KA'ELEPULU POND AND WETLAND DREDGING

KAILUA, O'AHU

SEDIMENT SAMPLING AND ANALYSIS REPORT

JUNE 2017

Prepared for:

Enchanted Lake Residents Association

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oceanit

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Introduction

As part of the efforts to maintain environmental quality and ecosystem services of Ka'elepulu Pond and Wetland, Oceanit has been hired by the Enchanted Lake Residents Association to design, permit, and provide bidding and construction phase support services for the Ka'elepulu Pond and Wetland Dredging project. This report covers efforts to sample and analyze sediments from the pond. This information will be used to provide input for the design of project best management practices and sediment disposal options as part of the final project design.

The objective of this Sediment Sampling Analysis Report is to detail the methods, physical observations, and chemical analysis results of the sediment sampling effort and to discuss the results as they pertain to the dredging project.

1.0 Project Background

Sediment Sampling and Analysis was conducted by Oceanit Laboratories Inc. under the authority of the Enchanted Lake Residents Association as a part of the contract referenced above. A prior planning study performed by AECOM (2008) is referenced.

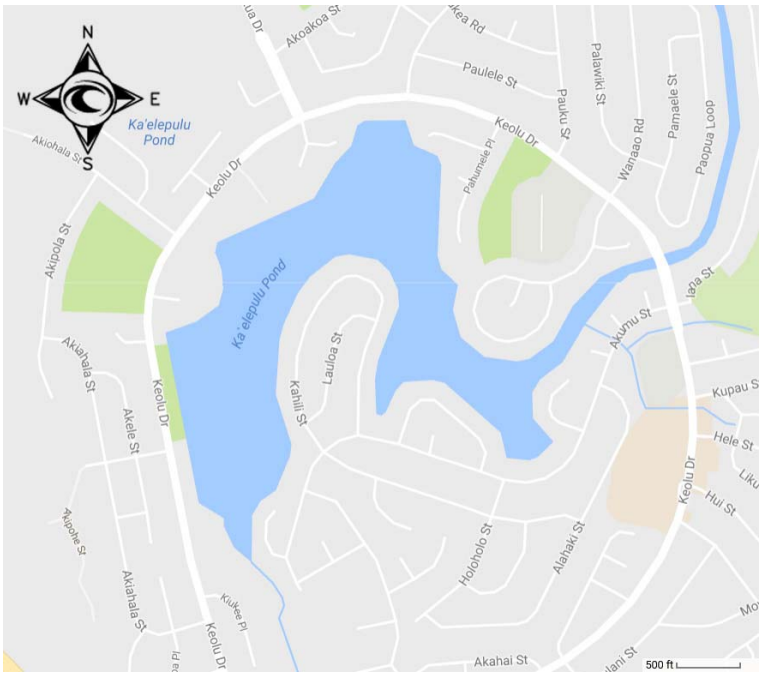


Figure 1-1. Pond location map.

1.1 Site Description, History, and Contaminants

Ka'elepulu stream, pond and wetland are located on the windward side of O'ahu in the Ko'olaupoko District (see Figure 1-1). The pond collects runoff from the Ka'elepulu watershed and has a basin area of approximately 79 acres and depth of approximately 9 feet.

Prior to urbanization of the area as a residential neighborhood in 1954, the area was used to grow sugar, taro, and rice. The area is now nearly completely urbanized with a shopping center, homes, and roadways. Throughout the development process, runoff from grading and filling operations was conveyed into the pond, causing shoaling at outfall locations. Currently a large shoal exists at the downstream end of Ka'elepulu Pond. The stream mouth openings that occur on an approximately monthly basis provide tidal flushing of the waters of the Ka'elepulu system. The shoal located at the outlet of Ka'elepulu Pond presents a hindrance to the flows that would improve water quality on a regular basis.

