SITE INVESTIGATION WORK PLAN

East Kapolei II Pesticide Mixing and Loading Site
Ewa, Oahu, Hawaii
TMK (1) 9-1-017: Parcel 93 (Portion)

Prepared For:
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1.0 INTRODUCTION AND PURPOSE

This Site Investigation Work Plan (WP) presents the objectives and strategies for site investigation activities at the East Kapolei II Pesticide Mixing and Loading Site (referred to herein as the East Kapolei PML site). EnviroServices & Training Center, LLC (ETC) has been contracted by the Hawaii State Department of Hawaiian Home Lands (DHHL) to provide environmental engineering services in support of future remedial action at the East Kapolei PML site. This WP has been prepared to satisfy Task 2.6 ("Prepare Substructure Soil Sampling Workplan") in Attachment A: Scope of Work as described in the June 30, 2009 Agreement for Remedial Action between DHHL and the Hawaii State Department of Health (DOH).

The general purpose of this WP is to provide a detailed description of additional site characterization activities to be conducted at the East Kapolei PML site to further delineate the extent of chemical impacts in site soils and to provide additional data to be used in scoping applicable and appropriate remedial alternatives. This WP will identify the Data Quality Objectives (DQOs) for this phase of work; designate the types and quantities of samples to be collected; and detail the Quality Assurance/Quality Control (QA/QC) procedures to ensure that sampling design and measurement error meet the DQOs.

Previous environmental investigations have identified elevated concentrations of contaminants typically associated with historic sugar cane cultivation in soils within the East Kapolei PML site. DHHL plans to identify and implement appropriate remedial actions to address environmental hazards associated with the elevated contaminant concentrations. Gaps in the existing data include the estimation of mean contaminant concentrations in site soils within various areas of the PML site and estimations of the vertical extent of contamination. As such, the overall goal for the site investigation described in this WP is to obtain additional data to further delineate the extent and magnitude of contaminant impacts by filling data gaps and to facilitate estimating site remediation costs.

For the purposes of this investigation, analytical data will be compared to Hawaii Department of Health (DOH) Environmental Action Levels (EALs) for areas where a current or potential source of drinking water is not threatened and where the nearest surface water body is greater than 150 meters from the site.

2.0 BACKGROUND

2.1 Site Description

The project site is the former Oahu Sugar Company pesticide mixing and loading area located near the North-South Road approximately 1.2 miles east of Kapolei and 2.0 miles southwest of Waipahu. A map illustrating the site location is included as Figure 1 in Appendix I. The site is currently unoccupied, with two abandoned buildings and several elevated aboveground storage tanks.

The East Kapolei PML site consists of approximately 0.634-acres that are part of a larger 374.515-acre parcel owned by DHHL and identified as Tax Map Key (TMK): (1) 9-1-017:093, Honouliuli, Ewa, Oahu, Hawaii (see Appendix I, Figure 2). The property is located within the State Urban District and is zoned by the City and County of Honolulu for agricultural use.

The East Kapolei PML site has no street address and is accessible via cane haul roads from Palehua Road, an unimproved roadway. The site is centrally located within agricultural fields that either remain fallow or are currently under short-term lease to agricultural tenants, primarily Aloun Farms, for commercial cultivation of fruit and vegetables. Existing uses in the vicinity of the Project Site include the Ewa Villages Golf Course to the south, the West Loch Golf Course to the east, and city of Kapolei to the west. The nearest existing residences to the site are located in the Ewa Villages community and in the DHHL's "Kanehili" (East Kapolei I) development, situated approximately 0.7 miles southeast and 0.7 miles to the southwest, respectively.

The East Kapolei PML site is situated at an elevation of approximately 100 feet above mean sea level (msl) and the topography suggests a slight surface gradient to the south. No drinking water wells are located within one mile of the site, and the nearest surface water body is the West Loch of Pearl Harbor, located approximately 1.6 miles to the east.

The East Kapolei PML site is characterized by abandoned, derelict buildings and several elevated storage tanks surrounded by a chain-link fence. Ground cover within the fenced area consists primarily of crushed coral covering native clay. A concrete-lined irrigation ditch runs adjacent to and through the fenced area.

Existing structures located on the East Kapolei PML site include:

- A wooden building approximately 40-feet long by 18-feet wide that was formerly used for office space and pesticide storage and mixing;
- A smaller wooden building approximately 18-feet long by 14-feet wide formerly used to house a boiler;
- An unused utility pole; and
- Nine above ground storage tanks of various capacities, six of which are supported by steel structures and suspended at heights ranging from approximately 12 to 32 feet above the surface of the ground.

The East Kapolei PML site is not in use and is fenced off and locked. Warning signs are posted around the property. Outside of the fenced area, groundcover generally consists of loose native soil in the field areas, coral and cinder used as a base for the field roads, and concrete pads adjacent to the site gates.

2.2 Site Geology

The site is situated at an elevation of approximately 100 feet above msl. Soil at the Property is classified by the U.S. Department of Agriculture (USDA) Soil Conservation Service as Honouliuli clay (HxA). The Honouliuli Series consists of well-drained soils on coastal plains in the Ewa area. These soils developed in alluvium derived from basic igneous rock. Honouliuli clay is dark reddish-brown, very sticky and very plastic clay, with 0 to 2 percent slopes underlain with coral reef limestone. Permeability is moderately slow, runoff is slow, and the erosion hazard is no more than slight. Workability is slightly difficult because of the very sticky and very plastic clay. The shrink-swell potential is high (USDA, 1972).

Observations made during previous subsurface investigations at the site indicated that existing site soils generally consist of a dark reddish-brown clay interspersed with relatively thin layers of coralline material. Deeper soils exhibited a very plastic consistency, which impeded direct-push sampling efforts, slowed hollow-stem auger drilling for monitoring well installation, and slowed groundwater recharge into boreholes.

2.3 Site Hydrogeology

According to Mink & Lau, 1990, the site is located above two aquifers within the Pearl Harbor Aquifer Sector, Ewa Aquifer System. The upper aquifer is a basal, unconfined formation in sedimentary (nonvolcanic) lithology. Groundwater within this upper aquifer is currently used but is neither a drinking water source nor ecologically important. This groundwater source is considered replaceable, moderately saline, and has a high vulnerability to contamination. The lower aquifer is a basal, confined aquifer in horizontally extensive lavas. The groundwater in this lower aquifer is neither a drinking water source nor ecologically important, and is further characterized as being an irreplaceable formation with a low salinity (between 250 and 1000 milligrams Cl^- per liter) and low vulnerability to contamination.

The depth to groundwater in three monitoring wells installed within the site ranged from 79 to 85 feet below existing ground surface.

2.4 Historical Land Use

The East Kapolei PML site and surrounding lands were in sugarcane cultivation for over 100 years from approximately 1890 to 1994. Ewa Plantation Company operated the first sugar plantation in the area from 1890 to 1970, followed by Oahu Sugar Company, who leased the Project Site and surrounding lands from the Estate of James Campbell until 1994.

Ewa Plantation Company constructed the existing buildings at the project site in 1953. The site was actively used for the storage, mixing, and loading of agricultural pesticides for approximately 40 years up to 1994. Pesticides were stored, mixed, and loaded onto trucks for distribution and dispersal in the plantation fields. In the 1950s, pentachlorophenol with diesel or kerosene was also mixed and applied. It is suspected that soils at the site became contaminated as a result of periodic chemical spills over the years. Such spills were typically not cleaned up by the plantation. Storm water runoff and truck movement from the site appear to have dispersed pesticides and contaminants outside the currently fenced area.

Activities on the East Kapolei PML site ceased when Oahu Sugar Company shut down operations in 1994. Through a condemnation proceeding, the State of Hawaii acquired the Project Site on August 22, 1994 by Land Court Document No. 2181717, recorded at the State of Hawaii Bureau of Conveyances on September 21, 1994. The site has not been utilized since plantation activities ceased. Two abandoned buildings and several elevated storage tanks remain on the site. DHHL has completed consultation with the State Historic Preservation Division (SHPD) of the Department of Land and Natural Resources (DLNR) regarding the historic significance of the structures remaining on the Project Site. In a letter dated May 14, 2009, SHPD provided a determination regarding the historic significance of the site. SHPD determined that, although the structures on the property are eligible for nomination to the National Register for their association with sugar plantations in Hawaii, "demolition will be [a] 'no adverse effect to a historic property agreed upon mitigation.' The Architectural Inventory Survey and photographs are an appropriate mitigation and no further mitigation is needed. Work may proceed."

2.5 Future Land Use

Following completion of remediation activities, DHHL proposes the redevelopment of the East Kapolei PML site and surrounding lands as part of the agency's "East Kapolei II" community. DHHL's master plan for "East Kapolei II" shows the site as located within a five-acre lot. No residential units will be located on the site itself, however, future land uses to be hosted at the site are contingent upon the selected methods of remediation.

"East Kapolei II" will include 1,000 affordable, for-sale homes to be constructed by DHHL for native Hawaiian beneficiaries and 1,000 affordable rental units to be constructed by other agencies for the general public. Public facilities planned within the "East Kapolei II" development include schools, parks, and the Kroc Center, a major new community center to be built by the Salvation Army. The planned land uses in the vicinity of the Project Site are illustrated in Figure 5. The "East Kapolei II" community and DHHL's regional development plans are described in the agency's May 2008 *Kapolei Development Plan*. DHHL's mission is to manage effectively the Hawaiian Home Lands Trust and to develop and deliver lands to native Hawaiians. DHHL works in partnership with other government agencies, private sector entrepreneurs, and non-profit organizations to carry out this mission. This work includes collaborative visioning, long-range planning, resource allocation, and project-specific joint ventures. DHHL believes that these partnerships benefit not only its native Hawaiian beneficiaries but the larger community as well.

The "East Kapolei II" development is an example of DHHL's effective partnerships with government agencies, the private sector, and community organizations to develop its lands and improve community life. For the planned residential development, DHHL has reduced the cost of homes to beneficiaries and lessees by providing infrastructure, promoting energy efficiency, and partnering with developers. As noted above, the Salvation Army and DHHL are partnering to bring about a multi-service community complex in "East Kapolei II" with a broad range of programs to serve the public. In coordination with DLNR by way of a licensing agreement with the Hawaii State Department of Transportation (DOT), DHHL is protecting a unique ecosystem and the red ilima (abutilon menziesii) in a designated plant conservation reserve within "East Kapolei II". DHHL's partnership with the DOT and other agencies facilitated the construction of the North-South Road and related infrastructure improvements to the benefit of the greater Kapolei community.

2.6 Contaminants of Concern

Multiple lines of evidence, including data obtained from previous investigations at the site and descriptions of historic use, were used to identify the contaminants of concern (COC) for the East Kapolei PML site. The suspected sources of contamination at the East Kapolei PML site include spills/leaks/releases from the former mixing and loading ASTs, overfilling of mobile tanks, and spills/leaks/releases from mobile tanks. Specifically, COC include:

- Arsenic;
- Polychlorinated dibenzo-dioxins/polychlorinated dibenzo-furans (dioxins/furans, associated with pentachlorophenol);
- Pentachlorophenol; and
- Triazine pesticides (ametryn, atrazine, simazine, trifluralin).

Note that other chlorinated herbicides and organochlorine pesticides have been excluded from the COC list based on historical data. Pentachlorophenol and triazine pesticides were included based on elevated concentrations (i.e., exceeding appropriate action levels) in recent samples and based on their common usage in the Hawaii sugar industry.

2.7 Conceptual Site Model

A conceptual site model (CSM) provides a generalized framework regarding site-specific conditions relevant to potential contaminants, contaminant sources, migration pathways, routes of exposure, potential receptors, and environmental hazards (i.e., leaching to groundwater/ discharge to surface waters, ecological toxicity) that may be affected by the contaminants. Establishment of this framework is essential for assessing environmental hazards associated with the contaminants, determining who is at risk, determining appropriate remedial strategies, and addressing unacceptable hazards.

The following environmental hazards were initially considered:

- Direct exposure threats to human health;
- Intrusion of subsurface vapors into buildings;
- Leaching and subsequent threats to groundwater resources;
- Threats to terrestrial habitats; and
- Gross contamination and general resource degradation concerns.

Preliminary evaluation of environmental hazards based on the available data concluded that the primary environmental hazard posed by arsenic and dioxins/furans at the site is direct exposure threats to human health and that the primary environmental hazard posed by triazine pesticides is leaching and potential impacts to groundwater. As discussed in Section 4.7, these considerations were used to designate decision units for the proposed investigation. Decision units for areas suspected to have been primarily impacted by arsenic and dioxins were designated based on hypothetical exposure areas (i.e., 5000-square foot areas, similar to the field-area investigation). Decision units for areas suspected to have been primarily impacted by triazine pesticides were designated based on apparent concentrated spill areas.

2.7.1 Receptors of Concern

When identifying potential receptors, plausible exposure under both current and future land-use should be evaluated. Accordingly, potential receptors are identified for both current and future use scenarios. For the purposes of this investigation, the following potential receptors were identified.

