592	
Average back of queue (veh)		2	.6		4	2.2	4.3	19.5		1.6	87.6	
Uniform delay (s)		42.1	28.4		43.7	29.7	53.8	17		51.8	24.5	
Incremental delay (s)		0	0		2.5	0	19.3	1		0	128.9	
Initial queue delay (s)		0	0		0	0	0	0		0	0	
Delay (s)		42.1	28.4		46.2	29.7	73.1	18		51.8	153.4	
LOS		D	C		D	C	E	B		D	F	
Approach delay (s)/LOS	38.5	/	D	39.3	/	D	21.9	/	C	150.1	/	F
Intersection delay (s)/ LOS			80.3				/			F		

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: TOPM MIT 2013
Comment: 2013 TOTAL PM W/ MITIGATION

Site Information

Jurisdiction/Date: 10/11/05
EB/WB Street: KAPOLI ST
NB/SB Street: HONOAPIILA

Intersection Data

Area type: Other   Analysis period: .25 h   Signal type: Actuated-Field   % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	57	2	21	105	6	80	102	1338	48	43	1288	98
RTOR volume (veh/h)			0			20			0			25
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)		0			0			0			0	
Approach bicycle volume (bic/h)		0			0			0			0	
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTR							
WB		LTR						
NB			L	TR	R			
SB			L	TR				
Green (s)	13	15	12	59				
Yellow + All red (s)	5	5	5	6				

Cycle (s): 120   Lost time per cycle (s): 16   Critical v/c Ratio: .679

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration		LT	R		LT	R	L	T	R	L	TR	
No. of lanes		1	1		1	1	1	2	1	1	2	
Flow rate (veh/h)		64	23		121	65	111	1454	52	47	1479	
Capacity (veh/h)		192	170		222	196	177	1744	772	177	1723	
Adjusted saturation flow (veh/h)		1777	1571		1779	1571	1770	3547	1571	1770	3504	
v/c ratio		.333	.134		.543	.332	.627	.834	.068	.264	.859	
g/C ratio		.108	.108		.125	.125	.1	.492	.492	.1	.492	
Average back of queue (veh)		2.1	.7		4.2	2.1	4	25.3	1	1.5	26.6	
Uniform delay (s)		49.5	48.4		49.3	47.9	51.8	26.3	16	49.9	26.8	
Incremental delay (s)		0	0		2.7	0	6.8	3.7	0	0	4.6	
Initial queue delay (s)		0	0		0	0	0	0	0	0	0	
Delay (s)		49.5	48.4		52	47.9	58.6	30	16	49.9	31.4	
LOS		D	D		D	D	E	C	B	D	C	
Approach delay (s)/LOS	49.2	/	D	50.6	/	D	31.5	/	C	32	/	C
Intersection delay (s)/ LOS			33.2				/			C		

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Appendix C

Unsignalized Intersection
Level of Service (LOS) Calculations

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: EX AM 2005
Comment: 2005 EXISTING AM

Site Information

Jurisdiction/Date: 10/9/05
Major Street: HONOAPIILANI HWY
Minor Street: MAALAEA RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	T	R	
Lane 2	T	L		
Lane 3				

	NB			SB			WB			EB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		400		159	994				52			
PHF		.9		.9	.9				.9			
Proportion of heavy vehicles, HV		3		3	3				3			
Flow rate		444		177	1104				58			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft
Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	R	58	778	.075	<1	10	A	10 A
	2								
	3								
EB	1								
	2								
	3								
		1							
		4	177	1105	.16	1	8.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AMB AM 2013
Comment: 2013 AMBIENT AM

Site Information

Jurisdiction/Date: 10/9/05
Major Street: HONOAPIILANI HWY
Minor Street: MAALAEA RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	T	R	
Lane 2	T	L		
Lane 3				

	NB			SB			WB			EB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		547		159	1150				52			
PHF		.9		.9	.9				.9			
Proportion of heavy vehicles, HV		3		3	3				3			
Flow rate		608		177	1278				58			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft
Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	R	58	689	.084	<1	10.7	B	10.7 B
	2								
	3								
EB	1								
	2								
	3								
		1							
		4	177	960	.184	1	9.6	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	M&E PAC
Analysis Period/Year	TOT AM 2013
Comment	2013 TOTAL W/PROJ AM

Site Information

Jurisdiction/Date	10/10/05
Major Street	HONOAPIILANI HWY
Minor Street	MAALAEA RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	T	R	
Lane 2	T	L		
Lane 3				

	NB			SB			WB			EB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		651		163	1150				52			
PHF		.9		.9	.9				.9			
Proportion of heavy vehicles, HV		3		3	3				3			
Flow rate		723		181	1278				58			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	R	58	632	.092	<1	11.3	B	11.3 B
	2								
	3								
EB	1								
	2								
	3								
		1							
		4	181	868	.209	1	10.2	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	M&E PAC
Analysis Period/Year	EX PM 2005
Comment	2005 EXISTING PM

Site Information

Jurisdiction/Date	10/9/05
Major Street	HONOAPIILANI HWY
Minor Street	MAALAEA RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	T	R	
Lane 2	T	L		
Lane 3				

	NB			SB			WB			EB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		1001		94	856				93			
PHF		.9		.9	.9				.9			
Proportion of heavy vehicles, HV		3		3	3				3			
Flow rate		1112		104	951				103			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	R	103	472	.218	1	14.7	B	14.7 B
	2								
	3								
EB	1								
	2								
	3								
		1							
		4	104	618	.169	1	12	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	M&E PAC
Analysis Period/Year	AMB PM 2013
Comment	2013 AMBIENT PM

Site Information

Jurisdiction/Date	10/9/05
Major Street	HONOAPIILANI HWY
Minor Street	MAALAEA RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	T	R	
Lane 2	T	L		
Lane 3				

	NB			SB			WB			EB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		1255		94	991				93			
PHF		.9		.9	.9				.9			
Proportion of heavy vehicles, HV		3		3	3				3			
Flow rate		1394		104	1101				103			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	R	103	381	.27	1	17.9	C	17.9 C
	2								
	3								
EB	1								
	2								
	3								
		①							
		④	104	481	.217	1	14.5	B	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	M&E PAC
Analysis Period/Year	TOT PM 2013
Comment	2013 TOTAL W/PROJ PM

Site Information

Jurisdiction/Date	10/10/05
Major Street	HONOAPIILANI HWY
Minor Street	MAALAEA RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	T	R	
Lane 2	T	L		
Lane 3				

	NB			SB			WB			EB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		1347		96	1130				95			
PHF		.9		.9	.9				.9			
Proportion of heavy vehicles, HV		3		3	3				3			
Flow rate		1497		107	1256				106			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	R	106	353	.301	1	19.5	C	19.5 C
	2								
	3								
EB	1								
	2								
	3								
		①							
		④	107	439	.243	1	15.8	C	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	M&E PAC
Analysis Period/Year	TOT AM 2013
Comment	2013 TOTAL W/PROJ AM

Site Information

Jurisdiction/Date	10/11/05
Major Street	HONOAPIILANI HWY
Minor Street	PROJECT ACCESS RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	R		
Lane 2	T	T		R
Lane 3		T		

Movement	NB 1 (LT)	NB 2 (TH)	NB 3 (RT)	SB 4 (LT)	SB 5 (TH)	SB 6 (RT)	WB 7 (LT)	WB 8 (TH)	WB 9 (RT)	EB 10 (LT)	EB 11 (TH)	EB 12 (RT)
Volume (veh/h)		942			1377	58						69
PHF		.9			.9	.9						.9
Proportion of heavy vehicles, HV		3			3	3						3
Flow rate		1047			1530	64						77
Flare storage (# of vehs)												0
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1								
	2								
	3								
EB	1	R	77	344	.224	1	18.5	C	18.5
	2								
	3								C
		1							
		4							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	M&E PAC
Analysis Period/Year	TOT PM 2013
Comment	2013 TOTAL W/PROJ PM

Site Information

Jurisdiction/Date	10/11/05
Major Street	HONOAPIILANI HWY
Minor Street	PROJECT ACCESS RD

Input Data

Lane Configuration	NB	SB	WB	EB
Lane 1 (curb)	T	R		
Lane 2	T	T		R
Lane 3		T		

Movement	NB 1 (LT)	NB 2 (TH)	NB 3 (RT)	SB 4 (LT)	SB 5 (TH)	SB 6 (RT)	WB 7 (LT)	WB 8 (TH)	WB 9 (RT)	EB 10 (LT)	EB 11 (TH)	EB 12 (RT)
Volume (veh/h)		1503			1184	193						42
PHF		.9			.9	.9						.9
Proportion of heavy vehicles, HV		3			3	3						3
Flow rate		1670			1316	214						47
Flare storage (# of vehs)												0
Median storage (# of vehs)												

Signal upstream of Movement 2 ______ ft Movement 5 ______ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1								
	2								
	3								
EB	1	R	47	405	.116	<1	15.1	C	15.1
	2								
	3								C
		1							
		4							

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APPENDIX K.

Subdivision Preliminary Engineering Report

FINAL

Preliminary Engineering Report

For

Maalaea Mauka Subdivision
Honoapiilani Highway, Maalaea, Island of Maui, Hawaii

TMK: (2) 3-6-001: 018

November 2006

Prepared For:

Maalaea Property, LLC
355 West Waiko Road
Wailuku, HI 96793

Prepared By:

M&E Pacific, Inc.
METCALF & EDDY | AECOM
Suite 1900, Davies Pacific Center
841 Bishop Street
Honolulu, HI 96813

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TABLE OF CONTENTS

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SECTION 1
Introduction

SECTION 1 INTRODUCTION

1.1 PURPOSE

The objective of this preliminary engineering report is to evaluate the conceptual design of the proposed Maalaea Mauka Subdivision (MMS) and begin the next phase of planning to develop a schematic design. This report will evaluate existing and proposed infrastructure improvements necessary for inclusion in the schematic design prior to development of actual bid documents.

1.2 GENERAL INFORMATION

a. The proposed development site is a parcel identified as Tax Map Key 3-6-001: 018 located at the crossroads of West Maui, Kihei-Makena, and Wailuku-Kahului regions, and bounded by Honoapiilani Highway on the east. The parcel encompasses approximately 257 acres on the slopes of Kealaloloa (West Maui Mountains) overlooking Maalaea Small Boat Harbor and the Maalaea Triangle Waterfront Plaza. The property is designated by the State Land Use Commission as "Agricultural." See Figure 1, location map. The lands to the west and and upland of the project area are State owned. The land to the north (Lot 710, parcel TMK: 3-6-004:003) is also owned by Maalaea Property, LLC.

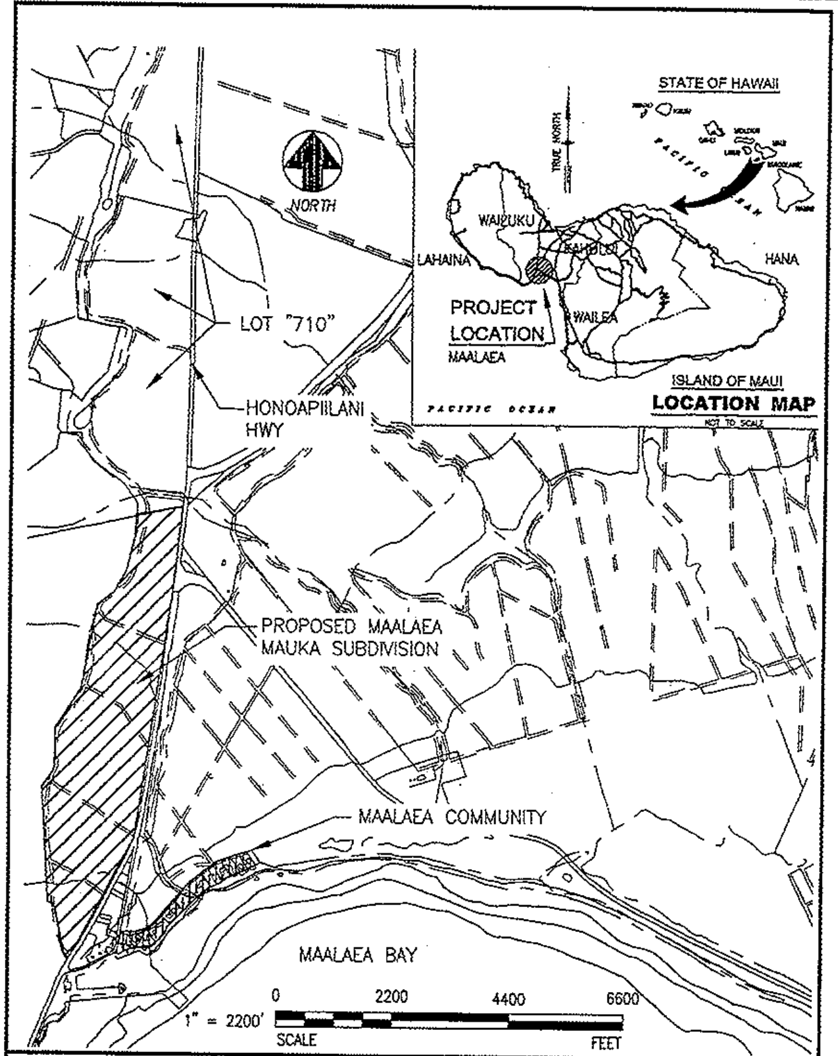
b. Owner: Maalaea Property, LLC.
355 West Waiko Rd.
Wailuku, HI 96793

Contact: Steven Kikuchi
Partner

c. Location Map (See Figure 1)

1.3 PROJECT DESCRIPTION

The planned development of this site includes a mix of single family and multi-family dwellings, including senior housing, apartment dwellings, a community center, a Public/Quasi-Public Facility, a wastewater pump station, and parks. Approximately 499 single family units (Custom-144 and Production-355) and 450 multi-family units (Single Family Patio Homes-164, Town Houses-100, Apartments-126, and Senior Housing-60) will be built.



M&E Pacific, Inc.
METCALF & EDDY | AECOM
DAVIES PACIFIC CTR, STE 1900
841 BISHOP ST
HONOLULU, HAWAII 96813

MAALAEA MAUKA SUBDIVISION PRELIMINARY ENGINEERING REPORT

SECTION 2
Existing Infrastructure

SECTION 2 EXISTING INFRASTRUCTURE

2.1 WATER SYSTEM

No infrastructure (wells, storage or distribution) exists on site. A nearby existing well identified as Pohakea #1 (State ID 4930-01) and located on the adjacent parcel (TMK: 3-6-004:003) has a rated capacity of 432,000 gpd. Nearby County water services are insufficient to supply potable water to the proposed project. New infrastructure will be required to service the project.

2.2 SEWER SYSTEM

The project site does not have any existing sewer collection system nor sewer treatment facility. The existing Maalaea Community includes condominiums, apartments, two hotels, and an industrial site. All existing neighbors have their own on-site wastewater treatment facility.

There are reports of failed wastewater treatment facilities along the Maalaea Bay. These failed treatment systems can lead to potential contamination of the nearby shoreline.

2.3 DRAINAGE

The existing drainage improvements on the project site are agricultural ditches and road side swales. The runoff from the site enters existing headwalls and drain inlets spaced along the mauka side of Honoapiilani Highway. The runoff is conveyed across the highway through culverts, pipes, ditch and channel to Maalaea Bay.

The Maalaea Waterfront Plaza (MWP), an existing commercial development on the triangular shaped parcel just downstream and across the highway has experienced flooding during large storms. The runoff from a portion of the project parcel is conveyed through this development.

According to the flood insurance rate map prepared by FEMA, most of the project site is situated in Zone C, which represents areas subject to only minimal flooding. Two areas on the southern portion of the site along existing gulches and continuing downstream toward Maalaea Bay are classified as Zone B. Zone B is defined as areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.

2.4 ELECTRICAL, TELEPHONE, AND CATV SYSTEMS

Existing high voltage overhead electrical, telephone and CATV transmission lines are located across the Honoapiilani Highway from the MMS project site.

2.5 ACCESS ROAD

Access to the project site is provided at three points along the southbound right lane of Honoapiilani Highway. The access roads are unpaved dirt roads approximately 9 feet wide. The first northern most access point is located approximately 0.25 mile south of the North Kihei Road intersection. The second access point is approximately 1.08 mile south of the North Kihei Road intersection or 0.35 mile past the Maalaea Road northern intersection. The third access point is located approximately 1.43 mile south of the North Kihei Road intersection or 0.70 mile past the Maalaea Road northern intersection, just before the Maalaea Road southern intersection.

SECTION 3
Proposed Improvements

SECTION 3 PROPOSED IMPROVEMENTS

3.1 WATER SYSTEM

The average daily demand for the 949 units, community center, wastewater facility, and fire station is 624,540 gpd. The demand will require an infrastructure consisting of wells and pumping facilities, storage capacity and a distribution system.

To meet the demands of the development, the following improvements are proposed (see figure 2):

- A total of six wells (five production wells and one backup well). This results in a requirement for three additional wells to be sited and installed in addition to the one existing well and two wells to be constructed in the near future. The new wells will require a full range of water quality testing in accordance with Hawaii Administrative Rules §11-20.

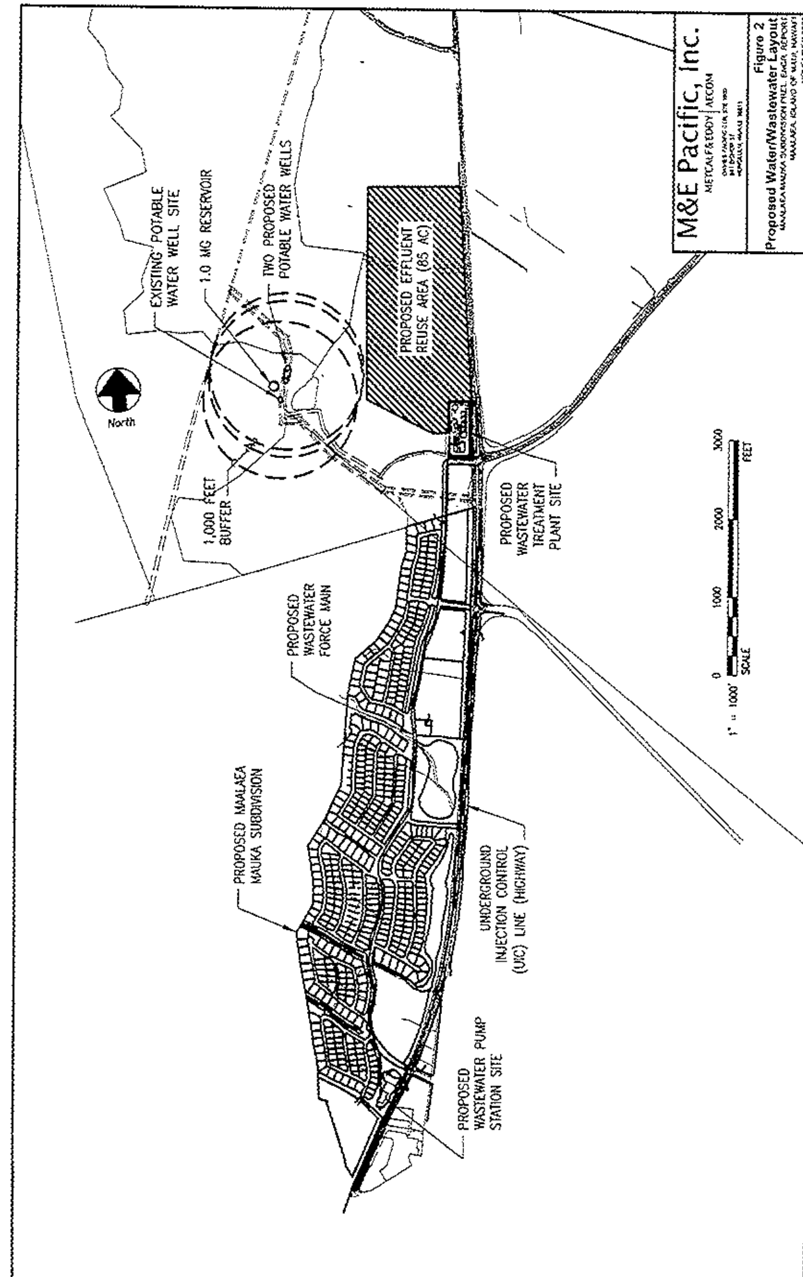
- A storage tank with capacity of 1,000,000 gallons will be required. This tank should be located upslope at the existing well site to provide gravity flow to the proposed project below.

- The distribution system must be capable of handling 2,651 gpm of flow. This will meet peak hourly demand as well as maximum daily demand plus fire flow. The minimum distribution water line diameter based on Maui County standards is 12 inch.

3.2 WASTEWATER SYSTEM

To mitigate shoreline pollution due to failed treatment systems, the proposed wastewater system will service the existing Maalaea Community and the proposed MMS. This proposed wastewater system consists of a new on-site sewer collection system including a pump station, and an offsite "regional" Maalaea Wastewater Treatment Plant (WWTP) and disposal system located on an adjacent parcel Lot 710. The WWTP is being designed to service the wastewater needs of the proposed Maalaea Mauka project with additional capacity integrated to allow a potential future service connection to the Maalaea Community. The Maalaea Community is responsible to connect to the new WWTP. See Figure 2.

In accordance with State Department of Health (DOH) wastewater systems regulations, the specific design standards will default to that of the City and County of Honolulu's Wastewater Design Standards. The recommended design capacity for the proposed WWTP is 600,000 gpd (0.60 mgd) with allowance for future expansion of this proposed facility to 1,200,000 gpd (1.2 mgd).



The proposed wastewater disposal system is an 85-acre effluent (categorized as R-1 water) reuse field specifically for crop/turf irrigation. DOH requires zero runoff of recycled water and zero percolation to the ground water aquifer during irrigation. During rainfall events, the DOH guidelines require that the effluent be stored or be discharged through a backup disposal system. A 1.2 million gallon effluent storage reservoir is recommended for the effluent reuse system. Injection wells will serve as a backup disposal system to the effluent reuse. If overflow occurs, the overflow from the proposed irrigation reservoir would discharge into the standby injection wells as a last resort. Also there will be no effluent irrigation within 50 feet of any drinking water supply well.

3.3 DRAINAGE

The proposed on-site drainage system consists of a detention basin and five subsurface detention systems located in a buffer area between Honoapiilani Highway and the proposed MMS (see Figure 3). The goal of the proposed drainage improvements is to reduce the proposed estimated peak storm runoff into the existing drainage system along Honoapiilani Highway to less than the existing hydrologic condition to prevent or at least mitigate flooding of the existing Maalaea Waterfront Plaza commercial development when a 50-year, 1-hour storm or more severe rainfall occurs.

The detention basin is a pond with a discharge structure. An estimated 5.3-acre detention basin surface area providing approximately 2,400,000 cubic feet storage volume is proposed to reduce the post development 904 cfs to 825 cfs (less than pre-development 865 cfs). Although this detention basin reduces the peak storm runoff to less than the existing, it still exceeds the desired 310 cfs by 515 cfs. The discharge structures consisting of a pipe culvert and a weir structure would dissipate the overflow from the detention basin to sheet flow traveling at less than 5 fps toward the 50-foot green space setback highway corridor. The proposed detention basin provides a "practical" means to mitigate the existing flooding condition.

The five subsurface detention systems consist of underground large diameter pipe network with a discharge culvert. For an assumed 96-inch diameter corrugated steel pipe, the configurations are:

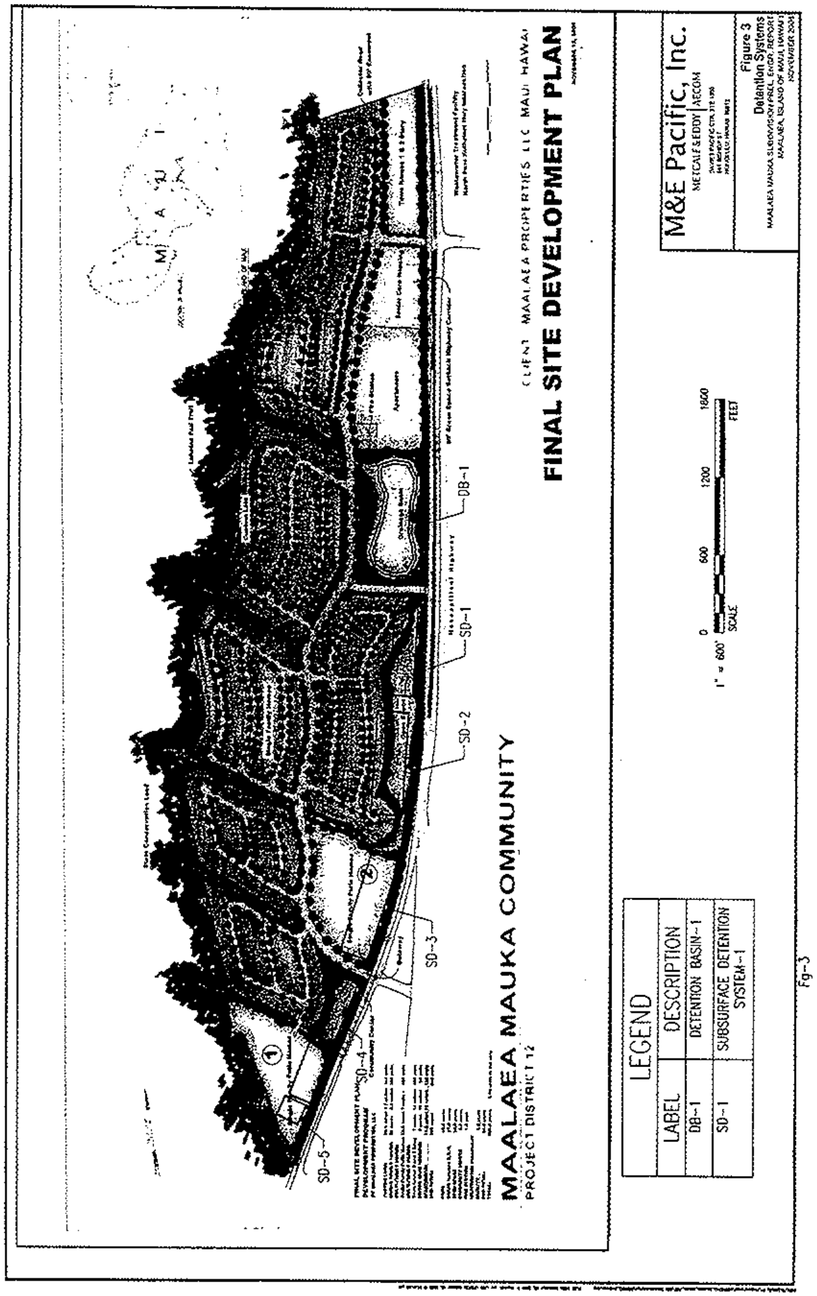
- 3.0 acre (reduces post development 320 cfs to 262 cfs < 320 cfs existing, but > 90 cfs desired);
- 4.4 acre (reduces post development 497 cfs to 381 cfs < 456 cfs existing, but > 20 cfs desired);

- 4.0 acre (reduces post development 364 cfs to 158 cfs < 288 cfs existing, and 158 cfs < 160 cfs desired);
- 4.1 acre (reduces post development 473 cfs to 364 cfs < 454 cfs existing, but > 320 cfs desired); and
- 0.7 acre (reduces post development 125 cfs to 70 cfs < 119 cfs existing, and 70 cfs < 110 cfs desired).

Although three out of the five subsurface detention systems do not reduce the peak storm runoff below the desired amount, during the design process, if other strategies are employed, the peak flow can be further reduced. Strategies to achieve this are:

1. Runoff from roof areas and parking areas is piped through perforated subdrains to underground french drains or dry wells; and
2. Install an infiltration trench along the 50' green space setback highway corridor. This infiltration trench has an excavated width of 3 to 10 feet and is backfilled with stone aggregate to for a subsurface catch basin.

Presently the existing culverts along Honoapiilani Highway are hydraulically undersized to convey the existing 100 year storm. The proposed drainage improvements will mitigate the overtopping flood condition across the highway. Overall, the storm runoff to be conveyed through the highway (along the development frontage) will go from 2,726 cfs down to 2,060 cfs, a reduction of 666 cfs.



3.4 ELECTRICAL, TELEPHONE, AND CATV SYSTEM

The electrical, telephone and CATV distribution system will be extended underground into the subdivision from the existing overhead system at some accessible location as determined by the respective utility companies.

3.5 ACCESS ROAD

The proposed access to the MMS is through two main access roads connecting into Honoapiilani Highway at the existing signalized intersections of North Kihei Road and Kapoli Street. A third secondary right-turn in, right-turn out access road is proposed midway between the above two access roads.

The proposed project is not expected to have an adverse impact on Honoapiilani Highway in the vicinity of the project site with adequate mitigation implemented. Specifically, the new makai bound approaches to the signalized intersections would require more green time (i.e. traffic signal) to accommodate projected traffic movement. New northbound left turn lanes would take green time away from southbound through traffic; however, there should be sufficient surplus in the through traffic green times to accommodate these reductions.

The following measures are needed to alleviate existing and future problems due to increases in traffic:

- A second left turn lane is needed on the southbound approach of Honoapiilani Highway at the North Kihei Road intersection to mitigate current traffic problems.
- A second southbound through lane on Honoapiilani Highway needs to be added at the Kapoli Street intersection to mitigate a future problem due to traffic growth.
- To eliminate a foreseen traffic safety problem, the Maalaea Road (north) intersection needs to be signalized or the left turn from the highway should be prohibited.

SECTION 4
Summary and Conclusion

SECTION 4 SUMMARY AND CONCLUSION

It is our professional opinion that the proposed Maalaea Mauka Subdivision is a suitable development for this parcel. Pending regulatory requirements for an Environmental Impact Statement for the proposed Maalaea Mauka Subdivision, this project can proceed to the final design phase.

SECTION 5
References

SECTION 5 REFERENCES

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APPENDIX L.

Water System Preliminary Engineering Report

PROPOSED MAALAEA MAUKA RESIDENTIAL SUBDIVISION

WATER SYSTEM
PRELIMINARY ENGINEERING REPORT

for

MA'ALAEA MAUKA VILLAGE
Ma'alaea, Maui

AUGUST 2006

Prepared for:

MA'ALAEA PROPERTIES, LLC
355 West Waiko Road
WAILUKU, MAUI, HAWAII 96793

Prepared by:

M&E Pacific, Inc.
METCALF&EDDY | AECOM
Davies Pacific Center, 841 Bishop Street
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EXECUTIVE SUMMARY

PURPOSE OF REPORT

The objective of this Preliminary Engineering Report (PER) is to provide a brief description and evaluation of the physical and regulatory requirements of the water supply and distribution system for the proposed Maalaea Mauka Subdivision.

PROJECT DESCRIPTION

Maalaea Mauka Subdivision is a proposed master planned community located at TMK (2) 3-6-01:018 will extend the existing and master planned Maalaea Village. Planning in this document will provide potable water for 949 single and multi-family units developed in Maalaea Mauka. It will incorporate a community center, parks, a wastewater treatment facility, a public/quasi-public facility and landscaped buffers linked by roads and pedestrian walkways as well as bike paths. The site is currently undeveloped.

The average daily demand for the 949 units, community center, wastewater facility, a public/quasi-publicfacility and parks at Maalaea Mauka is 619,900 gpd. The demand will require an infrastructure consisting of wells and pumping facilities, storage capacity and a distribution system.

EXISTING CONDITION

No infrastructure (wells, storage or distribution) exists on site. Nearby County water services are insufficient to supply potable water to the proposed project. New infrastructure will be required to service the project.

A nearby well identified as Pohakea #1 (State ID 4930-01) was recently completed at TMK 3-6-4: 03. This upslope well is capable of producing 432,000 gpd. Two wells are currently being installed in the project area and are assumed to be capable of producing 300,000 gpd each.

FINDINGS

- Maui County requires at least one well to act as standby or backup to production wells. This backup well must be equal to or greater in capacity than the producing wells. This planning document assumes that the existing 432,000 gpd well will be greater in capacity than any new wells and therefore will be designated as the backup well.
- To meet the demands of the development a total of six wells are required. This includes five production wells and one backup well. This results in a requirement for three additional wells to be sited and installed in addition to the one existing well and the two wells under construction.
- A storage tank with capacity of 1,000,000 gallons will be required. This tank should be located upslope at the existing well site to provide gravity flow to the proposed project below.

- The distribution system must be capable of handling 2,640 gpm of flow. This will meet peak hourly demand as well as maximum daily demand plus fire flow. The minimum distribution water line diameter based on county standards is 12 inch.
- The lack of water quality data in the vicinity of the existing Pohakea #1 well leads to the recommendation that water quality testing in accordance with HRS Chapter 11-20 be included as a requirement to the driller installing the two new wells.

ENGINEER'S CONCEPTUAL ESTIMATED CONSTRUCTION COSTS

The Engineer's conceptual estimate of construction costs are summarized below.

Water Wells	$3,070,000
Water Storage	$3,450,000
Water Distribution System	$1,480,000
Total Estimate of Construction	$8,000,000

Water distribution costs are inclusive only of a transmission main to convey water from the storage facility to the subdivision boundaries. Distribution costs shown in this report are exclusive of costs required for the installation of a distribution system within the boundaries of proposed subdivisions.

PROJECT SCHEDULE

A minimum of three years is required to complete all planning, permitting, design and construction tasks necessary to begin using this new public water source.

TABLE OF CONTENTS

1.0 Introduction

1.1 *Purpose*

The objective of this Preliminary Engineering Report (PER) is to provide a brief description and evaluation of the physical and regulatory requirements of water supply and distribution system for the proposed Maalaea Mauka Subdivision.

1.2 *Project Description*

Maalaea Properties, LLC proposes a new master planned community located at TMK (2) 3-6-01:018. It will consist of 949 single and multi-family units. It will incorporate a community center, a wastewater treatment facility, a public/quasi-public facility, parks and landscaped buffers linked by roads and pedestrian walkways as well as bike paths. The site is currently undeveloped.

1.3 *Preliminary Engineering Report Format*

This report will examine the requirements, both physical and regulatory, to install a water system infrastructure. It will describe the physical environment of the general area and then develop design criteria for the water distribution system, additional new water sources as well as storage capacities. In addition to design criteria, this report will provide conceptual cost estimates, rough schedules for completion of construction including design and permitting and identify appropriate regulatory requirements. The report will conclude with a summary of all findings and recommendations.

1.4 *General Information*

This report is produced by M&E Pacific, Inc. for Maalaea Properties, LLC. The report is required as a condition of the sale of the property.

Points of contact are as follows:

Developer:	Maalaea Properties, LLC
Contact:	Mr. Steven Kikuchi, Partner
Address:	355 West Waiko Road Wailuku, Hawaii 96793
Phone:	(808) 242-7807
Engineer:	M&E Pacific, Inc.
Contact:	Mr. Bruce Wade, P.E.
Address:	841 Bishop Street, Suite 1900 Honolulu, HI 96813
Phone:	808-521-3051

2.0 Physical Description of Area

2.1 *Location*

The project site is located on the lower slopes of the West Maui Mountains at the crossroads of the West Maui, Kihei-Makena, and Wailuku-Kahului regions. The property is undeveloped currently. FIGURE 1 - PROJECT LOCATION MAPS identifies the general vicinity of the property.

The project site is located between Maalaea and Waikapu on the island of Maui. It is bounded by Honoapiilani Highway to the east and on the west by the West Maui Mountains. The property is 257 acres in size.

2.2 *Topography*

Terrain at the project site gently slopes from the northwest to the southeast. The elevation at the northern end of the property is approximately 200 feet Mean Sea Level (MSL) while the elevation at the southern portion of the property is less than 80 feet MSL.

2.3 *Climate*

Generally temperatures statewide in Hawaii average about 74°F in March to 79°F in September. The *Atlas of Hawaii* describes temperatures in nearby Kihei as ranging from 60°F to 80°F in January to 65°F to 85°F in July.

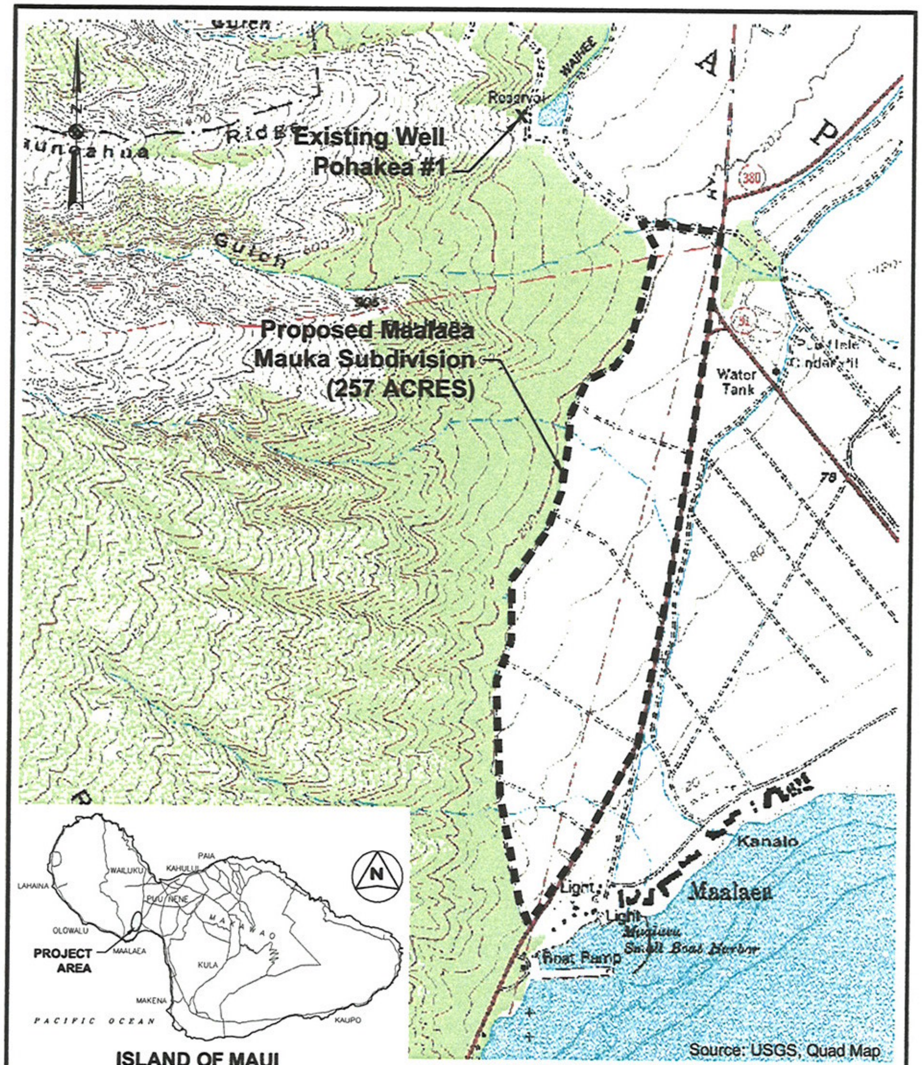
Annual rainfall averages 15 inches in the vicinity of the project site. The heaviest rains and the greatest rainfall accumulation tend to occur during the winter months from October to April while the summer months from May to September tend to be drier.

2.4 *Soils*

The project site is comprised of several soil types. The August 1972 edition of the *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai* describes the upper portion of the site as primarily consisting of Pulehu Cobbly Sily Loam, 3-7% slope (PtB) with some Stony Alluival Land (rSM). The middle portion of the site is described as Ewa Cobbly Silty Clay, 3-7% slope (EtB) while the lower portion of the site is described as Ewa Sitly Clay, 3-7% slope. FIGURE 2 – SOILS MAP depicts the property and these soils relative to each other.

Stony alluvial land (rSM) consists of stone, boulders and soil deposited by streams along gulches and alluvial fans. This soil is found on slopes ranging from 3 to 15%. It is found at elevations ranging from sea level up to 1,000 feet above sea level.

Pulehu Cobbly Silty Loam (PtB) is a well drained soil located on alluvial fans. It developed from alluvium that washed off of basic igneous rock. It is generally found on level to moderately sloping terrain at elevations ranging from sea level to 300 feet above sea level. It is geographically associated with the Ewa soils described below. This soil has slow runoff with a slight erosion hazard.



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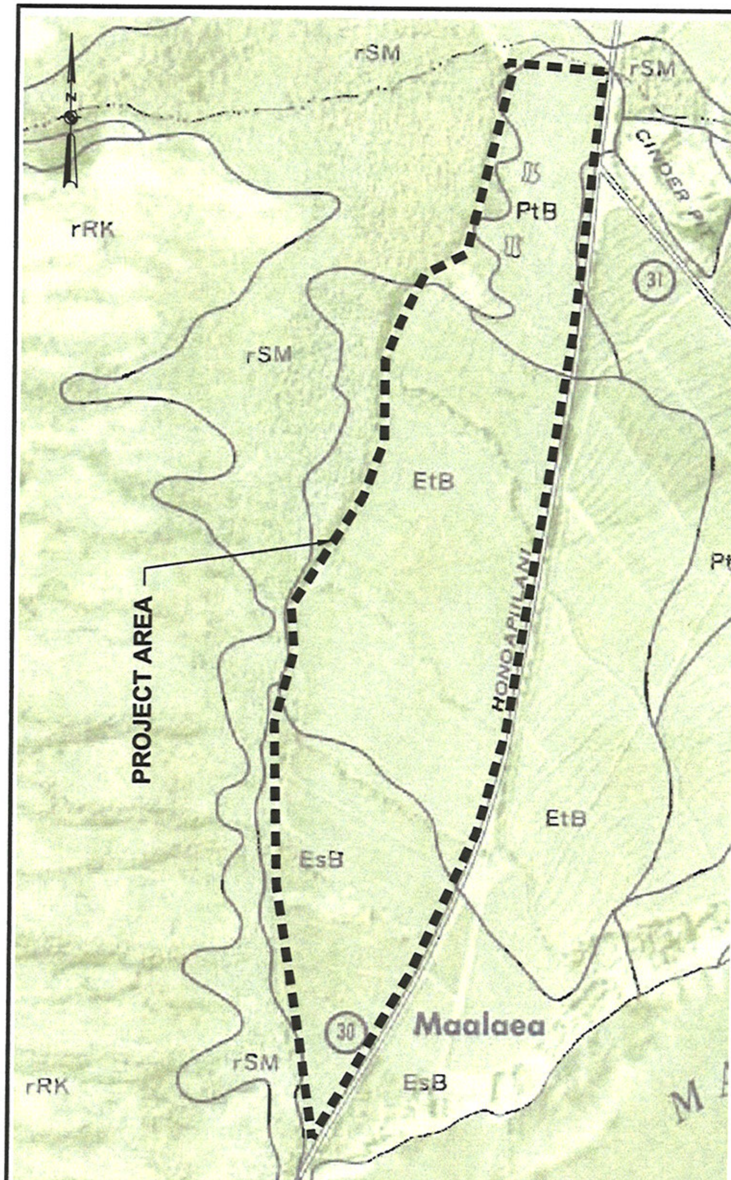
MAALAEA MAUKA
PRELIMINARY ENGINEERING REPORT

FIGURE 1
PROJECT LOCATION MAPS
July 2006



Source: USDA, Soil Conservation Service

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MAALAEA MAUKA
PRELIMINARY ENGINEERING REPORT

FIGURE 2
SOILS MAP
July 2006

Ewa Cobbly Silty Clay (EtB) is a member of the Ewa series of soils. Ewa series soils are well-drained soils found in basins and on alluvial fans. These soils also derived from basic igneous rocks. The representative profile includes a dark-reddish surface layer of silty clay loam that includes cobblestones and is about 18 inches thick. Its subsoil is about 42 inches thick, dark reddish-brown with subangular blocky structures. Its substratum consists of coral limestone, sand or gravelly alluvium. Permeability is moderate, runoff slow and the erosion hazard is slight.

Ewa Silty Clay (EsB) is similar in nature to the Ewa Cobbly Silty Clay described above except that it does not have cobbles.

2.5 Hydrology

The proposed project site sits atop the Waikapu aquifer system that is a subset of the larger Wailuku aquifer sector. This aquifer system, seen in FIGURE 3 – AQUIFER MAP, has a sustainable yield of 2 MGD.

Mink and Lau classified and assigned an aquifer code of 60101 to the Waikapu aquifer. They describe the aquifer type as a basal and unconfined aquifer lying in sedimentary rock of non-volcanic lithology. This potentially useful aquifer is not currently designated for either drinking water or as ecologically important. Saline levels are slight with chloride levels ranging from 250 to 1000 mg/L. It is defined as a replaceable source that is moderately vulnerable to contamination.

One of the State Commission on Water Resource Management's (CWRM) criteria for designation of a groundwater management area is pumpage of 90% of the sustainable yield of an aquifer. For Waikapu aquifer this is 1.8 MGD. Discussions with the CWRM indicate that there are relatively few wells drawing water from the Waikapu aquifer. The most current aquifer data published by the County of Maui states that 0.144 MGD is withdrawn from the aquifer on average.

Minimal data exist that describe the water quality of this aquifer. Two agencies were contacted for their records of water quality data relating to the installation of the existing Pohakea #1 well. The CWRM note that chlorides for this well were 160 mg/L, its temperature was 72.2 F and the water level was 7.43 feet mean sea level. The DOH Safe Drinking Water Branch has no record of source water quality test data for this well. Efforts are currently under way to test the existing Pohakea #1 well in accordance with Hawaii Administrative Rules §11-20.

No data exists to alleviate concerns regarding aquifer contamination. It is recommended that Maalaea Properties, LLC require all future wells to include a full range of water quality sampling and testing during their construction. Contaminants are to be tested in accordance with Hawaii Administrative Rules §11-20 and requirements are shown in Appendix A - *Required Water Quality Analyses*.

2.6 Infrastructure

A new well (State ID 4930-01) was completed recently and is approximately one-half mile upslope from the northern edge of the proposed Ma'alaea Mauka project site. This well is located at TMK 3-6-04: parcel 03 at a ground elevation of 320 feet MSL. This well is capable of producing 432,000 gallons per day of groundwater. Currently, 2 new wells are under construction and are assumed capable of producing 300,000 gpd each. No storage tank currently exists on this well site.

No water system infrastructure currently exists on the proposed project site. A nearby County system feeds a storage tank servicing the existing Ma'alaea community through an 8 inch line from Central Maui. Capacity in the nearby system is not adequate to support the proposed Ma'alaea Mauka project; therefore new infrastructure must be developed for this project.

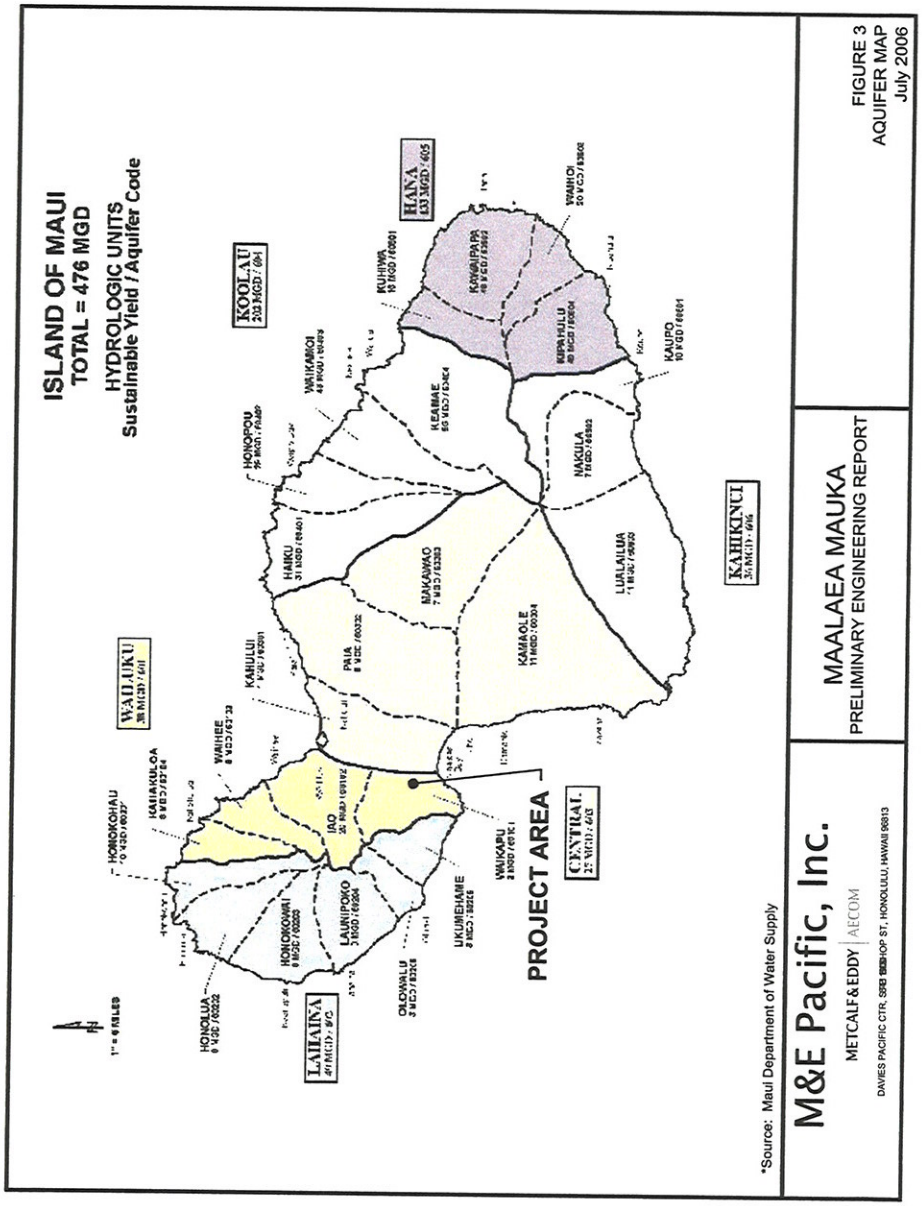
2.7 Zoning

The proposed project site is zoned agricultural.

2.8 Easement

An examination of TMK maps indicate there is only an electrical easement located on the very northern portion of the property.

Adjacent to the well site at TMK 3-6-4: par 03 is a roadway and utility easement as well as a powerline and electrical easement.



3.0 Water System Standards & Design Criteria

3.1 Design Criteria

The following section establishes design criteria and outlines calculations for the proposed Maalaea Mauka development. Criteria to be established include demand, pump capacity, groundwater wells, water storage capacity, and distribution.

3.2 Water System Standards

The State of Hawaii, *2002 Water System Standards* will be used to establish all design criteria as this system will be dedicated to the County of Maui, Department of Water Supply (DWS). All newly designed and constructed facilities under the jurisdiction of Maui DWS are subject to these standards. Adherence to these standards will permit the system to be dedicated to Maui DWS at a later date. This section summarizes the requirements according to standards for various parts of the potable water supply system.

3.2.1 Demand

The following table outlines design criteria with regard to domestic water consumption for the County of Maui. The criteria will be used to quantify the average daily demand (Q_{ave}), maximum daily demand (Q_{max}) and peak hour demand (Q_{peak}).

Table 3-1: Domestic Water Consumption

Land Use	Average Daily Demand (Q_{ave})	Fire Flow Requirement (FF)
Singe Family or Duplex	600 gpd/unit	1000 gpm for 2 hrs
Light Industry (WWTP)	6000 gpd/acre	2000 gpm for 2 hrs
Community Center, Parks	1700 gpd/acre	2000 gpm for 2 hrs

The following equations will used to calculate Q_{ave}, Q_{max} and Q_{peak};

Q_{ave} = Total Demand (includes homes, industry and parks) *(equation 3-1)*

Where,

Q_{ave} = Units x 600 gpd + acres x 6000 gpd/acre + acres x 1700 gpd/acre

$Q_{max} = 1.5 \times Q_{ave}$ *(equation 3-2)*

$Q_{peak} = 3.0 \times Q_{ave}$ *(equation 3-3)*

3.2.2 Pump Capacity & Groundwater Wells

PUMP CAPACITY CRITERIA
According to the *Water System Standards*, total pump capacity required (Q_{req}) must be capable of meeting the following;

1. Q_{max} with an operating time of 16 hours while simultaneously providing required FF independent of the reservoir. The standby unit may be used to determine the total flow required.

   $Cap_{req1} = Q_{max16HR} + FF$ - Standby Pump Capacity *(equation 3-4)*

2. Q_{max} during the duration of fire plus FF less ¾ of reservoir storage. According to the *Water System Standards* for Maui, the duration of a fire is assumed to be 2-hours

   $Cap_{req2} = [Q_{max2HR} + FF] - [0.75 \times \text{Reservoir Volume}]$ *(equation 3-5)*

3. Q_{max} with an operating time of 16 hours. The largest pumping unit shall be considered out of service.

   $Cap_{req3} = Q_{max16HR}$ *(equation 3-6)*

The largest of these required flows (Q_{req}) will be utilized as the minimum required pump capacity (Cap_{req}).

GROUNDWATER WELL REQUIREMENTS
The existing on-site well is capable of producing 432,000 gpd. For future wells, a conservative assumption of 70% of the known production capability is used. This amounts to 300,000 gpd per future well. The total number of wells required ($Wells_{req}$) will be determined by dividing the minimum capacity required by the estimated well production as show below. The *Water System Standards* require a minimum of one back-up well capable of producing equal to or greater than the largest production well. Therefore, the existing 432,000 gpd well will be considered the back-up well and out of service.

$Wells_{req} = Cap_{req} \div 300{,}000$ gpd *(equation 3-7)*

BACK-UP POWER REQUIREMENTS
Backup power is required for these well pumps. The following assumptions are used to determine the horsepower requirement for a single pump:

Flow = 41.7 lb/sec (432,000 gpd), or 29.0 lb/sec (300,000 gpd)
Lift = 350 ft
Efficiency = 60%

HP = [Flow x Lift] ÷ [efficiency x 550 ft-lb/sec/HP] *(equation 3-8)*

Sufficient reserve power must be supplied to support all operating and back-up wells.

3.2.3 Water Storage Capacity

According to the *Water System Standards* the storage capacity must capable of meeting;

1. Q_{max} consumption. Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

   $Vol_{req1} = Q_{max} \times 1$ day *(equation 3-9)*

2. Q_{max} plus FF for the duration of the fire (duration of a fire is assumed to be 2-hours). Reservoir ¾ full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

   $Vol_{req2} = [Q_{max2hr} + FF - \text{Pump Capacity}] \div 0.75$ *(equation 3-10)*

The larger of these two storage capacities (Vol_{req}) will be utilized as the water storage design criteria.

3.2.4 Distribution System

DISTRIBUTION SYSTEM CAPACITY
According to the *Water System Standards* the distribution system capacity must capable of;

1. Meeting maximum daily demand (Q_{max}) while simultaneously providing required fire flow (FF) and

   Sys $Cap_{req1} = Q_{max} + FF$ *(equation 3-11)*

2. Delivering peak hourly flow (Q_{peak}).

   Sys $Cap_{req2} = Q_{peak}$ *(equation 3-12)*

The larger of these two system capacities will be utilized as the minimum distribution system design criteria.

DISTRIBUTION SYSTEM PIPELINE SIZING
Water lines shall be sized to meet the following criteria:

- Q_{max} + FF with a residual pressure of 20 pounds per square inch (psi) at the critical fire hydrant.
- Peak Hour Water Demand with a minimum residual pressure of 40 psi.
- Minimum water line diameter is 8 inch.

- Carrying capacities of mains shall be determined through the use of the following values:
  - 8" & 12"—C = 110;
  - 16" & 20"—C = 120; and
  - 24" & larger—C = 130.
- Maximum flow velocities:
  - Distribution mains - without FF: 6 feet per second (fps);
  - Distribution mains - with FF @ Q_{max}: 10 fps;
  - Transmission mains -without water services or FF: 20 fps; and
  - Fire lines: 13 fps.
- Maximum static or pumping pressure, whichever is greater, shall not exceed 125 psi.

DISTRIBUTION SYSTEM LAYOUT

The transmission main will convey water from the reservoir to the subdivision. Preliminary calculations indicate the minimum size transmission line to satisfy standards is 12 inches. However, this line may be considerably larger to satisfy design criteria for the planned subdivision distribution system.

The distribution system will not incorporate dual lines. The transmission and distribution mains will be utilized for both public service and fire flow. Specific line sizing will be completed during design. Fire hydrants will be connected directly to the distribution mains.

Fire hydrant spacing will be 350 feet in single family residential areas, 250 feet in areas where multi-family units and the community center are located.

TREATMENT REQUIREMENTS

There are no treatment requirements for water produced from a groundwater source. However, there are treatment requirements for potable water distribution systems. Refer to *Section 3.3 Design Criteria* of this report.

New wells are required to be disinfected with chlorine following the completion of the well.

DISINFECTION

Disinfectant residuals must be maintained in the potable water system. Typically, chlorine is added to the produced groundwater at the wellhead prior to storage. Generally, disinfectant levels are maintained at approximately 0.2 mg/L. The Hawaii Administrative Rules limit disinfectant levels from exceeding 4.0 mg/L.

4.0 Preliminary Design Requirements

This project consists of the development of 949 homes for the Maalaea Mauka Development. A community center, a public/quasi-public , parks and a wastewater treatment facility will be developed to support the community. Section 4.0 establishes design requirements for this project.

4.1 Demand

The following table summarizes the projected development as well as FF demand for each type of land use. Preliminary planning indicates the development of both single and multi-family housing units in the proposed Maalaea Mauka subdivision. To ensure adequate water supply all water demand calculations for residential units in this report are conservatively assumed to be single family or duplex.

Table 4-1: Projected Development

Land Use	Development	FF Requirement
Single Family, Duplex	949 units	1250 gpm for 2 hrs
Community Center, Parks	5 acres	2000 gpm for 2 hrs*
Wastewater Treatment Plant	5 acres	2000 gpm for 2 hrs*
Public/Quasi-public Facility	2 acres	2000 gpm for 2 hrs*

*Denotes applicable FF requirement for design

Water demand for this community was calculated using Table 4-1 and the equations from Section 3.2.1. Table 4-2 summarizes calculations.

Table 4-2: Water Demand

Demand Type	Equation	Result
Q_{ave}	*3-1*	619,900 gpd
Q_{max}	*3-2*	929,850 gpd
Q_{peak}	*3-3*	1,859,700 gpd
FF	*Table 4-1*	2000 gpm for 2 hrs

Results shown in Table 4-2 will be used to calculate design requirements in the following sections.

4.2 Pump Capacity & Groundwater Wells

PUMP CAPACITY

The minimum pump capacity (Cap_{req}) must satisfy the three criteria listed in Section 3.2.2. Therefore, the largest Q_{req} must be used to determine minimum pump capacity requirement. The following table summarizes Cap_{req} for all criteria in Section 3.2.2. The assumed tank for these calculations is 1.0 MGD.

Table 4-3: Required Pump Capacity

Pump Capacity	Equation	Result
Cap_{req1}	*3-4*	1,202,775 gpd
Cap_{req2}	*3-5*	-432,512 gpd
Cap_{req3}	*3-6*	1,394,775 gpd

Equation *3-6* yields the largest required pumping capacity and will therefore be used as the minimum pump capacity requirement (Cap_{req}).

Cap_{req} = 1,394,775 gpd

GROUNDWATER WELL REQUIREMENTS
The minimum pump capacity requirement of 1,394,775 gpd will be used in conjunction with equation *3-7* to determine the total number of production wells needed for this development. The total number of production wells and back-up wells are shown below.

$Wells_{req}$ = 4.65 wells + 1 back-up well → **6 wells (total)**

There is one existing well installed on-site and two wells currently being constructed. Therefore, three additional wells must be installed to provide an adequate water supply for the proposed development of 949 homes.

$Wells_{new}$ = $Wells_{req}$ - $Wells_{exist}$ = **3 wells**

This development will require 5 production wells and at least one back-up well as determined by the Maui DWS. Potential well location can be seen in FIGURE 4 – PROPOSED EQUIPMENT LOCATION MAP. Final location of wells will be determined during design. Typical well spacing in Hawaii is 150 feet.

BACK-UP POWER REQUIREMENTS
Backup power requirements on equation *3-8* require at least a **200 HP generator**. The actual size of the generator(s) will be determined during design.

4.3 Water Storage

STORAGE CAPACITY
The minimum storage capacity must be capable of meeting all criteria outlined in Section 3.2.3. The following table summarizes Vol_{req} for all criteria in Section 3.2.3.

Table 4-4: Required Storage Capacity

Storage Capacity	Equation	Result
Vol_{req1}	*3-9*	929,850 gal
Vol_{req2}	*3-10*	223,317 gal

Equation *3-9* yields the largest required storage capacity and will therefore be used as the minimum storage capacity requirement (Vol_{req}). The *Water System Standards* state that reservoirs shall be built in standard sizes. Therefore a 1,000,000 gal tank must be built to satisfy water demand. Possible water storage reservoir can be seen in FIGURE 4 – PROPOSED EQUIPMENT LOCATION MAP

Vol_{req} = 1,000,000 gal

4.4 Distribution System

DISTRIBUTION SYSTEM CAPACITY
The minimum distribution system capacity (Sys Cap_{req}) must satisfy the two criteria listed in Section 3.2.4. Therefore, the largest Sys Cap_{req} must be used as the minimum distribution system capacity required. The following table summarizes distribution system capacities for all criteria in Section 3.2.4.

Table 4-5: Required Distribution System Capacity

Storage Capacity	Equation	Result
Sys Cap_{req1}	*3-11*	2,646 gpm
Sys Cap_{req2}	*3-12*	1,291 gpm

Equation *3-11* yields the largest required distribution system capacity and will therefore be used as the minimum distribution system capacity requirement (Sys Cap_{req}).

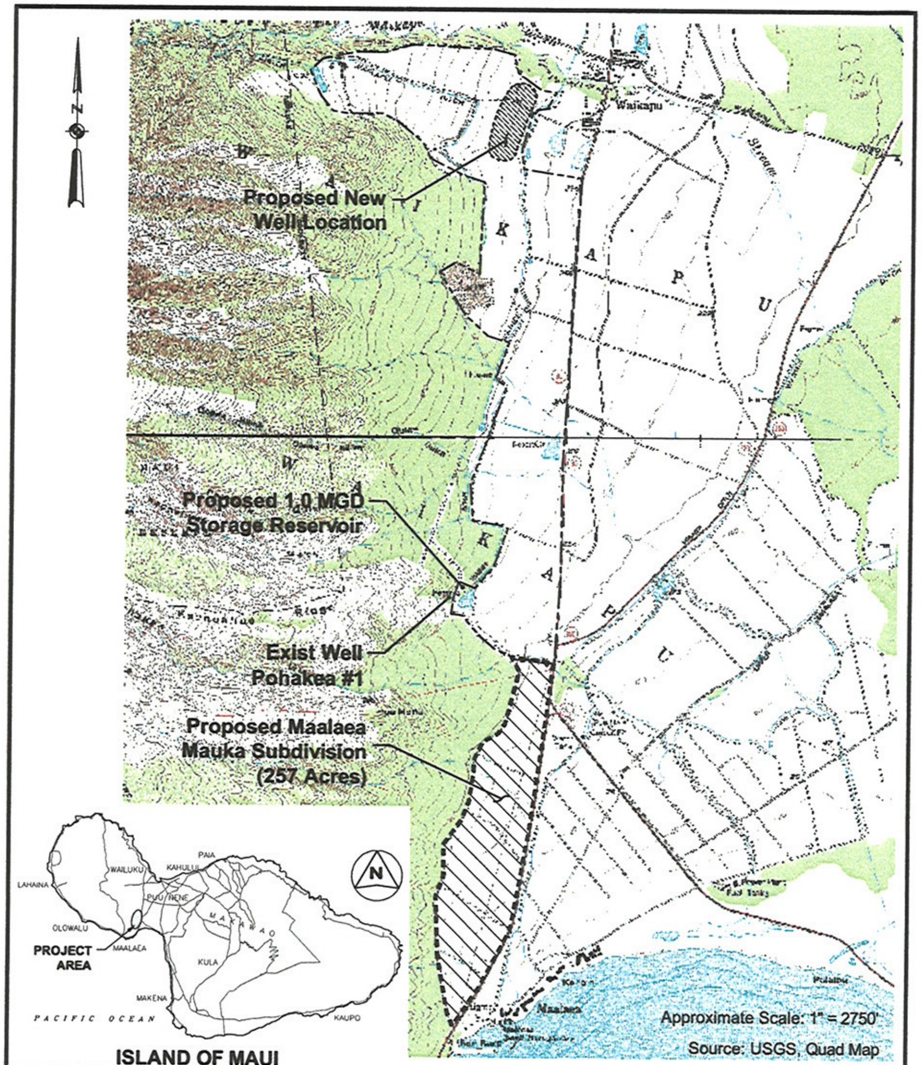
Sys Cap_{req} = 2,646 gpm

DISTRIBUTION SYSTEM PIPELINE SIZING
Distribution system pipeline sizing will be completed as part of the Construction Documents and meet the requirements outlined in Section 3.2.4.

DISTRIBUTION SYSTEM LAYOUT
Distribution system layout will be completed as part of the Construction Documents and meet the requirements outlined in Section 3.2.4.

WATER TREATMENT
Efforts are currently under way to conduct water quality testing for Pohakea #1 in accordance with DOH SDWB. Based on the results of the upcoming water quality tests, necessary treatment methods will be developed in accordance with the requirements established in Hawaii Administrative Rules §11-20.

DISINFECTION
See Section 3.2.4 for disinfection requirements.



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MAALAEA MAUKA
PRELIMINARY ENGINEERING REPORT

FIGURE 4
PROPOSED EQUIPMENT LOCATION MAP
July 2006

4.5 *Engineering Cost Estimate*

Costs provided in this section are for conceptual purposes only. These costs assume the use and upgrade of the existing wells including those now under construction as well as the installation of three additional wells. Land acquisition costs are not included in this estimate.

WATER WELLS

	Qty	Unit	Unit Cost	Cost
Mob/Demob	1	LS	$ 25,000	$ 25,000
Site Work	1	LS	$ 100,000	$ 100,000
Install Wells	3	ea	$ 200,000	$ 600,000
Submersible Pumps	6	ea	$ 10,000	$ 60,000
Control Building, 20'x10', CMU	1	ea	$ 100,000	$ 100,000
Piping, 6" DI	15,000	LF	$ 50	$ 750,000
Emergency Generators	1	LS	$ 200,000	$ 200,000
Instrumentation	6	ea	$ 50,000	$ 300,000
Subtotal				$ 2,135,000
Soft Costs	15	%		$ 320,000
Contingency	25	%		$ 615,000
Total				**$ 3,070,000**

WATER STORAGE

	Qty	Unit	Unit Cost	Cost
Mob/Demob	1	LS	$ 100,000	$ 100,000
Site Work	1	LS	$ 100,000	$ 100,000
Conc Tank, 110' D x 25' SW	2100	CY	$ 1,000	$ 2,100,000
Steel Roof	10,000	SF	$ 10	$ 100,000
Subtotal				$ 2,400,000
Soft Costs	15	%		$ 360,000
Contingency	25	%		$ 690,000
Total				**$ 3,450,000**

WATER DISTRIBUTION SYSTEM (excluding On-site Distribution)

	Qty	Unit	Unit Cost	Cost
Mob/Demob	1	LS	$ 100,000	$ 100,000
Excavation/Backfill	3,000	CY	$ 200	$ 600,000
Transmission Main, 12" PVC	3,000	LF	$ 100	$ 300,000
Chlorination/Flushing	1	LS	$ 10,000	$ 10,000
Subtotal				$ 1,010,000
Soft Costs	15	%		$ 170,000
Contingency	25	%		$ 300,000
Total				**$ 1,480,000**

5.0 Permit Requirements

The following permits and reports are required for the construction of the water system:

DOH Clean Water Branch

- NPDES NOI-C (Stormwater runoff during construction)
- NPDES NOI-F (Hydrotesting)

The following permits are required to install a new well and pumping unit:

DLNR Commission of Water Resource Management

- Well Construction Permit
- Well Completion Report
- Pump Installation Permit
- Pump Completion Report

Any well used to supply potable water to a public water system is subject to the requirements of the Department of Health, Safe Drinking Water Branch and their rules outlined under Hawaii Administrative Rules Title 11, Chapter 20.

Preconstruction

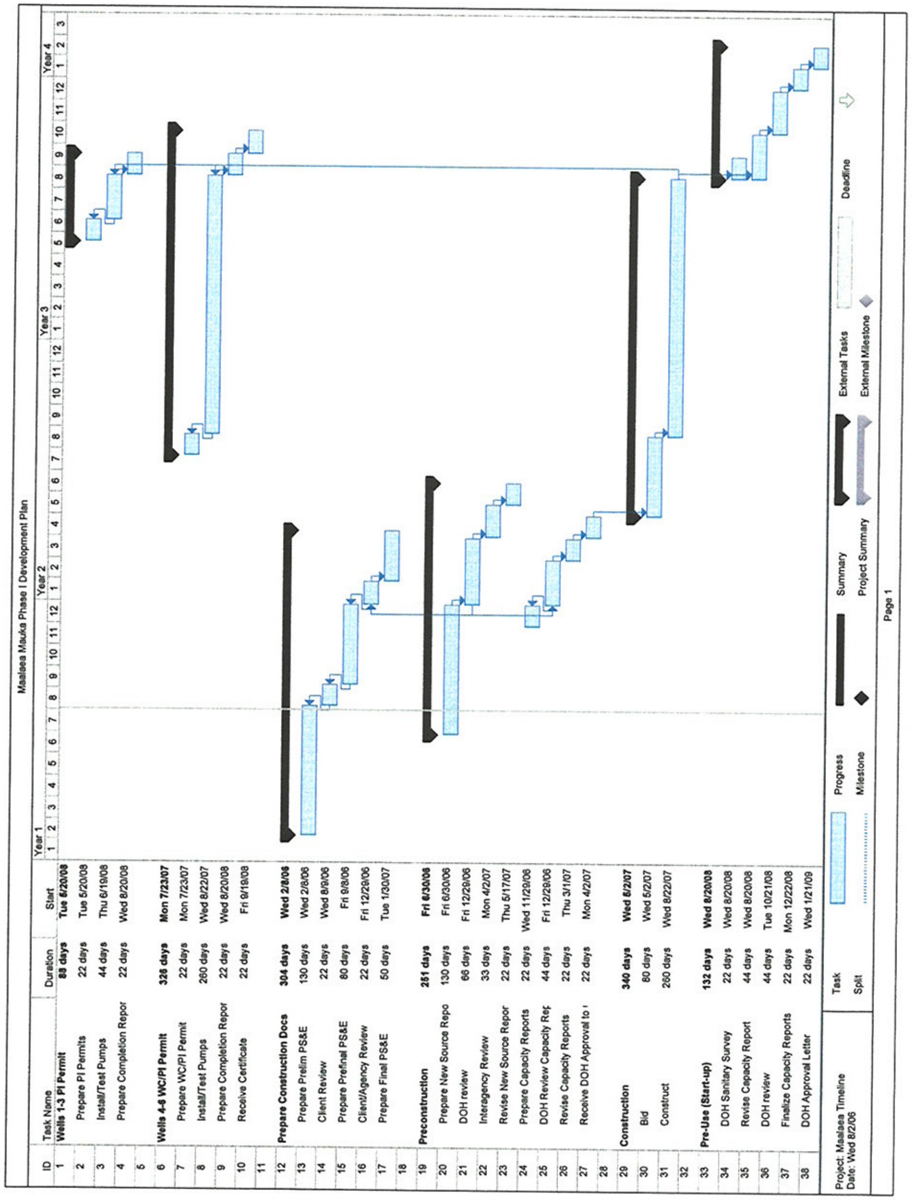
- New Source Engineering Report
- Technical, Financial and Managerial Capacity Reports
- Construction Plans and Specifications
- Approval of all items indicated above
- DOH signature on construction plans

Startup

- Revised New Source Engineering Report
- Revised Capacity Report
- Engineer's Certification of Construction in accordance with plans and specifications
- DOH Sanitary Survey
- Approval indicated by DOH issuance of letter approving use of new public water system

6.0 Project Schedule

The following project schedule details major tasks and estimates the time required to begin utilization of the proposed system as a potable water supply.



7.0 Summary & Recommendations

The project includes development of 949 single and multi-family housing units, a wastewater treatment facility, a community center, parks and landscaped buffers linked by roads and pedestrian walkways as well as bike paths.

7.1 *Water System*

DEMAND

The following table summarizes the Water Demand of the Maalaea Mauka Development.

Table 7-1: Water Demand Summary

Demand Type	Flow (gpd)	Flow (gpm)
Q_{ave}	619,900	430
Q_{max}	929,850	646
Q_{peak}	1,859,700	1,291
FF (2 hours)	240,000 (gals)	2,000

7.2 *Pump Capacity and Groundwater Wells*

PUMP CAPACITY

The required pump capacity required is **1,859,700 gpd** or **1291 gpm**.

GROUNDWATER WELLS

A total of **six wells** are required to support the proposed development. New wells are assumed capable of producing 300,000 gpd each. Five of six wells will be production wells while the remaining well will remain out of service and serve as the back-up well. Maui Department of Water Supply will determine if additional back-up wells will be required beyond the one required by the *Water System Standards.*

As three wells exist (or will exist in the near future), an additional three new wells are required to support the planned community.

Water quality testing in accordance with HRS Chapter 11-20 should be conducted during testing of all future wells. This is a requirement for all new public potable wells. In addition, testing of the two upcoming wells will alleviate Maui Planning Commission concerns over potential aquifer contamination during to previous agricultural activities.

BACK-UP POWER REQUIRMENTS

Each 300,000 gpd pump will require 31 HP of back-up power. The 432,000 gpd back-up well will require 44 HP of back-up power. The minimum HP required for all six wells is **200 HP**. The actual generator size(s) will be determined during design.

7.3 *Storage Capacity*

STORAGE TANK SIZE

The development requires a storage tank with a capacity of **1,000,000 gallons**.

7.4 *Distribution System*

DISTRIBUTION SYSTEM CAPACITY

The distribution system will require a minimum of **2,646 gpm** of capacity.

DISTRIBUTION SYSTEM PIPELINE SIZING AND LAYOUT

Distribution system pipeline sizing and layout will be completed during design and should meet minimum system requirements outlined in section 3.2.4.

WATER TREATMENT REQUIREMENTS

Efforts are currently under way to conduct water quality testing for Pohakea #1 in accordance with DOH SDWB. Based on the results of the upcoming water quality tests, necessary treatment methods will be developed in accordance with the requirements established in Hawaii Administrative Rules §11-20.

DISINFECTION

Disinfectant levels should be maintained at approximately 0.2 mg/L and can not exceed 0.4 mg/L.

8.0 References

County of Maui Department of Water Supply, *Personal Conversations*, October 6 and 7, 2004.

Hawaii Administrative Rules, Title 11, Chapter 20.

Mink, John F., Lau, L. Stephen, *Aquifer Identification and Classifications for Maui: Groundwater Protection Strategy for Hawaii*, February 1990. Technical Report No. 185, Water Resources Research Center, University of Hawaii at Manoa.

Munekiyo and Hiraga, *Ma'alaea Project District 12 Water Use Consumption Assessment*, July 7, 2004.

State of Hawaii, *Hawaii Well Construction & Pump Installation Standards*, February 2004. Department of Land and Natural Resources, Commission on Water Resource Management.

State of Hawaii, *Realty Atlas, Counties of Maui and Kalawao*, 2003. 37th Edition, Map Volumes – Zones 3 thru 6.

State of Hawaii, *Water System Standards*, 2002.

United States Department of Agriculture, *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*, August 1972. Soil Conservation Service

University of Hawaii, *Atlas of Hawaii*. 1973. Department of Geography. The University Press of Hawaii.

Appendix A

Required Water Quality Analyses

CONTAMINANTS TO BE TESTED IN ALL NEW SOURCES OF POTABLE WATER

(Based on Chapter 11-20, Rules Relating to Potable Water Systems, effective December 15, 1994 and EPA Phase V Rule effective January 17, 1994)

MICROBIOLOGICAL
- Total Coliform
- Fecal Coliform (MPN)
- Microscopic Particulate Analysis *(surface water sources, springs, shafts, tunnels, and wells with less than 50 feet of solid grouting - by EPA Consensus Method, EPS 910/0-92-029, October 1992)*

TURBIDITY

WATER QUALITY PARAMETERS
- pH
- Alkalinity
- Calcium
- Conductivity
- Temperature

INORGANIC CHEMICALS
- *Antimony*
- Arsenic
- Barium
- *Beryllium*
- Cadmium
- Chromium
- Copper
- *Cyanide*
- Fluoride
- Lead
- Mercury
- *Nickel*
- Nitrate (as nitrogen)
- Nitrite (as nitrogen)
- Selenium
- *Thallium*

ORGANIC CHEMICALS

Volatile Organic Chemicals
- Benzene
- Carbon Tetrachloride
- Chlorobenzene
- ortho-Dichlorobenzene
- para-Dichlorobenzene
- 1,2-Dichloroethane
- 1,1-Dichloroethylene
- cis-1,2-Dichloroethylene

Volatile Organic Chemicals (cont.)
- trans-1,2-Dichloroethylene
- *Dichloromethane*
- DCP (1,2-Dichloropropane)
- Ethylbenzene
- Styrene
- Tetrachloroethylene
- Toluene
- 1,1,1-Trichloroethane
- *1,1,2-Trichloroethane*
- *1,2,4-Trichlorobenzene*
- Trichloroethylene
- TCP (1,2,3-Trichloropropane)
- Vinyl Chloride
- Xylenes (total)

Synthetic Organic Chemicals
- 2,4-D
- Alachlor
- *Aldicarb*
- *Aldicarb Sulfone*
- *Aldicarb Sulfoxide*
- Atrazine
- *Benzo(A)Pyrene*
- Carbofuran
- Chlordane
- *Dalapon*
- DBCP (Dibromochloropropane)
- *Di(ethylhexyl)-Adipate*
- *Di(ethylhexyl)-Phthalate*
- *Dinoseb*
- *Diquat*
- *2,3,7,8-TCDD (Dioxin)*
- Endothall
- Endrin
- EDB (Ethylene Dibromide)
- *Glyphosate*
- Heptachlor
- Heptachlor Epoxide
- *Hexachlorobenzene*
- *Hexachlorocyclopentadiene*
- Lindane
- Methoxychlor
- *Oxamyl*
- Pentachlorophenol
- *Picloram*
- PCBs(Polychlorinated biphenyls)
- 2,4,5-TP (Silvex)
- *Simazine*
- Toxaphene

(see Notes on Page 2)

NOTES:

(1) With the exception of turbidity and water quality parameters, all analyses must be performed by a laboratory certified or approved by the Hawaii Department of Health, State Laboratories Division. However, turbidity and water quality parameters must be done using EPA approved methods.

(2) Please consult with the Safe Drinking Water Branch for acceptable laboratories to perform Microscopic Particulate Analysis.

(3) All laboratory reports must be submitted to allow the Department of Health to verify that the analyses were performed by an approved laboratory, using EPA approved methods for drinking water analysis. The EPA method and detection levels must be clearly stated for each chemical contaminant tested.

(4) The Director of Health may require additional analyses wherever appropriate to evaluate the new source.

APPENDIX M.

Wastewater System Preliminary Engineering Report

FINAL

PRELIMINARY ENGINEERING REPORT

for

MA'ALAEA MAUKA SUBDIVISION WASTEWATER SYSTEM

Ma'alaea, Hawaii

TMK: (2) 3-6-001:018 and 3-6-004:003

August 2006

Prepared by:

M&E Pacific, Inc.
METCALF & EDDY | AECOM
841 Bishop St, Suite 1900
Davies Pacific Center
Honolulu, HI 96813

Prepared for:

Ma'alaea Properties

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EXECUTIVE SUMMARY

The purpose of this report is to recommend a wastewater system for the proposed Maalaea Mauka Subdivision (MMS). The proposed wastewater system will receive wastewater from the existing Maalaea Community and the proposed MMS. A total of 1,580 properties will be served.