1.2 Existing Site Data and Previous Investigations

The 2008 AECOM study tested sediments taken from three locations within Ka'elepulu Pond and Wetland. The results tested negative for the presence of chlorinated pesticides and the RCRA 8 metals with exception of lead and chromium. The results of the sampling are shown below.

Table 3-3. Analytical Results

Organochlorine Pesticides	Method Blank	WKIP 52	WKIP 52 Dup	WKIP 14	WKIP 10	PQL	MDL	ERL	ERM	Units	MDL ERL Comp	MDL ERM Comp
Alpha-BHC	nd	nd	nd	nd	nd	0.005	0.002	*	*	mg/Kg		
Beta-BHC	nd	nd	nd	nd	nd	0.005	0.005	*	*	mg/Kg		
Gamma-BHC (Lindane)	nd	nd	nd	nd	nd	0.005	0.002	*	*	mg/Kg		
Delta-BHC	nd	nd	nd	nd	nd	0.005	0.004	*	*	mg/Kg		
Heptachlor	nd	nd	nd	nd	nd	0.005	0.002	*	*	mg/Kg		
Aldrin	nd	nd	nd	nd	nd	0.005	0.003	*	*	mg/Kg		
Heptachlor epoxide	nd	nd	nd	nd	nd	0.005	0.003	*	*	mg/Kg		
Gamma-Chlordane	nd	nd	nd	nd	nd	0.005	0.003	*	*	mg/Kg		
Endosulfan I	nd	nd	nd	nd	nd	0.005	0.004	*	*	mg/Kg		
Alpha-Chlordane	nd	nd	nd	nd	nd	0.005	0.003	*	*	mg/Kg		
Dieldrin	nd	nd	nd	nd	nd	0.01	0.003	*	*	mg/Kg		
p,p'-DDE	nd	nd	nd	nd	nd	0.01	0.005	0.002	0.027	mg/Kg	>ERL	<ERM
Endrin	nd	nd	nd	nd	nd	0.01	0.003	*	*	mg/Kg		
Endosulfan II	nd	nd	nd	nd	nd	0.01	0.005	*	*	mg/Kg		
p,p'-DDD	nd	nd	nd	nd	nd	0.01	0.003	0.002	0.020	mg/Kg	>ERL	<ERM
Endrinaldehyde	nd	nd	nd	nd	nd	0.01	0.005	*	*	mg/Kg		
Endosulfan sulfate	nd	nd	nd	nd	nd	0.01	0.005	*	*	mg/Kg		
p,p'-DDT	nd	nd	nd	nd	nd	0.01	0.005	0.001	0.007	mg/Kg	>ERL	<ERM
Endrin ketone	nd	nd	nd	nd	nd	0.01	0.005	*	*	mg/Kg		
Methoxychlor	nd	nd	nd	nd	nd	0.01	0.009	*	*	mg/Kg		
Chlordane (technical)	nd	nd	nd	nd	nd	0.05	0.005	0.001	0.006	mg/Kg	>ERL	<ERM
Toxaphene	nd	nd	nd	nd	nd	0.25	0.1	*	*	mg/Kg		

RCRA 8 Metals	Method Blank	WKIP 52	WKIP 52 Dup	WKIP 14	WKIP 10	PQL	MDL	ERL	ERM	Units
Lead (Pb)	nd	15	11	20	35	5	3.5	46.7	218	mg/Kg
Cadmium (Cd)	nd	nd	nd	nd	nd	1.25	0.5	1.2	9.6	mg/Kg
Chromium (Cr)	nd	11 (J)	9.1 (J)	30	53	12.5	5	81	370	mg/Kg
Arsenic (As)	nd	nd	nd	nd	nd	5	2	8.2	70	mg/Kg
Silver (Ag)	nd	nd	nd	nd	nd	1.25	1.5	1	3.7	mg/Kg
Barium (Ba)	nd	nd	nd	nd	nd	25	21	*	*	mg/Kg
Selenium (Se)	nd	nd	nd	nd	nd	12.5	7.5	*	*	mg/Kg
Mercury (Hg)	nd	nd	nd	nd	nd	0.5	0.1	0.15	0.71	mg/Kg
Nutrients	**Method Blank**	**WKIP 52**	**WKIP 52 Dup**	**WKIP 14**	**WKIP 10**	**PQL**	**RL**	**ERL**	**ERM**	**Units**
Total Kjeldhal Nitrogen	<1.0 (U)	1060	n/t	1300	n/t	257	257	*	*	mg-N/Kg
Total Phosphoruos	<.04 (U)	1050	n/t	987	n/t	130	130	*	*	mg/Kg
Grain Size	**Method Blank**	**WKIP 52**	**WKIP 52 Dup**	**WKIP 14**	**WKIP 10**					**Units**
% Gravel	na	20	na	30	n/t	na	na	na	na	%
% Sand	na	52	na	20	n/t	na	na	na	na	%
% Silt	na	18	na	22	n/t	na	na	na	na	%
% Clay	na	10	na	28	n/t	na	na	na	na	%