Future Site Users

Current land use plans identify residential development surrounding the existing East Kapolei PML site. The use of the area encompassing and including the current East Kapolei PML site has not been identified. Exposure pathways for future site users include:

- Inhalation of particulates from surface soil
- Dermal contact with soil
- Incidental ingestion of soil

Future Residents in Surrounding Areas

Future residents of surrounding dwellings may be exposed to contaminants stemming from the East Kapolei PML site. Exposure pathways for future residents in surrounding areas include:

- Inhalation of fugitive dust from site soil
- Dermal contact with soil and sediment from surface water runoff
- Incidental ingestion of soil and sediment from surface water runoff

Site Construction Worker

The future land use scenarios could include the development of the site. As a result, the construction worker would be present during development. It is assumed that construction workers could be exposed to contaminated soil. Specifically, the exposure pathways for a construction worker include:

- Inhalation of fugitive dust from soil
- Dermal contact with soil
- Incidental ingestion of soil

Aquatic Ecological Receptors

Although remote due to the site's distance to the nearest surface water body, aquatic ecological habitats may be impacted by contaminants through sediment runoff and dissolved chemicals that may enter the groundwater (and subsequently migrate to surface waters).

2.7.2 Exposure Pathways

Exposure is defined as the contact of an organism with a chemical or physical agent. An exposure pathway is defined as "the course a chemical or physical agent takes from a source to an exposed organism." It describes "a unique mechanism by which an individual or population is exposed to chemicals or physical agents at or originating from a site (USEPA, 1989)." In order for an exposure pathway to be considered potentially complete, four elements must exist: 1) a source or release from a source; 2) a transport/exposure media; 3) an exposure point (point of contact with the contaminated medium); and 4) an exposure route. The potential exposure pathways present at the property are described below.

A. Soil Exposure Pathway

Direct contact with soil may result in incidental oral ingestion and/or dermal absorption of COC. Although generally associated with surface soil, direct contact may also occur with subsurface soil during trenching and excavation work.

B. Air Exposure Pathway

Air exposure pathways become potential routes of exposure when COC enter the air via volatilization or via adsorption to fugitive dust particles. Volatilization occurs when COC partition to the air. Such volatilization may occur from surface soil, subsurface soil, and/or groundwater. When considering volatilization from subsurface soil or groundwater, transport of COC occurs through void spaces in unsaturated soils, asphalt, and concrete to the outdoor air or to future indoor air through foundation cracks. For this site, volatilization is not considered to be a concern due to the semi- to non-volatile nature of the COC.

Generation of fugitive dust may occur through disturbance of affected soil, such as wind or construction activities. Dust particles may be inhaled, may settle on human skin and be ingested (hand to mouth), and/or may settle on vegetation that may be ingested by humans.

C. Sediment Exposure Pathway

Receptors may be exposed to COC in sediment from the property as a result of surface runoff during storm events to nearby drainageways, which may eventually discharge to the ocean. Sediment may accumulate in the marine environment and be available for contact with various receptors. Recreational users of the marine environment (swimmers, surfers, fishermen) may come into direct contact with sediment and be exposed through oral ingestion and/or dermal absorption. Ecological receptors may live directly in the impacted sediment and may be exposed to COC through feeding within the sediment. As a secondary transport mechanism, COC may accumulate in ecological receptors (i.e., fish, shellfish), then be ingested by human receptors.

D. Groundwater Exposure Pathway

Groundwater beneath the site may have been impacted by surface spills through leaching from impacted soils, particularly associated with triazine pesticides. Receptors may be exposed to COC in the groundwater by direct contact or by inhaling volatile COC emitted from the groundwater to air. For this site, direct contact with groundwater is not anticipated since the aquifer is not considered to be usable as a drinking water resource and the depth to groundwater (approximately 80 feet below ground surface) makes direct human contact very unlikely. Inhalation of volatile COC is not anticipated due to the semi- to non-volatile nature of the COC.

Ecological receptors may also be affected in shallow marine environments within groundwater discharge zones.

2.8 Project Action Levels

The Action Levels (ALs) that will be used to evaluate data obtained from this investigation will be the DOH EALs for areas where a current or potential source of drinking water is not threatened and where the nearest surface water body is greater than 150 meters from the site. The ALs listed are for unrestricted (i.e., residential) land use and are intended to address potential direct exposure and leaching hazards as discussed in Section 2.7. Evaluation of analytical data will be performed in the Environmental Hazard Evaluation (EHE), which will be performed after completion of site sampling activities. Although not necessarily required, it is desirable to delineate the lateral and vertical extent of dioxin/furan toxic equivalency (TEQ) impacts to concentrations identified in the surrounding field areas (50-100 ng/kg). Initial data will be evaluated and, after consultation with DOH, the need for subsequent, follow-up data will be taken into consideration. Subsequent remedial alternatives will need to account for the environmental hazards identified through the evaluation of both current and historic data. A summary of current DOH EALs is provided in Table 1, below.

Table 1: Default DOH EALs for Soil

Contaminants of Concern	EAL
Arsenic	20 mg/kg
Dioxins/Furans TEQ	450 ng/kg
Pentachlorophenol	3.0 mg/kg
Ametryn (Triazine Pesticide)	11 mg/kg
Atrazine (Triazine Pesticide)	2.1 mg/kg
Simazine (Triazine Pesticide)	0.25 mg/kg
Trifluralin (Triazine Pesticide)	32 mg/kg

3.0 INVESTIGATION HISTORY

A number of environmental investigations have been performed throughout the Project Site and surrounding areas. Findings from these investigations indicate the presence of various pesticides and pesticide-related chemicals in site soils at elevated concentrations. The primary sources of site-specific information include the following documents:

- Miles, C.J., Yanagihara, K., Ogata, S., Van De Berg, G., and Boesch, R. 1990. *Soil and Water Contamination at Pesticide Mixing and Loading Sites on Oahu, Hawaii*. Conducted by the University of Hawaii and Hawaii State Department of Agriculture. Printed in: *Bulletin of Environmental Contamination and Toxicology*. 44:955-962. January 8.

- U.S. EPA. 2000. *Extent of Contamination, Oahu Sugar Company Site, Ewa, Hawaii, December 2000*. U.S. EPA Work Assignment No. 0-125, Lockheed Martin Work Order No. R1A00125, U.S. EPA Contract No. 68-C9-223.

- Hawaii State Department of Health. 2000. *Site Inspection – Ewa Sugar Mill/Oahu Sugar Co. Pesticide Mixing and Loading Site*. EPA Site ID Number HISFN0905536, submitted to EPA Region IX, July 3, 2000.

- AMEC Earth and Environmental Inc. 2004. *Phase I Environmental Site Assessment at East Kapolei Brownfield, Kapolei, Hawaii*. Prepared for the State of Hawaii DBEDT, ASO Log No. 02-131. September.

- EnviroServices & Training Center, LLC. 2007. *Final Site Investigation and Preliminary Remedial Alternatives Analysis Report, East Kapolei – Brownfields, Former Oahu Sugar Company, Pesticide Mixing and Loading Areas, Kapolei, Oahu, Hawaii TMK (1)-9-1-017: Parcel 088*. Prepared for the State of Hawaii DBEDT. August.

- Environet, Inc. 2009. *Phase I Environmental Site Assessment, East Kapolei Brownfields Site, Kapolei, Oahu, Hawaii 96707, TMK (1) 9-1-17: 71 (portion)*. Prepared for the State of Hawaii DHHL. January 22.

Data from other sources (i.e., DOH HEER Office, EPA Region 9) are available and have been reviewed, but such data have not been officially compiled into reports for release. Summary tables of the existing data have been included as Appendix II and a portion of the corresponding sample locations are shown in Appendix I, Figure 3.

In general, data from these previous investigations have indicated that the East Kapolei PML site has been impacted by arsenic, dioxins/furans, pentachlorophenol, and triazine pesticides. Patterns within the data suggest that the areas beneath the elevated ASTs, beneath a mixing tank built into the patio of the office/storage structure, and behind the boiler building contain the highest contaminant concentrations. Specifically:

- Arsenic concentrations as high as 160 mg/kg, dioxin concentrations as high as 752,000 ng/kg, and pentachlorophenol concentrations as high as 310 mg/kg were identified in soil beneath the elevated ASTs.
- Dioxin concentrations as high as 581,720 ng/kg and pentachlorophenol concentrations as high as 32.7 mg/kg were identified in soil beneath the mixing tank within the office/storage building.
- Dioxin concentrations as high as 1,814,480 ng/kg (in parts per million range), pentachlorophenol concentrations as high as 28.4 mg/kg, ametryn concentrations as high as 120 mg/kg, atrazine concentrations as high as 86 mg/kg, and trifluralin concentrations as high as 190 mg/kg were identified in soil behind the boiler building.

The contaminant concentrations detected during previous investigations are sufficient to necessitate site remediation to address the primary environmental hazards of direct human exposure and leaching to underlying groundwater resources.

DOH has since determined that the lateral extent of soil contamination has been partially delineated. However, DOH has indicated that further investigation is needed to both refine the lateral extents of impacted soils as it relates to potential remedial alternatives and to determine the vertical extent of contaminant impacts in site soils, specifically beneath existing structures.

In addition to the COC impacts within the fenced area of the East Kapolei PML site, previous data indicate that elevated arsenic concentrations and slightly elevated dioxin concentrations generally exist in surface and near surface soils adjacent to the southwest gate. Through discussions with the DOH, it was deemed that such data was sufficient and the impacted soils will be addressed during site remediation activities. Furthermore, soil observed in the concrete-lined irrigation ditch adjacent to the East Kapolei PML site and continuing west towards the new North-South Road currently under construction will be removed from the ditch and placed within the fenced area of the site. Finally, existing monitoring wells located at the East Kapolei PML site will need to be decommissioned in accordance with DOH HEER Office guidance during site remediation.

Note that an area-wide investigation was completed by TetraTech EM Inc. in December 2007 on the entire 404-acre property initially targeted for development, excluding approximately three acres centered on the East Kapolei PML site and approximately 83 acres on the western portion of the property where drainage basins were being excavated. Findings of the investigation indicated that "there are no elevated concentrations of chemicals of potential concern in the soil that suggest conditions are not suitable for residential reuse, or that any additional sampling or evaluation is necessary." These findings were documented in TetraTech EM Inc.'s December 12, 2007 *Final Site Assessment Report, East Kapolei Affordable Housing Project, Kapolei, Oahu, Hawaii* prepared for DOH HEER Office.

Based on this information, the bulk of the planned "East Kapolei II" community is being developed on land that has been deemed by the DOH as appropriate for residential development. Therefore, DHHL is focusing its efforts to address residual contamination at the East Kapolei PML site.

4.0 DATA QUALITY OBJECTIVES

The DQO process is an iterative approach for defining the criteria for environmental data collection operations. The process includes stating the problem to be investigated, identifying the decisions that need to be made, identifying the inputs to the decision making process, defining the boundaries of the investigation, developing decision rules that will be applied, specifying tolerable limits on the decision errors, and optimizing the sampling design to be used in the investigation. The DQO process is further described in the U.S. EPA January 2000 *Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/G-4 Final)* document. For the purposes of this project, a DQO decision-making process was formulated. DQOs described in the following sections detail the projected initial step in identifying COC concentrations at the property, comparing such concentrations to current ALs, and determining whether further evaluation and/or corrective actions may be needed to address such COC. Selected subsections are discussed to further define the objectives of the sampling activities.

4.1 Problem Statement

Previous environmental investigations at the East Kapolei PML site have indicated the presence of elevated COC concentrations in site soils. The suspected sources of contamination include historic spills/leaks/releases from the former mixing and loading ASTs, historic overfilling of mobile tanks, and historic spills/leaks/releases from mobile tanks. Existing data suggest that the highest COC concentrations were typically found within the fenced area of the site, adjacent to existing structures and beneath existing ASTs. The extent of contamination has generally been delineated within the existing fence line, with the exception of arsenic, which has been found at elevated concentrations in near surface (approximately 2 feet bgs) soils adjacent to and outside of the fence line.

The primary goals for this investigation are to obtain refined estimates of COC-impacted soil areas and volumes to assist in evaluating appropriate remedial alternatives. For the purposes of the investigation activities described herein, the problem statement to be addressed in this Site Investigation would be:

"In order to obtain more refined volume estimates of residual COC-impacted soil at the East Kapolei PML site, additional data for surface and subsurface soils is needed to evaluate appropriate remedial alternatives."

4.2 Decision Making

The decision making process includes a description of: 1) decisions to be made; 2) inputs to the decision-making process; 3) the boundaries of the investigation; and 4) development of the decision rules that will govern the process.

The decisions to be made for the project will be based on the Principle Study Questions (PSQs) for the project. The PSQs identify key unknown or unresolved issues that reveal the solution to the problem and the purpose for identifying the PSQs is to narrow the scope of the search for information needed to address the problem. Associated with each PSQ are feasible alternative actions (AAs) that might be taken based on the outcome of the investigation. The AAs should be consistent with regulatory objectives and should help achieve the goal of protecting human health and the environment. The PSQs and associated AAs for this project are provided in the table below.

PSQ#	PSQ	AA#	AA
1	Do mean COC concentrations in surface soil in the identified decision units exceed appropriate ALs for the East Kapolei PML site?	1a	Yes – Consider corrective actions to mitigate exposure pathways.
		1b	No – Decision unit will not be included in area requiring corrective actions.
2	Do mean COC concentrations in subsurface soil in the identified decision units exceed appropriate ALs for the East Kapolei PML site?	2a	Yes – Consider corrective actions to mitigate exposure pathways.
		2b	No – No further action regarding subsurface soil required.

A decision statement is then formulated for each PSQ. The decision statement links the AAs with the PSQ and expresses a choice between AAs based on the outcome of the investigation. The decision statements for this project are as follows:

- Decision Statement 1: Determine whether mean COC concentrations in surface soil within the identified decision units within the East Kapolei PML site exceed ALs and may require additional investigation and/or corrective actions to mitigate exposure pathways; if not then decision unit will not be included in the area requiring corrective actions.

