Draft

ENVIRONMENTAL HAZARD MANAGEMENT PLAN

Installation of Emergency Generators Associated with a Portion of TMK No.: (4) 1-2-02:001 Kekaha, Kauai, Hawaii

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ENVIRONMENTAL HAZARD MANAGEMENT PLAN
KEKAHA, KAUAI, HAWAII

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ACRONYMS AND ABBREVIATIONS

ac	acre(s)
ADC	Agribusiness Development Corporation
ASTM	American Society for Testing and Materials
BMP	Best management practice
CFR	Code of Federal Regulations
COPCs	Contaminants of Potential Concern
CSM	Conceptual Site Model
DLNR	Department of Land and Natural Resources
DU	Decision Unit
EAL	Environmental Action Level
EHMP	Environmental Hazard Management Plan
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
ft	feet/foot
ha	hectare(s)
HAZWOPER	Hazardous Waste Operations & Emergency
HDOH	State of Hawaii Department of Health
HEER	Hazard Evaluation and Emergency Response
HiOSH	Hawaii State Occupational Safety & Health
HRS	Hawaii Revised Statutes
KAA	Kekaha Agriculture Association
KSC	Kauai Sugar Company
m	meter(s)
mg/kg	milligrams per kilogram
NPDES	National Pollutant Discharge Elimination System
ng/kg	nanograms per kilogram
OSHA	Occupational Safety and Health Administration
PBET	Physiologically Based Extraction Test
PPE	Personal Protective Equipment
SI	Site Investigation
SSHP	Site-specific Safety and Health Plan
TBA	Targeted Brownfields Assessment
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxicity Equivalent
TMK	Tax Map Key
U.S.	United States
WP	Work Plan
WQC	Water Quality Certification

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1.0 INTRODUCTION AND PURPOSE

The Agribusiness Development Corporation (ADC), an agency administratively attached to the State of Hawaii Department of Agriculture, recently completed the State of Hawaii Environmental Review process (Hawaii Revised Statutes [HRS] 343) for the proposed installation of three containerized diesel-powered generator units on a single concrete pad. The generators will provide emergency back-up power to operate the existing drainage and irrigation system of the Kekaha Agricultural Lands. The proposed location of the project (project site), including alternative locations, is a 3.2 acre (ac) portion of land within the 13,000 ac Tax Map Key (TMK) (4) 1-2-02: Parcel 001. A portion of the project site was the Former Kekaha Sugar Company (KSC) Herbicide/Pesticide Mixing Facility. The project site was also formerly used for sugar cane cultivation.

The State of Hawaii Department of Health (HDOH), Hazard Evaluation and Emergency Response (HEER) Office identified this site to have potential for soil contamination and requested a Phase II Environmental Site Assessment (ESA). The ESA conducted by TEC for ADC in 2010 identified bio-accessible arsenic and dioxins/furans at concentrations greater than the applicable HDOH environmental action levels (EALs). .

The State of Hawaii Department of Health (HDOH), HEER Office, under the United States Environmental Protection Agency (USEPA [EPA]) Targeted Brownfields Assessment (TBA) Grant, conducted an environmental assessment to determine the lateral extent of contamination at the site brought about by previous sugarcane production. Results of the investigation indicated levels of dioxin and arsenic above the HDOH Environmental Action Levels (EAL) for residential landuse but below the EAL for commercial/industrial landuse. Based on the proposed use of the site for installation of diesel generator, an EHMP is required by HDOH. This EHMP incorporates the results of the Environmental Assessment in 2010 and the Phase I/II Investigation under TBA. To enable ADC to move forward with its proposed project, a preliminary EHMP has been prepared. It includes:

- A summary of the site history and investigations to date,
- Identification of the contaminants of potential concern (COPCs),
- The nature and extent of residual contamination,
- Potential environmental concerns from contamination,
- Institutional and engineering controls to address environmental concerns,
- Guidance on handling contaminated media during future site activities,
- Protections for construction workers,
- Site access restrictions, and
- Measures for disturbed or breached engineering controls.

2.0 BACKGROUND

A description of the project site, including history, site investigation (SI) history, COPCs, and conceptual site model (CSM) is provided below.

2.1 SITE DESCRIPTION

The project site is located in the western Kauai town of Kekaha (Figure 2-1). The TMK parcel associated with the project site measures approximately 13,000 ac. The project site is a small portion of the parcel, measuring approximately 3.2 ac, as seen in Figure 2-2. The project site consists of a flat, sparsely vegetated parcel triangular in shape, bordered by roads on two sides and an irrigation canal to the north.

The generator installation site is located within the 3.2 ac project site. The generator installation site will include a pad for the generators and associated components, as well as a 6,000 gallon fuel tank. The area will include a roof and fence. The fenced area is anticipated to be approximately 108 by 68 feet (ft), occupying a total of 7,323 square ft (0.17 ac).

The project site is easily accessed via Hukipo Road. It is directly across the street from a storage shed area, which is regularly accessed by Kekaha Agriculture Association management and contractors. The site is approximately 500 ft (150 m) from Kekaha Road, the nearest main route. Kaumualii Highway is located approximately 1,500 ft (500 meters [m]) south of the site.

2.2 HISTORIC LAND USE

The project site is located north of Old Kekaha Sugar Mill. A carpenter shop and a paint shop are located on the east adjacent property. The Former KSC Office is located to the west. A portion of the project site was the Former KSC Herbicide/Pesticide Mixing Facility. The project site was also formerly used for sugar cane cultivation. Soils associated with former sugarcane production facilities have been identified as areas with potential contamination of arsenic, lead, mercury, dioxins/furans, and pesticides such as pentachlorophenol (HDOH 2009).

2.3 CURRENT LAND USE

Current land use is designated agricultural, which is considered a restricted use under HDOH guidelines (2009). The project site is currently not in use; however remnants of past activities are still visible on-site, including an old shelter and piping material. The project site is bordered by a canal and agricultural plot to the north. A carpenter shop is located approximately 50 feet east of the project site and fueling tanks are located approximately 100 feet west of the project site.

2.4 SUMMARY OF PROJECT SITE INVESTIGATION HISTORY

In 2010, TEC was contracted to perform a Phase II ESA at the proposed generator installation site. The Phase II consisted of multi-incremental surface soil sampling for COPCs associated with the former sugarcane cultivation operations. The 3.2 ac sample area was divided into three relatively equal decision units (DU1, DU2, and DU3), each slightly larger than one (1) ac (Figure 2-3). The laboratory results identified arsenic and dioxins/furans in soil at levels greater than applicable HDOH EALs (HDOH 2008; 2010a; 2010b) (Table 2-1 and 2-2). HDOH subsequently required the preparation of an Environmental Hazard Management Plan (EHMP) prior to the initiation of construction activities at the project site.

HDOH has proposed to further characterize the site by sampling the boundary of the project site in attempts to define the lateral extent of the contamination. Under the EPA TBA Grant, the EPA Contractor, Weston Solutions, Inc. collected soil samples around the former herbicide mixing and loading area to determine the lateral extent of contamination. The results of the TBA can be viewed in the Remedial Action Work Plan, however are incorporated in this EHMP.