(J) = Estimated concentration when the value is less than ARI's established reporting limits

(U) = Indicates that the target analyte was not detected at the reported concentration

PQL = Practical Quantization Limit

MDL = Method Detection Limit

ERL = Effect Range-Low

ERM = Effect Range-Median

RL = Reporting Limit

n/t = Not Taken

* = No Data

Mg/Kg = milligrams per kilogram

Mg-N/Kg = Mg-Nitrogen per Kg

Dup = duplicate

na = not applicable

nd = not detected

Table 3-4. Sediment Analysis Percent Retained in Each Size Fraction

Location	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Fine Silt	Very Fine Silt	Clay	Total Fines
WKIP 52	21.3	12	14.1	14.9	7.3	3	11.4	2.5	2.2	2.0	9.3	27.4
WKIP 14	28.9	3.5	3.9	4.3	4.7	4.6	3.5	7.5	6.0	5.4	27.6	50.1
Hele Channel	68.7	18	6.5	2.5	1.6	1.1	na	na	na	na	na	1.7

na = Not Available (there was not enough fines to be split and stay within capacity of the balance)

1.3 Site-Specific Definition of Problems

Prior to commencement of the proposed dredging project, this study is being conducted to address the following questions:

Identification and Quantification of Contaminants: What pollutants, if any, are found in the stream-bottom sediments and in what quantities?

Disposal Options for Dredged Sediments: What limitations exist on disposal options, and what are potential disposal locations or beneficial uses?

1.4 Data Gaps

No record of chemical sediment testing could be found prior to the 2008 study referenced above. The pond has not been dredged since at least the time of neighborhood development.

1.5 Data Quality Objectives (DQOs)

Data from this study will supplement previous data. Data will be interpreted to help determine if any additional or special handling will be required during dredging and sediment disposal.

2.0 Project Scope and Objectives

The project objective is to characterize the current chemical characteristics of sediment within the design dredge depths in Ka'elepulu Pond. This information is needed to determine whether or not, and to what degree special handling and disposal methods will be required during dredging and sediment disposal. Recommendations for special dredged material handling and disposal will be provided based upon the data acquired.

2.1 Description of Tasks

Ka'elepulu Pond shall undergo a sediment chemical analysis: conducting sediment sampling, chemical analysis, comparison with Hawaii Department of Health Tier 1 Environmental Action Levels (EALs), and recommendations for the dredging and dredged material disposal plan.

2.2 Applicable Regulations/Standards

The sediment samples and selected analyses were chosen to demonstrate whether or not chemicals of concern are present in quantities such that the sediments pose a danger to the surrounding environment, or need to be managed as a hazardous waste. Recommended

Environmental Action Levels (EALs) set by the State of Hawaii Department of Health (DOH), Office of Hazard Evaluation and Emergency Response (HEER) in the document "Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater" (Summer 2008) were consulted to determine whether detected chemical compound levels are acceptable for the various disposal options.