- Decision Statement 2: Determine whether mean COC concentrations in subsurface soil within the identified decision units within the East Kapolei PML site exceed ALs and may require additional investigation and/or corrective actions to mitigate exposure pathways; if not then no further action regarding subsurface soil is required.

4.3 Decision Inputs

The purpose of identifying decision inputs is to specify the information needed to support the decision statements. This information is necessary so that appropriate data may be collected to resolve the decision statement. Although data from previous environmental investigations exist, additional data is needed to provide refined estimates of the affected areas and volumes of soil to evaluate the feasibility of various remedial alternatives. For the purposes of this investigation, the inputs to the decision-making process will include the following:

- The source of information on the environmental variables to be used in the decision-making process will be new data obtained through collection of surface and subsurface soil samples at the property.

- Surface and subsurface soil samples will be processed and quantitatively analyzed by a National Environmental Laboratory Accreditation Conference (NELAC)-certified laboratory.

- Analytical data will be compared to projects ALs, which are current DOH EALs for sites where a current or potential drinking water source is not threatened and where the nearest surface water body is greater than 150 meters from the site.

- Laboratory reporting limits will need to be lower than the ALs and laboratory quality control parameters will meet those limits specified in the standard EPA analytical methods described in the Third Edition of *SW-846 On-line Test Methods for Evaluating Solid Waste Physical/Chemical Methods* and in the selected laboratory's quality assurance program.

4.4 Investigation Boundaries

The investigation boundaries define the population, or site characteristics, that environmental data are intended to represent. Spatial boundaries for this investigation include the areas within the existing security fencing delineating the approximate boundaries of the East Kapolei PML site.

This investigation is not constrained by temporal boundaries since the contaminant sources are due to historic usage of the property. The usability of the data gathered during this investigation is not constrained by temporal boundaries since the COC being investigated are relatively persistent in the environment persistent and will not greatly vary in concentrations in the soil over relatively short time periods.

Spatial limitations that may be encountered during the investigation include the presence of subsurface features (i.e., buried concrete pads, large rocks, very tight/plastic clay, etc.) and the existing concrete irrigation ditch that traverses a portion of the site, which may inhibit collection of specific samples.

The environmental media of interest for this investigation will be surface soil (defined as the existing soil layer between 0 to 6 inches bgs) and subsurface soil (depths to be specified below). Soil will be defined as any portion of the representative soil samples that pass through a 2-millimeter sieve.

4.5 Decision Rules

The decision rules are statements regarding the regulatory response action that would be appropriate depending on whether the data indicated COC concentrations are greater or less than the appropriate AL. In theory, the environmental data are used to estimate the statistical parameter of interest (typically the mean). However, in practice, the statistical parameters will almost surely differ from the true parameter value due to the natural variability (compositional and distributional heterogeneity) in data combined with the need to take a relatively small sample (in comparison to the overall size of the entire population of interest). The uncertainty associated with the difference between the theoretical estimate and the true parameter value results in the possibility of decision error and can be minimized (but not eliminated) through the sampling design.

Using the information discussed in the previous steps of the DQO process, the following Decision Rules were formulated to govern the decision making process for the investigation at the property:

"*If* COC concentrations in surface and/or subsurface soil decision units at the property exceed the ALs established for this project, *then* additional activities may need to be performed to evaluate and/or mitigate exposure pathways to potential receptors. *If* COC concentrations in surface and/or subsurface soil decision units at the property are below the ALs, *then* no additional activities will need to be performed for the specific decision unit and the exposure pathways for the specific decision unit will be considered incomplete."

4.6 Decision Error

Decision errors occur when sample data misleads the decision maker(s) into making a wrong decision and therefore taking the wrong response action. The possibility of a decision error exists since decisions are based on sample data that may be inaccurate due to random and systematic errors incurred at different stages of acquisition. Sources of decision error include sampling error (both field sampling and laboratory subsampling), analytical error (laboratory error during analysis), statistical error (improper use of statistical analysis and data assumptions), and regulatory interpretation error. The primary source of decision error is usually the sampling error. The primary phenomena that cause sampling error are the two types of heterogeneity, compositional heterogeneity and distributional heterogeneity.

Compositional heterogeneity is the natural state of particles that make up the population and refers to the variability of concentrations between particles that make up the population. Distributional heterogeneity is the natural state of particles that make up the population and refers to the nonrandom placement of particles within the population.

Heterogeneity can be controlled through representative sampling. A truly representative sample includes some of all the particles of all the different concentrations in the exact proportion that exists in the population. Heterogeneity is generally the prime contributor to total sampling error. Controlling heterogeneity is essential to controlling total sampling error, thereby reducing the potential for decision error.

Total sampling error consists of several components: fundamental error, grouping and segregation error, materialization error (consists of delimitation error and extraction error), preparation error, long-range heterogeneity fluctuation error, and periodic heterogeneity fluctuation error.

Fundamental error is the result of compositional heterogeneity. It is the only error that cannot be eliminated and the only error that can be estimated prior to sampling. Increasing the number of random samples collected so that the population is better represented and increasing the sample mass to be analyzed are the primary methods that can be used to control fundamental error.

Grouping and segregation error is the result of distributional heterogeneity, which may be due to nature (gravity, chemistry) or due to man (movement of material, process changes). In some cases, mixing may reduce the magnitude of grouping and segregation error, but in other cases mixing may promote segregation and therefore increase the magnitude of grouping and segregation error. Controlling the fundamental error and collecting a sample that consists of numerous random increments (i.e., 30 to 50) are methods to control grouping and segregation error.

Materialization error consists of delimitation error and extraction error. Delimitation error is caused by collection of an improper increment shape and is a function of selecting the proper sampling tool. Extraction error is caused by incomplete extraction of the ideal increment shape and is a function of proper use of the sampling tool. Proper increment shape collection and extraction is essential for maintaining equiprobable selection of all particles in the population and thereby controlling materialization error.

Preparation error is the error that occurs after sampling, but before analysis. Preparation error is the only non-selective error and may be due to several factors, such as losses (i.e., physical loss of fine particles), cross-contamination, and/or documentation (i.e., incorrect labeling). Preparation error can be controlled by maintaining a sample’s integrity prior to analysis.

Long-range heterogeneity fluctuation error (i.e., error that is caused by changes in contaminant concentrations across space or over time due to natural or physical processes) and periodic heterogeneity fluctuation error (i.e., error that is caused by periodic levels across space or over time due to natural or physical processes) are not significant for the purposes of this SAP due to the semi-volatile/non-volatile and relatively immobile nature of the COPC in soil.

Although other decision errors, such as measurement error and statistical error, can contribute to the total error, such errors can be controlled by checking laboratory quality control data and by ensuring the use of appropriate assumptions in the statistical analysis.

Decision errors are defined by the assumed "true value" or baseline condition. The baseline condition becomes the assumed outcome when insufficient evidence exists to refute the baseline condition. The outcome opposite the baseline condition then becomes the alternate decision. For the purposes of this investigation, since previous environmental investigations have indicated that COC concentrations in areas to be sampled generally exceed ALs, it was decided that the more conservative baseline condition would be that "COC concentrations exceed the appropriate ALs."

There are two general types of decision errors associated with the assumed baseline, a false acceptance error and a false rejection error. A false acceptance error occurs when the decision is made that the baseline condition is true, but in actuality, it is false. Conversely, a false rejection error occurs when the decision is made that the baseline condition is false, but in actuality, it is true. For the purposes of this investigation, decision errors are defined as follows:

- *False Acceptance:* The decision is made that data indicate COC concentrations exceed the ALs, when in actuality, the COC concentrations are below the ALs. The consequence of making a false acceptance error is the decision to perform additional activities to address the elevated COC concentrations, when in actuality such activities do not need be performed. This decision error is the less severe since it does not increase the risk to human health or the environment.

- *False Rejection:* The decision is made that data indicate COC concentrations are below the ALs, when in actuality the COC concentrations exceed the ALs. The consequence of making a false rejection error is the decision to forego additional activities to address elevated COC concentrations, when in actuality such activities should be performed to protect potential receptors. This decision error is the more severe consequence since the risk to human health and the environment remains unaddressed.

Controlling the various sources of decision error, and in particular, controlling sampling error, will minimize the possibility of decision-making errors. Therefore, it is essential that an appropriate sampling methodology designed to minimize the sources of significant decision error (sampling error) be selected. Furthermore, it would be prudent to incorporate a statistics-based margin of error, such as adding the standard deviation calculated from replicate samples to the mean COC concentrations, to further reduce the potential for decision errors.

4.7 Sampling Design

In order to minimize the occurrence of decision errors, a statistics-based sampling design was selected to generate data that provides an effective representation of existing mean COC concentrations within various decision units at the property. The objective of the sampling design is to provide sufficient data to resolve the Decision Statements described in Section 4.2.

ETC will use a multi-increment sampling approach for collection and analysis of soil samples. Multi-increment sampling is a method employed to obtain representative samples that exhibit mean 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. If data is considered sufficiently accurate and precise, then the data can be considered reliable estimates of the true concentrations.

Sampling accuracy is usually achieved by some type of random sampling. In random sampling, every unit in the population has a theoretically equal chance of being sampled and measured. Consequently, statistics generated by the sample (i.e., mean and standard deviation of the mean) are unbiased (accurate) estimators of true population parameters – in other words, the sample is representative of the population.

Sampling precision is commonly achieved by taking an appropriate amount of samples from the population. By looking at the equation for the standard deviation of the mean of a sample (standard error of the mean), precision increases (variability decreases) as the number of samples increase, although it is not a one-to-one relationship. Another method to increase the sampling precision is to increase the physical size (weight or volume) of the samples that are collected and analyzed. This technique has the effect of minimizing between-sample variation and decreasing the standard deviation of the mean of the sample. Increasing the number of samples collected and/or the size of the samples from a population not only increases sampling precision, it also has the secondary effect of increasing sampling accuracy.

The multi-increment sampling technique takes into account the need for sufficiently accurate and precise sample data. The technique includes requirements for: 1) collection of random samples; 2) collection of a larger number of samples; and 3) collection of a physically larger sample volume than standard discrete sampling techniques.

The multi-increment sampling approach will provide mean COC concentrations for the specific decision unit that the sample is meant to represent. Therefore, defining the appropriate decision units is essential for meeting the project DQOs.

In general, the former East Kapolei PML site will be divided into twelve surface decision units, with each decision unit ranging from roughly 1,000 square feet to less than 5,000 square feet in area. Three of these surface decision units are considered spill area decision units, or areas where the highest COC concentrations are anticipated based on their location in relation to the historic contaminant sources (i.e., in the immediate vicinity of storage and mixing equipment).

The nine remaining surface decision units are considered investigation area decision units, or areas outside of the immediate vicinity of contaminant sources that may have been impacted through other mechanisms. These decision units were sized to be consistent with hypothetical exposure areas (i.e., maximum 5,000 square feet in area) to be consistent with the investigation of the nearby field areas.

The three spill area decision units will consist of four separate "layers" in order to identify the vertical extent of COC impacts. These layers will consist of a 0 to 0.5-foot layer, 0.5-foot to 2-foot layer, 2-foot to 5-foot layer, and 5-foot to 10-foot layer. The data obtained should provide a clearer picture of the volume of soil impacted by COC in these areas considered to be the most contaminated.

Five of the nine investigation area decision units will also include subsurface layers to identify the vertical extent of certain COC impacts. These layers will consist of a 0 to 0.5-foot layer, 0.5-foot to 2-foot layer, and 2-foot to 3-foot layer. Similar to the spill area decision units, depth layers will provide a better estimate of COC-impacted soil volumes.

Additional details regarding the sampling design are presented in the following sections.

5.0 SCOPE OF WORK

The planned scope of work to be conducted under this work plan will generally consist of the collection and analysis of multi-increment samples to assess specific COC impacts in both surface and subsurface soils at the East Kapolei PML site.

5.1 Surface Soil Investigation

The surface soil investigation will include the collection of multi-increment soil samples from twelve decision unit areas. Each soil increment will represent the 0 to 0.5-foot layer of existing soil. Each multi-increment sample collected will consist of thirty to fifty soil increments from stratified, random locations within the decision unit. The decision unit areas are shown on Figure 3 in Appendix I. A summary of decision units and anticipated laboratory analyses is presented in Table 2.

5.2 Subsurface Soil Investigation

The subsurface soil investigation will include the collection of multi-increment soil samples from eight decision unit areas. Collection of soil increments will be performed through use of a direct-push rig equipped with core samplers or through use of a backhoe to excavate shallow trenches or test pits on site. Each soil increment will represent the designated depth layer of existing soil (i.e., 0.5-foot to 2-foot layer, 2-foot to 3-foot layer, 2-foot to 5-foot layer, and/or 5-foot to 10-foot layer). Multi-increment samples collected using a direct-push rig will consist of at least five to ten soil increments from stratified, random locations within the decision unit. Multi-increment samples collected from trenches/test pits will consist of thirty to fifty soil increments from stratified, random locations within the decision unit. The decision unit areas are shown on Figure 3 in Appendix I. A summary of decision units and anticipated laboratory analyses is presented in Table 2.

5.3 Summary of Environmental Samples

A summary of the environmental samples anticipated at the East Kapolei PML site during this investigation is provided with corresponding analyses in Table 2.