Recommendations:

1. Phase 1
    a. Wastewater Flow
        i. Average Dry Weather (ADWF)-0.25 million gallons per day (mgd).
        ii. Design Flow-0.3 mgd
        iii. Peak Wet Weather Flow-2.0 mgd
    b. Collection System
        i. Sewer Lines-35,000 linear feet of 8-inch PVC or VCP sewer lines
        ii. Manholes-epoxy coated, concentric, precise concrete type with PVC coated rungs and gaskets spaced 350 linear feet apart.
        iii. Wastewater Pump Station-submersible with single or dual wet well, three pumps, ductile iron piping for the pump station piping, emergency generator, and 9,000 linear feet or American Water Works Association (AWWA) Standard High Density Polyethylene (HDPE).
    c. Wastewater Treatment Plant
        i. Equalization Basin-(1) equalization basin.
        ii. Headworks-(2) fine screen and (2) grit removal system.
        iii. Activated Sludge Process-(1) 0.3 mgd membrane bioreactor (MBR)
        iv. Disinfection System-(1) ultraviolet (UV) disinfection channel
        v. Support Facilities-(1) control building.
    d. Wastewater Disposal System
        i. Primary Effluent Disposal-reuse (43 acres for irrigation) and (1) recycle water reservoir.
        ii. Back-up Effluent Disposal-(1) injection well for back-up.
2. Phase 2
    a. Wastewater Flow
        i. Average Dry Weather Flow (ADWF)-0.5 mgd.
        ii. Design Flow-0.6 mgd.
        iii. Peak Wet Weather Flow (PWWF)-2.0 mgd.
    b. Collection System
        i. No expansion of the Collection System.
    c. Wastewater Treatment Plant
        i. Equalization Basin-(1) equalization basin.
        ii. Activated Sludge Process-(1) 0.3 mgd membrane bioreactor (MBR)
    d. Wastewater Disposal System
        i. Primary Effluent Disposal-reuse (42 acres for irrigation) and (1) recycle water reservoir.
        ii. Back-up Effluent Disposal-(1) injection well.
3. Phase 3

    a. Wastewater Flow
        i. Average Dry Weather (ADWF)-1.0 mgd.
        ii. Design Flow-1.2 mgd
        iii. Peak Wet Weather Flow-4.0 mgd
    b. Collection System
        i. No expansion of the Collection System.
    c. Wastewater Treatment Plant
        i. Equalization Basin-(2) equalization basin.
        ii. Headworks-(2) fine screen and (2) grit removal system.
        iii. Activated Sludge Process-(2) 0.3 mgd membrane bioreactor (MBR)
        iv. Disinfection System-(1) ultraviolet (UV) disinfection channel
    d. Wastewater Disposal System
        i. Primary Effluent Disposal-reuse (85 acres for irrigation) and (1) recycle water reservoir or (1) injection well.
        ii. Back-up Effluent Disposal-(2) injection wells.

The estimated Phase 1 construction cost is $26.1M and the estimated Phase 2 construction cost is $6.1M. Phases 1 and 2 construction should be completed in 2011. The cost estimate for Phase 3 construction is $15.4M. Phase 3 construction should be completed in 2013. Full build-out is expected in 2016.

1.0 PROJECT DESCRIPTION

1.1 Background

Ma'alaea Properties (MP) contracted with M&E Pacific (M&E) to prepare a Preliminary Engineering Report (PER) for the wastewater system at the proposed Ma'alaea Mauka Subdivision (MMS). Ma'alaea Properties proposes to develop a 257 acre subdivision on Maui. The project is located on the lower slopes of the West Maui Mountains near the Ma'alaea Bay (See Figure 1-1).

The existing project area is shown in Figure 1-2. On the southern end of the project, the land is bound by the Maui Ocean Center development and to the north by the Waikapu community. The state conservation land and the King Kamchamcha Golf Club are to the west of the project area, and the Honoapiilani Highway borders the project to the east. The project area is at the cross roads between the West Maui communities of Lahaina and Kaanapali and the Central-East Maui communities of Wailuku, Kahului, and Kihei. The project area is presently zoned for agricultural use.

The project area encompasses two lots – the proposed subdivision (Lot 260) and Waikapu Lot 710. The wastewater collection system will be part of the proposed subdivision and Lot 710 will be the location for the proposed offsite water system (See Ma'alaea Mauka Water System PER) and the wastewater treatment and disposal systems.

The MMS wastewater system will consists of the following components:

1. Wastewater Collection System.
   a. Gravity sewers.
   b. Pump stations.
2. Wastewater Treatment System.
   a. Wastewater Treatment Plant.
3. Wastewater Disposal System.
   a. Effluent reuse.
   b. Ground disposal.

1.2 Objective of Report

The objectives of this Preliminary Engineering Report (PER) are as follows:

1. Recommend a wastewater collection system;
2. Recommend wastewater treatment processes; and
3. Recommend a wastewater disposal system.

1.3 Definitions

The following table defines acronyms that are utilized in this report.

Table 1-1: Acronyms

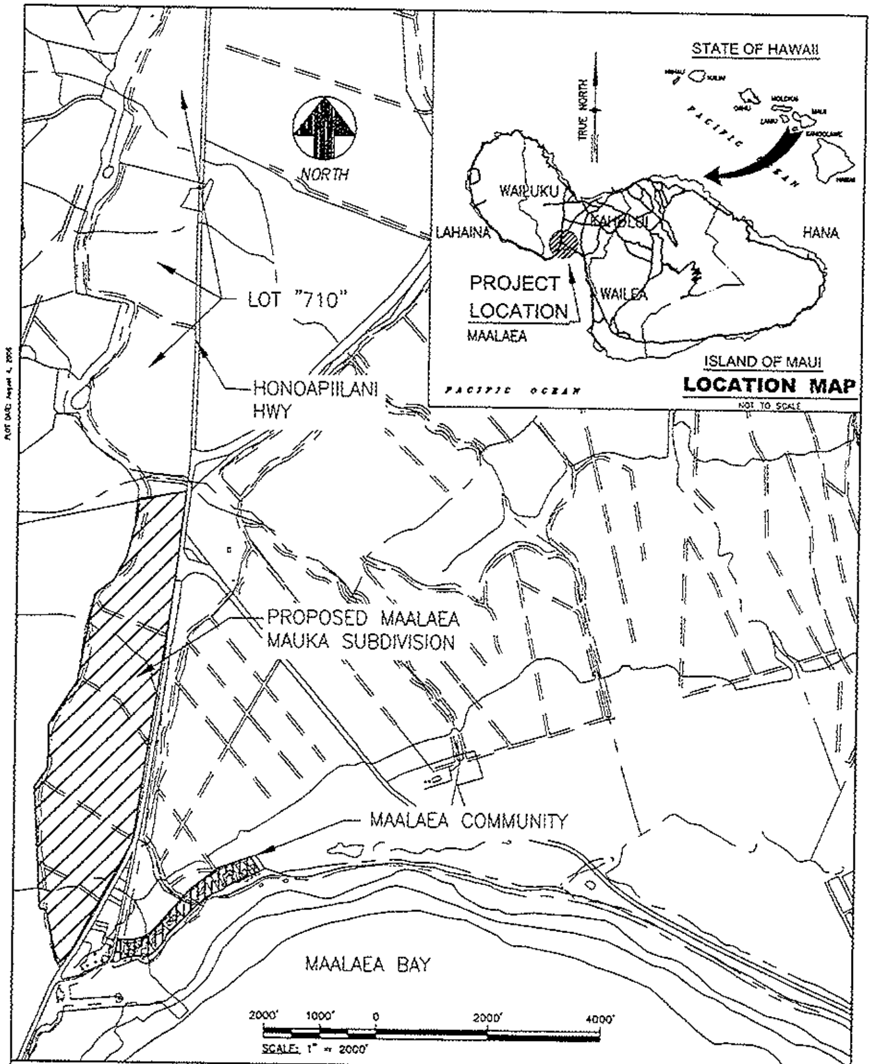
Acronyms	
BOD	5-day biochemical oxygen demand
DOH	State Department of Health
EA	Environmental Assessment
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
M&E	M&E Pacific, Inc.
mg/L	Milligrams per liter
mgd	Million gallons per day
MMS	Ma'alaea Mauka Subdivision
MP	Ma'alaea Properties
OHA	Office of Hawaiian Affairs
PER	Preliminary Engineering Report
TMK	Tax map key
WWPS	Wastewater pump station
WWTP	Wastewater treatment plant

1.4 Standards

This Preliminary Engineering Report will be prepared in accordance with the following standards and references:

1. State of Hawaii, Chapter 11-62 Wastewater Systems[1].
2. State of Hawaii, Guidelines for the Treatment and Reuse[2].
3. City and County of Honolulu, July 1984, Wastewater Design Standards, Volume 1.[3]
4. City and County of Honolulu, July 1984, Wastewater Design Standards, Volume 2.[4]

[1] State of Hawaii, 2004, "Hawaii Administrative Rules, Chapter 11-62, State DOH. http://www.hawaii.gov/health/about/rules/11-62.pdf
[2] State of Hawaii, 2002, "Guidelines for Treatment and Reuse of Recycled Water, State DOH. http://www.hawaii.gov/health/environmental/water/wastewater/pdf/reuse-final.pdf
[3] City and County of Honolulu, 1984, Wastewater Design Standards, Volume 1
[4] City and County of Honolulu, 1984, Wastewater Design Standards, Volume 2



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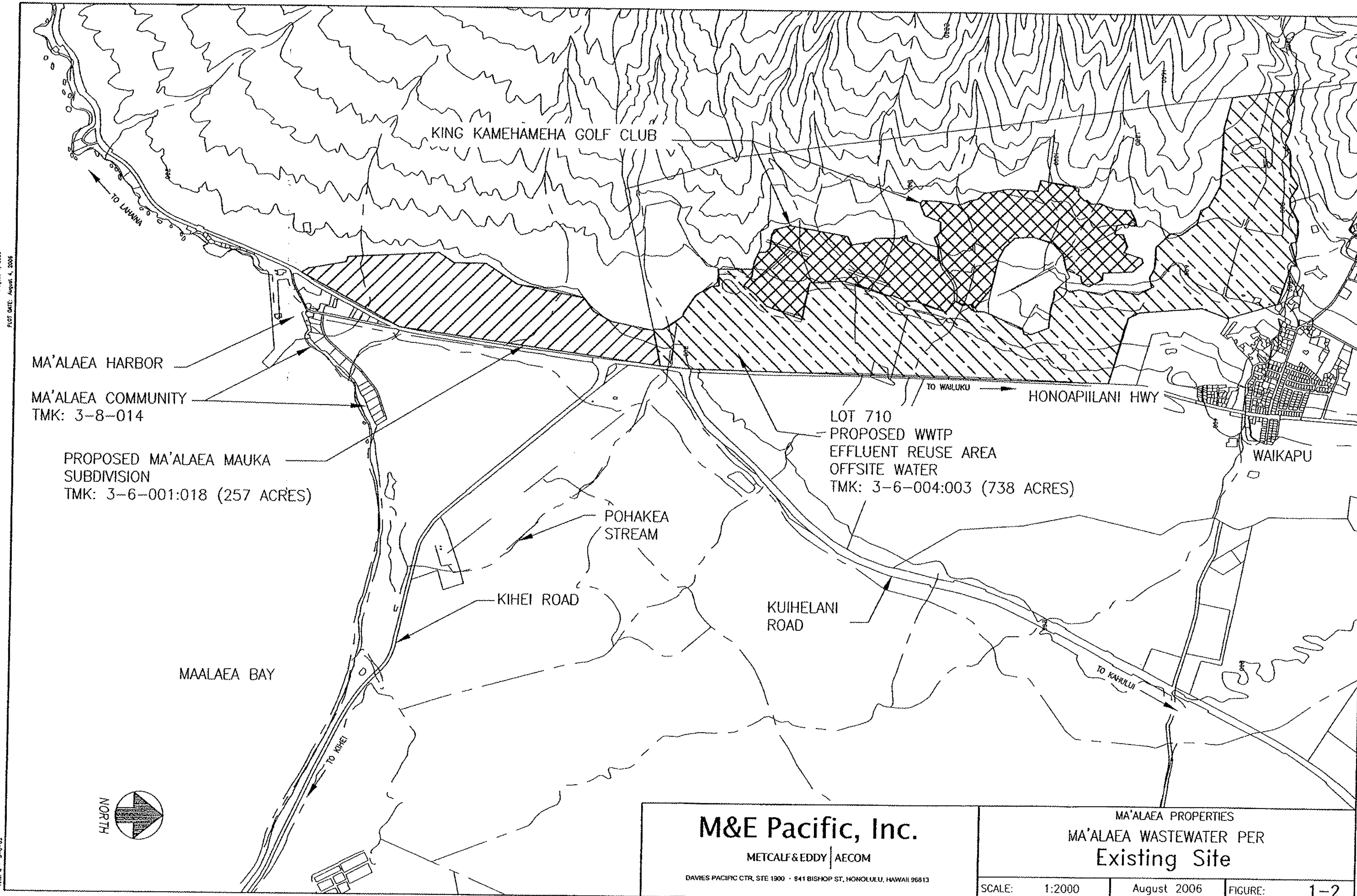
MA'ALAEA PROPERTIES

MA'ALAEA WASTEWATER PER

Location Map

SCALE:	1:2000	August 2006	FIGURE:	1–1


KING KAMEHAMEHA GOLF CLUB
TO LAHAINA
MA'ALAEA HARBOR
MA'ALAEA COMMUNITY
TMK: 3-8-014
PROPOSED MA'ALAEA MAUKA
SUBDIVISION
TMK: 3-6-001:018 (257 ACRES)
TO WAILUKU
HONOAPIILANI HWY
LOT 710
PROPOSED WWTP
EFFLUENT REUSE AREA
OFFSITE WATER
TMK: 3-6-004:003 (738 ACRES)
WAIKAPU
POHAKEA
STREAM
KIHEI ROAD
KUIHELANI
ROAD
TO KAHULUI
MAALAEA BAY
TO KIHEI
NORTH
M&E Pacific, Inc.
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MA'ALAEA PROPERTIES
MA'ALAEA WASTEWATER PER
Existing Site
SCALE: 1:2000
August 2006
FIGURE: 1-2

2.0 PROPOSED DESIGN CRITERIA

2.1 Design Flows

The service area for the proposed Ma'alaea Mauka WWTP includes the proposed subdivision and the existing Ma'alaea Community along the Ma'alaea Bay shoreline (See Figure 1-2). There have been reports of failed individual treatment systems along the Ma'alaea Bay communities. These failed treatment systems can lead to potential contamination of the nearby shoreline. To assist these communities and mitigate shoreline pollution due to failed treatment systems, Ma'alaea Properties has decided to provide a regional wastewater plant to not only serve the proposed development but to also serve the existing Ma'alaea Community. The Maalaea WWTP will have treatment capacity for the Maalaea Community, but the Maalaea Community will be responsible to connect to the WWTP.

The total number of residential lots is shown in Table 2-1.

Table 2-1: Projected Residential Lots

Maalaea Mauka WWTP Residential Lots			
Description	Single Family	Multi-Family	Total
Maalaea Community (existing)	0	631	631
MMS (future)	663	286	949
Total	**663**	**917**	**1,580**

The design of this project will be based on the State Department of Health (DOH) Wastewater Systems[1]. According to the State DOH standards, the specific design standards defaults to the City and County of Honolulu's (CCH) Wastewater Standards[3] if a county does not have its own wastewater standards. Since the County of Maui does not have its own wastewater standards, this project will use the City and County of Honolulu Wastewater Design Standards.

Based on the Wastewater Standards for the City and County of Honolulu[3], the projected wastewater flows are shown in Table 2-2 and details of these calculations can be found in Appendix B.

Table 2-2: Projected Wastewater Flows

Maalaea Mauka WWTP Flows					
TMK	ADWF (gpd)	Max Day Flow (gpd)	PWWF (gpd)	Residential Capita	Defacto Population (Total Capita)
Maalaea Community (existing)	154,810	533,479	555,364	1,723	1,821
MMS (future)	328,688	1,123,497	1,448,497	3,453	4,573
Total	**483,498**	**1,656,977**	**2,003,862**	**5,176**	**6,394**

ADWF: Average dry weather flow

PWWF: Peak wet weather flow

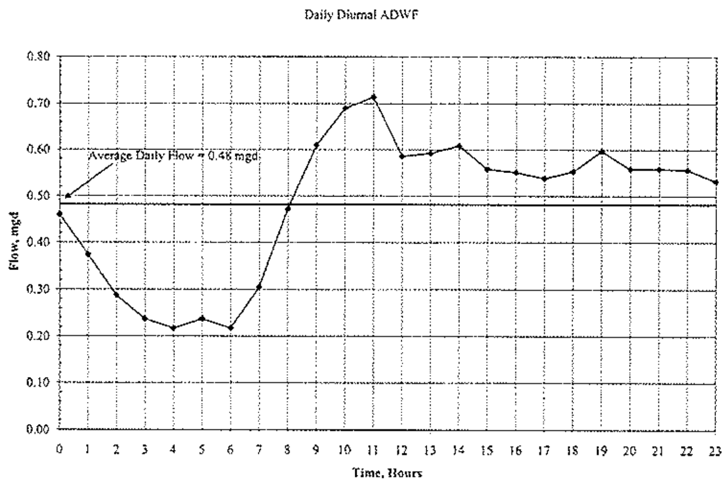
MF = Maximum Flow Factor based on Babbits Max Flow (CCH Wastewater Standards[3])

MF= 3.60 using resident population
MF= 3.45 using defacto population

The combined Average Dry Weather Flow (ADWF) from the proposed Ma'alaea Mauka Subdivision (TMK 3-6-001 plat) and the existing Ma'alaea community (TMK 3-8-014 plat) is approximately 480,000 gallons per day (gpd). It is expected that when this flow rate is achieved after 100 percent build-out of the proposed subdivision, the daily diurnal flow pattern will very likely exceed this amount. Thus, to adequately design the proposed WWTP, the Design Capacity of 600,000 gpd is recommended for the proposed WWTP and related wastewater system.

The projected daily diurnal flow pattern for an average daily flow of 480,000 gpd (0.48 mgd) is shown in Figure 2-1. The low flows of 220,000 gpd (0.22 mgd) are expected at 4 am and 6 am and the daily high flow of near 710,000 gpd (0.71 mgd) is expected at 11 am. Although there will be several hours per day when the flow is expected to exceed the Design Capacity of 600,000 gpd (0.60 mgd), the proposed WWTP will be designed to accommodate these intermittent spikes.

Figure 2-1: Expected Daily Diurnal Flow Pattern



The Maximum Daily (maximum dry weather flow) flow rate is calculated using the Babbit's factor as specified in the City and County of Honolulu Wastewater Standards. Using the "residential" capita of 5200, the calculated peaking factor is 3.6 and the Max Day flow rate is 1.66 mgd. The Peak Wet Weather Flow (peak hourly) of 2.0 mgd is calculated by adding the estimated wet weather infiltration rate to the maximum daily flow.

The Proposed Design Flow for the MMS wastewater system is shown in Table 2-3.

Table 2-3: Proposed Design Flow for Ma'alaea WWTP.

Proposed Design Flows	
Design	Value, mgd
Average Dry Weather Flow	0.48
Design Flow	0.60
Max Month Flow	0.61
Max Daily Flow	1.66
Peak Wet Weather Flow (peak hourly)	2.00

2.2 Design Loadings

The Design Standards, Volume 2, of the City and County of Honolulu[4] was used to determine the BOD and TSS design loading. The M&E textbook[5] was used to determine the maximum loading, total kjeldahl nitrogen, and total phosphorous design loading. Based on M&E experience, the average daily loads were 80 percent of the max monthly loads.

The proposed WWTP will be designed for the maximum monthly 5-day Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) loading of 323 mg/L and 323 mg/L, respectively. The Design Loading for MMS WWTP is shown in Table 2-4.

Table 2-4: Design Loading

Design Loading				
Description	Equiv Population	lbs/day per Capita	Average daily	Max Month
5-day Biochemical Oxygen Demand (BOD)				
lbs/day	5,176	0.20	1,035	1,304
mg/L			257	323
Chemical Oxygen Demand (COD)				
lbs/day	5,176	0.48	2,484	3,130
mg/L			616	776
Total Suspended Solids (TSS)				
lbs/day	5,176	0.20	1,035	1,304
mg/L			257	323
Total Kjedahl Nitrogen (TKN)				
lbs/day	5,176	0.03	155	196
mg/L			39	49
Total Phosphorous (TP)				
lbs/day	5,176	0.0076	39	50
mg/L			10	12

1. BOD and TSS lbs/day: City and County of Honolulu Wastewater Design Standards
2. Equiv Population: Residential Population
3. TKN and Total Phosporous: Metcalf & Eddy, Inc., 4 Edition, "Wastewater Engineering"
4. Max month factor from Lihue WWTP data = 1.26

As a comparison, plant data from two nearby County of Maui Wastewater Reclamation Facilities were collected. The Kihei Water Reclamation Facility data is shown in Table 2-5. The Kahului Water Reclamation Facility data is shown in Table 2-6.

[5] Metcalf & Eddy, Inc., 2003, "Wastewater Engineering: Treatment and Reuse", McGraw-Hill, Inc., edited by Tchobanoglous, G., Burton, F.L., and Stensel, H.D.

Table 2-5: Kihei Plant Data

Kihei Plant Data - Nov 2005 to Jan 2006			
Parameter	Value		
	Min	Avg	Max
Influent			
Flow, mgd	2.4	3.7	4.2
BOD, mg/L	127	177	231
TSS, mg/L	52	188	378
VSS, mg/L	38	166	338
TKN, mg/L	28	32	35
TP, mg/L	11	12	12
pH	7.0	7.6	8.1
Alkalinity, $mgCaCO_3/L$	N/A	N/A	N/A
Effuent			
BOD, mg/L	<2	<2	<3
TSS, mg/L	1.0	1.4	2.0
VSS, mg/L	N/A	N/A	N/A
TN, mg/L	3.9	5.5	7.3
TP, mg/L	6.8	7.9	9.3
pH	6.6	6.9	7.2
Alkalinity, $mgCaCO_3/L$	N/A	N/A	N/A

TSS = Total Suspended Solids
VSS = Volatile Suspended Solids
TN = Total Nitrogen
TP = Total Phosphorus

Table 2-6: Kahului Plant Data

Kahului Plant Data - Nov 2005 to Jan 2006			
Parameter	Value		
	Min	Avg	Max
Influent			
Flow, mgd	3.0	4.0	4.8
BOD, mg/L	N/A	N/A	N/A
TSS, mg/L	62	175	294
VSS, mg/L	N/A	N/A	N/A
TKN, mg/L	23	29	41
TP, mg/L	N/A	N/A	N/A
pH	6.4	6.9	7.3
Alkalinity, $mgCaCO_3/L$	160	238	395
Effuent			
BOD, mg/L	N/A	N/A	N/A
TSS, mg/L	1.0	2.6	5.0
VSS, mg/L	N/A	N/A	N/A
TN, mg/L	3.9	10.9	13.8
TP, mg/L	3.3	5.3	7.4
pH	6.4	6.9	7.3
Alkalinity, $mgCaCO_3/L$	N/A	N/A	N/A

TSS = Total Suspended Solids
VSS = Volatile Suspended Solids
TN = Total Nitrogen
TP = Total Phosphorus

Both facilities are designed for effluent recycle. The Kihei's effluent is currently recycled for agricultural, commercial, and park irrigation purposes. There is one commercial facility that recycles the effluent for toilet flush water. Kahului's effluent is only recycled for in-plant reuse. Both facilities are advanced activated sludge plants with effluent sand filters that are designed to satisfy the DOH effluent recycle standards. These facilities are also designed to biologically remove nitrogen and phosphorous through the same activated sludge process. The proposed MMS WWTP will be designed similarly.

The actual plant data from the Kihei and Kahului plants will be used to supplement the estimated proposed design loadings in Table 2-4. Since the proposed plant does not have actual plant data, it is common practice to compare the proposed design loadings with other existing facility data which has a similar potable water source. The data in Table 2-5 and Table 2-6 will also be used to compare and validate the calculations used to size the proposed MMS WWTP.

2.3 Effluent Criteria

Effluent criteria based on the State DOH Wastewater Systems[1] are shown in Table 2-7. This WWTP will be designed to produce R-1 quality effluent. The owner of the proposed facility desires to recycle effluent for irrigation purposes. R-1 quality water allows the widest range of irrigation uses with the least amount of regulation and restrictions. Table 2-7 compares effluent criteria for R-1, R-2, and ground disposal.

Table 2-7: Effluent Criteria

Effluent Criteria	
Description	Value
R-1 effluent turbidity, NTU	<2
R-1 effluent fecal coliform, median count per 100 mL	<2.2
R-1 effluent fecal coliform, grab sample count per 100	<23
R-2 effluent BOD, mg/L	<30
R-2 effluent TSS, mg/L	<30
R-2 effluent fecal coliform, median count per 100 mL	<23
R-2 effluent fecal coliform, grab sample count per 100	<200
Ground Disposal:	
Effluent BOD, mg/L	<30
Effluent TSS, mg/L	<30

Injection wells will be required for backup disposal system to the effluent irrigation system. If for any reason the backup injection well disposal system is used, the disinfection can be temporarily placed out of service.

In efforts to further reduce pollutants or nutrients from reaching ground water or the near shore waters, the proposed plant will be designed to reduce nitrogen and phosphorous in the effluent. Since no regulatory nutrient limits exist in Hawaii, the proposed plant will be designed to reduce nitrogen and phosphorous by at least 50 percent through biological treatment. The benefits include the following:

1. Reduce the potential of near shore algal blooms;
2. Reduce the potential of algal re-growth in the treated effluent and irrigation reservoirs; and
3. Recovery of energy used to oxidize the wastewater.

2.4 Future Expansion

The proposed design flows in Table 2-2 represent the short-term design flow capacity of the Ma'alaea Mauka Subdivision (MMS) WWTP. Alexander & Baldwin (A&B) plans to develop their property east of the Honoapiilani Highway and the proposed subdivision land. If A&B proposed subdivision development gains the necessary approvals, they may elect to connect to the MMS WWTP. There are also two possible developments

north of the WWTP site that may elect to connect to the WWTP. The developments are the proposed Waikapu development (20 homes) and the proposed OHA development (400 homes). The proposed MMS WWTP design will consider these future developments, and will allow for future expansion of the proposed facility. Since the long-term wastewater flow rate is unknown at this time, the ultimate design flow capacity of the MMS WWTP will be 1.2 mgd. It is expected that these developers will complete the necessary engineering and environmental documents to expand the proposed Ma'alaea Mauka Subdivision WWTP.

3.0 PROPOSED COLLECTION SYSTEM

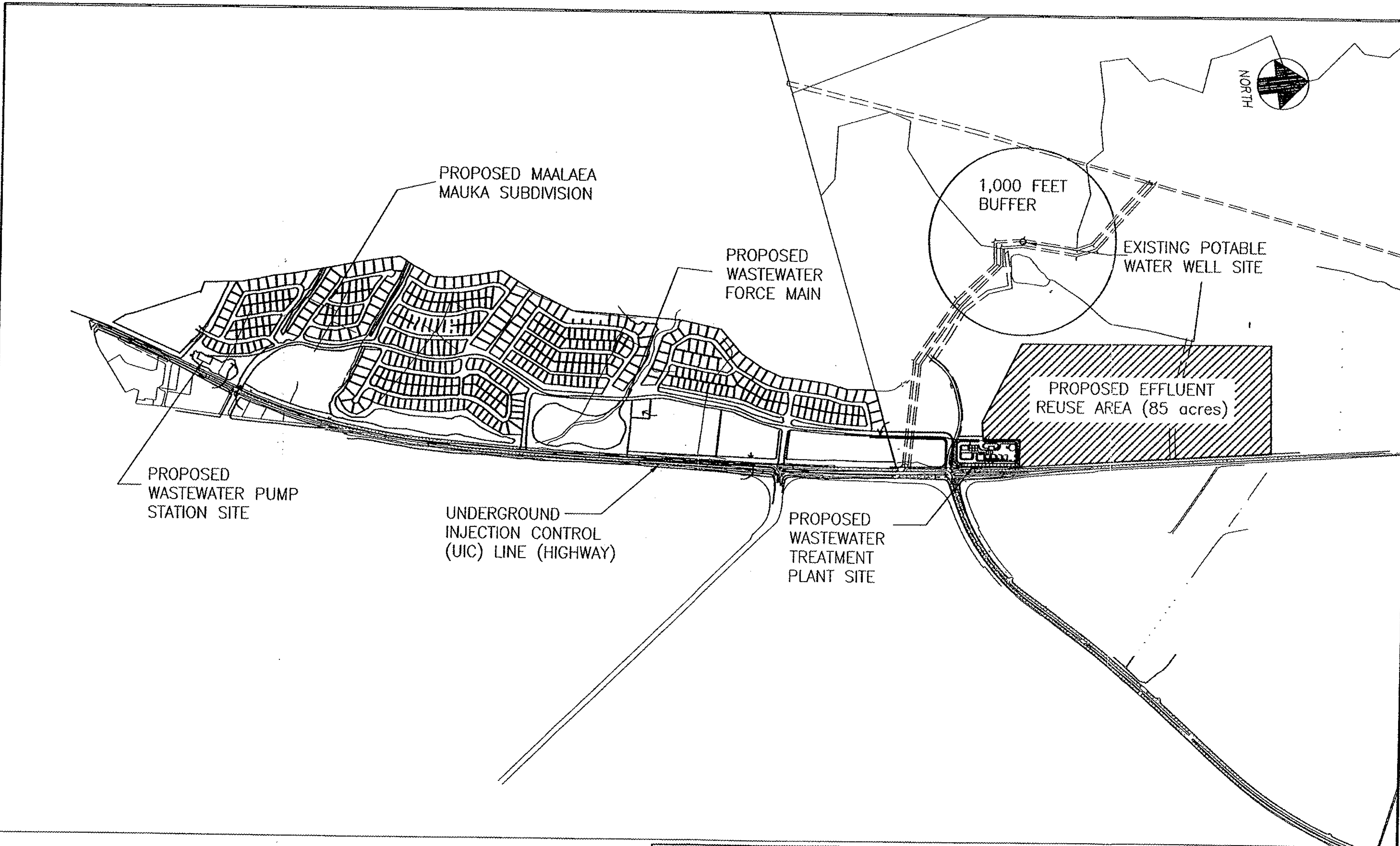
3.1 Proposed Sewer Lines

The gravity portion of the proposed collection system will be sized in accordance with the City and County of Honolulu, Wastewater Standards3. It is expected that the gravity portion of the collection system will consist of 8-inch PVC or VCP pipe material for the sewer mains and 10-inch to 12-inch PVC or VCP pipe material for the trunk mains. There will be approximately 35,000 linear feet of gravity lines. Manholes will be epoxy coated and of the concentric, pre-cast concrete type with PVC coated rungs. Manhole spacing within the proposed subdivision will be 350 linear feet on-center. Gaskets will be used to reduce wet weather inflow and infiltration. Design details and layout will be determined later.

3.2 Proposed Wastewater Pump Station

Wastewater Pump Station (WWPS) will be sized in accordance with the City and County of Honolulu, Wastewater Standards[3]. It is expected that the pump station will be the submersible type with single or dual wet well design. There will be three pumps and the pumps will be sized to discharge the PWWF with the largest pump unit on standby service. Piping within the pump station will be lined, ductile iron piping. Since an equalization basin is planned for the proposed WWTP, variable speed drives may not be required for the proposed pump station. The pump station will require an emergency generator.

The force main from the WWPS to the WWTP will be approximately 9,000 linear feet of 12-inch HDPE pipe. The approximate location of the WWPS site and force main alignment is shown in Figure 3-1. Design details and pump station layout will be determined later.



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MA'ALAEA PROPERTIES

MA'ALAEA WASTEWATER PER

Proposed Wastewater Layout

SCALE: 1:1000	August 2006	FIGURE: 3-1

4.0 PROPOSED WASTEWATER TREATMENT

4.1 Design Criteria

The proposed Ma'alaea Mauka WWTP will be designed in accordance with the DOH[1] and the City and County of Honolulu Wastewater Standards[4], respectively. The summary design criteria from the previous section are shown in Table 4-1.

Table 4-1: Proposed WWTP Design Criteria

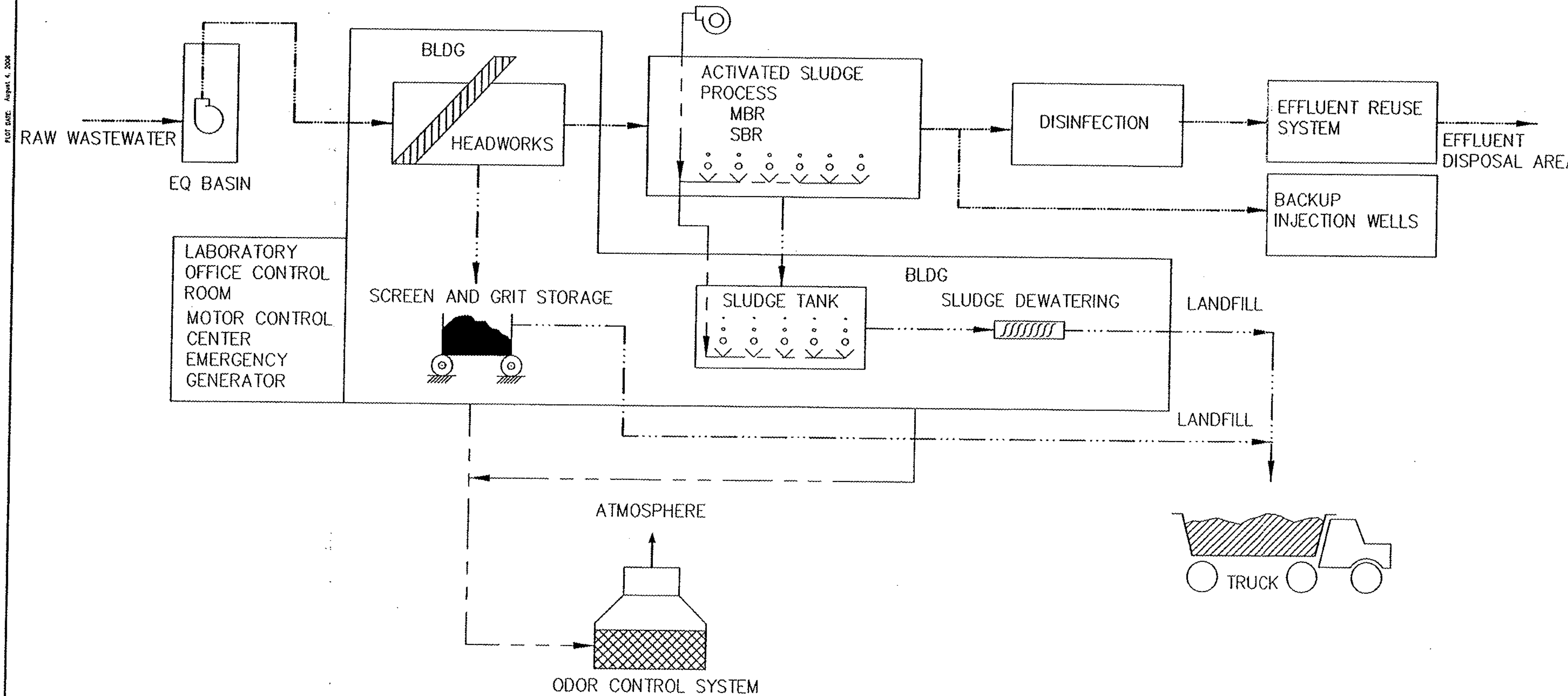
Proposed WWTP Design Criteria				
	Avg Daily	Max Month	Max Day*	PWWF*
Flows, mgd	0.48	0.61	1.66	2.00
Total BOD_5 mg/L	257	323		
Total COD, mg/L	616	776		
Total suspended solids mgTSS/L	257	323		
Total Kjeldahl Nitrogen mgN/L	39	49		
Total Phosphorous mgP/L	10	12		
pH	7.0	7.0		
Alkalinity, mg $CaCO_3$/L	250	250		
Calcium mg/L	160	160		
Magnesium mg/L	25	25		
Target SRT, days	25	25		
Temp, °C	25	27		
Target Effluent Quality	R-1	R-1		

SRT: Sludge Retention Time
*From City and County of Honolulu Standards

The proposed plant schematic and list of processes that will achieve the desired design criteria are listed in Table 4-2 and shown in Figure 4-1. The evaluations of these processes are described in the following sections.

Table 4-2: Proposed Unit Processes and Operation

Proposed Unit Processes and Operations
Equalization Basin
Headworks
Fine screens
Grit removal
Activated Sludge Process
Membrane Bioreactor (MBR) or Sequencing Batch Reactor (SBR) with sand filters
Disinfection System
Chlorination or Ultraviolet Disinfection
Effluent Reuse System
Recycle Water Reservoir
Pump station
Standby Effluent Injection Wells
Sludge Holding Tank/Thickener
Sludge Dewater
Noise and Odor Control Systems



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MA'ALAEA PROPERTIES
MA'ALAEA WASTEWATER PER
Proposed Plant Schematic

SCALE: NTS	August 2006	FIGURE: 4–1

4.2 Treatment Reliability and Redundancy

Based on the Wastewater Standards (CCH)[4], the proposed plant is considered a Reliability Class I treatment facility since the proposed facility will be discharging treated effluent to an effluent reuse area or standby injection wells. A Reliability Class I facility is defined as a treatment plant, which upon failure, would result in a threat to public health.

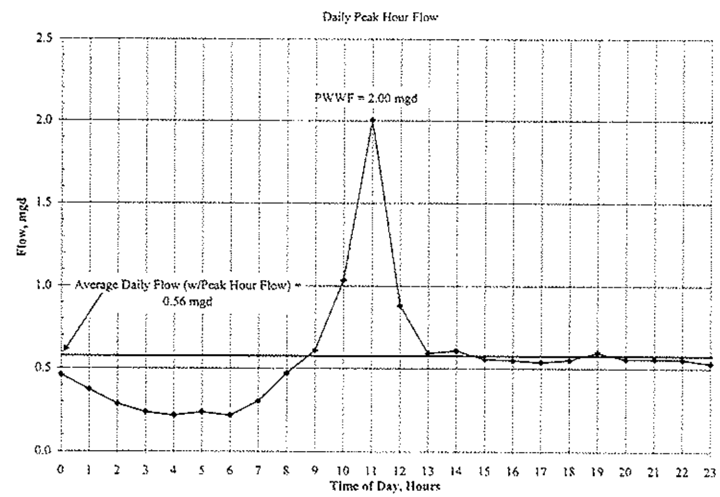
The following processes will include the following redundancies:

1. Equalization Basin
   a. Pumps will be sized to accommodate the peak hydraulic flow with the largest capacity unit on standby service.
2. Headworks
   a. Equipment will be sized to accommodate the peak hydraulic flow with one fine screen and grit removal equipment on standby service.
3. Activated Sludge
   a. Tanks, membranes, and filters will be sized to accommodate the peak hydraulic flow with one unit out of service.
   b. Aeration blowers will be sized to accommodate the peak air flow with one unit on standby
4. Sludge tanks
   a. Tanks will be sized to accommodate the peak sludge flow with one tank out of service.
   b. Tanks will be sized for a five day holding time with the sludge dewatering unit out of service.
5. Sludge dewatering
   a. If units are sized for less than 24 hours per week operation, only one unit is required. Physical space for a second unit will be considered during final stages of design.
   b. If greater than 24 hours per week operation is required, units will be sized to accommodate the peak sludge flow with one unit on standby service.
6. Odor Control
   a. Odor control will be sized for one standby unit out of service.

4.3 Equalization Basin

An equalization basin is required to minimize peak wet weather flows (PWWF) from flushing the biological solids from the plant and reducing the plant's treatment efficiencies during this period. The equalization basin will be designed to dampen a peak hourly flow of 2.0 mgd as shown in Figure 4-2.

Figure 4-2: Projected Peak Weather Flow Pattern



There are two types of equalization basins: (1) the "online" type basin receives flow continually on a 24/7 basis and (2) the "offline" equalization basin is used only during high flow or wet weather events.

Under normal PWWF events, it is expected that only one high flow pump will be required. Pumps will be controlled by the water level in each basin. The level controls will be set for the extreme case where all pumps can be activated by level. The equalization basin will be equipped with a mixing system to prevent settlement of solids, to reduce septic condition in the stored wastewater, and to break up surface scum and grease. It is expected that the mixing system will be the hydraulic mixing type.

For the sequencing batch reactor (SBR) process, an equalization basin is typically not required but it depends on the manufacturer of the SBR process. Most two-tank SBR systems will not require flow equalization since flow equalization is designed into the process.

For the membrane bioreactor (MBR) process, an equalization basin is necessary since the membranes throughput is limited due to the accumulation of solids on the filtering surface of the membrane. It is expected that the MBR system will be sized to process at least the Max Day flow of 1.7 mgd. Some membrane manufacturers can eliminate the need for an equalization basin by sizing the membrane tanks to serve as an equalization basin. However, this is also highly dependent on the type and manufacturer of the membranes.

At this conceptual stage of the design, a separate equalization basin will be considered for both processes and the need for the equalization basin will be further evaluated in the final stages of design. Without an equalization basin, the individual cost of the SBR or the MBR processes increases since the PWWF of 2.0 mgd will require larger equipment or tanks.

4.4 Headworks

The headworks will consist of fine screens and a grit removal system. Fine screens are required to remove rags, tissues, and other items from clogging downstream piping and equipment (diffusers, pumps etc). Fine screens are required especially if the MBR process is used. Grit removal is required to minimize the accumulation of sand and gravel in the downstream channels and tanks. Since the existing Maalaea Community Association's service area is adjacent to the ocean, sand will accumulate within the plant within a short period of time. Grit will also damage downstream equipment, pumps and piping and thereby reduce the normal service life of the equipment.

Screenings and grit will be washed and dewatered prior to disposal in a municipal landfill. Both screenings and grit must pass the EPA "Paint Filter Test" and be free of visible organic material prior to disposal. It is expected that the dried and wash screenings and grit will be stored in a covered six cubic yard dumpster that will be emptied once per week.

Typically, the headworks area is the most odorous process in a treatment plant. It is recommended that the screening and grit processing and storing areas be enclosed and ventilated to an odor control system. Odor control system will be discussed in a later section (see Paragraph 4.8).

4.5 Activated Sludge Process

The majority of the waste reduction occurs in the activated sludge process. The following two types of activated sludge processes will be considered for this project:

1. Membrane Bioreactor (MBR) process using submerged microfiltration membranes to remove 99.99 percent of all solids.
2. Sequencing Batch Reactor (SBR) process in which aeration and settling occurs in the same tank. With separate sand filters, this process can remove 99 percent of all solids. Although the effluent quality of the SBR does not equal that of the MBR, the combination of the SBR and sand filters can satisfy the DOH R-1 effluent requirements (See Table 2-7).

The cost estimate comparison is shown in Table 4-3.

Table 4-3: Life Cycle Cost for Activated Sludge Technology

Life Cycle Cost Activated Sludge Technologies	
Description	**Life Cycle Cost, $M**
MBR	$9.7
SBR (including sand filters)	$11.3

4.5.1 MBR

A MBR process is a biological treatment process (activated sludge process) combined with a separation process (membrane system). Typically, MBRs contain two trains for redundancy. MBR systems are widely used throughout the world and are considered an industry standard for the production of R-1 recycled water.

The activated sludge process consists of two zones, the anoxic zone and the aeration zone. The main purpose of the anoxic zone is to reduce BOD and nitrogen levels. Aerated effluent from the aeration zone is recycled back to the anoxic zone. The nitrate-rich recycle will allow for some BOD reduction to occur in the anoxic zone.

Denitrification, a process at which nitrates are converted into nitrogen gas is one of the primary biological reactions taking place within the anoxic zone. Although not a primary objective, some phosphorous is removed in the anoxic tank.

The aerobic zone is located downstream of the anoxic tank. The purpose of aeration is two-fold: 1) to supply the required oxygen to the metabolizing microorganisms and 2) to provide mixing so that the microorganisms can come into intimate contact with the dissolved and suspended organic matter[6]. The aeration zone further reduces BOD levels and converts ammonia to nitrates (nitrification). A recycle stream is used to maintain a high mixed liquor suspended solids (MLSS) concentration. The elevated MLSS, which is required for all membranes bioreactors, will allow more wastewater to be treated and oxidized than a standard activated sludge process such as the SBR.

Membrane bioreactor systems have two basic configurations: (1) the integrated bioreactor that uses membranes immersed in the bioreactor and (2) the recirculated MBR in which the mixed liquor circulates through a membrane module situated outside the bioreactor[5]. Membrane systems can be operated at mixed liquor suspended solids (MLSS) concentrations between 8,000 and 20,000 mg/L. There are a number of companies that produce different membranes. The membrane type and manufacturer will be determined during the design of the WWTP.

MBRs produce reliable R-1 recycled water. Unlike the conventional activated process, settleability of the activated sludge or mixed liquor is not a key factor with MBRs.

[6] USEPA, 1999, "Wastewater Technology Fact Sheet: Fine Bubble Aeration", USEPA Office of Water, Washington, D.C

Whether settleability is poor or not, the membranes will produce effluent with turbidity less than 1.0 NTU.

4.5.2 SBR

The SBR process is one in which all treatment cycles occur in one tank. According to *Wastewater Engineering*[5], all SBR systems have five steps in common, which are carried out in sequences as follows: (1) fill, (2) react (aeration), (3) settle (sedimentation/clarification), (4) draw (decant), and (5) idle. The key advantages of the SBR process is the ability to handle spikes in the influent wastewater loadings and the footprint size of the tanks since aeration and settling occurs in the same tank. SBR processes are fully automated and do not require frequent operator attention.

Sludge wasting is an important part of conventional activated sludge processes such as the SBR. The amount and frequency of sludge wasting is determined by performance requirements[5]. Sludge must be wasted often enough, to ensure that the microorganism population is stable and not "shocked" which can result in solids carryover into the effluent. After each solids carryover event, most conventional activated sludge processes will recover within days or weeks of each event since most biological processes do not recover quickly from an "unstable" condition.

In addition to the SBR process, sand filters are needed to produce R-1 effluent. The purpose of the sand filters is to catch any remaining suspended solids. This is the last step before the effluent is discharged for reuse or ground disposal.

There are several disadvantages of the SBR process. One disadvantage of SBRs is potential plugging of aeration devices during the selected operating cycles, depending on the aeration system used by the manufacturer[7]. SBRs produce more sludge because of the short retention time (SRT). MBRs have a longer SRT, which result in less sludge production[5] and the partial digestion of the sludge. SBR effluent is considerable lower in quality than the MBR and is also not as consistent and reliable as MBRs.

4.6 Disinfection System

The disinfection system is greatly influenced by the selected WWTP process and effluent disposal method. There are two methods of satisfying the disinfection requirements listed on Table 2-7, chlorination and ultraviolet light disinfection. Chlorination disinfection system kills harmful bacteria by destroying cell walls using a powerful oxidant – chlorine in liquid form, commonly called bleach or sodium hypochlorite. Ultraviolet (UV) light disinfection system uses the 254 nm UV light to disrupt the reproduction capability of bacteria and viruses and, thus, renders them harmless.

A chlorination system consists of the following components:

[7] USEPA, 1999, "Wastewater Technology Fact Sheet: Sequencing Batch Reactors", USEPA Office of Water, Washington, D.C

1. 14 day storage tank for bleach (2,000 gallons)
2. Bleach feed pumps.
3. A 120 min detention time chlorine contact tank (approximately 50,000 gallon tank).
4. Automatic controls and monitoring system.

An UV disinfection system consists of the following components:

1. Three UV (low pressure lamps) light banks in one open channel.
2. Lamp cleaning system.
3. Automatic controls and monitoring system.

Table 4-4: Disinfection Life Cycle Cost Comparison

Life Cycle Cost for Disinfection Technologies	
Description	**Life Cycle Cost, $M**
UV (includes small chlorination system)	$4.5
Chlorination	$6.3

In terms of capital cost and life cycle cost, both systems are competitive in Hawaii due to the high cost of shipping chemicals from the mainland USA. On the mainland USA, chlorination is considered more cost effective[8]. Both systems require periodic replacement of either bleach or light bulbs.

The UV system is by far the trend in water reuse projects mainly because there is significantly less dangerous and corrosive chemical to store on-site. Recently, the EPA has fined the County of Maui for failing to update the hazardous chemical use plan for using one ton chlorine cylinders at the County's three major wastewater treatment plants. The proposed Maalaea Mauka WWTP will not be using one-ton chlorine cylinders. One of the problems with UV disinfection system is that there is potential for re-growth of algae in the water reuse distribution system, especially in the effluent storage reservoir. Small amounts of chlorine dosed at infrequent periods will minimize the regrowth of algae in the distribution system. If UV is used as the primary means for disinfection, a small chlorination system, approximately 275 gallons to 1,000 gallons of sodium hypochlorite storage, may be required to minimize the regrowth of algae in the recycle water distribution system, and to chemically clean the standby injection wells on a once per month basis. This system's usage may range between 10 to 15 hours of operation per month and may average approximately 10 mg/L of chlorine per dosage.

4.7 Sludge Handling System

Two options for disposing sludge are available for the proposed plant. The sludge can be hauled and disposed either as a liquid in a nearby municipal wastewater treatment plant or as dewatered sludge to a municipal landfill.

[8] USEPA, 1999, "Wastewater Technology Fact Sheet: Ultraviolet Disinfection", USEPA Office of Water, Washington, D.C.

The proposed MBR plant will produce approximately 7,000 gpd of liquid waste sludge. A sludge holding tank is needed to hold the liquid sludge when one truck load is being hauled to the municipal plant. If the liquid sludge is hauled to the nearest municipal WWTP, approximately three to four trips are needed daily. The cost impacts of hauling liquid sludge would be labor, hauling cost, and septage charges incurred when disposing the sludge at a local municipal plant.

On site sludge dewatering is expected to produce 830 pounds per day of cake sludge when the wastewater flow approaches 0.6 mgd. If the operators use a 5 cubic yard cake sludge container, the dewatered sludge will be hauled to the county municipal landfill and compost operation approximately once per week. The cost impacts of hauling dewatered sludge would be the capital cost of the sludge handling facility, hauling cost, labor, and tipping fees at the local municipal landfill.

For onsite sludge handling, a sludge holding tank and dewatering facility is required. Since the solids retention time in the MBR is 25 days, the sludge is expected to be already stabilized and digested. Thus, an aerobic digester is not required for the MBR process. If the SBR process is used, aerobic digesters are required to stabilize approximately 20 days worth of sludge. For the MBR process, a sludge holding tank for at least 5 days of sludge is proposed. The purpose of the sludge holding tank is to allow the downstream sludge dewatering facility to operate on a "batch" mode of operation (as oppose to continuously operated); to produce a homogenous sludge feed characteristic that will allow for optimal sludge dewatering performance; and lastly to allow the sludge dewatering unit to be repaired during emergencies before having to haul liquid sludge to another municipal treatment plant.

The life cycle costs for both sludge handling options are listed in Table 4-5.

Table 4-5: Sludge Handling Life Cycle Cost Comparison

Life Cycle Cost for Sludge Handling	
Description	**Life Cycle Cost, $M**
Sludge Dewatering Facility	$5.8
Liquid Sludge Hauling	$5.3

4.8 Support Facilities

A one-story control building is recommended for support facilities. This building should be sized to accommodate offices for supervisory and administrative staff of the wastewater operation and maintenance crews. The laboratory should be sized to analyze wastewater samples. The maintenance area should be sized to accommodate work at the treatment plant and all pump stations. Other features of the control building include restrooms, shower, and locker rooms. There will be a room dedicated to the Supervisory Control and Data Acquisition (SCADA) equipment. The SCADA equipment will allow operators to monitor, record, and control any electrical equipment from a typical desktop computer or a portable laptop. The system can be configured for secure wireless or fiber

optic transmission of data. A plant-wide SCADA system can actually reduce the number of operators required thus reducing the annual cost of operations.

4.9 Noise and Odor Control Systems

Noise and odor control will be incorporated into the design and layout of the proposed WWTP. Blowers, pumps, fans and emergency diesel engine generators are among the loudest equipment at a typical WWTP. Every attempt will be made to house this equipment in a concrete or CMU building and satisfy DOH property line standards for noise reduction. If this equipment is not housed in a building, this equipment will be housed in a sound attenuated equipment enclosure.

The headworks and sludge handling facilities are among the odorous operations at a typical WWTP. Every attempt will be made to provide odor control and prevent fugitive emissions from the WWTP, and satisfy DOH property line standards for odor control. The primary foul odor emitted by a WWTP is hydrogen sulfide gas. This gas has a sharp "rotten egg" smell and is a DOH-regulated compound. The headworks and sludge handling facilities is expected to be fully enclosed within covered channels and a building, respectively, and the enclosed air spaced will be ventilated to an odor control system. The enclosed air space will be as air-tight to the extent possible. This will minimize the release of fugitive foul odors (leaks). The proposed odor control system (OCS) consists of the following components:

1. Odor Control Scrubbers:
   a. Either activated carbon or a biological scrubber will be used.
2. OCS fans with noise attenuated enclosures.
3. Fiberglass ductwork.

The activated carbon scrubber can remove approximately 99.99 percent of the foul odors nearly 99.9 percent of the time; and the biological scrubber can remove approximately 99 percent of the foul odors approximately 99 percent of the time. Both can satisfy the DOH standards for hydrogen sulfide emission control. The activated carbon has an expensive annual carbon replacement cost but is cheaper to install. While the biological scrubber, depending on the manufacturer, has no moving parts, virtually no annual replacement cost, and requires very little operator attention, but is more costly to install. Based on the life cycle cost, the both systems are virtually equivalent except that the performance favors the activated carbon scrubbers. The final design will determine the type of odor control system.

4.10 WWTP Utilities

The required utilities needed for the WWTP are potable water, electricity, telephone, and internet. The electricity is used throughout the WWTP. Telephone and internet will be available in the control building.

4.10.1 Water

The water supply will be from the Maalaea Mauka Subdivision water supply system (Refer to Maalaea Mauka Water System Revised Preliminary Engineering Report). The on-site potable water supply will consist of the following components:

1. Water meter
2. Backflow preventer
3. Fire hydrants spaced at 250 feet.

The potable water supply will be used for the following usage:

1. Potable water consumption by operators.
2. Fire flow
3. Non-potable water demand:
   a. Pump seal water.
   b. Polymer make-up water.

The potable water piping will only serve the control building. An air-gap tank in the control building will supply the non-potable water. To prevent cross-connections, only the non-potable water supply will be routed through the rest of the plant. Based on the Water System Standards 2002 for the County of Maui, the approximate water usages are as follows:

1. Potable water consumption:
   a. Approximately 5 acres of light industry.
   b. Average daily demand: 30,000 gpd
   c. Max daily demand: 45,000 gpd
   d. Peak hour: 90,000 gpd
2. Non-potable water consumption:
   a. Polymer makeup water: 10 gpm
   b. Pump seal water: 10 gpm
   c. Average daily demand: 20 gpm
   d. Peak hour: 50 gpm
   e. Supplied by onsite air gap tank and pumps.
3. R-1 Water Reuse:
   a. MBR: 10 gpm
   b. Headworks: 10 gpm
   c. Sludge dewatering: 30 gpm
   d. Onsite irrigation: 30 gpm
   e. Average daily demand: 80 gpm
   f. Peak demand: 200 gpm.
   g. Fire flow requirements: 2000 gpm at 2 hours

The potable water distribution system will be sized for 165,000 gpd which includes the maximum daily demand, and average non-potable water demand. The onsite water

pressure shall be a minimum of 20 psi at the farthest fire hydrant from the water meter. The non-potable water and R-1 plant water system will be sized for 50 gpm and 2200 gpm, respectively. The final design will determine the installed capacities of each system.

4.10.2 Drainage and Grading

Refer to the drainage report, titled *Waikapu Wastewater Treatment Plant Onsite Drainage Report*. This report determined that a 50-year, 1-hour storm event will produce runoff from the WWTP site that requires a retention pond volume of 214,000 gallons. The retention pond will be located within the proposed plant site.

There is approximately 25 feet of elevation change on the WWTP site. The grading will be finalized during the design of the proposed WWTP. The proposed onsite roads and natural slope of the land will redirect the onsite runoff into the retention pond. It is expected that the natural slope of the land will require minor grading as the existing slope is beneficial to the design of the proposed WWTP.

4.10.3 Electrical Systems

The onsite electrical system will be reduced to a 480 volt, three phase system from the main MECO electrical grid. Any motor greater than ¼ horsepower will be supplied from a 480 volt circuit. All other power usage such as for lighting and outlets, a 115 volt circuit will be used. An emergency generator will serve as a backup power source. This will satisfy the DOH requirements for two independent power supplies. Based on preliminary assessment, the total power load for the full build-out of the proposed WWTP will be approximately 1000 KW.

5.0 EFFLUENT DISPOSAL SYSTEM

There are essentially three methods for effluent disposal including surface discharge (ocean outfall or stream discharge), reuse especially for crop/turf irrigation, and ground disposal (injection wells, seepage pits/trenches, percolation ponds). The alternative for effluent disposal via an ocean outfall is not feasible for various reasons including cost ($4,600 per linear foot) and environmental requirements and therefore will not be considered for this project. Effluent reuse and ground disposal will be considered in this section.

5.1 Effluent Reuse

Over the last decade, the recycling of treated wastewater has gained public acceptance and is highly promoted as the preferred means of effluent disposal by the State of Hawaii and the Environmental Protection Agency as well.

Effluent reuse is governed by the DOH Chapter 11-62[1] and the Guidelines for the Treatment and Use of Recycled Water[2]. The proposed effluent reuse areas are determined based on a water budget calculation that uses the following input variables (See Appendix C):

1. Rainfall.
2. Evapotranspiration rate.
3. Irrigation application.

In Maalaea, rainfall is seasonal precipitation and is generally heaviest from November through April. The average annual rainfall is approximately 15 inches.
Between November and April less irrigation is needed. From May to October, especially the summer months, irrigation would be essential for proper plant growth. For the purpose of estimating the amount of recycled water needed, the peak irrigation water demand for the dry season, June through September, was selected.

For all reuse alternatives, DOH requires zero runoff of recycled water and zero percolation to the ground water aquifer during irrigation. During rainfall events, the DOH guidelines require that the effluent be stored or be discharged through a backup disposal system.

The Guidelines for the Treatment and Use of Recycled Water[2], states that R-1 water is suitable for any form of irrigation for food crops. Also, there will be no effluent irrigation within 50 feet of any drinking water supply well[2].

Another use of R-1 water is for landscape irrigation of golf courses. There are two golf courses nearby that could potentially use the recycled water. A long-term agreement for the use of the recycled water is necessary. Discussions between the Maalaea Properties and the golf course owners are ongoing.

The effluent reuse system would require an effluent storage facility for at least two days storage, recycled water pumps and recycled water transmission mains. As mentioned earlier, little irrigation is expected during the "wet" period of November through April. Therefore a 1.2 million gallon effluent storage reservoir is recommended for the effluent reuse system.

Injection wells will be a backup to the effluent reuse. If it occurs, the overflow from the proposed irrigation reservoir would discharge into the standby injection wells.

5.2 Ground Disposal

The proposed WWTP site is above the Underground Injection Control (UIC) line and therefore injection wells are theoretically not allowed. However, this project is seeking DOH approval to install and operate standby injection wells which are above the UIC boundary line (See Figure 3-1). The standby injection wells are proposed to be located within 150 feet mauka of the UIC boundary line, which is the Honoapiilani Highway. M&E sent a letter[9] to the DOH Safe Drinking Water Branch requesting comments on the location of standby injection wells relative to the UIC boundary. A reply letter[10] was received from the DOH Safe Drinking Water Branch. This letter states that "Assuming that the proposed injection wells are in the area where the UIC line is defined by Honoapiilani Highway, the 150 feet setback described in Hawaii Administrative Rules, Title 11, Chapter 23, Section 05(c) may be applicable for the proposed injection wells." See Appendix A.

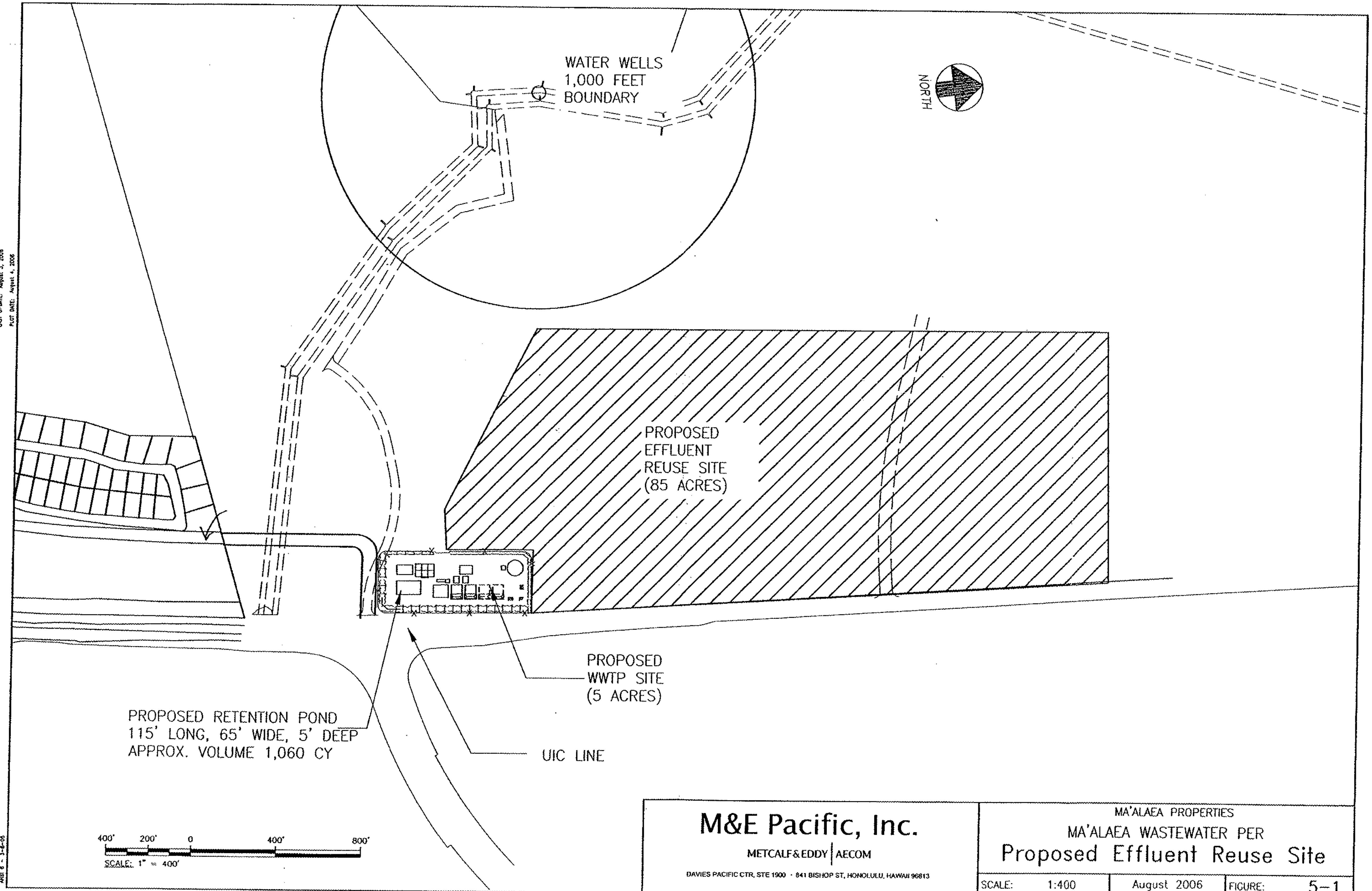
In accordance with the City and County of Honolulu Design Standards, Volume 2[4],"the total injection capacity of the injection system shall be equal to or greater than 200 percent of the design peak flow rate."

The following was compiled by Mink & Yuen[11]

1. The proposed injection wells will be approximately 640 feet deep and have a 16-inch diameter.
2. Each well should be cased and grouted to at least -250 ft., msl, and the bottom 150 ft. will have well screen that is open to the aquifer for injection to occur.
3. The capacity of each injection well is expected to be 1000 gpm (1.4mgd).
4. Three injection wells (two in service and one on standby) are required for the total injection capacity of 4.0 mgd (2 times PWWF).

[9] M&E Pacific, Inc. Letter dated July 6,2006 to State of Hawaii, Department of Health, Safe Drinking Water Branch. Subject: Proposed Maalaea Mauka Subdivision (Tax Map Key 3-6-001:018) and Proposed Wastewater Effluent Injection Wells Above the UIC Line (TMK 3-6-004:003). Refer to Appendix A.
[10] State of Hawaii, Department of Health, Safe Drinking Water Branch, Environmental Management Division. Subject: Reply to 7/6/2006 Letter Regarding Injection Wells at Proposed Maalaea Mauka Subdivision; Underground Injection Control (UIC). Refer to Appendix A.
[11] Mink & Yuen Inc. Impact of Proposed Injection Wells on Water Resources in the Waikapu Aquifer System, Maalaea, Maui. June 2006

It is expected that the standby injection well capacity may deteriorates over time. Standby injection wells will be periodically purge by compressed air and also chemically cleaned with liquid bleach. The proposed standby injection wells will be monitored for water depth, flow rate and amount entering wells, and chemical usage during cleaning operations. The impacts of the proposed standby injection wells to the ground water resources are discussed in detail in the Mink and Yuen, Inc., report titled *Impact of Proposed Injection Wells on Water Resources in the Waikapu Aquifer System, Maalaea, Maui*[11]. (See Appendix E)


WATER WELLS
1,000 FEET
BOUNDARY
NORTH
PROPOSED
EFFLUENT
REUSE SITE
(85 ACRES)
PROPOSED
WWTP SITE
(5 ACRES)
PROPOSED RETENTION POND
115' LONG, 65' WIDE, 5' DEEP
APPROX. VOLUME 1,060 CY
UIC LINE
400' 200' 0 400' 800'
SCALE: 1" = 400'
M&E Pacific, Inc.
METCALF&EDDY | AECOM
DAVIES PACIFIC CTR, STE 1900 · 841 BISHOP ST, HONOLULU, HAWAII 96813
MA'ALAEA PROPERTIES
MA'ALAEA WASTEWATER PER
Proposed Effluent Reuse Site
SCALE: 1:400
August 2006
FIGURE: 5-1

6.0 COST ESTIMATES

The cost estimates are based on the level of detail contained in the sketches and diagrams herein and not based on actual quantity take-off similar to that performed at the design phase. The cost should be used to measure the scale of differences in the costs. Therefore, these costs are not recommended for budgeting purposes.

The collection system consists of the pump station and the gravity lines. The construction cost for the collection system is $10.9M. The annual operation and maintenance (O&M) cost is $0.5M. The life cycle cost is estimated to be $18.7M.

The WWTP includes the EQ basin, headworks, MBR, sludge tanks, UV disinfection, sludge dewatering, and control building. Construction cost of the WWTP is estimated at $11.6M. The annual O&M is $1.1M and the life cycle cost is $28.1M.

The effluent disposal system is comprised of the R-1 pump station, irrigation area, R-1 distribution pump station, recycle water reservoir, and injection wells. The construction cost is $10.0M and the annual O&M cost is $0.4M. The estimated life cycle cost is $15.5M.

The overall wastewater system construction cost is $32.4M. The annual O&M cost is $2.0M. The estimated life cycle cost is $62.3M. See Table 6-1 for breakdown of the cost estimate. See Appendix D for the cost estimate calculations.

Table 6-1: Overall Cost Estimate

COST ESTIMATE FOR OVERALL WASTEWATER SYSTEM			
Life cycle analyses assumptions: 20 year life, 6% interest rate; 3% inflation rate Design flow = 0.6 mgd PWWF = 2.0 mgd			
Description	Estimated Construction Cost, $M	Estimated Annual O&M Cost, $M	Estimated Life Cycle Cost, $M
Collection System			
Pump Station	$1.9	$0.2	$5.3
Gravity Lines	$9.0	$0.3	$13.4
Subtotal	$10.9	$0.5	$18.7
Wastewater Treatment Plant			
EQ Basin	$0.7	$0.0	$1.3
Headworks	$0.9	$0.1	$2.2
MBR	$6.2	$0.2	$9.7
Sludge Tanks	$0.5	$0.1	$2.0
UV	$0.9	$0.2	$4.5
Sludge Dewatering	$1.7	$0.3	$5.8
Control Building	$0.7	$0.1	$2.5
Subtotal	$11.6	$1.1	$28.1
Effluent Disposal System			
R-1 Pump Station	$0.6	$0.0	$0.9
Irrigation	$5.3	$0.3	$9.7
R-1 Distribution Pump Station	$0.5	$0.0	$1.2
Recycle Water Reservoir	$1.5	$0.0	$1.5
Injection Wells	$2.1	$0.0	$2.2
Subtotal	$10.0	$0.4	$15.5
TOTAL	**$32.4**	**$2.0**	**$62.3**
Not included: Design Services during construction Construction Management			

The estimated annual revenue is $0.6M. This value is based on County of Maui sewer ordinance. The projected annual revenue will help offset the annual O&M cost of $1.9M. The net annual cost is $1.3M ($1.9M-$0.6M). Table 6-2 shows the estimated monthly and annual revenue.

Table 6-2: Revenue

Maalaea Mauka WWTP Revenue		
	Estimated Monthly Revenue	Annual Revenue
Maalaea Community (existing)	$17,900	$215,000
MMS (future)	$33,000	$396,000
Total	**$50,900**	**$611,000**

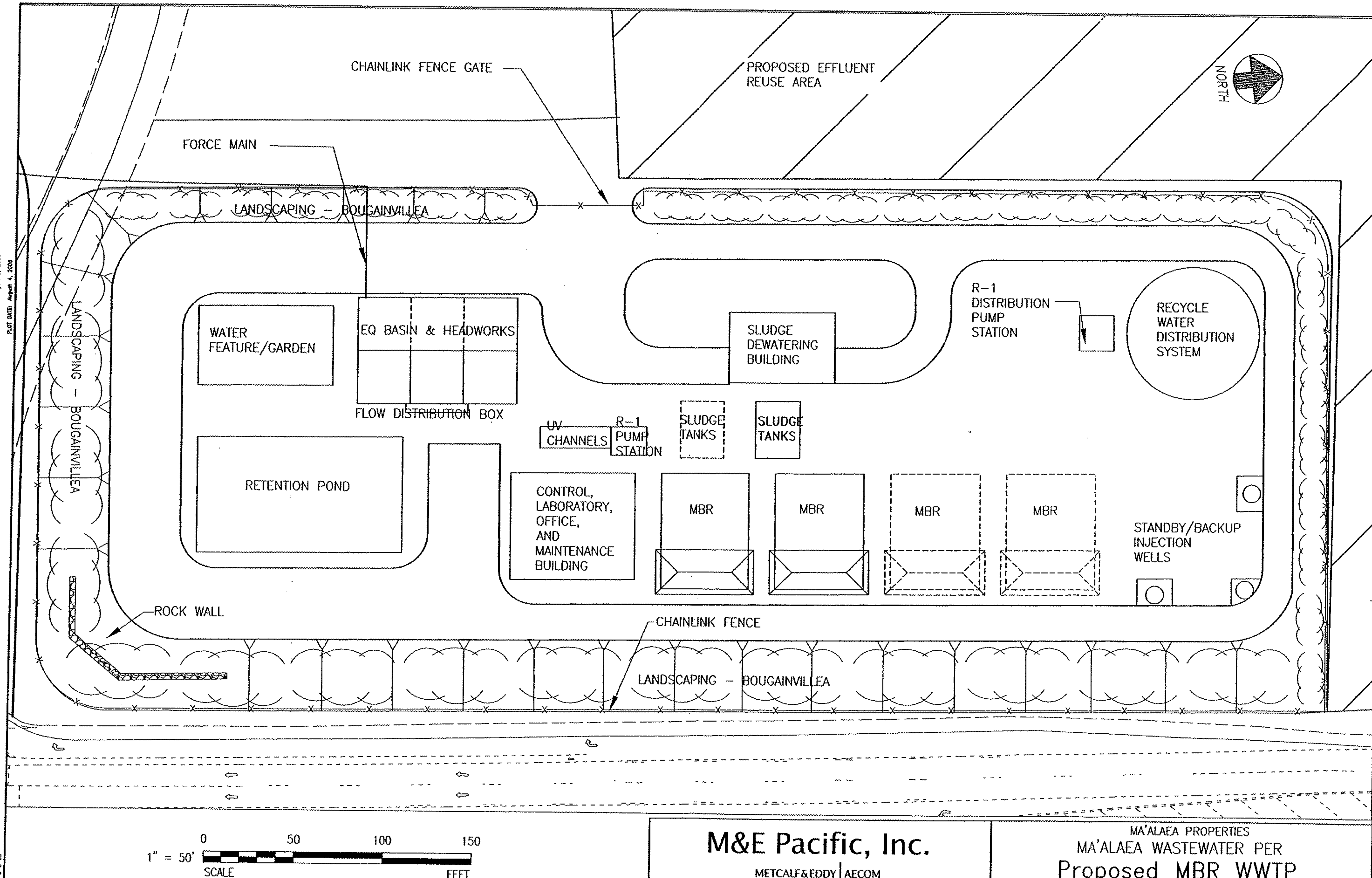
Since Maalaea Properties is assisting the Maalaea Community Association (MCA) by providing a regional WWTP, MCA may be required to pay a portion of the construction costs. The cost sharing is based on the prorated wastewater flow rate (PWWF) from the two communities. The MCA portion of the cost is 28%. Maalaea Properties will be solely responsible for the gravity lines, since it is not part of existing Maalaea Community Association subdivision. Maalaea Properties share of the construction cost is $26.0M and MCA's share is $6.5M. MCA's cost does not include the cost to convey their wastewater to the boundaries of the proposed Maalaea Properties subdivision. See Table 6-3.

Table 6-3: Development's Share of Cost

COST ESTIMATE BY DEVELOPMENT			
Life cycle analyses assumptions: 20 year life, 6% interest rate; 3% inflation rate Design flow = 0.6 mgd PWWF = 2.0 mgd			
Description	Estimated Construction Cost, $M	Maalaea Properties, $M	Maalaea Community Association Cost, $M
Collection System			
Pump Station	$1.9	$1.3	$0.5
Gravity lines	$9.0	$9.0	$0.0
Subtotal	$10.9	$10.4	$0.5
Wastewater Treatment Plant			
EQ Basin	$0.7	$0.5	$0.2
Headworks	$0.9	$0.6	$0.2
MBR	$6.2	$4.5	$1.7
Sludge Tanks	$0.5	$0.4	$0.1
UV	$0.9	$0.7	$0.3
Sludge Dewatering	$1.7	$1.2	$0.5
Control Building	$0.7	$0.5	$0.2
Subtotal	$11.6	$8.3	$3.2
Effluent Disposal System			
R-1 Pump Station	$0.6	$0.4	$0.2
Irrigation	$5.3	$3.9	$1.5
R-1 Distribution Pump Station	$0.5	$0.4	$0.1
Recycle Water Reservoir	$1.5	$1.1	$0.4
Injection Wells	$2.1	$1.5	$0.6
Subtotal	$10.0	$7.3	$2.8
TOTAL	**$32.4**	**$26.0**	**$6.5**
Not included: Design Services during construction Construction Management			

7.0 RECOMMENDATIONS

The short-term and long-term recommendations are described below. The proposed plant layout is shown in Figure 7-1.



M&E Pacific, Inc.

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MA'ALAEA PROPERTIES

MA'ALAEA WASTEWATER PER

Proposed MBR WWTP

SCALE: 1:50	August 2006	FIGURE: 7–1

7.1 Short-term

The short-term flow design flow is 0.6 mgd with a PWWF of 2.0 mgd. The short-term will be separated into two construction phases – Phase 1 for 0.3 mgd and Phase 2 for 0.6 mgd. The developer may opt to construct both Phases in one construction project. This will depend on the number of homes they expect to sell. Initially, the expected 100 percent build-out is expected within 5 years of the start of construction.

The proposed equalization basins will be the "online" type. During the projected peak flow event (Average Daily Flow with Peak Hour Flow), the equalization basin will need to accommodate 160,000 gallons volume and a continuous outflow of 0.71 mgd. In summary, the design information for the equalization basin is shown in Table 7-1.

Table 7-1: Proposed Equalization Basin Design

Proposed EQ Basins	
Description	Value
Design flow, mgd	0.6
Type	Online
Number of basins	2
Total volume, gallons	140,000
Type of pumps	Submersible
Number of pumps per basin	2
Pump capacities	
Low flow pump, gpm	300
High flow pump, gpm	650
Total station capacity, mgd (standby pump out of service)	1.3

M&E recommends two fine screens (one for redundancy) and two grit removal systems (one for redundancy). See Table 7-2 for details.

Table 7-2: Proposed Headworks Design.

Proposed Headworks	
Description	Value
Design flow	2.0 mgd
Fine Screens:	
Type	Rotary drum with integral washer/compactor
Number	2 (one redundant unit)
Screen opening	1-2 mm
Screening amount:	
Average day	5 cubic feet/day
Max day	10 cubic feet/day
Grit Removal System:	
Type	Vortex
Number	2 (one redundant unit)
Grit particle removal	
0.30 mm (50 mesh)	92-98%
0.24 mm (70 mesh)	80-90%
0.15 mm (100 mesh)	60-70%
Washer/Compactor type	Settling basin with screw/belt dewaterer
Grit pump type	Ni-hard resist recessed impeller
Grit amount:	
Average day	1.5 cubic feet/day
Max day	3.0 cubic feet/day

The MBR system is recommended for this WWTP because of the effluent reliability. Each MBR system will be modular in construction and is expected to treat 0.3 mgd. Each modular MBR system will consist of the following:

1. Two anoxic tanks with three passes each;
2. Two aeration tanks with two passes each;
3. Two membrane tanks with space for three cassettes;
4. Mixed liquor recycle pump station; and
5. Recycles mixed liquor from the aeration tanks to both the membrane tanks and anoxic tanks.

The type of membrane will be determined during the design of the WWTP. See Table 7-3.

Table 7-3: Proposed MBR Design

Proposed MBR	
Description	Value
Design Flow	0.6 mgd
MBR System:	
Number	2
Design Flow per MBR System	0.3 mgd
Membrane System:	
Number of Membrane Trains per System	2
Number of Cassettes per System	3 plus 3 spare space
Number of Modules per Cassette	48
Volume	20,000 gal
Total Membrane Trains	4
Total Cassettes Installed	6
Total Spare Space	6
Anoxic Tanks	
Number of Tanks per System	2
Passes per Tank	3
Volume per Pass	7,500 gal
Total Volume	90,000 gal
Aeration Tanks	
Number of Tanks per System	2
Volume per Tank	35,000 gal
Total Volume	140,000 gal
Solids Retention Time	25 days

It is recommended that an UV system be used for producing recycled water and a small hypochlorite system be used to periodically dose the recycled water distribution system and clean the standby injection wells. The chlorination system will effectively control the re-growth of bacteria and algae in the distribution system.

Table 7-4: Proposed UV System

Proposed UV System	
Description	Value
Design Flow	0.6 mgd
Design Peak Flow	2.0 mgd
Number of Channels	1
Number of Banks (1 for back-up)	3
Number of Modules per Bank	4
Number of Lamps per Module	8
Total Lamps	96
UV Transmittance	65% (minimum)
TSS	5 mg/L (maximum)
Maximum Average Particle Size	20 μm
Design Dose	80000 $\mu Ws/cm^2$
Redundancy	50%
Type of Level Controller	Serpentine Weir
Channel Dimensions	
Length	42 ft
Width	16 in
Depth	62 in

Although more expensive, the sludge dewatering option is recommended over the liquid sludge hauling option. The reason for selecting the sludge dewatering option is that the landfill composting operation would not be impacted significantly by the small quantity of dewatered sludge produced by the proposed WWTP. However, the municipal treatment may not be sized adequately to handle the pollutant loading from 7,000 gpd of liquid sludge. Thus, a sludge holding tank and a dewatering facility is recommended (see Table 7-5).

A sludge dewatering building is proposed. The sludge dewatering facility will consist of the following components:

1. Sludge dewaterer:
   a. Either a centrifuge or a sludge press will be used.
2. Polymer feed system.
3. Sludge feed pumps.
4. Cake sludge container

Either a centrifuge or sludge press will be mounted on an elevated platform. This will allow the dewatered (cake) sludge to be dropped into a cake sludge container below. It is expected that approximately 830 lbs per day of dewatered sludge will be generated when the wastewater flows approach 0.6 mgd. If the operators use a 5 cubic yard cake sludge container, the dewatered sludge will be hauled to the county municipal landfill and compost operation approximately once per week. A smaller cake sludge container is recommended for the startup period of the WWTP. Cake sludge should not be stored on-site for more than one week. This will minimize the attraction of insects and rodents. The final design will determine the type of sludge dewaterer to install.

Table 7-5: Proposed Sludge Tanks

Proposed Sludge Tanks	
Desciption	Value
Average Liquid Waste Sludge	7,000 gpd
Number of sludge tanks	1
Holding Time	5 days
Holding Capacity	40,000 gal

M&E Pacific recommends effluent reuse as the method of effluent disposal. Since the recycled water will be of R-1 quality, spray irrigation will be utilized. Table 7-6 summarizes the effluent reuse system. Maalaea Properties owns several hundred acres of land near the proposed WWTP site that can be irrigated.

Table 7-6: Proposed Effluent Reuse System

Proposed Effluent Reuse	
Description	Value
Design Flow	0.6 mgd
Recycle Water Reservoir	1.4 million gallons
Diameter	98 feet
Sidewall	25 feet
Type of Irrigation	Spray
Irrigation Demand (grass)	7167 gpad
Irrigation Area	85 acres
Irrigation piping	35,000 lf
Injection Wells	2
Diameter	16 in
Height	640 ft
Injection Well Capacity	1000gpm

The estimated capital cost for Phases 1 and 2 collection system, WWTP, and effluent reuse is $32.2M. The life cycle cost is $61.1M. A portion ($0.6M) of the operation and maintenance cost will be offset by the revenue for the sewage collection.