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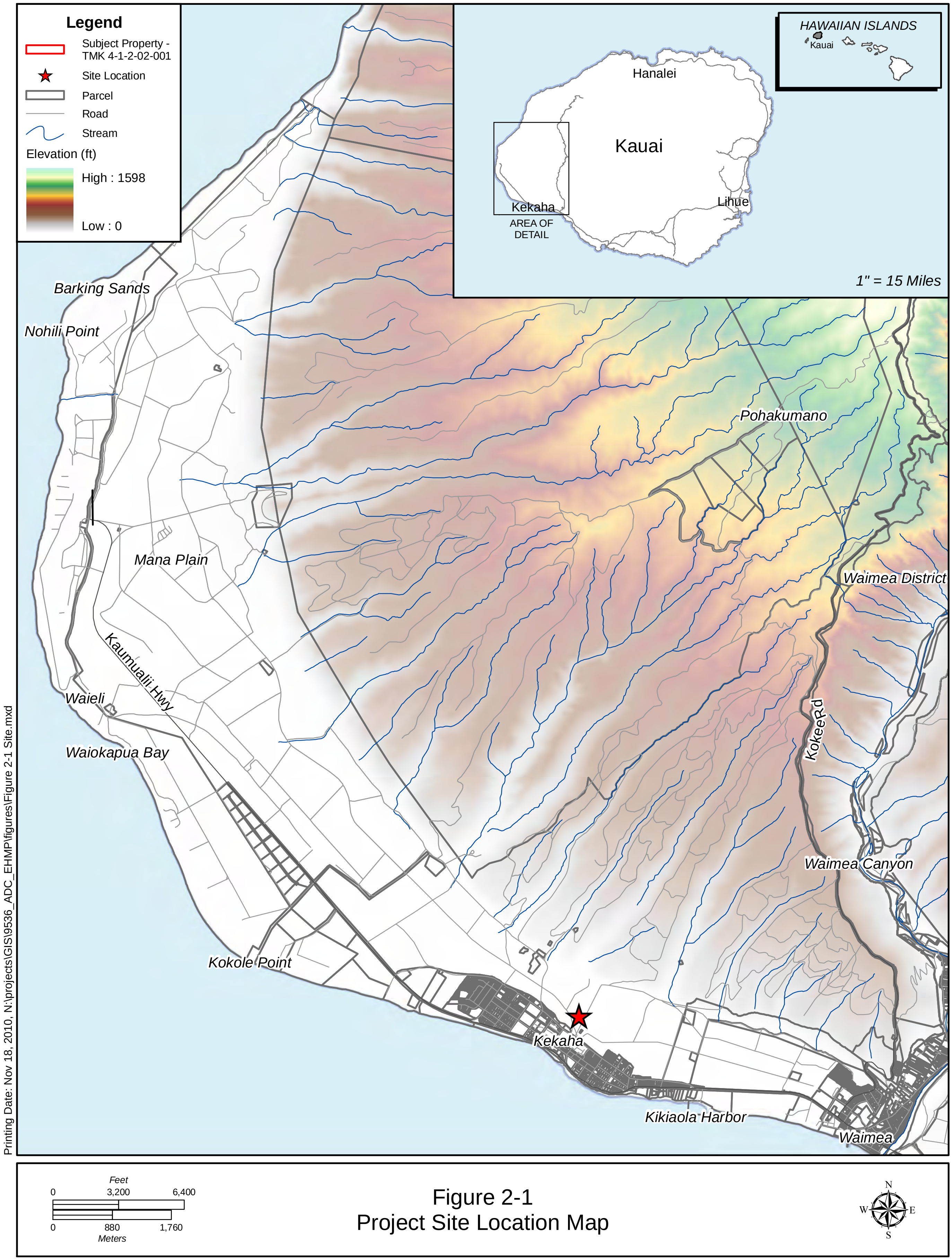

Figure 2-1
Project Site Location Map

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Feet
0 110 220
0 30 60
Meters

Figure 2-2
Aerial Overview of the Project Site

N W E S

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Printing Date: Dec 2, 2010, N:\projects\GIS\9536_ADC_EHMP\figures\Figure 2-3 DU.mxd

Figure 2-3
Phase II ESA Decision Units

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Table 2-1. Phase II ESA Analytical Results for Surface Soil Multi-Increment Sample Collection
Portion of TMK No: (4) 1-2-02:001, Kekaha, Kauai, Hawaii