Table 2: Summary of Decision Units, Sample Depths, Estimated Volumes, and Analyses

Decision Unit	Type/ Depth	Collection Protocol	Surface Area (sf)	Layer Vol. (cy)	Analyses
SA1	0-0.5’	MI	2560	47.4	arsenic, dioxins, PCP, triazines, SPLP triazines
	0.5'-2'	MI borings		142.2	arsenic, dioxins, PCP, triazines, SPLP triazines
	2'-5'	MI borings		284.4	arsenic, dioxins, PCP, triazines, SPLP triazines
	5'-10'	MI borings		474.1	arsenic, dioxins, PCP, triazines, SPLP triazines
SA2	0-0.5’	MI	1695	31.4	arsenic, dioxins, PCP, triazines, SPLP triazines
	0.5'-2'	MI borings		94.2	arsenic, dioxins, PCP, triazines, SPLP triazines
	2'-5'	MI borings		183.3	arsenic, dioxins, PCP, triazines, SPLP triazines
	5'-10'	MI borings		313.9	arsenic, dioxins, PCP, triazines, SPLP triazines
SA3	0-0.5’	MI	1050	19.4	arsenic, dioxins, PCP, triazines, SPLP triazines
	0.5'-2'	MI borings		58.3	arsenic, dioxins, PCP, triazines, SPLP triazines
	2'-5'	MI borings		116.7	arsenic, dioxins, PCP, triazines, SPLP triazines
	5'-10'	MI borings		194.4	arsenic, dioxins, PCP, triazines, SPLP triazines
IA1	0-0.5’	MI	4210	78	arsenic, dioxins
IA2	0-0.5’	MI	4480	83	arsenic, dioxins
IA3	0-0.5’	MI	4255	78.8	arsenic, dioxins
IA4	0-0.5’	MI	3615	66.9	arsenic, dioxins
IAT1	0-0.5’	MI	4710	87.2	arsenic, dioxins
	0.5'-2'	MI trench		261.7	arsenic, dioxins
	2'-3'	MI trench		174.4	arsenic, dioxins
IAT2	0-0.5’	MI	4850	89.8	arsenic, dioxins
	0.5'-2'	MI trench		269.4	arsenic, dioxins
	2'-3'	MI trench		179.6	arsenic, dioxins
IAT3	0-0.5’	MI	2885	53.4	arsenic, dioxins
	0.5'-2'	MI trench		160.3	arsenic, dioxins
	2'-3'	MI trench		106.9	arsenic, dioxins
IAT4	0-0.5’	MI	3000	55.6	arsenic, dioxins
	0.5'-2'	MI trench		166.7	arsenic, dioxins
	2'-3'	MI trench		111.1	arsenic, dioxins
IAT5	0-0.5’	MI	2460	45.6	arsenic, dioxins
	0.5'-2'	MI trench		136.7	arsenic, dioxins
	2'-3'	MI trench		91.1	arsenic, dioxins

Decision Units SA1 and SA3 = Spill Area decision units
Decision Units IA1 to IA4 = Investigation Area decision units (surface soil only)
Decision Units IAT1 to IAT5 = Investigation Area-Trench decision units

6.0 DESCRIPTION OF SAMPLING ACTIVITIES

This section provides information regarding specific field methods that ETC will employ to perform sampling activities during this site investigation. The activities described herein will be performed in general accordance with available section of the DOH HEER Office *Technical Guidance Manual for Implementation of the Hawaii State Contingency Plan, Interim Final* and the DOH's Summer 2008 (Updated October 2008) *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater*.

6.1 Surface Soil Sampling

Collection of surface multi-increment samples will be performed in a stratified, random manner (i.e., collect soil increments from random locations within each decision unit, but ensuring that each portion of the decision unit is represented) within each decision unit. ETC personnel will conceptually subdivide each decision unit and collect a proportional amount of increments from each area. Each soil increment will consist of soil from the 0 to 0.5-foot depth layer and thirty to fifty soil increments will be collected from each decision unit.

ETC personnel will use new or pre-cleaned, stainless steel or plastic scoops, spoons, corers or trowels to collect soil increments in each decision unit. Each increment will be placed into a new resealable plastic bag. Prior to handling any soil, ETC personnel will don a new pair of disposable gloves (latex/vinyl/nitrile). Gloves will be interchanged prior to collection of each multi-increment sample.

All sample containers will be labeled with the project name, sample identification number, date/time of sample collection, and sampler's initials. The samples will be kept in a sample cooler with ice pending delivery to the contracted laboratory.

6.2 Subsurface Soil Sampling

The collection of subsurface multi-increment samples will be performed with the use of a direct-push rig or backhoe. Subsurface multi-increment samples in the spill area decision units (SA1 through SA3) will be collected in a stratified, random manner within each decision unit using a direct-push rig equipped with stainless steel core samplers. The core samplers will be driven into the ground and soil increments from each depth layer (0.5-feet to 2-feet, 2-feet to 5-feet, and 5-feet to 10-feet) will be extracted and placed within the appropriate resealable plastic bag. Soil increments will be extracted from soil cores in a manner that provides a representative aliquot of soil from the targeted interval. For example, if the targeted interval is 2- to 5-feet, a wedge of soil will be removed from the core length-wise in order to represent soil from the entire 2- to 5-foot interval. Approximately five to ten soil increments from each depth layer will be collected from each of the three spill area decision units.

Subsurface multi-increment samples in the investigation area decision units targeted for trenching (IAT1 through IAT5) will be collected with the assistance of a backhoe. The backhoe will excavate trenches or test pits within each decision unit, with the intention that the trenches/test pits provide a representative vertical cross-section of subsurface soil throughout the decision unit. ETC anticipates excavating diagonal trenches to obtain the maximal coverage of the decision unit areas (for example, excavate one trench diagonally across a rectangular decision unit, then excavate a second trench diagonally in the opposite direction of the first trench across the decision unit, resulting in an "X" pattern). The excavated soil will be placed adjacent to the trench from which it originated to facilitate replacement of the soil after sample collection activities have been completed.

Once it appears that a relatively representative cross-section has been exposed, ETC personnel will collect thirty to fifty soil increments from each depth layer (0.5-feet to 2-feet and 2-feet to 3-feet) in a stratified, random manner using new or pre-cleaned, stainless steel or plastics scoops, spoons, corers, or trowels. The soil increments will then be placed in the appropriate resealable plastic bag (based on decision unit and depth layer).

Prior to handling any soil, ETC personnel will don a new pair of disposable gloves (latex/vinyl/nitrile). Gloves will be interchanged prior to collection of each multi-increment sample. All sample containers will be labeled with the project name, sample identification number, date/time of sample collection, and sampler's initials. The samples will be kept in a sample cooler with ice pending delivery to the contracted laboratory.

Upon completion of sample collection, the soil excavated from the trenches will be returned to the trench from which the soil originated. In no instance shall soil be removed from the site, other than the volumes required for sample analyses.

6.3 Sample Preservation and Handling Procedures

Sample handling and preservation will be in compliance with the respective method requirements. Table 3 below summarizes these requirements.

Table 3: Sample Handling and Preservation

Analyte	Analytical Method	Sample Container Size, Type	Preservation	Holding Time
Arsenic	EPA 6010B/6020	1-gallon resealable polyethylene bag	none	6 months
Dioxins/furans	EPA 8290	1-gallon resealable polyethylene bag	Dark, 4° C*	30 days*
Pentachlorophenol	EPA 8151A	1-gallon resealable polyethylene bag	Cool, 4° C	14 days
Triazine Pesticides	EPA 8270CM	1-gallon resealable polyethylene bag	Cool, 4° C	14 days

Note: Preservation and holding times in accordance with EPA SW-846 On-Line Revision 3: Test Methods for Evaluation Solid Wastes.
*Preservation and holding time specified for EPA Method 8290 are recommendations. The method states that dioxins/furans are very stable in the environment and holding times under the preservation conditions may be as high as a year.

6.4 Laboratory Analytical Procedures

ETC anticipates delivering a total of thirty-two multi-increment soil samples (twenty-six primary samples, six field replicate samples) to TestAmerica – Honolulu (TA-H) in Aiea, Hawaii with completed chain of custody documentation. ETC will instruct TA-H to perform multi-increment subsampling in accordance with the EPA's November 2003 *Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples* (EPA 600/R-03/027), which includes air-drying, sieving, and obtaining representative subsamples using either an appropriate mechanical splitter or through multi-increment sampling protocols. TA-H will be instructed to analyze the processed samples for total arsenic via EPA Method 6010B, dioxins/furans via EPA Method 8290, pentachlorophenol via EPA Method 8151A, and triazine pesticides via EPA Method 8270CM. TA-H anticipates an approximate 15- to 20-working day turn around time to perform the analyses.

ETC will also request that TA-H conduct additional analyses on select samples within the spill area decision units (SA1 and SA2). These analyses include pentachlorophenol using the Synthetic Precipitation Leaching Procedure (SPLP) via EPA Method 1312/8270C, SPLP triazine pesticides via EPA Method 1312/8270CM, total organic carbon (TOC) via EPA Method 9060, clay fraction analysis (physical analysis to approximate the percentage of clay particles during sieving), RCRA8 metals using the Toxicity Characteristic Leaching Procedure (TCLP) via EPA Method 1311/6010/7000 series, TCLP pentachlorophenol via EPA Method 1311/8270C, and TCLP organochlorine pesticides via EPA Method 1311/8081.

The SPLP analyses will be run to assess the mobility of pentachlorophenol and triazine pesticides in soil within the spill area decision units (SA1 and SA2). The TOC and clay fraction analysis will be run to assess some of the physical parameters of the soil within the spill area decision units to provide further information regarding contaminant mobility. The TCLP analyses will be run on soil from the spill area decision units (anticipated to contain the highest contaminant concentrations) to determine whether, if excavated, these soils would be considered a RCRA-regulated (hazardous) waste.

6.5 Sample Chain-of-Custody and Transportation

Chain of custody procedures are designed to ensure that the integrity of the samples is maintained through collection, transfer, analysis, and disposal. Custody of samples shall be maintained in accordance with applicable chain of custody guidelines. A sample is said to be in custody if:

- It is in one's actual physical possession or view
- It is in one's physical possession and has not been tampered with (i.e., it is under lock or official seal)
- It is retained in an area with secure access

Field personnel shall log individual samples onto carbon chain of custody forms. These forms will also serve as the request for analyses. The following information will be recorded on the chain of custody:

- Sample ID number
- Matrix
- Date and time of collection
- Preservative (if any)
- Number and type of containers
- Analytical method to be performed
- Number of pages

An ETC representative or a representative of the contracted laboratory shall retain custody of the samples at all times and will hand deliver the samples with chain of custody documentation for preparation and analysis.

Samples will be hand-delivered to TestAmerica – Honolulu in Aiea, Hawaii. All appropriate U.S. Department of Transportation (US DOT) regulations (e.g., 49 CFR 171-179) shall be followed in the shipment of environmental samples.

6.6 Sample Identification

This sample identification, or sample naming, procedure describes the naming convention for samples collected and analyzed during this field investigation. The following format will be used for multi-increment soil samples collected at the property.

DU.X where:

DU	=	decision unit designation (SA-spill area, A-area, or AT-area trench)
X	=	depth layer For SA decision units, A=0-0.5 ft, B=0.5-2 ft, C=2-5 ft, D=5-10 ft For IA decision units, A=0-0.5 ft For IAT decision units, A=0-0.5 ft, B=0.5-2 ft, C=2-3 ft

For example, the multi-increment sample collected from decision unit SA2 at a depth layer of 2 to 5 feet would be labeled "SA2.C."

Field replicate samples will be labeled in a similar manner as described above using fictitious depth layer designations such that the samples are indistinguishable from primary samples.

The labeling method will be used for all samples collected at the site. In the field logbook, personnel will record the sample number as well as other identifying information, including narrative, sample ID, date, time, depth, location, matrix description, and/or other comments as appropriate. Each sample container (resealable plastic bag) will be labeled with the sample ID, date/time of sampling, and sample depth layer using an indelible ink marker.

A spreadsheet with sample names, depth layers, and laboratory analyses has been prepared in advance of sampling to assist field personnel with avoiding potential sample labeling errors in the field (see Appendix III). The field team leader will be responsible for ensuring the naming convention and/or documenting any necessary modifications that are implemented.

6.7 Decontamination Procedures

Re-useable sampling tools, such as stainless steel corers, scoops, or trowels will be decontaminated by washing with a brush and potable water - Alconox™ solution, rinsing with potable water, then rinsing with distilled water. Spray bottles will be used to perform decontamination procedures in order to minimize the volume of decontamination fluids generated. Decontamination fluids will be allowed to drip directly onto the ground surface within the fenced area of the site.

Any disposable sample collection equipment (i.e., used PPE, disposable scoops/trowels) will be containerized at the end of each work day and disposed as solid waste.

6.8 List of Equipment, Containers, and Supplies

Field sampling equipment may include the following items:

- GPS instrumentation.
- Direct-push rig.
- Backhoe.
- Rotary impact hammer with augers and chisel bits (plus portable generator).
- Stainless steel or plastic scoops, spoons, corers, or trowels.
- Resealable polyethylene bags.
- Designated sample coolers with liquid or chemical ice.
- Personal protective equipment (PPE) that may include chemical-resistant suits, latex/vinyl/nitrile gloves, respirators, eye protection, hard hats, steel-toe boots, and/or boot covers.
- Other equipment, as necessary, to assist personnel with access to designated soil sampling depths.

6.9 Investigation Derived Waste

IDW includes disposable PPE, disposable sampling equipment, decontamination fluids, and any other material that may have come in contact with potentially contaminated materials. IDW generated on-site will be removed and properly disposed of off-site.

For all practical purposes, ETC anticipates that used PPE and disposable sampling equipment will be disposed as solid waste. Decontamination fluids will be allowed to evaporate within the fenced area of the East Kapolei PML site.