The estimated Phase 1 capital cost is $26.1M. Since most of the structures and process equipment must be constructed in Phase 1, the Phase 1 cost represents the bulk of the short-term cost. The Phase 2 capital cost is expected to be $6.1M. For processes such as the EQ Basins, and MBR systems that require two separate tanks or systems, it is expected that one of the two tanks or systems will be installed in Phase 1 and the other

will be installed in Phase 2. In this case, the cost will be evenly split between the phases. Only half of the irrigation area is necessary for Phase 1, therefore half of the capital cost is needed in Phase 1 and the other half is required in Phase 2.
The *Guidelines for the Treatment and Use of Recycled Water 5/15/02 Appendix K* states that, "at a minimum, two reactors must be simultaneously operated in any on-line reactor train. Standby UV equipment must be provided by one of the following options:

A standby reactor per reactor train.
A standby reactor train."

Therefore, the UV disinfection system will be constructed in Phase 1. See Table 7-7 for more details.

7.2 Long-term

The long-term or ultimate Design Flow is 1.2 mgd with a PWWF of 4.0 mgd. The long-term option will be considered Phase 3. All the equipment and tanks will be doubled except for the buildings. The building will be constructed in Phase 1 and sized for the Phase 3 flows. Buried utilities and process piping constructed in Phase 1 will allow space for Phase 2 and Phase 3 utilities and process piping. The Phase 1 site layout design will allow for future expansion to handle the Phase 3 Ultimate WWTP build-out.

Additional items include:
1. Two (2) Equalization Basins;
2. Two (2) Fine Screens;
3. Two (2) Grit Removal Systems;
4. Two (2) 0.3 mgd MBRs;
5. One (1) UV Disinfection Channel;
6. Additional Irrigation Area (85 acres) or One (1) Injection Well;
   a. Current developers do not have sufficient land for effluent reuse disposal of the Phase 3 flows.
   b. Other surrounding land owners, such as the golf course owners and A&B, must provide land for effluent reuse disposal.
7. Two (2) Injection Wells for back-up;
8. Additional volume in Recycle Water Reservoir;
9. One (1) Sludge Holding Tank; and
10. One (1) Sludge Dewater

The estimated Phase 3 capital cost is $15.6M. This cost is the same as the short-term cost except it does not include a collection system, a control building, irrigation, R-1 distribution pump station, and a recycle water reservoir. A collection system is not included in the cost estimate because it is not known where the development will be and how many homes will be built. Also, the collection system will be the responsibility of the developer. The control building from Phase 1 will be sized for the ultimate flow. Irrigation, R-1 distribution pump station, and recycle water reservoir are not included because Maalaea Properties does not have an addition 85 acres for effluent reuse disposal. Double the injection wells are needed for Phase 3 because there will be no irrigation. See Table 7-7.

Table 7-7: Capital Cost by Phase

COST ESTIMATE BY PHASE

Assumptions:
Design flow = 0.6 mgd
PWWF = 2.0 mgd

Description	Estimated Construction Cost, $M	Phase 1, $M	Phase 2, $M	Phase 3, $M
Collection System				
Pump Station	$1.9	$1.9	$0.0	$0.0
Gravity lines	$9.0	$9.0	$0.0	$0.0
Subtotal	$10.9	$10.9	$0.0	$0.0
Wastewater Treatment Plant				
EQ Basin	$0.7	$0.4	$0.4	$0.7
Headworks	$0.9	$0.9	$0.0	$0.9
MBR	$6.2	$3.1	$3.1	$6.2
Sludge Tanks	$0.5	$0.5	$0.0	$0.5
UV	$0.9	$0.9	$0.0	$0.9
Sludge Dewatering	$1.7	$1.7	$0.0	$1.7
Control Building	$0.7	$0.7	$0.0	$0.0
Subtotal	$11.6	$8.1	$3.4	$10.8
Effluent Disposal System				
R-1 Pump Station	$0.6	$0.6	$0.0	$0.6
Irrigation	$5.3	$2.7	$2.7	$0.0
R-1 Distribution Pump Station	$0.5	$0.5	$0.0	$0.0
Recycle Water Reservoir	$1.5	$1.5	$0.0	$0.0
Injection Wells	$2.1	$2.1	$0.0	$4.2
Subtotal	$10.0	$7.4	$2.7	$4.8
TOTAL	**$32.4**	**$26.3**	**$6.1**	**$15.6**

Not included:
- Design
- Services during construction
- Construction Management

7.3 Schedule

The preliminary schedule to construct the proposed WWTP is summarized as follows:

Completion of Phase 1 and 2 Design: 4 Quarter 2008

Completion of Phase 1 and 2 Construction: 2nd Quarter 2011
Completion of Phase 3 Design and Construction: 2nd Quarter 2013

The developer expects 100 percent full build-out to occur by 2016.

8.0 PERMITS

8.1 Environmental Assessment

This project is subject to the Hawaii Revised Statues (HRS) 343 (the EIS law), and the environmental review process administrated by the Office of Environmental Quality Control (OEQC). Therefore, this report will become part of an Environmental Impact Statement for the proposed Maalaea Mauka Subdivision.

8.2 Permits

The project may be subject to the following construction related permits:

1. NPDES Stormwater, Construction Dewatering, and Hydrotesting Permits
2. Underground Injection Control (UIC) Permit
3. Building Permits
4. Grading Permit
5. Excavation Permit
6. Pressure Vessel and Boiler Permit
7. Fuel Storage Tank Permit
8. DOH Wastewater Operation Permits
9. Department of Army (DA) Permit
10. Section 401 Water Quality Certification and Coastal Zone Management Consistency Review Approval.
11. State Land Use Commission (SLUC) Special Use Permit (SUP)
12. County Conditional Permit (SUP).

APPENDIX

Appendix A: Communications

METCALF & EDDY | AECOM

M&E Pacific, Inc.
100 Pauahi Street, Suite 207, Hilo, Hawaii 96720
T 808.961.2776 F 808.935.5934 www.m-e.aecom.com

July 6, 2006

Stuart Yamada
Safe Drinking Water Branch
Division of Environmental Management
Department of Health
119 Ala Moana Bvld.
Honolulu, HI 96814

Dear Mr. Yamada,

Subject: **Proposed Maalaea Mauka Subdivision (Tax Map Key 3-6-001: 018)**
Proposed Wastewater Effluent Injection Wells above the UIC line (TMK: 3-6-004:003)

On behalf of the owner, Maalaea Properties, LCC, we are requesting your preliminary comments and guidance regarding the proposed use of standby injections wells for the subject project. We greatly would appreciate any input you may have on the subject project. We would be most willing to meet with you and your staff to discuss this project at your convenience.

The proposed development site is located at the crossroads of West Maui, Kihei-Makena, and Wailuku-Kahului regions and bounded by Honoapiilani Highway on the east, Tax Map Key 3-6-001: 018 (See Figure 1-1). The parcel encompasses approximately 260 acres on the slopes of Kealaloloa (West Maui Mountains) overlooking Maalaea Small Boat Harbor and the Maalaea Triangle Waterfront Plaza. The planned development of this site includes a mix of single family and multi-family residences ranging from affordable to the higher end custom-built units. Approximately 900 units are proposed for the subject development. An Environmental Impact Statement (EIS) is currently being prepared by Munekiyo & Hiraga, Inc., for the subject development.

It is proposed that a private wastewater treatment plant (WWTP) will be constructed to treat and dispose of the wastewater generated by this development (portion of TMK 3-6-004:003). The service area for the WWTP will include the subject development and the existing development of Maalaea Community Association which is located along the shores of Maalaea Bay. The WWTP will be designed to produce R1 recycled water that will be reused for irrigation of pasture land. It is intended that injection wells would be used as a standby means of effluent disposal during non irrigation periods.

The overall project site is detailed in Figure 1-2. The proposed location of the wastewater treatment plant site including the proposed potable water wells, the intended irrigation reuse area, and the UIC boundary line are shown in Figure 4-3. As shown in Figure 5-1, the proposed injection wells will be located above the UIC line but no farther than 150 feet from the UIC boundary.

The design daily flow for the proposed wastewater treatment plant is currently estimated at 0.8 mgd. The peak wet weather flow is estimated at 2.5 mgd. Mink & Yuen will be retained to determine the number and depth of injection wells required for this proposed project. They will also model the impacts of the wells to the ground water resources. The results of their analysis will become part of the EIS documents.

Although no field work has been performed to date for the proposed injection wells, Mink & Yuen has estimated that the injection wells will be drilled to a depth of about (-) 400 feet MSL. The ground surface elevation is approximately 210 feet MSL. Based on cursory evaluations, we expect that the standby injection wells will be used approximately 1 percent of a calendar year. The wastewater flows will range from 0.2 mgd initially to 0.8 mgd at full

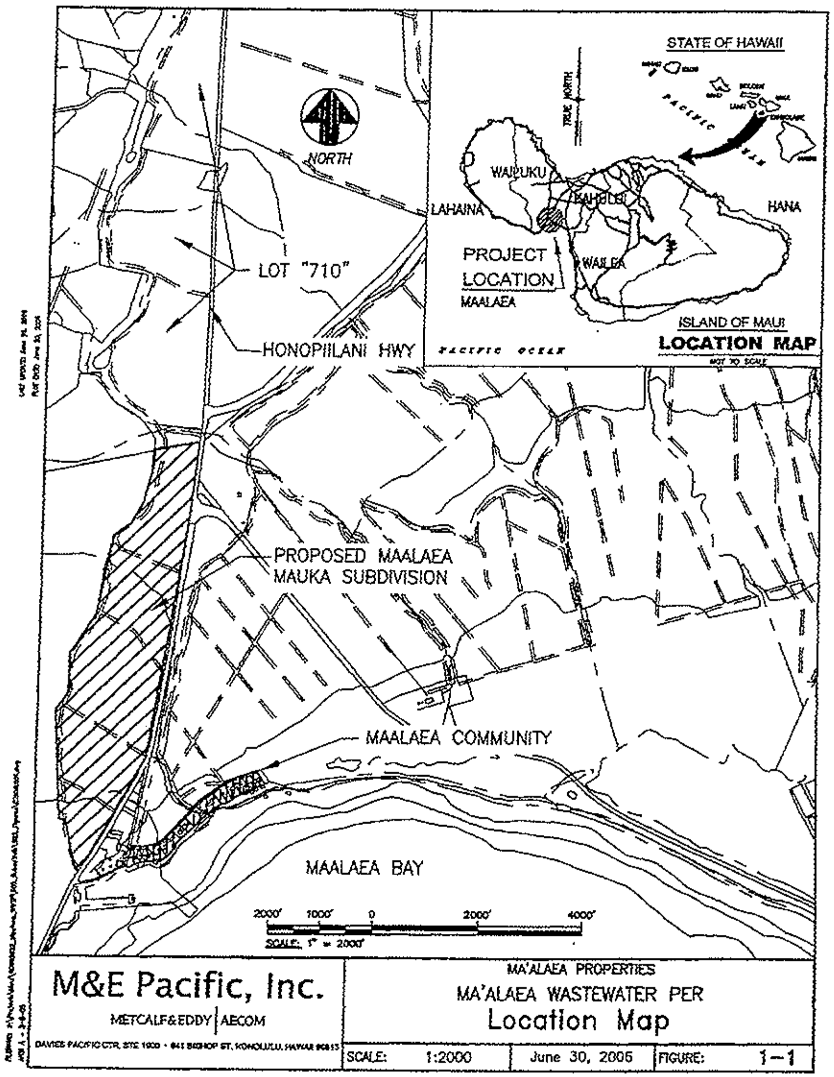
build-out of the proposed development. The peak wet weather flow of 2.5 mgd may never occur. However, the facility will be hydraulically designed to dispose the peak flow without spills.

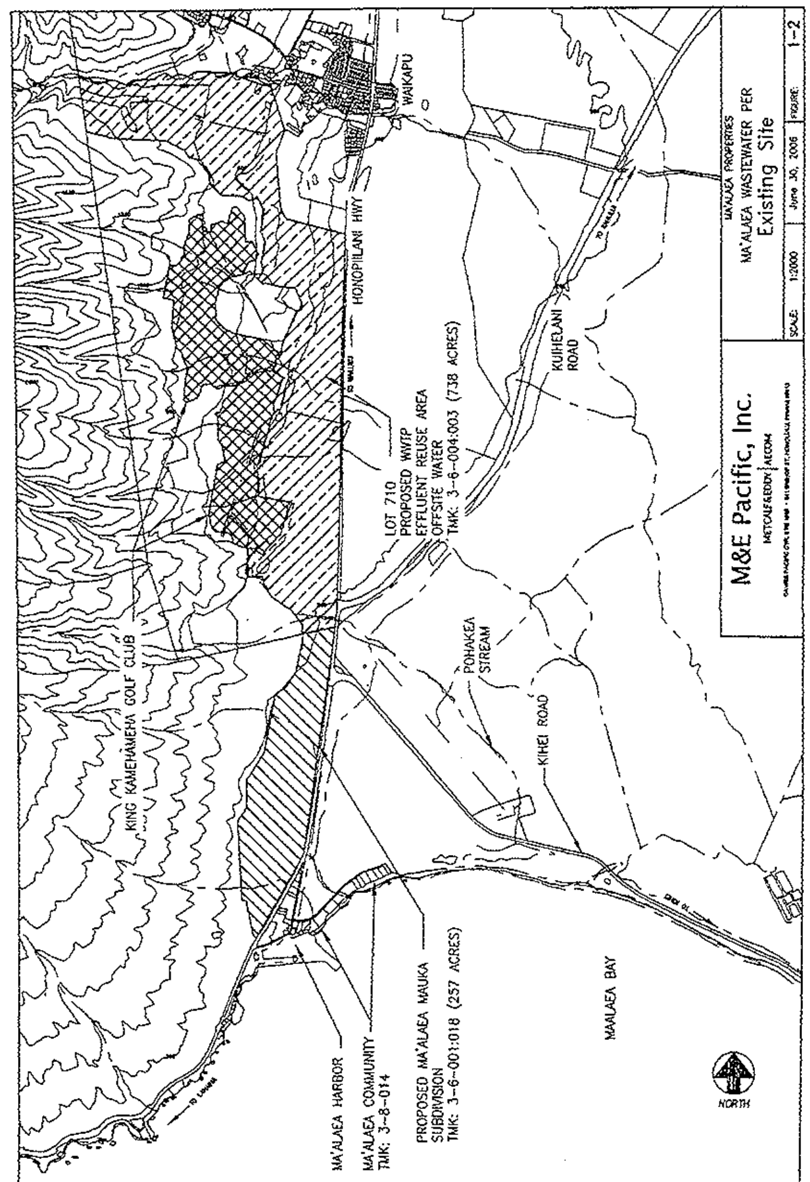
Thank you in advance for your assistance. Should you have any questions, please do not hesitate to call me (808-961-2776).

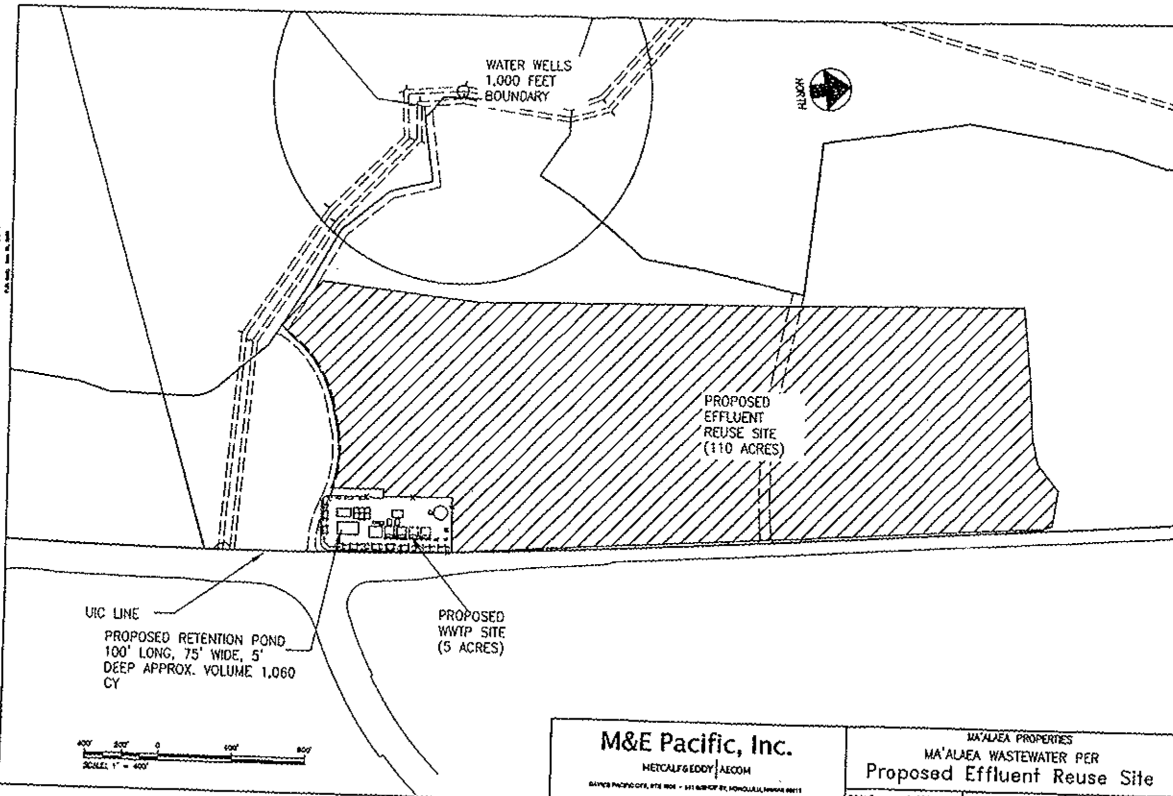
Yours sincerely,

Bert Saito, P.E.
Project Manager
bert.saito@m-e.aecom.com

Attachments
cc: Mr. Steven Kikuchi, Maalaea Properties, LLC
Mr. Dennis Tulang, M&E Pacific, Inc.
Ms. Trudy Hamic, M&E Pacific, Inc.
Mr. Glenn Bauer, Mink & Yuen, Inc.
Mr. Mark Roy, Munekiyo & Hiraga, Inc.


NORTH
LOT "710"
HONOPIILANI HWY
STATE OF HAWAII
TRUE NORTH
PACIFIC OCEAN
WAILUKU
KAHULUI
LAHAINA
WAILEA
HANA
PROJECT
LOCATION
MAALAEA
ISLAND OF MAUI
LOCATION MAP
NOT TO SCALE
PROPOSED MAALAEA
MAUKA SUBDIVISION
MAALAEA COMMUNITY
MAALAEA BAY
2000' 1000' 0 2000' 4000'
SCALE: 1" = 2000'
M&E Pacific, Inc.
METCALF&EDDY | AECOM
MA'ALAEA PROPERTIES
MA'ALAEA WASTEWATER PER
Location Map
SCALE: 1:2000
June 30, 2006
FIGURE: 1-1

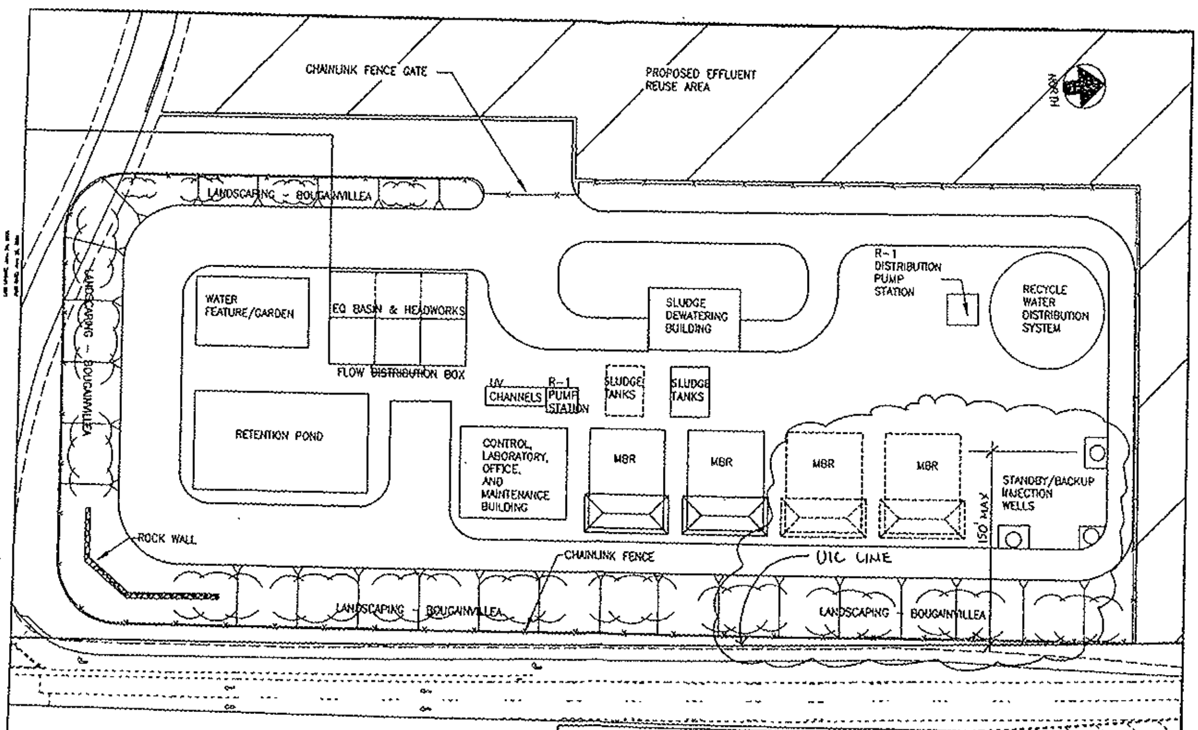

WAIKAPU
HONOPIILANI HWY
LOT 710
PROPOSED WWTP
EFFLUENT REUSE AREA
OFFSITE WATER
TMK: 3-6-004:003 (738 ACRES)
KUIHELANI ROAD
KING KAMEHAMEHA GOLF CLUB
POHAKEA STREAM
KIHEI ROAD
MA'ALAEA HARBOR
MA'ALAEA COMMUNITY
TMK: 3-8-014
PROPOSED MA'ALAEA MAUKA
SUBDIVISION
TMK: 3-6-001:018 (257 ACRES)
MAALAEA BAY
NORTH
M&E Pacific, Inc.
METCALF&EDDY | AECOM
MA'ALAEA PROPERTIES
MA'ALAEA WASTEWATER PER
Existing Site
SCALE: 1:2000
June 30, 2006
FIGURE: 1-2



M&E Pacific, Inc.
METCALF&EDDY | AECOM

MA'ALAEA PROPERTIES
MA'ALAEA WASTEWATER PER
Proposed Effluent Reuse Site

SCALE: 1:400 | June 30, 2006 | FIGURE: 4-3



M&E Pacific, Inc.
METCALF&EDDY | AECOM

MA'ALAEA PROPERTIES
MA'ALAEA WASTEWATER PER
Proposed MBR WWTP

SCALE: 1:50 | June 30, 2006 | FIGURE: 5-1

LINDA LINGLE
GOVERNOR OF HAWAII

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

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD/SDWB

RECEIVED
JUL 26 2006
By________

July 21, 2006

Mr. Bert Saito, P.E.
Project Manager
M&E Pacific, Inc.
100 Pauahi Street, Suite 207
Hilo, Hawai`i 96720

Dear Mr. Saito:

SUBJECT: REPLY TO 7/6/2006 LETTER REGARDING INJECTION WELLS AT **PROPOSED MA`ALAEA MAUKA SUBDIVISION;** UNDERGROUND INJECTION CONTROL (UIC)

The specific location of the proposed injection wells is unclear. Thus, we cannot confirm if a setback of the UIC line is possible. Except for the southern-most end of the project's boundary, the UIC line is defined by Honoapi`ilani Highway.

Assuming that the proposed injection wells are in the area where the UIC line is defined by Honoapi`ilani Highway, the 150 feet setback described in Hawai`i Administrative Rules, Title 11, Chapter 23, Section 05(c) may be applicable for the proposed injection wells.

Section 11-23-05(c) states, "In areas where the UIC line is defined by a roadway, a setback of one lot or one hundred fifty feet, whichever is less, from the mauka property line of that roadway may be considered to be within the exempted area. If the roadway is within a property, the setback shall extend to the mauka property line or to one hundred fifty feet from the mauka edge of said roadway, whichever is less. This interpretation of the UIC line shall be subject to all other conditions of this chapter. The applicant, on the permit application, shall request this interpretation, approval of which shall be based on the proximity and sensitivity of drinking water sources."

The following items should be addressed if Section 11-23-05(c) is applicable:

1. Representative water quality data of the area's groundwater in the proximity of the proposed injection wells must be obtained. Water quality data must include analyses for chlorides, total dissolved solids (TDS), and total coliform. If total coliform is present, then a fecal and streptococcus determination needs to be made;

2. If the TDS of the area's groundwater is greater than 5000 milligrams per liter (mg/l), then the UIC permitting process may proceed. A confirmation groundwater sample for TDS will be required to be obtained at the proposed injection well site. The groundwater sample should be representative of the uppermost portion of the watertable and should be taken no deeper than 10 feet below the watertable; and

3. If the TDS of the area's groundwater or the confirmation groundwater sample is less than 5000 mg/l, then the injection of wastewater will only be permissible in an injection zone that has a receiving water with a TDS value equivalent to seawater and is situated deep enough to prevent the injectant's migration from contaminating any potential or existing drinking water aquifer above it. An injectant flow analysis should be made to predict the effectiveness of the injection wells' design and depths to prevent contamination of overlying groundwater and to estimate the injectant's fate and environmental impact on groundwater and ocean waters. The analysis should evaluate the injection wells as being both primary and secondary disposal components.

After satisfactory review of the information requested above, a clearer decision will be made to either suspend or proceed with the UIC permitting process.

If you have any questions regarding this subject, please contact Norris Uehara of the Safe Drinking Water Branch at 586-4258.

Sincerely,

STUART YAMADA, P.E., CHIEF
Safe Drinking Water Branch
Environmental Management Division

NU:nbp

Appendix B: Wastewater Flow Calculations

2006_MML_DesignLoadings

MAALAEA-3-8-014:

Example 1: TMK 2-3-8-014-002-0000 (acreage for building)

Since there are units on this lot, only the lot acreage will be used. This only affects the Wet I/I.

$gad := \frac{gal}{acre \cdot day}$

$gpd := \frac{gal}{day}$

$Design\_Max\_Flow_1 := 0gpd$

$lot\_size_1 := 1.01acre$

$wet_{above} := 1250gad$

$Wet_{ii.1} := lot\_size_1 \cdot wet_{above}$

$Wet_{ii.1} = 1262\,gpd$

$PWWF_1 := Design\_Max\_Flow_1 + Wet_{ii.1}$

$PWWF_1 = 1262\,gpd$

Example 2: TMK 2-3-8-014-002-0039 (Multi-family unit in building)

$Defacto\_pop_{multi\_family} := 2.8$ capita/unit

$Residential\_pop_{multi\_family} := 2.8$ capita/unit

$ADF\_capita := 80gpd$

$AWF_2 := Defacto\_pop_{multi\_family} \cdot ADF\_capita$

$AWF_2 = 224\,gpd$

$Total\_residential\_pop := 5200$

$$MF := \frac{5}{\left(\frac{Total\_residential\_pop}{1000}\right)^{.2}}$$

$MF = 3.60$

$MWF_2 := AWF_2 \cdot MF$

$MWF_2 = 805\,gpd$

$Dry_{above} := 5gpd$

$Dry_{ii.2} := Defacto\_pop_{multi\_family} \cdot Dry_{above}$

$Dry_{ii.2} = 14\,gpd$

$ADWF_2 := AWF_2 + Dry_{ii.2}$

$ADWF_2 = 238\,gpd$

$Design\_Max\_Flow_2 := MWF_2 + Dry_{ii.2}$

$Design\_Max\_Flow_2 = 819\,gpd$

$Wet_{ii.2} := 0gpd$

$PWWF_2 := Design\_Max\_Flow_2 + Wet_{ii.2}$

$PWWF_2 = 819\,gpd$

Example 3: TMK 2-3-014-008-0000 (apartment building and number of units not given)

$lot\_size_3 := 0.92 acre$

$low\_density\_apart := \frac{85}{acre}$ capita/acre

$Defacto\_pop_3 := lot\_size_3 \cdot low\_density\_apart$

$Defacto\_pop_3 = 78$

$Residential\_pop_3 := lot\_size_3 \cdot low\_density\_apart$

$Residential\_pop_3 = 78$

$ADF\_capita = 80\,gpd$

$AWF_3 := Defacto\_pop_3 \cdot ADF\_capita$

$AWF_3 = 6256\,gpd$

$MF = 3.6$

$MWF_3 := AWF_3 \cdot MF$

$MWF_3 = 22494\,gpd$

$Dry_{above} = 5\,gpd$

$Dry_{ii.3} := Defacto\_pop_3 \cdot Dry_{above}$

$Dry_{ii.3} = 391\,gpd$

$ADWF_3 := AWF_3 + Dry_{ii.3}$

$ADWF_3 = 6647\,gpd$

$Design\_Max\_Flow_3 := MWF_3 + Dry_{ii.3}$

$Design\_Max\_Flow_3 = 22885\,gpd$

$wet_{above} = 1250\,gad$

$Wet_{ii.3} := lot\_size_3 \cdot wet_{above}$

$Wet_{ii.3} = 1150\,gpd$

$PWWF_3 := Design\_Max\_Flow_3 + Wet_{ii.3}$

$PWWF_3 = 24035\,gpd$

Future_MMS:

Example 4: Town Homes 1 and 2 Story

$Total\_units := 100$

$lot\_size_4 := 7 acre$

$Defacto\_pop_{multi\_family} = 2.8$

$Defacto\_pop_4 := Total\_units \cdot Defacto\_pop_{multi\_family}$

$Defacto\_pop_4 = 280$

$Residential\_pop_{multi\_family} = 2.8$

$Residential\_pop_4 := Total\_units \cdot Defacto\_pop_{multi\_family}$

$Residential\_pop_4 = 280$

$ADF\_capita = 80\,gpd$

$AWF_4 := Defacto\_pop_4 \cdot ADF\_capita$

$AWF_4 = 22400\,gpd$

$MF = 3.6$

$MWF_4 := AWF_4 \cdot MF$

$MWF_4 = 80541\,gpd$

$Dry_{above} = 5\,gpd$

$Dry_{ii.4} := Defacto\_pop_4 \cdot Dry_{above}$

$Dry_{ii.4} = 1400\,gpd$

$ADWF_4 := AWF_4 + Dry_{ii.4}$

$ADWF_4 = 23800\,gpd$

$Design\_Max\_Flow_4 := MWF_4 + Dry_{ii.4}$

$Design\_Max\_Flow_4 = 81941\,gpd$

$wet_{above} = 1250\,gad$

$Wet_{ii.4} := lot\_size_4 \cdot wet_{above}$

$Wet_{ii.4} = 8750\,gpd$

$PWWF_4 := Design\_Max\_Flow_4 + Wet_{ii.4}$

$PWWF_4 = 90691\,gpd$

Average Design Flows			
Type of Development	Capita	Design Flow	Unit
General (per capita)		80	gcd (gallons/capita/day)
Single family (per residence)	4	320	gallons/residence/day
Multi-family/apartment (per unit)	2.8	224	gallons/unit/day
Community Business (per acre)	140	11200	gad (gallons/acre/day)
Neighborhood Business (per acre)	40	3200	gad (gallons/acre/day)
Apartment (low density)	85	6800	gad (gallons/acre/day)
General Industry (per acre)	100	8000	gad (gallons/acre/day)
Parks/Community Center (per acre)*	40	200	gad (gallons/acre/day)

*Using State Standards and assuming Neighborhood business

Wet I/I (for sewers laid above the normal ground water table) (per acre)	1250
Dry I/I (for sewers laid above the normal ground water table) (per acre)	5

Future Maalaea Flows												
Lot	Area (acres)	Units per acre	Total Units	Defacto Population (Total Capita)	Residential Capita	Average Wastewater Flow (gpd)	Maximum Wastewater Flow (gpd)	Dry Weather I/I (gpd)	ADWF (gpd)	Design Max Flow (gpd)	Wet Weather I/I (gpd)	PWWF (gpd)
Custom Lots	38	3.7	144	576	576	46,080	165,838	2,880	48,960	168,718	47,500	216,218
Single Family Homes	80	4.4	355	1420	1420	113,600	408,836	7,100	120,700	415,936	100,000	515,936
Single Family Patio Homes	23.5	7	164	656	656	52,480	188,871	3,280	55,760	192,151	29,375	221,526
Town Homes 1 and 2 Story	7	14	100	280	280	22,400	80,616	1,400	23,800	82,016	8,750	90,766
Senior Care Housing	6	10	60	168	168	13,440	48,369	840	14,280	49,209	7,500	56,709
Apartments	11.5	11	126	353	353	28,224	101,576	1,764	29,988	103,340	14,375	117,715
Park	15.0			600		3,000	10,797	3,000	6,000	13,797	18,750	32,547
Roads (includes ROW)	37.0										46,250	46,250
Open Space	34.0										42,500	42,500
Community Center	5.0			200		1,000	3,599	1,000	2,000	4,599	6,250	10,849
Fire Station	1.0			40		3,200	11,517	200	3,400	11,717	1,250	12,967
Wastewater Treatment Facility	2.0			280		22,400	80,616	1,400	23,800	82,016	2,500	84,516
Total	260		949	4,573	3,453	305,824	1,100,633	22,864	328,688	1,123,497	325,000	1,448,497

Maalaea Existing (TMK 3-8-14)

APN	Lot Acreage	Lot Area	Building Type	Land Use	Defacto Population (Total Capita)	Residential Capita	Average Wastewater Flow	Maximum Wastewater Flow	Dry I/I	ADWF	Design Maximum Flow	Wet I/I	PWWF
2-3-8-014-001-0000	0.95	41,285		Apartment								1,188	1,188
2-3-8-014-001-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-001-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0000	1.01	44,039		Apartment								1,283	1,283
2-3-8-014-002-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0044			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-002-0045			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0000	2.59	112,864		Apartment								3,238	3,238
2-3-8-014-004-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820

APN	Lot Acreage	Lot Area	Building Type	Land Use	Defacto Population (Total Capita)	Residential Capita	Average Wastewater Flow	Maximum Wastewater Flow	Dry I/I	ADWF	Design Maximum Flow	Wet I/I	PWWF
2-3-8-014-004-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0044			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0045			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0046			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0047			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0048			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0049			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0050			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0051			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0052			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0053			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0054			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0055			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0056			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0057			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0058			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0059			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0060			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0061			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0062			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0063			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0064			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0065			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0066			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0067			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0068			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0069			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0070			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0071			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0072			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0073			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0074			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0075			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0076			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0077			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0078			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0079			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-004-0080			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-005-0000				Apartment									
2-3-8-014-008-0000	0.92	39,925	Residential	Apartment	78.2	78.2	6,256	22,515	391	6,647	22,906	1,160	24,056
2-3-8-014-009-0000	0.84	36,691	Residential	Apartment	71.4	71.4	5,712	20,557	357	6,069	20,914	1,050	21,964
2-3-8-014-011-0000	2.13	92,826		Apartment								2,663	2,663
2-3-8-014-011-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820

APN	Lot Acreage	Lot Area	Building Type	Land Use	Defacto Population (Total Capita)	Residential Capita	Average Wastewater Flow	Maximum Wastewater Flow	Dry I/I	ADWF	Design Maximum Flow	Wet I/I	PWWF
2-3-8-014-011-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0044			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0045			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0046			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0047			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0048			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0049			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0050			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0051			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0052			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0053			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0054			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0055			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0056			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0057			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0058			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0059			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0060			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0061			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0062			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0063			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0064			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0065			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0066			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0067			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0068			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0069			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0070			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0071			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0072			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0073			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0074			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0075			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0076			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0077			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-011-0078			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0000	1.75	76,317		Apartment								2,188	2,188
2-3-8-014-015-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0044			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0045			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0046			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0047			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0048			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0049			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0050			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0051			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0052			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0053			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0054			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0055			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0056			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0057			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0058			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0059			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0060			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0061			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0062			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0063			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0064			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0065			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0066			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0067			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0068			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0069			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0070			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0071			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0072			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0073			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0074			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0075			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0076			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0077			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0078			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0079			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0080			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0081			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0082			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-015-0083			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0000	1.78	77,493		Apartment								2,225	2,225
2-3-8-014-016-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0044			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820

APN	Lot Acreage	Lot Area	Building Type	Land Use	Defacto Population (Total Capita)	Residential Capita	Average Wastewater Flow	Maximum Wastewater Flow	Dry I/I	ADWF	Design Maximum Flow	Wet I/I	PWWF
2-3-8-014-016-0045			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0046			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-016-0047			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0000	2.29	99,865		Apartment								2,863	2,863
2-3-8-014-021-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0044			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0045			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0046			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0047			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0048			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0049			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0050			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0051			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0052			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0053			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0054			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0055			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0056			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0057			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0058			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0059			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0060			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0061			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0062			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0063			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0064			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0065			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0066			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0067			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0068			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0069			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0070			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0071			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0072			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0073			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0074			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0075			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0076			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0077			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0078			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-021-0079			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0000	1.24	54,014		Apartment								1,550	1,550
2-3-8-014-022-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820

APN	Lot Acreage	Lot Area	Building Type	Land Use	Defacto Population (Total Capita)	Residential Capita	Average Wastewater Flow	Maximum Wastewater Flow	Dry I/I	ADWF	Design Maximum Flow	Wet I/I	PWWF
2-3-8-014-022-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0010			Commercial	Hotel	15.9		1,272	4,579	80	1,352	4,659		4,659
2-3-8-014-022-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-022-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0000	1.27	55,250		Apartment								1,588	1,588
2-3-8-014-024-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0040			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0041			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0042			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0043			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0044			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-024-0045			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0000	0.71	30,640	Industrial (nec)	Industrial (nec)	71.0		5,680	20,442	355	6,035	20,797	888	21,684
2-3-8-014-026-0001			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0002			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0003			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0004			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0005			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0006			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0007			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0008			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820

APN	Lot Acreage	Lot Area	Building Type	Land Use	Defacto Population (Total Capita)	Residential Capita	Average Wastewater Flow	Maximum Wastewater Flow	Dry I/I	ADWF	Design Maximum Flow	Wet I/I	PWWF
2-3-8-014-026-0009			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0010			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0011			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0012			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0013			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0014			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0015			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0016			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0017			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0018			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0019			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0020			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0021			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0022			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0023			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0024			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0025			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0026			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0027			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0028			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0029			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0030			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0031			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0032			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0033			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0034			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0035			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0036			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0037			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0038			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0039			Condo-multiplex	Condominium	2.8	2.8	224	806	14	238	820		820
2-3-8-014-026-0040	0.93		Commercial	Hotel	11.2		895	3,220	56	951	3,276	35	3,311
Total					1,821	1,723	145,703	524,373	9,106	154,810	533,479	21,885	555,364

Appendix C: WWTP Calculations

DesignLoading:

Example

Equivalant population = residential population

$Total\_residential\_pop = 5176$

$parameter\_TSS := 0.2 \frac{lb}{day}$ per capita from CCH Wastewater Design Standards

$TSS_{avg} := parameter\_TSS \cdot Total\_residential\_pop$

$TSS_{avg} = 1035 \frac{lb}{day}$

$Monthly\_max\_factor := 1.26$ from experience and Lihue WWTP data

$TSS_{max} := TSS_{avg} \cdot Monthly\_max\_factor$

$TSS_{max} = 1304 \frac{lb}{day}$

$Flow_{ADWF} := 0.4835 mgd$

$$TSS_{avg\_conc} := \frac{TSS_{avg}}{Flow_{ADWF}}$$

$TSS_{avg\_conc} = 257 \frac{mg}{L}$

$TSS_{max\_conc} := TSS_{avg\_conc} \cdot Monthly\_max\_factor$

$TSS_{max\_conc} = 323 \frac{mg}{L}$

DesignData:

Some of the proposed design criteria was calculated above. pH, Alkalinity, Target SRT, and Temperature were estimated based on experience and Lihue WWTP, Kihei WWTP, and Kahalui WWTP data. Calcium and magnesium design criteria were based on the Biowin default criteria.

$Average\_Daily_{parameter} := Flow_{ADWF}$ Any parameter, using flow as example

$$Max\_month_{parameter} := \frac{Average\_Daily_{parameter}}{80\%}$$

$Max\_month_{parameter} = 0.60 mgd$

Design Loading				
Description	Equiv Population	lbs/day per Capita	Average daily	Max Month
5-day Biochemical Oxygen Demand (BOD)				
lbs/day	5,176	0.20	1,035	1,304
mg/L			257	323
Chemical Oxygen Demand (COD)				
lbs/day	5,176	0.48	2,484	3,130
mg/L			616	776
Total Suspended Solids (TSS)				
lbs/day	5,176	0.20	1,035	1,304
mg/L			257	323
Total Kjedahl Nitrogen (TKN)				
lbs/day	5,176	0.03	155	196
mg/L			39	49
Total Phosphorous (TP)				
lbs/day	5,176	0.0076	39	50
mg/L			10	12

1. BOD and TSS lbs/day: City and County of Honolulu Wastewater Design Standards
2. Equiv Population: Residential Population
3. TKN and Total Phosporous: Metcalf & Eddy, Inc., 4 Edition, "Wastewater Engineering"
4. Max month factor from Lihue WWTP data = 1.26

Proposed WWTP Design Criteria				
	Avg Daily	Max Month	Max Day*	PWWF*
Flows, mgd	0.48	0.61	1.66	2.00
Total BOD_5 mg/L	257	323		
Total COD, mg/L	616	776		
Total suspended solids mgTSS/L	257	323		
Total Kjeldahl Nitrogen mgN/L	39	49		
Total Phosphorous mgP/L	10	12		
pH	7.0	7.0		
Alkalinity, mg $CaCO_3$/L	250	250		
Calcium mg/L	160	160		
Magnesium mg/L	25	25		
Target SRT, days	25	25		
Temp, °C	25	27		
Target Effluent Quality	R-1	R-1		

SRT: Sludge Retention Time

*From City and County of Honolulu Standards

Max month factor from Lihue WWTP data =	1.26
Max daily factor from Lihue WWTP data =	1.73
Peak hour factor from Lihue WWTP data =	2.00

EQ Table

Actual = Normalized * Average

Example: ADWF Actual, Time = 5

$Normalized_2 := 0.59$

$Average_{ADWF} := 0.483mgd$

$Actual\_ADWF_2 := Normalized_2 \cdot Average_{ADWF}$

$Actual\_ADWF_2 = 0.28\ mgd$

Actual w/ PHF:

This is the same as ADWF Actual except for Time = 10, 11, and 12. At Time = 10 and 12, ADWF w/ PHF = ADWF Actual * 1.5. For Time = 11, ADWF w/ PHF = PWWF or 2.0 mgd.

ADWF w/PHF Total Vol_T = Σ(ADWF w/ PHF Vol) = ADWF w/PHF Total Vol_{T-1} + ADWF w/PHF Vol_T

Example: Time = 2

$ADWF\_PHF_0 := 0.46mgd$

$$ADWF\_PHF\_Vol_0 := \frac{ADWF\_PHF_0}{24}$$

$ADWF\_PHF\_Vol_0 = 0.02\ mgd$

$ADWF\_PHF_1 := 0.37mgd$

$$ADWF\_PHF\_Vol_1 := \frac{ADWF\_PHF_1}{24}$$

$ADWF\_PHF\_Vol_1 = 0.02\ mgd$

$ADWF\_PHF_2 := 0.29mgd$

$$ADWF\_PHF\_Vol_2 := \frac{ADWF\_PHF_2}{24}$$

$ADWF\_PHF\_Vol_2 = 0.01\ mgd$

$ADWF\_PHF\_Total\_Vol_2 := ADWF\_PHF\_Vol_0 + ADWF\_PHF\_Vol_1 + ADWF\_PHF\_Vol_2$

$ADWF\_PHF\_Total\_Vol_2 = 0.05\ mgd$

Pump Rate_ADWF_PHF = (Average ADWF w/PHF * (Time + 1))/24
Example: Time = 2

$Avg\_ADWF\_PHF := 0.56mgd$

$Time := 2$

$$Pump\_rate\_ADWF\_PHF_2 := Avg\_ADWF\_PHF \cdot \frac{Time + 1}{24}$$

$Pump\_rate\_ADWF\_PHF_2 = 0.07\,mgd$

Repeat using Max Flow

$Normalized_2 = 0.59$

$Average_{Max} := 0.61mgd$

$Actual\_Max_2 := Normalized_2 \cdot Average_{Max}$

$Actual\_Max_2 = 0.36\,mgd$

Max Total Vol_T = Σ(Max Vol) = Max Total Vol_{T-1} + Max Vol_T
Example: Time = 2

$Max_0 := 0.58mgd$

$$Max\_Vol_0 := \frac{Max_0}{24}$$

$Max\_Vol_0 = 0.02\,mgd$

$Max_1 := 0.47mgd$

$$Max\_Vol_1 := \frac{Max_1}{24}$$

$Max\_Vol_1 = 0.02\,mgd$

$Max_2 := 0.36mgd$

$$Max\_Vol_2 := \frac{Max_2}{24}$$

$Max\_Vol_2 = 0.02\,mgd$

$Max\_Total\_Vol_2 := Max\_Vol_0 + Max\_Vol_1 + Max\_Vol_2$

$Max\_Total\_Vol_2 = 0.06\,mgd$

Pump Rate Max = (Average Max * (Time + 1))/24
Example: Time = 2

$Avg\_Max := 0.61mgd$

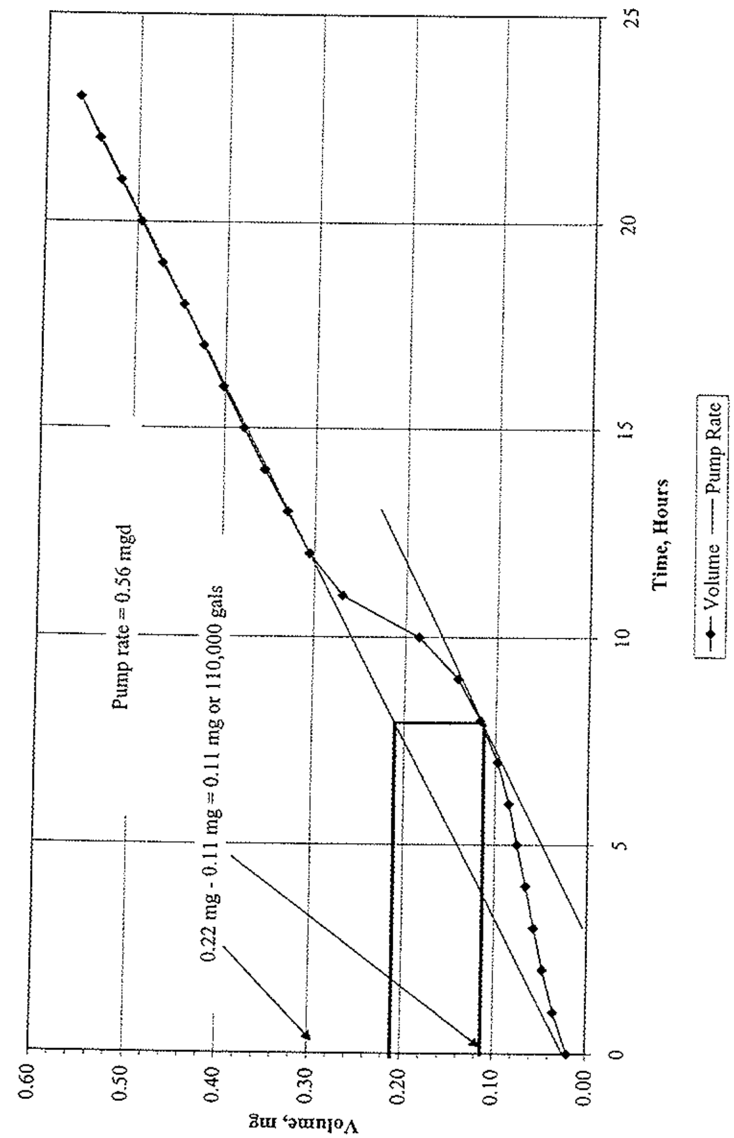
$Time = 2$

$$Pump\_rate\_Max_2 := Avg\_Max \cdot \frac{(Time + 1)}{24}$$

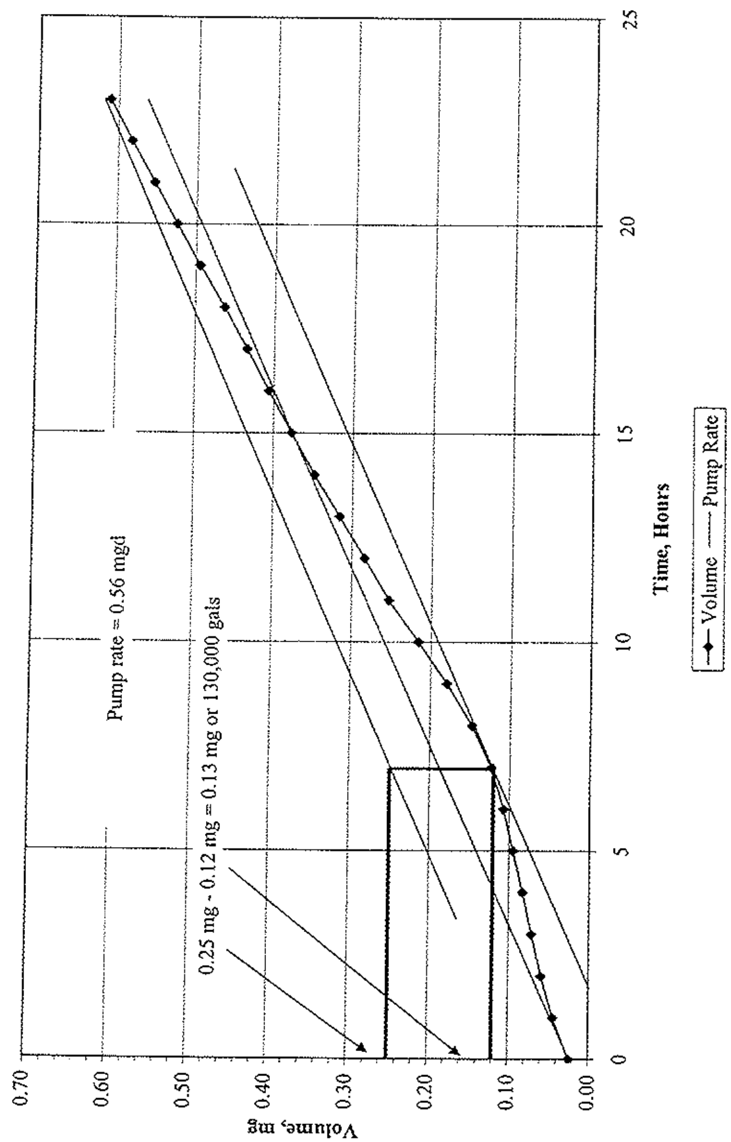
$Pump\_rate\_Max_2 = 0.08\,mgd$

EQ Basin										
Time	Normalized	Actual ADWF, mgd	ADWF w/PHF, mgd	ADWF w/PHF Volume, mil gal	ADWF w/PHF Total Vol., mil gal	Pump rate (0.56 mgd), mgd	Actual Max Month, mgd	Max Volume, mil gal	Max Total Vol., mil gal	Pump rate (0.61 mgd), mgd
0	0.95	0.46	0.46	0.02	0.02	0.02	0.58	0.02	0.02	0.03
1	0.77	0.37	0.37	0.02	0.03	0.05	0.47	0.02	0.04	0.05
2	0.59	0.29	0.29	0.01	0.05	0.07	0.36	0.02	0.06	0.08
3	0.49	0.24	0.24	0.01	0.06	0.09	0.30	0.01	0.07	0.10
4	0.45	0.22	0.22	0.01	0.07	0.12	0.27	0.01	0.08	0.13
5	0.49	0.24	0.24	0.01	0.08	0.14	0.30	0.01	0.10	0.15
6	0.45	0.22	0.22	0.01	0.08	0.16	0.27	0.01	0.11	0.18
7	0.63	0.30	0.30	0.01	0.10	0.19	0.38	0.02	0.12	0.20
8	0.97	0.47	0.47	0.02	0.12	0.21	0.60	0.02	0.15	0.23
9	1.26	0.61	0.61	0.03	0.14	0.23	0.77	0.03	0.18	0.25
10	1.43	0.69	1.03	0.04	0.19	0.26	0.87	0.04	0.22	0.28
11	1.48	0.71	2.00	0.08	0.27	0.28	0.90	0.04	0.25	0.31
12	1.21	0.59	0.88	0.04	0.31	0.31	0.74	0.03	0.28	0.33
13	1.22	0.59	0.59	0.02	0.33	0.33	0.75	0.03	0.32	0.36
14	1.26	0.61	0.61	0.03	0.36	0.35	0.77	0.03	0.35	0.38
15	1.15	0.56	0.56	0.02	0.38	0.38	0.70	0.03	0.38	0.41
16	1.14	0.55	0.55	0.02	0.40	0.40	0.70	0.03	0.41	0.43
17	1.11	0.54	0.54	0.02	0.42	0.42	0.68	0.03	0.43	0.46
18	1.14	0.55	0.55	0.02	0.45	0.45	0.70	0.03	0.46	0.48
19	1.23	0.60	0.60	0.02	0.47	0.47	0.75	0.03	0.49	0.51
20	1.16	0.56	0.56	0.02	0.50	0.49	0.71	0.03	0.52	0.53
21	1.15	0.56	0.56	0.02	0.52	0.52	0.70	0.03	0.55	0.56
22	1.15	0.56	0.56	0.02	0.54	0.54	0.70	0.03	0.58	0.59
23	1.10	0.53	0.53	0.02	0.56	0.56	0.67	0.03	0.61	0.61
24										
Sum				0.56						
Avg		0.48	0.56				0.61		0.61	

Equalization Basin for Estimated ADWF w/ Peak Hour Flow Conditions



Equalization Basin for Max Month conditions

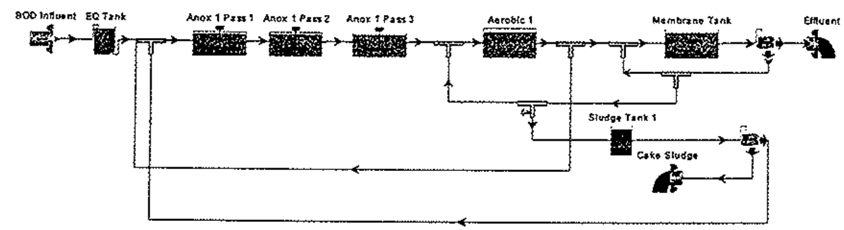


BioWin user and configuration data

Project details
Project name: Maalaea WWTP PER
Plant name: Maalaea WWTP

Steady state solution
Target SRT: 25 SRT: 25.013
Temperature: 25.0

Flowsheet



Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Membrane Tank	0.0400	445.6019	12.0	303
Aerobic 1	0.1400	1264.5459	14.8	573
Anox 1 Pass 1	0.0300	270.9741	14.8	Un-aerated
Anox 1 Pass 2	0.0300	270.9741	14.8	Un-aerated
Anox 1 Pass 3	0.0300	270.9741	14.8	Un-aerated

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint
Membrane Tank	1.0
Aerobic 1	2.0
Anox 1 Pass 1	0.0
Anox 1 Pass 2	0.0
Anox 1 Pass 3	0.0

Aeration equipment parameters

Element name	k1 in C =	k2 in C =	Y in Kla = C Usg ^	Area of one diffuser	% of tank area

File F:\Projects\Maui\60003632_Maalaea_WWTP\400 Tech_Support\402_WWTP_calcs\Proposed WWTP\new_2006_5_22_MML_ProposedMalaeaWWTP_MBR_25days_N_removal.bwc

	k1(PC)^0.25 + k2	k1(PC)^0.25 + k2	Y - Usg in [m3/(m2 d)]		covered by diffusers [%]
Membrane Tank	2.5656	0.0432	0.6250	0.0410	30.0000
Aerobic 1	2.5656	0.0432	0.7965	0.0410	20.0000
Anox 1 Pass 1	2.5656	0.0432	0.8200	0.0410	15.0000
Anox 1 Pass 2	2.5656	0.0432	0.8200	0.0410	10.0000
Anox 1 Pass 3	2.5656	0.0432	0.8200	0.0410	10.0000

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
Membrane Tank	0.9000	0.9500	101.3250	0.3250

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Surface turbulence factor [-]
Membrane Tank	0.0350	20.9500	2.0000	18.8000	0.0000	0.0000	0.2500

Configuration information for all Equalization Tank units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]
EQ Tank	0.1400	1264.5459	14.8

Configuration information for all Splitter units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]
WAS Splitter	0.0	N/A	N/A
Internal Recycle	0.0	N/A	N/A
Splitter17	0.0	N/A	N/A

Operating data Average (flow/time weighted as required)

Element name	Split type	Average Split specification
WAS Splitter	Flowrate [Side]	0.00714311545979705
Internal Recycle	Flow paced	250.00 %
Splitter17	Flow paced	300.00 %

Configuration information for all Sidestream Mixer units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]
Sidestream Mixer1	0.0	N/A	N/A
Sidestream Mixer21	0.0	N/A	N/A
Sidestream Mixer25	0.0	N/A	N/A

Configuration information for all Aerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Sludge Tank 1	0.0400	361.2988	14.8	82

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint
Sludge Tank 1	1.0

Local biological parameters

Element name	Max. spec. growth rate [1/d]	Substrate (NH4) half sat. [mgN/L]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	CO2 half sat. for autotrophs [mmol/L]
Sludge Tank 1	0.0000	0.7000	0.1700	0.0800	0.0100

Element name	Max. spec. growth rate [1/d]	Substrate half sat. [mg COD/L]	Anoxic growth factor [-]	Aerobic decay [1/d]	Anoxic/anaerobic decay [1/d]	Hydrolysis rate (AS) [1/d]	Hydrolysis half sat. (AS) [-]	Anoxic hydrolysis factor [-]	Anaerobic hydrolysis factor [-]	Adsorption rate of colloids [L/(mgCOD d)]	Ammonification rate [L/(mgN d)]	Fermentation rate [1/d]	Fermentation half sat. [mg COD/L]	Anaerobic growth factor (AS) [-]	Hydrolysis rate (AD) [1/d]	Hydrolysis half sat. (AD) [mg COD/L]
Sludge Tank 1	3.2000	5.0000	0.5000	0.6200	0.3000	2.1000	0.0600	0.2800	0.5000	0.8000	0.0400	3.2000	5.0000	0.1250	0.1000	0.1500

Element name	Max. spec. growth rate [1/d]	Max. spec. growth rate, P-limited [1/d]	Substrate half sat. [mgCOD/L]	Substrate half sat., P-limited [mgCOD/L]	Magnesium half sat. [mgMg/L]	Cation half sat. [mmol/L]	Calcium half sat. [mgCa/L]	Aerobic decay rate [1/d]	Anaerobic decay rate [1/d]	Sequestration rate [1/d]	Anoxic growth factor [-]
Sludge Tank 1	0.9500	0.4200	0.1000	0.0500	0.1000	0.1000	0.1000	0.1000	0.0400	6.0000	0.3300

Element name	Max. spec. growth rate of methanol utilizers [1/d]	Methanol half sat. [mgCOD/L]	Aerobic decay rate of methanol utilizers [1/d]	Anoxic/anaerobic decay rate of methanol utilizers [1/d]
Sludge Tank 1	6.4000	0.5000	0.2400	0.1200

Element name	Max. spec. growth	Substrate half sat.	Acetate inhibition	Decay rate [1/d]	Aerobic decay rate

	rate [1/d]	[mgCOD/L]	[mgCOD/L]		[1/d]
Sludge Tank 1	0.2500	10.0000	10000.0000	0.0500	0.5200

Element name	Acetoclastic Mu Max [1/d]	H2-utilizing Mu Max [1/d]	Acetoclastic Ks [mgCOD/L]	H2-utilizing CO2 half sat. [mmol/L]	H2-utilizing Ks [mgCOD/L]	Acetoclastic propionic inhibition [mgCOD/L]	Acetoclastic decay rate [1/d]	Acetoclastic aerobic decay rate [1/d]	H2-utilizing decay rate [1/d]	H2-utilizing aerobic decay rate [1/d]
Sludge Tank 1	0.3000	1.4000	100.0000	0.1000	0.1000	10000.0000	0.1300	0.6000	0.1300	0.6000

Element name	Heterotrophs low pH limit [-]	Heterotrophs high pH limit [-]	Methanol utilizers low pH limit [-]	Methanol utilizers high pH limit [-]	Autotrophs low pH limit [-]	Autotrophs high pH limit [-]	Poly P heterotrophs low pH limit [-]	Poly P heterotrophs high pH limit [-]	Heterotrophs low pH limit (anaerobic) [-]	Heterotrophs high pH limit (anaerobic) [-]	Propionic acetogens low pH limit [-]	Propionic acetogens high pH limit [-]	Acetoclastic methanogens low pH limit [-]	Acetoclastic methanogens high pH limit [-]	H2-utilizing methanogens low pH limit [-]	H2-utilizing methanogens high pH limit [-]
Sludge Tank 1	4.0000	10.0000	4.0000	10.0000	5.5000	9.5000	4.0000	10.0000	5.5000	8.5000	4.0000	10.0000	5.5000	8.5000	5.5000	8.5000

Element name	Heterotrophic DO limit [mgO2/L]	Aerobic denit. DO limit [mgO2/L]	Autotrophic DO limit [mgO2/L]	Anoxic NO3 limit [mgN/L]	NH3 nutrient limit [mgN/L]	NO3 nutrient limit [mgN/L]	PolyP limit [mgP/L]	VFA sequestration limit [mgCOD/L]	P uptake limit [mgP/L]	P nutrient limit [mgP/L]	Heterotrophic Hydrogen limit [mgCOD/L]	Propionic acetogens Hydrogen limit [mgCOD/L]
Sludge Tank 1	0.0500	0.0500	0.2500	0.1000	0.0050	0.0050	0.0100	5.0000	0.1500	0.0050	1.0000	5.0000

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Sludge Tank 1	2.5656	0.0432	0.8200	0.0410	10.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	BOD Influent
Flow	0.6
Total Carbonaceous BOD mg/L	323.000
Volatile suspended solids mg/L	291.000
Total suspended solids mgTSS/L	323.000

Total Kjeldahl Nitrogen mgN/L	49.000
Total P mgP/L	12.000
Nitrate N mgN/L	0.000
pH	7.000
Alkalinity mmol/L	5.000
Calcium mg/L	160.000
Magnesium mg/L	25.000
Dissolved oxygen mg/L	0.000

Element name	BOD Influent
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.8499
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for influent unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - Non-poly-P heterotrophs [gCOD/g of total COD]	0.0001
FZbm - Anoxic methanol utilizers [gCOD/g of total COD]	0.0001
FZba - Autotrophs [gCOD/g of total COD]	0.0001
FZbp - PAOs [gCOD/g of total COD]	0.0001
FZbpa - Propionic acetogens [gCOD/g of total COD]	0.0001
FZbam - Acetoclastic methanogens [gCOD/g of total COD]	0.0001
FZbhm - H2-utilizing methanogens [gCOD/g of total COD]	0.0001

Configuration information for all Effluent units

Configuration information for all Sludge units

Configuration information for all Dewatering unit units

Physical data

Element name	No Volume
Membrane	0.0
Centrifuge	0.0

Operating data Average (flow/time weighted as required)

Element name	Split type	Average Split specification
Membrane	Flow paced	300.00 %
Centrifuge	Ratio	0.08

Element name	Percent removal
Membrane	100.000
Centrifuge	95.000

BioWin Album

Album page - Conc

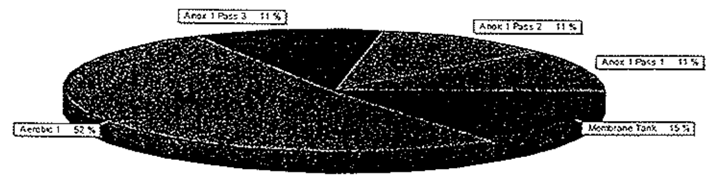
Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total N [mgN/L]	Total P [mgP/L]	Alkalinity [mmol/L]	pH []
BOD Influent	0.600	323.041	291.000	323.000	49.000	12.000	5.000	7.000
Anox 1 Pass 1	2.407	8863.320	6504.097	1578.551	538.217	479.265	3.284	6.779
Anox 1 Pass 2	2.407	8851.371	6500.030	1573.766	537.497	479.265	3.378	6.766
Anox 1 Pass 3	2.407	8837.110	6495.382	1569.838	537.487	479.265	3.416	6.749
Aerobic 1	3.899	11721.549	8576.760	2024.671	710.196	635.781	2.085	6.597
Membrane Tank	2.399	12300.304	8993.188	2113.399	744.866	667.327	2.054	6.590
WAS Splitter	1.493	16396.789	11988.273	2816.955	989.307	888.096	2.054	6.590
Internal Recycle	0.300	16396.789	11988.273	2816.955	989.307	888.096	2.054	6.590
Sludge Tank 1	0.007	14539.922	10564.301	1358.178	969.443	888.096	10.038	7.024
Centrifuge	0.007	785.156	570.472	73.835	174.548	272.420	10.034	7.045
Cake Sludge	0.001	186474.500	135487.160	17412.463	10905.625	8584.051	10.038	7.024
Effluent	0.599	0.000	0.000	0.867	10.895	4.434	2.054	6.590

Album page - Mass

Elements	Total suspended solids [lb/d]	Volatile suspended solids [lb/d]	Total Carbonaceous BOD [lb/d]	Total N [lb/d]	Total P [lb/d]	Alkalinity [kmol/d]
BOD Influent	1617.543	1457.108	1617.339	245.355	60.087	11.356
Anox 1 Pass 1	178012.400	130629.360	31703.873	10809.638	9625.645	29.916
Anox 1 Pass 2	177772.420	130547.680	31607.771	10795.170	9625.645	30.776
Anox 1 Pass 3	177485.990	130454.340	31528.879	10794.981	9625.645	31.119
Aerobic 1	381450.390	279110.580	65888.183	23111.658	20689.990	30.777
Internal Recycle	41051.354	30014.099	7052.590	2476.850	2223.457	2.333
Internal Recycle	205256.760	150070.490	35262.947	12384.249	11117.286	11.665
WAS Splitter	204279.300	149355.840	35095.021	12325.274	11064.344	11.609
WAS Splitter	977.448	714.647	167.925	58.975	52.941	0.056
Sludge Tank 1	866.757	629.761	80.964	57.791	52.941	0.271
Centrifuge	43.338	31.488	4.075	9.634	15.037	0.251
Centrifuge	823.419	598.273	76.889	48.156	37.905	0.020
Cake Sludge	823.419	598.273	76.889	48.156	37.905	0.020
Effluent	0.000	0.000	4.339	54.505	22.182	4.662

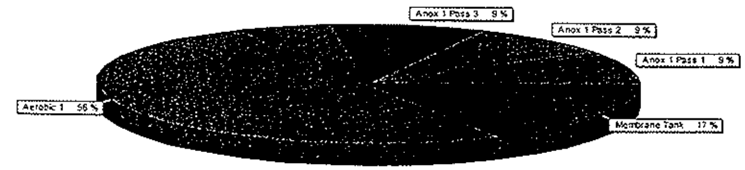
Album page - Distributions

Volume Distribution

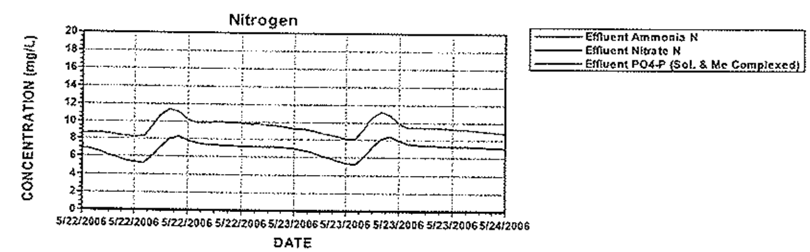


Album page - Distributions

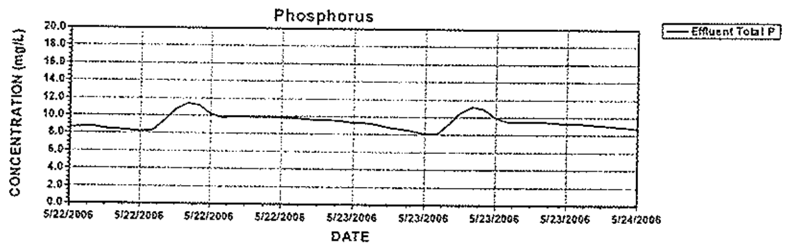
Mass Distribution



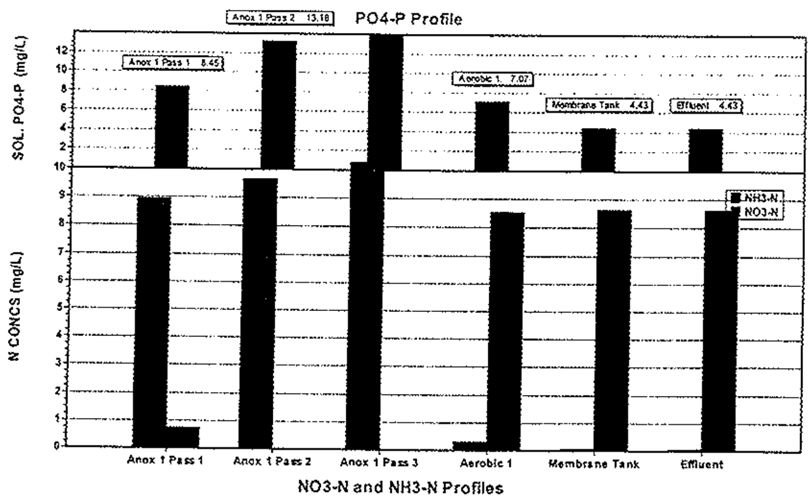
Album page - Permeate N and P



Album page - Permeate N and P



Album page - Profiles

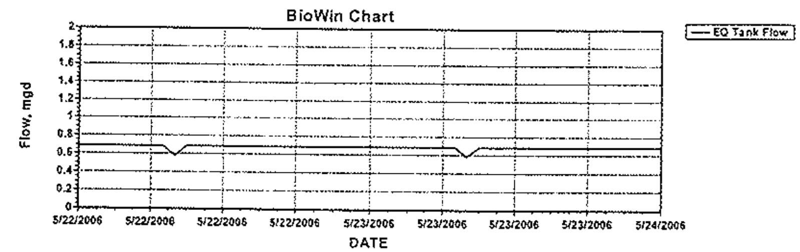


Album page - Aeration

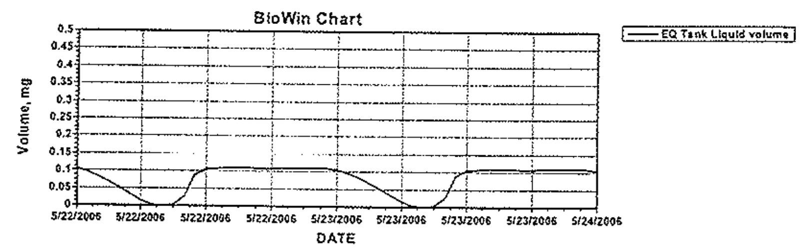
Elements	Total oxygen uptake rate [mgO/L/hr]	Carbonaceous OUR [mgO/L/hr]	Nitrogenous OUR [mgO/L/hr]	OTE [%]	OTR [lb/hr]	SOTE [%]	SOTR [lb/hr]	Air supply rate [ft3/min (20C, 1 atm)]	Air flow rate / diffuser [ft3/min (20C, 1 atm)]	# of diffusers []	Actual DO sat. conc. [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Oxygen content [%]
Membrane	45.530	39.957	5.573	7.989	14.469	11.875	21.023	173.502	0.573	303.000	7.829	0.049	8.637	19.572

Tank														
Aerobic 1	71.238	43.173	28.065	9.384	85.424	29.171	259.571	872.074	1.522	573.000	8.022	0.314	8.547	19.280
Anox 1 Pass 1	0.000	0.000	0.000	100.000	0.000	100.000	0.000	0.000	0.000	0.000	8.022	8.941	0.730	0.000
Anox 1 Pass 2	0.000	0.000	0.000	100.000	0.000	100.000	0.000	0.000	0.000	0.000	8.022	9.658	0.009	0.000
Anox 1 Pass 3	0.000	0.000	0.000	100.000	0.000	100.000	0.000	0.000	0.000	0.000	8.022	10.281	0.000	0.000

Album page - EQ



Album page - EQ



Global Parameters

Autotroph

Name	Default	Value	
Max. spec. growth rate [1/d]	0.90000	0.90000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.70000	0.70000	1.0000
Aerobic decay rate [1/d]	0.17000	0.17000	1.0290
Anoxic/anaerobic decay rate [1/d]	0.08000	0.08000	1.0290

CO2 half sat. for autotrophs [mmol/L]	0.01000	0.01000	1.0000

Heterotroph

Name	Default	Value	
Max. spec. growth rate [1/d]	3.20000	3.20000	1.0290
Substrate half sat. [mgCOD/L]	5.00000	5.00000	1.0000
Anoxic growth factor [-]	0.50000	0.50000	1.0000
Aerobic decay [1/d]	0.62000	0.62000	1.0290
Anoxic/anaerobic decay [1/d]	0.30000	0.30000	1.0290
Hydrolysis rate (AS) [1/d]	2.10000	2.10000	1.0290
Hydrolysis half sat. (AS) [-]	0.06000	0.06000	1.0000
Anoxic hydrolysis factor [-]	0.28000	0.28000	1.0000
Anaerobic hydrolysis factor [-]	0.50000	0.50000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.80000	0.80000	1.0290
Ammonification rate [L/(mgN d)]	0.04000	0.04000	1.0290
Fermentation rate [1/d]	3.20000	3.20000	1.0290
Fermentation half sat. [mgCOD/L]	5.00000	5.00000	1.0000
Anaerobic growth factor (AS) [-]	0.12500	0.12500	1.0000
Hydrolysis rate (AD) [1/d]	0.10000	0.10000	1.0500
Hydrolysis half sat. (AD) [mgCOD/L]	0.15000	0.15000	1.0000

Methanol utilizers

Name	Default	Value	
Max. spec. growth rate of methanol utilizers [1/d]	6.40000	6.40000	1.0290
Methanol half sat. [mgCOD/L]	0.50000	0.50000	1.0000
Aerobic decay rate of methanol utilizers [1/d]	0.24000	0.24000	1.0290
Anoxic/anaerobic decay rate of methanol utilizers [1/d]	0.12000	0.12000	1.0290

PolyP

Name	Default	Value	
Max. spec. growth rate [1/d]	0.95000	0.95000	1.0000
Max. spec. growth rate, P-limited [1/d]	0.42000	0.42000	1.0000
Substrate half sat. [mgCOD/L]	0.10000	0.10000	1.0000
Substrate half sat., P-limited [mgCOD/L]	0.05000	0.05000	1.0000
Magnesium half sat. [mgMg/L]	0.10000	0.10000	1.0000
Cation half sat. [mmol/L]	0.10000	0.10000	1.0000
Calcium half sat. [mgCa/L]	0.10000	0.10000	1.0000
Aerobic decay rate [1/d]	0.10000	0.10000	1.0000
Anaerobic decay rate [1/d]	0.04000	0.04000	1.0000
Sequestration rate [1/d]	6.00000	6.00000	1.0000
Anoxic growth factor [-]	0.33000	0.33000	1.0000

Propionic Acetogen

Name	Default	Value	
Max. spec. growth rate [1/d]	0.25000	0.25000	1.0290
Substrate half sat. [mgCOD/L]	10.00000	10.00000	1.0000
Acetate inhibition [mgCOD/L]	10000.00000	10000.00000	1.0000
Decay rate [1/d]	0.05000	0.05000	1.0290
Aerobic decay rate [1/d]	0.52000	0.52000	1.0290

Methanogen

Name	Default	Value	
Acetoclastic Mu Max [1/d]	0.30000	0.30000	1.0290
H2-utilizing Mu Max [1/d]	1.40000	1.40000	1.0290
Acetoclastic Ks [mgCOD/L]	100.00000	100.00000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.10000	0.10000	1.0000
H2-utilizing Ks [mgCOD/L]	0.10000	0.10000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.00000	10000.00000	1.0000
Acetoclastic decay rate [1/d]	0.13000	0.13000	1.0290
Acetoclastic aerobic decay rate [1/d]	0.60000	0.60000	1.0290
H2-utilizing decay rate [1/d]	0.13000	0.13000	1.0290
H2-utilizing aerobic decay rate [1/d]	0.60000	0.60000	1.0290

pH Inhibition

Name	Default	Value
Heterotrophs low pH limit [-]	4.00000	4.00000
Heterotrophs high pH limit [-]	10.00000	10.00000
Methanol utilizers low pH limit [-]	4.00000	4.00000
Methanol utilizers high pH limit [-]	10.00000	10.00000
Autotrophs low pH limit [-]	5.50000	5.50000
Autotrophs high pH limit [-]	9.50000	9.50000
PolyP heterotrophs low pH limit [-]	4.00000	4.00000
Poly P heterotrophs high pH limit [-]	10.00000	10.00000
Heterotrophs low pH limit (anaerobic) [-]	5.50000	5.50000
Heterotrophs high pH limit (anaerobic) [-]	8.50000	8.50000
Propionic acetogens low pH limit [-]	4.00000	4.00000
Propionic acetogens high pH limit [-]	10.00000	10.00000
Acetoclastic methanogens low pH limit [-]	5.50000	5.50000
Acetoclastic methanogens high pH limit [-]	8.50000	8.50000
H2-utilizing methanogens low pH limit [-]	5.50000	5.50000
H2-utilizing methanogens high pH limit [-]	8.50000	8.50000

Switching Functions

Name	Default	Value
Heterotrophic DO limit [mgO2/L]	0.05000	0.05000
Aerobic denit. DO limit [mgO2/L]	0.05000	0.05000
Autotrophic DO limit [mgO2/L]	0.25000	0.25000
Anoxic NO3 limit [mgN/L]	0.10000	0.10000
NH3 nutrient limit [mgN/L]	0.00500	0.00500
NO3 nutrient limit [mgN/L]	0.00500	0.00500
PolyP limit [mgP/L]	0.01000	0.01000
VFA sequestration limit [mgCOD/L]	5.00000	5.00000
P uptake limit [mgP/L]	0.15000	0.15000
P nutrient limit [mgP/L]	0.00500	0.00500
Heterotrophic Hydrogen limit [mgCOD/L]	1.00000	1.00000
Propionic acetogens Hydrogen limit [mgCOD/L]	5.00000	5.00000

Autotroph

Name	Default	Value
Yield [mgCOD/mgN]	0.24000	0.24000
N in biomass [mgN/mgCOD]	0.07000	0.07000
N in inert [mgN/mgCOD]	0.07000	0.07000
P in biomass [mgP/mgCOD]	0.02200	0.02200
P in inert [mgP/mgCOD]	0.02200	0.02200
Fraction to endogenous residue [-]	0.08000	0.08000
COD:VSS ratio [mgCOD/mgVSS]	1.42000	1.42000

Heterotroph

Name	Default	Value
Yield (aerobic) [-]	0.66600	0.66600
Yield (fermentation, low H2) [-]	0.10000	0.10000
Yield (fermentation, high H2) [-]	0.10000	0.10000
Yield (fermentation of methanol) [-]	0.10000	0.10000
H2 yield (fermentation low H2) [-]	0.35000	0.35000
H2 yield (fermentation high H2) [-]	0.0	0.0
H2 yield (methanol fermentation) [-]	0.35000	0.35000
Propionate yield (fermentation, low H2) [-]	0.0	0.0
Propionate yield (fermentation, high H2) [-]	0.70000	0.70000
CO2 yield (fermentation, low H2) [-]	0.50000	0.50000
CO2 yield (fermentation, high H2) [-]	0.0	0.0
N in biomass [mgN/mgCOD]	0.07000	0.07000
N in inert [mgN/mgCOD]	0.07000	0.07000
P in biomass [mgP/mgCOD]	0.02200	0.02200
P in inert [mgP/mgCOD]	0.02200	0.02200
Endogenous Residue [-]	0.08000	0.08000
COD:VSS ratio [mgCOD/mgVSS]	1.42000	1.42000
Yield (anoxic) [-]	0.54000	0.54000
Yield propionic (aerobic) [-]	0.50000	0.50000
Yield propionic (anoxic) [-]	0.41000	0.41000
Yield acetic (aerobic) [-]	0.40000	0.40000
Yield acetic (anoxic) [-]	0.32000	0.32000
Yield methanol (aerobic) [-]	0.50000	0.50000
Adsorp. max. [-]	1.00000	1.00000

Methanol utilizer

Name	Default	Value
Yield (anoxic) [-]	0.40000	0.40000
N in biomass [mgN/mgCOD]	0.07000	0.07000
N in inert [mgN/mgCOD]	0.07000	0.07000
P in biomass [mgP/mgCOD]	0.02200	0.02200
P in inert [mgP/mgCOD]	0.02200	0.02200
Endogenous Residue [-]	0.08000	0.08000
COD:VSS ratio [mgCOD/mgVSS]	1.42000	1.42000

PolyP

Name	Default	Value
Yield (aerobic) [-]	0.63900	0.63900
Yield (anoxic) [-]	0.52000	0.52000
Aerobic P/PHA uptake [mgP/mgCOD]	0.95000	0.95000
Anoxic P/PHA uptake [mgP/mgCOD]	0.35000	0.35000
Yield of PHA on sequestration [-]	0.88900	0.88900
N in biomass [mgN/mgCOD]	0.07000	0.07000
N in part. inert [mgN/mgCOD]	0.07000	0.07000
N in sol. inert [mgN/mgCOD]	0.07000	0.07000
P in biomass [mgP/mgCOD]	0.02200	0.02200
P in part. inert [mgP/mgCOD]	0.02200	0.02200
Fraction to endogenous part. [-]	0.25000	0.25000
Inert fraction of endogenous sol. [-]	0.20000	0.20000
P/Ac release ratio [mgP/mgCOD]	0.49000	0.49000
COD:VSS ratio [mgCOD/mgVSS]	1.42000	1.42000
Yield of low PP [-]	0.94000	0.94000

Propionic Acetogen

Name	Default	Value
Yield [-]	0.10000	0.10000
H2 yield [-]	0.40000	0.40000
CO2 yield [-]	1.00000	1.00000
N in biomass [mgN/mgCOD]	0.07000	0.07000
N in endogenous residue [mgN/mgCOD]	0.07000	0.07000
P in biomass [mgP/mgCOD]	0.02200	0.02200
P in endogenous residue [mgP/mgCOD]	0.02200	0.02200
Fraction to endogenous residue [-]	0.08000	0.08000
COD:VSS ratio [mgCOD/mgVSS]	1.42000	1.42000

Methanogen

Name	Default	Value
Acetoclastic yield [-]	0.10000	0.10000
H2-utilizing yield [-]	0.10000	0.10000
N in acetoclastic biomass [mgN/mgCOD]	0.07000	0.07000
N in H2-utilizing biomass [mgN/mgCOD]	0.07000	0.07000
N in acetoclastic endog. residue [mgN/mgCOD]	0.07000	0.07000
N in H2-utilizing endog. residue [mgN/mgCOD]	0.07000	0.07000
P in acetoclastic biomass [mgP/mgCOD]	0.02200	0.02200
P in H2-utilizing biomass [mgP/mgCOD]	0.02200	0.02200
P in acetoclastic endog. residue [mgP/mgCOD]	0.02200	0.02200
P in H2-utilizing endog. residue [mgP/mgCOD]	0.02200	0.02200
Acetoclastic fraction to endog. residue [-]	0.08000	0.08000
H2-utilizing fraction to endog. residue [-]	0.08000	0.08000
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.42000	1.42000
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.42000	1.42000

General

Name	Default	Value
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.60000	1.60000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.60000	1.60000
Ash content of biomass (synthesis ISS) [%]	8.00000	8.00000
Molecular weight of other anions [mg/mmol]	35.50000	35.50000
Molecular weight of other cations [mg/mmol]	39.10000	39.10000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.30000	0.30000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.30000	0.30000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.05000	0.05000
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.01000	0.01000
Bubble rise velocity (anaerobic digester) [cm/s]	23.90000	23.90000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.35000	0.35000

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.00000	17.00000	1.0000
Kl for CO2 [m/d]	10.00000	10.00000	1.0000
Kl for NH3 [m/d]	1.00000	1.00000	1.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.0000E+10	3.0000E+10	1.0000
Struvite redissolution rate [1/d]	3.0000E+11	3.0000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.00000	1.00000	1.0000
HDP precipitation rate [L/(molP d)]	1.0000E+8	1.0000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.0000E+8	1.0000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.0000E-4	5.0000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.9180E-14	6.9180E-14
HDP solubility product [mol/L]	2.7500E-22	2.7500E-22
HDP half sat. [mgTSS/L]	1.00000	1.00000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.01000	0.01000
Al to P ratio [molAl/molP]	0.80000	0.80000
Al(OH)3 solubility product [mol/L]	1.2590E+9	1.2590E+9
AlHPO4+ dissociation constant [mol/L]	7.9430E-13	7.9430E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.01000	0.01000
Fe to P ratio [molFe/molP]	1.60000	1.60000
Fe(OH)3 solubility product [mol/L]	0.05000	0.05000
FeH2PO4++ dissociation constant [mol/L]	5.0120E-22	5.0120E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.50000	0.50000
Beta [-]	0.95000	0.95000
Surface pressure [kPa]	101.32500	101.32500
Fractional effective saturation depth (Fed) [-]	0.32500	0.32500
Supply gas CO2 content [vol. %]	0.03500	0.03500
Supply gas O2 [vol. %]	20.95000	20.95000
Off-gas CO2 [vol. %]	2.00000	2.00000
Off-gas O2 [vol. %]	18.80000	18.80000
Off-gas H2 [vol. %]	0.0	0.0
Off-gas NH3 [vol. %]	0.0	0.0
Surface turbulence factor [-]	0.25000	0.25000
Set point controller gain []	1.00000	1.00000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.3873	0.3873
Vesilind hindered zone settling parameter (K) [L/g]	0.3700	0.3700
Clarification switching function [mg/L]	100.0000	100.0000
Specified TSS conc.for height calc. [mg/L]	2500.0000	2500.0000
Maximum compactability constant [mg/L]	15000.0000	15000.0000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.9341	0.9341
Maximum (practical) settling velocity (Vo') [ft/min]	0.6152	0.6152
Hindered zone settling parameter (Kh) [L/g]	0.4000	0.4000
Flocculent zone settling parameter (Kf) [L/g]	2.5000	2.5000
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010

Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

CALCULATIONS:

Inputs to Biowin:

Steady State Values

"Name"	"Value"
"Flow, mgd"	0.6
"Total Carbonaceous BOD, mg/L"	323
"Volatile Suspended Solids, mg/L"	291
"Total Suspended Solids, mg/L"	323
"Total Kjeldahl Nitrogen, mg/L"	49
"Total P, mg/L"	12
"Nitrate N, mg/L"	0.0
"pH"	7.0
"Alkalinity, mmol/L"	5.0
"Calcium, mg/L"	160
"Magnesium, mg/L"	25
"Dissolved oxygen, mg/L"	0.0

Dynamic Model Inputs

The Lihue WWTP Diurnal Flow pattern was used to create dynamic model inputs. The dynamic model input is to large to display property on Mathcad. The averages of the dynamic model input values equal to the above steady state values.