Method	Chemical	Units	HDOH Tier 1 EALs	Decision Unit 1 KSS01 July 15, 2010				Decision Unit 2 KSS02 July 15, 2010				Decision Unit 2 (Duplicate) KSS04 July 15, 2010				Decision Unit 2 (Triplicate) KSS05 July 15, 2010				Decision Unit 3 KSS03 July 15, 2010			
				Result	DQ	MDL	RL	Result	DQ	MDL	RL	Result	DQ	MDL	RL	Result	DQ	MDL	RL	Result	DQ	MDL	RL
6010/7471 (Heavy Metals)	ALUMINUM	mg/kg		7,740		0.755	199	7,560		0.73	192	6,850		0.722	190	6,130		0.731	192	6,810		0.721	190
	ARSENIC	mg/kg	20	21.2		0.0795	9.94	13.8		0.0768	9.61	13.2		0.076	9.5	13.1		0.0769	9.62	90		0.0759	9.49
	BARIUM	mg/kg	750	23		0.0835	19.9	27.9		0.0807	19.2	25.2		0.0798	19	24.9		0.0808	19.2	21.7		0.0797	19
	CADMIUM	mg/kg	12	ND		0.0805	3.98	ND		0.0778	3.84	ND		0.0769	3.8	ND		0.0779	3.85	ND		0.0769	3.8
	CALCIUM	mg/kg		215,000		8.25	1,990	253,000		7.97	1,920	247,000		7.88	1,900	267,000		7.98	1,920	244,000		7.87	1,900
	CHROMIUM	mg/kg	500	109		0.0726	9.94	99.1		0.0701	9.61	91.3		0.0693	9.5	87.4		0.0702	9.62	93.6		0.0693	9.49
	COBALT	mg/kg	40	20.5		0.0586	19.9	18.1	J	0.0567	19.2	17	J	0.056	19	15.9	J	0.0567	19.2	17.6	J	0.056	19
	IRON	mg/kg		36,300		4.77	994	30,200		0.922	192	27,200		0.912	190	27,700		0.923	192	24,500		0.911	190
	LEAD	mg/kg	200	76.9		0.0696	19.9	97.3		0.0672	19.2	90.5		0.0665	19	105		0.0673	19.2	16.3	J	0.0664	19
	MAGNESIUM	mg/kg		19,200		3.83	994	18,900		0.74	192	17,400		0.731	190	17,700		0.74	192	19,700		0.731	190
	MANGANESE	mg/kg		530		0.413	49.7	520		0.399	48	463		0.0788	9.5	452		0.0798	9.62	523		0.394	47.4
	MERCURY	mg/kg	4.7	0.165		0.000462	0.0231	0.0626		0.0000996	0.00498	0.0525		0.0000986	0.00493	0.0648		0.0001	0.00501	0.364		0.000498	0.0249
	POTASSIUM	mg/kg		522		0.944	199	538		0.913	192	545		0.902	190	526		0.913	192	553		0.901	190
	SELENIUM	mg/kg	10	2.92	J	0.0895	19.9	2.32	J	0.0865	19.2	2.84	J	0.0855	19	2.85	J	0.0865	19.2	2.77	J	0.0854	19
	SILVER	mg/kg	20	0.671	J	0.00696	9.94	0.0538	J	0.00672	9.61	0.53	J	0.00665	9.5	0.329	J	0.00673	9.62	0.309	J	0.00664	9.49
	SODIUM	mg/kg		1,360		1.04	199	1,770		1.01	192	1,590		0.997	190	1,540		1.01	192	1,540		0.996	190
	THALLIUM	mg/kg	1	ND		0.0298	39.8	ND		0.0288	38.4	ND		0.0285	38	ND		0.0288	38.5	ND		0.0285	38
	VANADIUM	mg/kg	110	46.7		0.0706	19.9	42.7		0.0682	19.2	37.1		0.0674	19	35.9		0.0683	19.2	38.1		0.0674	19
	ANTIMONY	mg/kg	6.3	2.1	J	0.0596	19.9	1.8	J	0.0576	19.2	2.27	J	0.057	19	1.78	J	0.0577	19.2	2.56	J	0.0569	19
	BERYLLIUM	mg/kg	4	ND		0.0623	0.994	ND		0.0602	0.961	ND		0.0595	0.95	ND		0.0603	0.962	ND		0.0595	0.949
	COPPER	mg/kg	230	36.9		0.0775	19.9	49.7		0.0749	19.2	76.8		0.0741	19	50		0.075	19.2	26		0.074	19
	NICKEL	mg/kg	150	113		0.0795	19.9	93.8		0.0768	19.2	91.7		0.076	19	85.4		0.0769	19.2	98		0.0759	19
	ZINC	mg/kg	600	117		0.0696	19.9	113		0.0672	19.2	198		0.0665	19	121		0.0673	19.2	48.2		0.0664	19
PBET (Bioaccessible Arsenic)	BIO-ACCESSIBLE ARSENIC	mg/kg	20	ND		0.08	1	NA		NA	NA	NA		NA	NA	NA		NA	NA	47.5		0.08	1
	TOTAL ARSENIC	mg/kg	20	26.2		0.0748	0.935	NA		NA	NA	NA		NA	NA	NA		NA	NA	126		0.063	0.787
8151A (Herbicides)	2,4,5-T	mg/kg	5.5	ND	*	0.0037	0.02	ND	*	0.0037	0.02	ND	*	0.0037	0.02	ND	*	0.0037	0.02	ND	*	0.0036	0.019
	2,4-D	mg/kg	0.2	ND	*	0.016	0.079	ND	*	0.016	0.08	ND	*	0.016	0.08	ND	*	0.016	0.079	ND	*	0.016	0.077
	2,4-DB	mg/kg		ND	*	0.013	0.079	ND	*	0.013	0.08	ND	*	0.013	0.08	ND	*	0.013	0.079	ND	*	0.013	0.077
	DALAPON	mg/kg	0.14	ND	*	0.0055	0.039	ND	*	0.0056	0.04	ND	*	0.0056	0.04	ND	*	0.0056	0.04	ND	*	0.0054	0.039
	DICAMBA	mg/kg		ND	*	0.0041	0.039	ND	*	0.0042	0.04	ND	*	0.0042	0.04	ND	*	0.0041	0.04	ND	*	0.004	0.039
	DICHLORPROP	mg/kg		ND	*	0.016	0.079	ND	*	0.017	0.08	ND	*	0.017	0.08	ND	*	0.016	0.079	ND	*	0.016	0.077
	DINOSEB	mg/kg		ND	*	0.0019	0.012	ND	*	0.0019	0.012	ND	*	0.0019	0.012	ND	*	0.0019	0.012	ND	*	0.0018	0.012
	MCPA	mg/kg		ND	*	2.5	7.9	ND	*	2.5	8	ND	*	2.5	8	ND	*	2.5	7.9	ND	*	2.4	7.7
	SILVEX (2,4,5-TP)	mg/kg	0.4	ND	*	0.0018	0.02	ND	*	0.0018	0.02	ND	*	0.0018	0.02	0.0021	J*	0.0018	0.02	ND	*	0.0017	0.019
	MCPP	mg/kg		ND	*	1.6	7.9	ND	*	1.6	8	ND	*	1.6	8	ND	*	1.6	7.9	ND	*	1.5	7.7

Notes:

NA - Not analyzed
ND - Indicates that the analyte was not detected above the MDL
mg/kg - milligrams per kilogram
PBET - Physiologically Based Extraction Test
HDOH Tier 1 EALs - Tier 1 Soil Environmental Action Levels set by the Hawaii Department of Health (2008, updated in 2009)
212 - Result exceeded the HDOH Tier 1 EAL

DQ - Data qualifier
MDL - Method detection limit
RL - Reporting limit
J - Result is less than the RL bur greater than or equal to the MDL and the concentration is an approximate value
* - Laboratory control spike or the laboratory control spike duplicate exceeds the control limits

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Table 2-2. Phase II ESA Analytical Results of Dioxins/Furans for Surface Soil Multi-Increment Sample Collection
Portion of TMK No: (4) 1-2-02:001, Kekaha, Kauai, Hawaii

Method	Chemical	Units	HDOH Tier 1 EALs	Decision Unit 1 KSS01 July 15, 2010				Decision Unit 2 KSS02 July 15, 2010				Decision Unit 3 KSS03 July 15, 2010			
				Result	DQ	TEF	TEQ	Result	DQ	TEF	TEQ	Result	DQ	TEF	TEQ
8290 (Dioxins/ Furans)	2,3,7,8-TCDD	ng/kg		30		1	30	12		1	12	130		1	130
	Total TCDD	ng/kg		130				25				180			
	1,2,3,7,8-PeCDD	ng/kg		220		1	220	23		1	23	78		1	78
	Total PeCDD	ng/kg		910				74				350			
	1,2,3,4,7,8-HxCDD	ng/kg		450		0.1	45	49		0.1	4.9	120		0.1	12
	1,2,3,6,7,8-HxCDD	ng/kg		1,400		0.1	140	360		0.1	36	640		0.1	64
	1,2,3,7,8,9-HxCDD	ng/kg		1,100		0.1	110	130		0.1	13	350		0.1	35
	Total HxCDD	ng/kg		9,600				1,400				3,600			
	1,2,3,4,6,7,8-HpCDD	ng/kg		38,000	E, G	0.01	380	10,000	E, G	0.01	100	25,000	E, G	0.01	250
	Total HpCDD	ng/kg		71,000				17,000				49,000			
	OCDD	ng/kg		300,000	E, G	0.0003	90	110,000	E, G	0.0003	33	260,000	E, G	0.0003	78
	2,3,7,8-TCDF	ng/kg		23	CON	0.1	2.3	4.4	Q CON	0.1	0.44	6	CON	0.1	0.6
	Total TCDF	ng/kg		140				41				360			
	1,2,3,7,8-PeCDF	ng/kg		42		0.03	1.26	14	J	0.03	0.42	10	J	0.03	0.3
	2,3,4,7,8-PeCDF	ng/kg		47		0.3	14.1	12	J	0.3	3.6	15	J	0.3	4.5
	Total PeCDF	ng/kg		800				180				530			
	1,2,3,4,7,8-HxCDF	ng/kg		430		0.1	43	78		0.1	7.8	170		0.1	17
	1,2,3,6,7,8-HxCDF	ng/kg		410		0.1	41	52		0.1	5.2	120		0.1	12
	2,3,4,6,7,8-HxCDF	ng/kg		250		0.1	25	39		0.1	3.9	86		0.1	8.6
	1,2,3,7,8,9-HxCDF	ng/kg		ND		0.1	0.86*	ND		0.1	2.7*	ND		0.1	0.6*
	Total HxCDF	ng/kg		8,100				2,000				5,500			
	1,2,3,4,6,7,8-HpCDF	ng/kg		7,100		0.01	71	1,600		0.01	16	4,100	G	0.01	41
	1,2,3,4,7,8,9-HpCDF	ng/kg		580		0.01	5.8	100		0.01	1	320	G	0.01	3.2
	Total HpCDF	ng/kg		24,000				6,600				18,000			
	OCDF	ng/kg		18,000	E	0.0003	5.4	5,300		0.0003	1.59	11,000		0.0003	3.3
	Total TEQ Concentration	ng/kg	240				**1,225**				**265**				**738**