E. Global Positioning System

ETC will conduct the following:

- Plan and layout appropriate decision units over varying areas of the property.
- Identify the coordinates of the decision units and upload coordinates as waypoints to the hand-held Trimble Pathfinder® Pro XR TSC1 datalogger.
- Identify and mark selected waypoints points in the field using the “Navigation” capabilities of the Trimble Pathfinder® Pro XR with differential beacon receiver GPS unit.

7.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

This Quality Assurance/Quality Control (QA/QC) Plan describes quality assurance and quality control procedures for the site investigation at the Property and incorporates by reference laboratory-specific QA/QC procedures. Laboratory-standard procedures are not reiterated except as necessary to describe the QA/QC plans for this project.

7.1 Quality Assurance/Quality Control Objectives

Quality assurance objectives for data measurement specific to QA/QC parameters include precision, accuracy, representativeness, comparability, completeness, and sensitivity. The following paragraphs describe these elements and the requirements for each element for this field investigation.

Precision refers to the degree to which data generated from replicate or repetitive measurements differ from one another, i.e., the ability to repeat the measurement and get fundamentally the same quantitative result. Sampling precision is commonly achieved by taking an appropriate amount of samples from the population and by increasing the physical size (weight or volume) of the samples that are collected and analyzed. Increasing the number of samples collected and/or the size of the samples from a population not only increases sampling precision, it also has the secondary effect of increasing sampling accuracy. Sampling precision can be determined by comparing multi-increment sample results from the same decision unit.

Measurement precision will be determined by the laboratory using matrix spikes (MS) and matrix spike duplicates (MSD) to measure reproducibility, expressed as Relative Percent Difference (RPD). Precision requirements for the laboratory are those described in the EPA's *SW-846 On-line Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*.

Accuracy refers to the closeness of the analytical data to the true value of the constituents being measured, as it exists at the site. Although the true value cannot be determined, reliable estimates of the true value can be made using analytical results from a representative subset of the population. Accuracy goals can be met by selecting a probabilistic sampling method where every unit in the population of interest has a theoretically equal chance of being sampled. Consequently, statistics generated by the sample (i.e., mean and standard deviation of the mean) are unbiased (accurate) estimators of true population parameters. Furthermore, sampling accuracy can also be increased by increasing the number of samples collected, making the data more representative of the population being sampled.

Measurement accuracy will be determined through the use of calibration checks, matrix spikes, and laboratory control samples (LCS)/laboratory control sample duplicates (LCSD). Accuracy will be based on percent recovery of spike samples. Accuracy requirements for the laboratory are those described in the EPA's *SW-846 On-line Test Methods for Evaluating Solid Waste Physical/Chemical Methods*.

Representativeness refers to how well the soil samples represent the population from which they were collected and how well the analysis represents the samples. Representativeness can be achieved by collecting a sufficient amount of samples. The multi-increment sampling approach is a statistically-derived method developed to ensure that samples being analyzed are representative of the population being sampled. If the analysis of method and reagent blanks are acceptable and if no unusual problems with the laboratory analyses are identified, then the data will be assumed to be representative of the samples.

Comparability measures how well past analyses related to the project compare to the new data. Comparability will be achieved through the use of standard field and laboratory procedures; EPA- and State of Hawaii-published guidance; and through the use of QA/QC samples.

Completeness refers to the number of acceptable data points divided by the possible number of data points for a sampling event or entire project. Test results may be unusable or unacceptable because of sample container breakage, poor laboratory QA, matrix interferences, etc. This investigation targets a goal of 90% completeness. If this completion goal is not met, the Project Manager will review this goal and the achievement of other data quality assurance objectives and make a recommendation as to the need for corrective action.

Sensitivity refers to the lowest concentration of an analyte that can be accurately quantified without qualifications in a sample matrix. Such concentrations are generally referred to as “method reporting limits (MRLs)” or “practical quantitation limits (PQLs),” and should not be confused with “method detection limits (MDLs),” which are minimum concentrations of an analyte that can be distinguished for a specific analytical method with 99% confidence that the concentration is greater than zero. The data will be considered adequately sensitive if either the MRLs/PQLs or MDLs are below the ALs for this project.

Data usability will be based on the use of the acceptance criteria outlined in the referenced tables together with an evaluation of project-specific MS/MSD, LCS/LCSD, and other relevant laboratory QA/QC checks. In accordance with SW-846, the criteria in the tables for organic and inorganic analyses reflect the laboratory's performance data. While it is understood that as a general rule, recoveries of most compounds spiked into samples should fall within the 70% to 130% range, the laboratory acceptance criteria reflect laboratory-specific performance, which accounts for effects of spike to background ratios, or other conditions.

In certain instances, it is possible that matrix effects and/or other factors (i.e., multi-increment sampling protocols) result in elevated MRLs/PQLs and MDLs due to the requirement for dilutions. This may result in some uncertainty when the contaminant is not detected in the sample, but the MDL exceeds the appropriate AL. In these cases, it is generally assumed that the contaminant concentrations are not a significant concern, as long as the MDL is reasonably close to the AL (e.g., within an order of magnitude). If such a situation arises, the Project Manager will make a determination on the data usability.

7.1.1 Quality Control Samples

Quality control (QC) check samples to be used for this project include field replicate soil samples. ETC anticipates collecting one primary multi-increment sample and two field replicate multi-increment samples (i.e., field triplicate samples) at a frequency of one set of field triplicate samples for every ten primary multi-increment samples (10%) for quality control purposes. The primary sample and the two field replicate samples will be collected in the same manner, as if three separate multi-increment samples were being collected from the same decision unit.

As shown in the Field Sampling Collection/Analysis Log (Appendix III), three decision units have been selected for triplicate sampling. Surface soil field replicate samples will be collected from decision units SA2 and AT5. Subsurface soil field replicate samples will be collected from decision unit AT1.

7.1.2 Calibration Procedures and Frequency

Calibration of field and laboratory equipment is an important part of the QA/QC process. The calibration procedures for anticipated field and laboratory equipment are summarized below.

A. GPS Calibration

Only trained personnel shall use and calibrate the GPS equipment in accordance with the manufacturer's instructions. A Trimble Pathfinder® Pro XR with differential beacon receiver, TSC1 hand-held datalogger, and Pathfinder® Office software will be used for this project.

B. Laboratory Equipment Calibration

Laboratory equipment calibration is a critical component of the laboratory QA/QC system. Laboratory equipment calibration procedures, QA/QC checks, sample preparation procedures, and management of standards will be conducted by the contracted, NELAC-certified laboratory, TestAmerica-Hawaii.

7.1.3 Data Analysis and Reporting

Laboratory turn around times will vary depending on the analysis. Results of analyses will be reported by the laboratory via electronic mail to ETC. Sample transport and mail transit time is not included in the standard turnaround time.

Data reduction and data validation will be completed by the contracted laboratory prior to delivery to ETC. Upon receipt of the analytical results, ETC will perform additional data validation to determine whether analytical data is acceptable for use in the context of this field investigation. ETC's evaluation will include an assessment of laboratory QC data, such as surrogate recoveries, MS/MSD percent recoveries and RPDs, and LCS/LCSD percent recoveries and RPDs.

7.2 Laboratory Quality Control Evaluation

The EPA methods for analysis of environmental samples contain explicit quality control requirements that must be met. These requirements include specific procedures and criteria for evaluating accuracy and precision, demonstrating the ability of the analyst to generate acceptable accuracy and precision, and demonstrating that extraneous interferences are under control. The laboratory will be required to document strict adherence to the general laboratory QA/QC requirements.

7.3 Field Quality Control Evaluation

In order to assess the effects of total error, relative standard deviation (RSD) values will be calculated for each set of triplicate samples. Generally, acceptable RSDs are 35% or less, indicating that the amount of estimated total error is acceptable for decision making.

Since data from multi-increment samples theoretically provides estimates of the mean concentrations in the particular decision unit being assessed, a measure of the variation from the mean is needed to evaluate how that variation affects the decision making process. In an effort to account for variance in the data and to minimize the occurrence of the more severe “false rejection” error referred to in Section 4.6, the standard deviation calculated from the sets of triplicate samples will be added to the reported COC concentrations for each multi-increment sample.

8.0 DOCUMENTATION AND REPORTING

Records shall be maintained as necessary for implementing and documenting the above-described field sampling activities. Specifically, documentation will be performed in a field logbook. The field log shall be kept in a bound, water-repellent field notebook with consecutively numbered pages. The logbook will be clearly identified with the project name, person responsible for maintaining the logbook, and beginning and ending date of the entries. Information in the logbook will include location, time on site, personnel and equipment present, visitors, down time, materials used, samples collected, measurements taken, unusual incidents, and any other observations or information that would be necessary to reconstruct field activities at a later date.

Other information to be contained in the logbook includes, but is not limited to:

- Photographic references
- Sample ID No. and sample collection time
- Meeting information
- Important times, dates, and content of communications
- Field calculations
- Level of PPE
- Weather conditions
- Visual observations
- Field QC information

The information documented in the field logbook and any other associated forms (i.e., laboratory chain of custody, sample collection log, etc.) will then be used to prepare a site investigation report. This report will provide written documentation of field sampling activities, provide figures showing the sampling locations and areas being assessed, and summarize analytical data and resultant comparisons to existing action levels. This report will be completed after receipt of all analytical data.

9.0 PROJECT SCHEDULE

The following conceptual schedule is based on the anticipated scope of work. Note that this schedule is an estimate only.

Activity	Calendar Days	Start Date	End Date
Lead Abatement	4 days	11/30/09	12/3/09
Site Demolition/Disposal	20 days	12/8/09	12/28/09
Field Sampling	11 days	12/29/09	1/8/10
Surface Soil Sampling	2 days	12/29/09	12/30/09
Subsurface Drilling	3 days	1/4/10	1/6/10
Trenching	2 days	1/7/10	1/8/10
Sample Analysis	33 days	1/11/10	2/12/10

The schedule shown above is only a conceptual model. Actual time frames to perform various activities may or may not require the time periods described. Efforts will be made to expedite the process to the extent feasible.

10.0 HEALTH AND SAFETY PLAN

A Site Safety and Health Plan (SSHP) was prepared in September 2009 as a previous task in the overall project. Field sampling activities will be conducted in accordance with the SSHP.

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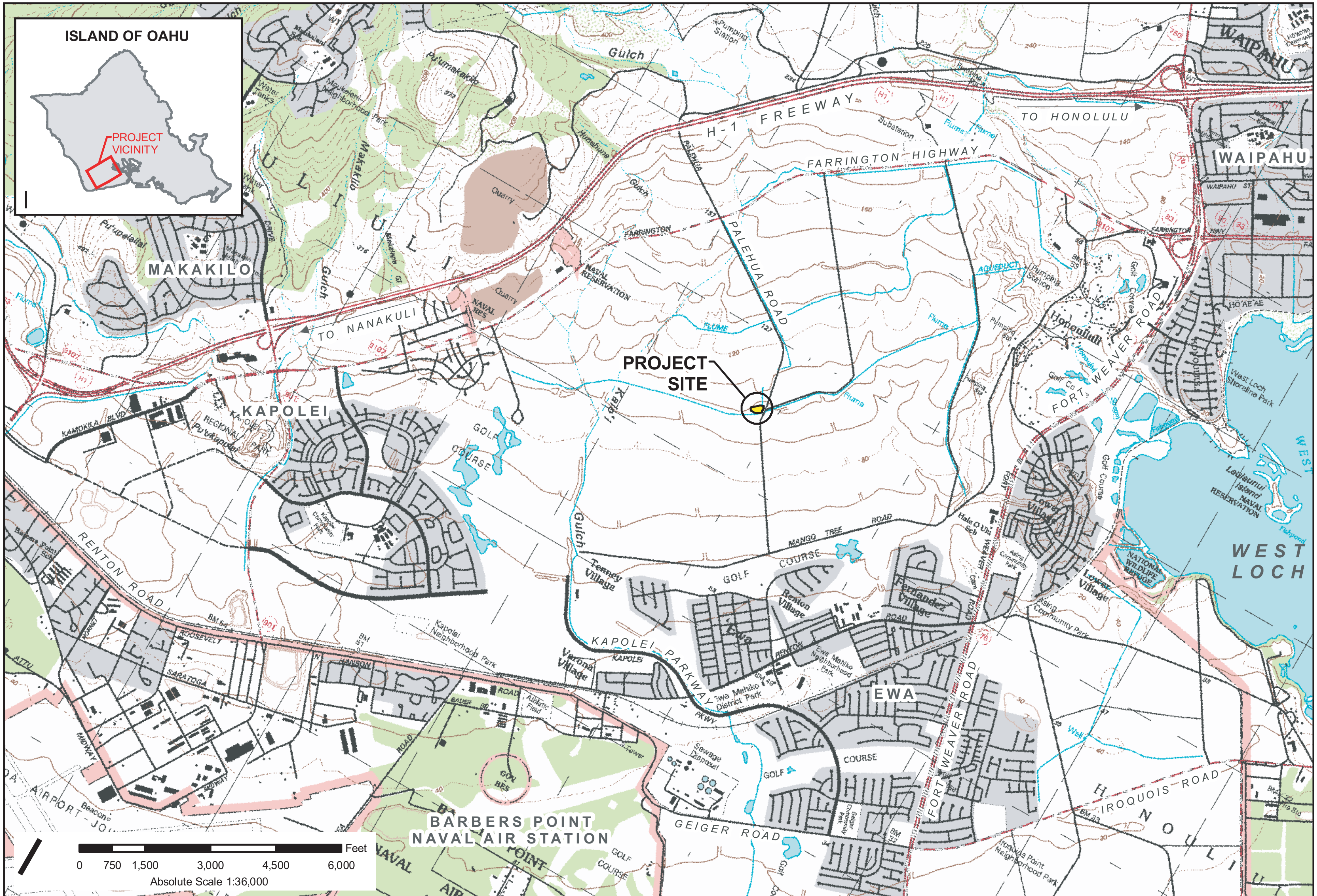
APPENDIX I