The lbs per capita values for COD, TKN, TP were used to calculate the respective concentrations. These values were obtained from Metcalf and Eddy, Inc., 4th edition texbook. The flow rate and the capita estiimates were based on the City and County of Honolulu Wastewater Standards, Vol 1, and on the State HAR Chapter 11-62. The developer provided the proposed Maalaea WWTP service area.

The plant will be designed for BNR although BNR is not required as a regulatory requirement. Since the County of Maui has converted all three major WWTP on the island to BNR, we believe that this proposed plant should be designed similarly.

Although the biowin model can simulate PWWF conditions, these flows will not be modelled. The PWWF will be used to model the hydraulics through the plant to ensure no spills at the PWWF conditions. The PWWF was based the Babbit Max Factor described in the City and County of Honolulu Wastewater Standards, Vol 1. The Babbit Max Factor was applied to the estimated residential population of the proposed Maalaea WWTP service area.

The alkalinity of the raw wastewater was estimated based on experience with other facilities state wide. The following calculations converts alkalinity as mg/L $CaCO_3$ to mol/Liter.

Alkalinity conversions:

$mmol := 10^{-3} mol$

$Alkconc := 250 \frac{mg}{L}$ as $CaCO_3$

$Ca := 40.08 \frac{gm}{mol}$

$C := 12.011 \frac{gm}{mol}$ $\quad C = 1.201 \times 10^4 \frac{mg}{mol}$

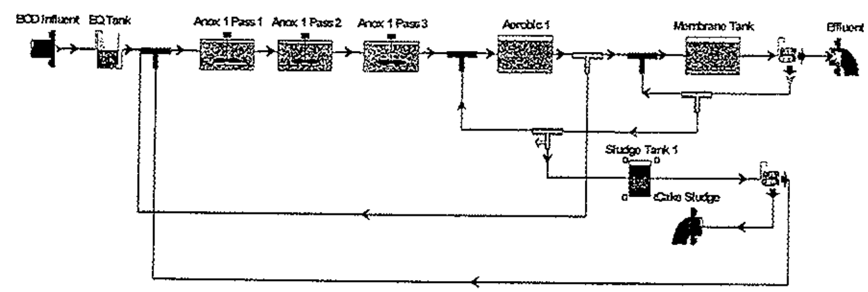
$O_3 := 3 \cdot 15.9994 \frac{gm}{mol}$ $\quad O_3 = 4.8 \times 10^4 \frac{mg}{mol}$

$CaCO_3 := Ca + C + O_3$ $\quad CaCO_3 = 100.1 \frac{gm}{mol}$

100 gram/mol of CaCO3 is 2 moles of alkalinity

$Alk_{mol} := \frac{2}{CaCO_3} Alkconc$ $\quad Alk_{mol} = 5.0 \frac{mmol}{L}$

We will be designing the plant for a Sludge Retention Time (SRT) of 25 days. The following calculations will compare the Biowin output mass balance information with typical design criteria values for the Aeration Tank and Sludge Tank.



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Membrane Tank	0.0400	445.6019	12.0	303
Aerobic 1	0.1400	1264.5459	14.8	573
Anox 1 Pass 1	0.0300	270.9741	14.8	Un-aerated
Anox 1 Pass 2	0.0300	270.9741	14.8	Un-aerated
Anox 1 Pass 3	0.0300	270.9741	14.8	Un-aerated

Album page - Conc

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total N [mgN/L]	Total P [mgP/L]	Alkalinity [mmol/L]	pH []
BOD Influent	0.600	323.041	291.000	323.000	49.000	12.000	5.000	7.000
Anox 1 Pass 1	2.407	8863.320	6504.097	1578.551	538.217	479.265	3.284	6.779
Anox 1 Pass 2	2.407	8851.371	6500.030	1573.766	537.497	479.265	3.378	6.766
Anox 1 Pass 3	2.407	8837.110	6495.382	1569.838	537.487	479.265	3.416	6.749
Aerobic 1	3.899	11721.549	8576.760	2024.671	710.196	635.781	2.085	6.597
Membrane Tank	2.399	12300.304	8993.188	2113.399	744.866	667.327	2.054	6.590
WAS Splitter	1.493	16396.789	11988.273	2816.955	989.307	888.096	2.054	6.590
Internal Recycle	0.300	16396.789	11988.273	2816.955	989.307	888.096	2.054	6.590
Sludge Tank 1	0.007	14539.922	10564.301	1358.178	969.443	888.096	10.038	7.024
Centrifuge	0.007	785.156	570.472	73.835	174.548	272.420	10.034	7.045
Cake Sludge	0.001	186474.500	135487.160	17412.463	10905.625	8584.051	10.038	7.024
Effluent	0.599	0.000	0.000	0.867	10.895	4.434	2.054	6.590

Album page - Mass

Elements	Total suspended solids [lb/d]	Volatile suspended solids [lb/d]	Total Carbonaceous BOD [lb/d]	Total N [lb/d]	Total P [lb/d]	Alkalinity [kmol/d]
BOD Influent	1617.543	1457.108	1617.339	245.355	60.087	11.356
Anox 1 Pass 1	178012.400	130629.360	31703.873	10809.638	9625.645	29.916
Anox 1 Pass 2	177772.420	130547.680	31607.771	10795.170	9625.645	30.776
Anox 1 Pass 3	177485.990	130454.340	31528.879	10794.981	9625.645	31.119
Aerobic 1	381450.390	279110.580	65888.183	23111.658	20689.990	30.777
Internal Recycle	41051.354	30014.099	7052.590	2476.850	2223.457	2.333
Internal Recycle	205256.760	150070.490	35262.947	12384.249	11117.286	11.665
WAS Splitter	204279.300	149355.840	35095.021	12325.274	11064.344	11.609
WAS Splitter	977.448	714.647	167.925	58.975	52.941	0.056
Sludge Tank 1	866.757	629.761	80.964	57.791	52.941	0.271
Centrifuge	43.338	31.488	4.075	9.634	15.037	0.251
Centrifuge	823.419	598.273	76.889	48.156	37.905	0.020
Cake Sludge	823.419	598.273	76.889	48.156	37.905	0.020
Effluent	0.000	0.000	4.339	54.505	22.182	4.662

BOD loading to the aeration tank:

$V_{aeration} := 140000 gal$ $\qquad V_{aeration} = 18715\,ft^3$

$BOD_{inf} := 1618 \frac{lb}{day}$ $\qquad BOD\_load := \frac{BOD_{inf}}{V_{aeration}}$ $\qquad BOD\_load = 86.5 \frac{lb}{day \cdot 1000ft^3}$

M&E Pacific, Inc.

This value is on the high side. The typical range is between 10 and 50 lb/(day*1000ft^3). However, since anoxic tanks will be provided upstream of the aeration tanks, some BOD reduction will occur in this tanks.

Hydraulic Loading to the aeration tank:

$Q_{inf} := 0.6 mgd$ $\qquad HLR_{aeration} := \frac{V_{aeration}}{Q_{inf}}$ $\qquad HLR_{aeration} = 5.6 hr$ $\qquad$ OK. In the 4-6 hr range.

Food to Mass ratio:

$Food := BOD_{inf}$ $\qquad MLSS_{aeration} := 11722 \frac{mg}{L}$ $\qquad Mass_{aeration} := V_{aeration} \cdot MLSS_{aeration}$ $\qquad Mass_{aeration} = 13695\,lb$

$FM_{ratio} := \frac{Food}{Mass_{aeration}}$ $\qquad FM_{ratio} = 0.12 \frac{1}{day}$ $\qquad$ OK. In the 0.1 to 0.4 day^{-1} range

Anoxic Volume to Aeration Volume:

$V_{anoxic} := 3 \cdot 30000 gal$ $\qquad V_{anoxic} = 1.2 \times 10^4\,ft^3$

$Anox_{ratio} := \frac{V_{anoxic}}{V_{aeration}}$ $\qquad Anox_{ratio} = 0.643$

$MLSS_{MBR} := 12300 \frac{mg}{L}$ $\qquad$ OK. In membrane tank. Range 9000 to 15000 mg/L.

Sludge Tank Design:

The sludge tank will be designed for a 5 day storage. Sludge tank will be aerated.

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Sludge Tank 1	0.0400	361.2988	14.8	82

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint
Sludge Tank 1	1.0

$mgd := 10^6 \frac{gal}{day}$ $\qquad gpm := \frac{gal}{min}$

$Q_{sludge} := .007 mgd$ $\qquad Q_{sludge} = 4.86 \frac{gal}{min}$

$V_{sludgetank} := 40000gal$

$HLR_{sludge} := \frac{V_{sludgetank}}{Q_{sludge}}$ $\quad HLR_{sludge} = 5.7\,day$

The sludge tank will have a 5 day holding, this gives 5 days to fix the dewater unit if it goes out of service.

VSS reduction:

$VSS_{sludge\_inf} := 630\,\frac{lb}{day}$ $\quad VSS_{sludge\_out} := 598\,\frac{lb}{day}$

$VSS_{reduction} := \frac{VSS_{sludge\_inf} - VSS_{sludge\_out}}{VSS_{sludge\_inf}}$ $\quad VSS_{reduction} = 5.1\,\%$

$TSS_{sludgetank} := 14540\,\frac{mg}{L}$

$TSS_{sludge\_inf} := 867\,\frac{lb}{day}$ $\quad TSS_{sludge\_out} := 823\,\frac{lb}{day}$

$TSS_{reduction} := \frac{TSS_{sludge\_inf} - TSS_{sludge\_out}}{TSS_{sludge\_inf}}$ $\quad TSS_{reduction} = 5.1\,\%$

Sludge Dewatering:

Operation Cycle: $cycle := 1$ $\quad week := 7day$

$Week := 3\,\frac{day}{week}$

$Day := 6\,\frac{hr}{day}$ $\quad Hour := Week \cdot Day$ $\quad Hour = 18\,\frac{hr}{week}$

Amount of sludge processed per operational hour

$TSS_{dewater\_inf} := TSS_{sludge\_out}$

$Solids_{dewater} := TSS_{dewater\_inf} \cdot \frac{7day}{week} \cdot \frac{week}{18hr}$ $\quad Solids_{dewater} = 320.1\,\frac{lb}{hr}$

$Q_{dewater} := Q_{sludge} \cdot 7\,\frac{day}{week} \cdot \frac{week}{18hr}$ $\quad Q_{dewater} = 45.4\,gpm$

For centrifuge operations, we require one centrifuge at $Q_{dewater} = 45.4\,gpm$ to process the waste sludge from the plant.

Two units may be required in the future should frequent problems occur with the single unit.

We may use an incline screw press technology. It is less expensive than the centrifuge. This technology is proven with a feed sludge consisting of primary solids and secondary solids. Our proposed plant will not have any primary solids thus this will be factored into the dewatering system selection process. Without primary solids, the efficiency of the inclined press will be reduced.

Part 1 - Introduction

Based on Reference Item 2 above, the plant will have a minimum of two parallel flow trains since it is considered a Reliability Class 1 facility that is discharging wastewater into an effluent reuse area and into backup injection wells. There will be two parallel tanks for the 0.6 mgd design flow and up to four parallel tanks for the ultimate flow of 1.2 mgd.

The proposed facility will not be treating 0.8 mgd from startup. Thus, it will be necessary to split the initial phase into two parallel treatment tanks to reduce the adverse impacts of treating small flows in large process tanks.

Part 2 - Design Criteria

Based on Reference 3 above, the aeration tank and anoxic tanks will have the following dimension ratios:

1. Length to width: 5 to 1 max.
Anoxic tanks will be sized for plug flow (elongated tanks) while the aeration tanks will be sized for complete mixed using fine bubble diffusers.

2. Width to depth: 1.5 to 1 avg

Based on Reference 3 above, the EQ basin will be sized for two wells with 2 pumps each. There will be two sizes of pumps in each wet well. One pump will be sized to discharge low initial flows and one to discharge the peak EQ basin flows of approximately 0.8 mgd.

$mgd := 10^6 \frac{gal}{day}$ $\quad Q_{design} := 0.8mgd$

Part 3 - Calculations

Anoxic Tanks: $Tank\_no_{nox} := 4$

Each tank will have 3 passes. Total volume of anoxic tank required at design capacity of $Q_{design8}$ is:

$V_{nox} := 3 \cdot 30000gal$ $\quad V_{nox} = 90000\,gal$ Total volume. From Biowin 2.2 output

$D_{nox} := 14.8ft$ Side water depth for the tanks

$A_{nox} := \frac{V_{nox}}{D_{nox}}$ $\quad A_{nox} = 812.9\,ft^2$

$W_{nox} := 1ft$ $\quad L_{nox} := 1ft$ Initial guess to solve two equations and two unknowns

Given

$L_{nox} = 2.5W_{nox}$ Plug flow reactor

$L_{nox} \cdot W_{nox} = \frac{A_{nox}}{Tank\_no_{nox}}$

$\begin{pmatrix} W_{nox} \\ L_{nox} \end{pmatrix} := Find(W_{nox}, L_{nox})$

$W_{nox} = 9.0\,ft$ $\quad L_{nox} = 22.5\,ft$

Each tank will have the following dimensions $D_{nox} = 14.8\,ft$, $W_{nox} = 9\,ft$ and $L_{nox} = 23\,ft$

$V_{nox\_check} := D_{nox} \cdot W_{nox} \cdot L_{nox} \cdot Tank\_no_{nox}$ $\quad V_{nox\_check} = 90000\,gal$ OK

Aeration Tanks: $Tank\_no_{at} := 4$

$V_{at} := 140000gal$ Total volume. From Biowin 2.2 output

$D_{at} := 14.8ft$ Side water depth for the tanks

$A_{at} := \frac{V_{at}}{D_{at}}$ $\quad A_{at} = 1264.5\,ft^2$

$W_{at} := 1ft$ $\quad L_{at} := 1ft$ Initial guess to solve two equations and two unknowns

Given

$L_{at} = 3.9W_{at}$ Complete Mix reactor

$L_{at} \cdot W_{at} = \frac{A_{at}}{Tank\_no_{at}}$

$\begin{pmatrix} W_{at} \\ L_{at} \end{pmatrix} := Find(W_{at}, L_{at})$

$W_{at} = 9.0\,ft$ $\quad L_{at} = 35.1\,ft$

Each tank will have the following dimensions $D_{at} = 14.8\,ft$, $W_{at} = 9\,ft$ and $L_{at} = 35\,ft$

$V_{at\_check} := D_{at} \cdot W_{at} \cdot L_{at} \cdot Tank\_no_{at}$ $\quad V_{at\_check} = 140000\,gal$ OK

total Aeration and Anoxic volume $V_{total} := V_{at} + V_{nox}$ $\quad V_{total} = 230000\,gal$

EQ Basin: $Tank\_no_{eq} := 2$

$V_{eq} := 140000gal$ Total volume. From Biowin 2.2 output

$D_{eq} := 14.8ft$ Side water depth for the tanks

$A_{eq} := \frac{V_{eq}}{D_{eq}}$ $\quad A_{eq} = 1264.5\,ft^2$

$W_{eq} := 1ft$ $\quad L_{eq} := 1ft$ Initial guess to solve two equations and two unknowns

Given

$L_{eq} = 1W_{eq}$ Complete Mix reactor

$L_{eq} \cdot W_{eq} = \frac{A_{eq}}{Tank\_no_{eq}}$

$\begin{pmatrix} W_{eq} \\ L_{eq} \end{pmatrix} := Find(W_{eq}, L_{eq})$

$W_{eq} = 25.1\,ft$ $L_{eq} = 25.1\,ft$

Each tank will have the following dimensions $D_{eq} = 14.8\,ft$, $W_{eq} = 25\,ft$ and $L_{eq} = 25\,ft$

$V_{eq\_check} := D_{eq} \cdot W_{eq} \cdot L_{eq} \cdot Tank\_no_{eq}$ $V_{eq\_check} = 140000\,gal$ OK

There will be the following two sizes of pumps in each EQ tank:

$Q_{eq\_pump1} := \frac{Q_{design}}{2}$ $Q_{eq\_pump1} = 278\,gpm$

$Q_{eq\_pump2} := Q_{design} + 0.1mgd$ $Q_{eq\_pump2} = 625\,gpm$

The estimated diurnal flow pattern is attached.

Membrane Tanks $Tank\_no_{mem} := 4$

$V_{mem} := 40000gal$ Total volume. From Biowin 2.2 output

$D_{mem} := 12ft$ Side water depth for the tanks

$A_{mem} := \frac{V_{mem}}{D_{mem}}$ $A_{mem} = 446\,ft^2$

$W_{mem} := 1ft$ $L_{mem} := 1ft$ Initial guess to solve two equations and two unknowns

Given

$L_{mem} = 1.12W_{mem}$ Complete Mix reactor

$L_{mem} \cdot W_{mem} = \frac{A_{mem}}{Tank\_no_{mem}}$

$\begin{pmatrix} W_{mem} \\ L_{mem} \end{pmatrix} := Find(W_{mem}, L_{mem})$

$W_{mem} = 10.0\,ft$ $L_{mem} = 11.2\,ft$

Each tank will have the following dimensions $D_{mem} = 12\,ft$, $W_{mem} = 10\,ft$ and $L_{mem} = 11\,ft$

$V_{mem\_check} := D_{mem} \cdot W_{mem} \cdot L_{mem} \cdot Tank\_no_{mem}$ $V_{mem\_check} = 4 \times 10^4\,gal$ OK

The vendor will ultimately size the membrane tanks. They will also supply the pumps:

$Q_{mem\_pump} := \frac{1.25Q_{design}}{2}$ $Q_{mem\_pump} = 347\,gpm$ Estimated capacities

Pumps may be driven by variable speed drives.

Sludge Tanks $Tank\_no_{sldg} := 2$

$V_{sldg} := 40000gal$ Total volume. From Biowin 2.2 output

$D_{sldg} := 14.8ft$ Side water depth for the tanks

$A_{sldg} := \frac{V_{sldg}}{D_{sldg}}$ $A_{sldg} = 361\,ft^2$

$W_{sldg} := 1ft$ $L_{sldg} := 1ft$ Initial guess to solve two equations and two unknowns

Given

$L_{sldg} = 1W_{sldg}$ Complete Mix reactor

$L_{sldg} \cdot W_{sldg} = \frac{A_{sldg}}{Tank\_no_{sldg}}$

$\begin{pmatrix} W_{sldg} \\ L_{sldg} \end{pmatrix} := Find(W_{sldg}, L_{sldg})$

$W_{sldg} = 13.4\,ft$ $L_{sldg} = 13.4\,ft$

Each tank will have the following dimensions $D_{sldg} = 14.8\,ft$, $W_{sldg} = 13\,ft$ and $L_{sldg} = 13\,ft$

$V_{sldg\_check} := D_{sldg} \cdot W_{sldg} \cdot L_{sldg} \cdot Tank\_no_{sldg}$ $V_{sldg\_check} = 4 \times 10^4\,gal$ OK

Recycle Water Reservoir

$V_{RWR} := 1400000gal$ PWWF-Effluent Disposal

$D_{RWR} := 25ft$ Side water depth for the reservoir

$A_{RWR} := \dfrac{V_{RWR}}{D_{RWR}}$ $\quad A_{RWR} = 7486\,ft^2$

$d_{RWR} := \left(\dfrac{4A_{RWR}}{\pi}\right)^{0.5}$ $\quad d_{RWR} = 97.6\,ft$

The reservoir will have the following dimensions $D_{RWR} = 25\,ft$ and $d_{RWR} = 98\,ft$

$V_{RWR\_check} := \pi \cdot \left(\dfrac{d_{RWR}}{2}\right)^2 \cdot D_{RWR}$ $\quad V_{RWR\_check} = 1.4 \times 10^6\,gal$ OK

Plant Hydraulics:

The plant hydraulic calculations will be performed separate from this calculations. The plant hydraulic calculations will determine the hydraulic profile, free board, top of wall elevations, open channel dimensions, pipe diameters, flumes and weir distribution boxes, etc. This will also allow the calculations and sizing of the pumps that are necessary within the proposed plants.

PUMP STATION

Force main:

City and County of Honolulu Standards (38.2.2)
Minimum velocity: 3.0 fps (desirable)
1.75 fps (absolute)
Maximum velocity: 10.0 fps

$fps := \dfrac{ft}{sec}$

$Q := 2.01\,mgd$ — PWWF for Maalaea Community & MMS

$d_1 := 12in$ — Initial guess of diameter of force main

$A_1 := \pi\left(\dfrac{d_1}{2}\right)^2$ — Cross sectional area

$v_1 := \dfrac{Q}{A_1}$ — v = velocity

$v_1 = 4.0\,fps$ — Velocity of force main with d = 12 in

Minimum velocity check for short-term

$Q_{ST\_ADWF} := 0.3mgd$

$v_{min\_1} := \dfrac{Q_{ST\_ADWF}}{A_1}$

$v_{min\_1} = 0.6\,fps$

$d_2 := 10in$ — Second guess of diameter of force main

$A_2 := \pi\left(\dfrac{d_2}{2}\right)^2$ — Cross sectional area

$v_2 := \dfrac{Q}{A_2}$ — v = velocity

$v_2 = 5.7\,fps$ — Velocity of force main with d = 10 in

Minimum velocity check for short-term

$Q_{ST\_ADWF} = 0.3\,mgd$

$v_{min\_2} := \dfrac{Q_{ST\_ADWF}}{A_2}$

$v_{min\_2} = 0.9\,fps$

$d := d_1$ $\quad v := v_1$

The force main will be $d = 12\,in$ and $v = 4\,fps$.

Wet Well Volume

Assumptions:

Pumps: $\theta = 4$ min/start

$cycle := 4min$ $\quad \theta = 4$ min/start

$n := 3$ $\quad n$ = number of pumps

Calculations:

$$Volume := \frac{cycle \cdot \left(\frac{Q}{n-1}\right)}{4}$$

$Volume = 93\,ft^3$

$volume_{height} := 10ft$

$volume_{width} := 5ft$

$$volume_{length} := \frac{Volume}{volume_{height} \cdot volume_{width}}$$

$volume_{length} = 2\,ft$

$wet\_well_{height} := volume_{height} + 5ft$ $\quad wet\_well_{height} = 15\,ft$

$wet\_well_{length} := volume_{length} + 5ft$ $\quad wet\_well_{length} = 7\,ft$

$wet\_well_{width} := volume_{width} + 5ft$ $\quad wet\_well_{width} = 10\,ft$

The wet well $Volume = 93\,ft^3$ and the proposed dimensions are $wet\_well_{length} = 7\,ft$, $wet\_well_{width} = 10\,ft$ and $wet\_well_{height} = 15\,ft$. Three pumps will be installed and there will be space for one additional pump for expansion.

Pump Check

Assumptions:

$FM := 9000ft$	Length of force main
$SH := 155ft$	Static Head = 210ft (elevation at WWTP) - 55ft (elevation at pump station site on lot 260)
$C_{new} := 140$	Hazen William Constant for new pipes

Calculations:

$$H_{L\_new} := 10.44 \frac{s^{1.85}}{m^{0.68}} \cdot FM \cdot \left(\frac{Q^{1.85}}{C_{new}^{\;1.85} \cdot d^{4.87}}\right)$$

$H_{L\_new} = 37\,ft$ $\quad$ Head Loss for new FM

$C_{old} := 100$

$$H_{L\_old} := 10.44 \frac{s^{1.85}}{m^{0.68}} \cdot FM \cdot \left(\frac{Q^{1.85}}{C_{old}^{\;1.85} \cdot d^{4.87}}\right)$$

$H_{L\_old} = 68\,ft$ $\quad$ Head Loss for old FM

$TDH_{new} := SH + 1.25H_{L\_new}$

$TDH_{new} = 201\,ft$ $\quad$ Total Dynamic Head for new pipe

$TDH_{old} := SH + 1.25H_{L\_old}$

$TDH_{old} = 240\,ft$ $\quad$ Total Dynamic Head for old pipe

The pumps need to be rated at $Q = 1396\,gpm$ and $TDH_{old} = 240\,ft$

$$weight\_water := 8.35 \frac{lb}{gal}$$

$Q_{weight} := Q \cdot weight\_water$

$$Q_{weight} = 11655 \frac{lb}{min}$$

$$hp_{conv} := 33000 \frac{\frac{ft \cdot lb}{min}}{hp}$$

$$hyd_{hp} := \frac{Q_{weight} \cdot TDH_{old}}{hp_{conv}}$$

$hyd_{hp} = 84.8\,hp$

$pump_{eff} := 75\%$

$motor_{eff} := 95\%$

$$brakehp := \frac{hyd_{hp}}{pump_{eff}}$$

$brakehp = 113\,hp$

$$Electrical\_hp\_input := \frac{brakehp}{motor_{eff}}$$

$Electrical\_hp\_input = 119\,hp$

$$kW\_input := \frac{brakehp}{motor_{eff}}$$

$kW\_input = 89\,kW$

Conclusion:

These results are for an engineering report. Further calculations are needed during the design phase. Three pumps are needed for this pump station. The three pumps will be in series and each pump will be rated at 1500 gpm and 240ft of head. Two pumps will be in service and one will be on standby. The force main is estimated to be 9000 ft and have a diameter of 12 in. At the ultimate PWWF, the velocity will be 4.0 fps. The pumps will be submersible with 15 starts per hour. The active wet well volume is 93 ft^3. The total dynamic head is estimated to be 201 ft when the pipe is new and 240 ft when the pipe is old. The power needed to run the pumps is 89 kW.

R-1 DISTRIBUTION PUMP STATION

Force main:

City and County of Honolulu Standards (38.2.2)
Minimum velocity: 3.0 fps (desirable)
1.75 fps (absolute)
Maximum velocity: 10.0 fps

$$fps := \frac{ft}{sec}$$

$Q := 0.6mgd$ ADWF

$d_1 := 8in$ Initial guess of diameter of force main

$A_1 := \pi\left(\frac{d_1}{2}\right)^2$ Cross sectional area

$v_1 := \frac{Q}{A_1}$ v = velocity

$v_1 = 2.7\,fps$ Velocity of force main with d = 12 in

$d_2 := 6in$ Second guess of diameter of force main

$A_2 := \pi\left(\frac{d_2}{2}\right)^2$ Cross sectional area

$v_2 := \frac{Q}{A_2}$ v = velocity

$v_2 = 4.7\,fps$ Velocity of force main with d = 10 in

$d := d_1$ $v := v_1$

The force main will be $d = 8\,in$ and $v = 2.7\,fps$.

Wet Well Volume

Assumptions:
There will be a recycle water reservoir for the distribution system.

No wet well is needed.

Pump Check

Assumptions:
$FM := 6000ft$ Length of force main

$SH := 130ft$ Static Head = 340ft (highest elevation for irrigation) - 210ft (elevation at WWTP)

$C_{new} := 140$ Hazen William Constant for new pipes

Calculations:

$$H_{L\_new} := 10.44 \frac{s^{1.85}}{m^{0.68}} \cdot FM \cdot \left(\frac{Q^{1.85}}{C_{new}^{\ 1.85} \cdot d^{4.87}} \right)$$

$H_{L\_new} = 19\,ft$ Head Loss for new FM

$C_{old} := 100$

$$H_{L\_old} := 10.44 \frac{s^{1.85}}{m^{0.68}} \cdot FM \cdot \left(\frac{Q^{1.85}}{C_{old}^{\ 1.85} \cdot d^{4.87}} \right)$$

$H_{L\_old} = 35\,ft$ Head Loss for old FM

$TDH_{new} := SH + 1.25 H_{L\_new}$

$TDH_{new} = 153\,ft$ Total Dynamic Head for new pipe

$TDH_{old} := SH + 1.25 H_{L\_old}$

$TDH_{old} = 174\,ft$ Total Dynamic Head for old pipe

The pumps need to be rated at $Q = 417\,gpm$ and $TDH_{old} = 174\,ft$ There will be a total of three pumps with two in service and one on standby. The pumps will be in series so each pump needs to be rated at 1000 gpm and 120 ft of head.

The pumps need to be rated at $Q = 417\,gpm$ and $TDH_{old} = 174\,ft$

$weight\_water := 8.35 \frac{lb}{gal}$

$Q_{weight} := Q \cdot weight\_water$

$Q_{weight} = 3479 \frac{lb}{min}$

$$hp_{conv} := 33000 \frac{\frac{ft \cdot lb}{min}}{hp}$$

$$hyd_{hp} := \frac{Q_{weight} \cdot TDH_{old}}{hp_{conv}}$$

$hyd_{hp} = 18.3\,hp$

$pump_{eff} := 75\%$

$motor_{eff} := 95\%$

$$brakehp := \frac{hyd_{hp}}{pump_{eff}}$$

$brakehp = 24\,hp$

$$Electrical\_hp\_input := \frac{brakehp}{motor_{eff}}$$

$Electrical\_hp\_input = 26\,hp$

$$KW\_input := \frac{brakehp}{motor_{eff}}$$

$KW\_input = 19.2\,kW$

Conclusion:

These results are for an engineering report. Further calculations are needed during the design phase. Two pumps are needed for this pump station. The two pumps will be in series and each pump will be rated at 425 gpm and 200ft of head. One pump will be in service and one will be on standby. The force main is estimated to be 9000 ft and have a diameter of 10 in. At the design flow, the velocity will be 5.7 fps. The pump station will not have a wet well because there is a recycle water reservoir. The total dynamic head is estimated to be 153 ft when the pipe is new and 174 ft when the pipe is old. The power needed to run the pumps is 19 kW.

R-1 PUMP STATION

Force main:

City and County of Honolulu Standards (38.2.2)
Minimum velocity: 3.0 fps (desirable)
1.75 fps (absolute)
Maximum velocity: 10.0 fps

$fps := \frac{ft}{sec}$

$Q := 0.6mgd$ Design Flow

$d_1 := 10in$ Initial guess of diameter of force main

$A_1 := \pi\left(\frac{d_1}{2}\right)^2$ Cross sectional area

$v_1 := \frac{Q}{A_1}$ v = velocity

$v_1 = 1.7fps$ Velocity of force main with d = 10 in

$d_2 := 8in$ Second guess of diameter of force main

$A_2 := \pi\left(\frac{d_2}{2}\right)^2$ Cross sectional area

$v_2 := \frac{Q}{A_2}$ v = velocity

$v_2 = 2.7fps$ Velocity of force main with d = 8 in

$d := d_2$ $v := v_2$

The force main will be $d = 8.0in$ and $v = 2.7fps$.

Wet Well Volume

Assumptions:
Pumps: submersible, θ = 4 min/start

$cycle := 4min$ θ = 4 min/start

$n := 2$ n = number of pumps

Calculations:

$$Volume := \frac{cycle\cdot\left(\frac{Q}{n-1}\right)}{4}$$

$Volume = 416.7gal$ $Volume = 55.7ft^3$

$volume_{height} := 5ft$

$volume_{width} := 3ft$

$$volume_{length} := \frac{Volume}{volume_{height}\cdot volume_{width}}$$

$volume_{length} = 3.7ft$

$wet\_well_{height} := volume_{height} + 5ft$ $wet\_well_{height} = 10.0ft$

$wet\_well_{length} := volume_{length} + 5ft$ $wet\_well_{length} = 9ft$

$wet\_well_{width} := volume_{width} + 5ft$ $wet\_well_{width} = 8.0ft$

The wet well $Volume = 55.7ft^3$ and the proposed dimensions are $wet\_well_{length} = 8.7ft$, $wet\_well_{width} = 8.0ft$ and $wet\_well_{height} = 10.0ft$. Two pumps will be installed and there will be space for one additional pump for expansion.

Pump Check

Assumptions:

$FM := 400ft$ Length of force main

$SH := 30ft$ Static Head

$C_{new} := 140$ Hazen William Constant for new pipes

Calculations:

$$H_{L\_new} := 10.44\frac{s^{1.85}}{m^{0.68}}\cdot FM\cdot\left(\frac{Q^{1.85}}{C_{new}^{1.85}\cdot d^{4.87}}\right)$$

$H_{L\_new} = 1ft$ Head Loss for new FM

$C_{old} := 100$

$$H_{L\_old} := 10.44\frac{s^{1.85}}{m^{0.68}}\cdot FM\cdot\left(\frac{Q^{1.85}}{C_{old}^{1.85}\cdot d^{4.87}}\right)$$

$H_{L\_old} = 2ft$ Head Loss for old FM

$TDH_{new} := SH + 1.25H_{L\_new}$

$TDH_{new} = 32ft$ Total Dynamic Head for new pipe

$TDH_{old} := SH + 1.25H_{L\_old}$

$TDH_{old} = 33\,ft$ Total Dynamic Head for old pipe

The pumps need to be rated at $Q = 417\,gpm$ and $TDH_{old} = 33\,ft$

$weight\_water := 8.35\,\frac{lb}{gal}$

$Q_{weight} := Q \cdot weight\_water$

$Q_{weight} = 3479\,\frac{lb}{min}$

$hp_{conv} := 33000\,\frac{\frac{ft \cdot lb}{min}}{hp}$

$hyd_{hp} := \frac{Q_{weight} \cdot TDH_{old}}{hp_{conv}}$

$hyd_{hp} = 3.5\,hp$

$pump_{eff} := 75\%$

$motor_{eff} := 95\%$

$brakehp := \frac{hyd_{hp}}{pump_{eff}}$

$brakehp = 5\,hp$

$Electrical\_hp\_input := \frac{brakehp}{motor_{eff}}$

$Electrical\_hp\_input = 5\,hp$

$KW\_input := \frac{brakehp}{motor_{eff}}$

$KW\_input = 3.6\,kW$

Conclusion:

These results are for an engineering report. Further calculations are needed during the design phase. Two pumps are needed for this pump station. The two pumps will be in series and each pump will be rated at 425 gpm and 35ft of head. One pump will be in service and one will be on standby. The force main is estimated to be 400 ft and have a diameter of 8 in. Only the design flow will be pumped; all peak flows will be sent to the injection wells. The pump station will have a wet and a dry well. The pumps will be submersible with 15 starts per hour. The active wet well volume is 56 ft^3. The total dynamic head is estimated to be 32 ft when the pipe is new and 33 ft when the pipe is old. The power needed to run the pumps is 4 kW.

Zenon Membrane Sizing

$mgd := \frac{gal}{day} \cdot 10^6$ $sf := ft^2$ $gpd := \frac{gal}{day}$

1 spare cassette per train:

$Q_{design} := 0.3mgd$

$Cas_{on\_duty\_tank} := 3$ 5 cassettes per tank (3 on duty & 2 spare)

$Mod_{cas} := 48$ Modules per cassette

$SA_{mod} := 340sf$

$SA_{cas} := Mod_{cas} \cdot SA_{mod}$

$SA_{cas} = 16320\,sf$

$SA_{tank} := Cas_{on\_duty\_tank} \cdot SA_{cas}$ $SA_{tank} = 48960\,sf$

$Flux_{design} := \frac{Q_{design}}{SA_{tank}}$ $Flux_{design} = 6.1\,\frac{gpd}{sf}$

$Flux_{zenon} := 6.1\,\frac{gpd}{sf}$

5 cassettes (3 online and 2 standbay) are needed for each 0.3 mgd MBRs. There will be two 0.3 mgd MBRs for the design flow of 0.6 mgd.

Calculating Evapotranspiration

Objective:
This calculation is used to determine the amount of irrigationland needed for the 0.6 mgd WWTP.

Assumptions:
Maalaea Area is Station Number 310.10 in "Pan Evaporation: State of Hawaii, 1894-1983."
Grass will be irrigated
Grass evapotranspiration is 100% of pan evaporation.

Calculations

$$pan\_evap := 96.4 \frac{in}{yr}$$

$$pan\_evap = 7167 \frac{gal}{acre \cdot day}$$

$$flow := 0.6mgd$$

$$estimate := \frac{flow}{pan\_evap}$$

$$estimate = 83.7\,acre$$

Conclusions:
Approximately 84 acres of agricultural land is needed for irrigation.

Appendix D: Developmental Cost Estimates

PROPOSED EQ BASIN
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 160,000 GPD EQ BASIN 53,000 Install cost factor 2 106,000
2 STRUCTURE BURIED CONC
3 FOUR (4) PUMPS AND VFD CONTROLS
4 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL AND SLUDGE HANDLING SYSTEMS
5 INSTALL COST DOES NOT INCLUDE TAXES AND SHIPPING COST TO HAWAII

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
EQ BASIN										
CONCRETE		120	CY	$750	$90,000	$0	$0	$0	$0	$90,000
MIXING SYSTEM		2	EA	$106,000	$212,000	$0	$0	$6,360	$0	$218,360
VFD		4	EA	$20,000	$80,000	$0	$0	$2,400	$0	$82,400
CONCRETE PAD FOR TANKS		8	CY	$150	$1,200	$0	$0	$0	$0	$1,200
SCADA EQUIPMENT		1	LS	$5,000	$5,000	$0	$0	$0	$0	$5,000
COVERS SURGE BASINS		2	EA	$75,000	$150,000	$0	$0	$0	$0	$150,000
CONTROLS		1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
Subtotal 1					$543,200	$0	$0	$8,910	$0	$552,110
Plant-wide Systems										
Miscellaneous Piping	5%		LS	-	$27,160	$0	$0	$815	$0	$27,975
Electrical	10%		LS	-	$54,320	$0	$0	$1,630	$0	$55,950
Instrumentation	10%		LS	-	$54,320	$0	$0	$1,630	$0	$55,950
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	5%		LS	-	$27,160	$0	$0	$815	$0	$27,975
Subtotal 2					$162,960	$0	$0	$4,889	$0	$167,850
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $0.72 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.1	HR	80	8	2,920
Electricity	450	KWH	0.20	90	32,850
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Equipment Maintenance	1	LS	10	10	3,650

TOTAL ANNUAL O&M COST ----> $0.04 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$0.6 million

TOTAL PRESENT WORTH ----> $1.3 million

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PROPOSED HEADWORKS FACILITY
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 600,000 GPD UNIT . EQUIPMENT FOB COST--->
2 STRUCTURE 316 SS
3 ONE (1) INTEGRATED SCREENING SYSTEMS (INCLUDES FINE SCREEN, WASHER, AND COMPA($200,000 Install cost factor 1.5 $300,000
4 ONE (1) INTEGRATED GRIT REMOVAL SYSTEMS (INCLUDES CLASSIFIER, WASHER, AND COMI $200,000 Install cost factor 1.5 $300,000
5 NEW TANKS WILL BE ABOVE GRADE
6 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL AND SLUDGE HANDLING SYSTEMS
7 INSTALL COST INCLUDES SHIPPING COST TO HAWAII AND FIELD WELD OF STRUCTURE

CAPITAL COSTS

ITEM

Component Costs (Installed)		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 0.0	PRIME MARKUP 0%	ITEM COST
HEADWORKS FACILITY										
CONCRETE PAD		33	CY	$150	$5,000	$0	$0	150.0	$0	$5,150
FINE SCREEN		1	LS	$300,000	$300,000	$0	$0	9000.0	$0	$309,000
GRIT REMOVAL		1	LS	$300,000	$300,000	$0	$0	9000.0	$0	$309,000
ODOR CONTROL SYSTEM		1	LS	$50,000	$50,000	$0	$0	1500.0	$0	$51,500
SCADA		1	LS	$5,000	$5,000	$0	$0	150.0	$0	$5,150
Subtotal 1					$660,000	$0	$0	19800.0	$0	$679,800
Plant-wide Systems										
Miscellaneous Piping	5%		LS	-	$33,000	$0	$0	990.0	$0	$33,990
Electrical	10%		LS	-	$65,000	$0	$0	1980.0	$0	$67,980
Instrumentation	1%		LS	-	$6,600	$0	$0	198.0	$0	$6,798
Landscaping	0.0%		LS	-	$0	$0	$0	0.0	$0	$0
Site Preparation	10%		LS	-	$66,000	$0	$0	1980.0	$0	$67,980
Subtotal 2					$171,600	$0	$0	5148.0	$0	$176,748
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $0.9 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	1	HR	80	80	29,200
Electricity	540	KWH	0.20	108	39,420
Water	25	1000 GAL	2.00	50	18,250
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Equipment Maintenance	1	LS	10	10	3,650

TOTAL ANNUAL O&M COST ----> $0.09 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$1.3 million

TOTAL PRESENT WORTH ----> $2.2 million

PROPOSED MEMBRANE BIOREACTOR (MBR)
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 600,000 GPD UNIT . EQUIPMENT FOB COST---> $ 2,500,000 Install Cost Factor 1.5 $ 3,750,000
2 STRUCTURE: STEEL
3 FOUR (4) MEMBRANE CELL TANKS
4 PROCESS EQUIPMENT PUMPS, BLOWERS, CONTROL VALVES, PLC CONTROLS, INSTRUMENTS, BLEACH FEED SYSTEM, ETC. ARE INCLUDED IN THE ABOVE COST
5 COST INCLUDES AERATION TANK AND BLOWERS
6 NEW TANKS WILL BE ABOVE GRADE
7 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL AND SLUDGE HANDLING SYSTEMS
8 INSTALL COST INCLUDES SHIPPING COST TO HAWAII AND FIELD WELD OF STRUCTURE

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL/ DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
MBR MEMBRANE CELL TANKS										
MEMBRANES	60%	1	LS	$2,250,000	$2,250,000	$0	$0	$67,500	$0	$2,317,500
PROCESS EQUIPMENT	40%	1	LS	$1,500,000	$1,500,000	$0	$0	$45,000	$0	$1,545,000
TANKS		121	CY	$750	$90,667	$0	$0	$2,720	$0	$93,387
SCADA EQUIPMENT		1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
ANOXIC TANK (CONCRETE)		233	CY	$750	$174,444	$0	$0	$5,233	$0	$179,678
AERATION TANK (CONCRETE)		333	CY	$750	$249,556	$0	$0	$7,487	$0	$257,042
Subtotal 1					$4,269,667	$0	$0	$128,090	$0	$4,397,757
Plant-wide Systems										
Miscellaneous Piping	10%		LS	-	$426,967	$0	$0	$12,809	$0	$439,776
Electrical	10%		LS	-	$426,967	$0	$0	$12,809	$0	$439,776
Instrumentation	10%		LS	-	$426,967	$0	$0	$12,809	$0	$439,776
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	10%		LS	-	$426,967	$0	$0	$12,809	$0	$439,776
Subtotal 2					$1,707,867	$0	$0	$51,236	$0	$1,759,104
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $6.2 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	3.0	HR	80	240	87,600
Electricity	1,800	KWH	0.20	360	131,400
Water	10	1000 GAL	2.00	20	7,300
NaOH		GPD	2.42	0	0
NaOCl/Polymers	10	GPD	1.65	17	6,023
NaHSO3		GPD	2.00	0	0
Equipment Maintenance	1	LS	10	10	3,650

TOTAL ANNUAL O&M COST ----> $0.24 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$3.5 million

TOTAL PRESENT WORTH ----> $9.7 million

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PROPOSED SLUDGE TANKS
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 600,000 GPD EQUIPMENT - EQUIPMENT COST $ 75,000 Install Cost Factor 1.5 $ 112,500
2 STRUCTURE: CONCRETE
3 ONE (1) AEROBIC DIGESTER TANKS WITH HYDRAULIC JET MIXERS
4 NEW TANKS WILL BE ABOVE GRADE
5 SCADA SYSTEM
6 INSTALL COST INCLUDES SHIPPING COST TO HAWAII
7 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL
8 INSTALL COST INCLUDES SHIPPING COST TO HAWAII

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL/ DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
SLUDGE TANK										
CONCRETE		105	CY	$750	$78,444	$0	$0	$2,353	$0	$80,798
COVER		2	EA	$20,000	$40,000	$0	$0	$1,200	$0	$41,200
MIXER/DIFFUSERS		2	EA	$112,500	$225,000	$0	$0	$6,750	$0	$231,750
SLUDGE FEED PUMPS		2	EA	$25,000	$50,000	$0	$0	$1,500	$0	$51,500
SCADA		1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
Subtotal 1					$398,444	$0	$0	$11,953	$0	$410,398
Plant-wide Systems										
Miscellaneous Piping	5%		LS	-	$19,922	$0	$0	$598	$0	$20,520
Electrical	8%		LS	-	$31,876	$0	$0	$956	$0	$32,832
Instrumentation	5%		LS	-	$19,922	$0	$0	$598	$0	$20,520
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	5%		LS	-	$19,922	$0	$0	$598	$0	$20,520
Subtotal 2					$91,642	$0	$0	$2,749	$0	$94,392
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $0.5 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	2	HR	80	160	58,400
Electricity	540	KWH	0.20	108	39,420
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Equipment Maintenance	1	LS	10	10	3,650

TOTAL ANNUAL O&M COST ----> $0.10 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$1.5 million

TOTAL PRESENT WORTH ----> $2.0 million

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PROPOSED UV DISINFECTION SYSTEM FOR R-1 APPLICATIONS
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 600,000 GPD EQUIPMENT - EQUIPMENT COST $ 400,000 Install Cost Factor 1.5 $ 600,000
2 STRUCTURE: 316 STEEL TANK
3 FOUR (4) UV BANKS - HORIZONTAL LOW PRESS - HIGH INTENSITY
4 NEW TANKS WILL BE ABOVE GRADE
5 SCADA SYSTEM
6 INSTALL COST INCLUDES SHIPPING COST TO HAWAII
7 CHLORINATION SYSTEM TO CONTROL REGROWTH OF BACTERIA AND ALGAE

CAPITAL COSTS

ITEM	QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)									
NEW UV DISINFECTION SYSTEM									
CONCRETE	32	CY	$750	$23,833	$0	$0	$715	$0	$24,545
UV EQUIPMENT & SS TANK	1	LS	$600,000	$600,000	$0	$0	$18,000	$0	$618,000
PUMPS	1	LS	$50,000	$50,000	$0	$0	$1,500	$0	$51,500
CHLORINATION SYSTEM	1	LS	$55,725	$55,725	$0	$0	$1,672	$0	$57,397
SCADA	1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
Subtotal 1				$734,558	$0	$0	$22,037	$0	$756,595
Plant-wide Systems									
Miscellaneous Piping	5%	LS	-	$36,728	$0	$0	$1,102	$0	$37,830
Electrical	8%	LS	-	$58,765	$0	$0	$1,763	$0	$60,528
Instrumentation	5%	LS	-	$36,728	$0	$0	$1,102	$0	$37,830
Landscaping	0.0%	LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	5%	LS	-	$36,728	$0	$0	$1,102	$0	$37,830
Subtotal 2				$168,948	$0	$0	$5,068	$0	$174,018
Non-Construction Costs									
Planning & Design		LS	-						
Services During Construction		LS	-						
Construction Management		LS	-						
Contingency	0%	LS	-						$0
Subtotal 3									$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ---> $0.9 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	2	HR	80	160	58,400
Electricity	576	KWH	0.20	115	42,048
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers	75	GPD	4.00	300	109,500
NaHSO3		GPD	2.00	0	0
Steel tank maintenance	1	LS	50	50	18,250
Lamp replacement	0.153	EA	200	31	11,200
Equipment Maintenance	1	LS	10	10	3,650

TOTAL ANNUAL O&M COST ---> $0.24 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$3.6 million

TOTAL PRESENT WORTH ---> $4.5 million

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CHLORINATION
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 2.0 MGD DISINFECTION SYSTEM
2 TYPE: HYPOCHLORITE 12.5%
3 New CHLORINE CONTACT TANK 120 MINUTES
4
5

CAPITAL COSTS

ITEM	QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)									
DISINFECTION SYSTEM									
CHEMICAL FEED PUMPS	3	EA	$35,000	$105,000	$0	$0	$3,150	$0	$108,150
RESIDUAL METER	1	EA	$50,000	$50,000	$0	$0	$1,500	$0	$51,500
MIXER	2	EA	$100,000	$200,000	$0	$0	$6,000	$0	$206,000
CONCRETE	185	CY	$750	$138,778	$0	$0	$4,163	$0	$142,941
Subtotal 1			$185,750	$493,778	$0	$0	$14,813	$0	$508,591
Plant-wide Systems									
Miscellaneous Piping	10%	LS	-	$49,378	$0	$0	$1,481	$0	$50,859
Electrical	10%	LS	-	$49,378	$0	$0	$1,481	$0	$50,859
Instrumentation	10%	LS	-	$49,378	$0	$0	$1,481	$0	$50,859
Landscaping	0.0%	LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	10%	LS	-	$49,378	$0	$0	$1,481	$0	$50,859
Subtotal 2				$197,511	$0	$0	$5,925	$0	$203,436
Non-Construction Costs									
Planning & Design		LS	-						
Services During Construction		LS	-						
Construction Management		LS	-						
Contingency	0%	LS	-						$0
Subtotal 3									$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ---> $0.71 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.1	HR	80	8	2,920
Electricity	9	KWH	0.29	3	953
Water	10	1000 GAL	2.00	20	7,300
NaOH		GPD	5.00	0	0
NaOCl/Polymers	250	GPD	4.00	1,000	365,000
NaHSO3		GPD	4.00	0	0
Sewer Maintenance		LF	0.20	0	0
Repair and Replacement	1	LS	50	50	18,250

TOTAL ANNUAL O&M COST ---> $0.38 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$5.60 million

TOTAL PRESENT WORTH ---> $6.31 million

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PROPOSED SLUDGE DEWATERING
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 600,000 GPD EQUIPMENT - EQUIPMENT COST $ 300,000 Install Cost Factor 1.5 $ 450,000
2 STRUCTURE: EQUIPMENT INSTALLED IN A CARPORT BLDG
3 ONE (1) DEWATERING UNIT
4 SCADA SYSTEM
5 INSTALL COST INCLUDES SHIPPING COST TO HAWAII
6 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
SLUDGE HANDLING FACILITY										
DEWATERING UNIT		1	EA	$450,000	$450,000	$0	$0	$13,500	$0	$463,500
PUMPS		1	LS	$50,000	$50,000	$0	$0	$1,500	$0	$51,500
BLDG FOR SLUDGE FACILITY		4,800	SF	$125	$600,000	$0	$0	$18,000	$0	$618,000
SCADA		1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
Subtotal 1					$1,105,000	$0	$0	$33,150	$0	$1,138,150
Plant-wide Systems										
Miscellaneous Piping	5%		LS	-	$55,250	$0	$0	$1,658	$0	$56,908
Electrical	8%		LS	-	$88,400	$0	$0	$2,652	$0	$91,052
Instrumentation	5%		LS	-	$55,250	$0	$0	$1,658	$0	$56,908
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	5%		LS	-	$55,250	$0	$0	$1,658	$0	$56,908
Subtotal 2					$254,150	$0	$0	$7,625	$0	$261,776
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $1.4 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	4	HR	80	320	116,800
Electricity	120	KWH	0.20	36	13,140
Water	75	1000 GAL	2.00	150	54,750
NaOH		GPD	2.42	0	0
NaOCl/Polymers	50	GPD	1.65	83	30,113
NaHSO3		GPD	2.00	0	0
Equipment maintenance	1	LS	10	10	3,650

TOTAL ANNUAL O&M COST ----> $0.22 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$3.3 million

TOTAL PRESENT WORTH ----> $4.6 million

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PROPOSED ONE STORY CONTROL, LABORATORY, OFFICE, AND MAINTENANCE BUILDING
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 BUILDING INCLUDES RESTROOMS, SHOWER, LOCKER ROOMS, MAINTENANCE AREA, OFFICES, SCADA ROOM, LABORATORY, AND PARKING SPACES.
2
3
4
5
6

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
BLDG		4,200	SF	$125	$525,000	$0	$0	$15,750	$0	$540,750
SCADA		1	LS		$50,000	$0	$0	$1,500	$0	$51,500
Subtotal 1					$575,000	$0	$0	$17,250	$0	$592,250
Plant-wide Systems										
Miscellaneous Piping	5%		LS	-	$28,750	$0	$0	$863	$0	$29,613
Electrical	8%		LS	-	$46,000	$0	$0	$1,380	$0	$47,380
Instrumentation	5%		LS	-	$28,750	$0	$0	$863	$0	$29,613
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	5%		LS	-	$28,750	$0	$0	$863	$0	$29,613
Subtotal 2					$132,250	$0	$0	$3,968	$0	$136,219
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $0.7 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	4	HR	80	320	116,800
Electricity	36	KWH	0.20	7	2,628
Water	2	1000 GAL	2.00	4	1,460
NaOH		GPD	2.42	0	0
NaOCl/Polymers	0	GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Equipment maintenance	0	LS	10	0	0

TOTAL ANNUAL O&M COST ----> $0.12 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$1.8 million

TOTAL PRESENT WORTH ----> $2.5 million

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PROPOSED SBR ACTIVATED SLUDGE PROCESS
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 600,000 GPD UNIT , EQUIPMENT FOB COST---> $ 685,714 Install Cost Factor 2.0 $ 1,371,428
2 STRUCTURE. CONCRETE JET TECH
4 TWO (2) SBR TANKS
5 NEW TANKS WILL BE ABOVE GRADE
6 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL AND SLUDGE HANDLING SYSTEMS
7 INSTALL COST INCLUDES SHIPPING COST TO HAWAII
8 COST BELOW INCLUDES LAND ACQUISITION COST

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
SEQUENCING BATCH REACTORS										
CONCRETE		1,134	CF	$750	$850,778	$0	$0	$0	$0	$850,778
SBR EQUIPMENT		1	LS	$1,371,428	$1,371,428	$0	$0	$41,143	$0	$1,412,571
EFFLUENT PUMPS		1	LS	$50,000	$50,000	$0	$0	$1,500	$0	$51,500
SCADA		1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
Subtotal 1					$2,277,206	$0	$0	$42,793	$0	$2,319,999
Plant-wide Systems										
Miscellaneous Piping	10%		LS	-	$227,721	$0	$0	$6,832	$0	$234,552
Electrical	30%		LS	-	$683,162	$0	$0	$20,495	$0	$703,657
Instrumentation	15%		LS	-	$341,581	$0	$0	$10,247	$0	$351,828
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	10%		LS	-	$227,721	$0	$0	$6,832	$0	$234,552
Subtotal 2					$1,480,184	$0	$0	$44,406	$0	$1,524,589
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) -----> $3.8 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST	
Labor	4	HR	80	320	116,800	
Electricity	2,700	KWH	0.20	540	197,100	
Water	10	1000 GAL	2.00	20	7,300	
NaOH		GPD	2.42	0	0	
NaOCl/Polymers	100	GPD	1.65	165	60,225	15 mg/L dosage
NaHSO3		GPD	2.00	0	0	
Equipment Maintenance	1	LS	10	10	3,650	

TOTAL ANNUAL O&M COST -----> $0.39 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$5.7 million

TOTAL PRESENT WORTH -----> $9.6 million

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PROPOSED MODIFICATIONS TO R-1 EFFLUENT PUMPS AND SAND FILTER
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 600,000 GPD DISINFECTION SYSTEM $300,000 Install Cost Factor 2.0 $ 600,000
2 TYPE: UPFLOW SAND FILTER W/ AUTOMATIC BACKWASH
3
4
5
6
7
8

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
PUMPS AND SAND FILTERS										
CONCRETE		45	CY	$750	$33,833	$0	$0	$1,015	$0	$34,848
FEED PUMPS		1	LS	$75,000	$75,000	$0	$0	$2,250	$0	$77,250
EFFLUENT PUMPS		1	LS	$75,000	$75,000	$0	$0	$2,250	$0	$77,250
SAND FILTER EQUIPMENT		1	EA	$600,000	$600,000	$0	$0	$18,000	$0	$618,000
SCADA		1	LS		$5,000	$0	$0	$150	$0	$5,150
Subtotal 1					$788,833	$0	$0	$23,665	$0	$812,498
Plant-wide Systems										
Miscellaneous Piping	10%		LS	-	$78,883	$0	$0	$2,367	$0	$81,250
Electrical	10%		LS	-	$78,883	$0	$0	$2,367	$0	$81,250
Instrumentation	5%		LS	-	$39,442	$0	$0	$1,183	$0	$40,625
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	5%		LS	-	$39,442	$0	$0	$1,183	$0	$40,625
Subtotal 2					$236,650	$0	$0	$7,100	$0	$243,750
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $1.056 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.50	HR	80	40	14,600
Electricity	360	KWH	0.20	72	26,280
Water		1000 GAL	2.00	0	0
NaOH	0	GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Equipment Maintenance	1	LS	20	20	7,300

TOTAL ANNUAL O&M COST ----> $0.0482 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$0.717 million

TOTAL PRESENT WORTH ----> $1.773 million

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PROPOSED GRAVITYLINES
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 2.0 MGD UNIT : CUSTOM DESIGN
2 INSTALL COST INCLUDES SHIPPING COST TO HAWAII
3 35,000 LF OF GRAVITY SEWERS
4 8 IN GRAVITY SEWERLINES
5 MANHOLES EVERY 350 FT

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
8 INCH GRAVITY SEWERLINES		35,000	LF	$150	$5,250,000	$0	$0	$157,500	$0	$5,407,500
ECC. MANHOLES		100	EA	$10,000	$1,000,000	$0	$0	$30,000	$0	$1,030,000
Subtotal 1					$6,250,000	$0	$0	$187,500	$0	$6,437,500
Plant-wide Systems										
Miscellaneous Piping	10%		LS	-	$625,000	$0	$0	$18,750	$0	$643,750
Electrical	10%		LS	-	$625,000	$0	$0	$18,750	$0	$643,750
Instrumentation	10%		LS	-	$625,000	$0	$0	$18,750	$0	$643,750
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	10%		LS	-	$625,000	$0	$0	$18,750	$0	$643,750
Subtotal 2					$2,500,000	$0	$0	$75,000	$0	$2,575,000
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $9.01 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	5.00	HR	80	80	29,200
Electricity	0	KWH	0.20	0	0
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Other	1	LS	20	20	7,300
SEWER CLEANING/INSPECTION	3,500	LF	0.20	700	255,500

TOTAL ANNUAL O&M COST ----> $0.29 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$4.34 million

TOTAL PRESENT WORTH ----> $13.36 million

PROPOSED PUMP STATION COST
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 2.0 MGD UNIT : CUSTOM DESIGN
2 STRUCTURE: CONCRETE TANK
3 ONE (1) WET WELL & ONE (1) DRY WELL (SAME SIZE)
4 SUBMERSIBLE PUMPS
5 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL AND SLUDGE HANDLING SYSTEMS
6 INSTALL COST INCLUDES SHIPPING COST TO HAWAII

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
MISC PUMP STATION										
CONCRETE		58	CY	$750	$43,667	$0	$0	$1,310	$0	$44,977
PUMPS		2	EA	$100,000	$200,000	$0	$0	$6,000	$0	$206,000
CONTROLS		1	LS	$10,000	$10,000	$0	$0	$300	$0	$10,300
FORCE MAIN		9,000	LF	$100	$900,000	$0	$0	$27,000	$0	$927,000
EMERGENCY GENERATOR										
PACKAGE EG		1	EA	$100,000	$100,000	$0	$0	$0	$0	$100,000
CONCRETE		27	CY	$750	$20,222	$0	$0	$0	$0	$20,222
FUEL TANK		1	EA	$15,000	$15,000	$0	$0	$0	$0	$15,000
Subtotal 1					$1,288,889	$0	$0	$34,610	$0	$1,323,499
Plant-wide Systems										
Miscellaneous Piping	10%		LS	-	$128,889	$0	$0	$3,867	$0	$132,756
Electrical	10%		LS	-	$128,889	$0	$0	$3,867	$0	$132,756
Instrumentation	10%		LS	-	$128,889	$0	$0	$3,867	$0	$132,756
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	10%		LS	-	$128,889	$0	$0	$3,867	$0	$132,756
Subtotal 2					$515,556	$0	$0	$15,467	$0	$531,024
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $1.85 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.10	HR	80	8	2,920
Electricity	2,136	KWH	0.285	609	222,197
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Other	1	LS	20	20	7,300

TOTAL ANNUAL O&M COST ----> $0.23 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$3.46 million

TOTAL PRESENT WORTH ----> $5.31 million

PROPOSED R-1 PUMP STATION COST
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 2.0 MGD UNIT : CUSTOM DESIGN
2 STRUCTURE: CONCRETE TANK
3 ONE (1) WET WELL & ONE (1) DRY WELL (SAME SIZE)
4 SUBMERSIBLE PUMPS
5 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL AND SLUDGE HANDLING SYSTEMS
6 INSTALL COST INCLUDES SHIPPING COST TO HAWAII

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
MISC PUMP STATION										
CONCRETE		44	CY	$750	$33,333	$0	$0	$1,000	$0	$34,333
PUMPS		2	EA	$100,000	$200,000	$0	$0	$6,000	$0	$206,000
CONTROLS		1	LS	$10,000	$10,000	$0	$0	$300	$0	$10,300
FORCE MAIN		400	LF	$100	$40,000	$0	$0	$1,200	$0	$41,200
EMERGENCY GENERATOR										
PACKAGE EG		1	EA	$100,000	$100,000	$0	$0	$0	$0	$100,000
CONCRETE		27	CY	$750	$20,222	$0	$0	$0	$0	$20,222
FUEL TANK		1	EA	$15,000	$15,000	$0	$0	$0	$0	$15,000
Subtotal 1					$418,556	$0	$0	$8,500	$0	$427,055
Plant-wide Systems										
Miscellaneous Piping	10%		LS	-	$41,856	$0	$0	$1,256	$0	$43,111
Electrical	10%		LS	-	$41,856	$0	$0	$1,256	$0	$43,111
Instrumentation	10%		LS	-	$41,856	$0	$0	$1,256	$0	$43,111
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	10%		LS	-	$41,856	$0	$0	$1,256	$0	$43,111
Subtotal 2					$167,422	$0	$0	$5,023	$0	$172,444
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ——> $0.60 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.10	HR	80	8	2,920
Electricity	96	KWH	0.20	19	7,008
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Other	1	LS	20	20	7,300

TOTAL ANNUAL O&M COST ——> $0.02 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$0.26 million

TOTAL PRESENT WORTH ——> $0.86 million

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PROPOSED R-1 DISTRIBUTION PUMP STATION COST
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 0.6 MGD UNIT : CUSTOM DESIGN
2 STRUCTURE: CONCRETE TANK
3 ONE DRY WELL, NO WET WELL IS NEEDED BECAUSE OF THE RECYCLE WATER RESERVOIR
4 SUBMERSIBLE PUMPS
5 COST ABOVE DOES NOT INCLUDE NOISE AND ODOR CONTROL AND SLUDGE HANDLING SYSTEMS
6 INSTALL COST INCLUDES SHIPPING COST TO HAWAII

CAPITAL COSTS

ITEM		QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)										
MISC PUMP STATION										
CONCRETE		22	CY	$750	$16,667	$0	$0	$500	$0	$17,167
PUMPS		2	EA	$100,000	$200,000	$0	$0	$6,000	$0	$206,000
CONTROLS		1	LS	$10,000	$10,000	$0	$0	$300	$0	$10,300
FORCE MAIN (SEE IRRIGATION)			LF	$100	$0	$0	$0	$0	$0	$0
EMERGENCY GENERATOR										
PACKAGE EG		1	EA	$100,000	$100,000	$0	$0	$0	$0	$100,000
CONCRETE		27	CY	$750	$20,222	$0	$0	$0	$0	$20,222
FUEL TANK		1	EA	$15,000	$15,000	$0	$0	$0	$0	$15,000
Subtotal 1					$361,889	$0	$0	$6,800	$0	$368,689
Plant-wide Systems										
Miscellaneous Piping	10%		LS	-	$36,189	$0	$0	$1,086	$0	$37,275
Electrical	10%		LS	-	$36,189	$0	$0	$1,086	$0	$37,275
Instrumentation	10%		LS	-	$36,189	$0	$0	$1,086	$0	$37,275
Landscaping	0.0%		LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	10%		LS	-	$36,189	$0	$0	$1,086	$0	$37,275
Subtotal 2					$144,756	$0	$0	$4,343	$0	$149,100
Non-Construction Costs										
Planning & Design			LS	-						
Services During Construction			LS	-						
Construction Management			LS	-						
Contingency	0%		LS	-						$0
Subtotal 3										$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ——> $0.52 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.10	HR	80	8	2,920
Electricity	480	KWH	0.20	96	35,040
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Other	1	LS	20	20	7,300

TOTAL ANNUAL O&M COST ——> $0.05 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$0.67 million

TOTAL PRESENT WORTH ——> $1.19 million

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PROPOSED IRRIGATION AREA
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 85 ACRES OF SPRAY IRRIGATION
2 APPLICATION RATE 7,167 GPD/ACRE
3 40,000 LF OF PIPING

CAPITAL COSTS

ITEM	QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)									
IRRIGATION SYSTEM									
PIPING	40,000	LF	$100	$4,000,000	$0	$0	$120,000	$0	$4,120,000
SPRAY IRRIGATION	1	LS	$20,000	$20,000	$0	$0	$600	$0	$20,600
CONTROLS	1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
Subtotal 1				$4,025,000	$0	$0	$120,750	$0	$4,145,750
Plant-wide Systems									
Miscellaneous Piping	5%	LS	-	$201,250	$0	$0	$6,038	$0	$207,288
Electrical	8%	LS	-	$322,000	$0	$0	$9,660	$0	$331,660
Instrumentation	5%	LS	-	$201,250	$0	$0	$6,038	$0	$207,288
Landscaping	0.5%	LS	-	$20,125	$0	$0	$604	$0	$20,729
Site Preparation	10%	LS	-	$402,500	$0	$0	$12,075	$0	$414,575
Subtotal 2				$1,147,125	$0	$0	$34,414	$0	$1,181,540
Non-Construction Costs									
Planning & Design		LS	-						
Services During Construction		LS	-						
Construction Management		LS	-						
Contingency	0%	LS	-						$0
Subtotal 3									$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ——> $5.327 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.1	HR	80	8	2,920
Electricity		KWH	0.20	0	0
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Maintenance	4,000	LF	0.20	800	292,000

TOTAL ANNUAL O&M COST ——> $0.295 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$4.388 million

TOTAL PRESENT WORTH ——> $9.715 million

P:\Projects\Maui\60003632_Maalaea_WWTP\400 Tech_Support\405_Cost_Estimate\[2006_6_12_MML_CostEstimate_BS.xls]LookupTable

PROPOSED RECYCLE WATER RESERVOIR
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 1.4 MGD TANK
2 STRUCTURE: EPOXY COATED BOLTED CARBON STEEL TANK WITH AQUASTOR ALUMINUM DOME ROOF
3 INSTALL COST DOES NOT INCLUDE TAXES AND SHIPPING COST TO HAWAII

CAPITAL COSTS

ITEM	QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)									
BOLTED STEEL TANK	1		$1,100,000	$1,100,000	$0	$0	$33,000	$0	$1,133,000
Subtotal 1				$1,100,000	$0	$0	$33,000	$0	$1,133,000
Plant-wide Systems									
Miscellaneous Piping	5%	LS	-	$55,000	$0	$0	$1,650	$0	$56,650
Electrical	10%	LS	-	$110,000	$0	$0	$3,300	$0	$113,300
Instrumentation	10%	LS	-	$110,000	$0	$0	$3,300	$0	$113,300
Landscaping	0.0%	LS	-	$0	$0	$0	$0	$0	$0
Site Preparation	5%	LS	-	$55,000	$0	$0	$1,650	$0	$56,650
Subtotal 2				$330,000	$0	$0	$9,900	$0	$339,900
Non-Construction Costs									
Planning & Design		LS	-						
Services During Construction		LS	-						
Construction Management		LS	-						
Contingency	0%	LS	-						$0
Subtotal 3									$0

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) —— $1.47 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.1	HR	80	8	2,920
Electricity	0	KWH	0.20	0	0
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers		GPD	1.65	0	0
NaHSO3		GPD	2.00	0	0
Equipment Maintenance	0	LS	10	0	0

TOTAL ANNUAL O&M COST ——> $0.00 million

20-YEAR PRESENT WORTH

Interest rate	6%	
Inflation rate	3%	
Number of years	20	
Present worth of O&M		$0.04 million

TOTAL PRESENT WORTH ——> $1.5 million

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PROPOSED INJECTION WELLS FOR BACKUP EFFLUENT DISPOSAL
CAPITAL AND OPERATION & MAINTENANCE COSTS FOR PLANNING PURPOSES

ASSUMPTIONS

1 1.4 MGD WELLS
2 INJECTION WELLS WITH CASING

CAPITAL COSTS

ITEM	QUAN	UNIT	UNIT COST	BARE COST	SUB OH & PROFIT 0%	PRIME OH & PROFIT 0%	MOBIL / DEMOB 3%	PRIME MARKUP 0%	ITEM COST
Component Costs (Installed)									
INJECTION WELLS									
CONCRETE	595	CY	$750	$446,578	$0	$0	$13,397	$0	$459,975
WELLS	2	LS	$500,000	$1,000,000	$0	$0	$30,000	$0	$1,030,000
SCADA	1	LS	$5,000	$5,000	$0	$0	$150	$0	$5,150
Subtotal 1				$1,451,578	$0	$0	$43,547	$0	$1,495,125
Plant-wide Systems									
Miscellaneous Piping	5%	LS	-	$72,579	$0	$0	$2,177	$0	$74,756
Electrical	8%	LS	-	$116,126	$0	$0	$3,484	$0	$119,610
Instrumentation	5%	LS	-	$72,579	$0	$0	$2,177	$0	$74,756
Landscaping	0.5%	LS	-	$7,258	$0	$0	$218	$0	$7,476
Site Preparation	10%	LS	-	$145,158	$0	$0	$4,355	$0	$149,513
Subtotal 2				$413,700	$0	$0	$12,411	$0	$426,111
Non-Construction Costs									
Planning & Design		LS	-						
Services During Construction		LS	-						
Construction Management		LS	-						
Contingency	10%	LS	-						$192,124
Subtotal 3									$192,124

TOTAL CONSTRUCTION COST (Subtotal 1+Subtotal 2+Subtotal 3) ----> $2.1 million

ANNUAL OPERATION & MAINTENANCE (O&M) COSTS

ITEM	DAILY QUANT	UNIT	UNIT COST	DAILY COST	ANNUAL COST
Labor	0.1	HR	80	8	2,920
Electricity		KWH	0.20	0	0
Water		1000 GAL	2.00	0	0
NaOH		GPD	2.42	0	0
NaOCl/Polymers	10	GPD	1.65	17	6,023
NaHSO3		GPD	2.00	0	0

TOTAL ANNUAL O&M COST ----> $0.01 million

20-YEAR PRESENT WORTH

Interest rate	6%
Inflation rate	3%
Number of years	20
Present worth of O&M	$0.13 million

TOTAL PRESENT WORTH ----> $2.2 million

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Maalaea Existing (TMK 3-8-14)

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-001-0000	0.95		Apartment			
2-3-8-014-001-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-001-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0000	1.01		Apartment			
2-3-8-014-002-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0030		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-002-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0041		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0044		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-002-0045		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0000	2.59		Apartment			
2-3-8-014-004-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0041		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-004-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0044		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0045		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0046		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0047		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0048		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0049		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0050		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0051		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0052		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0053		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0054		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0055		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0056		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0057		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0058		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0059		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0060		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0061		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0062		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0063		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0064		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0065		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0066		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0067		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0068		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0069		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0070		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0071		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0072		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0073		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0074		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0075		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0076		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0077		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0078		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0079		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-004-0080		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-005-0000			Apartment			
2-3-8-014-008-0000	0.92	Residential	Apartment	7225	$809.93	$9,719
2-3-8-014-009-0000	0.84	Residential	Apartment	7225	$739.50	$8,874
2-3-8-014-011-0000	2.13		Apartment			
2-3-8-014-011-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0017		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-011-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0041		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0044		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0045		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0046		Condo-muluplex	Condominium	238	$29.00	$348
2-3-8-014-011-0047		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0048		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0049		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0050		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0051		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0052		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0053		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0054		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0055		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0056		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0057		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0058		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0059		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0060		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0061		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0062		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0063		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0064		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0065		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0066		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0067		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0068		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0069		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0070		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0071		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0072		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0073		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0074		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0075		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0076		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0077		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-011-0078		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0000	1.75		Apartment			
2-3-8-014-015-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0006		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-015-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0041		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0044		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0045		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0046		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0047		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0048		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0049		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0050		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0051		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0052		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0053		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0054		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0055		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0056		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0057		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0058		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0059		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0060		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0061		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0062		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0063		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-015-0064		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0065		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0066		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0067		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0068		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0069		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0070		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0071		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0072		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0073		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0074		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0075		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0076		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0077		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0078		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0079		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0080		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0081		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0082		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-015-0083		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0000	1.78		Apartment			
2-3-8-014-016-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0036		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-016-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0041		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0044		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0045		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0046		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-016-0047		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0000	2.29		Apartment			
2-3-8-014-021-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0041		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0044		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0045		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-021-0046		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0047		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0048		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0049		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0050		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0051		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0052		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0053		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0054		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0055		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0056		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0057		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0058		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0059		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0060		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0061		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0062		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0063		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0064		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0065		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0066		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0067		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0068		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0069		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0070		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0071		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0072		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0073		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0074		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0075		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0076		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0077		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0078		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-021-0079		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0000	1.24		Apartment			
2-3-8-014-022-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0010		Commercial	Hotel	1351.9	$16.39	$197
2-3-8-014-022-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0022		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-022-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0041		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-022-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0000	1.27		Apartment			
2-3-8-014-024-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0035		Condo-multiplex	Condominium	238	$29.00	$348

APN	Lot Acreage	Building Type	Land Use	ADWF	Monthly Revenue	Annual Revenue
2-3-8-014-024-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0040		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0041		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0042		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0043		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0044		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-024-0045		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0000	0.71	Industrial (nec)	Industrial (nec)	6035	$46.43	$557
2-3-8-014-026-0000	0.71		Apartment			
2-3-8-014-026-0001		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0002		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0003		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0004		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0005		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0006		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0007		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0008		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0009		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0010		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0011		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0012		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0013		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0014		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0015		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0016		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0017		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0018		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0019		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0020		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0021		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0022		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0023		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0024		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0025		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0026		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0027		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0028		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0029		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0030		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0031		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0032		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0033		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0034		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0035		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0036		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0037		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0038		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0039		Condo-multiplex	Condominium	238	$29.00	$348
2-3-8-014-026-0040		Commercial	Hotel	950.69	$14.35	$172
Total				156544	$17,925	$215,095

Maui County Sewer User Fees				
Description		Base	Additional 1,000 gal	
Single Family (up to 9,000 gal water consumed)		$18.00	$2.25	
Multi-Family (up to 6,000 gal water consumed)		$18.00	$2.25	
Flate rate per dwelling unit per month				
	Haliimaile	$8.50		
	Residential Carehomes	$56.00		
	Single Family (Private water system)	$34.50		
	Multi-Family (Private water system)	$29.00		
Non-Residential		$9.50	Single Meter	Dual Meter
	Commercial/Government/Religious		$3.62	4.5
	Hotel		$5.10	6.4
	Industrial/Food Service/Restaurant		$6.12	7.65

Future Maalaea Revenue

Lot	Area (acres)	Total Units	ADWF (gpd)	Monthly Revenue	Annual Revenue
Custom Lots	38	144	48960	$4,968	$59,616
Single Family Homes	80	355	120700	$12,248	$146,970
Single Family Patio Homes	23.5	164	55760	$5,658	$67,896
Town Homes 1 and 2 Story	7	100	23800	$2,900	$34,800
Senior Care Housing	6	60	14280	$3,360	$40,320
Apartments	11.5	126	29988	$3,654	$43,848
Park	15.0		6000		
Roads (includes ROW)	37.0				
Open Space	34.0				
Community Center	5.0		2000	$17	$201
Fire Station	1.0		3400	$17	$208
Wastewater Treatment Facility	2.0		23800	$146	$1,748
Total	**260**	**949**	**328,688**	**$32,967**	**$395,607**

Appendix E: Impacts of Proposed Injection Wells

IMPACT OF PROPOSED INJECTION WELLS ON WATER RESOURCES IN THE WAIKAPU AQUIFER SYSTEM, MAALAEA, MAUI

Prepared By

Mink & Yuen, Inc.