Notes:

DQ - Data qualifier
CON - Semi-volatile organic compounds
E - Estimated result, concentration exceeds the calibration range
G - Elevated reporting limit due to matrix interference
J - Estimated result, results is less than the reporting limit
Q - Estimated maximum possible concentration (EMPC)
TEF - Toxicity Equivalence Factor, set by the World Health Organization in 2005 (HDOH 2009)
TEQ - Toxicity Equivalent concentration, TEQ= Result x TEF
ng/kg - nanograms per kilograms
ND - Indicates that the analyte was not detected above the dection limit (DL)
* - For analytes not detected above the DL, TEQ=DL x TEF

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3.0 MAP OF AREAS WITH CONTAMINANTS ABOVE TIER 1 EALS

Figure 3-1 shows the project site and areas that exceeded the Tier 1 EALs for bio-accessible arsenic and Toxicity Equivalent (TEQ) dioxins. As part of the EPA TBA, HDOH collected additional samples to determine the lateral extent of the contamination (see RA WP, TEC 2011).

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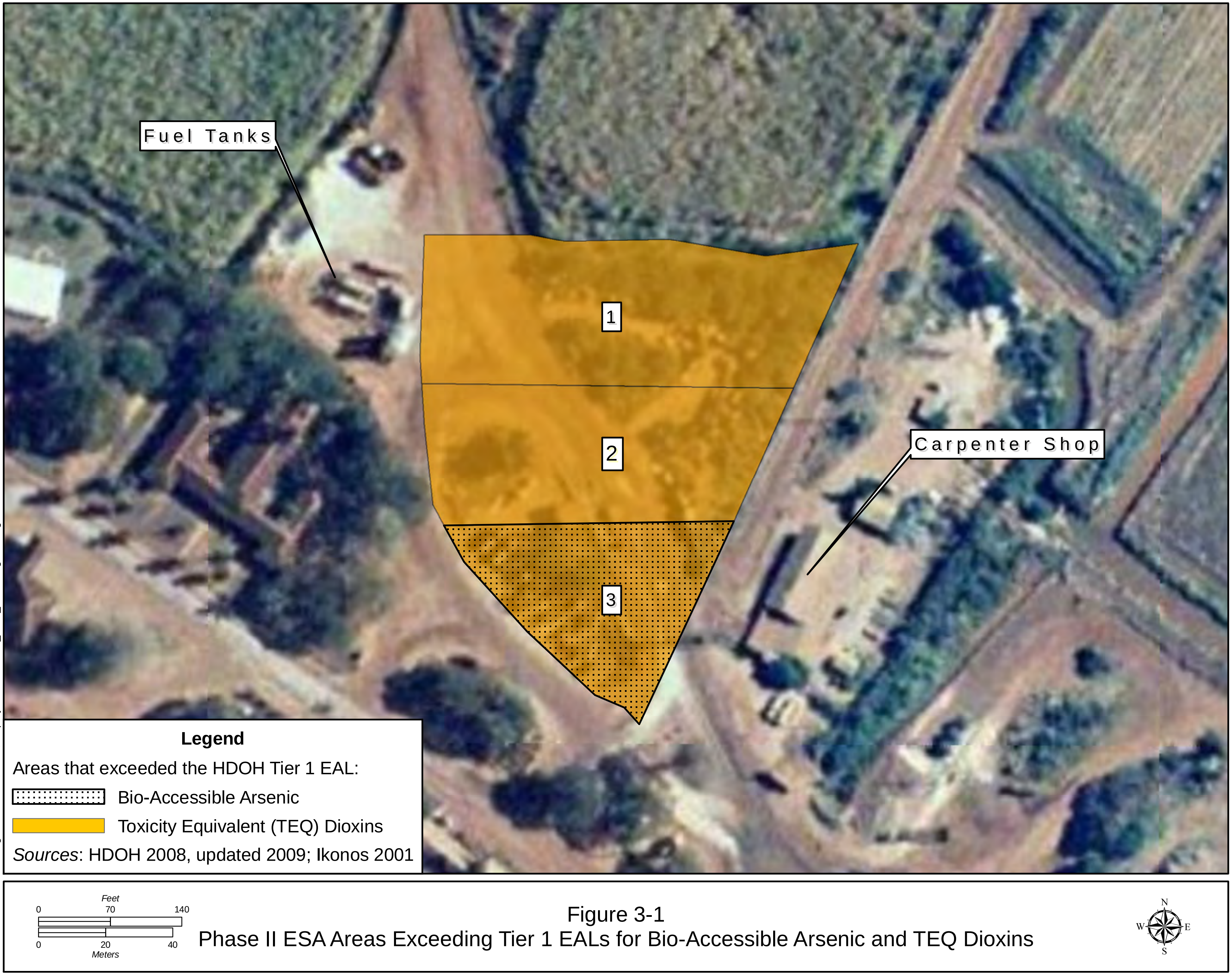

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Figure 3-1
Phase II ESA Areas Exceeding Tier 1 EALs for Bio-Accessible Arsenic and TEQ Dioxins

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4.0 SUMMARY OF POTENTIAL ENVIRONMENTAL HAZARDS

This section summarizes the findings of the Phase II ESA and identifies potential environmental hazards on the project site. Discussion of the methodology can be found in the Phase II ESA (TEC 2010).

4.1 CONTAMINANTS OF POTENTIAL CONCERN

The Phase II ESA examined pre-remedial site conditions in accordance with the *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* (HDOH 2008, updated 2009). The Phase II ESA, as stated above, identified arsenic and dioxins/furans as COPCs in the soil.

Based on the analytical results presented in Tables 2-1 and 2-2, the arsenic and dioxins/furans levels were at concentrations greater than the applicable HDOH Tier 1 Soil EALs for sites where groundwater is not a current or potential source of drinking water (HDOH 2008, Table B). Additionally, due to the proximity of surface water, applicable EALs are for sites less than or equal to 150 m from a surface water body.