FIGURES

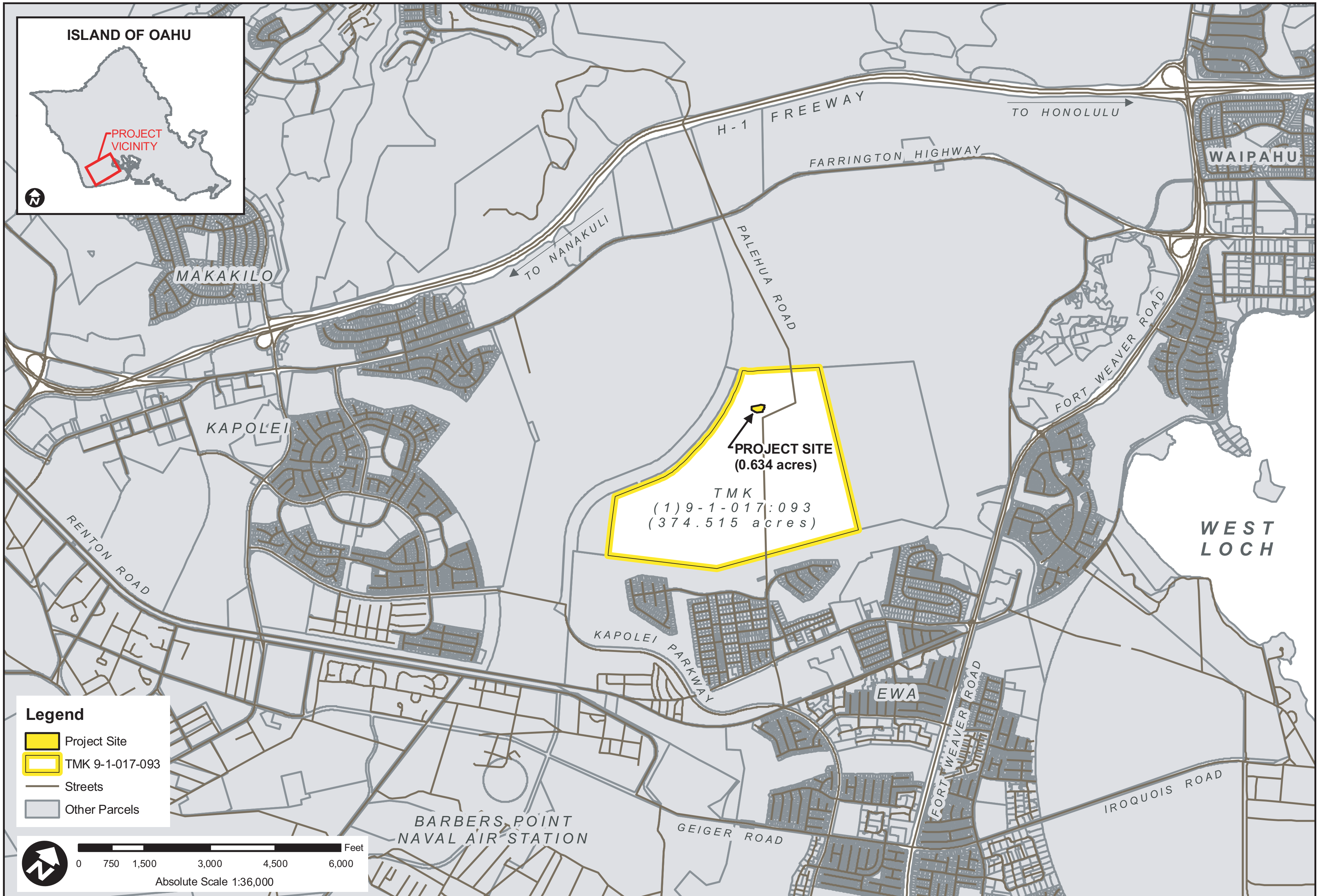


EnviroServices & Training Center, LLC

ETC Project 09-2011

December 2009

Figure 1 - Location Map
Site Investigation Work Plan
East Kapolei PML Site
Ewa, Oahu, Hawaii

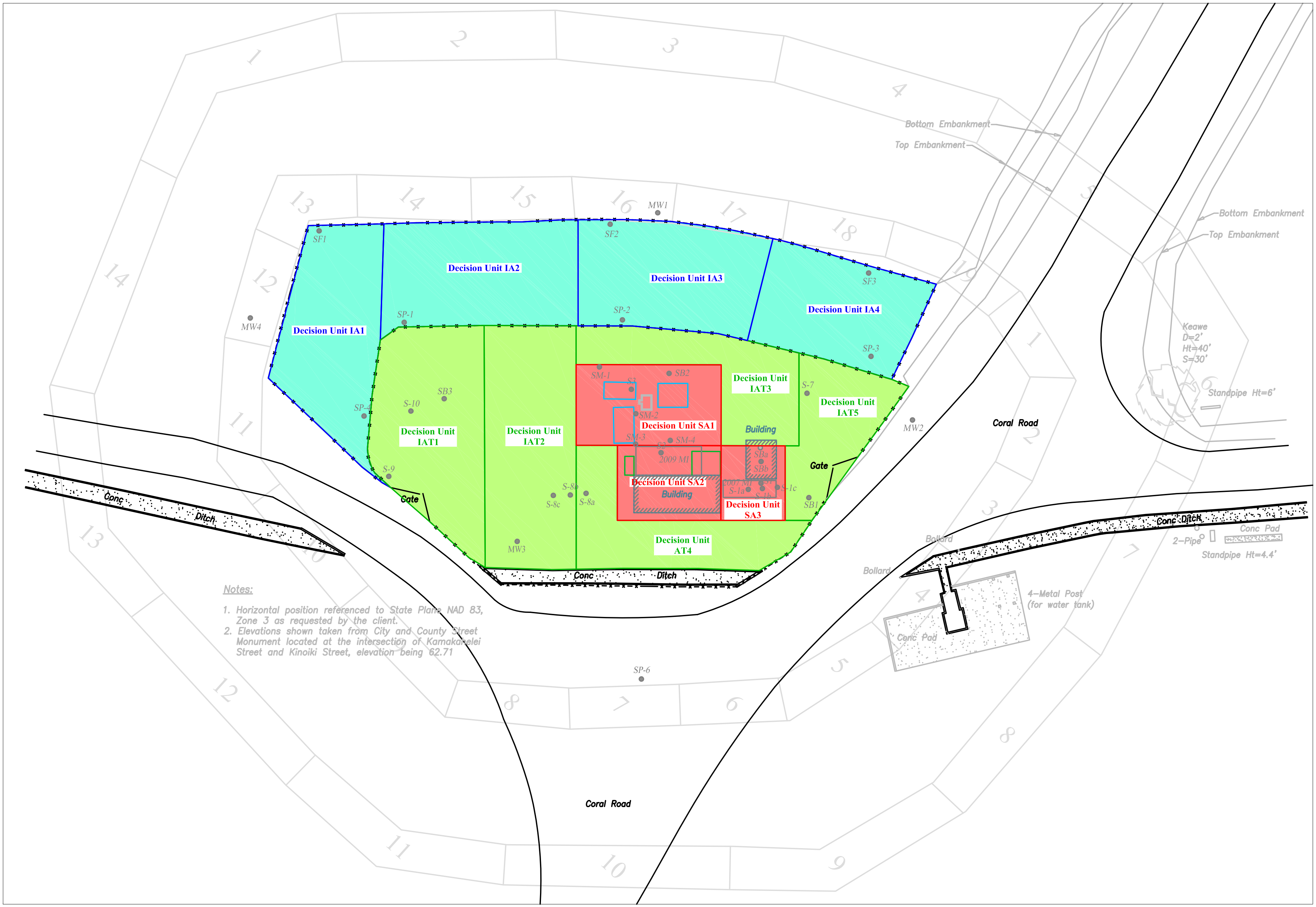


EnviroServices & Training Center, LLC

ETC Project 09-2012

December 2009

Figure 2 - Parcel Map
Site Investigation Work Plan
East Kapolei PML Site
Ewa, Oahu, Hawaii



30' 0' 30' 60'

Graphical Scale: 1" = 60'
Note: Original Sheet Size is 8.5x11, For All Other Sizes Scale Accordingly

EnviroServices & Training Center LLC

Project 09-2011

December 2009

Figure 3 - Decision Unit Locations
Site Investigation Work Plan
East Kapolei PML Site
Ewa, Oahu, Hawaii

APPENDIX II

SUMMARY OF HISTORIC DATA

Table 1: 1990 UH/Dept. of Ag Data

Sample Location	Depth (cm)	Diuron	Atrazine	Terbacil	Ametryn	Hexazinone	DDT	DDE	DDD
Boring 1	0 - 10	ND	**3472**	ND	**17664**	2.19	**6.339**	0.304	1.867
	10 - 17	ND	**1613**	ND	**8333**	1.25	**2.39**	0.110	0.570
	17 - 30	0.27	**147.3**	1.4	**623.9**	1	0.418	0.030	0.079
	30 - 61	0.71	**16.94**	3.3	**69.32**	1.15	0.048	0.009	0.018
	152 - 183	1.22	**2.68**	ND	**184.8**	2.08	ND	ND	ND
	244 - 274	1.05	1.6	ND	**53.4**	1.38	ND	ND	ND
Boring 2	0 - 15	1.26	**6.77**	3.38	**19.71**	0.23	0.025	0.060	0.100
	61 - 91	0.08	0.03	1.43	1.59	0.1	ND	ND	ND
	152 - 183	ND	0.09	0.32	2.06	0.18	ND	ND	ND
	244 - 274	ND	0.8	ND	3.03	0.25	ND	ND	ND
Boring 3	0 - 18	1.1	**5.36**	1.43	7.42	ND	ND	0.004	0.005
	61 - 91	0.06	0.12	0.71	0.53	ND	ND	ND	ND
	152 - 183	0.22	0.32	0.43	0.38	ND	ND	ND	ND
	244 - 274	0.18	0.61	ND	0.53	0.11	ND	ND	ND
MDL		0.06	0.01	0.05	0.02	0.02	0.003	0.002	0.004
DOH EAL		4.5	2.1	160	11	400	1.7	1.4	2.0

Location of borings are unknown.
ND = not detected
MDL = method detection limit (ppm wet weight)
DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

Shading and bold type = exceedance of the EAL

Table 2: Surface Soil Sample Data, DOH May 1997/September 1999

Metals and Pesticides Only

Sample ID	S1	S2	S3	S4	S5 (bg)	S6 (S4 dup)	DOH EAL
Arsenic	**29.9**	**27.2**	**51.7**	13.9	11.5	13	20
Chromium	127	84.1	69	67.8	74.3	65	500
Lead	153	**200**	**230**	43.1	8.6	43.9	200
Mercury	0.64	0.82	0.3	nd<0.06	nd<0.05	nd<0.05	4.7
Zinc	**1740**	**1900**	**1120**	241	107	233	600
PCP (SVOC)	**8.1**	1.4	1.1	nd<4.3	nd<0.37	nd<4.3	3
PCP (ChlorHerb)	**13**	0.98	**8.9**	0.55	nd<0.042	0.46	3
DDE	0.11	nd<0.038	nd<0.0034	0.0037	nd<0.0037	0.0046	1.4
DDD	nd<0.038	0.057	0.0073	nd<0.0034	nd<0.0037	0.0058	2
DDT	0.068	0.3	0.0039	0.0051	0.0056	0.0069	1.7
2,4-D	nd<0.21	0.62	nd<0.21	0.38	nd<0.21	0.41	0.98
Dalapon	**nd<2.1**	**nd<2.3**	**nd<2.1**	**nd<2.0**	**nd<2.1**	**nd<2.0**	1.4
Dioxin TEQ (ppt)	**752,000**	--	--	**73700**	--	--	450

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

Table 3: Soil Sample Data - Metals, EPA December 2000

Sample ID	Depth	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc
BG	0-1	14	290	nd<5.3	120	**56**	30	7	2000	nd<0.11	53	**220**	120
SB	0-1	16	130	nd<5.2	180	35	140	**270**	1600	0.54	65	**110**	**3500**
S-1a,b,c	0-1	**39**	190	nd<3.1	170	33	180	**300**	820	0.92	71	**110**	**2400**
S-1c	1-2	**22**	210	0.81	100	29	35	30	1100	0.16	44	**170**	440
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	0-1	18	140	nd<2.5	77	**44**	49	16	1600	nd<0.1	95	**130**	260
S-8	0-0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-9	0-0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-10	0-0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDa,b,c	0-1	18	150	nd<2.6	95	**47**	52	14	1800	nd<0.01	110	**140**	140
SF-1	0-1	11	260	nd<2.7	93	**55**	29	6.4	2000	0.16	51	**210**	120
SF-2	0-1	9.6	270	nd<5.5	94	**57**	30	7.4	2100	nd<0.11	54	**220**	130
SF-3	0-1	8.9	300	nd<2.8	100	**58**	30	6.9	2100	nd<0.11	53	**220**	120
SF-4	0-1	**43**	280	nd<2.7	84	**57**	35	6.1	2200	nd<0.11	57	**210**	130
SM-1	0-1	**50**	150	nd<1.5	62	22	55	**210**	680	0.15	57	68	**720**
	1-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SM-2	0-1	**160**	230	nd<2.9	160	33	170	**240**	880	nd<1.3	95	**130**	**2000**
	1-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SM-3	0-1	**30**	250	nd<2.7	100	22	72	**350**	690	nd<0.39	52	76	**3000**
	1-2[1]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-3[1]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SM-4	1-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-1	0-1	12	150	nd<2.7	62	34	33	35	1300	0.16	54	**130**	130
SP-2	0-1	16	190	nd<5.5	75	**43**	34	33	1500	nd<0.11	54	**170**	170
	1-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-3	0-1	16	200	nd<2.8	91	**49**	41	39	1800	nd<0.11	68	**170**	270
SP-4	1-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-6	1-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EALs		**20**	**750**	**12**	**500**	**40**	**230**	**200**	**NA**	**4.7**	**150**	**110**	**600**