2.3 Chain of Custody

Oceanit staff collected sediment samples at each of the predetermined locations within Ka'elepulu Pond on May 10, 2017. The samples were placed on ice after collection, field composited according to the protocol below, and delivered to AECOS Laboratories, where the samples were then tested. The chain of custody for these samples was documented.

3.0 Sampling Methods

3.1 Rationale/Design

This section outlines the rationale for the field sampling protocols. The goal is to provide the laboratory with unbiased, representative samples from sediments found in Ka'elepulu Pond for chemical analysis. Water level measurement data from an established water level benchmark was used to document sample elevations relative to Mean Sea level (MSL).

3.2 Quantity of Sediment Samples and Locations

3.2.1 Number of samples

A total of ten full-depth samples were collected from unique sample sites within the pond. Sample locations were documented using a handheld GPS and are considered to be accurate to within about 10-feet. Two areas within the pond (see below) were identified with each representing a decision unit. Samples were obtained from five points within each decision unit, and composited to create a single sample from each of the two decision units. Each composited sample was divided into two aliquots, with one being retained frozen for future possible additional analyses if necessary.

3.2.2 Location of samples and spatial analysis

The exact boundaries of the proposed dredge areas are defined by the pre-dredge bathymetric survey. The two decision units represent the two areas to be dredged that will produce the most sediment for disposal: the shoal where Ka'elepulu Pond outlets to Ka'elepulu Stream and the shoal adjacent to the proposed staging and dewatering site. Approximate surface area boundaries were drawn to represent the approximate dredging limits for these areas prior to completion of the bathymetric survey. Five locations within each decision unit (DU) were selected prior to the field event at approximate equidistant spacing. The coordinates of each sample site were overlaid onto a map and located in the field through digital GPS mapping software. The sampling location map is shown in Figure 4-1.