Arsenic

Laboratory results for soil samples collected at DU1 and DU3 reported total arsenic concentrations greater than 20 mg/kg, the HDOH Tier 1 EAL.

Laboratory results for the soil sample collected at DU1 detected a total arsenic concentration of 21.2 mg/kg using EPA Method 6010/7471. No bio-accessible arsenic was detected in soil sample DU1 above the laboratory detection limit of 0.08 mg/kg.

Laboratory results for the soil sample collected at DU3 reported total arsenic of 90 mg/kg using EPA Method 6010/7471. Bio-accessible arsenic of 47.5 mg/kg, which is greater that the HDOH Tier 2 EAL for residential land use of 23 mg/kg, was detected in the soil sample from DU3 using the physiologically based extraction test (PBET) Method. Also PBET results indicated that 37.6 percent of the total arsenic was determined to be bio-accessible.

In comparison with Tier 2 arsenic EALs for sites with restricted land use, the elevated levels of bio-accessible arsenic in DU3 is consistent with Category C-2 soils. Category C-2 is designated for soils with bio-accessible arsenic concentrations greater than 23 mg/kg but less than or equal to 95 mg/kg (HDOH 2010a).

What is Arsenic? – Arsenic is a naturally occurring element in the earth's crust and is found in Hawaii at low levels (20 mg/kg total arsenic) naturally in native soils. However, elevated levels of arsenic have been identified in soils at former sugar cane fields, former pesticide storage or mixing areas, former sugar plantation camps, and wood treatment plants. The presence of elevated levels of soil arsenic at some historic sugar plantation areas is believed to be related to the widespread use of sodium arsenite (an inorganic arsenic compound) or other arsenic-based herbicides/pesticides in and around the cane fields in the 1920s through 1940s. Arsenic is stable in the environment and therefore remains in the soil many years after use (HDOH 2010c).

Exposure Pathways – People are exposed to arsenic mainly through their diet. Pathways on-site would be by two methods: 1. through unintentional ingestion of soil; and 2. dust inhalation. The main concern is that on a regular basis some people may unintentionally swallow very small amounts of contaminated soil - especially young children who are unaware of the hazards and may be exposed to contaminated soil through normal play activities. Residual dirt on produce grown in arsenic-contaminated soil and on hands after gardening or outside work may also contribute to arsenic exposure through accidental ingestion of soil particles. In most cases the amount of inorganic arsenic that a person could be exposed to from contaminated soils is estimated to be less than inorganic arsenic in their normal diet. Inhalation of arsenic in dust is another route of exposure, however in most circumstances this is a very minor source of exposure. Arsenic in soil is not believed to be absorbed through bare skin in significant amounts (HDOH 2010c).

Arsenic is found in shellfish and fish from many areas of the world. Arsenic in seafood is primarily organic arsenic, a different chemical form than inorganic arsenic used in the past on sugar plantations, in canec board products, and for wood treatment. Organic arsenic compounds are generally not considered toxic or harmful. Common island diets contain trace amounts of inorganic arsenic in foods such as rice, fish, chicken, and seaweed, and no adverse health effects have been reported from arsenic in these foods. HDOH tested produce from community gardens with elevated soil arsenic and found arsenic levels were similar to levels in produce from grocery stores across the mainland U.S. Produce grown in soil with elevated arsenic is considered safe to eat provided it is washed to remove soil and dust. In some parts of the world, arsenic in drinking water is a concern. HDOH has implemented a water quality-testing program for all public water systems in the state, including testing for arsenic and other chemicals. Results of these tests have not detected arsenic in any of the State's public drinking water (HDOH 2010a, 2010c).

Arsenic binds to other chemicals like iron and aluminum oxides that are abundant in many of the soils in Hawai'i. This characteristic significantly reduces the mobility of the contaminant and health risk for humans. Also, arsenic bound very tightly in soils is typically not taken up by plants (HDOH 2010c).

Health Concerns – Long-term, continuous exposure to trace levels of inorganic arsenic similar to that found in natural food products has not been shown to pose a significant health risk. Exposure to inorganic arsenic above these levels can pose an increased risk of cancer as well as noncancerous risks. Exposure to high levels of arsenic over long periods of time have shown human health symptoms that include changes in skin pigmentation (dark spots), thickening or warts on the palms of the hands and soles of the feet, damage to heart and blood vessels, and inflammation of the liver. Long-term exposure to high levels of arsenic has also been associated with an increased risk of cancer.

These types of health effects have been identified in some countries where drinking water is contaminated with high amounts of arsenic. In these cases exposure to inorganic arsenic is significantly higher than that would occur from exposure to arsenic in soil at the site, even under uncontrolled conditions. Following implementation of the EHMP, exposure to arsenic in soil at the site is anticipated to be well below typical dietary intake for people on an Asian-Pacific diet that includes seafood, chicken and rice." There have not been any health effects documented from soil arsenic exposure in Hawai'i. Health effects from exposure to arsenic soil on Hawai'i have not been documented. Arsenic does not accumulate in the body (bioaccumulate), so removing the exposure route (i.e. washing hands and produce before eating) will reduce arsenic levels in the body (HDOH 2010c).

Dioxins/Furans

Note: Dioxins and furans (dioxins) identified in soil at the project site are believed to be associated with the use of pentachlorophenol as a weed killer in sugarcane fields from the 1940s - 1960s. Pentachlorophenol contained trace levels of dioxins as a manufacturing impurity.

Laboratory results for soil samples collected at DU1, DU2, and DU3 reported a total toxicity equivalent (TEQ) dioxin concentration greater than the 2010 HDOH TEQ dioxin soil action level for unrestricted (e.g., residential) land use, but less than the 2010 HDOH TEQ dioxin soil action level for restricted (e.g., commercial/industrial) use.

Laboratory results for the soil sample collected at DU1 reported a total TEQ concentration of 1,225 nanograms per kilogram (ng/kg). Laboratory results for the soil sample collected at DU2 reported a total TEQ concentration of 265 ng/kg. Laboratory results for the soil sample collected at DU3 reported a total TEQ concentration of 738 ng/kg.

The 2010 HDOH TEQ dioxin soil action level for unrestricted (e.g., residential), land use is 240 ng/kg and for commercial/industrial use is 1,500 ng/kg (HDOH 2010b).

As a result of elevated dioxin levels in all three DUs, the entire investigation site contains Category C Soils, considered moderately impacted soils with TEQ dioxins between 240 ng/kg and 1,500 ng/kg (HDOH 2010b).

What is Dioxin? – Dioxins are a group of chemicals that form as unwanted byproducts from incomplete burning of household and industrial waste. They also can be produced during bleaching of paper pulp and the manufacture of certain chlorinated chemicals like polychlorinated biphenyls (PCBs), chlorinated phenols, chlorinated benzene and certain pesticides. Exhaust from vehicles, forest fires, and burning wood also release dioxins into the air. Very small amounts of dioxins, that are not considered harmful, are present in bleached paper products including facial or toilet tissue, paper towels, and disposable diapers (IDPH 2009).

Exposure Pathways –Agricultural workers using pesticides or solvents may be exposed to dioxins. Industrial accidents have been responsible for most cases of dioxin poisoning in humans. Firefighters and cleanup crews responding to electrical system fires and hazardous waste accidents also may be exposed to dioxins.