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

NA = not analyzed

Table 4: Soil Sample Data - Pesticides, EPA December 2000

Sample ID	Depth	DDD	DDE	DDT	delta-BHC	Dieldrin	Endrin Aldehyde	Chlordane
BG	0-1	nd<0.035	nd<0.035	nd<0.035	nd<0.018	**nd<0.035**	nd<0.035	nd<0.018
SB	0-1	0.034	0.04	0.067	nd<0.017	0.0027	nd<0.035	0.0068
S-1a,b,c	0-1	nd<0.041	nd<0.041	nd<0.041	0.079	**0.049**	nd<0.041	nd<0.02
S-1c	1-2	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA
	3-4	NA	NA	NA	NA	NA	NA	NA
S-7	0-1	nd<0.34	nd<0.34	nd<0.34	nd<0.0.17	**nd<0.34**	**nd<0.34**	nd<0.0.17
S-8	0-0.25	NA	NA	NA	NA	NA	NA	NA
S-9	0-0.25	NA	NA	NA	NA	NA	NA	NA
S-10	0-0.25	NA	NA	NA	NA	NA	NA	NA
SDa,b,c	0-1	nd<0.35	nd<0.35	nd<0.35	nd<0.018	**nd<0.036**	**nd<0.35**	nd<0.17
SF-1	0-1	nd<0.037	nd<0.037	nd<0.037	nd<0.018	**nd<0.037**	nd<0.037	nd<0.018
SF-2	0-1	nd<0.037	nd<0.037	nd<0.037	nd<0.018	**nd<0.037**	nd<0.018	nd<0.018
SF-3	0-1	nd<0.038	nd<0.038	nd<0.038	nd<0.019	**nd<0.039**	nd<0.038	nd<0.019
SF-4	0-1	nd<0.036	nd<0.036	nd<0.036	nd<0.018	**nd<0.036**	nd<0.036	nd<0.018
SM-1	0-1	nd<0.034	0.014	nd<0.034	0.013	**nd<0.034**	nd<0.034	nd<0.017
	1-2	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA
SM-2	0-1	nd<0.038	0.043	0.22	**0.14**	**nd<0.038**	**0.084**	0.0095
	1-2	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA
SM-3	0-1	0.13	0.081	0.31	nd<0.018	**nd<0.036**	0.036	nd<0.018
	1-2 (1)	NA	NA	NA	NA	NA	NA	NA
	2-3 (1)	NA	NA	NA	NA	NA	NA	NA
SM-4	1-2	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA
SP-1	0-1	nd<0.036	nd<0.036	0.035	nd<0.018	**nd<0.036**	nd<0.036	0.0032
SP-2	0-1	nd<0.038	nd<0.038	0.041	nd<0.019	**nd<0.038**	nd<0.038	nd<0.019
	1-2	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA
SP-3	0-1	nd<0.037	nd<0.037	nd<0.037	nd<0.018	**nd<0.037**	nd<0.018	nd<0.018
SP-4	1-2	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA
SP-6	1-2	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA
EALs		**2**	**1.4**	**1.7**	**0.09**	**0.03**	**0.06**	**7**

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

NA = not analyzed

Table 5: Soil Sample Data - Herbicides, EPA December 2000

Sample ID	Depth	Ametryn	Glyphosate	Diuron	Atrazine	Simazine	Terbacil	Trifluralin	Propiconazole	2,4-D	Dalapon	Picloram
BG	0-1	nd<0.69	**nd<5.25**	nd<0.087	nd<0.69	**nd<0.69**	nd<0.69	nd<0.69	nd<0.11	0.047	nd<0.0099	nd<0.03
SB	0-1	3.6	**34**	3.02	nd<6.9	**nd<6.9**	nd<6.9	nd<6.9	nd<1.1	0.64	nd<0.02	nd<0.059
S-1a,b,c	0-1	**120**	**4.61**	**16.5**	**86**	**nd<8**	nd<8	**190**	nd<1.3	**1.7**	nd<0.01	nd<0.031
S-1c	1-2	**35**	**26**	0.5	nd<0.67	**nd<0.67**	nd<0.67	nd<0.67	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	0-1	nd<6.7	**nd<5.07**	0.0788	**nd<6.7**	**nd<6.7**	nd<6.7	0.77	nd<1.1	0.024	nd<0.0098	nd<0.029
S-8	0-0.25	NA	NA	NA	**nd<14**	NA	NA	NA	NA	NA	NA	NA
S-9	0-0.25	NA	NA	NA	**nd<14**	NA	NA	NA	NA	NA	NA	NA
S-10	0-0.25	NA	NA	NA	**nd<15**	NA	NA	NA	NA	NA	NA	NA
SDa,b,c	0-1	nd<6.9	**nd<5.36**	0.0613	**nd<6.9**	**nd<6.9**	nd<6.9	nd<6.9	nd<1.1	0.026	nd<0.01	nd<0.03
SF-1	0-1	nd<0.73	**nd<5.47**	0.0765	nd<0.73	**nd<0.73**	nd<0.73	nd<0.73	nd<0.11	nd<0.02	nd<0.01	nd<0.03
SF-2	0-1	nd<0.72	**nd<5.42**	0.047	nd<0.72	**nd<0.72**	nd<0.72	nd<0.72	nd<0.11	0.12	nd<0.0099	nd<0.03
SF-3	0-1	nd<0.75	nd<1.131	0.0504	nd<0.75	**nd<0.75**	nd<0.75	nd<0.75	nd<0.12	0.061	nd<0.01	nd<0.03
SF-4	0-1	nd<0.71	**nd<5.32**	0.0235	nd<0.71	**nd<0.71**	nd<0.71	nd<0.71	nd<0.11	0.034	nd<0.0099	nd<0.03
SM-1	0-1	2.1	**2.43**	0.683	**nd<3.4**	**nd<3.4**	nd<3.4	nd<3.4	nd<0.052	nd<0.2	nd<0.0099	0.044
	1-2	NA	NA	NA	**nd<7.1**	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SM-2	0-1	8	**5.93**	3.03	**nd<7.6**	**nd<7.6**	0.94	1.9	nd<1.2	0.62	0.037	nd<0.03
	1-2	NA	NA	NA	nd<0.8	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SM-3	0-1	**13**	**21.8**	**10.1**	**3**	**2.9**	nd<3.2	nd<7.1	nd<1.1	0.32	nd<0.0099	nd<0.03
	1-2[(1)]	NA	NA	NA	nd<0.72	NA	NA	NA	NA	NA	NA	NA
	2-3[(1)]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SM-4	1-2	NA	NA	NA	nd<0.72	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-1	0-1	nd<7.1	**2.63**	0.188	**nd<7.1**	**nd<7.1**	nd<7.1	nd<7.1	nd<1.1	0.18	nd<0.01	nd<0.03
SP-2	0-1	nd<3.8	**2.52**	0.374	**nd<3.8**	**nd<3.8**	nd<3.8	nd<3.8	nd<0.58	0.1	nd<0.0099	nd<0.03
	1-2	NA	NA	NA	nd<0.77	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-3	0-1	nd<7.3	**nd<5.48**	0.2	**nd<7.3**	**nd<7.3**	nd<7.3	nd<7.3	nd<1.1	0.057	nd<0.01	nd<0.03
SP-4	1-2	NA	NA	NA	**nd<7.7**	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-6	1-2	NA	NA	NA	**nd<7.1**	NA	NA	NA	NA	NA	NA	NA
	2-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EALs		**11**	**1.9**	**4.5**	**2.1**	**0.25**	**160**	**32**	**160**	**0.98**	**1.4**	**NA**

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

NA = not analyzed

Table 6: Soil Sample Data - Dioxins, PCP, Tetrachlorophenol, EPA December 2000

Sample ID	Depth	Dioxin TEQ (ppt)	2,3,4,6-Tetrachlorophenol	Pentachlorophenol
BG	0-1	65	nd<0.35	nd<0.35
SB	0-1	**63100**	**nd<3.5**	1.6
S-1a,b,c	0-1	**333600**	**nd<4.1**	**15**
S-1c	1-2	**271000**	NA	**22**
	2-3	**33400**	NA	NA
	3-4	**42000**	NA	NA
S-7	0-1	**2300**	**nd<8.5**	**nd<8.5**
S-8	0-0.25	**1700**	NA	0.09
S-9	0-0.25	**1500**	NA	nd<0.363
S-10	0-0.25	**1700**	NA	nd<1.874
SDa,b,c	0-1	**1400**	**nd<8.7**	**nd<8.7**
SF-1	0-1	64	nd<1.8	nd<1.8
SF-2	0-1	89	nd<1.8	nd<1.8
SF-3	0-1	84	nd<1.9	nd<1.9
SF-4	0-1	207	nd<1.8	nd<1.8
SM-1	0-1	**94300**	0.57	**17**
	1-2	**3600**	NA	**310**
	2-3	**1300**	NA	NA
SM-2	0-1	**44400**	0.36	**7.5**
	1-2	360	NA	nd<0.399
	2-3	**640**	NA	NA
SM-3	0-1	**98000**	**nd<9**	1.7
	1-2[1]	**2900**	NA	**14**
	2-3[1]	**2000**	NA	NA
SM-4	1-2	**2900**	NA	**14**
	2-3	**2000**	NA	NA
SP-1	0-1	**4800**	**nd<3.6**	**nd<3.6**
SP-2	0-1	**10900**	**nd<3.9**	**nd<3.9**
	1-2	**2300**	NA	nd<0.388
	2-3	**900**	NA	NA
SP-3	0-1	**8500**	**nd<3.7**	**nd<3.7**
SP-4	1-2	**1900**	NA	nd<0.384
	2-3	220	NA	NA
SP-6	1-2	270	NA	nd<0.359
	2-3	370	NA	NA
EALs		**450**	**3.3**	**3**

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

NA = not analyzed

Table 7: Discrete Soil Sample Data, ETC 2006

Sample Location	Sample ID	TEQs (ng/kg)	Arsenic (mg/kg)	Diuron (mg/kg)	Atrazine (mg/kg)	Simazine (mg/kg)	Ametryn (mg/kg)	SPLP Atrazine (mg/l)	SPLP Simazine (mg/l)	SPLP Ametryn (mg/l)	Dieldrin (mg/kg)	Trifluralin (mg/kg)	PCP (mg/kg)	2,3,4,6-Tetrachloro-phenol (mg/kg)
MW-1, 0' bgs	2010-1-0	50.94	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CAS Kelso			7.5											
MW-1, 3' bgs	2010-1-3	1.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-2, 0' bgs	2010-2-0	**522.05**	NA	*0.055*	*0.077*	*0.077*	0.023	NA	NA	NA	NA	NA	***35***	***35***
CAS Kelso			8.5											
MW-2, 3' bgs	2010-2-3	**1238.36**	**23.1**	*0.055*	*0.076*	*0.076*	0.044	NA	NA	NA	NA	NA	***35***	***35***
MW-2, 6' bgs	2010-2-6	1.53	0.19	*0.064*	NA	NA	NA	NA	NA	NA	NA	NA	*2.1*	*2.1*
MW-3, 0' bgs	2010-3-0	13.40	*0.22*	*0.054*	*0.074*	*0.074*	0.018	NA	NA	NA	NA	NA	*87*	*87*
MW-3, 3' bgs	2010-3-3	3.50	2.6	*0.052*	*0.069*	*0.069*	*0.069*	NA	NA	NA	NA	NA	*84*	*84*
MW-4, 0' bgs	2010-4-0	NA	NA	*0.063*	*0.081*	*0.081*	0.011	NA	NA	NA	*0.0041*	0.032	*2.0*	*2.0*
CAS Kelso			6.7											
MW-4, 3' bgs	2010-4-3	NA	*0.24*	*0.059*	*0.076*	*0.076*	*0.076*	NA	NA	NA	*0.0038*	*0.00076*	*1.9*	*1.9*
SB-1, 0' bgs	2010-5-0	**563.14**	NA	*0.052*	*0.072*	*0.072*	0.018	*0.0022*	*0.0022*	*0.0022*	NA	NA	*1.7*	*1.7*
SB-1, 3' bgs	2010-5-3	96.00	NA	0.036	*0.080*	*0.080*	0.037	*0.0022*	*0.0022*	0.00048	NA	NA	*1.9*	*1.9*
SB-1, 6' bgs	2010-5-6	137.38	NA	*0.061*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB-1, 9' bgs	2010-5-9	101.54	NA	*0.061*	NA	NA	NA	NA	NA	NA	NA	NA	*2.0*	*2.0*
SB-2, 0' bgs	2010-6-0	5.73	1.5	*0.055*	*0.069*	*0.069*	0.025	*0.0024*	*0.0024*	0.00093	*0.034*	0.260	*89*	*89*
CAS Kelso			12.5											
SB-2, 3' bgs	2010-6-3	2.96	0.9	*0.060*	*0.079*	*0.079*	0.020	*0.0023*	*0.0023*	*0.0023*	*0.0040*	*0.00079*	*1.9*	*1.9*
SB-3, 0' bgs	2010-7-0	20.85	NA	*0.055*	*0.068*	*0.068*	0.087	*0.0024*	*0.0024*	0.0017	NA	NA	*87*	*87*
SB-3, 3' bgs	2010-7-3	1.32	NA	*0.062*	*0.081*	*0.081*	*0.081*	*0.0022*	*0.0022*	*0.0022*	NA	NA	*2.0*	*2.0*
DOH EALs		450	20	4.5	2.1	0.25	11				0.03	32	3	3.3

NA = not analyzed

Dioxin/furan TEQs calculated based on 2005 World Health Organization TEFs

Blue, italicized values indicate result below reporting limit, reporting limit provided.