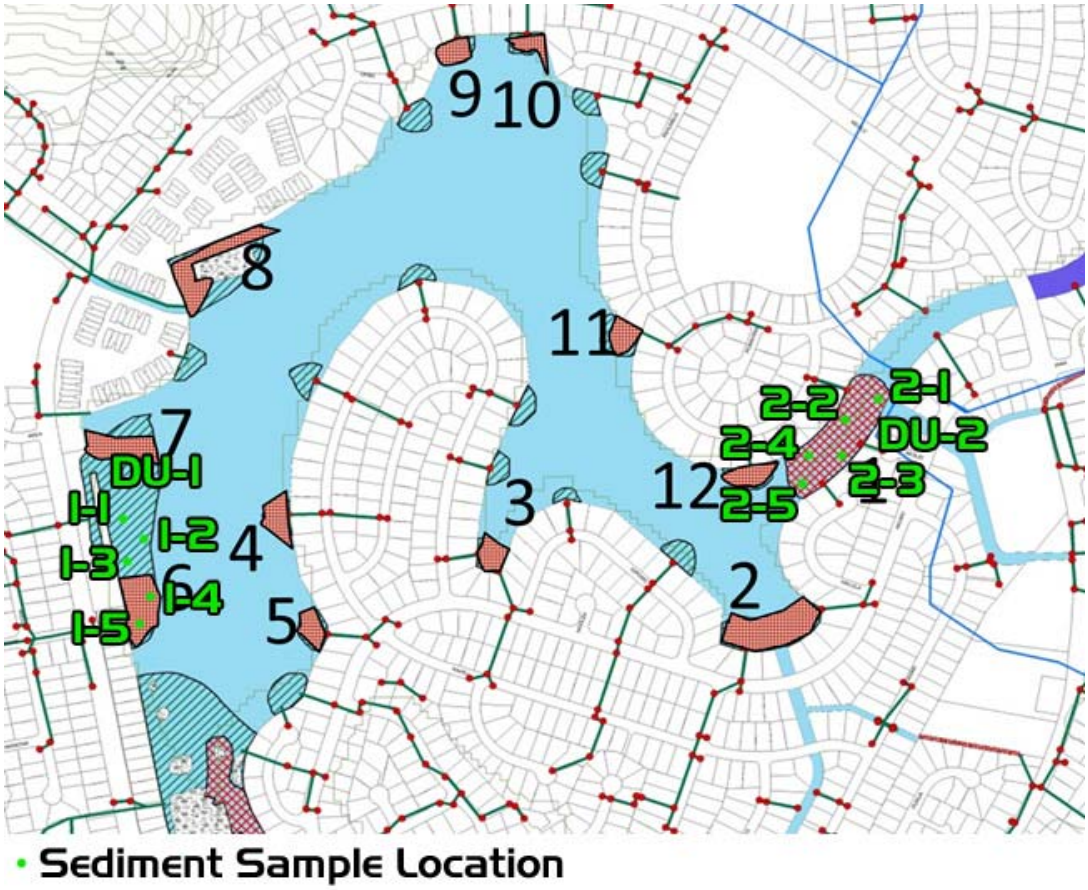


Figure 4-1. Decision Units and Sampling Locations at Ka'elepulu Pond

Location ID	WGS84 Deg Min Sec					
	N			E		
	D	M	S	D	M	S
1-1	21	22	45	-157	44	25
1-2	21	22	44	-157	44	24
1-3	21	22	43	-157	44	25
1-4	21	22	41	-157	44	24
1-5	21	22	40	-157	44	24
2-1	21	22	50	-157	43	52
2-2	21	22	50	-157	43	53
2-3	21	22	48	-157	43	53
2-4	21	22	48	-157	43	55
2-5	21	22	46	-157	43	55

Table 4-1. Sampling Location IDs & GPS Coordinates

3.3 Discrete/Composite Sediment Sampling Requirements

Discrete samples were taken from each location to a range of depths below substrate surface from 2.1' to 5.2'. Each of the samples from each decision unit were combined into one homogeneous composite sample.

3.4 Sample Collection and Field and Laboratory Analysis

After compositing, samples collected were immediately placed on ice and prepared for delivery to the laboratory for analysis. None of the analyses were conducted in the field. Each composite sample was tested for all identified priority pollutants.

3.5 Field Procedures

Sampling took place from a small boat that was navigated into position over each sampling point with the use of digital GPS mapping. To prevent drifting at each site, the boat was moored to the pond bottom using a three point mooring with small anchors. Time of day and water depth was noted after mooring at each location.

3.5.1 Sampling Methods and Procedures for Underwater Sediments

At each location a clean, beveled end 1.5" PVC pipe was forced by hand into the pond bed sediment until refusal. A lumber cushion was placed on top of the PVC pipe and a small sledge hammer used to drive the pipe into the sediment. Pipes were hammered until either hard surface was reached, one foot below approximate dredge depth was reached, or the top of the pipe extended below the water surface. After reaching the proper depth, the distance from the water surface to the top of the pipe was measured, the top of the pipe filled with water, capped such that an airtight seal is made, and the pipe extracted using a twisting motion. On the boat, the bottom of each pipe was capped and the pipe labeled with sample location ID and 'Up' direction. Samples from five locations (one DU) were collected before returning to shore.

On shore, the top caps were removed and water decanted from above the sediment cores. The distance from the top of the pipe to the top of the sediment core was measured. The bottom caps were then removed and each pipe's contents were placed into a clean 5 gallon bucket. They were then mixed with a clean pair of wooden chop sticks until homogenous. Once each location sample was well mixed, equal amounts of each sample were composited into a stainless steel bowl. A stainless steel spoon was used to mix the composite sample in the stainless steel bowl until homogenous. Lab provided glass sample jars were filled, two for each DU and placed on ice. Three samples were submitted to the lab, one from each DU and one duplicate sample from DU #2. One sample from each DU were saved and placed into a freezer for preservation. All samples were labeled using indelible ink and placed in a cooler on ice after composition.