Human exposure to dioxins is through diet (i.e. eating meat, dairy products, fish and other seafood). On-site pathways would be similar as those for arsenic, mostly through two methods: 1. unintentional ingestion of soil; and 2. dust inhalation, and to a lesser degree by contact.

Persons who burn household waste may come into contact with dioxins in the resultant ash, soil, gas or smoke. More than 90% of human exposure to dioxins is through food, mainly meat, dairy products, fish and shellfish (WHO 2010, HDOH 2010b). Dairy products and meat from grazing animals have lower dioxin levels than fish or other seafood. Fruits and other fresh produce can have dioxins in small amounts on their outer surfaces from pesticide sprays or contaminated dust. Freshwater fish such as carp, catfish or buffalo fish that feed on microscopic plants and animals could ingest dioxins present in the sediment. They are often eaten by larger animals, and the dioxins get into their body fat. People are generally not exposed to dioxins in surface water unless they come into contact with contaminated sediments (IDPH 2009).

Dioxins in the Environment – *Dioxins have* been detected throughout the world in soil, surface water, sediment, plants and animal tissue (WHO 2010). As described above, dioxins are formed during the burning of fuel and wastes, and are released into the air. Soil near the burn areas also may be contaminated with dioxins. Surface water bodies can become contaminated when rainwater carries dioxin contaminated soil into surface water and when some industries discharge their dioxin-contaminated waste directly into surface water (IDPH 2009). Dioxins do not easily dissolve in water (hydrophobic), so they tend to settle to the bottom and cling to the sediment. Dioxins are very persistent in the environment, lasting for a very long time before breaking down (WHO 2010). In surface waters and sediments, dioxins can pass into aquatic organisms and eventually find their way into the food chain. Dioxins are easily absorbed by animals and are stored in fatty tissue (IDPH 2009).

Health Concerns – Due to the omnipresence (found everywhere) of dioxins, all people have background exposure, which is not expected to affect human health (WHO 2010). Dioxins are absorbed into the human body through the digestive and respiratory tracts or through skin contact. They are then distributed throughout the body. Whether dioxins cause a health effect is determined by the dose, which depends on:

- how much gets into your body,
- how it gets into your body, and
- how long you have been exposed.

Long-term, continuous exposure to trace levels of dioxins similar to that found in natural food products has not been shown to pose a significant health risk. Exposure to dioxins above these levels can pose an increased risk of cancer as well as noncancerous risks. Exposure to dioxins in soil at the site is anticipated to be below typical dietary intake following implementation of the EHMP.

Exposure to high levels of dioxins can cause severe skin acne, which results in small, pale yellow skin lesions that may last from weeks to years. Dioxins can cause short-term liver effects without any visible symptoms. Studies of people exposed to high levels of dioxins through occupation, accidents or military service do not suggest that adverse health effects will occur at low levels in the environment (IDPH 2009). These studies have also shown that the body eliminates dioxin at faster rates at higher concentrations vs. old models of steady half-lives of elimination. Re-calculation, based on more accurate models of dioxin elimination, demonstrates that dioxin is probably not as potent a carcinogen as was once thought (CCD 2005). A large historical study suggested workers exposed to dioxins for many years had increased cancer rates. However, other environmental factors may be related to the cancer. Studies have shown that reproductive, immune and nervous systems of the developing fetus and children are more susceptible to dioxins (IDPH 2009).

In animal studies, dioxins have caused nerve damage, birth defects, increased rates of miscarriages and changes to the immune system. Although the EPA has classified dioxins as a probable human carcinogen (cancer causing chemical), there is not sufficient evidence to prove that exposure to the low levels of dioxins normally found in the environment in general cause cancer. One dioxin, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), is listed as a known human carcinogen and all the others as probable human carcinogens (IDPH 2009).

Determination

Arsenic and TEQ dioxins each exceeded the Tier 1 EALs. Therefore, a comparison with additional targeted EALs was conducted. Bio-accessible arsenic and TEQ dioxin concentrations were compared with the appropriate Tier 2 EALs (HDOH 2008, Figure 4-3b and Figure 4-4b, respectively).

This comparison revealed that the soils at the project site are classified as Category C-2 for sites with restricted land use. For Category C-2 soils:

- Bio-accessible arsenic is between 23 mg/kg and 95 mg/kg, restricting land use to commercial/industrial and exemplified by contamination at or nearby former pesticide storage and mixing areas or sugarcane plantations; and/or
- Dioxins are between 240 ng/kg and 1,500 ng/kg, exemplified by contamination at or nearby former pesticide storage and mixing areas that included the use of pentachlorophenol and similar pesticides but are not considered to pose health risks under commercial/industrial uses.

4.2 CONCEPTUAL SITE MODEL FOR POTENTIAL HUMAN/ECOLOGICAL RECEPTORS

A CSM provides a framework regarding potential sources of contamination, types of contaminants, contaminated media, exposure and migration pathways, and receptors. The CSM was used in the preparation of the project Phase II ESA (Table 4-1). Based on the results of the site investigation, the following are identified as potential human receptors:

- On-site workers – including any personnel conducting work on-site as normal site operations;
- On-site workers (construction) – including personnel involved in any demolition or construction during future site activities; and
- On-site trespassers – including individuals that may access the site without permission.

The following potential exposure pathways have been identified:

- Incidental ingestion or dermal contact with soil;
- Inhalation of fugitive dust; and

- Incidental ingestion and dermal contact with surface water runoff and sediment.

4.3 POTENTIAL ENVIRONMENTAL HAZARDS

Direct exposure to contaminated surface soil, and impacts to terrestrial and aquatic habitats are potential environmental hazards posed by arsenic and dioxin contaminated surface soils at the investigation site.

4.4 TARGETED ENVIRONMENTAL HAZARDS

Direct exposure is likely the most detrimental environmental hazard to human health and the environment and therefore is the targeted environmental hazard. No sensitive terrestrial and aquatic habitats have been reported on or adjacent to the project site.

Results of the Phase II ESA classified the project site as having Category C-2 soils due to high concentrations of bio-accessible arsenic in DU3 and elevated levels of dioxins/furans in DU1, DU2, and DU3. Category C-2 soils do not necessarily pose health risks under commercial/industrial land use; however, they may pose potential risks under residential or other sensitive uses (HDOH 2010a & 2010b). At a commercial/industrial site, long-term management of these soils is required if left in place.

The proposed project, i.e. installation of three containerized diesel-powered generator units on-site within DU2 will not change the land use classification. Other than temporary construction workers during the generator installation, there will be no operators on-site on a regular basis.