Pink values indicate an estimated value.

Boldfaced value indicates concentration exceeds EAL.

Shaded value indicates reporting limit exceeds EAL.

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

Table 8: Multi-Increment Soil Sample Data, ETC 2006

Sample Location	Sample ID	TEQs (ng/kg)	Adjusted TEQ Values (ng/kg)	Arsenic (mg/kg)	Diuron (mg/kg)	Atrazine (mg/kg)	Simazine (mg/kg)	Ametryn (mg/kg)	Dieldrin (mg/kg)	Trifluralin (mg/kg)	PCP (mg/kg)	2,3,4,6-Tetrachloro-phenol (mg/kg)
Ring 1, DU1	2010-01-1	57.80	70.41	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU2	2010-01-2	38.97	47.48	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU3	2010-01-3	51.87	63.19	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU4	2010-01-4	146.22	178.13	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU5	2010-01-5	52.59	64.07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU6	2010-01-6	47.39	57.72	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU7	2010-01-7	156.04	190.09	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU8	2010-01-8	369.82	**450.51**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU9	2010-01-9	**484.75**	**590.52**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU10	2010-01-10	**819.30**	**998.07**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU11	2010-01-11	190.12	231.60	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU12	2010-01-12	80.27	97.79	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU13	2010-01-13	69.94	85.20	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU14	2010-01-14	67.86	82.67	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU15	2010-01-15	74.01	90.16	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU16	2010-01-16	83.74	102.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU17	2010-01-17	77.57	94.50	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU18	2010-01-18	79.41	96.73	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 1, DU19	2010-01-19	285.64	347.97	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phase I ESA Area	2010-03-1	15.70	19.13	4.4	0.022	0.055	*0.067*	*0.067*	*0.0034*	*0.00067*	*1.7*	*1.7*
Replicate, Ring 1, DU1	2010-04-1	37.26	45.39	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replicate, Ring 1, DU1	2010-04-2	53.25	64.86	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replicate, Ring 1, DU18	2010-05-01	84.37	102.77	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replicate, Ring 1, DU18	2010-05-02	91.98	112.05	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 2, DU11	2010-02-11	172.36	209.97	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 2, DU12	2010-02-12	353.37	430.48	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ring 2, DU13	2010-02-13	141.44	172.30	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replicate, Ring 2, DU13	2010-08-1	144.86	176.47	NA	NA	NA	NA	NA	NA	NA	NA	NA
DOH EALs		450	450	20	4.5	2.1	0.25	11	0.03	32	3	3.3

NA = not analyzed

Dioxin/furan TEQs calculated based on 2005 World Health Organization TEFs

Adjusted TEQ Values = TEQ values plus highest calculated RSD (21.82%).

Blue, italicized values indicate result below reporting limit, reporting limit provided.

Pink values indicate an estimated value.

Boldfaced value indicates concentration exceeds EAL.

Table 9: Groundwater Sample Data, ETC 2006

Sample Location	Sample ID	Dissolved Arsenic (mg/l)	Diuron (mg/l)	Atrazine (mg/l)	Simazine (mg/l)	Ametryn (mg/l)	Dieldrin (mg/l)	Trifluralin (mg/l)	PCP (mg/l)	2,3,4,6-Tetrachloro-phenol (mg/l)	Glyphosate (mg/l)
MW-2	2010-2	*0.0020*	*0.0010*	*0.0019*	*0.0019*	*0.0019*	*0.000096*	*0.000019*	*0.054*	*0.054*	*0.0046*
MW-3	2010-3	*0.0020*	0.0014	0.00096	*0.0019*	*0.0019*	*0.000096*	*0.000019*	*0.052*	*0.052*	*0.0046*
MW-4	2010-4	*0.0020*	*0.0010*	0.00093	*0.0019*	*0.0019*	*0.000096*	*0.000019*	*0.050*	*0.050*	*0.0046*
Replicate MW-3	2010-7	*0.0020*	0.0013	0.00088	*0.0019*	*0.0019*	*0.000096*	*0.000019*	*0.053*	*0.053*	*0.0046*
Development Water	2010-8	0.0011	0.00062	0.00069	*0.0019*	*0.0019*	*0.000094*	*0.000019*	*0.048*	*0.048*	*0.0046*
DOH EALs		0.069	0.2	0.35	0.01	0.15	0.00071	0.02	0.013	0.01	0.6

Blue, italicized values indicate result below reporting limit, reporting limit provided.

Pink values indicate an estimated value.

Shaded value indicates reporting limit exceeds EAL.

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

Table 10: Multi-Increment Soil Sample Data, DOH 2007

Sample ID	SL01	SL02	SL03	Default EAL
Pentachlorophenol	**11**	ND	**8.3**	3
2,3,4,6-Tetrachlorophenol	ND	ND	ND	3.3
Diuron	0.46	0.51	0.57	4.5
Chlorinated Herbicides (mg/kg)				
2,4-D	ND	ND	**400**	0.98
2,4-DB	ND	ND	ND	
2,4,5-T	ND	ND	ND	
2,4,4,5-TP	ND	ND	ND	
Dalapon	ND	ND	ND	1.4
Dicamba	ND	ND	ND	
Dichloropropene	ND	ND	ND	
Dinoseb	ND	ND	ND	
MCPA	ND	ND	ND	
MCPP	ND	ND	ND	
Dioxins TEQ (ppb)	**144.95**	NA	NA	0.45
Trifluralin	**49**	**58**	**63**	32
Atrazine	**8**	**33**	**41**	2.1
Ametryn	9	**27**	**35**	11
Dieldrin	ND	ND	ND	0.03
Simazine	ND	ND	ND	0.25

Table 11: SPLP Soil Sample Data and K_d Values, DOH 2007

Sample ID	SL01	K_d (SL01)	SL02	K_d (SL02)	SL03	K_d (SL03)	Composite	K_d (Composite)
SPLP (μg/l)								
Pentachlorophenol	ND		ND		ND			
Diuron	0.013	**15**	0.014	**16**	0.0041	120	5.1	86
Dieldrin	ND<0.0095		ND<0.004		ND<0.010			
Trifluralin	0.012	4100	0.0043	13000	0.012	5200	12	5000
Ametryn	0.0077	1100000	0.0076	3500	0.78	25	600	30
Simazine	0.002		0.0011		0.002			
Atrazine	0.33	**3**	0.13	230	0.79	32	1300	**6.9**

K_d values < 20 cm^3/g indicate potential leaching hazards

Table 12: Discrete Soil Sample Data - Arsenic, Lead, Dioxins, EPA January 2009

Samples Collected at 1-foot

Sample ID	Dioxin TEQ	Arsenic	Lead
EK-01	160	10	12
EK-02	110	*8*	16
EK-03	70	*8*	15
EK-04	84	11	14
EK-05	58	*9*	22
EK-06	73	*8*	15
EK-07	27	8	*8*
EK-08	83	**20**	*8*
EK-09	180	8	*8*
EK-10	210	11	*8*
EK-11	400	**25**	13
EK-12	31	9	23
EK-13	64	*9*	18
EK-14	46	*9*	23
EK-15	41	*9*	23
EK-16	94	9	15
EK-17	61	*9*	26
EK-18	99	10	19
EK-19	170	*9*	21
EK-20	**470**	12	30
EK-21	120	16	14
EK-22	28	9	*8*
EK-23	340	7	*8*
EK-24	6.1	11	*8*
EK-25	16	**64**	8
EK-26	56	*6*	*8*
EK-27	34	8	*8*
EK-28	54	**24**	27
EK-29	46	8	*8*
EK-30	42	*6*	*8*
EK-31	300	15	35
EK-32	90	*6*	*7*
EK-33	22	6	*8*
EK-34	13	9	*8*
EK-35	43	*6*	14
EK-36	17	*6*	*8*
EK-37	31	7	*8*
EK-39	23	*6*	*8*
EK-40	12	7	*7*
EK-41	6.4	**25**	*12*
EK-42	9.2	8	*7*
EK-43	34	*8*	16
EK-44	76	*9*	29
EK-45	94	*7*	17
EK-46	280	**20**	21
Mean	96.08	11.44	14.38
Std Dev	107.35	9.45	7.48
EALs	450	20	200

Samples Collected at 2-feet

Sample ID	Dioxin TEQ	Arsenic	Lead
EK-01	48	19	*11*
EK-02	110	*9*	20
EK-03	37	*9*	18
EK-04	44	*8*	23
EK-05	27	13	16
EK-06	75	9	21
EK-07	63	**90**	*9*
EK-08	73	**56**	18
EK-09	280	**95**	15
EK-10	210	*10*	*15*
EK-11	**480**	**30**	14
EK-21	50	14	10
EK-22	70	**30**	*8*
EK-23	200	*7*	11
EK-24	8	**519**	80
EK-25	8.4	**202**	12
EK-26	360	7	*8*
EK-27	15	8	*7*
EK-28	8	12	18
EK-29	18	19	*8*
EK-30	62	16	*9*
EK-31	39	--	--
EK-32	10	**21**	*7*
EK-33	5	7	*8*
EK-34	13	7	12
EK-35	15	11	44
EK-36	110	**44**	*9*
EK-37	40	14	*8*
EK-38	130	**67**	*8*
EK-39	63	**43**	*8*
EK-40	18	**105**	14
EK-41	15	**112**	128
EK-42	6.6	**308**	**203**
EK-43	80	*8*	17
EK-44	65	10	21
EK-45	9.5	*8*	18
EK-46	**880**	**20**	27
Mean	101.23	**54.64**	24.80
Std Dev	167.58	100.71	38.66
EALs	450	20	200

Dioxin TEQ results in ng/kg

Blue, italicized values indicate result below reporting limit, reporting limit provided.

Boldfaced value indicates concentration exceeds EAL.

Table 13: Multi-Increment Soil Sample Data, DOH 2009

Sample Location	TEQs (ng/kg)	DDT (mg/kg)	PCP (mg/kg)
Boiler Room 1	**447180**	*0.701*	***89.4***
Boiler Room 2	**1814480**	*0.701*	**20.3**
Boiler Room 3	**868080**	0.883	**28.4**
Spill Area 1	**427480**	**4.04**	**21.5**
Spill Area 2	**581720**	**3.56**	**20.4**
Spill Area 3	**371360**	**2.41**	**32.7**
DOH EALs	450	1.7	3

Collected by DOH HEER to be used in thermal desorption treatability study.

Dioxin/furan TEQs calculated based on 2005 World Health Organization TEFs

Blue, italicized values indicate result below reporting limit, reporting limit provided.

Boldfaced value indicates concentration exceeds EAL.

DOH EAL = Summer 2008 (October 2008 Update) Hawaii Department of Health, Default Tier 1 Environmental Action Levels, NDW, >150m

APPENDIX III

FIELD SAMPLE COLLECTION AND ANALYSIS LOG

Field Sample Collection/Analysis Log

Sample ID	Collection Date/Time	Depth (ft)	Incremental Subsampling	Arsenic	Dioxins	PCP	Triazines	SPLP PCP	SPLP Triazines	Clay Fraction	TOC	TCLP RCRA8	TCLP PCP	TCLP Pesticides
SA1.A		0-0.5	1	1	1	1	1	1	1	1	1	1	1	1
SA1.B		0.5-2	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA1.C		2-5	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA1.D		5-10	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA2.A		0-0.5	1	1	1	1	1	1	1	1	1	1	1	1
SA2.B		0.5-2	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA2.C		2-5	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA2.D		5-10	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA2.E*		0-0.5	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA2.F*		0-0.5	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA3.A		0-0.5	1	1	1	1	1	1	1	1	1	1	1	1
SA3.B		0.5-2	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA3.C		2-5	1	1	1	1	1	1	1	1	1	NA	NA	NA
SA3.D		5-10	1	1	1	1	1	1	1	1	1	NA	NA	NA
IA1		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IA2		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IA3		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IA4		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT1.A		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT1.B		0.5-2	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT1.C		2-3	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT1.D**		0.5-2	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT1.E**		0.5-2	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT2.A		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT2.B		0.5-2	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT2.C		2-3	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT3.A		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT3.B		0.5-2	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT3.C		2-3	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT4.A		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT4.B		0.5-2	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT4.C		2-3	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT5.A		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT5.B		0.5-2	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT5.C		2-3	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT5.D***		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
IAT5.E***		0-0.5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Subtotal:	37	37	37	14	14	14	14	14	14	3	3	3

NA = not analyzed
*Field replicate of SA2.A
**Field replicate of IAT1.B
***Field replicate of IAT5.A