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Honolulu, Hawaii 96826

Prepared For

M & E Pacific, Inc.

100 Pauahi Street, Suite 207

Hilo, Hawaii 96720

July 2006

IMPACT OF PROPOSED INJECTION WELLS ON WATER RESOURCES IN THE WAIKAPU AQUIFER SYSTEM, MAALAEA, MAUI

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Hilo, Hawaii 96720

July 2006

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FIGURES

TABLES

Introduction

This report discusses the impact to groundwater resources by the disposal of treated R-1 effluent. Disposal will be by injection wells during peak wet weather flow (in the) Maalaea area of Maui. Maalaea Properties will develop lands located over the Waikapu Aquifer System as delineated by the Commission on Water Resource Management (CWRM). The Maalaea Mauka Wastewater Treatment Plant (WWTP) and at least three new injection wells will serve the proposed subdivision. The proposed site for injection wells is at 240± feet above mean sea level (ft., msl). An alternate site is at 150 ft., msl.

The State Department of Health (DOH) Underground Injection Control (UIC) program mandates injection wells because DOH believes that large, shallow disposal pits of wastewater will eventually discharge at the coastline, creating an environmental and health risk. Furthermore, the nature of the sedimentary material overlying the Maalaea property is clay-rich and more impermeable to large, shallow pits as a means of disposal

The plan calls for injecting a wet weather peak flow of 2.5 million gallons per day (mgd), or a flow rate of 1,750 gallons per minute (gpm). The estimated injection usage is at least once per month during the wet season (November through April) and once every three months for the dry season (May through October). The Injection period could be only a few hours to more than a day.

Average injection rate will be 800,000 gallons per day (gpd). However, injection will occur occasionally over the life of the treatment plant facility.

To accomplish this, at least three 16-inch diameter 1,000 gpm wells (one back-up well) are needed. They should be drilled to a bottom elevation of -400 ft., msl. If the upper site is used, the depth of each well will be 640 ft. (240 ft., msl + 400 ft). If the alternate site is chosen, the depth of each well will be 550 ft. (150 ft., msl + 400 ft.). Each well should be cased and grouted to at least -250 ft., msl, and the bottom 150 ft. will have well screen that it is open to the aquifer for injection to occur.

The design for the wells should be such that the injected effluent will not 1) affect other groundwater sources within the Waikapu Aquifer; 2) and will dissipate far enough offshore as to have little or no impact to near shore waters. These conditions assume that the injection will be under standard steady-state conditions, and will not affect existing potable sources. However, the planned episodic discharge into the ground may not behave in the standard way as described by steady-state analytical equations.

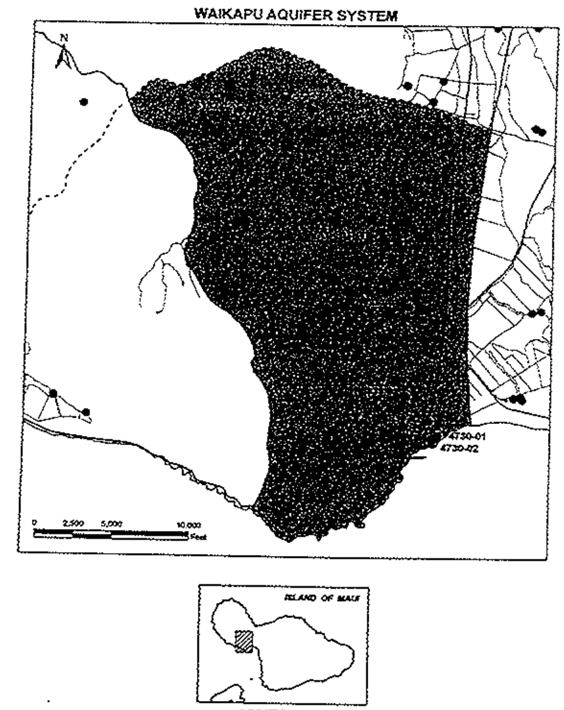
Waikapu Aquifer System

The Waikapu Aquifer System is located south of the Iao Aquifer System. The Iao Aquifer System provides much of the potable drinking water to Central Maui. The Waikapu system is bounded on the north by Waikapu Valley and on the east the Kahului Aquifer System between Waikapu and Maalaea. See Figure 1. For the most part, the system is mountainous to the west, leaving a narrow swath of land between Hoopiilani Highway and the steep ridges for well development.

Indeed, on the alluvial slopes below the ridges, a few wells have been drilled. Most recently the Pohakea Well No. 1 (State Well No. 4930-01) was drilled and tested. This well can produce 300 gpm of potable water. Presently, two new wells are planned and will be drilled near Pohakea 1, and each will be fitted with 350 gpm pumps (installed capacity of 0.5 mgd). Other wells within the aquifer are either unused or used for irrigation.

CWRM has assigned a sustainable yield of 2 mgd for this aquifer. As more geohydrologic data becomes available, the sustainable yield may be amended and changed. At the present time the U. S. Geological Survey (USGS) is building a numerical groundwater model to include the "head and shoulders" of Maui. The results of the model could alter the estimated aquifer recharge value as the USGS is incorporating fog-drip into the hydrologic budget. The two

new Pohakea wells presently being constructed can provide additional hydrologic data that may help in any adjustments of sustainable yield.



LOCATION MAP
FIGURE 1

Geology of the Area

Stearns and Macdonald (1942) describe the geology and hydrology of Maui in detail. The volcanic unit names have been updated by Langenheim and Clague (1987), and these names will be used in this discussion. Figures 2 and 3 are the geologic map of Stearns and Macdonald (1942) and a cross-section made from the map showing the relationship of the volcanics with the talus and alluvium. The Wailuku Basalt, which is the shield-building volcanic unit of the West Maui Mountains, plunges steeply (see Figure 2) below the talus and alluvium that was deposited below elevation of 800 to a 1,000 ft., msl as a thick apron on top of the volcanic basement. Near Waikapu Valley the lavas dip near 20 degrees, and near Maalaea the dip is about 15 degrees. As a consequence, the volcanic basement is projected to be at least -240 ft., msl at Hoopiilani Highway.

Overlying the Wailuku Basalt are the Honolua Volcanics that erupted after the filling of the West Maui caldera. These rocks outcrop and appear as short, stubby lava flows. Also mapped in the region is a rejuvenated lava and cinder cone known as Puu Hele, mapped as Lahaina Volcanics. This eruption occurred much later than the main eruptives and penetrated the talus/alluvial apron. The nature of the cone at depth is unknown and could pose either an obstruction or conduit for an effluent plume migrating to the coast.

Figure 2 adapted from Stearns and Macdonald, 1942

EXPLANATION

SEDIMENTARY ROCKS

QUATERNARY

Recent

Unconsolidated deposits

Chiefly younger alluvium consisting of unconsolidated poorly sorted, poorly rounded, stream-laid brown silt, sand, and gravel. It carries small quantities of water near the mouths of the perennial streams, but the quality of the water is poor below lands irrigated with brackish well water. A small amount of calcareous beach sand along the shore and large talus fans in the summit depression of Haleakala Volcano are included.

Pleistocene and Recent

Calcareous sand dunes

Mostly consolidated or partly consolidated fine-grained cross-bedded cream-colored dunes composed of calcareous sand blown inland from ancient beaches during the Pleistocene. Includes some Recent unconsolidated beach and dune sand near Honokohau P. O. and along the west and north shores of Haleakala Volcano. All the dunes are permeable, but only those along the coast carry water, which is brackish in most places.

Consolidated earthy deposits

Chiefly older alluvium, consisting of mottled brown to red-brown deeply weathered, poorly sorted nearly impermeable friable conglomerates, usually forming conspicuous terraces along the principal streams. Near the heads of valleys it grades into coarse angular talus and landslide deposits. Much of the older alluvium is covered with a thin discontinuous layer of younger alluvium that is mapped with the Pa and on the isthmus the deposits mapped as Ra include patches of older alluvium.

Kaupo mud flow

Firmly cemented impermeable breccia more than 300 feet thick at the mouth of Kaupo Valley, composed of angular and subangular debris with blocks up to 50 feet across; probably nonvolcanic in origin and derived from talus fans in the head of the valley. It perches water in the overlying gravel and lavas.

IGNEOUS ROCKS

WEST MAUI ROCKS

Historic

Middle (?) and late Pleistocene and Recent

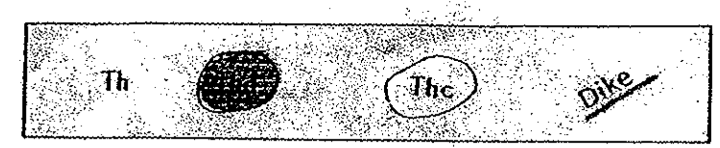
Lahaina volcanic series

Includes cinder cones and associated volcanics at Kekaa Point, Puu Laina, Puu Kilea, and Puu Hele.

Ql Thin flows of picritic basalt and nepheline basanite. The lava from Puu Laina carries brackish water along the shore.

Qlc Cinder cones built by firefountains at the source of the lava flows. They are permeable but carry no water.

Probably Pliocene and early and middle Pleistocene



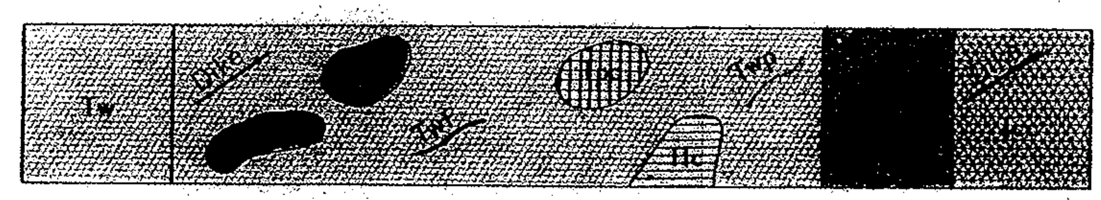
Honolua volcanic series

Th Massive flows of oligoclase andesite and soda trachyte reaching 300 feet in thickness, weathering to white or ashy gray. A few of the clinker beds carry water in wet areas.

Thd Bulbous domes of massive lava at the source of most of the lava flows. They support swamps and perennial water holes in wet areas because of their impermeability.

Thc Cinder cones built by firefountains at the vents. They are permeable but do not carry water.

Dikes Dense dikes 6 to 25 feet wide filling fissures through which the lavas were erupted. They confine water at high levels.



Wailuku volcanic series

Tw Thin-bedded flows of aa and pahoehoe basalt, chiefly olivine-bearing, poured out in rapid succession. They are highly permeable and freely yield water to wells, but the water is slightly brackish along the southern and southwestern shores.

Twc Cones of partly consolidated and weathered cinders and spatter 10 to 100 feet high, built along fissures by firefountains at the source of the lava flows. They are very permeable if saturated and freely yield water to wells and tunnels.

Twf Thin beds of friable red and yellow weathered vitric tuff interbedded with the lavas and perching a few springs in wet areas.

Tpc Pit craters caused by collapse from which little or no lava flowed. Some are filled with breccia and lava, others with conglomerates, shales, and lava, and still others with talus and hillwash. One yields a little water to a tunnel in Waihee Valley, the others have low permeability.

Tlc Cone on the south shore composed of permeable thin highly scoriaceous lava beds. Similiar cones elsewhere are too small to show.

Twp Beds a few inches to 50 feet thick of angular and subangular explosion debris, chiefly blocks torn from vent walls by phreatic explosions. They do not carry water.

Tdc Dike complex, composed of swarms of closely spaced nearly impermeable dikes, mostly less than 4 feet wide, underlying the former rift zones. A few dikes are plotted therein to show the trend of the swarms. The dikes confine large quantities of water at high level in the intervening compartments occupied by permeable lava flows. The dike complex supplies many springs, tunnels, and perennial streams.

Tcc Caldera complex, the whole gamut of rocks, consisting of vent breccias, lava flows, bosses, talus, and pyroclastics, that accumulated in the main summit caldera of collapse. Most of the outcrops in Iao Valley and all at the heads of Waikapu, Ukumehame, and Olowalu Canyons are firmly cemented vent breccias cut by dikes. The rocks as a whole have low permeability but yield small quantities of water.

Dikes and Bosses The dikes outside the dike complex are similar to those in the dike complex but are less numerous. Some form definite swarms which confine water at high levels in the intervening permeable lava flows. This water supplies a few tunnels and springs. The bosses are mostly impermeable dense bodies of rock that cooled in vent throats or were intruded into cavities. A few are sufficiently jointed to yield small flows of water.

SYMBOLS

- ●72 Test hole
- Dug well
- Spring
- 38 Spring (See table in text)
- Water hole or ancient Hawaiian well
- 60 Water-development or exploration tunnel described in text
- 23 Maui-type well not in use
- 11 Maui-type well with vertical shaft
- 10 Maui-type well with inclined shaft
- 24 Maui-type well supplemented by drilled wells
- Drilled well equipped with pump at Kahului, Puunene, Airport, and Hana only

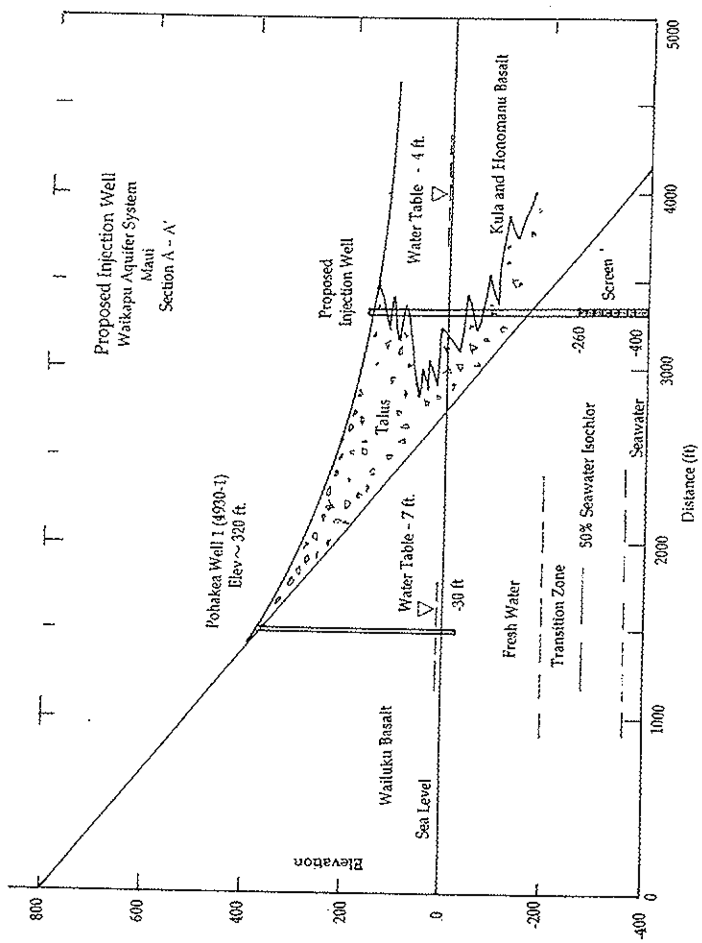


FIGURE 3

Hydrology of Waikapu Aquifer System

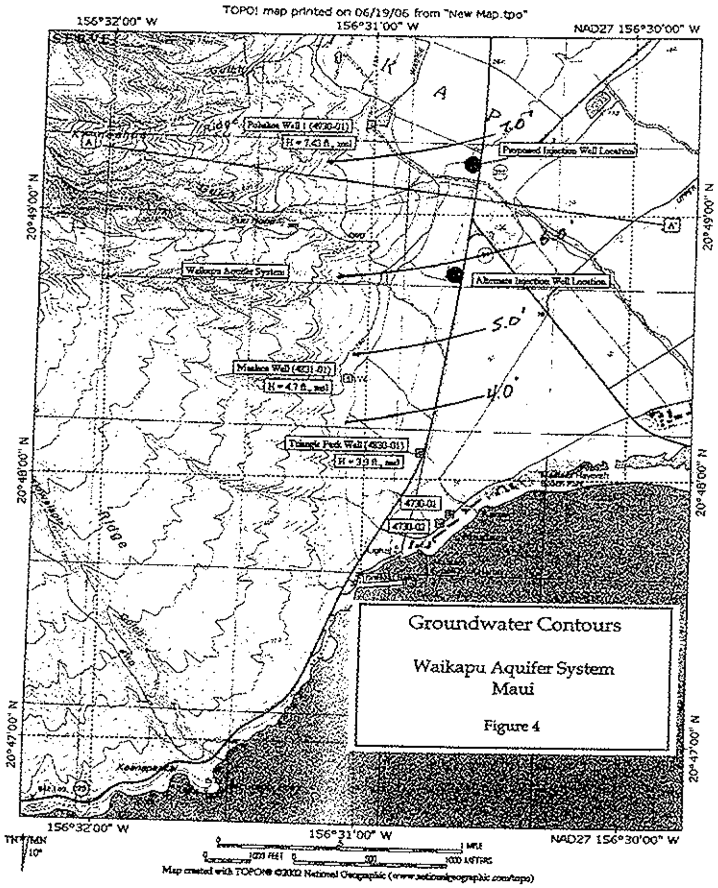
Groundwater in the Waikapu Aquifer System occurs both as high-level dike aquifers in the interior valleys where ground elevation exceeds 2,000 ft., msl, and as a moderately thin basal lens that provides both potable and brackish groundwater. Basal water levels vary from 7.4 ft., msl at Pohakea Well No. 1 to about a foot above sea level near the coast at Maalaea Harbor. Figure 4 shows the location of some of the wells in the area and their initial water levels.

The talus and alluvium may have some groundwater, but due to the nature of the material and its lack of permeability, the amount is probably very small. It may be confined to valley filling alluvium.

Table 1 presents a summary (from CWRM well database) of existing well data for relevant wells drilled in the Waikapu Aquifer System which could be affected by the injection of R-1 effluent.

Table 1: Summary of well data in Waikapu Aquifer System

Well No.	Well Name	Owner	Casing Dia. In	Total Depth ft.	Ground El. Ft.	Static Head ft.	Chloride Mg/L	Use
4730-01	TMK 3-8-14-18	Mawson		35				N/A
4739-02	TMK 3-8-14-19	Lindberg	6	45	15	1.83		Irr
4830-01	Maalaea Triangle	Triangle Partners	8	84	52	4.37	215	Irr
4831-01	Maalaea 272	State DOWALD	8	219	166	4.7	250	Obs
4930-01	Pohakea 1	A&B Properties	6	350	321	7.43	160	Mun
4931-01	TH110	Wailuku Sugar	1	325	313	6.5		Unu



Groundwater Contours

Waikapu Aquifer System
Maui

Figure 4

. Appendix A presents a more detailed summary of wells listed in Table 1. One anomalous well is the Maalaea Triangle Park well no. 4830-01 which encountered basalt at a shallow depth. The aquifer could be either be Kula Basalt from Haleakala or a shallow lava flow from West Maui. The well falls within the boundaries of the Waikapu Aquifer System, and the water levels measured in the well are consistent with water levels within the Waikapu Aquifer System.

Aquifer testing for the Maalaea 272 well (4831-01) and Pohakea 1 well (4930-01) demonstrates that the Wailuku Basalt aquifer is very permeable. The constant rate test for Maalaea 272 conducted in 1965 ran at 400 gpm with 4 ft. of drawdown. Chlorides remained at 260 mg/L (State of Hawaii, 1967). Analysis of the pump test results yielded a hydraulic conductivity value of 2,500 ft/d. Pohakea 1 was tested at 330 gpm with a maximum drawdown of 5.1± ft., but the stable drawdown after 1440 minutes of pumping was 3.7± ft. At the conclusion of the test, the well fully recovered inside five minutes, which means a highly transmissive aquifer, and therefore, a high hydraulic conductivity. Chlorides remained steady at 160 mg/L.

Hydraulic Gradient in Waikapu Aquier System

The hydraulic gradient within the aquifer is important when calculating how the effluent plume will behave over time. Figure 4 shows the water level contours deduced from the initial water level data from wells. Pohakea 1 is approximately 9,500 ft. from the ocean. Pohakea 1 has a water level of 7.43 ft., msl and the ocean has a water level of zero ft. The hydrologic gradient is calculated to be:

$$\Delta h/\Delta x = (7.43 \text{ ft.} - 0 \text{ ft.})/9{,}500 \text{ ft.} \qquad (1)$$

$$= 0.00078 \text{ ft/ft}$$

However, the distance between Pohakea 1 and Maalaea 272 well is 6,000 ft. and a head differential of 2.7± ft. The water level gradient is 0.00045 ft/ft. The distance of the Maalaea 272 well from the coast is 4,500 ft. and the initial head is 4.7 ft., mls. The calculated gradient is 0.001. The average gradient is 0.00074 ft/ft, and this figure will be used throughout this report.

Coastal Groundwater Discharge and Calculated Water Level

To calculate coastal groundwater discharge, a variation of the Darcy Equation is used as applied to Hawaii and basal lens conditions. As shown in State Dept. of Land and Natural Resources Report R54 (Wilson Okamoto & Assoc., 1977, p. 65), a freely discharging basal lens has a parabolic upper surface. The equation for the parabolic surface is:

$$h^2 = ax \qquad (2)$$

Where h is the water level or head above sea level, x is the distance from the discharge point at the coast, and a = 2q/gk. This term is defined as a function of hydraulic conductivity, k, a specific groundwater discharge, q, and the Ghyben-Herzberg constant, g, or 41 (40 plus 1 to calculate the transmissivity and the area of a one-foot strip within the aquifer). To calculate q, equation 2 is rearranged to be:

$$q = (41 \cdot k \cdot h^2)/2x \qquad (3)$$

If x is equal to 9,500 ft., k is equal to 2,500 ft/d, which assumes that the aquifer homogeneous and isotropic, and h is equal to 7.43 ft., msl, then the specific discharge at the coast is 297 ft^3/d or 2,228 gpd. If Maalaea 272 well (4,500 ft. from the coast, and a head of 4.7 ft., msl) is used then the specific discharge is 252 ft^3/d or 1,885 gpd. Let the average discharge be 274 ft^3/d. Therefore, a, in equation 2 becomes 0.0053, and,

$$h^2 = 0.0053x \qquad (4)$$

If the proposed injection wells are drilled about 9,200 ft. inland, then the calculated water level at that point would be 6.9± ft., msl. Using the Ghyben-Herzberg constant of 40, the theoretical depth below sea level of the mid-point of the transition zone is -279± ft., msl. At this point, the groundwater will have a TDS of 17,500 mg/L. If the injection wells are drilled at an alternate site 6,800 ft. inland and down gradient of Puu Hele, then calculated water level would be 6.0±

ft., msl and the depth to the transition zone mid-point would be ~240± ft., msl. Shallower injection well can be designed for this location, thus saving money.

Injection Well Hydraulics as Steady-State for Maalaea Injection Wells

The following discussion will assume steady-state injection applying the analytical equations for injection hydraulics. As mentioned above, episodic release of effluent by injection may affect the aquifer differently and will be discussed later. For this discussion steady-state will be 0.8 mgd (average injection) and 2.5 mgd (peak injection).

The R-1 wastewater injected into the Wailuku Basalt aquifer will have a lower density than the ambient groundwater in the aquifer. If the difference in the densities is great, then the injected wastewater will rise as a plume around the well until it encounters the overlying low permeability talus and alluvial material (see Figure 3). Some of the wastewater will move up gradient along interface until it reaches a stagnation point, while most of the wastewater will move down gradient as slug in the ambient groundwater flow field. Some of the wastewater will enter the overlying sediments due to the positive potential in the aquifer relative to that in the sediments. The amount of effluent entering into the sediments and the seepage area affected depends on the permeability of the sedimentary contact and the rate of injection.

If the density of the effluent is similar to the density of the water in the aquifer, then the effluent will not rise but instead form a plume in the groundwater flow field. However, it is expected that the effluent injected into the mid and lower portion of the transition zone will be great enough for the wastewater to move vertically upward. Assuming the transition zone is half seawater and half freshwater, the TDS concentration will be 17,500 mg/L (seawater is 35,000 mg/L). The density of the groundwater will be 1.0188, while the density of the effluent is taken as 1.0000 because it is almost fresh water.

To analytically predict where the effluent will move once injected into the mid-point of the transition zone in a basal aquifer, four characteristics of the plume have to be analyzed: 1) the buoyancy gradient; 2) radius of the buoyant column; 3) the up gradient movement of the plume; and 4) the amount of discharge into the overlying sediments.

The Buoyancy Gradient

The buoyancy gradient is expressed as:

$$\{g(a) - g(c)\}/g(a) \qquad (5)$$

Where g(a) is the density of the groundwater where injection will take place or 1.0188, and g(c) is the density of the effluent taken at 1.0000. The density difference is 0.0188. If the effluent were injected into seawater, the density difference would have 0.025. The buoyancy gradient as used in Hawaii has been derived by Burnham and others (1977) and Mink and Lau (1980).

Because the gradient is high, the upward velocity could be great depending upon the vertical permeability of the aquifer and the porosity of the volcanic rock. If the vertical permeability is 250 ft/d (a tenth of the horizontal permeability of 2,500 ft/d) and the porosity (n) is taken at 0.10, which is commonly used in groundwater modeling, then the vertical velocity is:

$$V = 0.0188\ (k/n) = 47\ \text{ft/d} \qquad (6)$$

If, however, the vertical permeability to horizontal permeability ratio is 1:100 or 25 ft/d, the velocity becomes only 4.7 ft/d. The average horizontal velocity in the aquifer using hydraulic conductivity (k) as 2,500 ft/d, porosity at 0.10, and the average gradient at 0.00074 ft/ft is calculated to be 18.5 ft/d.

If the vertical permeability ratio is low, then the effluent will rise high enough to be captured by the ambient groundwater flow. If the vertical permeability is high (1:10), the effluent plume will rise beyond the horizontal flow field to the basalt/sedimentary contact.

Radius of the Buoyant Column

Burnham and others (1977) derived an equation to determine the radius of the cylindrical slug of effluent along the screen of the injection well. The average radius, r(av), is:

$$r(av) = (2/3)\ (Q/\pi kg)^{0.5} \qquad (7)$$

where Q is the injection rate of 2.5 mgd (334,225 ft^3/d) through the length of the screen or 150 ft., k is the vertical permeability (250 ft/d and 25 ft/d), and g is the buoyancy gradient or 0.0188. The average radius of cylindrical slug along the screen will be 99 ft. for a vertical hydraulic conductivity of 250 ft/d and 314 ft. for a vertical hydraulic conductivity of 25 ft/d. For an injection rate of 0.8 mgd, (106,952 ft^3/d) with same vertical permeabilities, the average radius of the cylindrical slug will be 56 ft. and 178 ft., respectively.

Assuming the effluent plume reaches overlying sediments of lower permeability, the plume will migrate up gradient to a stagnation point where the movement of the plume is equal to average flow of the groundwater in the opposite direction.

Up Gradient Movement of the Plume

If there is a steady-state injection of effluent into the aquifer, the up gradient stagnation point can be calculated. The calculation assumes an aquifer that is homogeneous and isotropic, confined and infinite in extent. Despite these conditions, the result is a good approximation of what happens in after the effluent rises in the basal lens. The USEPA uses the following equation in their Well Head Protection software (WHPA program).

Steady-state injection always applies a greater head potential to the ambient groundwater flow field. By doing so forces the effluent into aquifer. As the effluent enters the aquifer it will migrate up gradient to a stagnation point. There may be some dispersion at the edges of the plume, but for the most part, the plume will migrate as a slug of water. How far the plume will travel up gradient before stopping is defined at r(stag):

$$r(stag) = Q/(2\pi bkI) \qquad (8)$$

where Q is the injection rate 2.5 mgd (334,225 ft^3/d), b is the thickness of the slug for 150 ft. (length of the screen), k is the horizontal hydraulic conductivity or 2,500 ft/d, and I is the gradient of the flow field or 0.00074 ft/ft. The stagnation point is 192 ft. up gradient from the injection well. The stagnation point for 0.8 mgd (106,952 ft^3/d) steady-state injection will be 61 ft. up gradient from the well.

Down gradient from the injection wells, the plume will expand to a maximum width using the following equation and the parameters used above:

$$w(max) = Q/kbI \qquad (9)$$

The maximum width for 2.5 mgd will be 1,204 ft. If two injection wells are close to each other including one standby well, and each discharging up to 875 gpm, the maximum width of the plume will be similar to one well discharging 1,750 gpm. Similarly for injection of 0.8 mgd, the maximum width of the plume will be 385 ft.

Seepage of Effluent into the Overlying Sediments

As stated earlier, the overlying sediment contact with the West Maui Basalt is estimated to be at least -240 ft., msl at the planned Maalaea WWTP

adjacent to Hoopiilani Highway. When the effluent is injected into the transition zone of the basalt aquifer buoyancy will cause the plume to rise and perhaps have contact with the overlying sediment. The permeability of sediment is quite low compared to basalt. It could be on the order of 1 ft/d, perhaps 0.1 ft/d. This means that the amount of seepage into the sediments is small compared to the amount of groundwater flux in the system.

Summary and Conclusions

The above analytical steady-state analysis of the movement and fate of the effluent plume suggests that there will be no effect on the Pohakea well field located 2,500 ft. up gradient from the proposed injection wells. The plume could have a minimal effect on the non-potable Maalaea Triangle Park Well (4830-01) located down gradient from the injection wells. However, this well is very shallow compared to the depth of injection, only upward seepage could cause nutrients to increase in the well over time.

The analytical steady-state analysis does not directly solve for the movement of a short-term average injection rate of 0.8 mgd (555 gpm) with a peak flow rate of 2.5 mgd (1,750 gpm) as envisioned. When transient injection of effluent occurs and enters the lower aquifer from the deep injection wells, it will rise due to buoyancy, and then be entrained in the groundwater flow field of the Maalaea Aquifer System. The amount of injectant will probably have no impact on the hydrologically up gradient Pohakea well field and minimal or no impact on the down gradient Maalaea Triangle Park well. Injecting fresher water into the lower transition zone will not cause salt water to rise in the aquifer.

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APPENDIX A

Summary of Well Data:

1) 4931-01 (TH 110; Stearns and Macdonald, 1942, p. 215)

Drilled:	1933
Grd. Elev.:	313 ft., msl
Depth:	325 ft (-12 ft., msl)
Solid Cas.:	309 ft. (1 in. dia.)
Perf. Cas.:	309 ft. to 313 ft.
Max. Cl:	300 mg/L
Min. Cl:	150 mg/L
Water Level:	7.0 ft., msl
Status:	Unused

Geologic Log:

0-15	Talus
15-49*.	Honolua Volcanics**
49-325	Wailuku Basalt**

*Stearns states that the bottom of the Honolua Volcanics is uncertain as core was not seen.

**Nomenclature from Langenheim and Clague, 1987.

2) 4930-01 Pohakea Well No. 1

Drilled:	2004
Grd. Elev.:	321 ft., msl
Depth:	350 ft (-29 ft., msl)
Solid Cas.:	330 ft. (6 in. ID.)
Perf. Cas.:	Bottom 20 ft. of 6 in. ID perforated
Test. Cl:	160 mg/L
Water Level:	7.43 ft., msl
Status:	Pump installed for municipal use, at the present time unused.

Driller's Log:

0-175	West Maui talus/sediments
175-250	Soft blue rock (Wailuku Basalt)
250-340	Hard blue rock (Wailuku Basalt)
340-350	Hard and soft rock, cinder free (Wailuku Basalt)

3) 4831-01 (Maalaea Well 272, DLNR C43)

Drilled:	1965
Grd. Elev.:	166 ft., msl
Depth:	219 ft (-53 ft., msl)
Solid Cas.:	187 ft. (8 in. ID.)
Perf. Cas.:	Bottom 20 ft. of 8 in. ID perforated
Test. Cl:	250± mg/L
Water Level:	4.7± ft., msl
	10/11/65 = 4.71 ft., msl
	10/25/65= 4.78 ft, msl
Status:	Obs. (from CWRM Well Database)

Driller's log in C43:

158-166	Gray hard rock
166-187	Gray medium rock
187-190	Gray hard rock
190-219	Red-gray medium rock

Chemical analyses (see C43): 250 mg/L

4) 4830-01 (Triangle Park Well)

Drilled:	1997
Grd. Elev.:	50.41 ft., msl (TOC = 52.04 ft., msl)
Depth:	84 ft (-34 ft., msl)
Solid Cas.:	54 ft. (8 in. ID.)
Perf. Cas.:	54 ft. to 74 ft.
Test. Cl:	215± mg/L
Water Level:	3.29 ft., msl
Temperature:	74° F
Status:	in use (irrigation well)

Driller's Log:

0-36	Red dirt
36-46	Med. hard blue rock with some vesicles
46-53	Loose rock (rubble)
53-58	Med. hard rock
58-66	Loose rock and cinders
66-72	Black sand
72-84	Hard porous rock

Comments:

Chlorides during test ranged from 195 to 215.
At 82 gpm the drawdown was 0.02± ft.

5) 4730-01 (TMK: 3-8-14:18) Owner: R. Mawson (from CWRM Well Database)

Depth: 35 ft.
Min. Cl: 490 mg/L
Status:NA

Geology: TW (Wailuku Basalt)

6) 4730-02 (TMK: 3-8-14:19) Owner: E. Lindberg (from CWRM Well Database)

Drilled:	1956
Grd. Elev.:	15 ft., msl
Depth:	45 ft (-30 ft., msl)
Solid Cas.:	20 ft.
Max. Cl:	634 mg/L
Water Level:	3.8 ft., msl
Status:	Irr (1971)

Geology: TW

APPENDIX N.

Subdivision Preliminary Drainage Report

Drainage Report and Calculations

For

Maalaea Mauka Subdivision
Honoapiilani Highway, Maalaea, Island of Maui, Hawaii
TMK: (2) 3-6-001:018

August 2006

Prepared For:

Maalaea Properties, LLC
355 West Waiko Road
Wailuku, HI 96793

Prepared By:

M&E Pacific, Inc.
METCALF & EDDY | AECOM
Suite 1900, Davies Pacific Center
841 Bishop Street
Honolulu, HI 96813

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SECTION 1 INTRODUCTION

1.1 PURPOSE

The objective of this drainage report is to develop a drainage system for the proposed Maalaea Mauka Subdivision (MMS) and evaluate its impacts on the existing drainage system. A drainage report is required to obtain County of Maui approval for the proposed project.

This report analyzes the conditions before and after the construction of the work that will occur on this property.

1.2 GENERAL INFORMATION

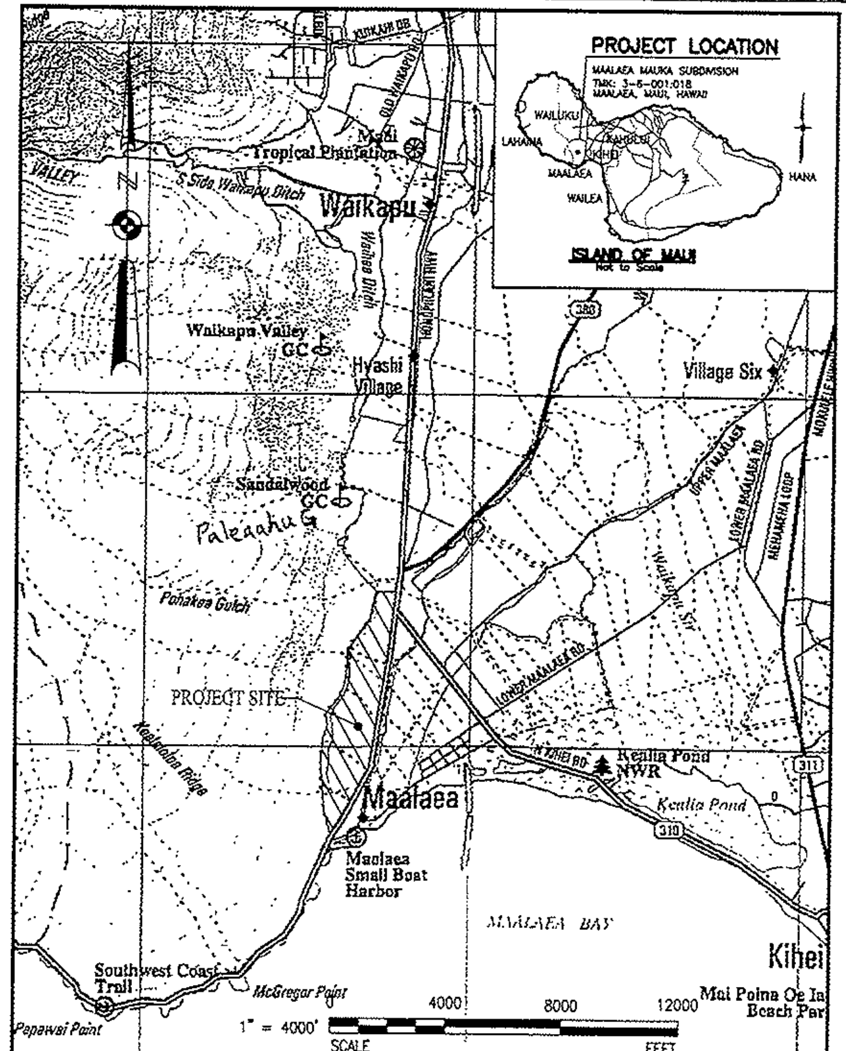
a. The proposed development site is a parcel identified as Tax Map Key 3-6-001: 018 located at the crossroads of West Maui, Kihei-Makena, and Wailuku-Kahului regions, and bounded by Honoapiilani Highway on the east. The parcel encompasses approximately 260 acres on the slopes of Kealaloloa (West Maui Mountains) overlooking Maalaea Small Boat Harbor and the Maalaea Triangle Waterfront Plaza. The current real estate property class is Agricultural. The County Council voted to designate this parcel as Project District 12 in 1998. See Figure 1, location map. The lands to the west and upland of the project area are State owned.

   The planned development of this site includes a mix of single family and multi-family dwellings, including senior housing, apartment dwellings, a community center, a fire station, a package wastewater pump station, and parks. Approximately 949 units will be built: 355 single family, 164 single family patio, 144 custom, 60 senior housing, 126 apartment; and 100 multi-family units.

b. Owner: Maalaea Properties, LLC.
   355 West Waiko Rd.
   Wailuku, HI 96793

   Contact: Steven Kikuchi
   Partner

c. Location Map (See Figure 1)



M&E Pacific, Inc.
METCALF&EDDY | AECOM
DAVIES PACIFIC CTR. STE 1000
841 BISHOP ST
HONOLULU, HAWAII 96813

Location Map
MAALAEA MAUKA SUBDIVISION DRAINAGE REPORT

SECTION 2
Physical Environment

SECTION 2 PHYSICAL ENVIRONMENT

2.1 LOCATION

The proposed MMS (TMK: 3-6-001:018) is located on the mauka side of Honoapiilani Highway south of the intersection with Kuihelani Highway and north of Maalaea Triangle Waterfront Plaza and overlooking Maalaea Small Boat Harbor in the Wailuku District on the island of Maui.

2.2 TOPOGRAPHY

The project site is located in Central Maui, the isthmus between West Maui and East Maui. Central Maui is generally flat and fairly level. The project site is sloping at a gentle grade between 4 and 6 percent. Mainly wild grasses, shrubs, and small trees cover the site.

The project site was previously cultivated in sugarcane and pineapple. While no longer used for large-scale agricultural activities, portions of the property were being used for small-scale farming activities. The land now remains vacant.

The proposed grading will allow for three major access roads into the residential development from Honoapiilani Highway. Additionally, open areas for landscaping and detention basins will provide a visual buffer between the development and the highway.

2.3 SOILS

The NRCS Hawaii website (www.hi.nrcs.usda.gov) provides an online database of State of Hawaii soils. This database categorizes the soils on the project site as: MuA, ONC, PfB and PpA. These four soils all are classified as "B," hydrological type. See Figure 2, Soils Map.

- MuA, Molokai silty clay loam, 0 to 3% slopes, covers approximately 40% of the parcel. Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil.

- ONC, Olinda loam, 4 to 12% slopes, covers approximately 27% of the parcel. Runoff is slow and the erosion hazard is slight.

- PfB, Pauwela clay, 3 to 7% slopes, covers approximately 27% of the parcel. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil.

- PpA, Pulehu silt loam, 0 to 3% slopes is on approximately 6% of the parcel. Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.4 inches per foot of soil.

Other soils located off-site, but in the drainage basins are MID, MJD, MuB, ONC and PcC. All these soils are also classified as "B," hydrological type.

- MID, Makaalae silty clay, 7 to 25% slopes, is on rough, low mountain slopes. Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate.

- MJD, Makaalae extremely stony silty clay, 7 to 25% slopes, is similar to MID except that stones cover 3 to 15% of the surface.

- MuB, Molokai silty clay loam, 3 to 7% slopes, has slow to medium runoff and the erosion hazard is slight to moderate.

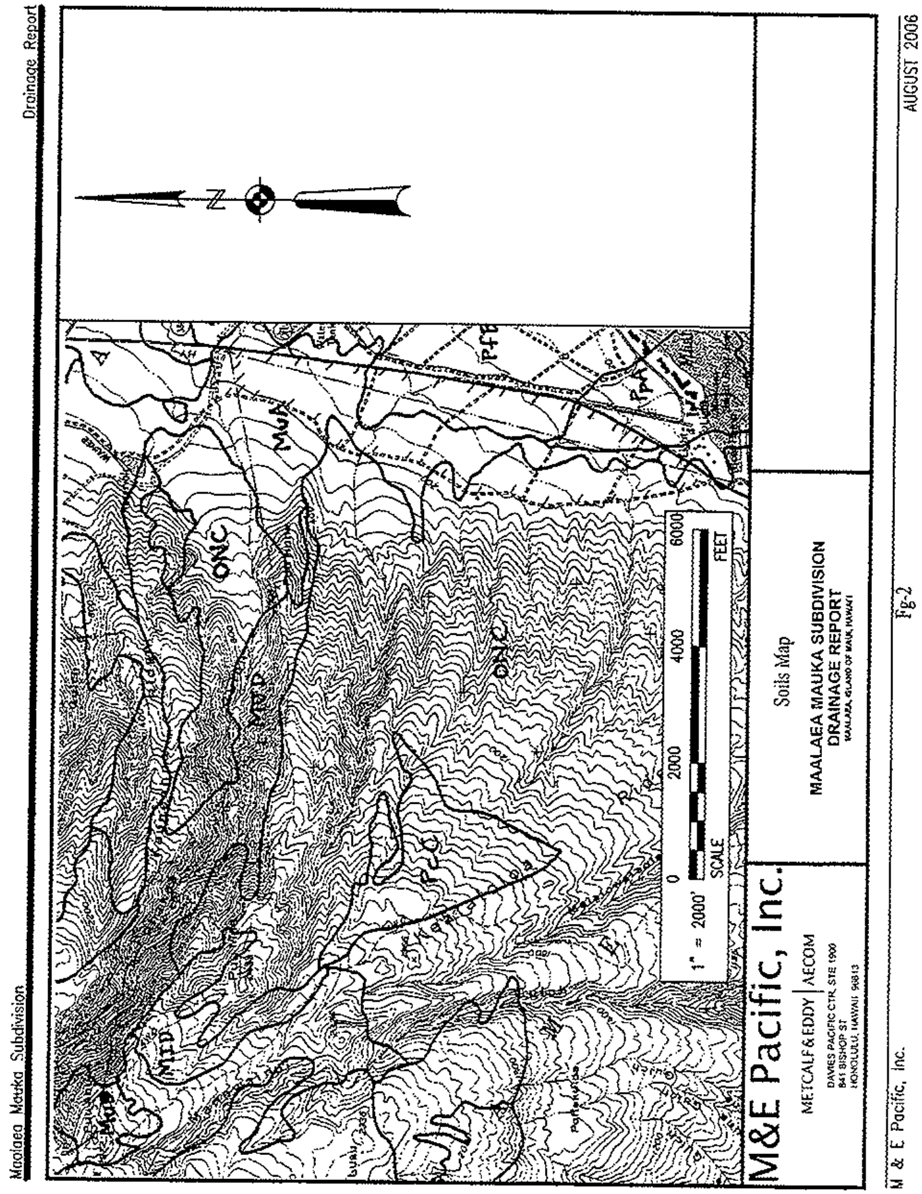
- ONC, Olinda loam, 4 to 12%, covers approximately 80% of the off-site basin area. PcC, Paia silty clay, 7 to 15% slopes, has slow to medium runoff and the erosion hazard is slight to moderate.

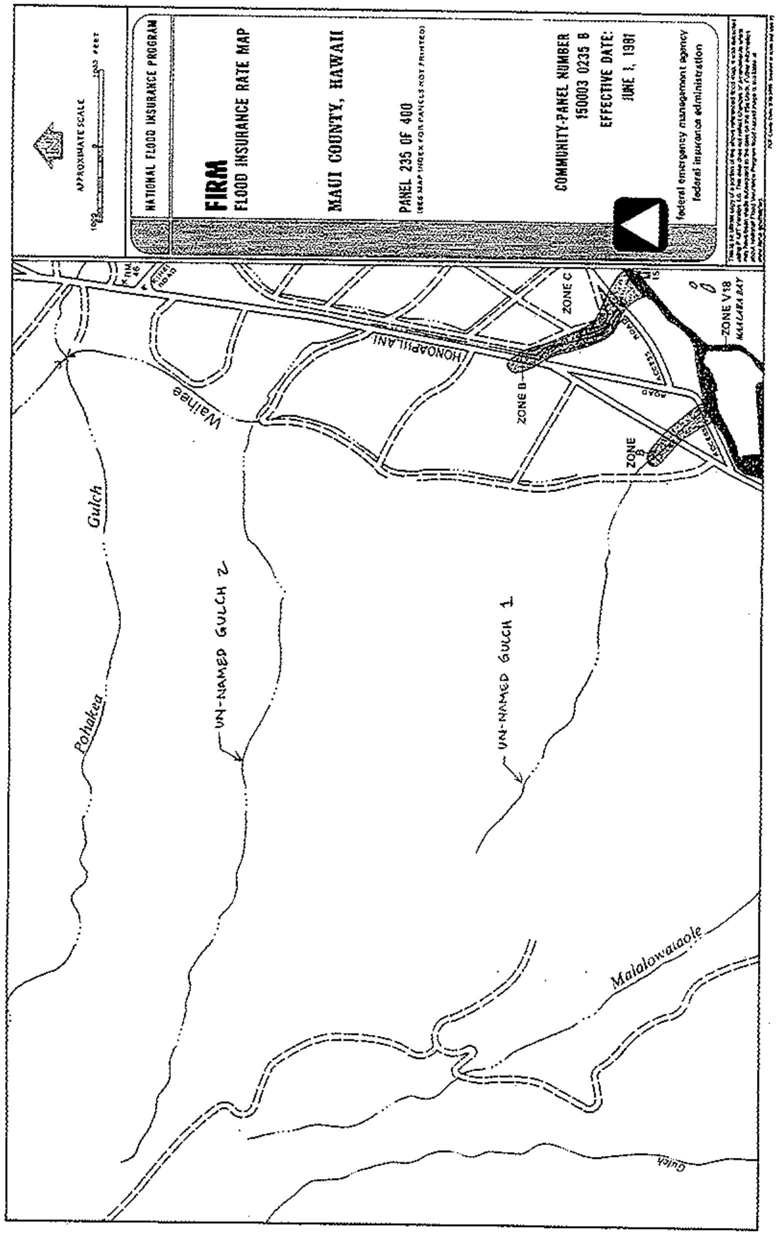
2.4 DRAINAGE/FLOODING

According to the FEMA Flood Insurance Rate Maps (Community-Panel Number 150003 0235 B, June 1, 1981), two areas on southern portion of the site along existing gulches and continuing downstream toward Maalaea Bay are classified as Zone B. Zone B is defined as areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. See the attached Figure 3 for reference.

2.5 RAINFALL

Annual median rainfall in this region, according to the Atlas of Hawaii is 15 inches.





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SECTION 3
Drainage

SECTION 3 DRAINAGE

3.1 METHODOLOGY

The "Department of Public Works and Waste Management – County of Maui – Chapter 4 – Rules for the Design of Storm Drainage Facilities in the County of Maui," is the basic design reference effective since November 12, 1995.

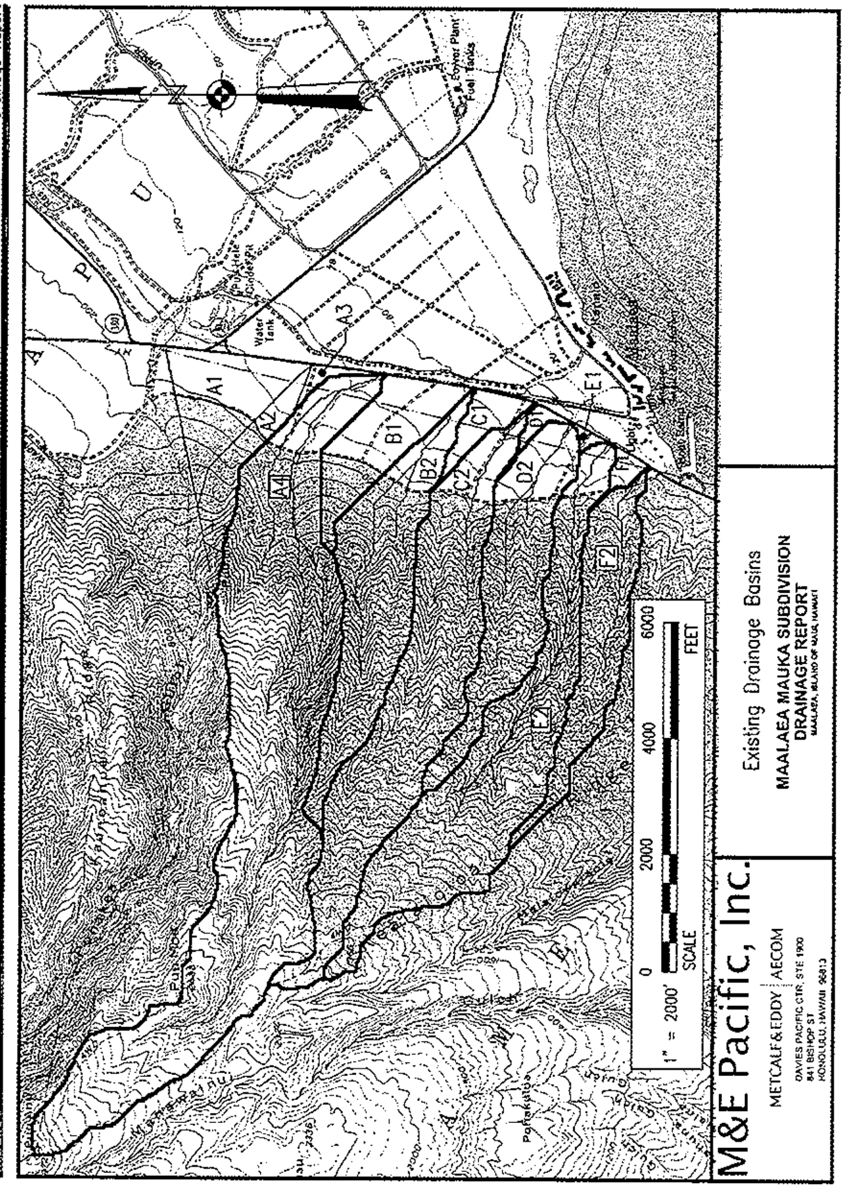
3.2 EXISTING DRAINAGE CONDITIONS AND SYSTEM

3.2.1 Existing Project Site

The site is an approximately 260 acre parcel, and is presently zoned Agricultural and designated as Project District 12. The only existing drainage improvements on the site are agricultural ditches and road side swales. The runoff from the site, enters existing headwalls and drain inlets spaced along the mauka side of Honoapiilani Highway. The runoff is conveyed across the highway through culverts, pipes, ditch and channel to Maalaea Bay.

The Maalaea Waterfront Plaza (MWP), an existing commercial development on the triangular shaped parcel just downstream and across the highway has experienced flooding during large storms. The runoff from a portion of the project parcel is conveyed through this development. The existing drainage system within this development must be evaluated to determine the allowable capacity of the drainage structures which receive storm runoff from the project site.

Refer to Figure 4, Existing Drainage Basins. The current off-site storm runoff consists of five large drainage basins (larger than 100 acres) and four smaller drainage basins. The on-site storm runoff consists of the previously mentioned drainage basins and five smaller on-site drainage basins. A total of 14 drainage basins affect the project site:



Drainage Basin (D)	Area (Acre)	Remark
A1	67.49	Off-site and on-site
A2	34.70	Off-site and on-site
A3	5.74	Off-site and on-site
A4	499.10	Off-site and on-site
B1	69.45	Off-site and on-site
B2	151.82	Off-site and on-site
C1	19.65	On-site
C2	246.21	Off-site and on-site
D1	6.00	On-site
D2	130.47	Off-site and on-site
E1	2.67	On-site
E2	234.11	Off-site and on-site
F1	6.54	On-site
F2	94.69	Off-site and on-site

In accordance with the County Drainage Standards, §15-04-05 Hydrologic criteria, Recurrence interval:
(b) For drainage areas of 100 acres or less with sump, or tailwater effect, T_m (recurrence interval) = 50 year based on 1 hour storm.
(c) For the design of roadway culverts and bridges with drainage areas less than 100 acres, T_m = 50 year based on 1 hour storm.
(d) For drainage areas greater than 100 acres and all streams, the National Resources Conservation Service (NRCS, formerly Soil Conservation Service) hydrograph method shall be used, T_m = 100 year based on 24 hour storm.
(e) Retention and Detention Basins:
T_m = 50 year based on 1 hour storm for drainage areas 100 acres or less.

T_m = 100 year based on 24 hour storm for drainage areas more than 100 acres.

(f) When a drainage area of less than 100 acres contributes to a major stream or channel with a total drainage area greater than 100 acres, the contributory drainage system shall be designed for 10 year or 50 year storm, whichever is applicable.

Runoff Quantity:
(a) **Rational Method**: For drainage areas of 100 acres or less, the rational method along with the accompanying reference tables and charts, or latest revision thereof, shall be used etc.

$Q = CIA$
Where Q = flow rate in cubic feet per second, cfs
C = runoff coefficient
I = rainfall intensity in inches per hour for a duration equal to the time of concentration

A = drainage area in acres

NRCS Method, Hydrograph Analysis
(a) For drainage areas greater than 100 acres and all streams, the NRCS method shall be used.
(b) The procedure for computing the peak flows and plotting the hydrographs shall be as outlined in the NRCS, National Engineering Handbook, Section 4, Hydrology, Supplement, or latest revision thereof or Erosion and Sediment Control Guide for Hawaii, NRCS, March 1981, or latest revision thereof.
(c) The NRCS computer program TR55 or TR20 may be used in lieu of the NRCS hydrograph analysis. Federal Emergency Management Agency (FEMA) storm flows shall be with the minimum storm flow in drainage basins where flows have been determined in the "Flood Insurance Study," Maui County.

The drainage basin areas require use of both the Rational Method and NRCS Method. Consider the Rational Method first in estimating the existing flows for the small basins less than or equal to 100 acres.

Rational Method: $Q = CIA$
Determine "C" for off-site areas using Table 1.

Watershed Characteristics	Description	Value
Infiltration, moderate	Medium	0.07
Relief, extreme	Steep	0.08
Vegetal Cover, moderate	Good	0.03
Development Type, Low	Agricultural	0.15
	Sum, Σ	**0.33**

Use C = **0.33** for existing off-site areas.

Determine "C" for on-site areas using Table 1.

Watershed Characteristics	Description	Value
Infiltration, moderate	Medium	0.07
Relief, moderate	Rolling	0.03
Vegetal Cover, moderate	Good	0.03
Development Type, Low	Agricultural	0.15
	Sum, Σ	0.28

Determine "C" for on-site areas using Table 2. C = **0.30** (Unimproved areas) > 028

Use C = **0.30** for existing on-site areas.

A weighted average of the "C" values is used for each small basin.

For D-A1: $C = \frac{(0.33 \times 25.28ac) + (0.30 \times 42.21ac)}{67.49ac} = 0.31$

For D-A2: $C = \frac{(0.33 \times 25.06ac) + (0.30 \times 9.64ac)}{34.7ac} = 0.32$

For D-A3: $C = 0.30$

For D-B1: $C = \frac{(0.33 \times 20.54ac) + (0.30 \times 48.91ac)}{69.45ac} = 0.31$

For D-C1, D-D1, D-E1, and D-F1: $C = 0.30$

For D-F2: $C = \frac{(0.33 \times 92.22ac) + (0.30 \times 2.47ac)}{94.69ac} = 0.33$

Determine T_c, time of concentration from Plate 1, Overland Flow Chart. See Appendix A for the County Drainage Standards tables and plates referred to. Appendix A contains a series of Plate 1 showing the determination of the time of concentration for the drainage areas less than 100 acres.

Determine "I," rainfall intensity. Using the 50 Year-1 Hour-Rainfall plate, approximately 2.9 inches of rain falls on the project site. Enter Plate 2 with the 1-hour rainfall value and the required time of concentration. Obtain the design rainfall intensity in inches per hour.

The following table summarizes the estimated rainfall intensity for each small basin:

Drainage Basin	I (in)	T_c (min)	I (in/hr)
A1	2.9	61	2.9
A2	2.9	34	3.9
A3	2.9	49	3.2
B1	2.9	40	3.5
C1	2.9	35	3.8
D1	2.9	29	4.1
E1	2.9	23.5	4.4
F1	2.9	22	4.5
F2	2.9	38	3.7

The following table summarizes the determination of peak runoff for the small drainage basins using the Rational Method:

Drainage Basin	C	I (in/hr)	A (ac)	Q (cfs)
A1	0.31	2.9	67.49	61
A2	0.32	3.9	34.7	43
A3	0.30	3.2	5.74	6
B1	0.31	3.5	69.45	75
C1	0.30	3.8	19.65	22
D1	0.30	4.1	6	7
E1	0.30	4.4	2.67	4
F1	0.30	4.5	6.54	9
F2	0.33	3.7	94.69	116

Determine the peak runoff for the large basins using the NRCS computer program WinTR-55, version 1.0.08. The existing soil on both the on-site and off-site drainage areas are type "B," hydrological classification. The existing land use is shrub and brush rangeland-good. The curve number, CN for a large drainage basin is the weighted average based on:

Soil Hydrological Classification	CN
A	39
B	**61**
C	74
D	80

The typical curve number, CN for the existing condition in the large drainage basins is **61**. The time of concentration, T_c is estimated using the Kirpich Equation developed for agricultural watersheds.
For overland flow over grassy mountains,

$$T_c = m \times 0.00013 \times \frac{L^{0.77}}{S^{0.385}} \times C_t$$

Where T_c = *time of concentration in hours.*

$m = 2.000$ *Earth type coefficient*

L = *length of the overland flow in feet.*

S = *average overland slope in ft / ft.*

$C_t = 1.760$ *time of concentration coefficient*

An adjustment is made for watersheds with a CN less than 80 using the following equation:

$$T_c = T_c \times (1 + (80 - CN) \times 0.04$$

Where CN = *Curve Number*

From the "Rainfall Frequency Atlas of the Hawaiian Islands," Technical Paper No. 43, 1962, the rainfall, "P" for 100-year, 24-hour storm is determined for each of the large basins.

Appendix A contains the printout from the WinTR-55 program for the large basins. The following table summarizes the resulting peak runoff, Q_p:

Drainage Basin	Area (ac)	CN	P (in)	T_c (hr)	Q_p (cfs)
A4	499.1	61	12.9	1.659	865
B2	151.82	61	12.1	1.014	320
C2	246.21	61	12.2	1.286	456
D2	130.47	61	11.7	0.851	288
E2	234.11	61	12.1	1.167	454

The existing storm runoff from the design storms' precipitation falling on the drainage basins of the on-site and off-site areas flowing into the existing drainage system along Honoapiilani Highway have been estimated.

3.2.2 Existing Maalaea Waterfront Plaza

Based on as-built plans, the following evaluates the existing drainage system along the Honoapiilani Highway and within the Maalaea Waterfront Plaza (MWP) which receive storm runoff from the project site.

Use the Rational Method to evaluate the existing drainage system within Maalaea Waterfront Plaza.

Determine "C" for MWP using Table 1.

Watershed Characteristics	Description	Value
Infiltration, moderate	Medium	0.07
Relief, low	Flat (0 – 5%)	0.0
Vegetal Cover, high	Poor (< 10%)	0.05
Development Type, extreme	Industrial & Business	0.55
	Sum, Σ	0.67

Determine "C" for on-site areas using Table 2. C = **0.70** (Business, neighborhood areas) > 0.67

Use C = **0.70** for existing areas.
Use C = **0.95** for paved roadways.

Rainfall for 50-year, 1-hour storm is approximately 2.6 in. Assume the typical time of concentration for each drainage area is 5 minutes. The rainfall intensity from Plate 2 is **6.7 in/hr**.

$Q_{50} = CIA = 0.70 \times 6.7 \times A = 4.69 \times A$ is the basic equation used to determine the inlet flows into the drainage system at MWP.

The existing drainage system at MWP has two drainline systems receiving runoff from the project site. One is drainline DL-M which receives runoff from two headwalls and inlets along Honoapiilani Highway and from within MWP. The main trunk of DL-M runs along Maalaea Road and discharges into Maalaea Bay.

The second is drainline DL-H which receives runoff from two headwalls and inlets along Honoapiilani Highway and discharges into Maalaea Bay. The hydraulic analysis of DL-M and DL-H are contained in Appendix A.

3.2.3 Existing Honoapiilani Highway

Use the Rational Method to estimate the existing storm runoff from the pavement along Honoapiilani Highway contributing flows to inlets/headwalls receiving runoff from the project site.

Use C = **0.95** for the paved highway. Rainfall for 50-year, 1-hour storm is approximately 2.8 in. Assume typical time of concentration for each drainage area along the highway is 10 minutes. The rainfall intensity from Plate 2 is **5.7 in/hr.**

$Q_{50} = CIA = 0.95 \times 5.7 \times A = 5.42 \times A$ is the basic equation used to determine the inlet flows from pavement runoff into the drainage system along Honoapiilani Hwy. The hydraulic analysis of the miscellaneous structures along the highway is contained in Appendix A.

The following table summarizes the estimated storm runoff capacities of the various inlet structures and headwalls along the highway.

3.3 PROPOSED DRAINAGE CONDITIONS AND SYSTEM

3.3.1 Proposed Project Site Conditions

The proposed improvements will change the land use from previous agricultural use to residential development which by nature will increase hardscape (i.e. road pavements, sidewalks, housing) and reduce rainfall infiltration into the ground. The design intention is to reduce the post development peak runoff by the installation of detention basin areas between the development and the mauka side of Honoapiilani Highway.

Determine the post development runoff from the drainage basins based on County allowed improvements in the current Project District 12:

On-site (Developed)

Residential dwellings (single-family)	141.5 ac
Residential dwellings (multi-family)	7.0 ac
Apartment dwellings	11.5 ac
Senior Housing	6.0 ac
Package WW Pump Station	2.0 ac
Community Center	5.0 ac
Fire Station	1.0 ac
Park	15.0c
Open Space	34.0
Collector Roads	37.0 ac
Total	260.0 ac

From Table 2, County Drainage Standards:

Type of Drainage Area	Runoff Coefficient, C
Residential Single-family areas	0.50
Residential Multi-units, attached	0.75
Apartment Dwelling areas	0.70
Industrial, light areas	0.80
Residential, suburban	0.40
Parks, cemeteries	0.25
Unimproved areas	0.30
Streets, Asphaltic	0.95

Estimate the weighted "C" for the post developed parcel.

MAALAEA MAUKA SUBDIVISION
EXISTING DRAINAGE CROSSING HONOAPIILANI HWY.

[illegible]

Development Area	(1) Area, ac	(2) C	(1) x (2) (3)
Residential dwellings (single-family)	141.5	0.50	70.75
Residential dwellings (multi-family)	7.0	0.75	5.25
Apartment dwellings	11.5	0.70	8.05
Senior Housing	6.0	0.70	4.20
Package WW Pump Station	2.0	0.80	1.60
Community Center	5.0	0.40	2.00
Fire Station	1.0	0.80	0.80
Park	15.0	0.25	3.75
Open Space	34.0	0.30	10.20
Collector Roads	37.0	0.95	35.15
Total	260.0	0.55*	141.75

*Note: Composite "C" = (3)/(1) for total development area.

From Table 3, Minimum Runoff Coefficients for Built-up Areas:
Residential Areas, C = 0.55 to 0.70

Since, $C = 0.55$ use C = **0.55 (Post Developed on-site area)**

Consider the Rational Method first in estimating the post development flows for the small basins less than or equal to 100 acres.

Rational Method: $Q = CIA$
Use C = **0.33** for existing off-site areas.

A weighted average of the "C" values is used for each small basin.

For D-A1: $C = \dfrac{(0.33\times 25.28ac)+(0.55\times 42.21ac)}{67.49ac} = 0.47$

For D-A2: $C = \dfrac{(0.33\times 25.06ac)+(0.55\times 9.64ac)}{34.7ac} = 0.39$

For D-A3: $C = 0.55$

For D-B1: $C = \dfrac{(0.33\times 20.54ac)+(0.55\times 48.91ac)}{69.45ac} = 0.48$

For D-C1, D-D1, D-E1, and D-F1: $C = 0.55$

For D-F2: $C = \dfrac{(0.33\times 92.22ac)+(0.55\times 2.47ac)}{94.69} = 0.34$

Determine T_c, time of concentration from Plate 1, Overland Flow Chart. See Appendix A for the County Drainage Standards tables and plates referred to. Appendix A contains a series of Plate 1 showing the determination of the time of concentration for the drainage areas less than 100 acres.

Determine "I," rainfall intensity. Using the 50 Year-1 Hour-Rainfall plate, approximately 2.9 inches of rain falls on the project site. Enter Plate 2 with the 1-hour rainfall value and the required time of concentration. Obtain the design rainfall intensity in inches per hour.

The following table summarizes the estimated rainfall intensity for each small basin:

Drainage Basin	I (in)	T_c (min)	I (in/hr)
A1	2.9	61	2.9
A2	2.9	34	3.9
A3	2.9	49	3.2
B1	2.9	40	3.5
C1	2.9	35	3.8
D1	2.9	29	4.1
E1	2.9	23.5	4.4
F1	2.9	22	4.5
F2	2.9	38	3.7

The following table summarizes the determination of peak runoff for the small drainage basins using the Rational Method:

Drainage Basin	C	I (in/hr)	A (ac)	Q (cfs)
A1	0.47	2.9	67.49	92
A2	0.39	3.9	34.7	53
A3	0.55	3.2	5.74	10
B1	0.48	3.5	69.45	117
C1	0.55	3.8	19.65	41
D1	0.55	4.1	6	14
E1	0.55	4.4	2.67	6
F1	0.55	4.5	6.54	16
F2	0.34	3.7	94.69	120

Determine the peak runoff for the large basins using the NRCS computer program WinTR-55, version 1.0.08. The existing soil on both the on-site and off-site drainage areas are type "B," hydrological classification. The existing off-site land use is shrub and brush rangeland-good. The proposed on-site land use is residential. The curve number, CN for a large drainage basin is the weighted average based on:

Soil Hydrological Classification	Off-site CN	On-site CN
A	39	77
B	61	85
C	74	90
D	80	92

The curve number, CN for the post-developed condition in the large drainage basins is the weighted average of the off-site area and on-site area.

D-A4: $$CN = \frac{(467.91ac \times 61) + (31.19ac \times 85)}{499.1ac} = 62.5$$

D-B2: $$CN = \frac{(130.31ac \times 61) + (21.51ac \times 85)}{151.82ac} = 64.4$$

D-C2: $$CN = \frac{(220.56ac \times 61) + (25.65ac \times 85)}{246.21ac} = 63.5$$

D-D2: $$CN = \frac{(98.94ac \times 61) + (31.53ac \times 85)}{130.47ac} = 66.8$$

D-E2: $$CN = \frac{(221.43ac \times 61) + (12.68ac \times 85)}{234.11ac} = 62.3$$

The time of concentration, T_c is estimated using the Kirpich Equation developed for agricultural watersheds.
For overland flow over grassy mountains,

$$T_c = m \times 0.00013 \times \frac{L^{0.77}}{S^{0.385}} \times C_t$$

Where T_c = *time of concentration in hours.*

$m = 2.000$ *Earth type coefficient*

L = *length of the overland flow in feet.*

S = *average overland slope in ft / ft.*

$C_t = 1.760$ *time of concentration coefficient*

An adjustment is made for watersheds with a CN less than 80 using the following equation:

$$T_c = T_c \times (1 + (80 - CN) \times 0.04$$

Where CN = *Curve Number*

From the "Rainfall Frequency Atlas of the Hawaiian Islands," Technical Paper No. 43, 1962, the rainfall, "P" for 100-year, 24-hour storm is determined for each of the large basins.

Appendix B, contains the printout from the WinTR-55 program for the large basins. The following table summarizes the resulting peak runoff, Q_p:

Drainage Basin	Area (ac)	CN	P (in)	T_c (hr)	Q_p (cfs)
A4	499.1	62.5	12.9	1.602	903.96
B2	151.82	64.4	12.1	0.936	362.49
C2	246.21	63.5	12.2	1.213	497.44
D2	130.47	66.8.	11.7	0.739	364.45
E2	234.11	62.3	12.1	1.133	473.31

The post-developed storm runoff from the design storms' precipitation falling on the drainage basins of the on-site and off-site areas and flowing into the existing drainage system along Honoapiilani Highway have been estimated. See Figure 5, Finished Drainage Basins on page 23 for reference.

3.3.2 Proposed On-site Detention Basin and Subsurface Detention Systems

The following table compares the estimated existing and proposed storm runoff from each drainage basin. Also the proposed detention and maximum target detention discharge are listed. The proposed detention basin (DB) is a proposed pond which is sized to attenuate the inflow runoff and to discharge runoff downstream at a reduced flow rate. A detention basin is a pond with a discharge structure. Subsurface detention (SD) system is an underground assumed large pipe network with a discharge culvert. The maximum target discharge is based on the estimated inlet capacity of the existing drainage structures along Honoapiilani Highway and the existing drainage system at Maalaea Waterfront Plaza. See Figure 6, Detention Systems and Headwalls/Inlets on page 24 for reference.

Drainage Basin	Exst Q (cfs)	Prop. Q (cfs)	Prop. Detention	Maximum Target Q (cfs)
A1	61	92	DB-1	--
A2	43	53	DB-1	--
A3	6	10	DB-1	--
A4	865	904	DB-1[1]	310
B1	75	117	SD-1	--
B2	320	362	SD-1[2]	90
C1	22	41	SD-2	--
C2	456	497	SD-2[3]	20
D1	7	14	SD-3	--
D2	288	364	SD-3[4]	160
E1	4	6	SD-4	--
E2	454	473	SD-4[5]	320
F1	9	16	SD-5	--
F2	109	113	SD-5[6]	110

Notes:
1. Discharge to headwall of 10' x 6' box culvert (BL Sta. 14+20).
2. Discharge to headwall of 5' x 3' box culvert (BL Sta. (-) 0+40).
3. Discharge to headwall of 6' x 2.5' box culvert (BL Sta. (-) 9+05).
4. Discharge to headwall of 6' x 4' box culvert (BL Sta. (-) 18+44).
5. Discharge to headwall of 6' x 4' box culvert (BL Sta. (-) 18+41) and to headwall of 6' x 4' box culvert (BL Sta. (-) 27+77).
6. Discharge to headwall of 4' x 4' box culvert (BL Sta. (-) 33+16).

Attempt to size the proposed detention systems to meet at least the maximum target discharges. See Appendix C for the planning estimates for detention systems in the buffer area between the residential and the highway.

DB-1 is estimated to reduce the peak storm runoff from post-developed condition drainage basins D-A1 thru D-A4 from 904 cfs to 825 cfs which exceeds the desired 310 cfs by 515 cfs. The proposed DB-1 does reduce the peak storm runoff to below the existing 865 cfs. The current subdivision configuration allows for approximately 5.3 acre detention basin surface area and approximately 2,400,000 cubic feet storage volume. An estimated 14.0 acre detention basin surface area would provide approximately 5,500,000 cubic feet storage volume, allowing peak flow attenuation to less than 310 cfs; however, this appears an impractical solution. The proposed DB-1 will include discharge structures consisting of a pipe culvert and a weir structure which would dissipate the overflow from DB-1 to sheet flow traveling at less than 5 fps toward the 50' green space setback highway corridor.

SD-1 is a subsurface detention system which should be sized to reduce the peak storm runoff from the post-developed condition drainage basin D-B1 and D-B2 from 362 cfs to a desired 90 cfs, but not more than 320 cfs (existing condition). A preliminary layout assuming 96" large corrugated steel pipe (CSP) is sized approximately 720' x 180' (3.0 ac) with a storage capacity of approx. 489,000 cubic feet to reduce the peak flow below 320 cfs to 262 cfs. During the design process, if other strategies are employed, the peak flow can be further reduced. Strategies to achieve this are:

1. Runoff from roof areas and parking areas is piped through perforated subdrains to underground french drains or dry wells; and

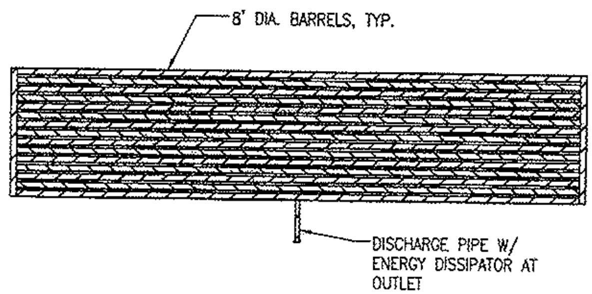
2. Install an infiltration trench along the 50' green space setback highway corridor. This infiltration trench has an excavated width of 3 to 10 ft and is backfilled with stone aggregate to form a subsurface catch basin.

SD-2 is a subsurface detention system which should be sized to reduce the peak storm runoff from the post-developed condition drainage basin D-C1 and D-C2 from 497 cfs to a desired 20 cfs, but not more than 456 cfs (existing condition). An unrealistic layout size of over 41 ac is required to reduce the peak storm flow to below 20 cfs. An alternate layout size of 800' x 240' (4.4 ac) with a storage capacity of approx. 782,000 cubic feet does reduce the peak flow to 381 cfs which exceeds the desired 20 cfs by 361 cfs. This alternate layout does reduce the peak storm runoff to below the existing 456 cfs. This underground storage layout will include a discharge structure consisting of a pipe culvert and pipe outlet riprap which will protect against erosion and spread the discharge toward the 50' green space setback at below erosive velocity (< 5 fps). During design, application of the previously listed strategies can reduce the layout size and/or the peak storm flow.

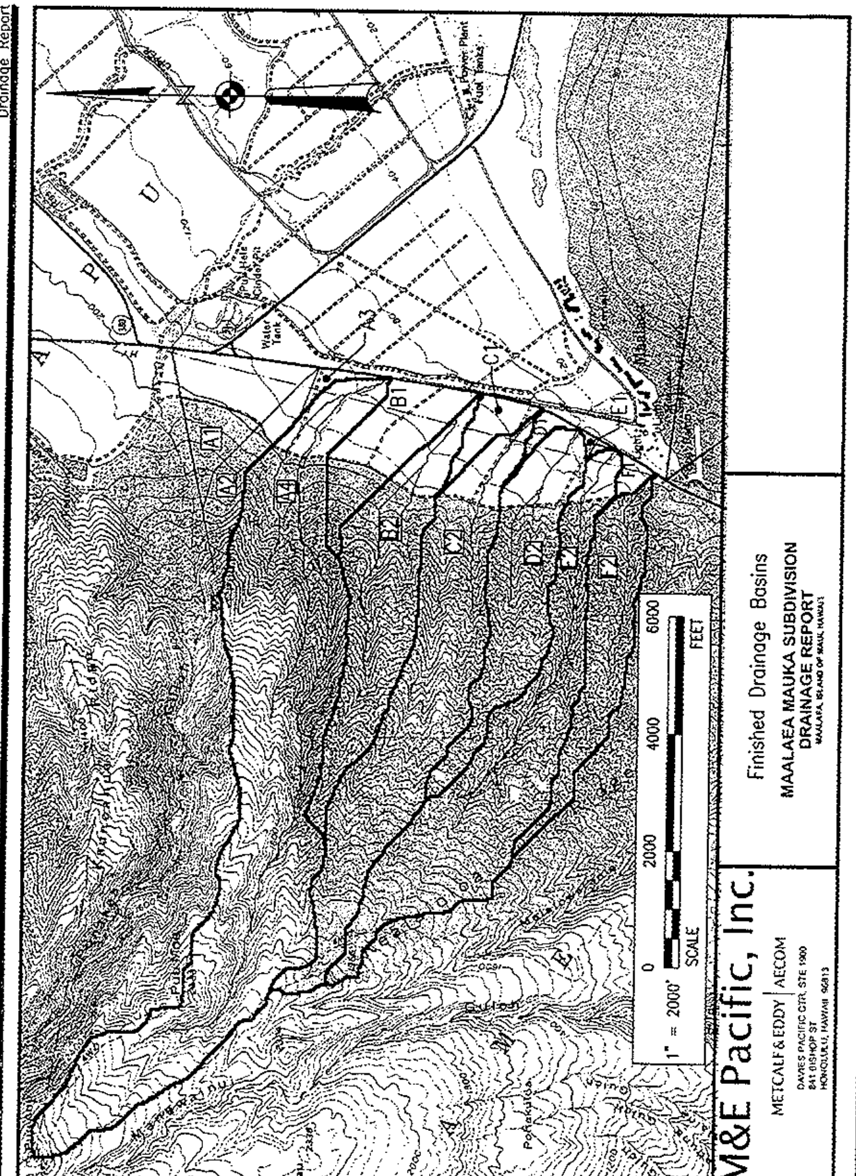
SD-3 is a subsurface detention system which should be sized to reduce the peak storm runoff from the post-developed condition drainage basin D-D1 and D-D2 from 364 cfs to a desired 160 cfs, but not more than 288 cfs (existing condition). A preliminary layout assuming 96" dia. CSP is sized approx. 800' x 220' (4.0 ac) with a storage capacity of approx. 708,000 cubic feet to reduce the peak flow below 160 cfs to 158 cfs. During design, application of the previously listed strategies can reduce the layout size and/or the peak storm flow.