Table 4-1. Conceptual Site Model

Portion of TMK No.: (4) 1-2-02:001
Kekaha, Kauai, Hawaii

Primary Sources	Primary Release Mechanism	Secondary Sources	Secondary Release Mechanism	Pathway	Exposure Route	Potential Receptors									
						Current Land Use				Future Land Use*				Current	
						On-site Workers	On-site Construction Workers	On-site Trespassers	Offsite Residents	On-site Workers	On-site Construction Workers	On-site Trespassers	Offsite Residents	Terrestrial Ecological	Aquatic Ecological
Pesticides, Herbicides, and other Agricultural Treatment Chemicals	Drips, leaks, and spills	Surface Soil	None	Surface Soil	Ingestion	◊	◊	◊		◊	◊	◊		◊	◊
					Dermal	◊	◊	◊		◊	◊	◊		◊	◊
			Dust	Ambient Air	Inhalation	◊	◊	◊		◊	◊	◊		◊	◊
			Surface Water Runoff	Surface Water and Sediments	Ingestion	◊	◊	◊		◊	◊	◊		◊	◊
					Dermal	◊	◊	◊		◊	◊	◊		◊	◊
			Leaching	Subsurface Soil	Ingestion		◊				◊			◊	
					Dermal		◊				◊			◊	
				Ground-water	Ingestion										
					Dermal										
					Inhalation										

Notes:

◊ - Potentially complete exposure pathway

* - No significant change to the land use is planned in the near future

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5.0 INSTITUTIONAL AND ENGINEERING CONTROLS: REQUIREMENTS AND IMPLEMENTATION

Appropriate measures to reduce exposure to contaminated media are defined as institutional or engineering controls. Institutional controls are legal or administrative measures designed to prevent exposure to contaminants through laws, rules, permits, requirements, contracts, warnings, or advisories. Institutional controls can also restrict land use and on-site activity to reduce the potential for exposure. Engineering controls are tangible measures to prevent physical contact with contaminated media (HDOH 2009).

Category C-2 soils can be managed in place at commercial/industrial sites with minimal engineering controls provided that off-site movement of contaminated media is prevented. Institutional controls should restrict the use or transport of soils from the site to areas with unrestricted/residential land use (HDOH 2010a).

Although, arsenic and dioxin/furans concentrations in soils are found below the HDOH Final Tier 1 EALs for commercial/industrial land use, (only one sample showing dioxin/furan slightly [300 parts per trillion] above the EAL for commercial/industrial), HDOH recommends remediating the soil to be more protective of the human health and the environment. Managing the soil in place is one of the remedial alternatives that will be protective of the human health that would provide a remedy and institutional controls without disturbing the ground and vegetation that is currently containing contaminated soil.

ADC in working with HDOH has identified controls for implementation that are more protective of human health than required based on the soil levels identified at the site. These controls are identified in Section 5.1 and 5.2 below.

5.1 INSTITUTIONAL CONTROLS AND IMPLEMENTATION

The project site land use is anticipated to remain as agricultural for the foreseeable future. Residential or unrestricted land use shall not be permitted following the approval and implementation of this project. Should a land use change be requested to residential or unrestricted use, a new EHMP prepared in coordination with HDOH would be necessary. Recommended institutional controls include the following:

- ADC, has done their environmental due diligence including providing publicly available environmental documentation for the proposed project, meeting with two community leaders to discuss the project and remedies, and preparing educational fact sheets associated with soil contaminants associated with the site.
- Clearly identify areas of the property with capped or uncapped Category C-2 soil on surveyed, post-redevelopment maps and include in any management plan. Identify any isolated areas where bio-accessible arsenic-contaminated soil is to be capped for permanent on-site management. These areas must be clearly identified on surveyed, post-redevelopment map(s) of the property.
- No trespassing signs will be placed at the project site entrances off Kekaha Road and at select points along the perimeter cattle fence.

- Boulders will be placed along the edge of the access roads adjacent to the project site to restrict vehicle access.
- Forbid reuse of contaminated soils without the expressed permission of HDOH. Landfill use may be possible with HDOH permission. An EPA toxicity characteristic leaching procedure (TCLP) may be required by the landfill for disposal.

5.2 ENGINEERING CONTROLS AND IMPLEMENTATION

Engineering controls disrupt the exposure pathway of contaminants to the surrounding area reducing potential impacts to human health and the environment. Based on the selection of Alternative 1 in the Remedial Action Work Plan, the following are recommended engineering controls:

- On-site vegetation will be maintained where feasible during construction activities and dust suppression measures put in place.
- A 3-4 inch gravel barrier will be installed at the access roads from Kekaha Road and adjacent to the project site, adjacent FHMA-05 and FHMA-06 areas (Figure 5-1), and on-site where vegetation disturbance was unavoidable.
- Long-term maintenance of the on-site vegetation, future landscaping, gravel barrier areas, boulders, and cattle fence will be performed on a regular basis. The gravel and vegetative cover will prevent offsite movement of the soils via windblown dust, storm water runoff, or other processes.
- Leaching of contaminants to groundwater is not an issue due to the relative immobility (i.e. contaminants bind strongly to soil particles) and insolubility of arsenic and dioxin.
- As an option, ADC may place a permanent chain-link fence around the perimeter of the generator installation site. This would be more of a security measure.

Figure 5-2 identifies the project site and soil managed areas.

Printing Date: May 2, 2011, M:\projects\GIS\6766_ADC_EA\figures\Figure 2-3 Location of Remedial Action Areas.mxd

Figure 5-1
Location of Remediai Action Areas
Kekaha, Kauai, Hawaii

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Printing Date: July 6, 2011, M:\projects\GIS\6766_ADC_EA\figures\RAWH\Figure 4-1 Position of Cattle Fence.mxd

Figure 5-2
Managed Area Site Map
Kekaha, Kauai, Hawaii

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6.0 LONG-TERM MONITORING REQUIREMENTS

Long-term exposure to Category C-2 soils does not pose a significant risk to workers and nearby neighborhood provided that contact with fugitive dust is minimized. Observance of institutional controls and routine maintenance of engineering controls will disrupt exposure pathways. Leaching from former sugarcane fields is not considered a significant concern because arsenic in this case is relatively immobile and dioxins do not pose a potential leaching threat under any condition (HDOH 2008).

As part of the long-term monitoring requirements, a Kekaha Agriculture Association (KAA) Soil Remediation Management Inspection Checklist (Inspection Checklist) has been prepared for the site (see Appendix A). The Inspection Checklist provides a mechanism to make sure the engineering controls are properly maintained and corrective actions are implemented as necessary. The inspection checklist will be submitted to ADC on a monthly basis. KAA will also prepare a Corrective Action Report that will photo document the remedial action procedures used.

7.0 SOIL AND GROUNDWATER MANAGEMENT FOR FUTURE SITE ACTIVITIES

Category C-2 soils require long-term management. Even though these soils do not pose a significant health risk, long-term management ensures such soils will not be inadvertently transferred to a more sensitive off-site location. State and U.S. EPA hazardous waste disposal and management requirements may apply.

7.1 CONSULTATION WITH HEER OFFICE

Future grubbing or excavation activities that may disturb the 3-4” of gravel material shall require consultation with the HDOH HEER Office. Future site activities may also require a project Work Plan (WP) to address potential hazards to construction workers. The WP should comply with prevailing regulations and HDOH HEER guidance.

7.2 PRE-EXCAVATION EVALUATION

Breaches of the vegetation cover during construction may lead to soil accumulation, potentially resulting in surface water runoff and contamination of nearby soils.

7.3 EROSION CONTROL MEASURES

Establish erosion control measures before initiating any excavation to prevent contaminated soils from leaving the site via any water pathways. Determine what permits and plans are necessary before excavation. These could include National Pollutant Discharge Elimination System (NPDES) permit, grading/stockpiling permit, dewatering permit, an erosion control plan, or 401 water quality certification (WQC).