3.5.2 Sample Containers and Preservation Techniques

Certified clean sample containers were provided by AECOS Laboratory. Eight (8) ounce glass jars with Teflon lids will contain the samples for each of the DUs to be analyzed for

pesticides and heavy metals. Filled bottles will immediately be chilled on ice in coolers while in the field.

3.5.3 Decontamination Procedures

Gloves used by personnel were replaced between sample sites. The PVC coring tubes used for sampling as well as stainless steel bowls and utensils used for homogenizing core samples were not reused between each decision unit sample.

4.0 Results

4.1 Field Logbook and/or Sample Field Sheets

A field notebook with numbered, water resistant pages was kept noting the date, weather conditions, personnel, time and location of each sediment sample, sample bottle label, analyses to be performed, general water conditions, depth and any personal protective equipment used. The chain of custody (COC) form numbers and the total sample bottle count will also be recorded upon delivery to the laboratory.

4.2 Photographic Records

A digital camera was used on site to record any noteworthy findings or events and document site conditions and sampling locations. A photo record of the sampling events with a photographic record in Section 4.6

4.3 Sample Documentation

4.3.1 Sample Numbering and Labels

Sample bottles were numbered sequentially starting from one. Sample bottles were directly marked with indelible ink, including the project code, site name, sample identification number, date.

4.3.2 Chain-of-Custody Records

A chain of custody form was initiated upon transfer of the samples from Oceanit personnel to the laboratory responsible for sample shipment. Thereafter the chain of custody form was filled in by each of the respective labs performing analyses. Originals of all chain of custody documents will be furnished by the laboratories with the analysis results.

4.4 Documentation Procedures/Data Management and Retention

Copies of all documentation are included in this report. Originals are maintained by Oceanit.

4.5 Summary of Results & Conclusion

Samples collected in the field were analyzed and the results are summarized in Table 4-2.

4.5.1 Dredged Material Handling & Disposal

No Organochlorine pesticides were detected in DU-1 or DU-3. Trace levels of the Organochlorine pesticides Chlordane, Alpha-Chlordane, Gamma-Chlordane, Trans-Nonachlor and 2,4'-DDE were detected in DU-2, although none of the levels were above Tier 1 EALs. These same compounds were not detected in the field control duplicate of DU-2. All nine RCRA metals were detected in both decision units, but all were well below the Tier 1 EALs.

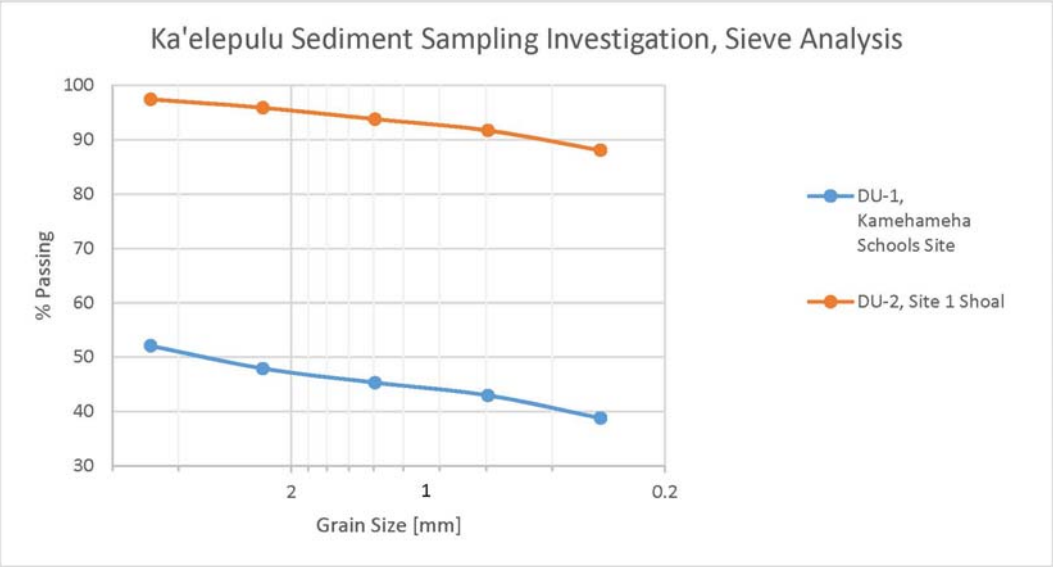
Based on the results of the chemical testing of the sediment, it would not be classified as hazardous waste nor would any restrictions be placed upon the distribution of this material based upon any contaminant levels. Sediment from DU-1, DU-2 and DU-3 is determined to be found suitable for potential disposal as solid waste at a permitted upland landfill, on-site at an upland disposal site or at another upland location off-site.