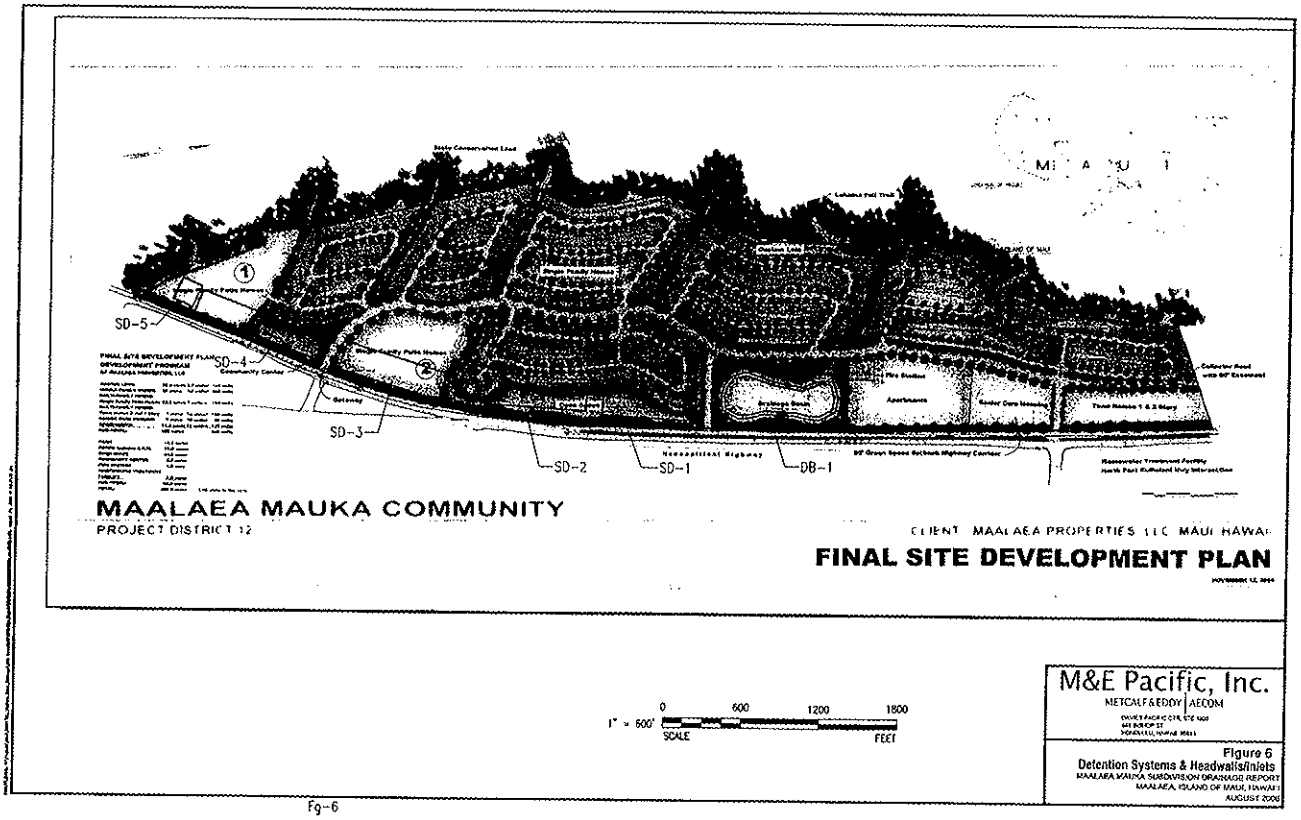
SD-4 is a subsurface detention system which should be sized to reduce the peak storm runoff from the post-developed condition drainage basin D-E1 and D-E2 from 473 cfs to a desired 320 cfs, but not more than 454 cfs (existing condition). A preliminary layout assuming 96" dia. CSP is sized approx. 1000' x 180' (4.1 ac) with a storage capacity of approx. 729,000 cubic feet to reduce the peak flow below 454 cfs to 364 cfs. During design, application of the previously listed strategies can reduce the layout size and/or the peak storm flow.

SD-5 is a subsurface detention system which should be sized to reduce the peak storm runoff from the post-developed condition drainage basin D-F1 and D-F2 from 125 cfs to a desired 110 cfs, but not more than 119 cfs (existing condition). A preliminary layout assuming 96" dia. CSP is sized approx. 160' x 180' (0.7 ac) with a storage capacity of approx. 120,500 cubic feet to reduce the peak flow below 110 cfs.



TYPICAL SUBSURFACE DETENTION SYSTEM – PLAN





SECTION 4
Summary

SECTION 4 SUMMARY

4.1 SUMMARY AND CONCLUSION

The surface runoff from the proposed improvements will be detained by a permanent detention basin and a series of permanent subsurface detention systems located in a buffer area between Honoapiilani Highway and the proposed Maalaea Mauka residential development. The use of perforated subdrains and drywells to collect storm runoff from roofs and parking areas for disposal of storm runoff is another possibility which should be considered during the design phase.

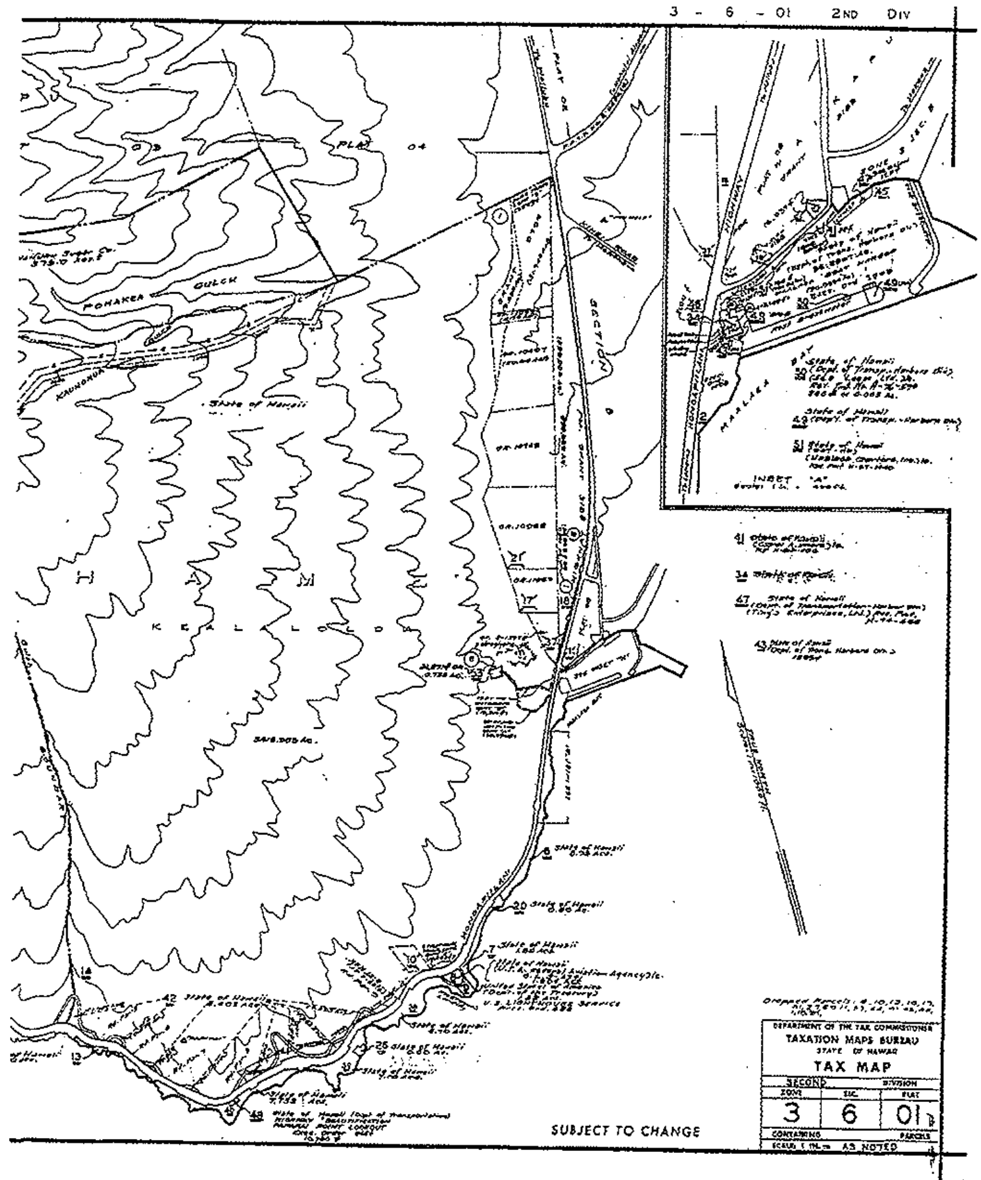
The goal is to reduce the proposed estimated peak storm runoff into the existing drainage system along the Honoapiilani Highway to less than the existing hydrologic condition to prevent or at least mitigate flooding of the existing Maalaea Waterfront Plaza commercial development when a 50-year, 1-hour storm or more severe rainfall occurs.

Presently the existing culverts along Honoapiilani Highway are hydraulically undersized to convey the existing 100 year storm. The Maalaea Mauka improvements will mitigate the overtopping flood condition across Honoapiilani Highway. Overall, the storm runoff to be conveyed through the highway (along the development frontage) will go from 2726 cfs down to 2060 cfs, a reduction of 666 cfs.

APPENDICES

Appendix A	Hydrologic Calculations – Existing Drainage Basins
Appendix B	Hydrologic Calculations – Finished Drainage Basins
Appendix C	Hydrologic Calculations – Detention Systems

APPENDIX A
Hydrologic Calculations – Existing Drainage Basins



5

Table 1

GUIDE FOR THE DETERMINATION OF RUNOFF COEFFICIENTS FOR BUILT-UP AREAS*

WATERSHED CHARACTERISTICS	EXTREME	HIGH	MODERATE	LOW
INFILTRATION	NEGLIGIBLE 0.20	SLOW 0.14	MEDIUM 0.07	HIGH 0.0
RELIEF	STEEP (> 25%) 0.08	HILLY (15 - 25%) 0.06	ROLLING (5 - 15%) 0.03	FLAT (0 - 5%) 0.0
VEGETAL COVER	NONE 0.07	POOR (< 10%) 0.05	GOOD (10 - 50%) 0.03	HIGH (50 - 90%) 0.0
DEVELOPMENT TYPE	INDUSTRIAL & BUSINESS 0.55	HOTEL-APARTMENT 0.45	RESIDENTIAL 0.40	AGRICULTURAL 0.15

*NOTE: *The design coefficient "c" must result from a total of the values for all four watershed characteristics of the site.*

Table 2

RUNOFF COEFFICIENTS

Type of Drainage Area	Runoff Coefficient C
Business:	
Downtown areas	0.95
Neighborhood areas	0.70
Residential:	
Single-family areas	0.50
Multi-units, detached	0.60
Multi-units, attached	0.75
Suburban	0.40
Apartment dwelling areas	0.70
Industrial:	
Light areas	0.80
Heavy areas	0.90
Parks, cemeteries	0.25
Playgrounds	0.35
Railroad-yard areas	0.40
Unimproved areas	0.30
Streets:	
Asphaltic	0.95
Concrete	0.95
Brick	0.85
Drive and walks	0.85
Roofs	0.95
Lawns:	
Sandy, soil, flat, 2%	0.10
Sandy, soil, avg., 2-7%	0.15
Sandy, soil, steep, 7%	0.20
Heavy soil, flat, 2%	0.17
Heavy soil, avg., 2-7%	0.22
Heavy soil, steep, 7%	0.35

Table 3

MINIMUM RUNOFF COEFFICIENTS FOR BUILT-UP AREAS

RESIDENTIAL AREAS:	C = 0.55 to 0.70
HOTEL-APARTMENT AREAS:	C = 0.70 to 0.90
BUSINESS AREAS:	C = 0.80 to 0.90
INDUSTRIAL AREAS:	C = 0.80 to 0.90

The type of soil, the type of open space and ground cover, and the slope of the ground shall be considered in arriving at reasonable and acceptable runoff coefficients.

Table 4

APPROXIMATE AVERAGE VELOCITIES OF RUNOFF FOR CALCULATING TIME OF CONCENTRATION

TYPE OF FLOW	VELOCITY IN FPS FOR SLOPES (in percent) INDICATED			
OVERLAND FLOW:	0-3%	4-7%	8-11%	12-15%
Woodlands	1.0	2.0	3.0	3.5
Pastures	1.5	3.0	4.0	4.5
Cultivated	2.0	4.0	5.0	6.0
Pavements	5.0	12.0	15.0	18.0
OPEN CHANNEL FLOW:				
Improved Channels	Determine Velocity by Manning's Formula			
Natural Channel* (not well defined)	1.0	3.0	5.0	8.0

**These values vary with the channel size and other conditions so that the ones given are the averages of a wide range. Wherever possible, more accurate determinations should be made for particular conditions by Manning's formula.*

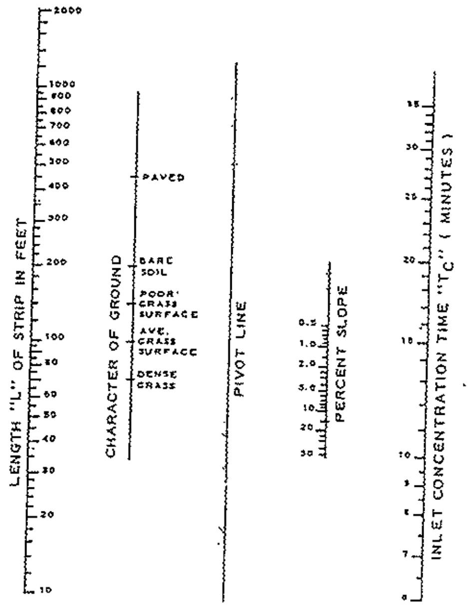
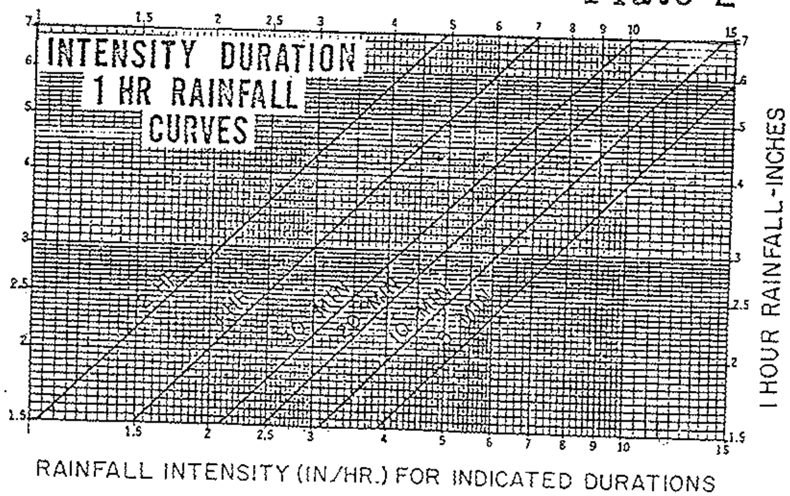


Plate 1

Overland
Flow
Chart

Plate 2



D - A1

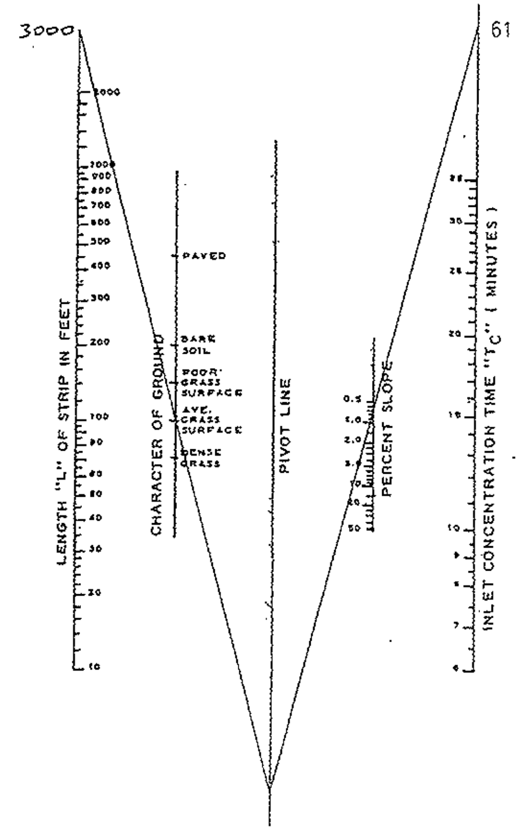


Plate 1

Overland
Flow
Chart

D - A2

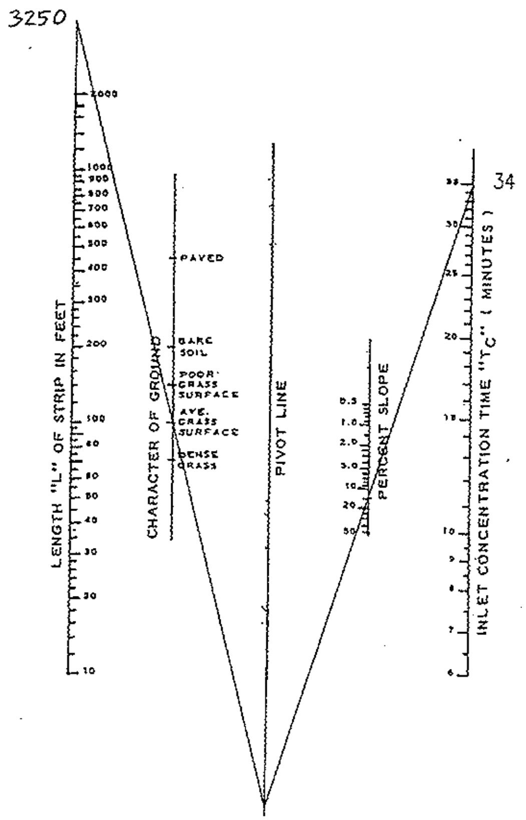


Plate 1

Overland Flow Chart

D - A3

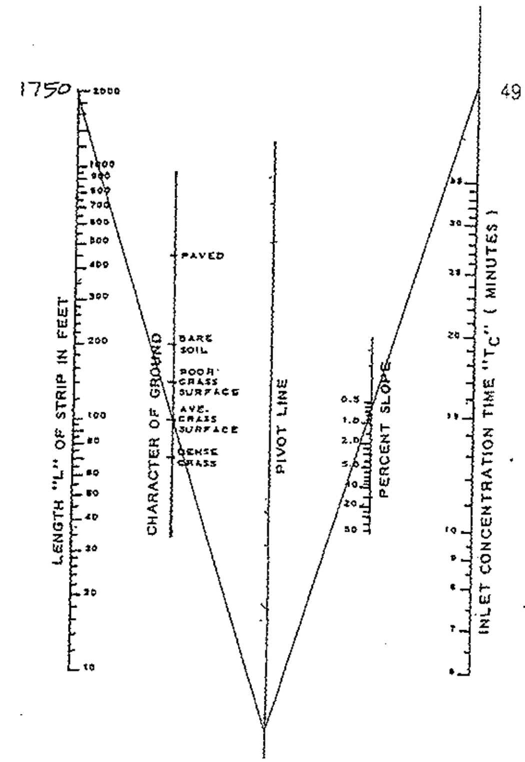


Plate 1

Overland Flow Chart

D -B1

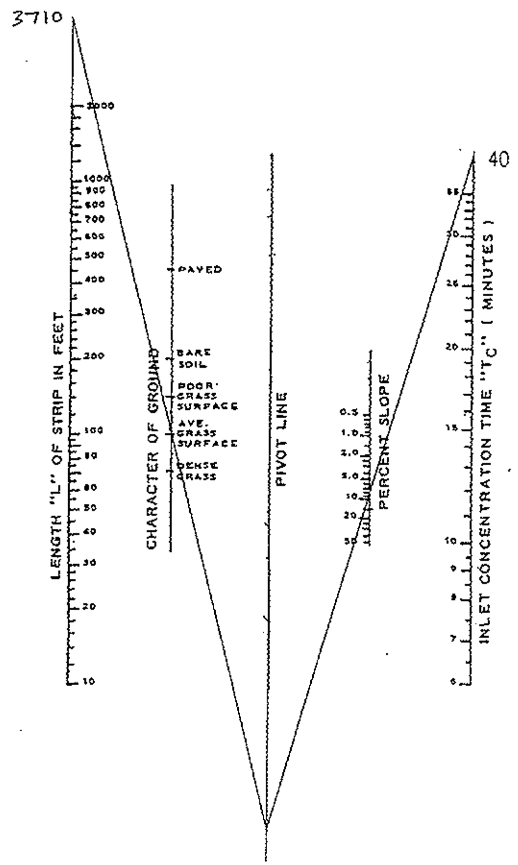


Plate 1

Overland
Flow
Chart

D - C1

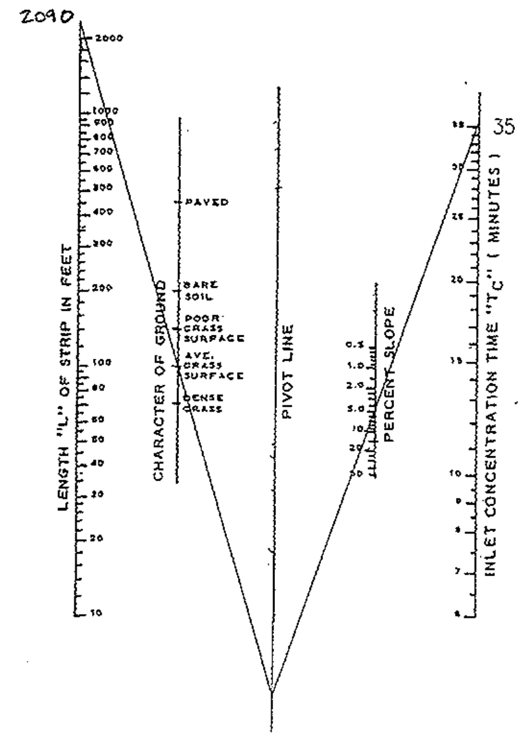


Plate 1

Overland
Flow
Chart

D - D1

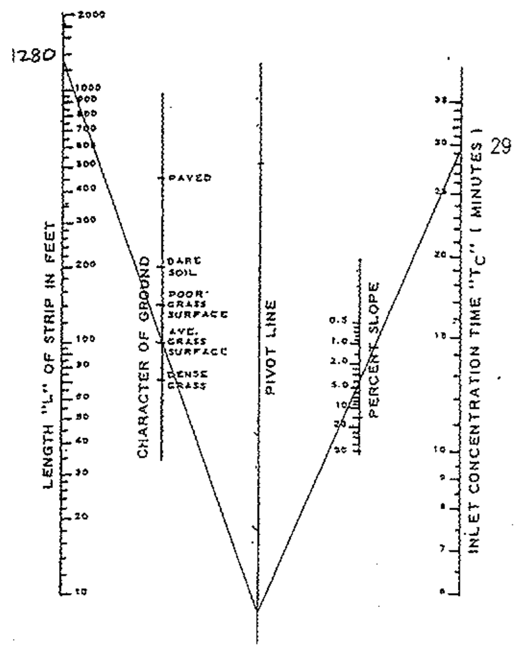


Plate 1

Overland Flow Chart

D - E1

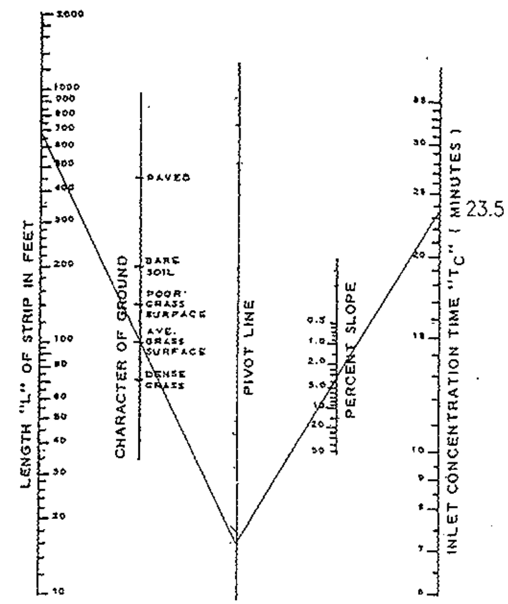


Plate 1

Overland Flow Chart

D -F1

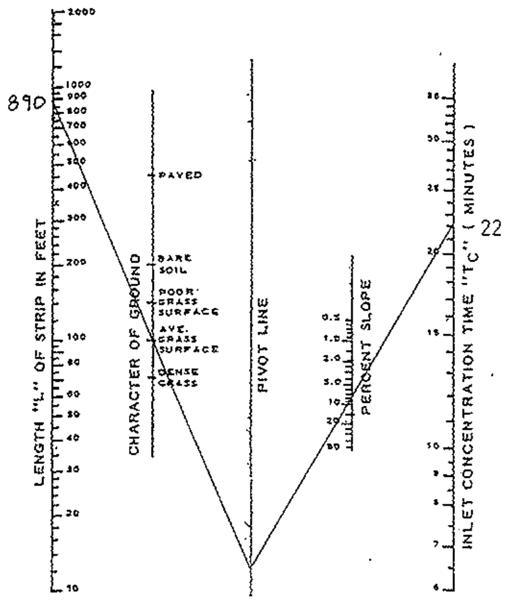
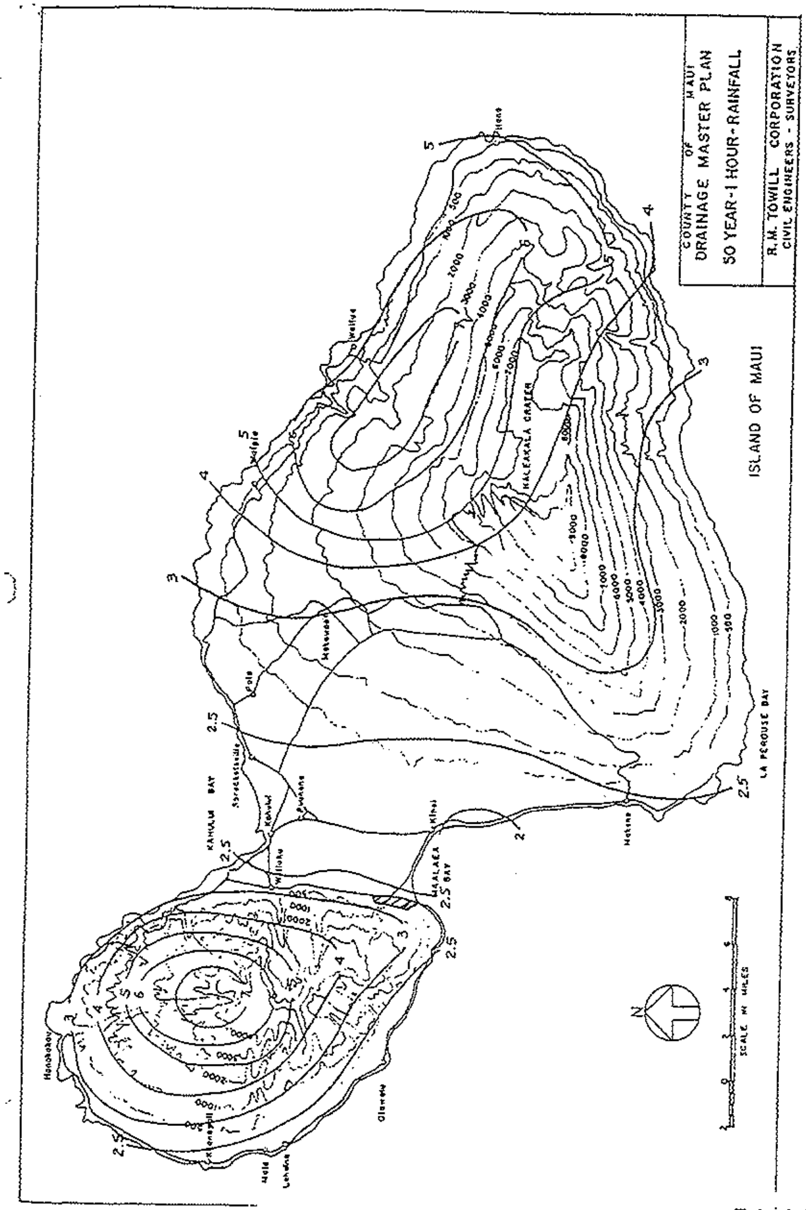


Plate 1

Overland Flow Chart



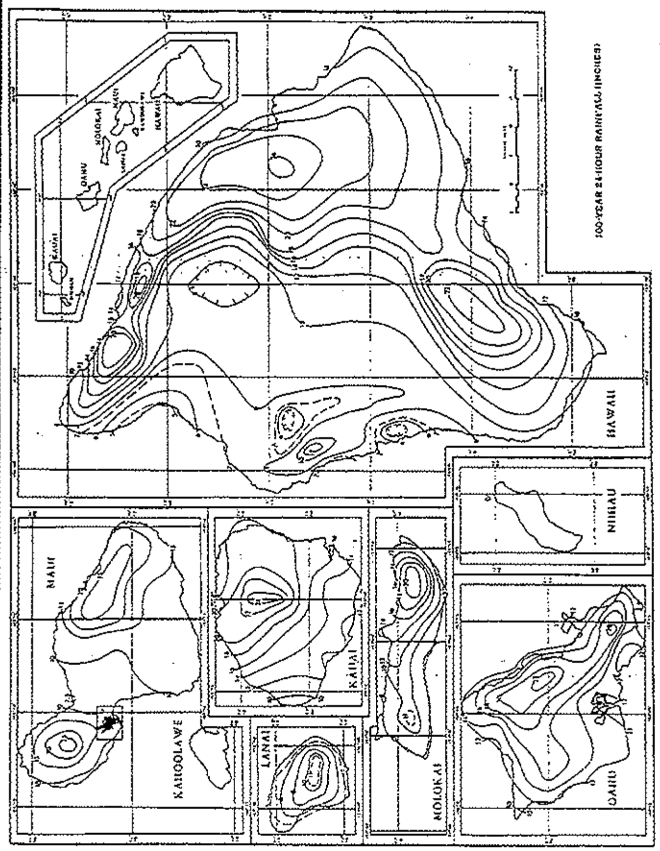


FIGURE 50.—100-yr, 24-hr. rainfall (in.)

57

M&E Pacific, Inc.
METCALF & EDDY | AECOM
DAVIES PACIFIC CTR. STE 1800
841 BISHOP ST.
HONOLULU, HAWAII 96813

MAALAEA MAUKA SUBDIVISION
DRAINAGE REPORT
MAALAEA, ISLAND OF MAUI, HAWAII

D-A4 (Exst)

PI

Maalaea Mauka Subdivision
Existing
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
A4	865.39
	10.94
REACHES	
OUTLET	865.39

WinTR-55 Current Data Description

--- Identification Data ---

```
User:      PI                                       Date:        10/3/2005
Project:   Maalaea Mauka Subdivision                Units:       English
SubTitle:  Existing                                 Areal Units: Acres
State:     Hawaii
County:    Maui
Filename:  C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_Ex_A4.w55
```

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
A4	Offsite & Exst Onsite	Outlet	499.1	61	1.659

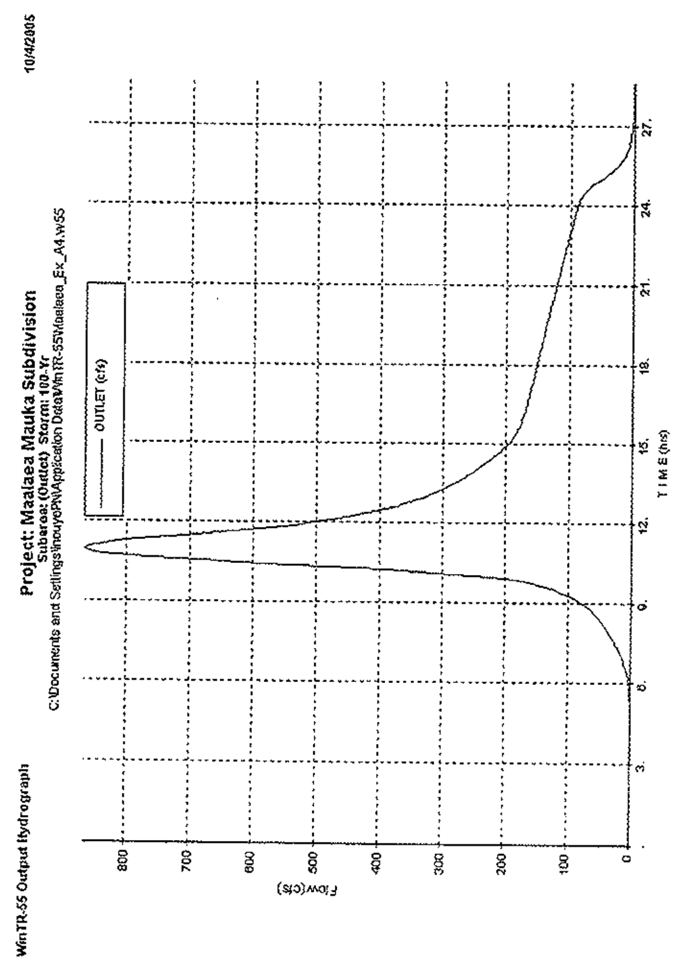
Total area: 499.10 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.9	.0

```
Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type I
Dimensionless Unit Hydrograph:  <standard>
```

D-B2 (Exst)

PI

Maalaea Mauka Subdivision
Existing
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
B2	319.50 10.55
REACHES	
OUTLET	319.50

WinTR-55 Current Data Description

--- Identification Data ---

User: PI
Project: Maalaea Mauka Subdivision
SubTitle: Existing
State: Hawaii
County: Maui
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_Ex_B2.w55

Date: 10/4/2005
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
B2	Offsite & Exst Onsite	Outlet	151.82	61	1.014

Total area: 151.82 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.1	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>

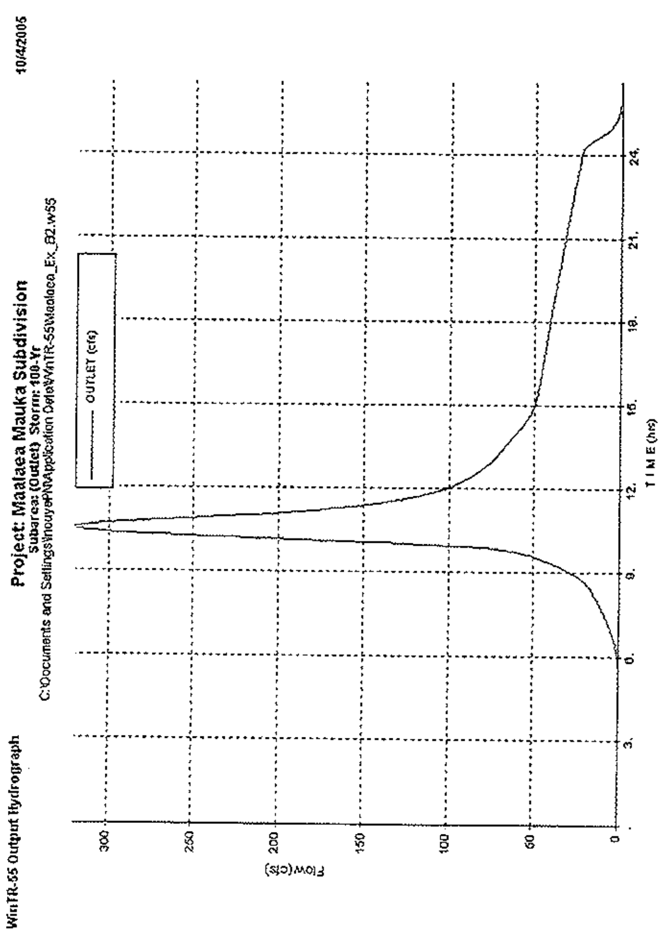
D-C2 (Exst)

PI

Maalaea Mauka Subdivision
Existing
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
C2	455.75 10.72
REACHES	
OUTLET	455.75



WinTR-55 Current Data Description

--- Identification Data ---

User:	PI	Date:	10/4/2005
Project:	Maalaea Mauka Subdivision	Units:	English
SubTitle:	Existing	Areal Units:	Acres
State:	Hawaii		
County:	Maui		
Filename:	C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_Ex_C2.w55		

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
C2	Offsite & Exst Onsite	Outlet	246.21	61	1.286

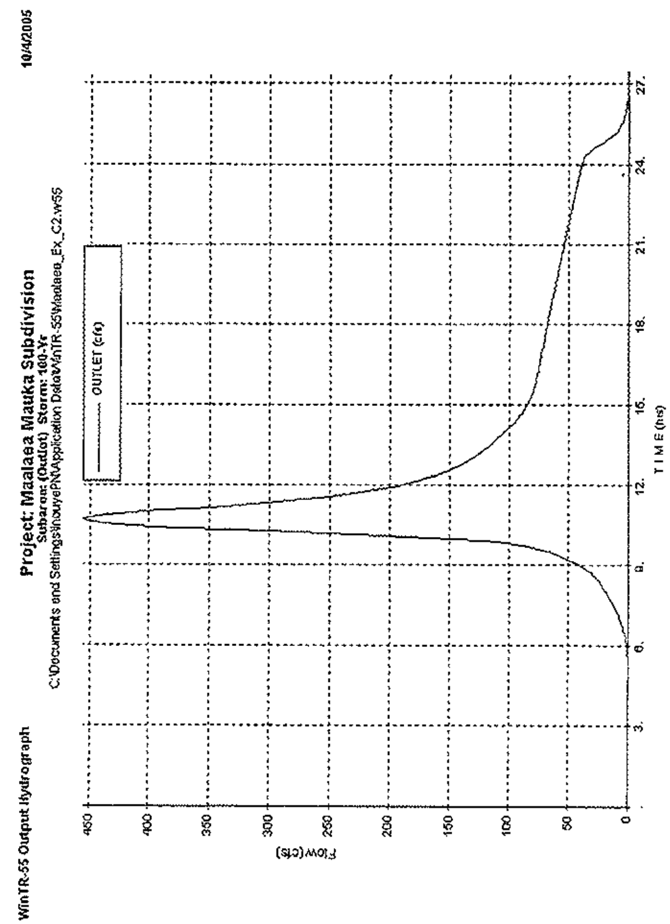
Total area: 246.21 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.2	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>



D-D2 (Exst)

PI

Maalaea Mauka Subdivision
Existing
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
D2	288.27
	10.43
REACHES	
OUTLET	288.27

WinTR-55 Current Data Description

--- Identification Data ---

User: PI
Project: Maalaea Mauka Subdivision
SubTitle: Existing
State: Hawaii
County: Maui
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_Ex_D2.w55

Date: 10/4/2005
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
D2	Offsite & Exst Onsite	Outlet	130.47	61	0.851

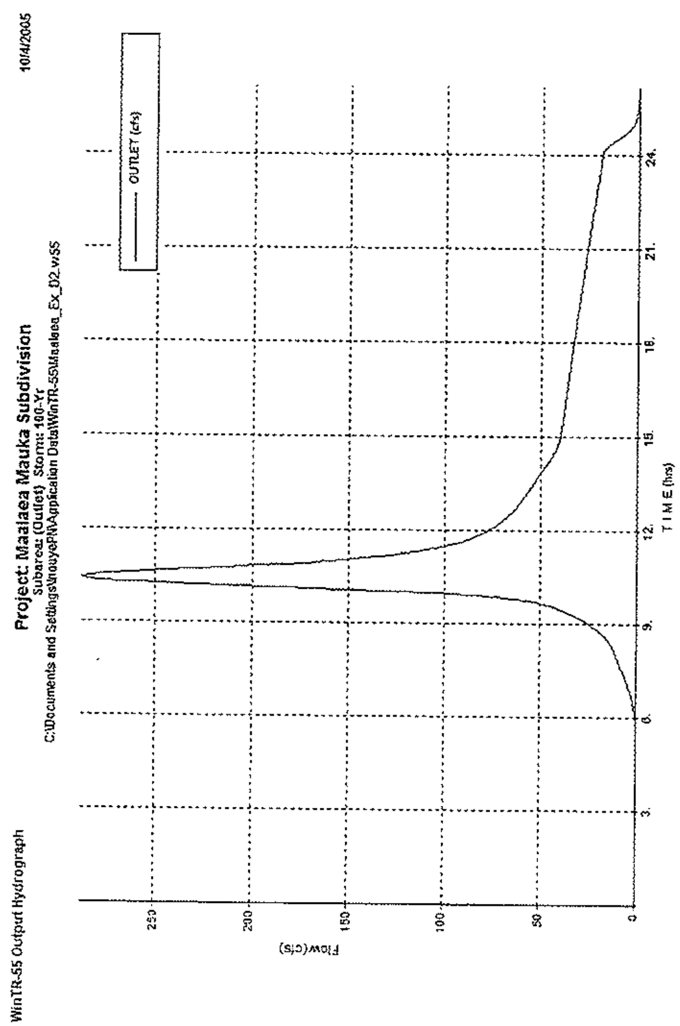
Total area: 130.47 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	11.7	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>



D-E2 (Exst)

PI

Maalaea Mauka Subdivision
Existing
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
E2	453.70
	10.61
REACHES	
OUTLET	453.70

WinTR-55 Current Data Description

--- Identification Data ---

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User:      PI                                        Date:        10/4/2005
Project:   Maalaea Mauka Subdivision                 Units:       English
SubTitle:  Existing                                  Areal Units: Acres
State:     Hawaii
County:    Maui
Filename:  C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_Ex_D2.w55
```

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
E2	Offsite & Exst Onsite	Outlet	234.11	61	1.167

Total area: 234.11 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.1	.0

```
Storm Data Source:                User-provided custom storm data
Rainfall Distribution Type:       Type I
Dimensionless Unit Hydrograph:    <standard>
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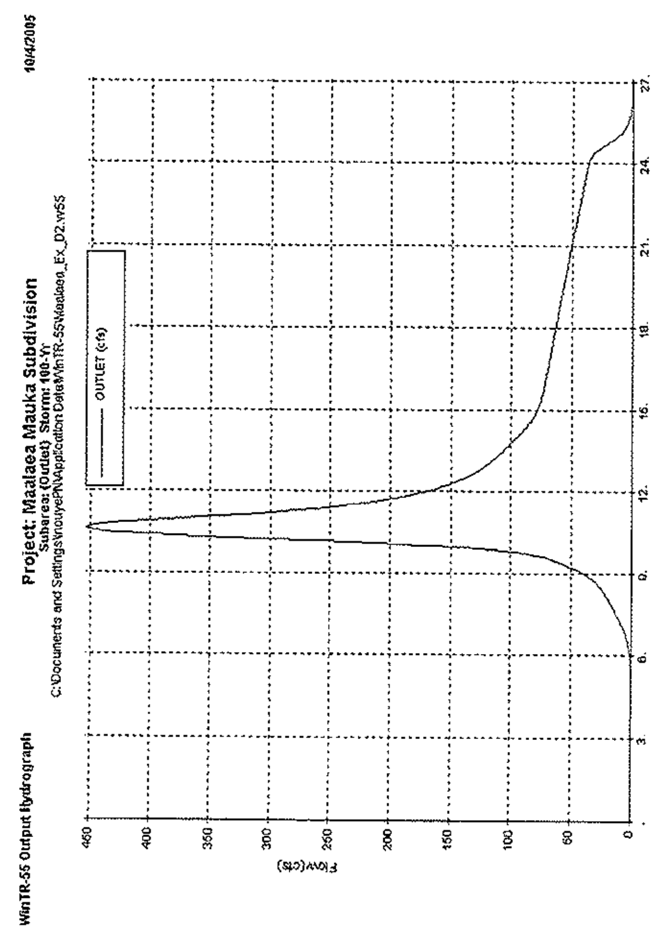
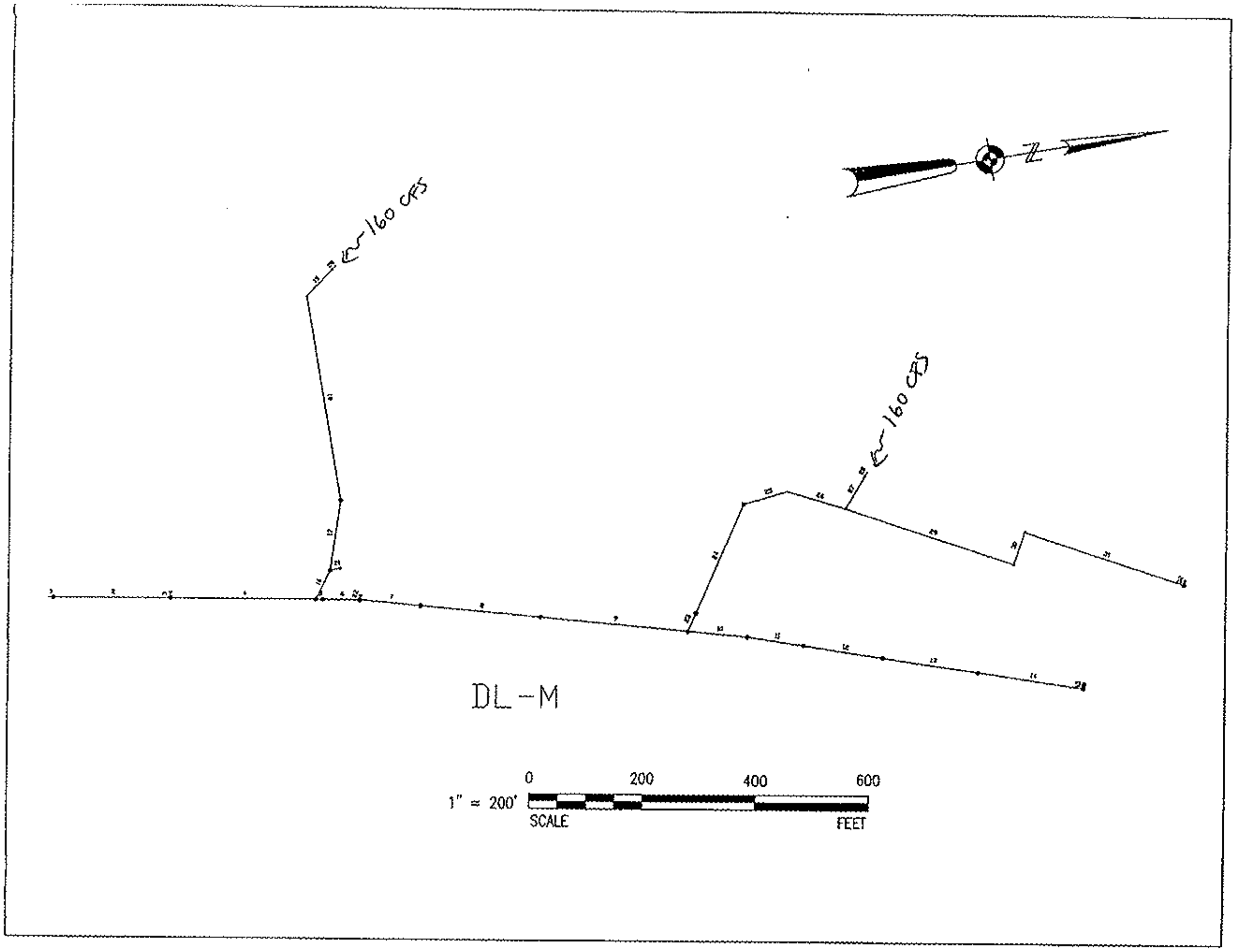
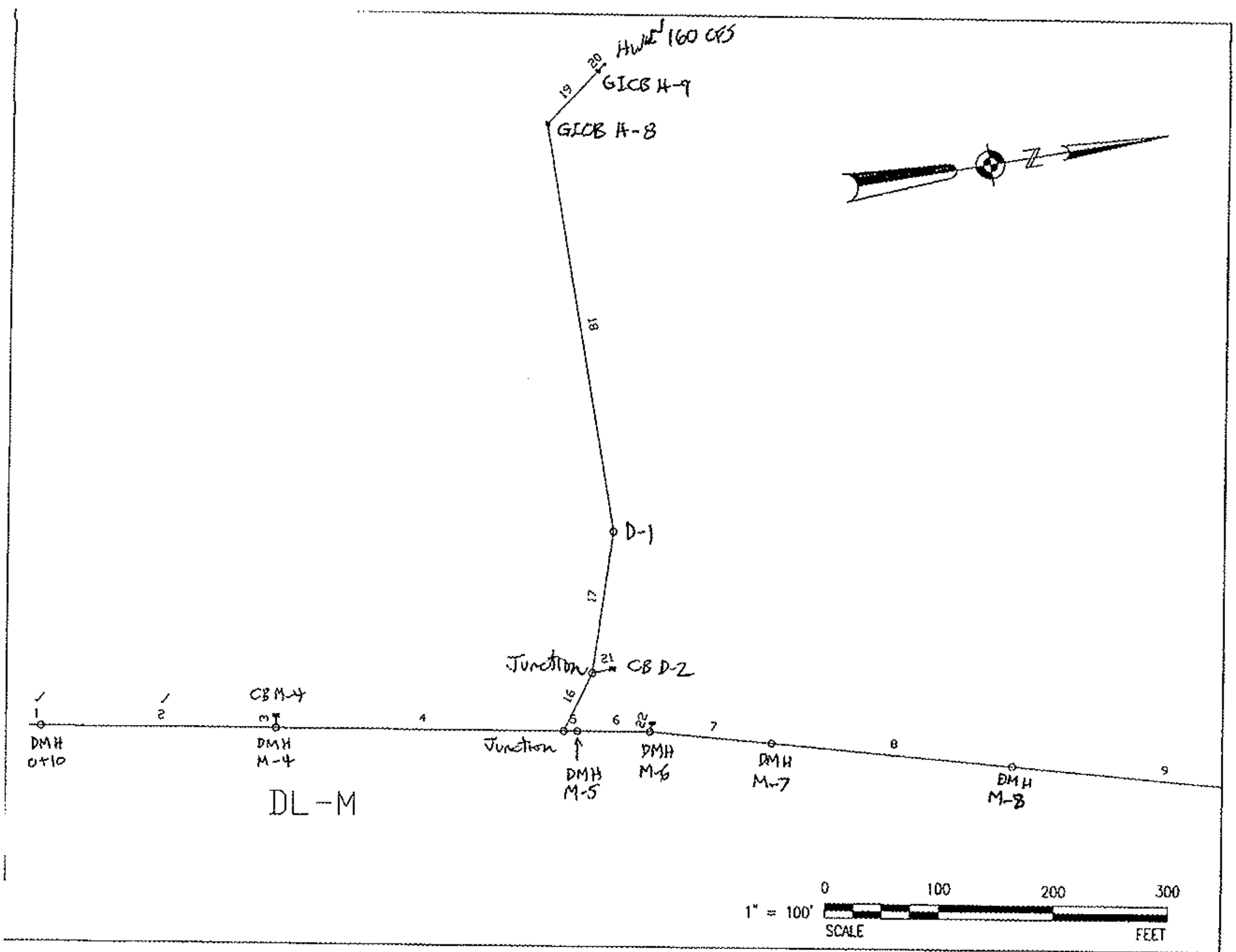
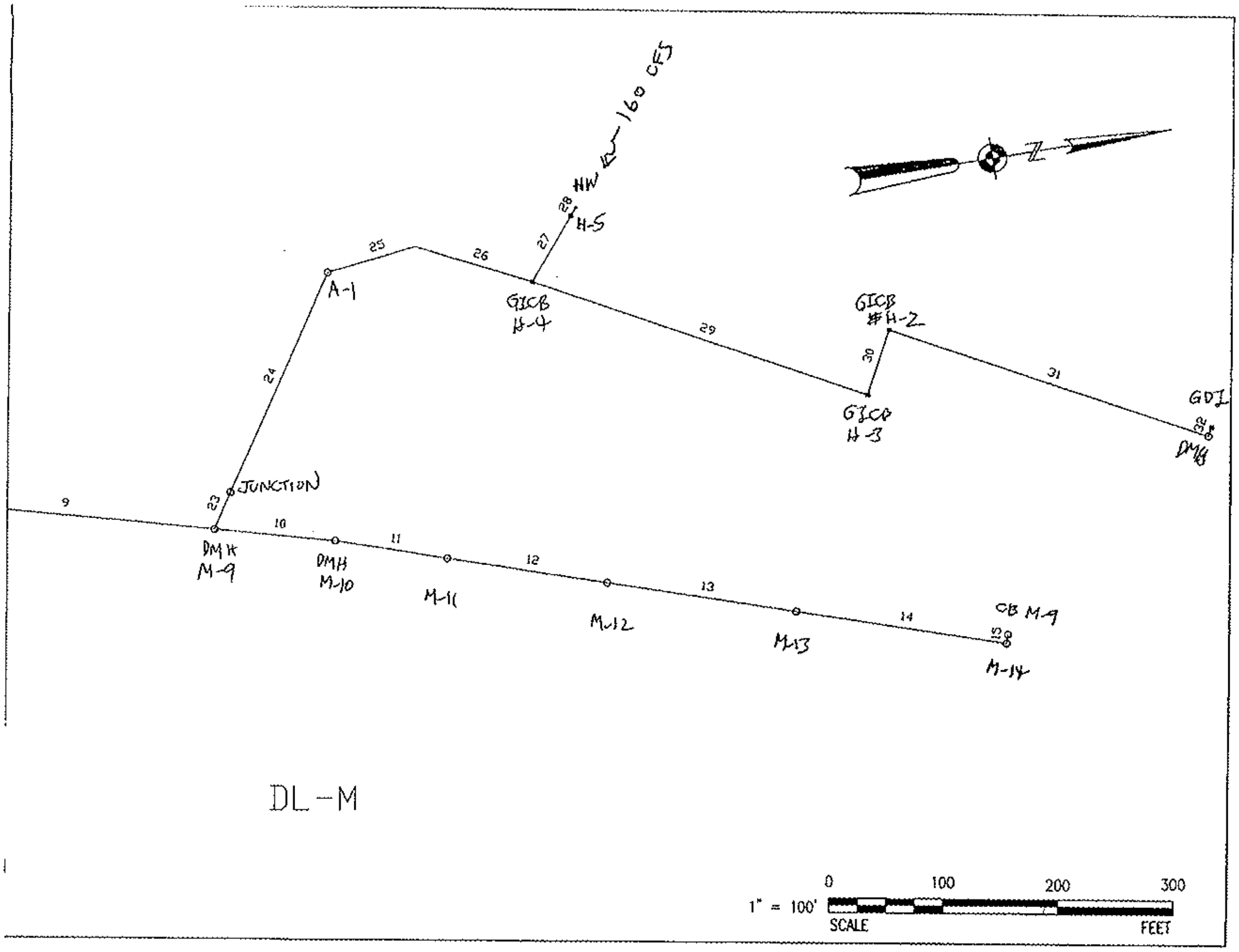




~160 CFS
~160 CFS
DL-M
0
200
400
600
1" = 200'
SCALE
FEET



HW 160 CFS
GICB H-9
GICB H-8
D-1
Junction
CB D-2
CB M-4
DMH
0+10
DMH
M-4
Junction
DMH
M-5
DMH
M-6
DMH
M-7
DMH
M-8
DL-M
0
100
200
300
1" = 100'
SCALE
FEET



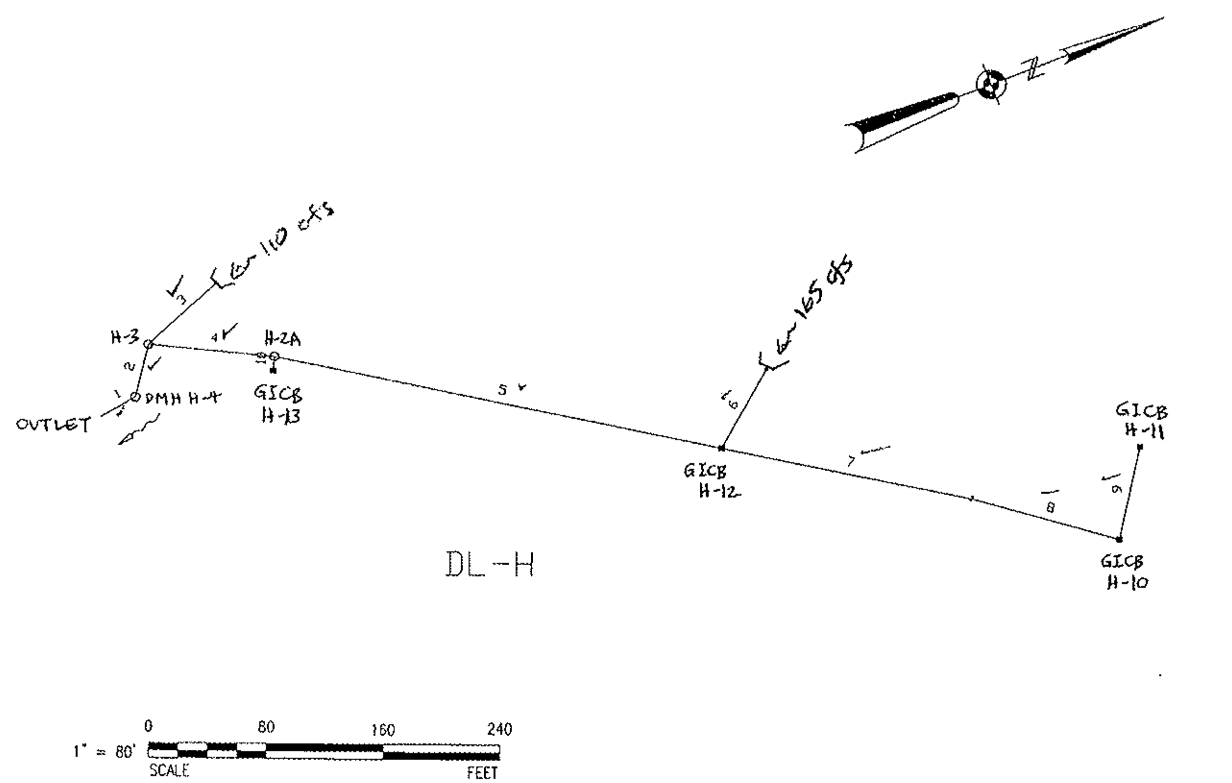
DRAINAGE.XLS

PROJECT: MAALAEA MAUKA SUBDIVISION
DRAIN LINE: DL-M
DRAINAGE DESIGN DATA
DATE: 9/23/2005
COMPUTED BY: PI
CHECKED BY:

Inlet	Q Accum.	dn	Vf	Size of Pipe	Length of Seg.	Sf	S	Lower Invert	Upper Invert	Hf	Man A	B	C	D	Ent. Cont.	Hydraulic Grade Elevation Down	Hydraulic Grade Elevation Up	Finished Grade Elevation	Remarks
OUTLET																			
RC BOX	397.37	5.31	4.73	12'x 7'	10.00	1.65%	0.50%	-8.00	-8.00								3.00	8.00	Full; 5.00'FB
DMH 0+10										0.16						3.16			
RC BOX	397.37	3.33	4.73	12'x 7'	204.00	1.65%	1.64%	-7.95	-0.90		0.04	0.00	0.03	0.17	5.39		3.40	8.00	Full; 4.60'FB
DMH M-4										3.36						6.76			
RC BOX	394.00	6.76	4.75	-10'x 8'	253.19	0.40%	1.86%	2.45	2.45		0.04	0.00	0.03	0.17	5.39		9.21	13.70	Open; 4.49'FB
Junction										1.00						13.92			
RC BOX	218.79	4.23	2.64	-10'x 8'	12.00	0.12%	1.83%	7.16	7.16		0.04	0.24	0.03	0.17	5.39		14.40	22.13	Open; 7.73'FB
DMH M-5										0.01						14.41			
CAP	218.79	2.56	6.59	78	64.74	0.45%	4.25%	7.38	7.38		0.10	0.00	0.00	0.00	5.39		14.52	22.35	Open; 7.83'FB
DMH M-6										0.29						14.81			
CAP	198.98	2.33	6.00	78	108.00	0.38%	4.99%	10.13	10.13		0.10	0.67	0.07	0.00	5.27		15.66	23.73	Open; 8.07'FB
DMH M-7										0.41						17.85			
CAP	198.98	2.95	6.00	78	212.00	0.38%	2.11%	15.52	15.52		0.08	0.51	0.05	0.00	5.27		20.84	26.21	Open; 5.37'FB
DMH M-8										0.80						22.95			
CAP	197.44	3.06	5.95	78	263.25	0.37%	1.82%	20.00	20.00		0.08	0.51	0.05	0.00	5.27		25.32	31.09	Open; 5.77'FB
DMH M-9										0.97						27.84			
CAP	180.65	1.75	6.39	72	35.00	0.47%	13.69%	24.78	24.78		0.08	0.53	0.16	0.00	5.27		30.20	36.92	Open; 6.72'FB
Junction										0.17						31.32			
CAP	178.27	2.92	6.31	72	210.00	0.46%	2.03%	29.57	29.57		0.10	0.61	0.06	0.05	5.28		34.96	37.00	Open; 2.04'FB
DMH A-1										0.97						36.76			
CAP	178.27	3.15	6.31	72	80.00	0.46%	1.56%	33.84	33.84		0.09	0.61	0.18	0.00	5.28		39.30	49.15	Open; 9.85'FB
Bend										0.37						39.67			
CAP	178.27	2.03	6.31	72	108.00	0.46%	7.60%	35.09	35.09		0.09	0.61	0.06	0.00	5.28		40.44	51.10	Open; 10.66'FB
GICB H-4										0.50						45.33			
RC BOX	165.21	3.65	6.89	6'x 4'	67.00	0.28%	0.22%	43.30	43.30		0.09	0.61	0.18	0.00	5.28		48.76	51.90	Open; 3.14'FB
GICB H-5										0.19						48.95			
RC BOX	160.00	3.41	6.67	6'x 4'	8.00	0.27%	0.25%	43.45	43.45		0.12	0.05	0.08	0.00	4.20		49.19	51.40	Full; 2.21'FB
HEADWALL										0.02						49.22			
								43.47	43.47		0.11	0.68	0.07	0.00	4.2		50.08	51.40	Full; 1.32'FB
Junction																			
CAP	175.21	2.21	5.28	78	57.00	0.39%	4.67%	7.16	7.16								14.40	22.13	Open; 7.73'FB
Junction										0.17						14.57			
CAP	168.12	2.10	5.07	78	125.00	0.27%	5.25%	9.82	9.82		0.06	0.03	0.04	0.02	4.94		14.82	24.00	Open; 9.18'FB
DMH D-1										0.34						18.48			
CAP	168.12	2.46	5.07	78	363.00	0.27%	2.91%	16.38	16.38		0.05	0.00	0.03	0.00	4.88		21.29	30.86	Open; 9.57'FB
GICB H-8										0.97						29.40			
RC BOX	164.06	1.1	6.84	6'x 4'	65.00	0.28%	6.25%	26.94	26.94		0.11	0.00	0.10	0.00	4.88		31.91	45.90	Open; 13.99'FB
GICB H-9										0.18						32.10			
RC BOX	160.00	1.09	6.67	6'x 4'	8.00	0.27%	6.25%	31.00	31.00		0.11	0.03	0.08	0.00	4.28		35.36	45.70	Ent. Cont.; 10.34'FB
HEADWALL										0.02						35.38			
								31.50	31.50		0.11	0.68	0.07	0.00	4.2		36.24	45.70	Ent. Cont.; 9.46'FB
Junction																			
CAP	7.09	0.33	2.26	24	18.00	0.17%	50.56%	9.82	9.82								14.82	24.00	Ent. Cont.; 9.18'FB
CB D-2										0.03						19.25			
								18.92	18.92		0.02	0.08	0.00	0.00	1.28		20.20	24.06	Open; 3.86'FB
GICB H-4																			
CAP	7.79	0.80	1.59	30	310.00	0.07%	1.39%	43.30	43.30								48.76	51.90	Ent. Cont.; 3.14'FB
GICB H-3										0.21						48.97			
CAP	5.25	0.73	1.67	24	60.00	0.09%	1.13%	47.62	47.62		0.01	0.00	0.00	0.17	1.25		49.15	54.30	Open; 5.15'FB
GICB H-2										0.06						49.21			
								48.30	48.30		0.01	0.03	0.00	0.17	1		49.47	53.30	Open; 3.83'FB

DRAINAGE.XLS

PROJECT		MAALAEA MAUKA SUBDIVISION																DATE: 9/23/2005	
DRAIN LINE		DL-H							DRAINAGE DESIGN DATA									COMPUTED BY: PI	
																		CHECKED BY:	
Inlet	Q Accum.	dn	Vf	Size of Pipe	Length of Seg.	Sf	S	Lower Invert	Upper Invert	Hf	Man A	B	C	D	Ent. Cont.	Hydraulic Grade Elevation Down	Up	Finished Grade Elevation	Remarks
CAP	2.71	0.72	0.86	24	293.00	0.02%	0.32%												
DMH										0.07						49.97			
								49.25	49.25		0.00	0.00	0.00	0.17	1		50.42	55.90	Open; 5.48'FB
CAP	2.71	0.54	0.86	24	8.00	0.02%	1.00%			0.00									
GDI																50.42			
								49.33	49.33		0.00	0.01	0.00	0.00	1		50.44	55.90	Open; 5.46'FB



DRAINAGE.XLS

PROJECT: MAALAEA MAUKA SUBDIVISION
DRAIN LINE: DL-H
DRAINAGE DESIGN DATA
DATE: 9/23/2005
COMPUTED BY: PI
CHECKED BY:

Inlet	Q Accum.	dn	Vf	Size of Pipe	Length of Seg.	Sf	S	Lower Invert	Upper Invert	Hf	Man A	B	C	D	Ent. Cont.	Hydraulic Grade Elevation Down	Hydraulic Grade Elevation Up	Finished Grade Elevation	Remarks
OUTLET								17.80	17.80								21.80	28.50	Ent. Cont.; 6.70'FB
RC BOX	285.07	3.01	11.88	6'x 4'	27.00	0.85%	1.11%												
DMH H-4								18.10	18.10	0.23	0.46	1.34	0.92	0.00	8	22.03	27.02	28.50	Ent. Cont.; 1.48'FB
CAP	285.07	2.84	7.41	84	37.00	0.52%	4.32%												
DMH H-3								19.70	19.70	0.19	0.14	0.25	0.28	0.00	6.58	27.21	27.89	31.90	Full; 4.01'FB
CAP	175.07	2.74	6.19	72	86.00	0.45%	2.45%												
DMH H-2A								21.81	21.81	0.38	0.09	0.02	0.06	0.28	5.16	28.27	28.72	32.90	Full; 4.18'FB
CAP	172.59	2.71	6.10	72	314.00	0.43%	2.48%												
GICB H-12								29.60	29.60	1.36	0.12	0.00	0.17	0.02	5.1	32.31	34.88	39.00	Open; 4.12'FB
RC BOX	165.00	1.46	6.88	6'x 4'	62.00	0.28%	2.81%												
HEADWALL								31.34	31.34	0.18	0.12	0.73	0.08	0.00	4.6	35.05	36.02	39.00	Ent. Cont.; 2.98'FB
DMH H-3								19.70	19.70								26.85	31.90	Ent. Cont.; 5.05'FB
RC BOX	110.00	1.15	6.88	4'x 4'	62.00	0.13%	6.61%												
HEADWALL								23.80	23.80	0.08	0.12	0.73	0.08	0.00	4.6	26.93	28.48	32.00	Ent. Cont.; 3.52'FB
GICB H-12								29.60	29.60								34.88	39.00	Ent. Cont.; 4.12'FB
CAP	4.80	0.55	1.53	24	175.00	0.08%	2.87%												
BEND								34.63	34.63	0.11	0.01	0.00	0.00	0.00	1	35.18	35.63	43.00	Open; 7.37'FB
CAP	4.80	0.55	1.53	24	103.00	0.08%	2.83%												
GICB H-10								37.54	37.54	0.08	0.01	0.03	0.00	0.00	1	38.09	38.54	43.20	Open; 4.66'FB
CAP	2.40	0.50	0.76	24	65.00	0.02%	1.02%												
GICB H-11								38.20	38.20	0.01	0.00	0.01	0.00	0.00	1	38.70	39.20	43.20	Open; 4.00'FB

Culvert Designer/Analyzer Report
Location-~~1~~ 2

Comments: Asbuilt data are not available; preliminary analysis is based on assumed elevations. Revise analysis when topographic survey performed.

Analysis Component			
Storm Event	Design	Discharge	113.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	113.00 cfs	Check Discharge	200.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-4 x 4 ft Box	113.00 cfs	28.59 ft	19.00 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location: ~~8~~ 2

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	28.59 ft	Discharge	113.00 cfs
Inlet Control HW Elev	28.59 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	28.47 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.20		

Grades			
Upstream Invert	23.80 ft	Downstream Invert	19.70 ft
Length	62.00 ft	Constructed Slope	0.066129 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.49 ft
Slope Type	Steep	Normal Depth	1.17 ft
Flow Regime	Supercritical	Critical Depth	2.92 ft
Velocity Downstream	19.00 ft/s	Critical Slope	0.005718 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	4 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	28.47 ft	Upstream Velocity Head	1.46 ft
Ke	0.20	Entrance Loss	0.29 ft

Inlet Control Properties			
Inlet Control HW Elev	28.59 ft	Flow Control	Transition
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	16.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

Culvert Designer/Analyzer Report
Location: ~~7~~ 3

Comments: Asbuilt data are not available; preliminary analysis is based on assumed elevations. Revise analysis when topographic survey performed.

Analysis Component			
Storm Event	Design	Discharge	170.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	170.00 cfs	Check Discharge	400.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-5 x 4 ft Box	170.00 cfs	36.15 ft	15.23 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location 3

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	36.15 ft	Discharge	170.00 cfs
Inlet Control HW Elev	36.15 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	36.02 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.20		

Grades			
Upstream Invert	31.34 ft	Downstream Invert	29.60 ft
Length	62.00 ft	Constructed Slope	0.028065 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.88 ft
Slope Type	Steep	Normal Depth	1.49 ft
Flow Regime	Supercritical	Critical Depth	2.92 ft
Velocity Downstream	15.23 ft/s	Critical Slope	0.004266 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	6.00 ft
Section Size	6 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	36.02 ft	Upstream Velocity Head	1.46 ft
Ke	0.20	Entrance Loss	0.29 ft

Inlet Control Properties			
Inlet Control HW Elev	36.15 ft	Flow Control	Transition
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	24.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

Culvert Designer/Analyzer Report
Location 4

Comments: Asbuilt data are not available; preliminary analysis is based on assumed elevations. Revise analysis when topographic survey performed.

Analysis Component			
Storm Event	Design	Discharge	170.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	170.00 cfs	Check Discharge	400.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-6 x 4 ft Box	170.00 cfs	36.31 ft	13.07 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location- 4

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	36.31 ft	Discharge	170.00 cfs
Inlet Control HW Elev	36.31 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	36.18 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.20		

Grades			
Upstream Invert	31.50 ft	Downstream Invert	31.00 ft
Length	8.00 ft	Constructed Slope	0.062500 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.17 ft
Slope Type	Steep	Normal Depth	1.13 ft
Flow Regime	Supercritical	Critical Depth	2.92 ft
Velocity Downstream	13.07 ft/s	Critical Slope	0.004268 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	6.00 ft
Section Size	6 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	36.18 ft	Upstream Velocity Head	1.48 ft
Ke	0.20	Entrance Loss	0.29 ft

Inlet Control Properties			
Inlet Control HW Elev	36.31 ft	Flow Control	Transition
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	24.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

Culvert Designer/Analyzer Report
Location- 5

Comments: Asbuilt data are not available; preliminary analysis is based on assumed elevations. Revise analysis when topographic survey performed.