Deploy relevant Best Management Practices (BMPs) to retain contaminated soil on-site. Control the vehicle entrance of the project site with gravel to prevent tracking dirt and debris off-site on vehicle tires. Other BMPs may include installation of a small berm and silt fence along the project site perimeter or redirecting potential off-site storm water intrusion.

7.4 DUST CONTROL MEASURES

Require the contractor to use standard dust suppression techniques and procedures, such as frequent water truck spraying on the soil to minimize dusty conditions. This mitigation measure is typically sufficient at preventing the off-site transport of potentially contaminated dust particles. If extensive excavation is required, construct dust barriers along the perimeter of the site. The contractor must also comply with ambient air quality standards in Hawaii Administrative Rules § 11-59 and § 11-60.1, at a minimum, to prevent deterioration of existing air quality.

7.5 SOIL EXCAVATION AND HANDLING

Coordinate and sequence construction activities to result in minimal soil disturbance and dust generation. For example, perform all earthwork activities (trenching, grading, etc.) before mobilizing other trade personnel to minimize the number of workers exposed to potentially contaminated soil.

7.6 SOIL STOCKPILING/STORAGE

Any contaminated soil excavated and stockpiled on-site should be placed in a designated temporary stockpile area on a thick layer of polyethylene sheeting for a barrier. Cover the stockpile with a thin polyethylene sheet anchored to the stockpile to prevent disturbance by storm events (i.e. wind and rain). Design the edges of the stockpile area to prevent stormwater run-off.

7.7 SOIL DISPOSAL

Use excavated soils on-site, wherever possible. Use such soil beneath paved or compacted surfaces. Include a permeable marker to identify the interface between the clean and contaminated soils.

Landfill disposal may be possible with HDOH approval. An EPA Toxicity Characteristic Leaching Procedure (TCLP) test may be required by the landfill for disposal. Use of an iron sulfate ($FeSO_4$) soil amendment on arsenic-contaminated excavated soil may decrease leaching potential and assist with meeting TCLP disposal requirements.

7.8 GROUNDWATER HANDLING AND DISPOSAL

A dewatering permit may be required if groundwater intrusion is anticipated during construction. The dewatering permit would identify controls to prevent the release of untreated groundwater to surface water bodies. If possible, retain groundwater on-site through the use of temporary settling basins or groundwater discharge trenches rather than discharge or disposal off-site. If discharge is necessary, the contractor must obtain appropriate permits (National Pollutant Discharge Elimination System [NPDES], discharge, etc.) prior to release. The contractor will ensure that any arsenic or dioxins in the water meet applicable thresholds, which may require on-site treatment.

8.0 EXPOSURE MANAGEMENT

Exposure to contaminated dust, soils or groundwater during construction can be managed by isolating the contaminated media and eliminating exposure routes, points, or both. The following controls enable this.

8.1 AWARENESS/TRAINING FOR CONTAMINATION MANAGED ON-SITE

ADC shall make this plan available to the public and post signs around the construction site.

8.2 CONSTRUCTION WORKER NOTIFICATION

As part of ADCs contract for the Installation of the Emergency Generators and associated Remedial Actions, all contractors will be required to follow Department of Labor and Industrial Relations, Hawaii State Occupational Safety & Health (HiOSH) requirements. Hawaii is one of 26 jurisdictions approved by the Federal Occupational Safety and Health Administration (OSHA) to operate its own state's safety and health program under Section 18(b) of the Occupational Safety and Health Act of 1970. HIOSH administers Hawaii's State Plan Program. This program has jurisdiction over most employment in the State in both the private and public sector, with some exceptions (such as domestic workers, U.S. Postal Service, maritime activity, e.g. shipbuilding, marine terminals and long shoring). While OSHA has jurisdiction over all Federal employment and private sector workers working in maritime activities, Hawaii has jurisdiction over private sector employment on Federal lands, including military bases, with the exception of any employment in any of the Hawaii National Parks. In addition, copies of this EHMP must be made available to all contractors for review and reference.

8.3 CONSTRUCTION WORKER PROTECTION

Requirements identified by HiOSH shall be followed, which may include but are not limited to the following. The use of personal protective equipment (PPE) is an important strategy to eliminate exposure to contaminants. Workers should don PPE prior to the start of work that disturbs contaminated soils. After leaving the work area, workers should remove PPE immediately and wash their hands and faces with soap and water. The contractor's site specific safety and health plan should detail PPE level and type appropriate to each task.

Workers are not allowed to smoke, drink, or eat within the work zone near potentially contaminated soil or groundwater.

8.4 USE RESTRICTIONS TO PROTECT SITE WORKERS AND GUESTS

Use restrictions identified by HiOSH shall be followed, which may include but are not limited to the following. No work or activities that will disturb the engineering controls are permitted without prior approval from ADC or HDOH HEER Office staff. Only trained personnel may access the site if contaminated soil is exposed. The following is a general emergency response protocol for arsenic or dioxin exposure.

8.4.1 Emergency Response for Exposure to Chemicals

Emergency response for chemicals shall follow HiOSH recommendations, which may include but are not limited to the following. If soils contaminated with arsenic or dioxins come into contact with the eyes or skin, immediately and thoroughly rinse the eyes or skin. An eye wash station and soap and water should be made available on-site during any activity disturbing potentially contaminated soil.

8.4.2 Internal Exposure to Chemicals

Requirements identified by HiOSH shall be followed, which may include but are not limited to the following. The exiting medical examination should identify any on-site COPCs that may have been accumulated in the body over the course of work. Review the medical report thoroughly and follow any recommendations the medical professional may have for follow on medical treatment.

8.4.3 Inhalation Exposure to Chemicals

Requirements identified by HiOSH shall be followed, which may include but are not limited to the following. The exiting medical examination should identify any on-site COPC that may have been accumulated in the body over the course of work. Review the medical report thoroughly and follow any recommendations the medical professional may have for follow on medical treatment.

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Appendix A - Soil Remediation Management Inspection Checklist

KAA Soil Remediation Management Inspection Checklist and Corrective Action Report

Please fax to ADC office at 808-586-0189 upon completion of Inspection or Corrective Action *DRAFT*

DATE:(MM/DD/YY) / / **INSPECTOR NAME:**

Boulders ___OK ___ PROBLEM

Describe Problem(s), if any:

Corrective Action:

Est Completion Date (MM/DD/YY): / / *Actual Completion Date:* / /

Supervisor Signature verifying correction action:

Ground Cover Vegetation ___OK ___ PROBLEM

Describe Problem(s), if any:

Corrective Action:

Est Completion Date (MM/DD/YY): / / *Actual Completion Date:* / /

Supervisor Signature verifying correction action:

Gravel Cover (3-4") ___OK ___ PROBLEM

Describe Problem(s), if any:

Corrective Action:

Est Completion Date (MM/DD/YY): / / *Actual Completion Date:* / /

Supervisor Signature verifying correction action:

Perimeter Fence ___OK ___ PROBLEM

Describe Problem(s), if any:

Corrective Action: *DRAFT*

Est Completion Date (MM/DD/YY): / / *Actual Completion Date:* / /

Supervisor Signature verifying correction action:

SUPERVISOR SIGNATURE: **DATE:** / /