Ka'elepulu Pond Sediment Sampling Chemical Results & Corresponding EALs June 2017				
Parameter Analyzed	Tier 1 Soil EALs (Summer 2016, Table B 2)	DU-1	DU-2	DU-2 (Duplicate)
1) Metals (all values in mg/kg)				
Arsenic	24	4.93	1.47	1.34
Barium	1,000	10.1	19.3	18.2
Cadmium	14	0.473	0.502	0.427
Chromium	1,100	66.6	144	137
Lead	200	5.85	31.6	24.3
Mercury	5	<0.0426	1.32	1.19
Selenium	78	1.54	<0.194	<0.188
Silver	78	<0.224	<0.369	<0.0358
2) Organochlorine Pesticides (all values in µg/kg)				
Aldrin	3,900	<2.2	<1.9	<1.9
Alpha-BHC	-	<4.5	<3.9	<3.7
Beta-BHC	-	<2.2	<1.9	<1.9
Delta-BHC	-	<4.5	<3.9	<3.7
Gamma-BHC	-	<2.2	<1.9	<1.9
Chlordane	17,000	<22	28	<19
Dieldrin	2,500	<2.2	<1.9	<1.9
Trans-Nonachlor	-	<2.2	3.3	2.4
2,4'-DDD	-	<2.2	<1.9	<1.9
2,4'-DDE	-	<4.5	<3.9	<3.7
2,4'-DDT	-	<2.2	<1.9	<1.9
4,4'-DDD	-	<2.2	3.4	<1.9
4,4'-DDE	-	<2.2	4.7	4.4
4,4'-DDT	-	<2.2	<1.9	<1.9
Endosulfan I	13,000	<2.2	<1.9	<1.9
Endosulfan II		<2.2	<1.9	<1.9
Endosulfan Sulfate	-	<2.2	<1.9	<1.9
Endrin	3,800	<2.2	<1.9	<1.9
Endrin Aldehyde	-	<2.2	<1.9	<1.9
Endrin Ketone	-	<2.2	<1.9	<1.9
Heptachlor	140	<2.2	<1.9	<1.9
Heptachlor Epoxide	71	<4.5	<3.9	<3.7
Methoxychlor	16,000	<2.2	<1.9	<1.9
Toxaphene	490	<45	<39	<37
Alpha-Chlordane	-	<2.2	5.1	2.7
Gamma-Chlordane	-	<4.5	5.6	<3.7
Cis-nonachlor	-	<2.2	3.0	<1.9
Oxychlordane	-	<2.2	<1.9	<1.9
Mirex	-	<2.2	<1.9	<1.9

NOTES:

•EALs taken from 'Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater', Hawaii DOH, Rev Summer 2016, Table B-2: Soil Action Levels (Potentially impacted groundwater is not a current or potential drinking water resource; Surface water body is located within 150m of release site)
•A dash indicates EAL not available

Table 4-2. Sediment Sample Chemical Results



A sieve analysis was performed on the material from each decision unit

4.6 Photographs

Samples were taken over the stern of a small vessel with an A frame to assist in lifting when necessary

Figure The samples were collected using 1.5" PVC pipe and transferred to clean plastic buckets

Samples were mixed and composited in stainless steel bowls with a stainless steel spoon