Analysis Component			
Storm Event	Design	Discharge	169.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	169.00 cfs	Check Discharge	400.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-6 x 4 ft Box	169.00 cfs	48.25 ft	9.68 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~8~~ 5

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	48.25 ft	Discharge	169.00 cfs
Inlet Control HW Elev	48.25 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	48.11 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.20		

Grades			
Upstream Invert	43.47 ft	Downstream Invert	43.45 ft
Length	8.00 ft	Constructed Slope	0.002500 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	2.91 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.91 ft
Velocity Downstream	9.68 ft/s	Critical Slope	0.004260 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	6.00 ft
Section Size	6 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	48.11 ft	Upstream Velocity Head	1.31 ft
Ke	0.20	Entrance Loss	0.26 ft

Inlet Control Properties			
Inlet Control HW Elev	48.25 ft	Flow Control	Transition
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	24.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

Culvert Designer/Analyzer Report
Location-~~10A~~ 6A

Analysis Component			
Storm Event	Design	Discharge	15.00 cfs
Peak Discharge Method: User-Specified			
Design Discharge	15.00 cfs	Check Discharge	30.00 cfs
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	N/A ft		

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	15.00 cfs	48.12 ft	6.41 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~10A~~ 6A

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	48.12 ft	Discharge	15.00 cfs
Inlet Control HW Elev	48.05 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	48.12 ft	Control Type	Outlet Control
Headwater Depth/ Height	1.16		

Grades			
Upstream Invert	45.80 ft	Downstream Invert	45.50 ft
Length	60.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	1.40 ft
Slope Type	Mild	Normal Depth	1.54 ft
Flow Regime	Subcritical	Critical Depth	1.40 ft
Velocity Downstream	6.41 ft/s	Critical Slope	0.006318 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	48.12 ft	Upstream Velocity Head	0.53 ft
Ke	0.50	Entrance Loss	0.27 ft

Inlet Control Properties			
Inlet Control HW Elev	48.05 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~10B~~ 6B

Analysis Component			
Storm Event	Design	Discharge	15.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	15.00 cfs	Check Discharge	30.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	15.00 cfs	51.68 ft	7.05 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~10B~~ 6B

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	51.68 ft	Discharge	15.00 cfs
Inlet Control HW Elev	51.58 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	51.68 ft	Control Type	Outlet Control
Headwater Depth/ Height	1.18		

Grades			
Upstream Invert	49.33 ft	Downstream Invert	49.25 ft
Length	8.00 ft	Constructed Slope	0.010000 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.28 ft
Slope Type	Steep	Normal Depth	1.19 ft
Flow Regime	Supercritical	Critical Depth	1.40 ft
Velocity Downstream	7.05 ft/s	Critical Slope	0.006318 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	51.68 ft	Upstream Velocity Head	0.64 ft
Ke	0.50	Entrance Loss	0.32 ft

Inlet Control Properties			
Inlet Control HW Elev	51.58 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~11A~~ 7A

Analysis Component			
Storm Event	Design	Discharge	37.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	37.00 cfs	Check Discharge	80.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-6 x 2.5 ft Box	37.00 cfs	55.10 ft	14.11 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~14A~~ 7A

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	55.10 ft	Discharge	37.00 cfs
Inlet Control HW Elev	55.10 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	55.03 ft	Control Type	Inlet Control
Headwater Depth/ Height	0.52		

Grades			
Upstream Invert	52.00 ft	Downstream Invert	47.00 ft
Length	154.00 ft	Constructed Slope	0.032468 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.05 ft
Slope Type	Steep	Normal Depth	1.05 ft
Flow Regime	Supercritical	Critical Depth	1.90 ft
Velocity Downstream	14.11 ft/s	Critical Slope	0.006810 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.50 ft
Section Size	6 x 2.5 ft	Rise	6.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	55.03 ft	Upstream Velocity Head	0.95 ft
Ke	0.20	Entrance Loss	0.19 ft

Inlet Control Properties			
Inlet Control HW Elev	55.10 ft	Flow Control	Unsubmerged
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	15.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

Culvert Designer/Analyzer Report
Location-~~14B~~ 7B

Analysis Component			
Storm Event	Design	Discharge	12.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	12.00 cfs	Check Discharge	30.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-29 x 18 Inch Arch	12.00 cfs	55.35 ft	5.75 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~11B~~ 7B

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	55.35 ft	Discharge	12.00 cfs
Inlet Control HW Elev	54.29 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	55.35 ft	Control Type	Outlet Control
Headwater Depth/ Height	1.79		

Grades			
Upstream Invert	52.67 ft	Downstream Invert	52.00 ft
Length	117.00 ft	Constructed Slope	0.005728 ft/ft

Hydraulic Profile			
Profile	CompositeM2Pressure	Depth, Downstream	0.96 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	0.98 ft
Velocity Downstream	5.75 ft/s	Critical Slope	0.021855 ft/ft

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	nd Alu[illegible]Rivetedless CR 3x1 Corrugations Historic	Span	2.42 ft
Section Size	29 x 18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	55.35 ft	Upstream Velocity Head	0.28 ft
Ke	0.50	Entrance Loss	0.14 ft

Inlet Control Properties			
Inlet Control HW Elev	54.29 ft	Flow Control	Unsubmerged
Inlet Type	18" CR, 90 ° headwall	Area Full	2.8 ft²
K	0.00830	HDS 5 Chart	34
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Designer/Analyzer Report
Location-~~11B~~ 7C

Analysis Component			
Storm Event	Design	Discharge	12.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	12.00 cfs	Check Discharge	30.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-29 x 18 inch Arch	12.00 cfs	57.25 ft	5.75 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~11C~~ 7C

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	57.25 ft	Discharge	12.00 cfs
Inlet Control HW Elev	56.12 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	57.25 ft	Control Type	Outlet Control
Headwater Depth/ Height	1.83		

Grades			
Upstream Invert	54.50 ft	Downstream Invert	52.67 ft
Length	200.00 ft	Constructed Slope	0.009150 ft/ft

Hydraulic Profile			
Profile	CompositeM2Pressure	Depth, Downstream	0.96 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	0.98 ft
Velocity Downstream	5.75 ft/s	Critical Slope	0.021855 ft/ft

Section			
Section Shape	Arch	Mannings Coefficient	0.025
and AluSection Material Headless CR 3x1 Corrugations Historic		Span	2.42 ft
Section Size	29 x 18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	57.25 ft	Upstream Velocity Head	0.28 ft
Ke	0.50	Entrance Loss	0.14 ft

Inlet Control Properties			
Inlet Control HW Elev	56.12 ft	Flow Control	Unsubmerged
Inlet Type	18" CR, 90 ° headwall	Area Full	2.8 ft²
K	0.00830	HDS 5 Chart	34
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Designer/Analyzer Report
Location-~~11D~~ 7D

Analysis Component			
Storm Event	Design	Discharge	21.00 cfs
Peak Discharge Method: User-Specified			
Design Discharge	21.00 cfs	Check Discharge	40.00 cfs
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	N/A ft		

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	21.00 cfs	60.35 ft	9.46 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~11D~~ 7D

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	60.35 ft	Discharge	21.00 cfs
Inlet Control HW Elev	60.35 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	60.24 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.55		

Grades			
Upstream Invert	57.25 ft	Downstream Invert	54.50 ft
Length	195.00 ft	Constructed Slope	0.014103 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.33 ft
Slope Type	Steep	Normal Depth	1.33 ft
Flow Regime	Supercritical	Critical Depth	1.64 ft
Velocity Downstream	9.46 ft/s	Critical Slope	0.008598 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	60.24 ft	Upstream Velocity Head	0.90 ft
Ke	0.50	Entrance Loss	0.45 ft

Inlet Control Properties			
Inlet Control HW Elev	60.35 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~12~~ 8

Analysis Component			
Storm Event	Design	Discharge	98.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	98.00 cfs	Check Discharge	150.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-5 x 3 ft Box	98.00 cfs	67.39 ft	10.29 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~12~~ 8

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	67.39 ft	Discharge	98.00 cfs
Inlet Control HW Elev	67.39 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	67.16 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.30		

Grades			
Upstream Invert	63.50 ft	Downstream Invert	62.50 ft
Length	133.00 ft	Constructed Slope	0.007519 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.90 ft
Slope Type	Steep	Normal Depth	1.88 ft
Flow Regime	Supercritical	Critical Depth	2.29 ft
Velocity Downstream	10.29 ft/s	Critical Slope	0.004444 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	5.00 ft
Section Size	5 x 3 ft	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	67.16 ft	Upstream Velocity Head	1.14 ft
Ke	0.20	Entrance Loss	0.23 ft

Inlet Control Properties			
Inlet Control HW Elev	67.39 ft	Flow Control	Transition
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	15.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

Culvert Designer/Analyzer Report
Location-~~13A~~ 9A

Analysis Component			
Storm Event	Design	Discharge	18.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	18.00 cfs	Check Discharge	40.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 Inch Circular	18.00 cfs	76.67 ft	10.07 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~13A~~ 9A

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	76.67 ft	Discharge	18.00 cfs
Inlet Control HW Elev	76.62 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	76.67 ft	Control Type	Outlet Control
Headwater Depth/ Height	1.33		

Grades			
Upstream Invert	74.00 ft	Downstream Invert	72.81 ft
Length	55.00 ft	Constructed Slope	0.021636 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.11 ft
Slope Type	Steep	Normal Depth	1.05 ft
Flow Regime	Supercritical	Critical Depth	1.53 ft
Velocity Downstream	10.07 ft/s	Critical Slope	0.007285 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	76.67 ft	Upstream Velocity Head	0.76 ft
Ke	0.50	Entrance Loss	0.38 ft

Inlet Control Properties			
Inlet Control HW Elev	76.82 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~13B~~ 9B

Analysis Component			
Storm Event	Design	Discharge	27.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	27.00 cfs	Check Discharge	60.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	27.00 cfs	77.11 ft	9.04 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~13B~~ 9B

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	77.11 ft	Discharge	27.00 cfs
Inlet Control HW Elev	77.08 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	77.11 ft	Control Type	Outlet Control
Headwater Depth/ Height	2.15		

Grades			
Upstream Invert	72.81 ft	Downstream Invert	72.33 ft
Length	80.00 ft	Constructed Slope	0.006000 ft/ft

Hydraulic Profile			
Profile	CompositeM2Pressure	Depth, Downstream	1.81 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.81 ft
Velocity Downstream	9.04 ft/s	Critical Slope	0.012496 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	77.11 ft	Upstream Velocity Head	1.15 ft
Ke	0.50	Entrance Loss	0.57 ft

Inlet Control Properties			
Inlet Control HW Elev	77.08 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~13C~~ 9C

Analysis Component				
Storm Event	Design	Discharge		23.00 cfs
Peak Discharge Method: User-Specified				
Design Discharge	23.00 cfs	Check Discharge		50.00 cfs
Tailwater Conditions: Constant Tailwater				
Tailwater Elevation	N/A ft			

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 Inch Circular	23.00 cfs	80.79 ft	10.38 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~12C~~ 9 C

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	80.79 ft	Discharge	23.00 cfs
Inlet Control HW Elev	80.79 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	80.55 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.73		

Grades			
Upstream Invert	77.33 ft	Downstream Invert	74.00 ft
Length	198.00 ft	Constructed Slope	0.016990 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.33 ft
Slope Type	Steep	Normal Depth	1.33 ft
Flow Regime	Supercritical	Critical Depth	1.71 ft
Velocity Downstream	10.38 ft/s	Critical Slope	0.009682 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	80.55 ft	Upstream Velocity Head	1.01 ft
Ke	0.50	Entrance Loss	0.50 ft

Inlet Control Properties			
Inlet Control HW Elev	80.79 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~13D~~ 9D

Analysis Component			
Storm Event	Design	Discharge	22.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	22.00 cfs	Check Discharge	50.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	22.00 cfs	84.03 ft	10.08 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~13D~~ 9D

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	84.03 ft	Discharge	22.00 cfs
Inlet Control HW Elev	84.03 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	83.85 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.64		

Grades			
Upstream Invert	80.75 ft	Downstream Invert	77.33 ft
Length	212.00 ft	Constructed Slope	0.016132 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.31 ft
Slope Type	Steep	Normal Depth	1.31 ft
Flow Regime	Supercritical	Critical Depth	1.88 ft
Velocity Downstream	10.08 ft/s	Critical Slope	0.009114 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	83.85 ft	Upstream Velocity Head	0.95 ft
Ke	0.50	Entrance Loss	0.48 ft

Inlet Control Properties			
Inlet Control HW Elev	84.03 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~15A~~ 11A

Analysis Component			
Storm Event	Design	Discharge	368.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	368.00 cfs	Check Discharge	800.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-10 x 8 ft Box	368.00 cfs	94.70 ft	16.84 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~15A~~ 11 A

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	94.70 ft	Discharge	368.00 cfs
Inlet Control HW Elev	94.70 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	94.57 ft	Control Type	Inlet Control
Headwater Depth/ Height	0.95		

Grades			
Upstream Invert	89.00 ft	Downstream Invert	86.50 ft
Length	127.00 ft	Constructed Slope	0.019685 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.19 ft
Slope Type	Steep	Normal Depth	1.87 ft
Flow Regime	Supercritical	Critical Depth	3.48 ft
Velocity Downstream	16.84 ft/s	Critical Slope	0.003287 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	10.00 ft
Section Size	10 x 6 ft	Rise	6.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	94.57 ft	Upstream Velocity Head	1.74 ft
Ke	0.20	Entrance Loss	0.35 ft

Inlet Control Properties			
Inlet Control HW Elev	94.70 ft	Flow Control	Unsubmerged
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	60.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

Culvert Designer/Analyzer Report
Location-~~15B~~ 11 B

Analysis Component			
Storm Event	Design	Discharge	21.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	21.00 cfs	Check Discharge	40.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	21.00 cfs	97.85 ft	11.12 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~15B~~ 11B

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	97.85 ft	Discharge	21.00 cfs
Inlet Control HW Elev	97.85 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	97.74 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.55		

Grades			
Upstream Invert	94.75 ft	Downstream Invert	91.75 ft
Length	141.00 ft	Constructed Slope	0.021277 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.16 ft
Slope Type	Steep	Normal Depth	1.16 ft
Flow Regime	Supercritical	Critical Depth	1.64 ft
Velocity Downstream	11.12 ft/s	Critical Slope	0.008596 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	97.74 ft	Upstream Velocity Head	0.90 ft
Ke	0.50	Entrance Loss	0.45 ft

Inlet Control Properties			
Inlet Control HW Elev	97.85 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~15C~~ 11C

Analysis Component			
Storm Event	Design	Discharge	22.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	22.00 cfs	Check Discharge	50.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	22.00 cfs	103.02 ft	11.95 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~15C~~ 11C

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	103.02 ft	Discharge	22.00 cfs
Inlet Control HW Elev	103.02 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	102.85 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.63		

Grades			
Upstream Invert	99.75 ft	Downstream Invert	94.75 ft
Length	201.00 ft	Constructed Slope	0.024876 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.14 ft
Slope Type	Steep	Normal Depth	1.14 ft
Flow Regime	Supercritical	Critical Depth	1.68 ft
Velocity Downstream	11.95 ft/s	Critical Slope	0.009114 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	102.85 ft	Upstream Velocity Head	0.95 ft
Ke	0.50	Entrance Loss	0.48 ft

Inlet Control Properties			
Inlet Control HW Elev	103.02 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~15D~~ 11D

Analysis Component			
Storm Event	Design	Discharge	24.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	24.00 cfs	Check Discharge	50.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 Inch Circular	24.00 cfs	108.39 ft	11.84 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~15D~~ 11D

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	108.39 ft	Discharge	24.00 cfs
Inlet Control HW Elev	108.39 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	108.08 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.82		

Grades			
Upstream Invert	104.75 ft	Downstream Invert	99.75 ft
Length	216.00 ft	Constructed Slope	0.023148 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.23 ft
Slope Type	Steep	Normal Depth	1.23 ft
Flow Regime	Supercritical	Critical Depth	1.74 ft
Velocity Downstream	11.84 ft/s	Critical Slope	0.010303 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	108.09 ft	Upstream Velocity Head	1.07 ft
Ke	0.50	Entrance Loss	0.53 ft

Inlet Control Properties			
Inlet Control HW Elev	108.39 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~18~~ 12

Analysis Component			
Storm Event	Design	Discharge	9.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	9.00 cfs	Check Discharge	20.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	9.00 cfs	125.91 ft	8.42 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~18~~ 12

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	125.91 ft	Discharge	9.00 cfs
Inlet Control HW Elev	125.76 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	125.91 ft	Control Type	Outlet Control
Headwater Depth/ Height	0.86		

Grades			
Upstream Invert	124.20 ft	Downstream Invert	122.00 ft
Length	122.00 ft	Constructed Slope	0.018033 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.75 ft
Slope Type	Steep	Normal Depth	0.75 ft
Flow Regime	Supercritical	Critical Depth	1.07 ft
Velocity Downstream	8.42 ft/s	Critical Slope	0.005037 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	125.91 ft	Upstream Velocity Head	0.43 ft
Ke	0.50	Entrance Loss	0.21 ft

Inlet Control Properties			
Inlet Control HW Elev	125.76 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location-~~17~~ 13

Analysis Component				
Storm Event		Design	Discharge	27.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	27.00 cfs	Check Discharge	60.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-30 inch Circular	27.00 cfs	3.68 ft	7.26 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location ~~17~~ 13

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	3.68 ft	Discharge	27.00 cfs
Inlet Control HW Elev	3.60 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	3.68 ft	Control Type	Outlet Control
Headwater Depth/ Height	1.18		

Grades			
Upstream Invert	0.72 ft	Downstream Invert	0.43 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	1.77 ft
Slope Type	Mild	Normal Depth	1.91 ft
Flow Regime	Subcritical	Critical Depth	1.77 ft
Velocity Downstream	7.26 ft/s	Critical Slope	0.005986 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	3.68 ft	Upstream Velocity Head	0.71 ft
Ke	0.50	Entrance Loss	0.36 ft

Inlet Control Properties			
Inlet Control HW Elev	3.60 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	4.9 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Location ~~18~~ 14

Analysis Component			
Storm Event	Design	Discharge	155.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	155.00 cfs	Check Discharge	320.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-3 x 6 ft Box	155.00 cfs	7.50 ft	11.85 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Location-~~18~~ 14

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	7.50 ft	Discharge	155.00 cfs
Inlet Control HW Elev	7.50 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	7.35 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.19		

Grades			
Upstream Invert	0.34 ft	Downstream Invert	0.00 ft
Length	67.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	4.36 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	4.36 ft
Velocity Downstream	11.85 ft/s	Critical Slope	0.009277 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	3 x 6 ft	Rise	6.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	7.35 ft	Upstream Velocity Head	1.60 ft
Ke	0.20	Entrance Loss	0.32 ft

Inlet Control Properties			
Inlet Control HW Elev	7.50 ft	Flow Control	Transition
Inlet Type	90 ° headwall w 3/4" chamfers	Area Full	18.0 ft²
K	0.51500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	1
C	0.03750	Equation Form	2
Y	0.79000		

FHWA Urban Drainage Design Program, HY-22
HYDRAULIC PARAMETERS OF OPEN CHANNELS

Trapezoidal, Rectangular, or Triangular X-Section
Date: 09/12/2005

Project No. :
Project Name.:MAALAEA MAUKA SUBDIVISION DRAINAGE
Computed by :PI

INPUT PARAMETERS

1.	Channel Slope (ft/ft)	0.0151
2.	Channel Bottom Width (ft)	6.00
3.	Left Side Slope (Horizontal to 1)	1.00
4.	Right Side Slope (Horizontal to 1)	1.00
5.	Manning's Coefficient	0.030
6.	Discharge (cfs)	425.49
7.	Depth of Flow (ft)	4.00

OUTPUT RESULTS

Cross Section Area (Sqft)	40.00
Average Velocity (ft/sec)	10.64
Top Width (ft)	14.00
Hydraulic Radius (ft)	2.31
Froude Number	1.11

APPENDIX B
Hydrologic Calculations – Finished Drainage Basins

D- A4 (Proposed)

```
PI                        Maalaea Mauka Subdivision
                                   Proposed
                             Maui County, Hawaii

                        Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach     100-Yr
Identifier     (cfs)
             (hr)
-------------------------------------------------------------------------------
SUBAREAS
A4             903.96
            10.87

REACHES

OUTLET         903.96
```

WinTR-55 Current Data Description

--- Identification Data ---

```
User:      PI                                  Date:        10/5/2005
Project:   Maalaea Mauka Subdivision           Units:       English
SubTitle:  Proposed                            Areal Units: Acres
State:     Hawaii
County:    Maui
Filename:  C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_New_A4.w55
```

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
A4	Offsite and Prop. Onsite	Outlet	499.1	62	1.602

Total area: 499.10 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

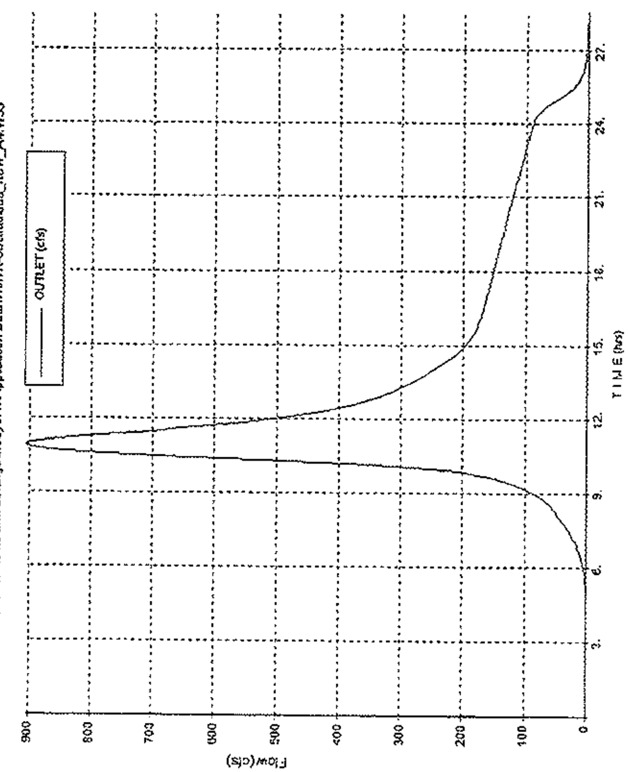
2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.9	.0

```
Storm Data Source:               User-provided custom storm data
Rainfall Distribution Type:      Type I
Dimensionless Unit Hydrograph:   <standard>
```


Project: Maalaea Mauka Subdivision

Subarea: (Outlet) Storm: 100-Yr

C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_New_A4.w55



D-B2 (Prop)

PI

Maalaea Mauka Subdivision
Proposed
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
B2	362.49
	10.45
REACHES	
OUTLET	362.49

WinTR-55 Current Data Description

--- Identification Data ---

User: PI
Project: Maalaea Mauka Subdivision
SubTitle: Proposed
State: Hawaii
County: Maui
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_New_B2.w55

Date: 10/5/2005
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
B2	Offsite & Prop. Onsite	Outlet	151.82	64	0.936

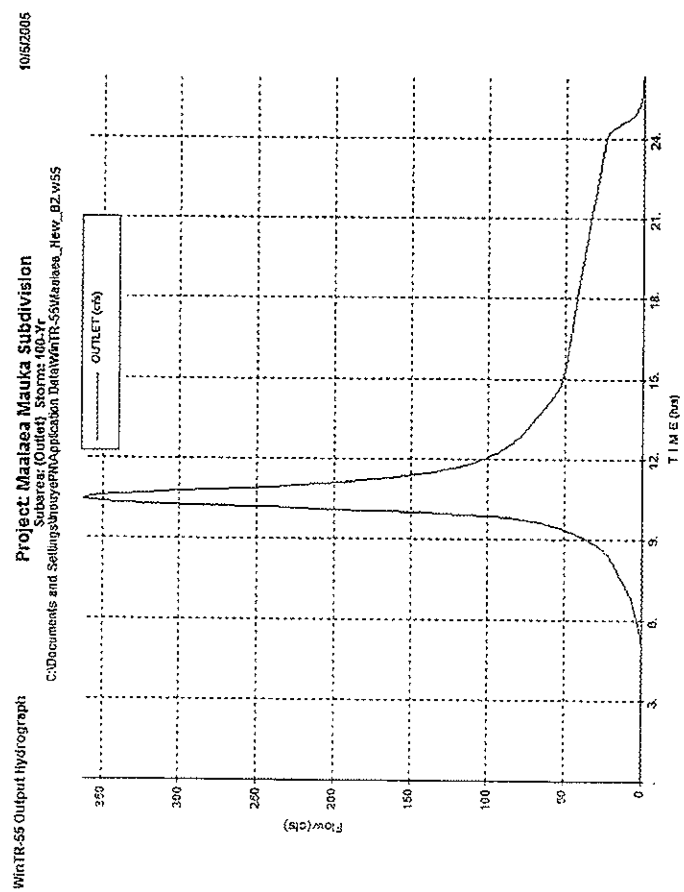
Total area: 151.82 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.1	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>



D - C2 (Prop.)

```
PI                          Maalaea Mauka Subdivision
                                     Proposed
                               Maui County, Hawaii

                        Hydrograph Peak/Peak Time Table

 Sub-Area        Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach     100-Yr
Identifier     (cfs)
             (hr)
---------------------------------------------------------------------------------
SUBAREAS
C2             497.44
            10.67

REACHES

OUTLET         497.44
```

WinTR-55 Current Data Description

--- Identification Data ---

```
User:      PI                                    Date:        10/5/2005
Project:   Maalaea Mauka Subdivision             Units:       English
SubTitle:  Proposed                              Areal Units: Acres
State:     Hawaii
County:    Maui
Filename:  C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_New_C2.w55
```

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
C2	Offsite & Prop. Onsite	Outlet	246.21	63	1.213

Total area: 246.21 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.2	.0

```
Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type I
Dimensionless Unit Hydrograph:  <standard>
```

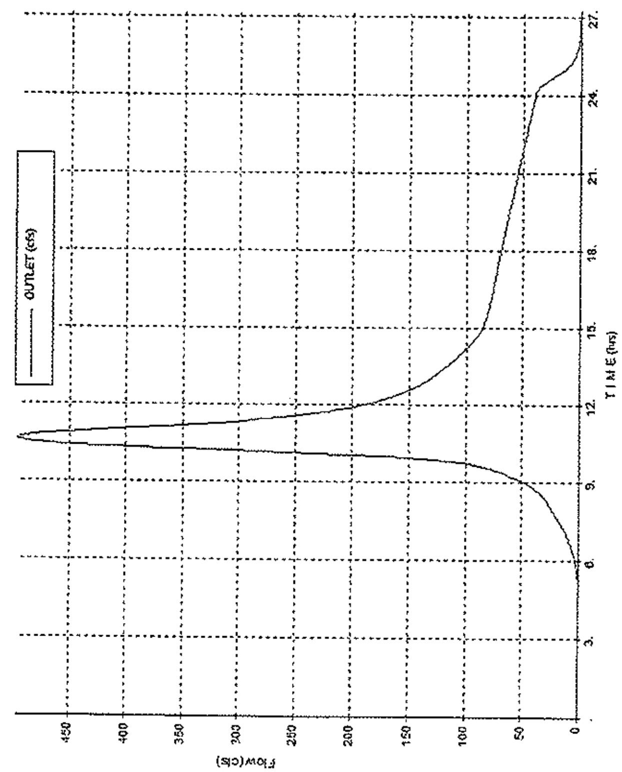

WinTR-55 Output Hydrograph

Project: Maalaea Mauka Subdivision

Subarea: (Outlet) Storm: 100-Yr

C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_New_C2.w55

10/5/2005



D - D2 (Prop.)

PI

Maalaea Mauka Subdivision
Proposed
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
D2	364.45 10.32
REACHES	
OUTLET	364.45

WinTR-55 Current Data Description

--- Identification Data ---

User: PI
Project: Maalaea Mauka Subdivision
SubTitle: Proposed
State: Hawaii
County: Maui
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_New_D2.w55

Date: 10/5/2005
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
D2	Offsite & Prop. Onsite	Outlet	130.47	67	0.739

Total area: 130.47 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	11.7	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>

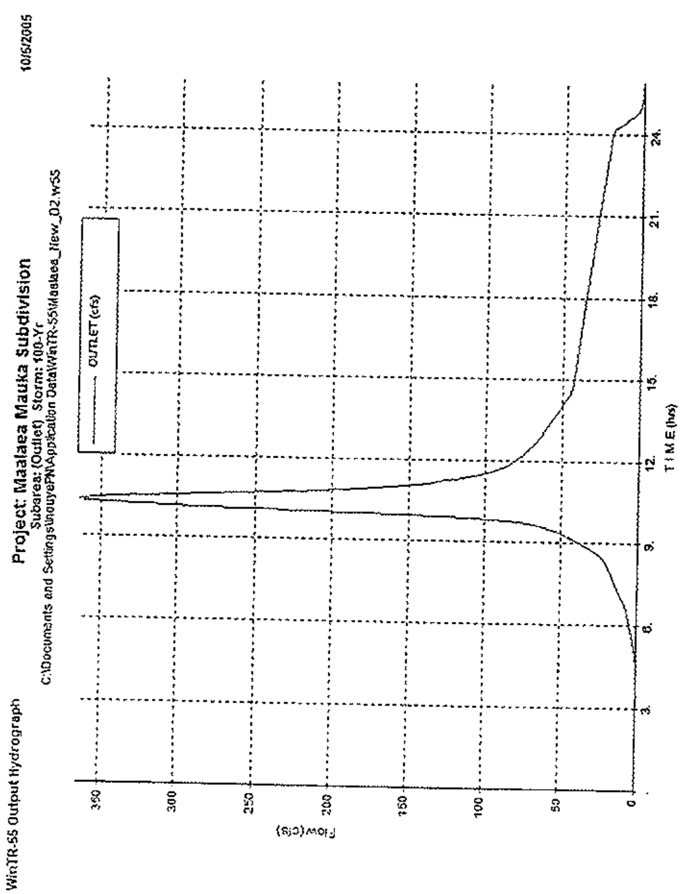
D-E2 (Prop.)

PI

Maalaea Mauka Subdivision
Proposed
Maui County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
E2	473.31 10.57
REACHES	
OUTLET	473.31



WinTR-55 Current Data Description

--- Identification Data ---

User:	PI	Date:	10/5/2005
Project:	Maalaea Mauka Subdivision	Units:	English
SubTitle:	Proposed	Areal Units:	Acres
State:	Hawaii		
County:	Maui		
Filename:	C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Maalaea_New_E2.w55		

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
E2	Offsite & Prop. Onsite	Outlet	234.11	62	1.133

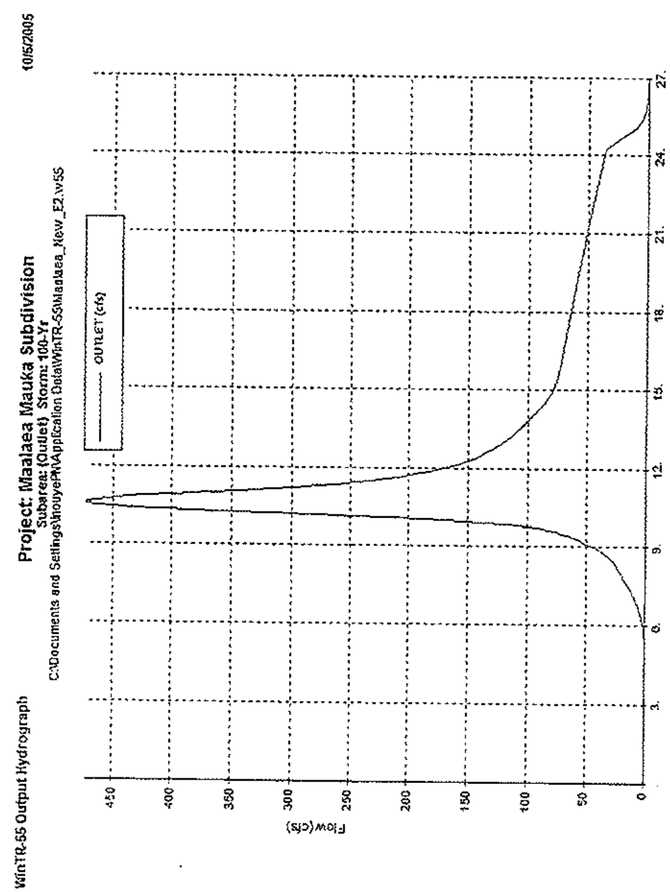
Total area: 234.11 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	12.1	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>



APPENDIX C
Hydrologic Calculations – Detention Systems

Hydrograph Plot

DB-1 (DETENSION BASIN)

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 9 2006, 4:32 PM

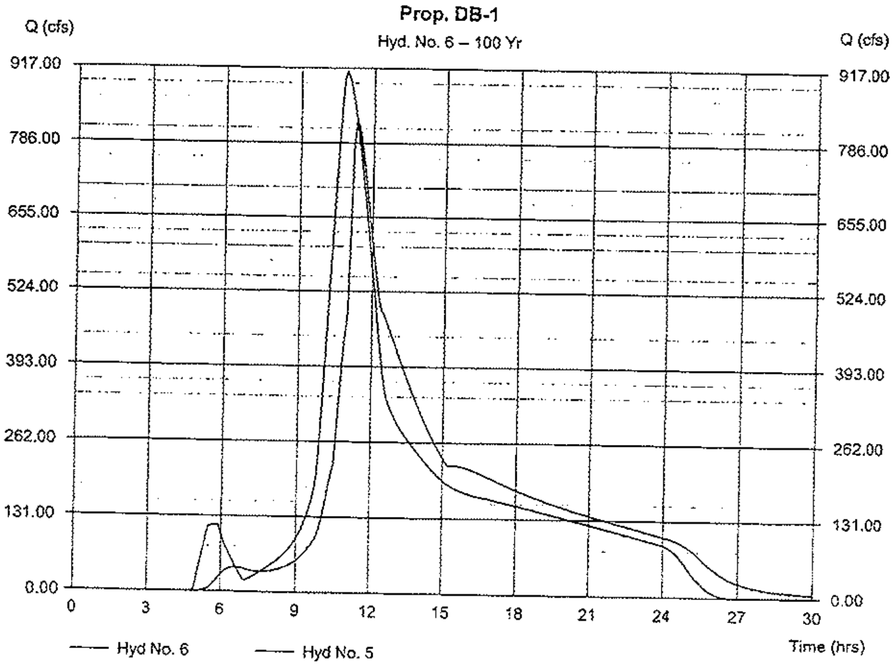
Hyd. No. 6

Prop. DB-1

Hydrograph type	= Reservoir	Peak discharge	= 824.29 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 5	Max. Elevation	= 101.19 ft
Reservoir name	= Prop. DB-1	Max. Storage	= 2,402,104 cuft

Storage Indication method used.

Hydrograph Volume = 14,658,500 cuft



Pond Report

DB-1

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 9 2006, 4:32 PM

Pond No. 1 - Prop. DB-1

Pond Data

Bottom LxW = 820.0 x 220.0 ft Side slope = 2.0:1 Bottom elev. = 89.50 ft Depth = 12.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	89.50	180,400	0	0
0.60	90.10	182,902	108,990	108,990
1.20	90.70	185,415	110,494	219,484
1.80	91.30	187,940	112,006	331,490
2.40	91.90	190,476	113,524	445,015
3.00	92.50	193,024	115,050	560,064
3.60	93.10	195,583	116,582	676,646
4.20	93.70	198,154	118,121	794,766
4.80	94.30	200,737	119,667	914,433
5.40	94.90	203,331	121,220	1,035,653
6.00	95.50	205,936	122,779	1,158,432
6.60	96.10	208,553	124,346	1,282,778
7.20	96.70	211,181	125,920	1,408,698
7.80	97.30	213,821	127,500	1,536,198
8.40	97.90	216,473	129,088	1,665,286
9.00	98.50	219,136	130,682	1,795,968
9.60	99.10	221,811	132,283	1,928,251
10.20	99.70	224,497	133,892	2,062,143
10.80	100.30	227,194	135,507	2,197,650
11.40	100.90	229,903	137,128	2,334,778
12.00	101.50	232,624	138,758	2,473,536

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 84.00	0.00	0.00	0.00
Span (in)	= 84.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 89.50	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

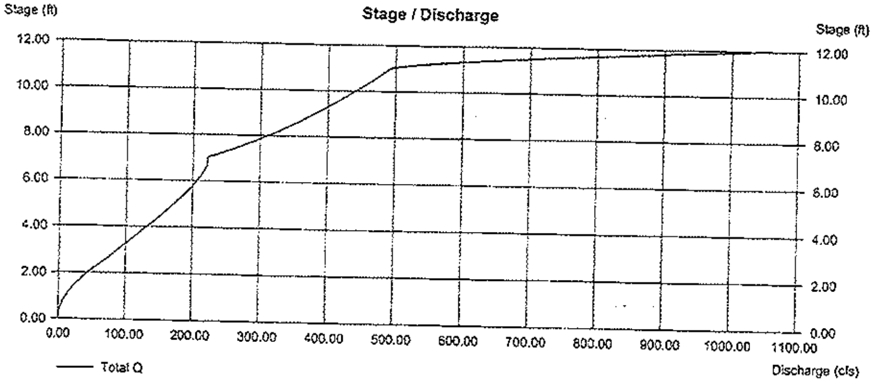
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 200.00	0.00	0.00	0.00
Crest El. (ft)	= 100.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge



Hydrograph Plot

SD-1 (SUBSURFACE DETENTION)

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 23 2006, 4:43 PM

Hyd. No. 6

UG Storage Small

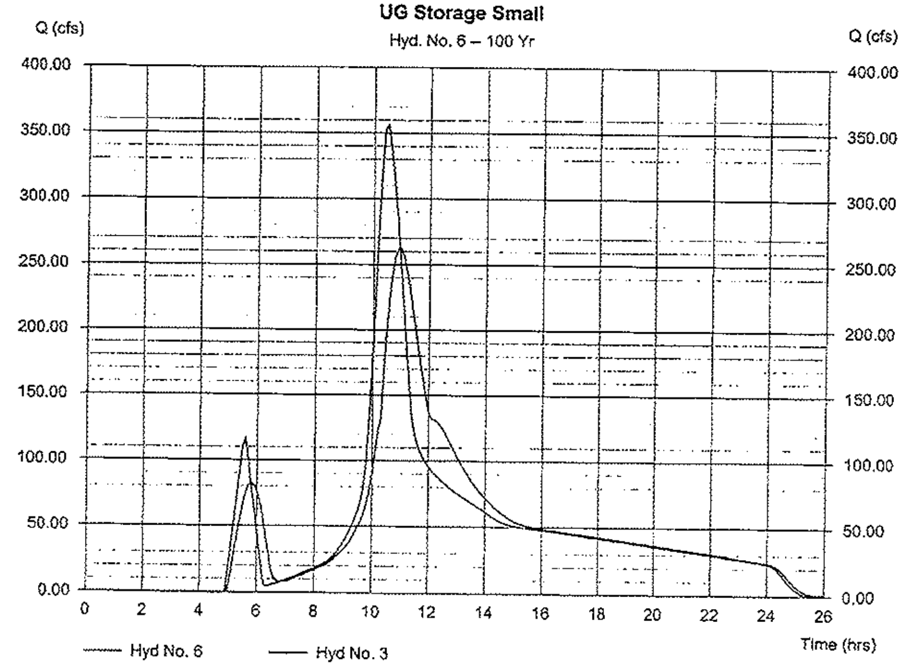
Hydrograph type	= Reservoir	Peak discharge	= 262.09 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Max. Elevation	= 73.55 ft
Reservoir name	= UG Storage Small	Max. Storage	= 489,258 cuft

Storage Indication method used.

Hydrograph Volume = 4,321,917 cuft

UG Storage Small

Hyd. No. 6 -- 100 Yr



Pond Report

SD - 1

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 23 2006, 4:43 PM

Pond No. 4 - UG Storage Small

Pond Data

Pipe dia. = 8.00 ft Pipe length = 720.0 ft No. Barrels = 15.0 Slope = 0.50 % Invert elev. = 65.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	65.00	00	0	0
0.58	65.58	00	3,224	3,224
1.16	66.16	00	5,678	8,902
1.74	66.74	00	7,048	15,950
2.32	67.32	00	17,976	33,926
2.90	67.90	00	28,626	62,551
3.48	68.48	00	34,254	96,805
4.06	69.06	00	40,166	135,972
4.64	69.64	00	45,604	182,576
5.22	70.22	00	48,253	230,828
5.80	70.80	00	49,591	280,420
6.38	71.38	00	49,558	329,978
6.96	71.96	00	48,360	378,338
7.54	72.54	00	45,454	423,792
8.12	73.12	00	40,225	464,018
8.70	73.70	00	34,158	498,176
9.28	74.28	00	28,632	526,808
9.86	74.86	00	17,927	544,735
10.44	75.44	00	7,043	551,778
11.02	76.02	00	5,673	557,451
11.60	76.60	00	3,219	560,669

Culvert / Orifice Structures

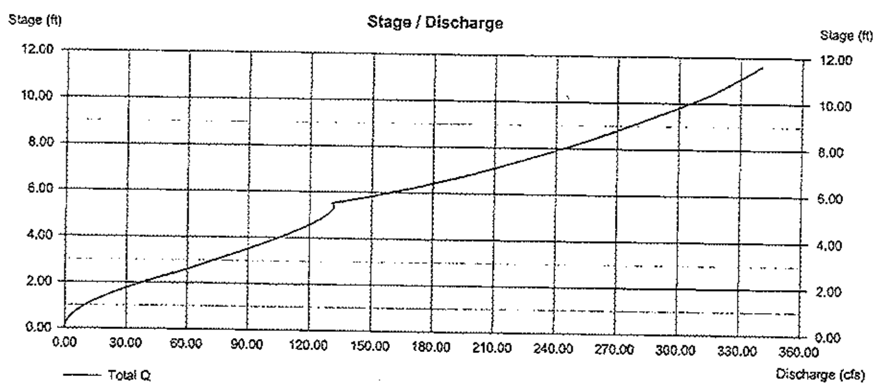
	[A]	[B]	[C]	[D]
Rise (in)	= 66.00	0.00	0.00	0.00
Span (in)	= 66.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 65.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

SD-2 (N/A; UNFEASIBLE) SUPERSEDED

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 9 2006, 9:45 AM

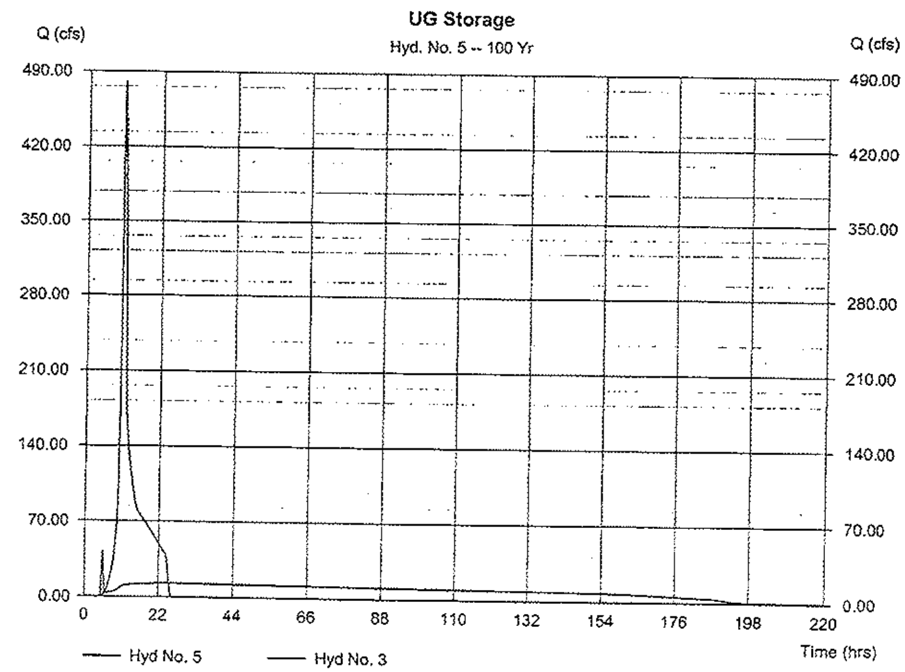
Hyd. No. 5

UG Storage

Hydrograph type = Reservoir		Peak discharge	= 12.69 cfs
Storm frequency = 100 yrs		Time interval	= 6 min
Inflow hyd. No. = 3		Max. Elevation	= 63.39 ft
Reservoir name = UG Storage		Max. Storage	= 5,767,430 cuft

Storage Indication method used.

Hydrograph Volume = 6,478,575 cuft



Pond Report

SD-2 (N/A ; UNFEASIBLE) SUPERSEDED

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 9 2006, 9:45 AM

Pond No. 2 - UG Storage

Pond Data

Pipe dia. = 8.00 ft Pipe length = 1660.0 ft No. Barrels = 90.0 Slope = 0.50 % Invert elev. = 53.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	53.00	00	0	0
0.82	53.82	00	69,929	69,929
1.63	54.63	00	121,219	191,149
2.45	55.45	00	147,299	338,448
3.26	56.26	00	161,814	500,262
4.08	57.08	00	168,655	668,917
4.89	57.89	00	400,598	1,069,515
5.71	58.71	00	612,131	1,681,646
6.52	59.52	00	700,784	2,382,430
7.34	60.34	00	731,682	3,114,112
8.15	61.15	00	696,134	3,810,245
8.96	61.97	00	697,693	4,507,938
9.78	62.78	00	731,436	5,239,374
10.60	63.60	00	700,264	5,939,638
11.41	64.41	00	611,345	6,550,982
12.23	65.23	00	400,154	6,951,136
13.04	66.04	00	168,230	7,119,366
13.86	66.86	00	162,131	7,281,497
14.67	67.67	00	147,153	7,428,649
15.49	68.48	00	120,856	7,549,505
16.30	69.30	00	69,832	7,619,336

Culvert / Orifice Structures

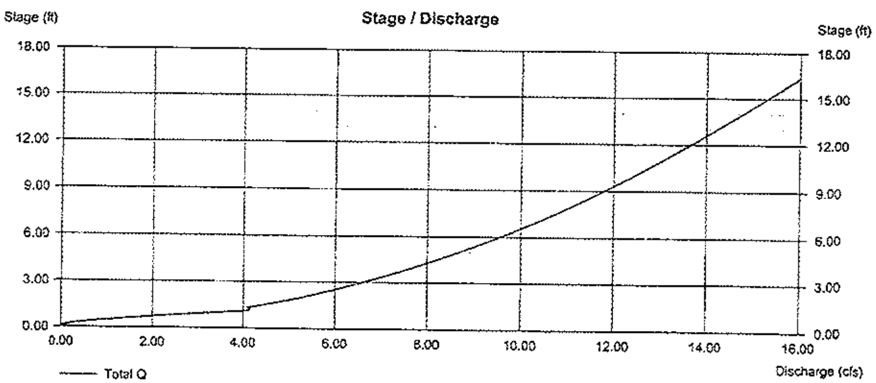
	[A]	[B]	[C]	[D]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 53.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= —	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

SD-2 (Alt.)

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 9 2006, 10:55 AM

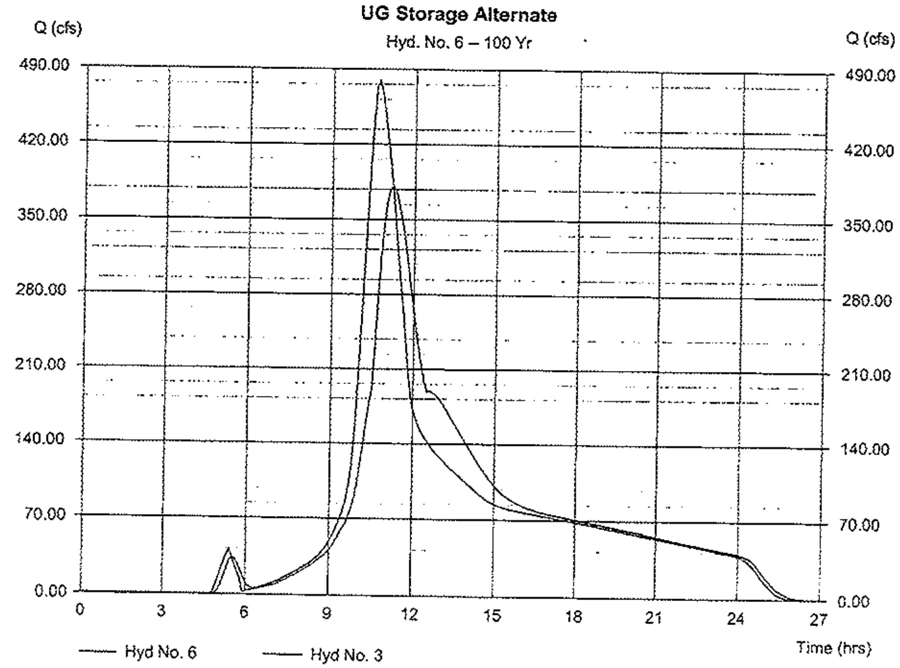
Hyd. No. 6

UG Storage Alternate

Hydrograph type	= Reservoir	Peak discharge	= 380.98 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Max. Elevation	= 62.62 ft
Reservoir name	= UG Storage Alternate	Max. Storage	= 782,191 cuft

Storage Indication method used.

Hydrograph Volume = 6,481,825 cuft



Pond Report

SD-2 (Alt.)

Hydraflow Hydrographs by Intelisolve — Wednesday, Aug 9 2006, 10:55 AM

Pond No. 3 - UG Storage Alternate

Pond Data

Pipe dia. = 8.00 ft Pipe length = 800.0 ft No. Barrels = 20.0 Slope = 0.50 % Invert elev. = 53.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	53.00	00	0	0
0.60	53.60	00	4,977	4,977
1.20	54.20	00	8,754	13,732
1.80	54.80	00	10,851	24,583
2.40	55.40	00	22,311	46,893
3.00	56.00	00	41,855	88,748
3.60	56.60	00	51,377	140,125
4.20	57.20	00	58,465	198,590
4.80	57.80	00	67,850	266,440
5.40	58.40	00	72,745	339,185
6.00	59.00	00	74,969	414,154
6.60	59.60	00	74,963	489,117
7.20	60.20	00	72,887	562,005
7.80	60.80	00	67,814	629,819
8.40	61.40	00	58,300	688,119
9.00	62.00	00	51,391	739,510
9.60	62.60	00	41,810	781,321
10.20	63.20	00	22,254	803,575
10.80	63.80	00	10,844	814,418
11.40	64.40	00	8,746	823,165
12.00	65.00	00	4,969	828,134

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 78.00	0.00	0.00	0.00
Span (in)	= 78.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 53.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

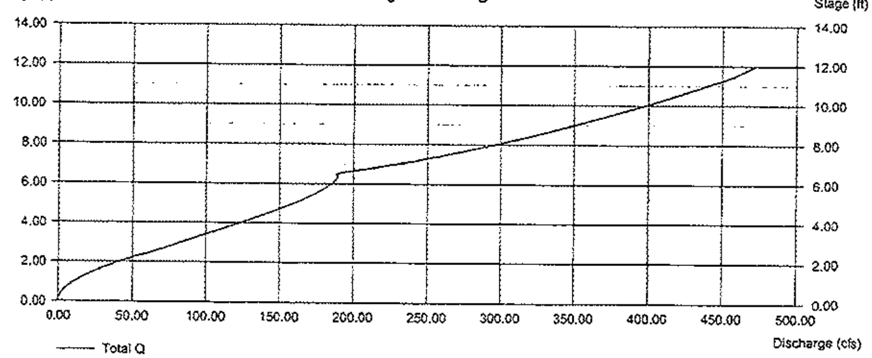
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= —	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge



Hydrograph Plot

SD-3

Hydraflow Hydrographs by Intelisolve — Thursday, Aug 24 2006, 8:47 AM

Hyd. No. 5

UG Storage

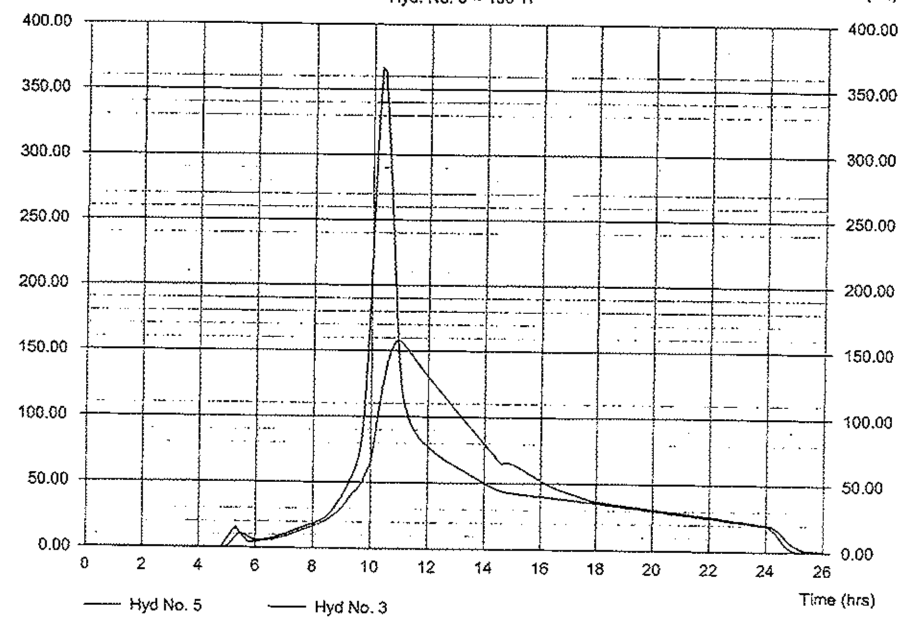
Hydrograph type	= Reservoir	Peak discharge	= 157.79 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Max. Elevation	= 54.07 ft
Reservoir name	= UG Storage	Max. Storage	= 707,445 cuft

Storage Indication method used.

Hydrograph Volume = 3,501,628 cuft

UG Storage

Hyd. No. 5 -- 100 Yr



SD-3

Pond Report

Hydraflow Hydrographs by Intelisolve — Thursday, Aug 24 2006, 8:47 AM

Pond No. 2 - UG Storage

Pond Data

Pipe dia. = 8.00 ft Pipe length = 800.0 ft No. Barrels = 19.0 Slope = 0.50 % Invert elev. = 45.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	45.00	00	0	0
0.60	45.60	00	4,728	4,728
1.20	46.20	00	8,316	13,044
1.80	46.80	00	10,308	23,352
2.40	47.40	00	21,195	44,546
3.00	48.00	00	39,761	84,307
3.60	48.60	00	48,807	133,115
4.20	49.20	00	55,541	188,655
4.80	49.80	00	64,456	253,111
5.40	50.40	00	69,106	322,218
6.00	51.00	00	71,219	393,436
6.60	51.60	00	71,214	464,650
7.20	52.20	00	69,241	533,891
7.80	52.80	00	64,422	598,313
8.40	53.40	00	55,384	653,698
9.00	54.00	00	48,820	702,518
9.60	54.60	00	39,719	742,237
10.20	55.20	00	21,141	763,378
10.80	55.80	00	10,301	773,678
11.40	56.40	00	8,308	781,987
12.00	57.00	00	4,720	786,707

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 45.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

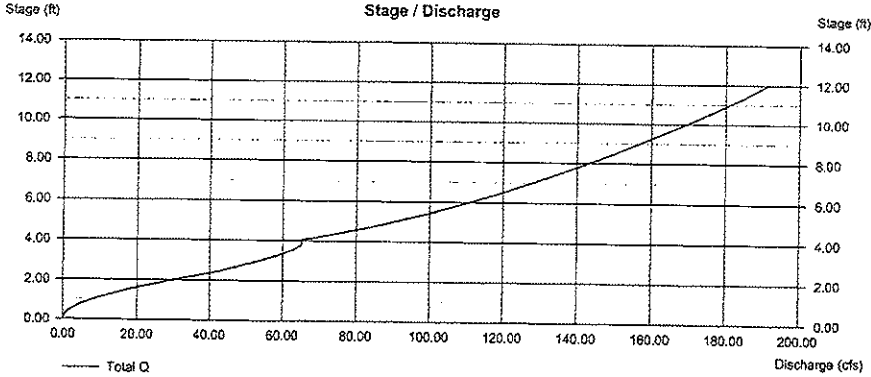
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= —	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge



SD-4

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve — Thursday, Aug 24 2006, 9:14 AM

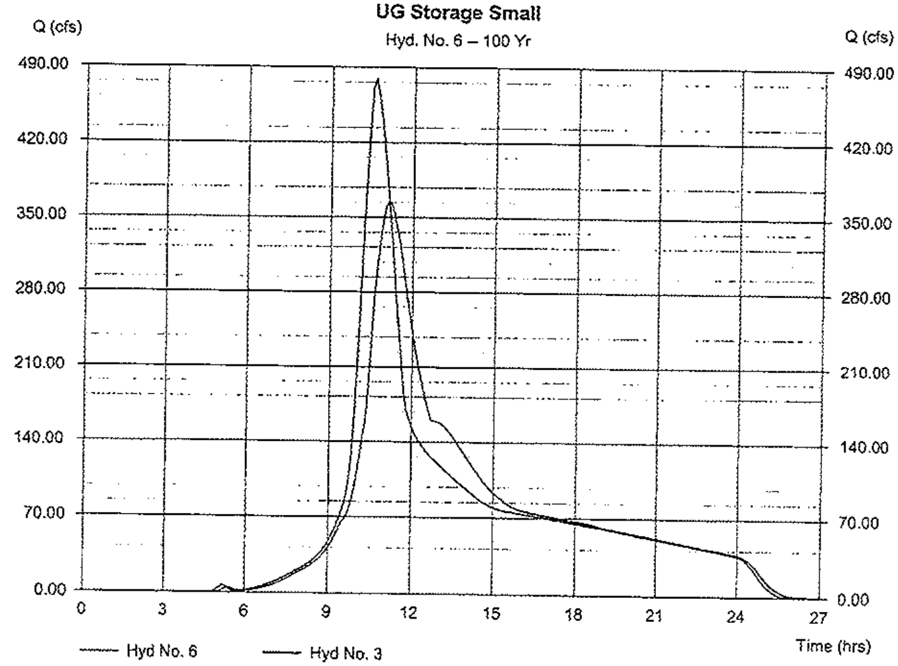
Hyd. No. 6

UG Storage Small

Hydrograph type	= Reservoir	Peak discharge	= 364.21 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Max. Elevation	= 54.34 ft
Reservoir name	= UG Storage Small	Max. Storage	= 729,368 cuft

Storage Indication method used.

Hydrograph Volume = 6,064,715 cuft



Pond Report

SD-4

Hydraflow Hydrographs by Intelisolve

Thursday, Aug 24 2006, 9:14 AM

Pond No. 3 - UG Storage Small

Pond Data

Pipe dia. = 8.00 ft Pipe length = 1000.0 ft No. Barrels = 15.0 Slope = 0.50 % Invert elev. = 44.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	44.00	00	0	0
0.65	44.65	00	5,169	5,169
1.30	45.30	00	9,049	14,218
1.95	45.95	00	11,181	25,398
2.60	46.60	00	13,732	39,131
3.25	47.25	00	36,012	75,142
3.90	47.90	00	49,149	124,291
4.55	48.55	00	56,612	180,903
5.20	49.20	00	61,885	242,788
5.85	49.85	00	70,048	312,836
6.50	50.50	00	73,154	385,989
7.15	51.15	00	73,321	459,311
7.80	51.80	00	69,906	529,216
8.45	52.45	00	61,948	591,164
9.10	53.10	00	56,466	647,631
9.75	53.75	00	49,118	696,749
10.40	54.40	00	35,987	732,735
11.05	55.05	00	13,716	746,451
11.70	55.70	00	11,174	757,625
12.35	56.35	00	9,054	766,679
13.00	57.00	00	5,148	771,827

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 72.00	0.00	0.00	0.00
Span (in)	= 72.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 44.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

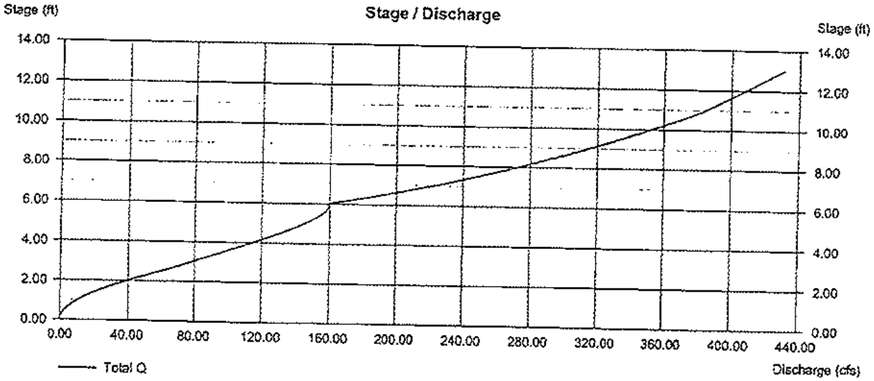
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= —	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge



Hydrograph Plot

SD-5

Hydraflow Hydrographs by Intelisolve

Wednesday, Aug 9 2006, 2:17 PM

Hyd. No. 8

UG Storage

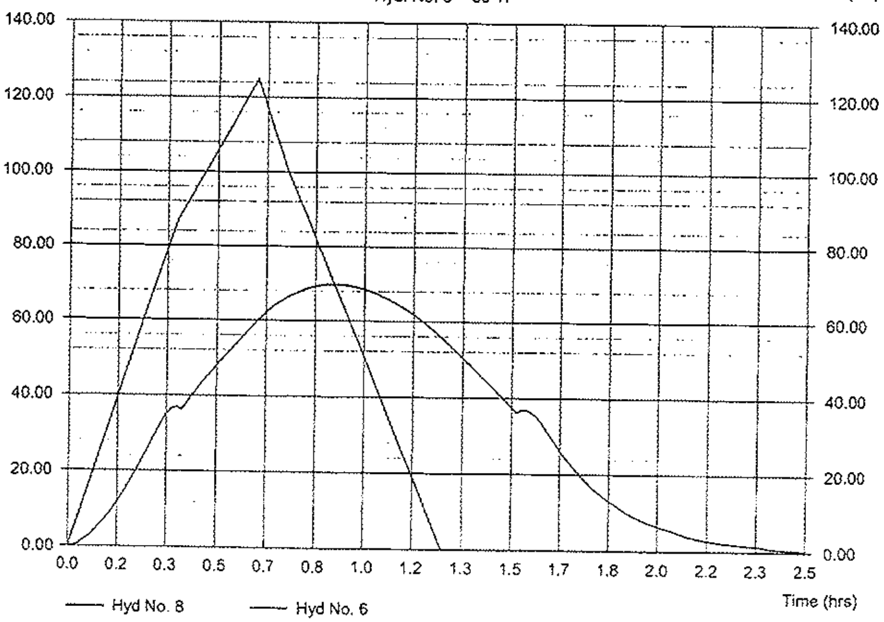
Hydrograph type	= Reservoir	Peak discharge	= 69.80 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Inflow hyd. No.	= 6	Max. Elevation	= 39.92 ft
Reservoir name	= UG Storage	Max. Storage	= 120,504 cuft

Storage Indication method used.

Hydrograph Volume = 296,963 cuft

UG Storage

Hyd. No. 8 – 50 Yr



Pond Report

SD-5

Hydraflow Hydrographs by Intelisolve — Wednesday, Aug 9 2006, 2:17 PM

Pond No. 2 - UG Storage

Pond Data

Pipe dia. = 8.00 ft Pipe length = 160.0 ft No. Barrels = 15.0 Slope = 0.50 % Invert elev. = 33.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	33.00	00	0	0
0.44	33.44	00	672	672
0.88	33.88	00	3,084	3,756
1.32	34.32	00	5,314	9,070
1.76	34.76	00	6,692	15,762
2.20	35.20	00	7,674	23,436
2.64	35.64	00	8,383	31,820
3.08	36.08	00	8,901	40,721
3.52	36.52	00	9,295	50,016
3.96	36.96	00	9,542	59,558
4.40	37.40	00	9,636	69,193
4.84	37.84	00	9,661	78,854
5.28	38.28	00	9,533	88,387
5.72	38.72	00	9,276	97,662
6.16	39.16	00	8,898	106,561
6.60	39.60	00	8,387	114,948
7.04	40.04	00	7,662	122,610
7.48	40.48	00	6,694	129,304
7.92	40.92	00	5,305	134,608
8.36	41.36	00	3,076	137,684
8.80	41.80	00	670	138,355

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 36.00	0.00	0.00	0.00
Span (in)	= 36.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 33.00	0.00	0.00	0.00
Length (ft)	= 280.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

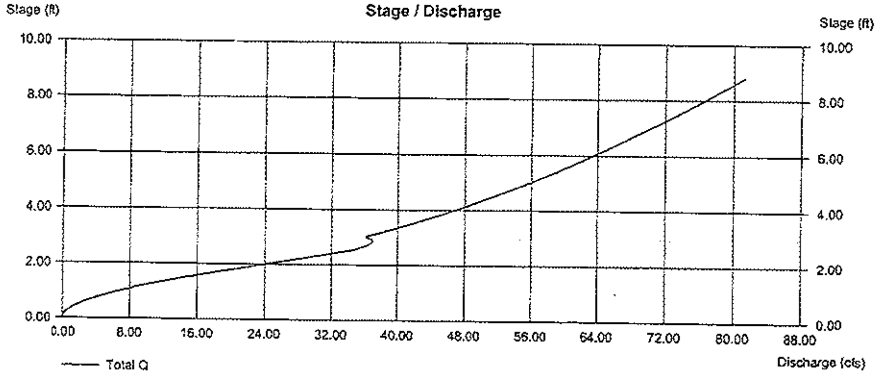
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= —	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge



APPENDIX O.

Wastewater Treatment Facility Preliminary Drainage Report

Drainage Report and Calculations

For

Waikapu 710 Subdivision
Honoapiilani Highway, Waikapu, Island of Maui, Hawaii
TMK: (2) 3-6-004:003 & 006

September 2006

Prepared For:

Maalaea Property, LLC
355 West Waiko Road
Wailuku, HI 96793

Prepared By:

M&E Pacific, Inc.
METCALF & EDDY | AECOM
Suite 1900, Davies Pacific Center
841 Bishop Street
Honolulu, HI 96813

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SECTION 1
Introduction

SECTION 1 INTRODUCTION

1.1 PURPOSE

The objective of this preliminary drainage report is to develop a drainage system for the proposed Waikapu 710 Subdivision (W710S) initial development of a new wastewater treatment plant (WWTP) and an effluent reuse field. A drainage report is required to obtain County of Maui approval for the proposed project.

This report analyzes the conditions before and after the construction of the first phase of work that will occur on this property.

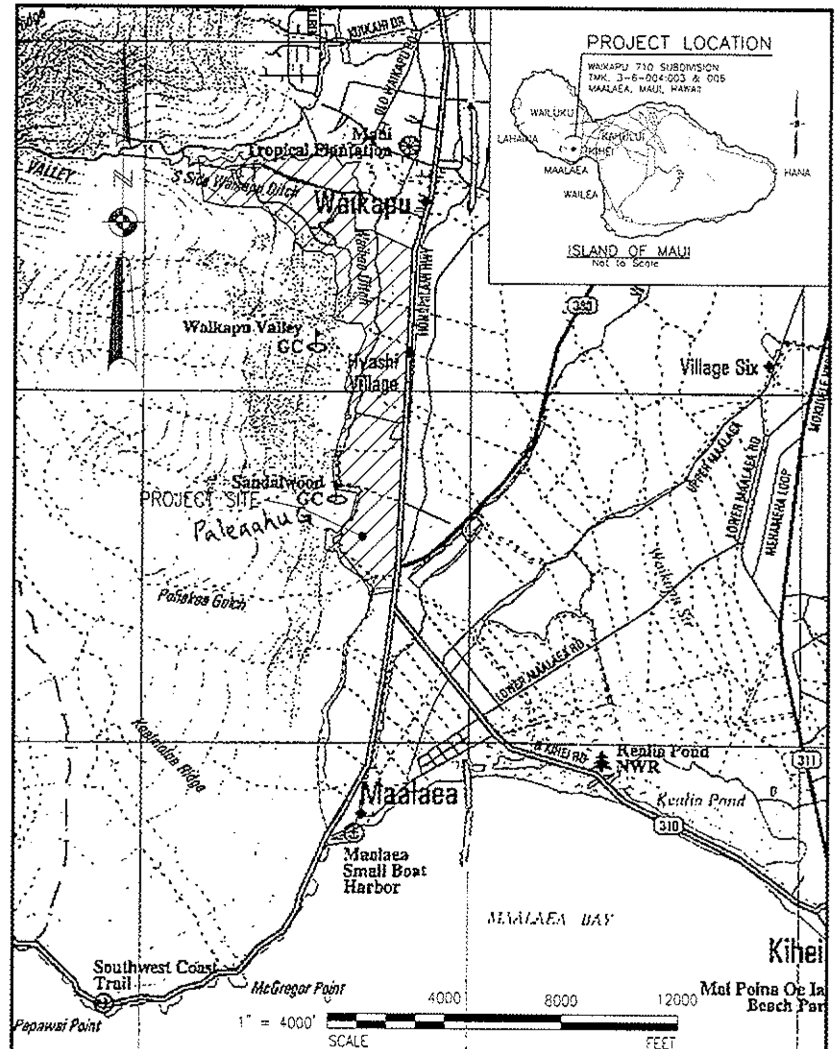
1.2 GENERAL INFORMATION

a. The proposed development site is a two-parcel area identified as Tax Map Key 3-6-004: 003 & 006 located in Central Maui, Waikapu region, bounded by Honoapiilani Highway on the east and the Waihee ditch (irrigation) and the Kahili Golf Course on the west. The parcel encompasses approximately 710 acres on the slopes of Kealaloloa (West Maui Mountains). The current real estate property class is Agricultural. See Figure 1, Location Map. The lands to the west and upland of the project area are privately and State owned.

b. Owner: Maalaea Property, LLC.
355 West Waiko Rd.
Wailuku, HI 96793

Contact: Steven Kikuchi
Partner

c. Location Map (See Figure 1)



M&E Pacific, Inc.
METCALF & EDDY | AECOM
DAVIES PACIFIC CTR, STE 1900
841 BISHOP ST
HONOLULU, HAWAII 96813

Location Map
WAIKAPU 710 SUBDIVISION DRAINAGE REPORT
WAIKAPU, ISLAND OF MAUI, HAWAII

SECTION 2
Physical Environment

SECTION 2 PHYSICAL ENVIRONMENT

2.1 LOCATION

The proposed W710S (TMK: 3-6-004:003 & 006) is located on the mauka side of Honoapiilani Highway north of the intersection with Kuihelani Highway and south of Waiko Road in the Wailuku District on the island of Maui.

2.2 TOPOGRAPHY

The project site is located in Central Maui, the isthmus between West Maui and East Maui. Central Maui is generally flat and fairly level. The project site is sloping at a rolling grade between 5 and 13 percent. Mainly pineapple/sugarcane fields, wild grasses, shrubs, and small trees cover the site.

The project site was previously cultivated in sugarcane and pineapple. While no longer used for large-scale agricultural activities, portions of the property were being used for small-scale farming activities. The land now remains vacant.

2.3 SOILS

The NRCS Hawaii website (www.hi.nrcs.usda.gov) provides an online database of State of Hawaii soils. This database categorizes the soils on the project site as: PtB, EsB, PsA, IcB, rSM, PtA and PrB. These seven (7) soils all are classified as "B," hydrological type. See Figure 2, Soils Map.

- PtB, Pulehu cobbly clay loam, 3 to 7% slopes, has moderate permeability. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.4 inches per foot of soil.

- EsB, Ewa silty clay, 3 to 7% slopes, has moderate permeability. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil.

- PsA, Pulehu clay loam, 0 to 3% slopes, is similar to PtB described previously.

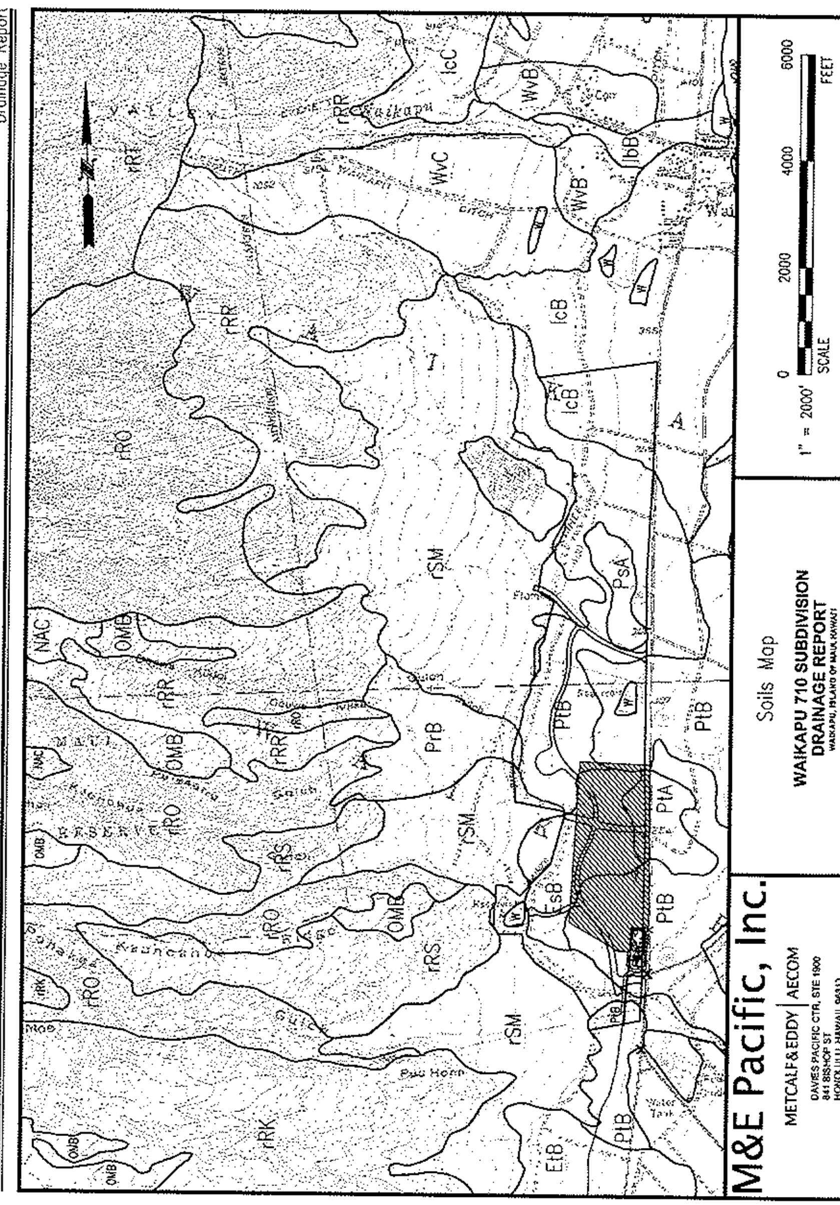
- IcB, Iao clay, 3 to 7% slopes, has moderately slow permeability. Runoff is medium and the erosion hazard is slight to moderate. The available water capacity is about 1.7 inches per foot of soil.

- rSM, stony alluvial land, consists of stones, boulders and soils deposited by streams along the bottoms of gulches and on alluvial fans. Permeability is moderate. Runoff is slow, and the erosion hazard is slight.

- PtA, Pulehu cobbly clay loam, 0 to 3% slopes, is similar to PtB described previously.
- PrB, Pulehu cobbly silt loam, 3 to 7% slopes, is similar to PtB described previously.

Other soils located off-site, but in the drainage basins are rRO, rRS, rRT, rRR, WvC, NAC and OMB:

- rRO, rock outcrop consists of areas where exposed bedrock covers more than 90% of the surface. Permeability is negligible and runoff is rapid. Erosion hazard is negligible.
- rRS, rough broken and stony land consists of very steep, stony gulches. Permeability is slow and runoff is rapid. Erosion hazard is slight.
- rRT, rough mountainous land consists of very steep land broken by numerous intermittent drainage channels. Permeability is negligible and runoff is rapid. Erosion hazard is negligible.
- rRR, rough broken land consists of very steep land broken by numerous intermittent drainage channels. Permeability is slow and runoff is rapid. Erosion hazard is slight.
- WvC, Wailuku silty clay, 7 to 15% slopes, has moderate permeability and runoff is slow to medium. Erosion hazard is slight to moderate.
- NAC, Naiwa silty clay loam, 3 – 20% slopes, with moderately rapid permeability. Runoff is medium and erosion hazard is moderate to severe.
- OMB, Oli silt loam, 3 – 10% slopes, has medium runoff and moderate erosion hazard.

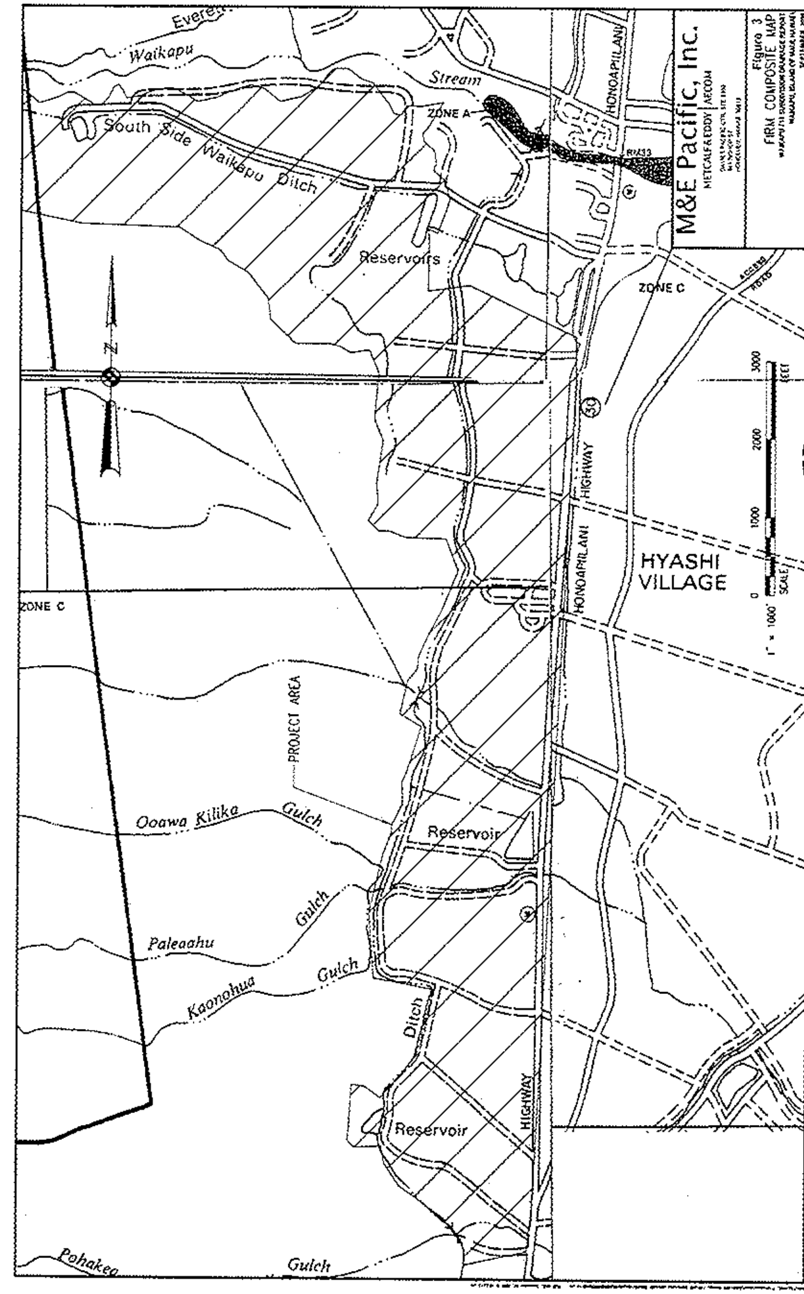


2.4 DRAINAGE/FLOODING

According to the FEMA Flood Insurance Rate Maps (Community-Panel Numbers 150003 0235 B, June 1, 1981; 0255 B, June 1, 1981; 0170 B, June 1, 1981; and 0190 D, March 16, 1995), the entire project parcel is classified Zone C. Zone C is defined as areas of minimal flooding (no shading). See the attached Figure 3 (composite FEMA maps) for reference.

2.5 RAINFALL

Annual median rainfall in this region, according to the Atlas of Hawai'i, is 15 inches.



SECTION 3
Drainage

SECTION 3 DRAINAGE

3.1 METHODOLOGY

The "Department of Public Works and Waste Management – County of Maui – Chapter 4 – Rules for the Design of Storm Drainage Facilities in the County of Maui," is the basic design reference effective since November 12, 1995.

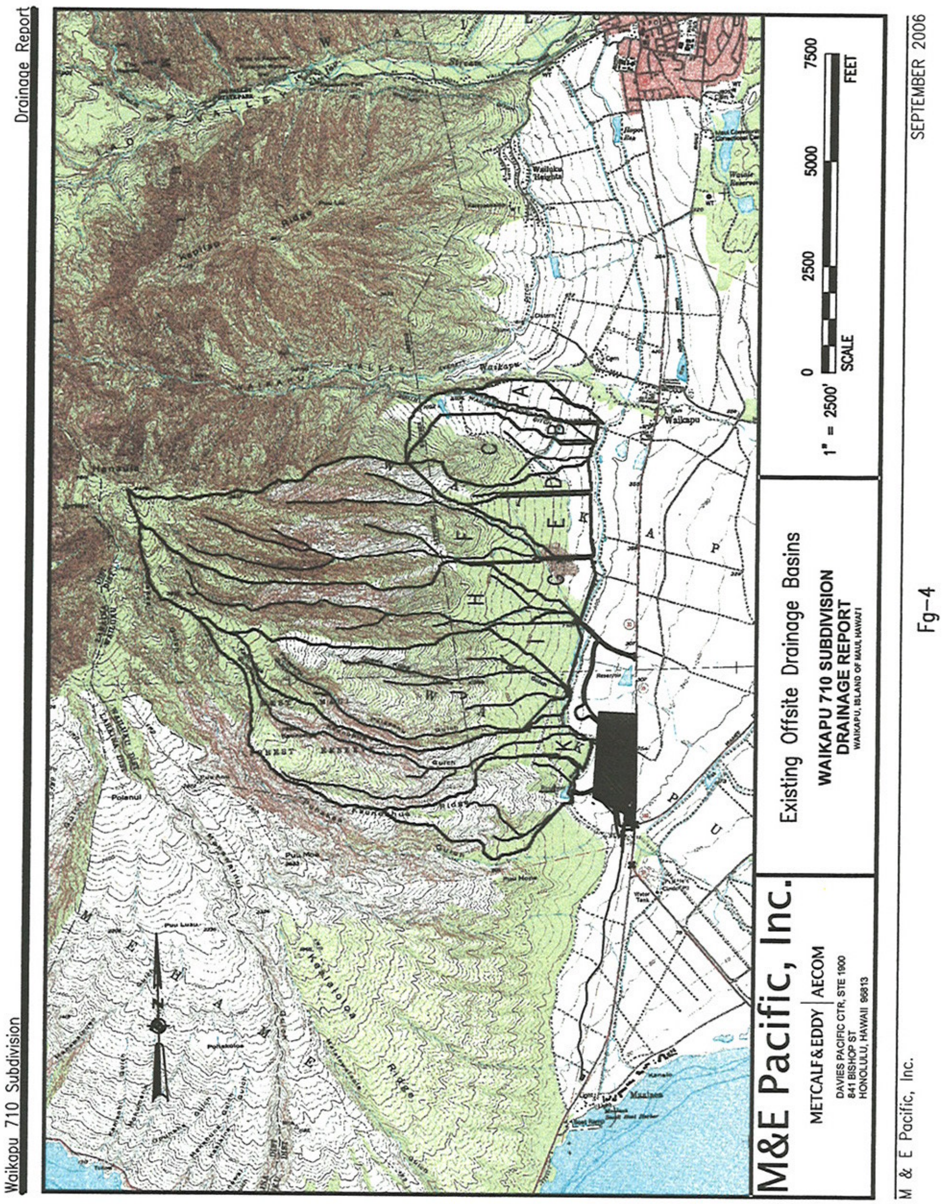
3.2 EXISTING DRAINAGE CONDITIONS AND SYSTEM

3.2.1 Existing Project Site

The site is an approximately 710 acre parcel, and is presently zoned Agricultural. Running along the western property boundary is the Waihee Ditch (owned by the Wailuku Water Company) and is used to convey irrigation water supply. The only existing drainage improvements on the site are agricultural ditches and road side swales. The runoff from the site enters existing headwalls and drain inlets spaced along the mauka side of Honoapiilani Highway. The runoff is conveyed across the highway through culverts, pipes, ditch and channel to another parcel downstream and makai of Honoapiilani Highway.

Refer to Figure 4, Existing Offsite Drainage Basins. The current off-site storm runoff consists of seven large drainage basins (larger than 100 acres) and five smaller drainage basins. A total of 12 offsite drainage basins affect the project site:

Drainage Basin (D)	Area (Acre)	Remark
A	58.71	Runoff passes through portion of parcel to remain un-improved.
B	95.38	Ditto
C	195.19	Ditto
D	77.69	Ditto
E	112.21	Ditto
F	769.04	Ditto
G	77.69	**Runoff passes through portion of parcel planned for future development**
H	540.07	Ditto
I	72.72	Ditto
J	604.61	Ditto
K	431.94	Ditto
L	235.88	Ditto



In accordance with the County Drainage Standards, §15-04-05 Hydrologic criteria, Recurrence interval:

(a) For drainage areas of 100 acres or less, T_m (recurrence interval) = 10 year based on 1 hour storm, unless otherwise specified.

(b) For drainage areas of 100 acres or less with sump, or tailwater effect, T_m = 50 year based on 1 hour storm.

(c) For the design of roadway culverts and bridges with drainage areas less than 100 acres, T_m = 50 year based on 1 hour storm.

(d) For drainage areas greater than 100 acres and all streams, the National Resources Conservation Service (NRCS, formerly Soil Conservation Service) hydrograph method shall be used, T_m = 100 year based on 24 hour storm.

(e) Retention and Detention Basins:
T_m = 50 year based on 1 hour storm for drainage areas 100 acres or less.
T_m = 100 year based on 24 hour storm for drainage areas more than 100 acres.

(f) When a drainage area of less than 100 acres contributes to a major stream or channel with a total drainage area greater than 100 acres, the contributory drainage system shall be designed for 10 year or 50 year storm, whichever is applicable.

Scenario (b) will be used for the smaller drainage areas on the site (≤100 acres), while scenario (d) will be used for the larger drainage areas (>100 acres).

Runoff Quantity:
(a) **Rational Method**: For drainage areas of 100 acres or less, the rational method along with the accompanying reference tables and charts, or latest revision thereof, shall be used.

$Q = CIA$

Where Q = flow rate in cubic feet per second, cfs
C = runoff coefficient
I = rainfall intensity in inches per hour for a duration equal to the time of concentration
A = drainage area in acres

NRCS Method, Hydrograph Analysis

(a) For drainage areas greater than 100 acres and all streams, the NRCS method shall be used.

(b) The procedure for computing the peak flows and plotting the hydrographs shall be as outlined in the NRCS, National Engineering Handbook, Section 4, Hydrology, Supplement, or latest revision thereof or Erosion and Sediment Control Guide for Hawaii, NRCS, March 1981, or latest revision thereof.

(c) The NRCS computer program TR55 or TR20 may be used in lieu of the NRCS hydrograph analysis. Federal Emergency Management Agency (FEMA) storm flows shall be with the minimum storm flow in drainage basins where flows have been determined in the "Flood Insurance Study," Maui County.

The drainage basin areas require use of both the Rational Method and NRCS Method. Consider the Rational Method first in estimating the existing flows for the small basins less than or equal to 100 acres.

Rational Method: $Q = CIA$

Determine "C" for off-site areas using Table 1. The following example is used for Drainage Basin A:

Watershed Characteristics	Description	Value
Infiltration, high	Slow	0.14
Relief, moderate	Rolling	0.03
Vegetal Cover, moderate	Good	0.03
Development Type, Low	Agricultural	0.15
	Sum, Σ	**0.35**

Use C = **0.35** for existing off-site DB-A. The remaining smaller drainage basins have the same watershed characteristics as DB-A except for varying infiltration and relief characteristics. For "Infiltration, moderate," description "Medium," the value is 0.07 (< 0.14). For "Relief, high," description "Hilly," the value is 0.06 (> 0.03).

DB-B and DB-D have slow infiltration and hilly relief;
C = 0.14 + 0.06 + 0.03 + 0.15 = **0.38**.

DB-G and DB-I have medium infiltration and rolling relief;
C = 0.07 + 0.03 + 0.03 + 0.15 = **0.28**.

Determine "C" for on-site areas using Table 1.

Watershed Characteristics	Description	Value
Infiltration, moderate	Medium	0.07
Relief, moderate	Rolling	0.03
Vegetal Cover, low	High	0.00
Development Type, Low	Agricultural	0.15
	Sum, Σ	0.25

Determine "C" for on-site areas using Table 2. C = **0.30** (Unimproved areas) > 0.25

Use C = **0.30** for existing on-site areas.

Determine T_c, time of concentration from Plate 3, Time of Concentration (of small agricultural drainage basin). See Appendix A for the County Drainage Standards tables and plates referred to.

Determine "I," rainfall intensity. Using Plate 7, 50 Year-1 Hour-Rainfall plate, approximately 3.0 to 3.3 inches of rain falls on the project site. Enter Plate 2 with the 1-hour rainfall value and the required time of concentration. Obtain the design rainfall intensity in inches per hour.

The following table summarizes the estimated rainfall intensity for each small basin:

Drainage Basin	I (in)	T_c (min)	I (in/hr)
A	3.1	22	4.9
B	3.3	28	4.6
D	3.3	21	5.1
G	**3.0**	**29**	**4.3**
I	**3.0**	**29**	**4.3**

The following table summarizes the determination of peak runoff for the small drainage basins using the Rational Method:

Drainage Basin	C	I (in/hr)	A (ac)	Q (cfs)
A	0.35	4.9	58.71	101
B	0.38	4.6	95.38	167
D	0.38	5.1	77.28	150
G	**0.28**	**4.3**	**77.67**	**94**
I	**0.28**	**4.3**	**72.72**	**88**

Determine the peak runoff for the large basins using the NRCS computer program WinTR-55, version 1.0.08. The existing land use is shrub and brush rangeland-good. The curve number, CN, for a large drainage basin is the weighted average based on:

Soil Hydrological Classification	CN
A	39
B	61
C	74
D	80

The curve number, CN, for the existing condition in the large drainage basins varies from 62.9 to 78.2. The time of concentration, T_c is estimated using the Kirpich Equation developed for agricultural watersheds.
For overland flow over grassy mountains.

$$T_c = m \times 0.00013 \times \frac{L^{0.77}}{S^{0.385}} \times C_t$$

Where T_c = *time of concentration in hours.*
$m = 2.000$ *Earth type coefficient*
L = *length of the overland flow in feet.*
S = *average overland slope in ft / ft.*
$C_t = 1.760$ *time of concentration coefficient*

An adjustment is made for watersheds with a CN less than 80 using the following equation:

$$T_c = T_c \times (1 + (80 - CN) \times 0.04$$

Where CN = *Curve Number*

From the "Rainfall Frequency Atlas of the Hawaiian Islands," Technical Paper No. 43, 1962, the rainfall, "P" for 100-year, 24-hour storm is determined for each of the large basins.

Appendix A contains the printout from the WinTR-55 program for the large basins. The following table summarizes the resulting peak runoff, Q_p:

Drainage Basin	Area (ac)	CN	P (in)	T_c (hr)	Q_p (cfs)
C	195.19	74	13.0	0.552	893.40
E	112.21	63	13.0	0.847	328.04
F	769.04	78	13.0	0.863	2903.99
H	**540.07**	**77**	**13.0**	**0.902**	**1961.95**
J	**604.61**	**71**	**13.0**	**0.927**	**1973.12**
K	**431.94**	**73**	**13.0**	**1.054**	**1352.66**
L	**235.88**	**72**	**13.0**	**0.580**	**1018.12**

The existing storm runoff from the design storms' precipitation falling on the drainage basins of the off-site areas DB-A through DB-F flow through the northern end of the parcel not currently planned for development. This storm runoff flows through the parcel into the existing drainage system along Honoapiilani Highway.

The existing off-site areas DB-G through DB-L flow through the proposed improvement area and into the existing drainage system along Honoapiilani Highway.

3.3 PROPOSED DRAINAGE CONDITIONS AND SYSTEM

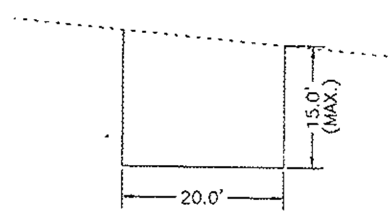
3.3.1 Proposed Project Site Conditions

The future proposed improvements will change the land use from previous agricultural use to residential development, which by nature will increase hardscape (i.e. road pavements, sidewalks, housing) and reduce rainfall infiltration into the ground. The initial phase of work will involve installation of a new WWTP and an 85-acre effluent reuse field. The design intention is to re-direct offsite stormwater from flowing over the WWTP and effluent reuse field by diverting the runoff through a proposed drainage channel along the mauka property line toward two proposed detention basins to retard the concentrated flow, remove some suspended sediments and "distribute and dissipate" the discharge at a rate which will not erode the ground.

3.3.2 Proposed Diversion Channel

The proposed reinforced concrete diversion channel will "divide" the flow from DB-G, DB-H, DB-I and DB-J toward the north and the flow from DB-K and DB-L toward the south. A high point is selected between DB-J and DB-K along the mauka property boundary.

A preliminary sizing of the diversion channel sections assumes a slope of 0.005 ft/ft. An examination of the hydrographs for the larger basins (DB-H and DB-J) indicates that the controlling design flows can be based on the peak flows of the superposition of their hydrographs. Considering the diversion channel flowing north, the peak flow of the combination of the hydrographs for DB-H and DB-J is approximately 4,000 cfs. An approximate 20' w x 15' h rectangular section can convey this flow. Considering the diversion channel flowing south, the peak flow of the combination of hydrographs for DB-K and DB-L is approximately 2,200 cfs. An approximate 20' w x 10' h rectangular section can convey this flow.



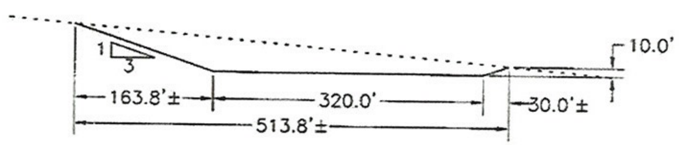
TYPICAL DITCH SECTION

3.3.3 Proposed On-site Detention Basins

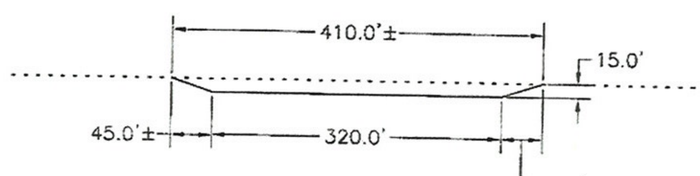
Two detention basins are needed to receive the flows from the north and south diversion channels. The proposed detention basin, Pond "A" receiving the flow from the north channel is sized to distribute and dissipate the flow within a reasonable area and is approximately 1,280' long x 320' wide at the bottom with side slopes at 3h:1v and 10' deep. For this preliminary sizing, seven 42" diameter pipe culverts and a weir structure running 1,280' along the length of the basin are assumed for the discharge structures. Appropriate energy dissipation structures and turf reinforcement are needed at the outlets. Pond "A" does not significantly attenuate the peak flow.

The proposed detention basin, Pond "B" receiving the flow from the south channel is approximately 960' long x 320' wide at the bottom with side slopes at 3h:1v and 15' deep. For this preliminary sizing, seven 42" diameter pipe culverts are assumed for the discharge structures. Appropriate energy dissipation structures and turf reinforcement are needed at the outlets. Pond "B" does attenuate the peak discharge significantly from 2,133 cfs to 1,070 cfs.

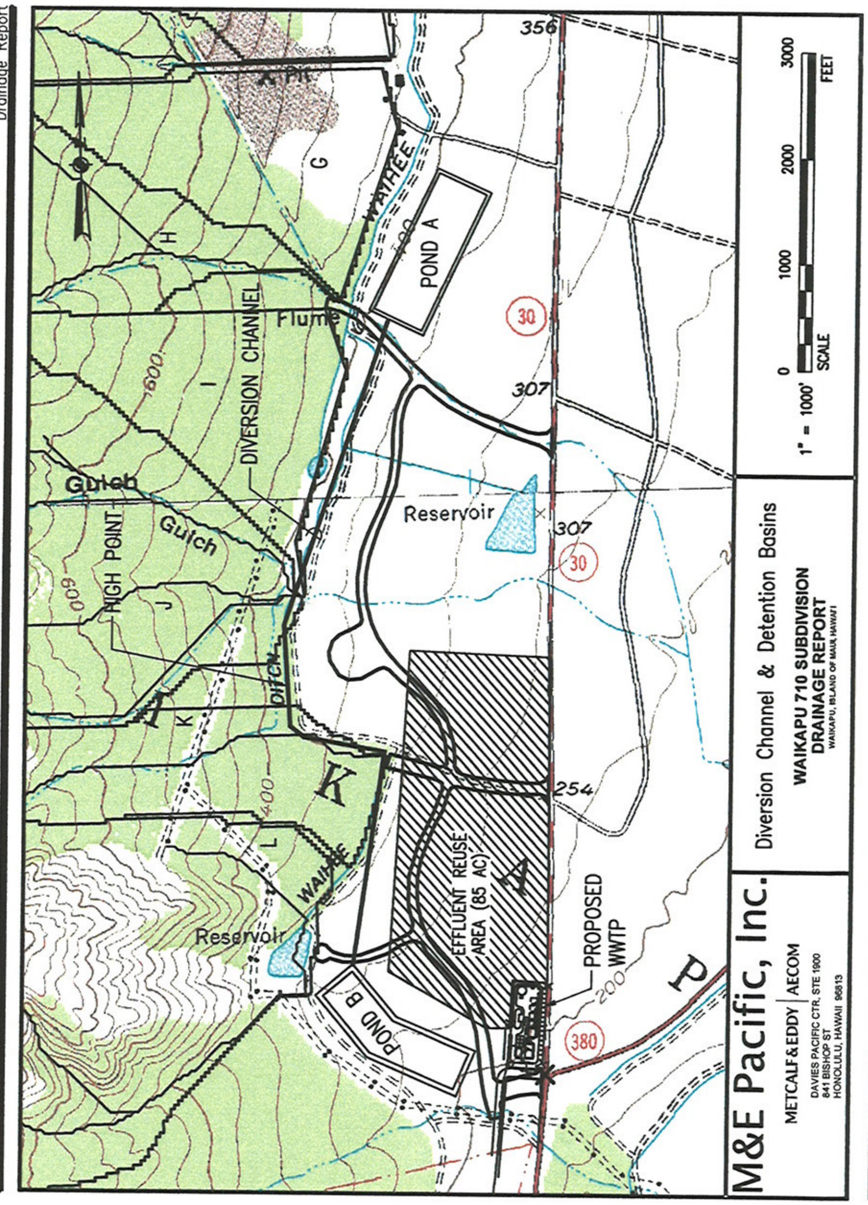
Figure 5 represents the on-site drain system analysis for this project (See Appendix B for Hydrologic and Hydraulic Analysis).



TYPICAL POND "A" SECTION



TYPICAL POND "B" SECTION



SECTION 4
Summary

SECTION 4 SUMMARY

4.1 SUMMARY AND CONCLUSION

The surface runoff from the off-site drainage basins will be diverted around the proposed WWTP and effluent reuse field. Two permanent detention basins will distribute and dissipate the runoff on-site.

APPENDICES

APPENDIX A

Hydrologic Calculations – Existing Drainage Basins

M&E Pacific, Inc. *Engineers & Architects*

REFERENCES:

1. DPWWM, COUNTY OF MAUI, CHAPTER 4, "RULES FOR THE DESIGN OF STORM DRAINAGE FACILITIES IN THE COUNTY OF MAUI," NOV. 1995.
2. WEATHER BUREAU, US DEPT. OF COMMERCE, RAINFALL FREQUENCY ATLAS OF THE HAWAIIAN ISLANDS, TECHNICAL PAPER NO. 43, 1962.
3. SOIL CONSERVATION SERVICE, US DEPT. OF AGRICULTURE, EROSION AND SEDIMENT CONTROL GUIDE FOR HAWAII, MAR. 1981.

JOB NO.	BY	SUBJECT	DATE	SHEET NO.
	PI	WAIKAPU 71D DRAINAGE (PRELIMINARY)	3/22/06	1

M&E Pacific, Inc. *Engineers & Architects*

ESTIMATE PEAK STORM RUNOFFS FOR DRAINAGE BASINS 100 ACRES OR LESS IN SIZE.

DB-A, 58.71 AC ; $Q = CIA$ (RATIONAL METHOD)

$i_{50Y,1HR} = 3.1''$ (RAINFALL FOR STORM WITH RECURRENCE INTERVAL 50 YEARS & 1 HOUR DURATION)

DETERMINE C, RUNOFF COEFFICIENT, FROM TABLE 1

INFILTRATION (SLOW)	0.14
RELIEF (ROLLING)	0.03
VEGETAL COVER (GOOD)	0.03
DEVELOPMENT (A.G.)	0.15
Σ	0.35 = C

DETERMINE T_c, TIME OF CONCENTRATION FROM PLATE 3.

$$K = \frac{L}{\sqrt{S}} = \frac{4754'}{\sqrt{0.1069}} = 14540'$$

$$T_c = 0.0136\,K^{0.77} = 22 \text{ MIN}$$

FROM TABLE 4, AVE $V \simeq 4.0$ FPS (PASTURES)

$$T_c = \frac{4754'}{4 \text{ FPS}} = 1188 \text{ SEC OR } 20 \text{ MIN} \sim 22 \checkmark$$

FROM PLATE 7, $i_{50Y,1HR} = 3.1''$

FROM PLATE 2, $I = 4.9$ IN/HR

$$Q = CIA = 0.35(4.9)(58.71) = 101 \text{ CFS} \quad (\text{DB-A})$$

JOB NO.	BY	SUBJECT	DATE	SHEET NO.
				2

DB-B, 95.38 AC, $i_{50Y,1HR} \sim 3.3"$

SIMILARLY $C = 0.38$ (HILLY RELIEF)

DETERMINE T_c:

$$K = \frac{8308'}{\sqrt{0.1649}} = 20459'$$

$$T_c = 0.0136 K^{0.77} = 28 \text{ MIN}$$

$$\frac{8308'}{4.5 FPS} = 1846 \text{ SEC OR } 31 \text{ MIN} \sim 28$$

FROM PLATE 2, $I_{50Y,1HR} = 4.6$ IN/HR

$$Q = CIA = 0.38(4.6)(95.38) = 167 \text{ CFS (DB-B)}$$

DB-D, 77.~~69~~ 28 AC, $i_{50Y,1H} \sim 3.3"$

SIMILARLY $C = 0.38$

T_c: $K = \frac{6236'}{\sqrt{0.2114}} = 13563'$

$$T_c = 0.0136 K^{0.77} = 21 \text{ MIN}$$

$$\frac{6236'}{5 FPS} = 1247 \text{ SEC OR } 21 \text{ MIN}$$

FROM PLATE 2, $I_{50Y,1H} = 5.1$ IN/HR

$$Q = 0.38 \times 5.1 \times 77.\cancel{69}^{28} = \cancel{151}^{150} \text{ CFS (DB-D)}$$

DB-G; 77.~~69~~ 7 AC, $i_{50Y,1HR} \sim 3.0"$

DETERMINE C:

INFILTRATION (MEDIUM)	0.07
RELIEF (ROLLING)	0.03
VEGETAL COVER (GOOD)	0.03
DEVELOPMENT (AG)	0.15
Σ	0.28 = C

T_c: $K = \frac{5842'}{\sqrt{0.0802}} = 20629'$

$$T_c = 0.0136 K^{0.77} = 29 \text{ MIN}$$

$$\frac{5842'}{4 FPS} = 1460 \text{ SEC OR } 24 \text{ MIN} \sim 29$$

FROM PLATE 2, $I_{50Y,1HR} \sim 4.3$ IN/HR

$$Q = 0.28 \times 4.3 \times 77.\cancel{69}^{7} = 94 \text{ CFS (DB-G)}$$

M&E Pacific, Inc. *Engineers & Architects*

DB – I, 72.72 AC, $i_{50Y,1HR} \sim 3.0''$

DETERMINE C:

INFILTRATION (MEDIUM)	0.07
RELIEF (ROLLING)	0.03
VEG. COVER (GOOD)	0.03
DEV. TYPE (AG)	0.15
	Σ 0.28 = C

$$T_c: \; K = \frac{5120'}{\sqrt{0.0797}} = 18136'$$

$$T_c = 0.0136\,K^{0.77} = 29 \text{ MIN}$$

$$\frac{5120'}{4 \text{ FPS}} = 1280 \text{ SEC OR } 21 \text{ MIN} \sim 29 \checkmark$$

FROM PLATE 2, $I_{50Y,1HR} \sim 4.3$ IN/HR

$$Q = 0.28 \times 4.3 \times 72.72 = 88 \text{ CFS (DB–I)}$$

JOB NO.	BY	SUBJECT	DATE	SHEET NO.
				5

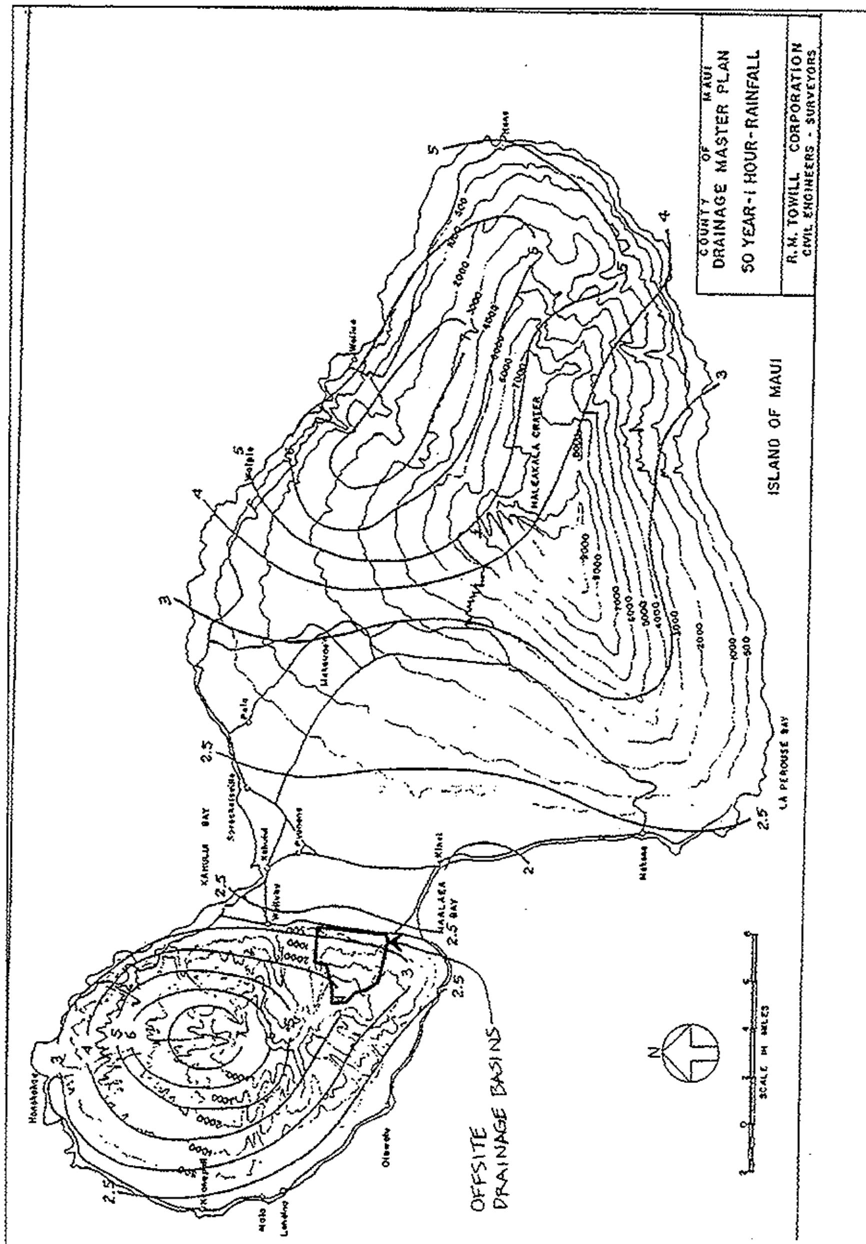


PLATE 7

6

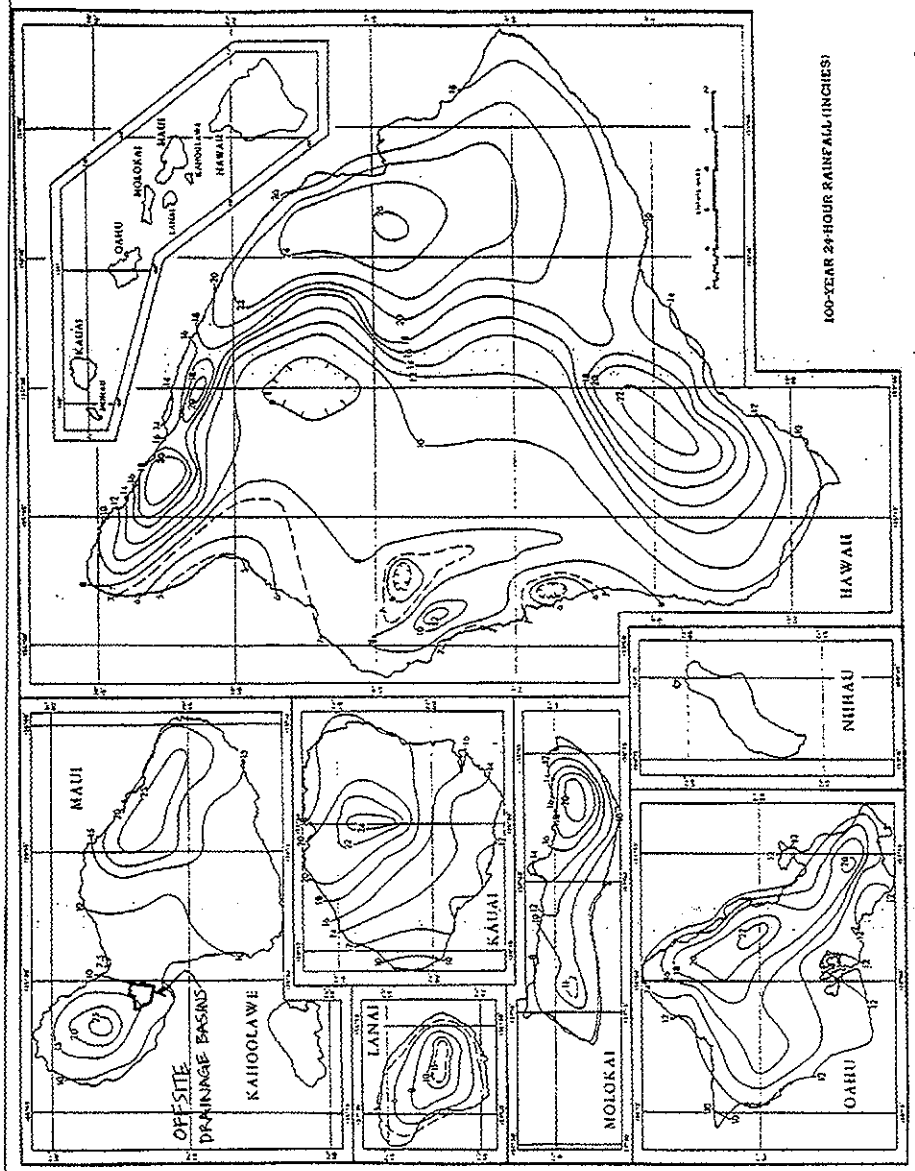


FIGURE 66.—100-yr. 24-hr. rainfall (in.)

Table 1

GUIDE FOR THE DETERMINATION OF RUNOFF COEFFICIENTS FOR BUILT-UP AREAS*

WATERSHED CHARACTERISTICS	EXTREME	HIGH	MODERATE	LOW
INFILTRATION	NEGLIGIBLE 0.20	SLOW 0.14	MEDIUM 0.07	HIGH 0.0
RELIEF	STEEP (> 25%) 0.08	HILLY (15 - 25%) 0.06	ROLLING (5 - 15%) 0.03	FLAT (0 - 5%) 0.0
VEGETAL COVER	NONE 0.07	POOR (< 10%) 0.05	GOOD (10 - 50%) 0.03	HIGH (50 - 90%) 0.0
DEVELOPMENT TYPE	INDUSTRIAL & BUSINESS 0.55	HOTEL - APARTMENT 0.45	RESIDENTIAL 0.40	AGRICULTURAL 0.15

*NOTE: *The design coefficient "C" must result from a total of the values for all four watershed characteristics of the site.*

Table 2

RUNOFF COEFFICIENTS

Type of Drainage Area	Runoff Coefficient C
Business:	
Downtown areas	0.95
Neighborhood areas	0.70
Residential:	
Single-family areas	0.50
Multi-units, detached	0.60
Multi-units, attached	0.75
Suburban	0.40
Apartment dwelling areas	0.70
Industrial:	
Light areas	0.80
Heavy areas	0.90
Parks, cemeteries	0.25
Playgrounds	0.35
Railroad-yard areas	0.40
Unimproved areas	0.30
Streets:	
Asphaltic	0.95
Concrete	0.95
Brick	0.85
Drive and walks	0.85
Roofs	0.95
Lawns:	
Sandy, soil, flat, 2%	0.10
Sandy, soil, avg., 2-7%	0.15
Sandy, soil, steep, 7%	0.20
Heavy soil, flat, 2%	0.17
Heavy soil, avg., 2-7%	0.22
Heavy soil, steep, 7%	0.35

Table 3

MINIMUM RUNOFF COEFFICIENTS FOR BUILT-UP AREAS

RESIDENTIAL AREAS:	C = 0.55 to 0.70
HOTEL-APARTMENT AREAS:	C = 0.70 to 0.90
BUSINESS AREAS:	C = 0.80 to 0.90
INDUSTRIAL AREAS:	C = 0.80 to 0.90

The type of soil, the type of open space and ground cover, and the slope of the ground shall be considered in arriving at reasonable and acceptable runoff coefficients.

Table 4

APPROXIMATE AVERAGE VELOCITIES OF RUNOFF FOR CALCULATING TIME OF CONCENTRATION

TYPE OF FLOW	VELOCITY IN FPS FOR SLOPES (in percent) INDICATED			
	0-3%	4-7%	8-11%	12-15%
OVERLAND FLOW:				
Woodlands	1.0	2.0	3.0	3.5
Pastures	1.5	3.0	4.0	4.5
Cultivated	2.0	4.0	5.0	6.0
Pavements	5.0	12.0	15.0	18.0
OPEN CHANNEL FLOW:				
Improved Channels	Determine Velocity by Manning's Formula			
Natural Channel* (not well defined)	1.0	3.0	5.0	8.0

**These values vary with the channel size and other conditions so that the ones given are the averages of a wide range. Wherever possible, more accurate determinations should be made for particular conditions by Manning's formula.*

Plate 1

Overland Flow Chart

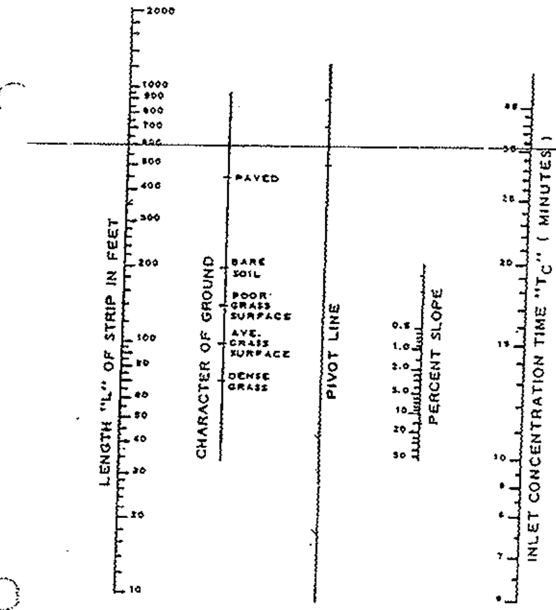
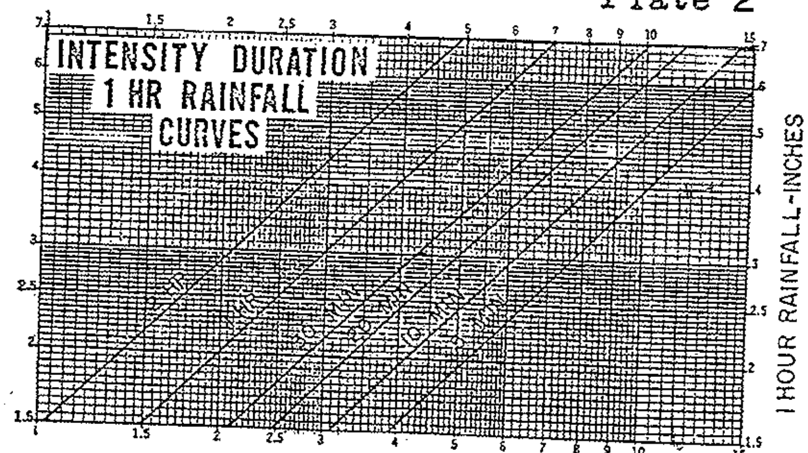
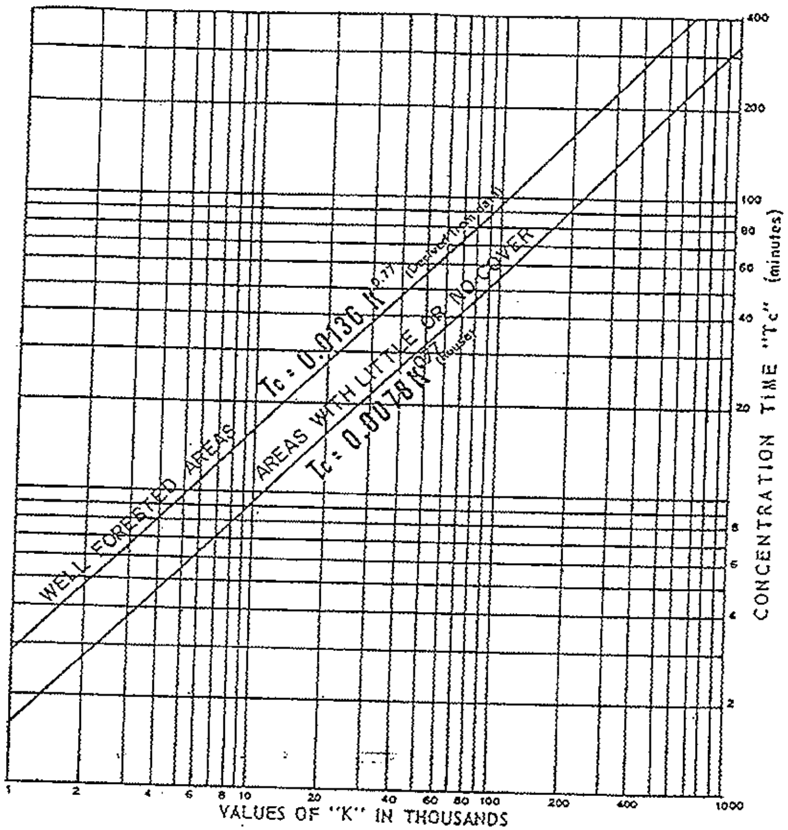


Plate 2





L = Maximum length of travel in feet
H = Difference in elevation between most remote point and outlet in feet.
S = Slope H/L

$$K = \frac{L}{\sqrt{S}} = \sqrt{\frac{L^3}{H}}$$

Use upper curve for well forested areas.
Use lower curve for areas with little or no cover.

SOURCE: CITY PLANNING COMMISSION
Graph from Hunter Rouse Engineering Hydraulics

Plate 3
Time of Concentration
(OF SMALL AGRICULTURAL DRAINAGE BASIN)

DB-A (58.71 AC; following results are from **TR-55 model (WMS 7.1) and are for information only)**
Warnings for basin 64B:

* No warnings were detected

in this basin.

Computations for basin 64B:

* Runoff curve number (CN):

74.0

* Area (Am):

0.092 square miles

* Rainfall (P):

13.000 inches

* Potential maximum retention (S):

3.514 inches

* Runoff (Q):

9.565 inches

* Time of Concentration (Tc):

0.417 hours

* Initial abstraction (Ia):

0.703 inches

* Initial abstraction/Precip (Ia/P):

0.054

* Unit peak discharge (Qu):

328.152 cfs per sq mile per inch

* Pond and swamp factor (Fp):

1.000

* Peak discharge (Qp):

288.754 cubic feet per second (DB-A for information only)

Q ≅ 101 CFS (RATIONAL METHOD) ←

DB-B (95.38 AC; following results are from **TR-55 model (WMS 7.1) and are for information only)**
Warnings for basin 80B:

* No warnings were detected

in this basin.

Computations for basin 80B:

* Runoff curve number (CN):

74.3

* Area (Am):

0.149 square miles

* Rainfall (P):

13.000 inches

* Potential maximum retention (S):

3.459 inches

* Runoff (Q):

9.608 inches

* Time of Concentration (Tc):

0.542 hours

* Initial abstraction (Ia):

0.692 inches

* Initial abstraction/Precip (Ia/P):

0.053

* Unit peak discharge (Qu):

293.198 cfs per sq mile per inch

* Pond and swamp factor (Fp):

1.000

* Peak discharge (Qp):

419.743 cubic feet per second (DB-B for information only)

Q = 167 CFS (RATIONAL) ←

WinTR-55 Current Data Description

--- Identification Data ---

```
User:      PI                                       Date:        8/3/2006
Project:   Waikapu 710 Subdivision                  Units:       English
SubTitle:  DB-C                                     Areal Units: Acres
State:     Hawaii
County:    Honolulu
Filename:  C:\Documents and Settings\InouyePN\Application Data\WinTR-
55\Waikapu_C.w55
```

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
C		Outlet	195.19	74	0.552

Total area: 195.19 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	13.0	.0

```
Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type I
Dimensionless Unit Hydrograph:  hawaii
```

PI

Waikapu 710 Subdivision
DB-C
Honolulu County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
--	
SUBAREAS	
C	893.40 10.22
REACHES	
OUTLET	893.40

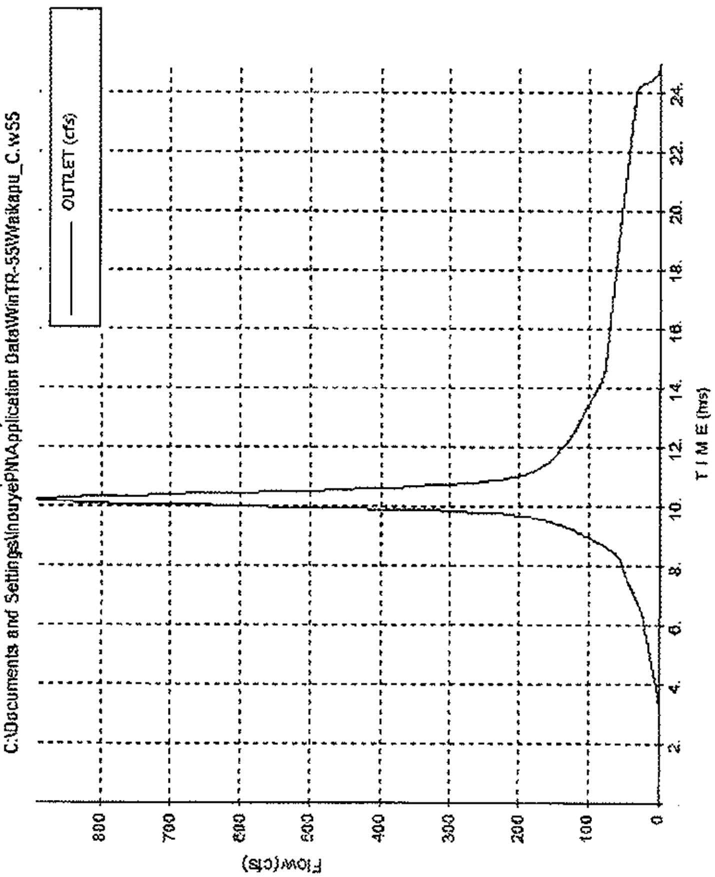
WinTR-55 Output Hydrograph

Project: Waikapu 710 Subdivision

8/3/2006

Subarea: (Outlet) Storm: 100-Yr

C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Waikapu_C.w55



DB-D (77.~~69~~28 AC; following results are from **TR-55 model (WMS 7.1) and are for information only)**
Warnings for basin 84B:

* No warnings were detected

in this basin.

Computations for basin 84B:

* Runoff curve number (CN):

72.4

* Area (Am):

0.121 square miles

* Rainfall (P):

13.000 inches

* Potential maximum retention (S):

3.812 inches

* Runoff (Q):

9.331 inches

* Time of Concentration (Tc):

0.515 hours

* Initial abstraction (Ia):

0.762 inches

* Initial abstraction/Precip (Ia/P):

0.059

* Unit peak discharge (Qu):

297.323 cfs per sq mile per inch

* Pond and swamp factor (Fp):

1.000

* Peak discharge (Qp):

335.689 cubic feet per second (DB-D)

Q = 151 CFS (RATIONAL) ←

WinTR-55 Current Data Description

--- Identification Data ---

User:	PI	Date:	8/3/2006
Project:	Waikapu 710 Subdivision	Units:	English
SubTitle:	DB-E	Areal Units:	Acres
State:	Hawaii		
County:	Honolulu		

Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Waikapu_E.w55

--- Sub-Area Data ---

Name	Description	Reach	Area (ac)	RCN	Tc
E		Outlet	112.21	63	0.847

Total area: 112.21 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	13.0	.0

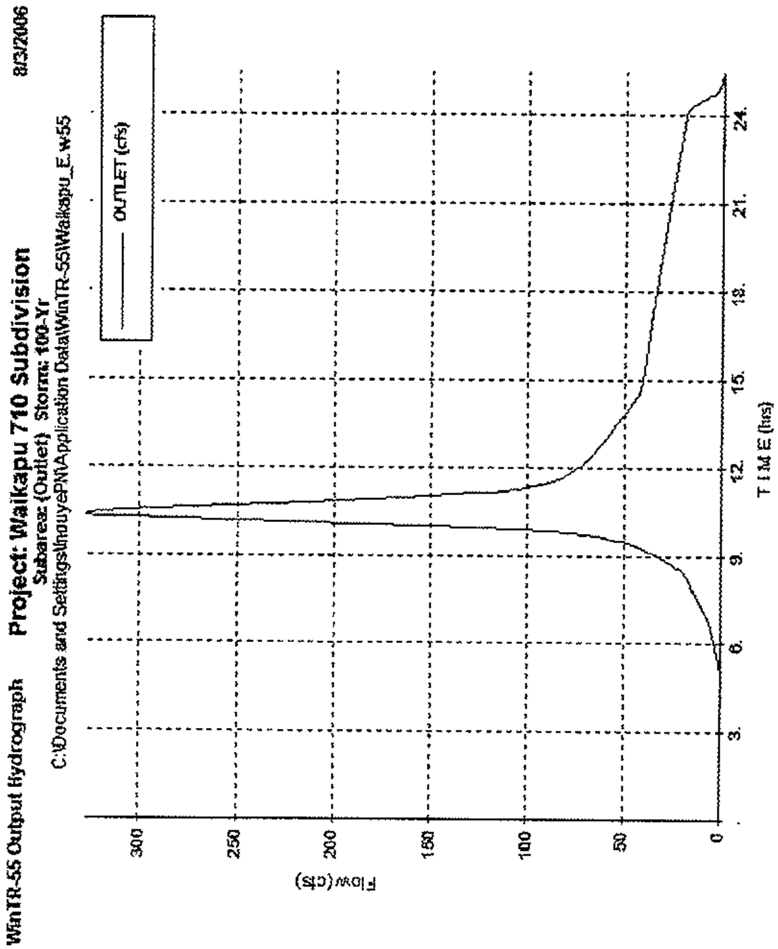
Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: hawaii

PI

Waikapu 710 Subdivision
DB-E
Honolulu County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
E	328.04 10.38
REACHES	
OUTLET	328.04



WinTR-55 Current Data Description

--- Identification Data ---

User:	PI	Date:	8/3/2006
Project:	Waikapu 710 Subdivision	Units:	English
SubTitle:	DB-F	Areal Units:	Acres
State:	Hawaii		
County:	Honolulu		

Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Waikapu_F.w55

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
F		Outlet	769.04	78	0.863

Total area: 769.04 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	13.0	.0

Storm Data Source:	User-provided custom storm data
Rainfall Distribution Type:	Type I
Dimensionless Unit Hydrograph:	hawaii

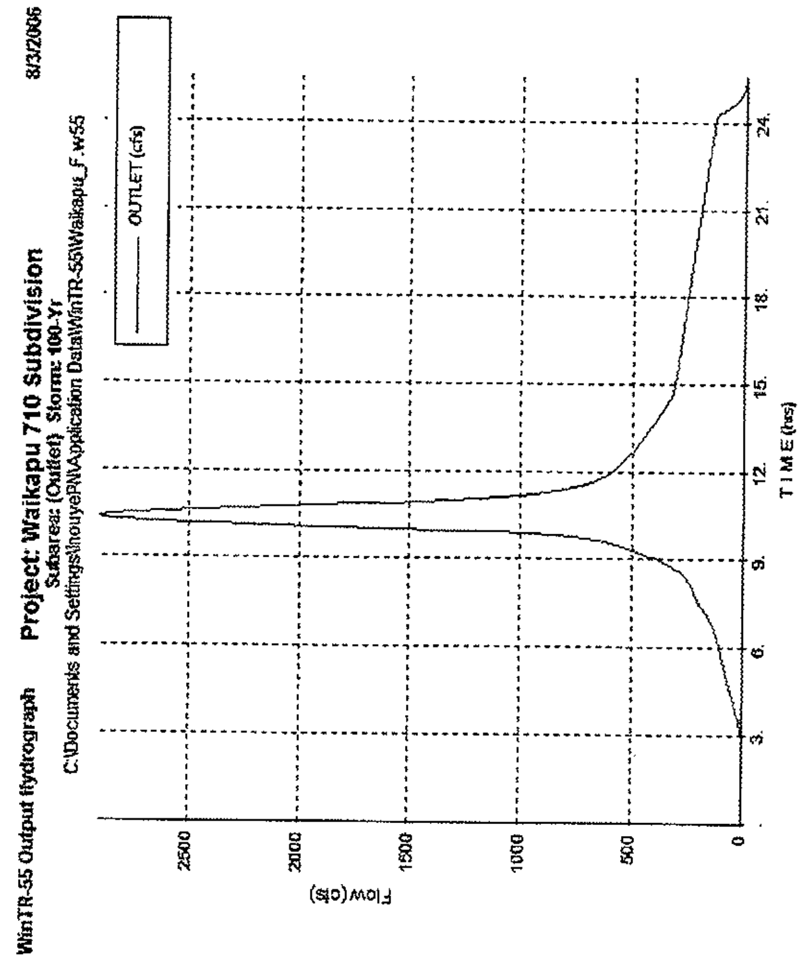
```
PI                         Waikapu 710 Subdivision
                                    DB-F
                           Honolulu County, Hawaii

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach     100-Yr
Identifier     (cfs)
             (hr)
--------------------------------------------------------------------------------
--
SUBAREAS
P             2903.99
          10.42

REACHES

OUTLET        2903.99
```



DB-G (77.~~69~~ 67 AC)
Warnings for basin 76B:

* No warnings were detected

  in this basin.

Computations for basin 76B:

* Runoff curve number (CN):

  58.1

* Area (Am):

  0.121 square miles

* Rainfall (P):

  13.000 inches

* Potential maximum retention (S):

  7.212 inches

* Runoff (Q):

  7.117 inches

* Time of Concentration (Tc):

  1.024 hours

* Initial abstraction (Ia):

  1.442 inches

* Initial abstraction/Precip (Ia/P):

  0.111

* Unit peak discharge (Qu):

  196.121 cfs per sq mile per inch

* Pond and swamp factor (Fp):

  1.000

* Peak discharge (Qp):

  168.888 cubic feet per second (DB-G)

Q = 94 CFS (RATIONAL)

WinTR-55 Current Data Description

--- Identification Data ---

```
User:     PI                                    Date:        8/3/2006
Project:  Waikapu 710 Subdivision               Units:       English
SubTitle: DB-H                                  Areal Units: Acres
State:    Hawaii
County:   Honolulu
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-
55\Waikapu_H.w55
```

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
H		Outlet	540.07	77	0.902

Total area: 540.07 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	13.0	.0

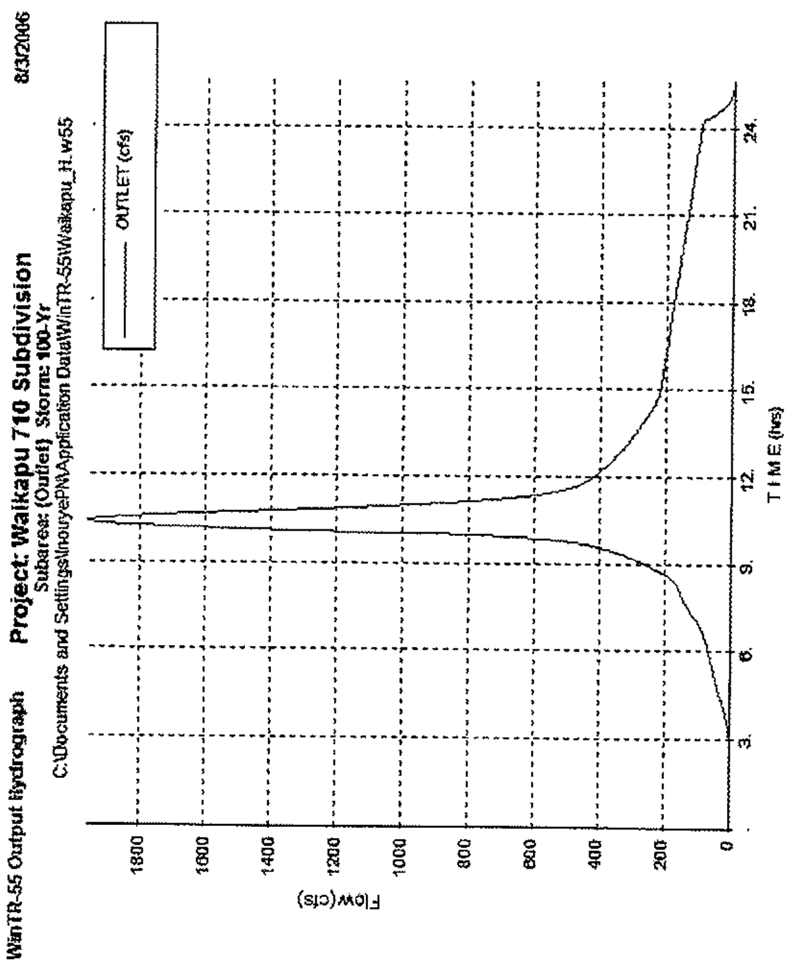
```
Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type I
Dimensionless Unit Hydrograph:  hawaii
```


PI

Waikapu 710 Subdivision
DB-H
Honolulu County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
--	
SUBAREAS	
H	1961.95 10.40
REACHES	
OUTLET	1961.95



16A

DB-I (72.72 AC; following results are from **TR-55 model (WMS 7.1) and are for information only)**
Warnings for basin 75B:

* No warnings were detected

in this basin.

Computations for basin 75B:

* Runoff curve number (CN):

61.3

* Area (Am):

0.114 square miles

* Rainfall (P):

13.000 inches

* Potential maximum retention (S):

6.313 inches

* Runoff (Q):

7.632 inches

* Time of Concentration (Tc):

0.864 hours

* Initial abstraction (Ia):

1.263 inches

* Initial abstraction/Precip (Ia/P):

0.097

* Unit peak discharge (Qu):

218.629 cfs per sq mile per inch

* Pond and swamp factor (Fp):

1.000

* Peak discharge (Qp):

190.223 cubic feet per second (DB-I for information only)

Q = 38 CFS (RATIONAL)

WinTR-55 Current Data Description

--- Identification Data ---

User: PI
Project: Waikapu 710 Subdivision
SubTitle: DB-J
State: Hawaii
County: Honolulu
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Waikapu_J.w55

Date: 8/3/2006
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
J		Outlet	604.61	71	0.927

Total area: 604.61 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	13.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: hawaii

PI

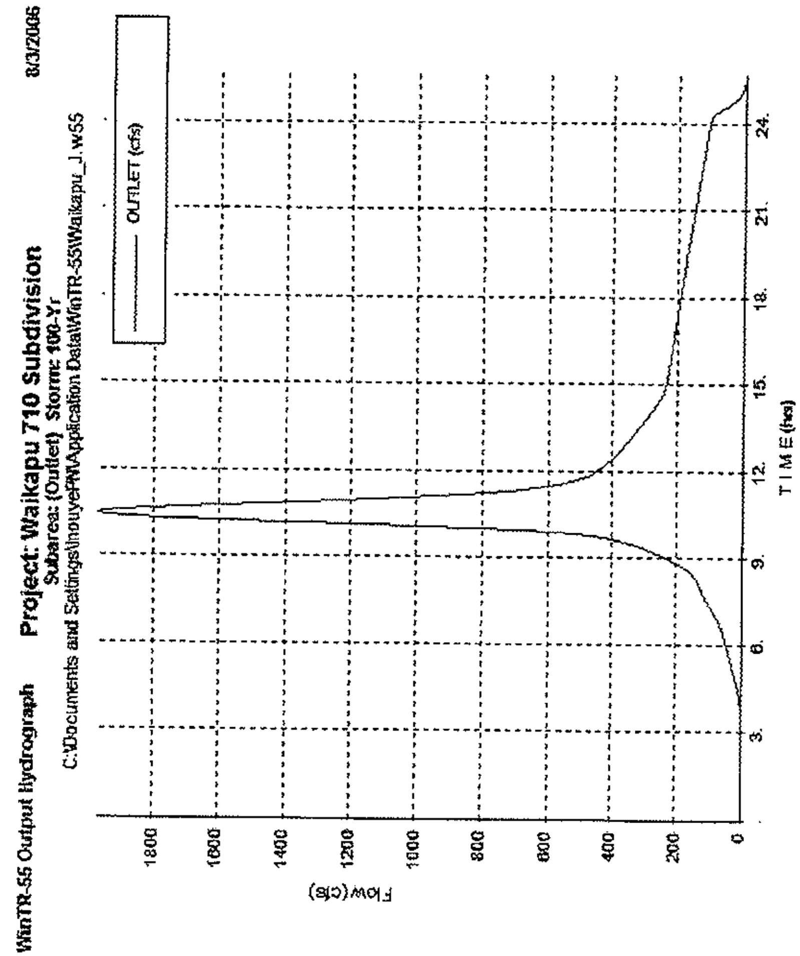
Waikapu 710 Subdivision
DB-J
Honolulu County, Hawaii

Hydrograph Peak/Peak Time Table

```
 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach     100-Yr
Identifier     (cfs)
             (hr)
--------------------------------------------------------------------------------
--
SUBAREAS
J             1973.12
            10.44

REACHES

OUTLET        1973.12
```

WinTR-55 Current Data Description

--- Identification Data ---

User: PI
Project: Waikapu 710 Subdivision
SubTitle: DB-K
State: Hawaii
County: Honolulu
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Waikapu_K.w55

Date: 8/3/2006
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
K		Outlet	431.94	73	1.054

Total area: 431.94 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	13.0	.0

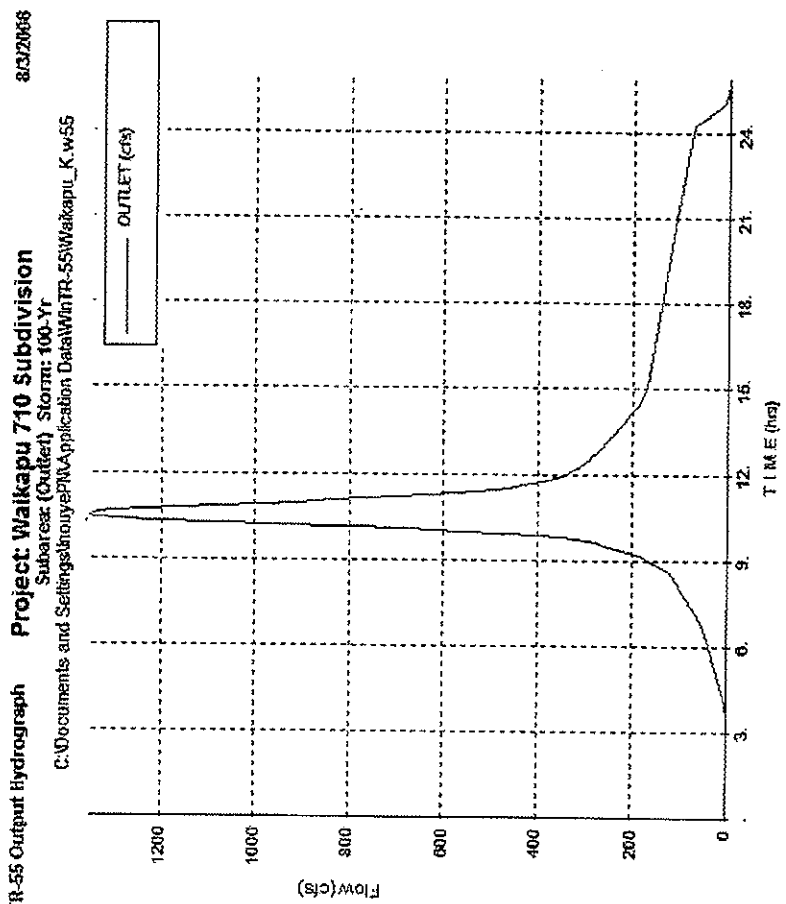
Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: hawaii

PI

Waikapu 710 Subdivision
DB-K
Honolulu County, Hawaii

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
SUBAREAS	
K	1352.66 10.53
REACHES	
OUTLET	1352.66



22A

WinTR-55 Current Data Description

--- Identification Data ---

User: PI
Project: Waikapu 710 Subdivision
SubTitle: DB-L
State: Hawaii
County: Honolulu
Filename: C:\Documents and Settings\InouyePN\Application Data\WinTR-55\Waikapu_L.w55

Date: 8/3/2006
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
L		Outlet	235.88	72	0.580

Total area: 235.88 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
.0	.0	.0	.0	.0	23.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: hawaii

PI

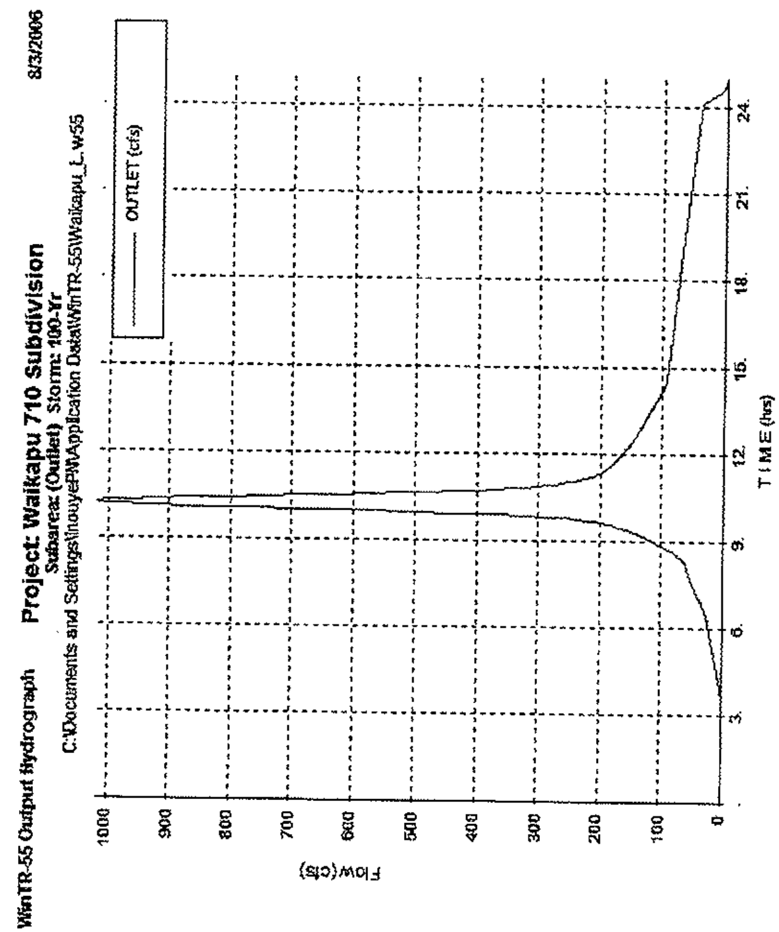
Waikapu 710 Subdivision
DB-L
Honolulu County, Hawaii

Hydrograph Peak/Peak Time Table

```
 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      100-Yr
Identifier      (cfs)
              (hr)
--------------------------------------------------------------------------------
--
SUBAREAS
L             1018.12
            10.24

REACHES

OUTLET        1018.12
```

APPENDIX B

Hydrologic Calculations – Diversion Channel & Detention Basins

North Diversion Channel
Worksheet for Rectangular Channel

Project Description	
Worksheet	North Diversion Ditch
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

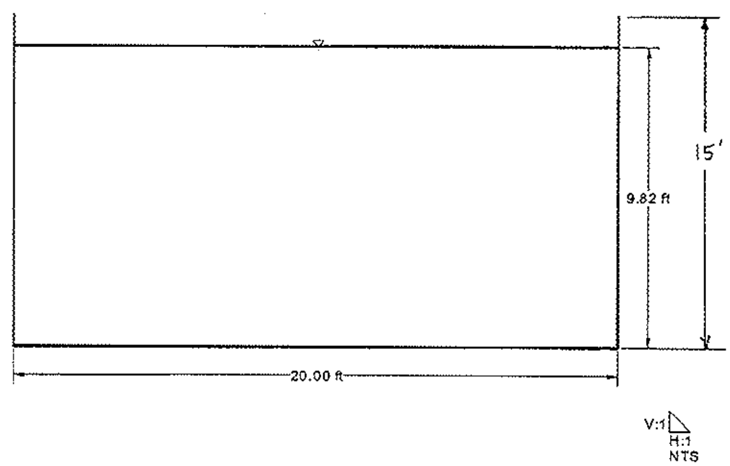
Input Data		
Mannings Coefficient	0.015	
Slope	0.005000	ft/ft
Bottom Width	20.00	ft
Discharge	4,000.00	cfs

Results		
Depth	9.82	ft
Flow Area	196.5	ft²
Wetted Perimeter	39.65	ft
Top Width	20.00	ft
Critical Depth	10.75	ft
Critical Slope	0.003932	ft/ft
Velocity	20.36	ft/s
Velocity Head	6.44	ft
Specific Energy	16.27	ft
Froude Number	1.15	
Flow Type	Supercritical	

Cross Section
Cross Section for Rectangular Channel (North Divesion Chan.)

Project Description	
Worksheet	North Diversion Ditch
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.005000 ft/ft
Depth	9.82 ft
Bottom Width	20.00 ft
Discharge	4,000.00 cfs



South Diversion Channel
Worksheet for Rectangular Channel

Project Description	
Worksheet	South Diversion Ditch
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

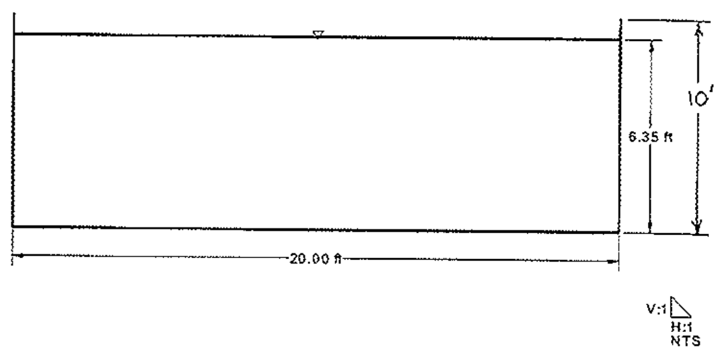
Input Data	
Mannings Coefficient	0.015
Slope	0.005000 ft/ft
Bottom Width	20.00 ft
Discharge	2,200.00 cfs

Results	
Depth	6.35 ft
Flow Area	127.1 ft²
Wetted Perimeter	32.71 ft
Top Width	20.00 ft
Critical Depth	7.22 ft
Critical Slope	0.003501 ft/ft
Velocity	17.31 ft/s
Velocity Head	4.66 ft
Specific Energy	11.01 ft
Froude Number	1.21
Flow Type	Supercritical

Cross Section
Cross Section for Rectangular Channel (South Diversion Chan.)

Project Description	
Worksheet	South Diversion Ditch
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.005000 ft/ft
Depth	6.35 ft
Bottom Width	20.00 ft
Discharge	2,200.00 cfs



Hydrograph Plot (North Diversion Channel)

Hydraflow Hydrographs by Intelisolve

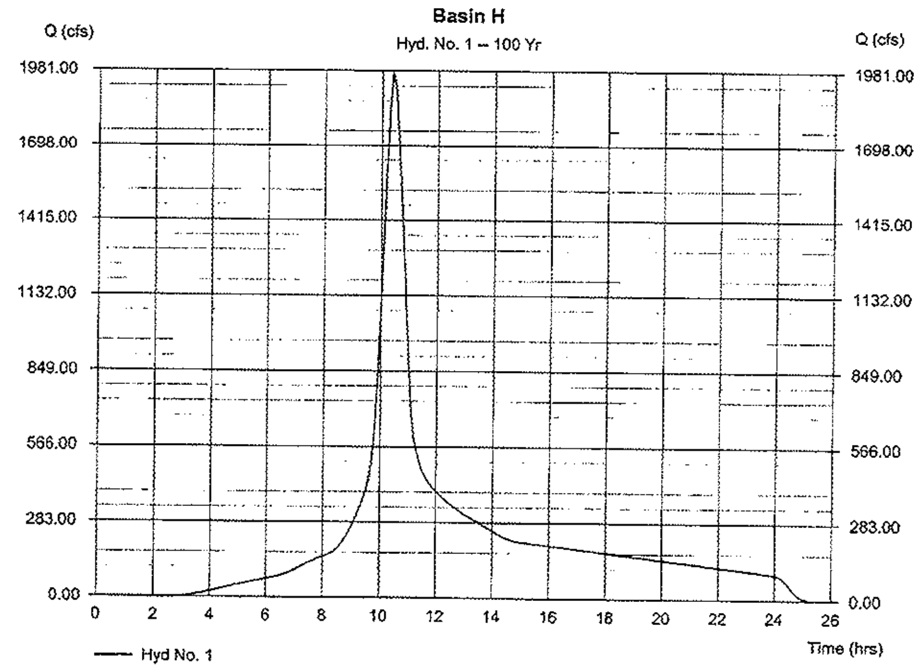
Thursday, Aug 3 2006, 5:19 PM

Hyd. No. 1

Basin H

Hydrograph type	= SCS Runoff	Peak discharge	= 1974.27 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 540.07 ac	Curve number	= 77.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 54.1 min
Total precip.	= 13.00 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 580

Hydrograph Volume = 19,187,410 cuft



Hydrograph Plot (North Diversion Channel)

Hydraflow Hydrographs by Intelisolve

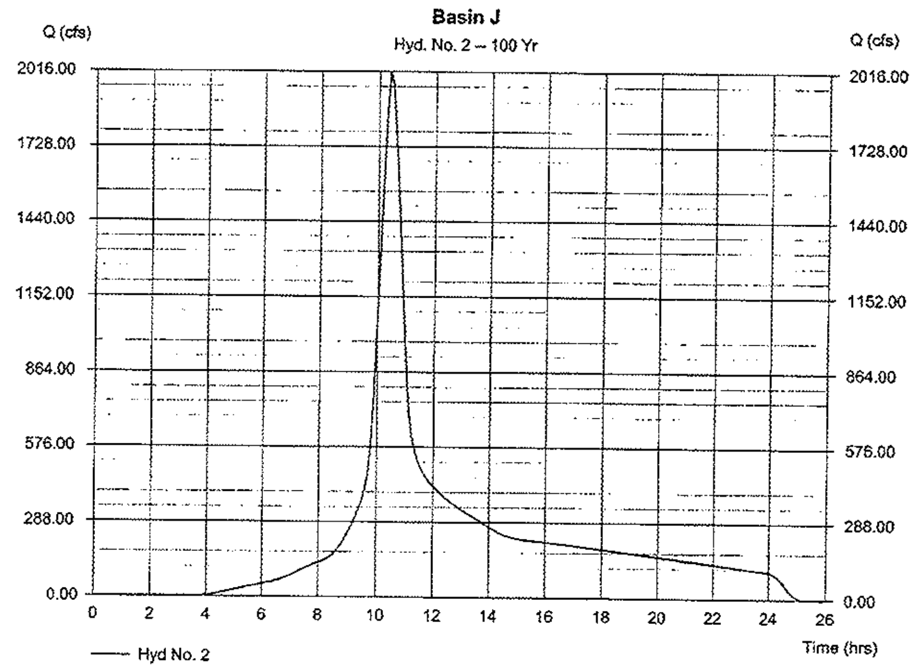
Thursday, Aug 3 2006, 5:19 PM

Hyd. No. 2

Basin J

Hydrograph type	= SCS Runoff	Peak discharge	= 2014.53 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 604.61 ac	Curve number	= 71.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 55.6 min
Total precip.	= 13.00 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 580

Hydrograph Volume = 19,592,580 cuft



Hydrograph Plot (North Diversion Channel)

Hydraflow Hydrographs by Intelisolve

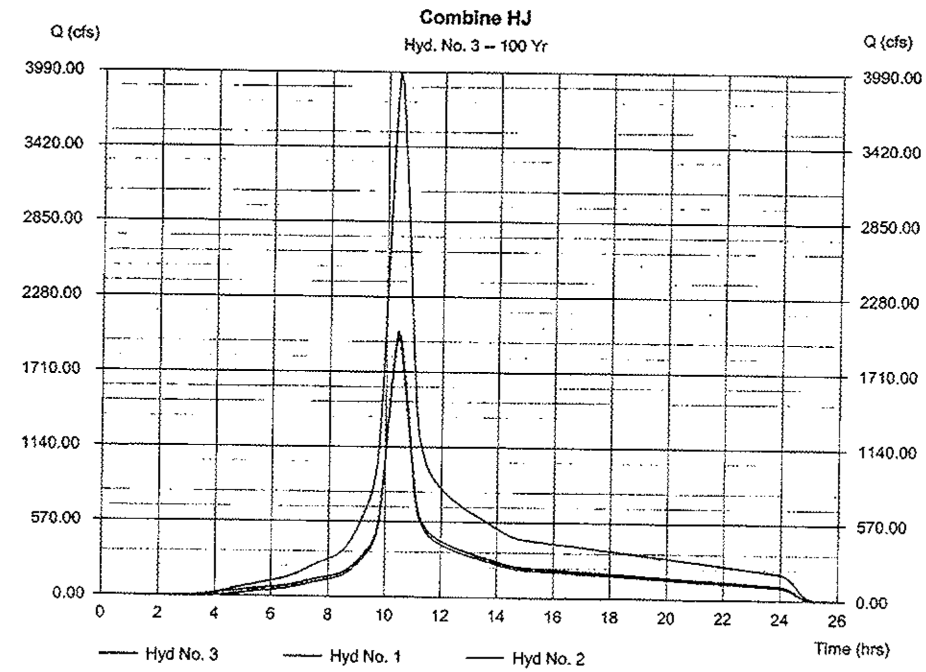
Thursday, Aug 3 2006, 5:19 PM

Hyd. No. 3

Combine HJ

Hydrograph type	= Combine	Peak discharge	= 3988.80 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyds.	= 1, 2		

Hydrograph Volume = 38,779,978 cuft



Hydrograph Plot (North Diversion Channel & Pond "A")

Hydraflow Hydrographs by Intelisolve — Thursday, Aug 3 2006, 5:19 PM

Hyd. No. 4

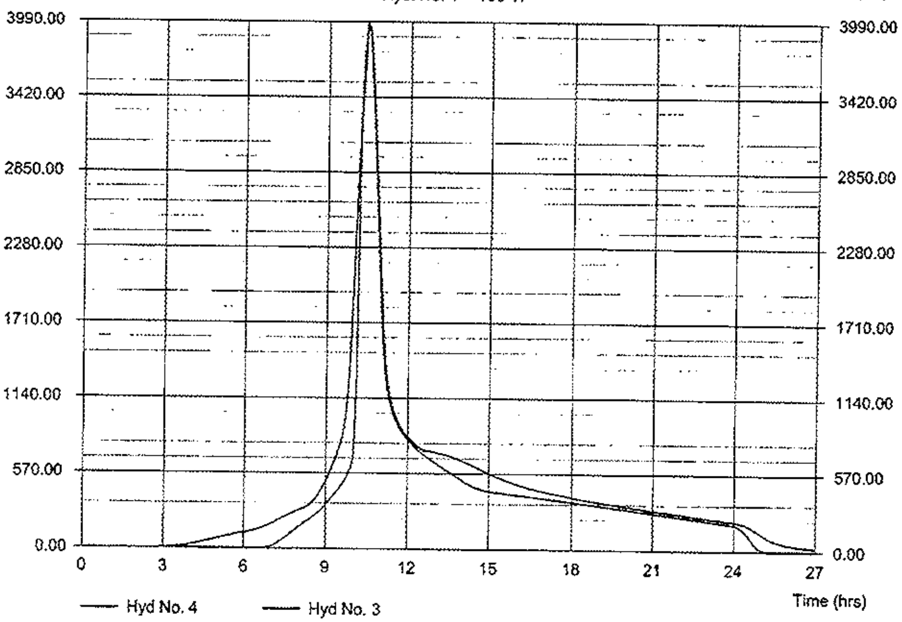
Pond A

Hydrograph type	= Reservoir	Peak discharge	= 3945.61 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Max. Elevation	= 373.96 ft
Reservoir name	= Pond A	Max. Storage	= 4,568,463 cuft

Storage Indication method used. — Hydrograph Volume = 37,940,960 cuft

Pond A

Hyd. No. 4 – 100 Yr



Pond Report

Hydraflow Hydrographs by Intelisolve — Thursday, Aug 3 2006, 5:19 PM

Pond No. 1 - Pond A

Pond Data

Bottom LxW = 1280.0 x 320.0 ft Side slope = 3.0:1 Bottom elev. = 364.00 ft Depth = 10.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	364.00	409,600	0	0
0.50	364.50	414,409	206,002	206,002
1.00	365.00	419,238	208,411	414,412
1.50	365.50	424,081	210,829	625,241
2.00	366.00	428,944	213,256	838,496
2.50	366.50	433,825	215,692	1,054,188
3.00	367.00	438,724	218,136	1,272,324
3.50	367.50	443,641	220,591	1,492,915
4.00	368.00	448,576	223,053	1,715,968
4.50	368.50	453,529	225,526	1,941,494
5.00	369.00	458,500	228,006	2,169,500
5.50	369.50	463,489	230,497	2,399,997
6.00	370.00	468,496	232,995	2,632,992
6.50	370.50	473,521	235,504	2,868,496
7.00	371.00	478,564	238,020	3,106,516
7.50	371.50	483,625	240,546	3,347,062
8.00	372.00	488,704	243,082	3,590,144
8.50	372.50	493,801	245,625	3,835,769
9.00	373.00	498,916	248,179	4,083,948
9.50	373.50	504,049	250,740	4,334,688
10.00	374.00	509,200	253,312	4,588,000

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 42.00	0.00	0.00	0.00
Span (in)	= 42.00	0.00	0.00	0.00
No. Barrels	= 7	0	0	0
Invert El. (ft)	= 366.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

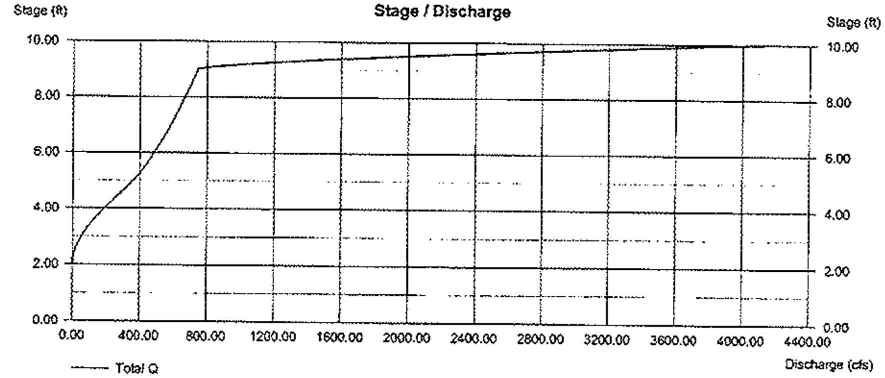
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1280.00	0.00	0.00	0.00
Crest El. (ft)	= 373.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge



Hydrograph Plot (South Diversion Channel)

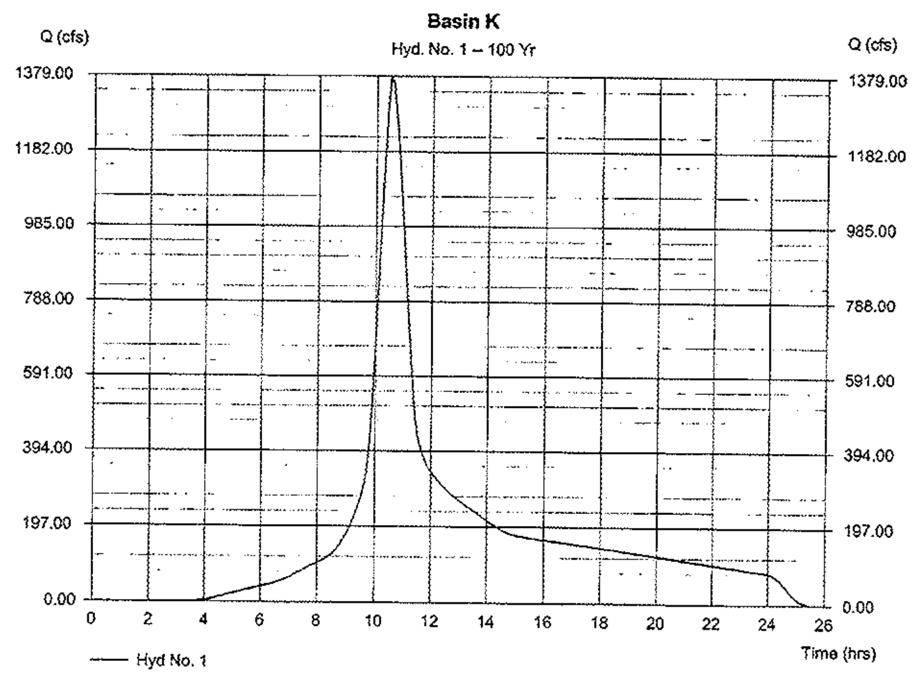
Hydraflow Hydrographs by Intelisolve — Thursday, Aug 3 2006, 5:25 PM

Hyd. No. 1

Basin K

Hydrograph type	= SCS Runoff	Peak discharge	= 1376.14 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 431.94 ac	Curve number	= 72.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 63.2 min
Total precip.	= 13.00 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 580

Hydrograph Volume = 15,145,580 cuft



Hydrograph Plot (South Diversion Channel)

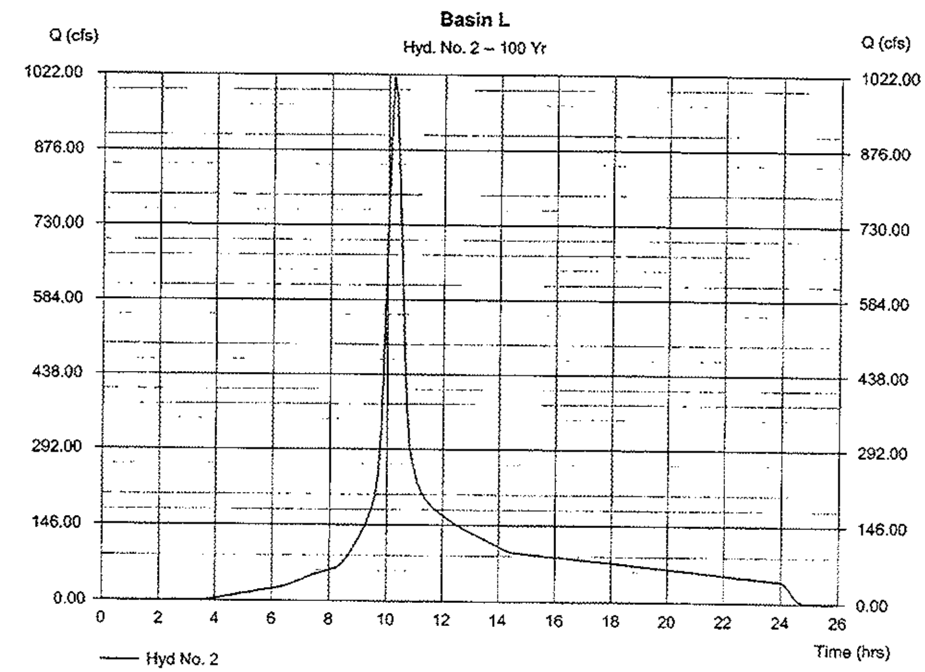
Hydraflow Hydrographs by Intelisolve — Thursday, Aug 3 2006, 5:25 PM

Hyd. No. 2

Basin L

Hydrograph type	= SCS Runoff	Peak discharge	= 1016.97 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 235.88 ac	Curve number	= 72.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 34.8 min
Total precip.	= 13.00 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 580

Hydrograph Volume = 8,040,021 cuft



Hydrograph Plot (South Diversion Channel)

Hydraflow Hydrographs by Intelisolve

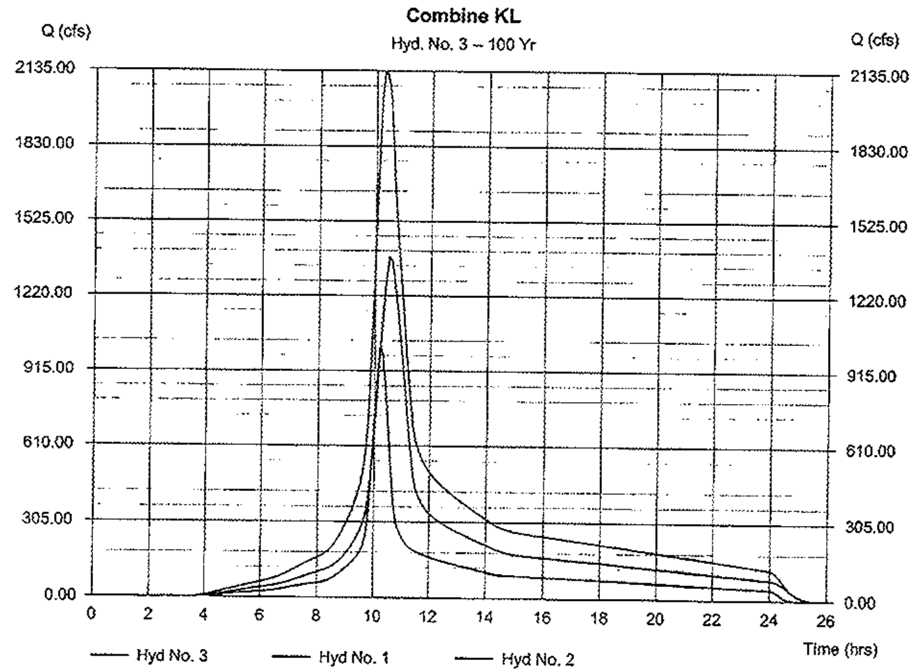
Thursday, Aug 3 2006, 5:25 PM

Hyd. No. 3

Combine KL

Hydrograph type	= Combine	Peak discharge	= 2133.10 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyds.	= 1, 2		

Hydrograph Volume = 23,185,600 cuft



Hydrograph Plot (South Diversion Channel & Pond "B")

Hydraflow Hydrographs by Intelisolve

Thursday, Aug 3 2006, 5:25 PM

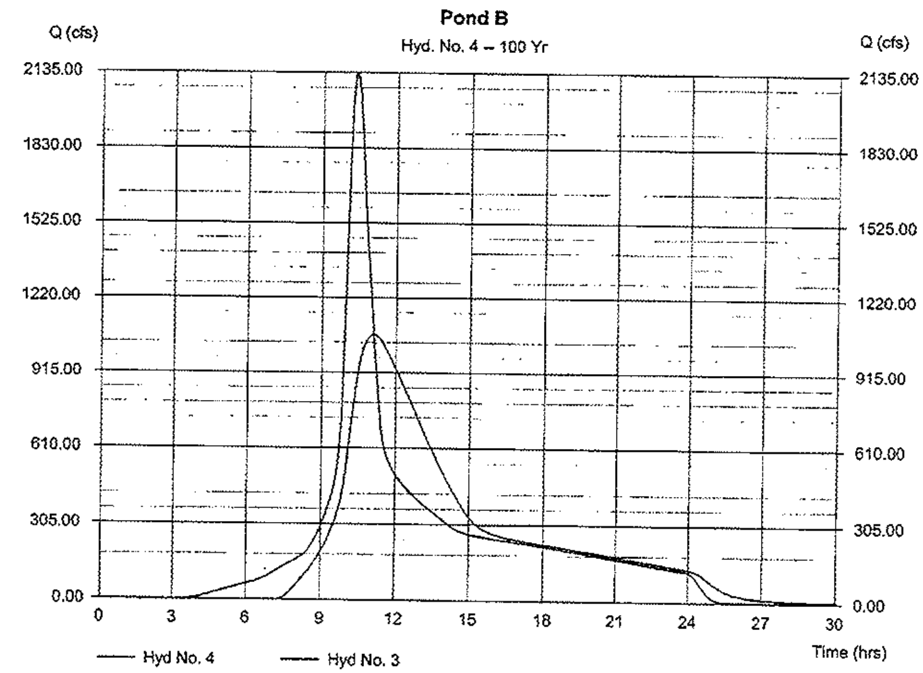
Hyd. No. 4

Pond B

Hydrograph type	= Reservoir	Peak discharge	= 1070.02 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Max. Elevation	= 209.64 ft
Reservoir name	= Pond B	Max. Storage	= 5,359,029 cuft

Storage Indication method used.

Hydrograph Volume = 22,564,020 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Thursday, Aug 3 2006, 5:25 PM

Pond No. 1 - Pond B

Pond Data

Bottom LxW = 960.0 x 320.0 ft Side slope = 3.0:1 Bottom elev. = 195.00 ft Depth = 15.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	195.00	307,200	0	0
0.75	195.75	312,980	232,565	232,565
1.50	196.50	318,801	236,915	469,481
2.25	197.25	324,662	241,296	710,777
3.00	198.00	330,564	245,707	956,484
3.75	198.75	336,506	250,149	1,206,633
4.50	199.50	342,489	254,621	1,461,254
5.25	200.25	348,512	259,122	1,720,376
6.00	201.00	354,576	263,658	1,984,032
6.75	201.75	360,680	268,219	2,252,251
7.50	202.50	366,825	272,811	2,525,062
8.25	203.25	373,010	277,436	2,802,498
9.00	204.00	379,236	282,090	3,084,588
9.75	204.75	385,502	286,774	3,371,362
10.50	205.50	391,809	291,489	3,662,851
11.25	206.25	398,156	296,235	3,959,086
12.00	207.00	404,544	301,010	4,260,096
12.75	207.75	410,972	305,816	4,565,912
13.50	208.50	417,441	310,652	4,876,564
14.25	209.25	423,950	315,519	5,192,083
15.00	210.00	430,500	320,416	5,512,499

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 42.00	0.00	0.00	0.00
Span (in)	= 42.00	0.00	0.00	0.00
No. Barrels	= 7	0	0	0
Invert El. (ft)	= 197.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= —	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge