FINAL

Land Use Control Plan for Quarry Pit Landfill (MCB Hawaii Site 0002)

Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii

July 2015

Department of the Navy
Naval Facilities Engineering Command, Hawaii
400 Marshall Road
JBPHH HI 96860-3139

Architect and Engineering Services
Contract Number N62742-11-D-1821, CTO 0021

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Prepared for:

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Prepared by:

element environmental llc
environmental · engineering · water resources
98-030 Hekaha Street, Unit 9
Aiea, HI 96701

Prepared under:

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LIST OF ACRONYMS AND ABBREVIATIONS

AAV	Amphibious Assault Vehicle
ASTM	American Society for Testing and Materials
BEQ	Bachelor Enlisted Quarters
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLB	Combat Logistics Battalion
COPC	chemical of potential concern
CSRS	Confirmation Study Ranking System
CTO	Contract Task Order
CWA	Clean Water Act
DCE	1,1-dichloroethene
DD	Decision Document
DL	detection limit
DLA	Defense Logistics Agency
DoD	Department of Defense, United States
DOE	Department of Energy, United States
DOH	Department of Health, State of Hawaii
DON	Department of the Navy, United States
DRO	diesel range organic
DU	Decision Unit
E2	Element Environmental, LLC
EAL	Environmental Action Level
EC	engineering control
EPA	Environmental Protection Agency, United States
ETI	Earth Tech, Inc.
FAI	Fukunaga & Associates, Inc.
GIS	Geographic Information System
HEER	Hazard Evaluation and Emergency Response Office
HLA	Harding Lawson Associates
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HOCC	Hawaii One Call Center
IAS	Initial Assessment Study
IC	institutional control
LRO	lube oil range organic
LUC	Land Use Control
LUCP	Land Use Control Plan
MCAS	Marine Corps Air Station
MCB Hawaii	Marine Corps Base Hawaii
MCON	Military Construction
µg/L	microgram per liter
mg/kg	milligram per kilogram
MI	multi-increment
MLI	McDaniel Lambert, Inc.
MW	monitoring well
MWASR	Monitoring Well Abandonment Summary Report

NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Department of the Navy
NEESA	Naval Energy and Environmental Support Activity
NTR	Navy Technical Representative
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
ppm	part per million
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
RMTC	R.M. Towill Corporation
ROD	Record of Decision
RTC	response to comment
sHHRA	screening human health risk assessment
SI	Site Inspection
SLERA	screening-level ecological risk assessment
SVOC	semi-volatile organic compound
TP	test pit
TPH	total petroleum hydrocarbon
U.S.	United States
UST	underground storage tank
VOC	Volatile Organic Compound
WMA	Wildlife Management Area

Section 1 Introduction

This Land Use Control Plan (LUCP) has been prepared to identify and discuss Land Use Controls (LUCs) required to protect human health and the environment at the former Quarry Pit Landfill (Site 0002), Marine Corps Base Hawaii (MCB Hawaii), Kaneohe, located on Oahu, Hawaii (Figure 1).

Soil and groundwater at the site contains residual levels of chemicals at concentrations that do not pose an immediate risk to human health, but do exceed levels that allow for unrestricted land use. The Navy will use this LUCP to implement the LUCs needed to ensure the long-term integrity of LUCs at the site, protect human health, and complete the final remedy.

The purpose of this LUCP is to recommend notice, monitoring, and enforcement mechanisms needed to ensure long-term effectiveness of the LUCs at the site, and to clearly identify the roles and responsibilities of the Navy, State of Hawaii Department of Health (DOH), MCB Hawaii, and subsequent property owners tasked with maintaining the LUCs.

This LUCP was prepared by Element Environmental, LLC (E2) for the United States (U.S.) Department of the Navy (DON), Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii), under the Architect and Engineering Services, Contract N62742-11-D-1821, Contract Task Order (CTO) 0021. This LUCP has been developed in cooperation with and with the agreement of all responsible parties. This LUCP was submitted for review to the DOH. Responses to comments on the Draft LUCP are included in Appendix A.

The LUCs are being implemented as part of the final remedy selected for the site pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] 300).

The following LUCs are required for the Quarry Pit Landfill:

- Restriction of future land use to recreation use (e.g., park/playfield, etc.), training (non-ground disturbing), or industrial/commercial use with land use restrictions;
- Monitor the institutional (legal) controls with geographic information systems (GIS) applications and project reviews;
- Maintenance of a two-foot cap to prevent exposure of debris buried in the landfill;
- Land use restrictions/concerns through the Base dig permit process;
- Prohibition of unauthorized disturbance, excavation, removal, or use of site soil;
- CERCLA five-year reviews of LUC effectiveness with compliance reporting; and
- Decommissioning of monitoring wells (see the *Final Monitoring Well Abandonment Summary Report (MWASR)* dated June 2014 and *Addendum to the Final MWASR* dated September 2014 [E2 2014b and 2014c, respectively]).

The overall objective of these LUCs is to protect human health by preventing exposure to debris and/or contaminated soils left in place at the site. The selection of these LUCs was based on a Decision Document (DD) (E2 2014a) prepared for the site. The DOH has provided regulatory

oversight during the development and evaluation of remedial alternatives, and has concurred with the selection of LUCs as part of the final remedy for the site.

The implementation of LUCs, as detailed in this LUCP, is being conducted in accordance with the following policy and guidance issued by the Department of Defense (DoD), DON, and the U.S. Environmental Protection Agency (EPA):

- *Policy on Land Use Controls Associated with Environmental Restoration Activities* [includes DoD Guidance on Land Use Controls Associated with Environmental Restoration Activities for Property Planned for Transfer out of Federal Control] (DoD 2001a).
- *Guidance on Land Use Control Agreements with Environmental Regulatory Agencies* (DoD 2001b).
- *Monitoring and Enforcement of Land Use Controls* (DON 2003). Includes *Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other post-Record of Decision (ROD) Actions* (EPA and DON 2003).
- *Land Use Controls*. Policy Memorandum 99-02 (DON 1999).
- *Sample Federal Facility Land Use Control ROD Checklist with Suggested Language* [includes *Navy/Army/Defense Logistics Agency [DLA] Remedial Design [RD] or Remedial Action Work Plan [RAWP] Checklist*] (EPA 2006).
- *A Guide to Establishing Institutional Controls at Closing Military Installations* (DoD 1998).
- *Land Use Controls at DOD Transferring Properties*. Base Realignment and Closure (BRAC) Environmental Program Fact Sheet. Draft (DoD 2002).
- *Institutional Controls: A Guide to Implementing, Monitoring, and Enforcing Institutional Controls at Superfund, Brownfields, Federal Facility, Underground Storage Tank (UST) and Resource Conservation and Recovery Act (RCRA) Corrective Action Cleanups*. Draft (EPA 2002).

Additional guidance regarding the effective use, monitoring, and enforcement of LUCs were also consulted during the preparation of this LUCP (American Society for Testing and Materials [ASTM] 2005; Borak and Wagner 2005; Connell and Pickett 2000; DoD 1997; U.S. Department of Energy [DOE] 2000; and EPA 2000a, 2000b, and 2004).

Section 2 Background Information

2.1 Site Locations and Description

MCB Hawaii is located on the windward side of Oahu, and occupies the entire 2,951-acre Mokapu Peninsula. MCB Hawaii is bordered to the west by Kaneohe Bay, to the north by the Pacific Ocean, to the east by Kailua Bay, and to the south by the Nu'upia Ponds Wildlife Management Area (WMA) (Figure 2).

The Quarry Pit Landfill Site is located in the south-central portion of MCB Hawaii and is approximately 12.65 acres and is bounded by Mokapu Road on the north, the 3rd Marine Motor Pool ("motor pool" or "Marine Motor Pool") (Building 6030) and a small wetland area on the east, Querulous Street to the south, and Harris Avenue on the west.

The nearest occupied buildings are: a Sprung instant structure, which is located on the southern portion of the landfill; the Combat Logistics Battalion 3/CLB-3 Medical Platoon Navy Personnel Unit Medical Logistics building ("Medical Warehouse") (Building 4088), which lies to the west of the site; and Area 6755C3, High Mobility Multipurpose Wheeled Vehicle (HMMWV) Egress Assistance Trainer, consisting of one Sprung instant structure and one small wood structure, which lies to the southwest of the site.

The central portion of the landfill is currently vacant, but was used by Paintball Hawaii & Pacific AirSoft, a commercial paintball and airsoft facility that operated onsite from 2000 until January 2012. The grass and shrubs within a large section of the former paintball field were maintained by mowing or weed whacking. The remainder of the site, with the exception of a grassy area adjacent to Mokapu Road to the north, is overgrown with vegetation.

2.2 Site History

The site was first excavated for construction material of Fort Hase and Naval Air Station Kaneohe Bay in the 1940s. In the 1950s the two bases were merged to form the Marine Corps Air Station (MCAS) Kaneohe Bay. The site was used intermittently between the 1940s and 1972 for storage and/or disposal. Documents indicate that the landfill was open for solid waste disposal between the years from 1972 to 1976 when it was the primary on-base landfill. During that period most solid waste was accepted except for residential waste. Approximately 165,379 cubic yards of waste was disposed at the landfill. Wastes included petroleum, oil, lubricants, solvents, paints, thinners, batteries, mercury, and transformer oils. Borehole logs for the construction of the adjacent Medical Warehouse showed general trash, such as, cans, paper, wood, and unidentified organic debris.

Some time prior to 1959, two buildings were constructed adjacent to, or partially on, the southwest corner of the landfill. Building 1020, the building located furthest to the south, was a theater, and Building 116 was a self-serve laundromat (DON 1967). The Medical Warehouse, located on the west side of the site, was built in 1989. The motor pool was constructed on the east side of the adjacent wetland in 1990 (R.M. Towill Corporation [RMTC]).

2.3 Previous Investigations and Removal Actions

This section provides an overview of previous investigations, studies, and site reconnaissance conducted between 1984 and 2010. There have been four prior studies for the site:

- the *Initial Assessment Study (IAS) of Marine Corps Air Station (MCAS) Kaneohe Bay, Hawaii* (Naval Energy and Environmental Support Activity [NEESA] April 1984);
- *Site Inspection (SI) Quarry Pit Landfill, Marine Corps Air Station (MCAS), Kaneohe Bay, Hawaii* (Harding Lawson Associates [HLA] September 20, 1989);
- *Focused Site Inspection Report, Site 2, Quarry Pit Landfill, Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii* (DON March 2007a); and
- the *Remedial Investigation/Feasibility Study (RI/FS) for the Quarry Pit Landfill (MCB Hawaii Site 2), Marine Corps Base Hawaii, Kaneohe, Hawaii* (E2 September 2012).

The 2012 RI/FS recommended LUCs be implemented at the site through the development of a LUCP.

Initial Assessment Study (NEESA 1984). The NEESA performed an IAS at MCB Hawaii to identify and assess sites posing potential threats to human health or the environment caused by past hazardous substance storage, handling, or disposal practices at naval activities (NEESA 1984). The IAS, which is similar to a preliminary assessment under the CERCLA, used information from historical records, aerial photographs, surface and aerial surveys, and personnel interviews to identify 18 sites at MCB Hawaii, including the Quarry Pit Landfill. Each site was then evaluated for contamination characteristics, migration pathways, and pollutant receptors. The evaluation used the two-step Confirmation Study Ranking System (CSRS) to systematically evaluate the relative severity of potential problems. The CSRS determines whether a confirmation study, which is similar to the SI under CERCLA, should be recommended for a site. The IAS recommended no confirmation studies for the Quarry Pit Landfill (Site 0002) provided it be left undisturbed, and listed the site as a construction hazard area. The EPA Region 9 representatives, however, reviewed the findings of the IAS, and after discussions with NAVFAC Field Division Pacific representatives, requested that further investigation be performed at the site (DON 2007).

Test Borings – BEQ Parking Lot Northeast of Building 4088 (1977). On June 15, 1977, Soils International completed a report entitled "Report, Foundation Investigation, Modernization of Bachelor Enlisted Quarters, Kaneohe Marine Corps Air Station, Kaneohe, Oahu, Construction Contract No. N62471-77-C-1351". According to Fukunaga and Associates, Inc. (FAI) (2011) who reviewed the document, borings and test pits were installed for a Bachelor Enlisted Quarters (BEQ) parking lot located northeast of Building 4088 (currently referred to as the "Lemon Lot", see Figure 2). Subsurface conditions encountered in the borings and test pits generally consisted of approximately 15 to 17.5 feet of fill mixed with "sanitary landfill" material consisting of lumber, metal debris, plastic, and cloth.

The landfill materials in some borings extended to depths of about four to eight feet below the water table. The fill was classified as "moderately firm" clayey silty sand and was underlain by dense coral limestone to the bottom of the borings at depths ranging from 15 to 20 feet below existing grades.

The test pits encountered similar fill material underlain by sanitary landfill material to the bottom of the excavations at 0.5 to 7.5 feet below existing grades at the time of their investigation.

Test Borings – Medical Warehouse (Building 4088) (1984). A series of test borings, drilled in 1984 prior to construction of the Medical Warehouse (Building 4088), indicated the presence of refuse in some locations in the future warehouse site. Building 4088 is located adjacent to the west side of the landfill (Figure 2).

According to FAI (2011), who reviewed the August 16, 1985, "Record Drawing FY 86 Military Construction (MCON) Project P-502 Medical Warehouse, MCAS Kaneohe Bay, NAVFAC Drawing No. 7064263 – 7064266," subsurface conditions encountered in available borings generally consisted of 0.5 to 9 feet of fill underlain by stiff silt and clay or medium dense sandy coral gravel and sand, and/or moderately hard coral. "Rubbish fill" was encountered in some of the borings drilled at the southeastern side of the warehouse. The logs described the rubbish fill as miscellaneous debris, broken cans, wood, plastic, paper, organic matter, wire, and papers. Below the fill and underlying rubbish fill, coral reef deposits consisting of medium dense coralline sand and gravel and moderately hard coral were generally encountered to the bottom of the borings to depths of 11.5 to 65 feet below existing grades.

Based on the 1985 record drawing, this warehouse consists of a pre-engineered building supported on shallow foundations founded on compacted granular fill. Foundation notes called for an allowable soil bearing pressure of 2,500 pounds per square foot for footings founded on compacted granular fill. Structural details on the drawings called for removal of trash to depths of about 9 to 16 feet below existing grades at the time of construction. The details also called for backfilling the excavations, approximately 6 to 13 feet below the footing, with compacted granular fill (FAI 2011).

Test Borings – Miles Equipment Facility and Rations Warehouse (Building 3098) (1986). According to FAI (2011), who reviewed the January 17, 1986, "Record Drawing, Miles Equipment Facility and Rations Warehouse (Building 3098), Marine Corps Air Station, Kaneohe Bay, Hawaii, NAVFAC Drawing No. 7056608," borings drilled for Building 3098, Miles Equipment Facility and Rations Warehouse, located near the southeastern corner of the landfill site, generally consisted of coralline gravel to depths of 25 feet below existing grades. Rubbish fill was not indicated in the boring logs for this building. This structure is now identified as HMMWV Egress Assistance Trainer (see Figure 2).

Test Borings – Marine Motor Pool (Building 6030) (1987). According to FAI (2011), who reviewed the June 3, 1987, "Record Drawing, FY87 MCON Project P-530, Combat Vehicle & Field Maintenance Shops (Building 6030), Part A, Marine Corps Air Station, Kaneohe Bay, Hawaii, NAVFAC Drawing No. 7069545, 7069546," subsurface conditions encountered in the borings for this facility generally consisted of several feet of clayey silt at the surface underlain by "calcareous rubblestone" to the bottom of the borings at 5 to 21.5 feet below existing grades (see Figure 2).

Site Inspection (HLA 1989). In response to regulatory comments on the IAS, a SI was conducted at the Quarry Pit Landfill by HLA in 1989. The purpose of the SI was to evaluate whether the wastes disposed of at the landfill posed a threat to human health or the environment. The scope of the investigation included collection and analysis of groundwater samples, and performance of a water level assessment.

The target analytes in the groundwater were volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), lead, and mercury. Fuel-related hydrocarbons were detected in the groundwater sample collected from monitoring well (MW) MW-05, which is located cross-gradient from the landfill and 250 feet directly downgradient from the exchange service station (Figure 2). The report concluded that leaking fuel tanks at the service station, not the Quarry Pit Landfill, were the source of the fuel-related hydrocarbons in the groundwater at MW-05.

The compound 1,1-dichloroethene (DCE) was detected in the groundwater sample from cross-gradient well MW-06 at its detection limit (DL) of 1.0 microgram per liter (µg/L), which was below the National Primary Drinking Water Standard maximum concentration level of 7 µg/L for 1,1-DCE. No other target analytes were detected in the groundwater samples collected from the other MWs.

Although the SI report concluded that the public health risks at the time due to the landfill were likely minimal, it recommended that more comprehensive investigations and risk assessments be considered should land-use changes be planned for the landfill (HLA 1989).

Wetland Boundary Delineations (USACE 2002). Ground-based wetland boundary delineations were determined at MCB Hawaii during 2001 to 2002 by a qualified wetland ecologist with the USACE (2002), assisted by MCB Hawaii natural resources staff. The wetland located between the Quarry Pit Landfill and the motor pool was one of seven wetland areas identified and mapped as jurisdictional under the criteria of the Clean Water Act (CWA) administered by the USACE. The wetland was described in the report as follows:

The wetland is part of a large swale that runs along the west side of the motor pool and includes a drainage sump that collects runoff from the adjacent motor pool parking lot;

In addition to overland runoff, there are four 36-inch-diameter reinforced concrete pipe culverts (all integrated into a grouted rock apron), which terminate in this area;

The west side of the wetland, adjacent to the landfill, has a berm that is four to six feet higher than the wetland bottom and two to three feet higher than the landfill surface;

An overflow swale appears to exit out of this wetland area towards Nu'upia Ponds to the south; however, a gradual upland slope precludes this from happening except under very large flow conditions;

The edges of the pond were dominated by Christmas berry that blended into sourbush in the wetland. Other vegetation included milo, koa haole, and kamani. A lone wiliwili tree (*Erythina sandwicensis)* was observed at the south end of the wetland. Aquatic species observed included toads and mosquito fish.

The wetland was opportunistically plowed (not cleared) on July 11, 2001 using amphibious assault vehicles (AAVs). The AAVs helped to take the vegetation all the way down to the ground surface. Indian fleabane, California grass, and Christmas berry were removed from the centers of the wetland, but were still dominant at the edges. Prior to the AAV clearing, the center of the wetland was dominated by California grass. In December 2001, the large open area was recolonized primarily with sedges. Clearing with the AAVs enhances the amount of available habitat for waterbirds.

The USACE report (2002) stated that the primary function of this wetland is to filter pollutants from runoff. The wetland also provides habitat to aquatic species. MCB Hawaii has annually operated the AAVs in the area to keep it open for drainage, control invasive grasses, and provide foraging for endangered waterbirds.

Focused Site Inspection (ETI in DON 2007). In 2007, Earth Tech, Inc. (ETI) conducted a focused SI at the Quarry Pit Landfill (Site 0002) (DON 2007) to determine whether COPCs from the landfill pose a threat to human health or the environment at the former Paintball/AirSoft facility and to evaluate the lateral and vertical extent of refuse and the thickness of the landfill cover. The scope of the investigation included a geophysical survey, six test pit excavations, soil sampling, sampling of soil-filled drums, and soil gas sampling.

The geophysical survey did not conclusively define the lateral and vertical extent of the landfill; however, test pits confirmed the thickness of the landfill cap, which was found to vary between two- and five-feet thick.

According to ETI (ETI in DON 2007), subsurface conditions encountered in test pits generally consisted of several feet of sandy silt and clayey gravel fill at the surface underlain by rubbish to the bottom of the test pits at depths of 2 to 5.5 feet below existing grades. Rubbish encountered in these pits generally included plastic sheeting, electrical wire fragments, plastic, wood, particle board debris, a metal wheel, 55-gallon drum fragments, Styrofoam, paper, a bicycle, glass, concrete, metal tubing, plastic cartons, glass bottles, glass panes, textiles, plastic bags, fast food wrappers, and electrical wire insulation. Excavation of the test pits were stopped in rubbish. Groundwater was not encountered in the test pits due to their relatively shallow depths.

Target analytes for the surface and subsurface soil samples included total petroleum hydrocarbon (TPH) as diesel range organics (DRO) and lubrication range organics (LRO), VOCs, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), mercury, other metals and elements. Only three analytes (acetone, benzo[a]pyrene, and TPH [carbon C_{10} to C_{40}]) were detected in the surface soil samples (collected from two of the six test pits) at concentrations exceeding the DOH Environmental Action Levels (EALs). An informal risk assessment, conducted by the Navy Environmental Health Center, indicated that there was no unacceptable risk to potential users and workers from soils at the former Paintball/AirSoft facility.

Detailed findings from the six exploratory test pits that were excavated at the west side of the landfill (Test Pit [TP]-1 through TP-6) are as follows:

- TP-1, located in the northwest corner of the landfill, had a three-foot layer of cover soil. Rubbish encountered in TP-1 included plastic sheeting, electrical wire fragments, miscellaneous plastic debris, and wood and particle board debris. Target analytes detected in the soil cover included the VOCs 2-butanone and acetone and the metals antimony, cobalt, and nickel; however, only acetone exceeded its EAL.
- TP-2, located southwest of TP-1 in an area that had been graded by the tenant, had a 2.25-foot layer of cover soil. Rubbish encountered in TP-2 included a metal wheel, 55-gallon drum fragments, Styrofoam, plastic debris, plastic sheeting, and oxidized steel debris. Target analytes detected in the soil cover included the VOC methylene chloride, TPH (C_{10} to C_{40}), and the metal zinc; however, only TPH exceeded its EAL.

- TP-3, located southeast of TP-2, had a two-foot layer of cover soil. Rubbish encountered in TP-3 included cinder block and concrete rubble. Target analytes detected in the soil cover included the VOCs ethylbenzene, m,p-xylene, o-xylene, and toluene; and the metals cadmium and mercury; however, none of the analytes were detected at concentrations that exceeded EALs.
- TP-4, located south of TP-2, had a five-foot layer of cover soil. Rubbish encountered in TP-4 included plastic bags with plastic, paper, Styrofoam, and some wood chips. Target analytes detected in the soil cover included the metals aluminum, antimony, chromium, copper, iron, manganese, and silver; however, none of the metals were detected at concentrations that exceeded EALs.
- TP-5, located southeast of TP-4, had a three-foot layer of cover soil. Rubbish encountered in TP-5 included plastic liners, paper, plastic trash, and wood debris. Target analytes detected in the soil cover included 11 of the 16 PAHs monitored by DOH and the metals lead and tin; however, only the PAH benzo(a)pyrene exceeded its EAL.
- TP-6, located south of TP-4 and TP-5, had a 3.5-foot layer of cover soil. Rubbish encountered in TP-6 included plastic sheeting, metal tubing, a bicycle, broken glass, paper, and concrete. Target analytes detected in the soil cover included the PCB Aroclor-1260 and the metals arsenic and selenium; however, none of the analytes were detected at concentrations that exceeded EALs.

Three permanent soil gas wells and six temporary soil gas wells were installed at the site. The three permanent wells were located adjacent to the east side of the Medical Warehouse (Wells GP #1, #2, and #3). The six temporary wells were located within the landfill (Wells TP-1 thru TP-6). All nine of the wells were monitored for VOCs, using a MiniRae 2000 photoionization detector (PID). The soil gas well with the highest concentration of VOCs, Well GP #3, was sampled and analyzed for site COPCs including VOCs in air, using EPA Method TO-14A, and Permanent Gases, using ASTM D1946-90. Chemicals of potential concern (COPCs) were not detected in the gas sample at concentrations exceeding screening criteria (DOH's 2005 shallow soil gas action levels for evaluation of vapor intrusion for residential land use); however, acetone, 2-butanone, benzene, toluene, ethylbenzene, m,p-xylene, o-xylene, 4-ethyltoluene, 1,2,4-trimethylbenzene, and 2-propanol were detected in the sample at concentrations above laboratory DLs. Methane was not detected in any of the three well samples.

Six temporary soil gas probes, installed at the bottom of each of the six test pits, were monitored for VOCs (using a PID) and the landfill gases methane, carbon dioxide, and oxygen, using a GA-90 landfill gas analyzer. PID readings in the temporary wells ranged from a low of 1.6 parts per million (ppm) in TP-6 to a high of 33.5 ppm in TP-1. Methane was not detected in any of the temporary gas wells. All of the wells had elevated concentrations of carbon dioxide and decreased concentrations of oxygen.

The soil contained within the drums on the east side of the landfill outside of the former Paintball/AirSoft facility was similar to that used for the landfill cover. Arsenic and nickel concentrations were detected at concentrations slightly above background concentrations and EALs. It was not known if the presence of arsenic and nickel was from the deteriorating metal drums or from the soils used to fill the drums. ETI concluded that the soils within the drums be considered non-hazardous for the purposes of disposal according to the criteria in 40 CFR §261.24.

The report recommended the following:

- Excavations be performed at each of the geophysical transect locations to better define the landfill boundary;
- At least one additional round of landfill gas monitoring be conducted at the Medical Warehouse perimeter gas probes for methane and carbon dioxide using field instrumentation;
- All of the soil-filled barrier drums present on the east side of the landfill be excavated and removed from the site and disposed of at an approved landfill before they deteriorate further;
- An additional round of groundwater samples be collected and analyzed; and
- An ecological risk assessment be performed to more fully assess any impacts the COPCs at the Quarry Pit Landfill may have on the environment, including the adjacent wetland.

Site Reconnaissance (E2 2010). A site reconnaissance of the subject property was conducted on May 7, 2010, during the proposal development phase of the RI/FS. E2 personnel met with Mr. Joel Narusawa, the NAVFAC Hawaii Navy Technical Representative (NTR) for the project, and Project Manager Mr. Brett Chambers and Natural Resource Manager Mr. Lance Bookless of the Environmental Compliance and Protection Department of MCB Hawaii. Mr. Bookless walked the field crew through portions of the project site to familiarize the project team members with the location of the wetland and the vegetation that would need to be cleared for the field work. Mr. Bookless requested that a 30-meter/100-foot vegetative buffer be left in place for dust and silt control at the northern half of the site (north along Mokapu Road, west along the Lemon Lot, and east along the boundary of the adjacent wetland). If the area needed to be cleared to permit freedom of movement of construction equipment, this buffer could be removed; however, new vegetation would need to be planted in its place, preferably native.

Observations of general site conditions were made that could affect sampling procedures, sampling locations, and health and safety requirements. The following observations were documented during the reconnaissance:

- The presence of one Sprung instant structure was observed on the southern portion of the landfill.
- The locations of adjacent structures (i.e., Medical Warehouse [Building 4088], 3rd Marine Motor Pool [Building 6030], and Area 6755C3 HMMWV Egress Assistance Trainer) were verified.
- The middle of the site was relatively clear of vegetation and contained various small obstacles/barriers utilized in the former Paintball/AirSoft operations.
- The northern end of the site was heavily vegetated with California grass and koa haole trees.
- A small soil berm approximately two to three feet in height was observed along the eastern boundary of the landfill adjacent to the wetland. A portion of the wetland was observed in the northern half of the site during the reconnaissance. The wetland bottom appeared to be four to six feet below the top of the berm. The wetland appeared to be relatively dry with some areas of standing water; however, MCB Hawaii personnel have observed a fair amount of standing water in the area as noted by the presence of various

birdlife. A stone revetment wall was observed along the eastern bank of the wetland near the edge of the motor pool parking lot.

- The three gas probe wells adjacent to the Medical Warehouse were observed to be intact and finished flush to grade.

The existing monitoring wells surrounding the landfill were located. Seven of the eight wells were finished aboveground with traffic bollards. The aboveground outer well casings were intact, but all were rusted and several of the outer well covers were damaged or missing. It appeared that one of the wells located along Mokapu Road was damaged with the aboveground outer well casing and the inner well cover both missing. The well appeared to still be intact below the existing ground surface.

RI/FS (E2 2012). In 2011, a RI/FS was prepared for the site. The project area was divided into a total of seven decision units (DUs) - the Quarry Pit Landfill was divided into DU-1 through DU-5, and the adjacent wetland area was divided into DU-6 and DU-7. The nature and extent of solid waste in the Quarry Pit Landfill were evaluated by conducting a geophysical survey, excavating trenches (20 total, Figure 3), drilling boreholes (210 total, Figure 4), and installing/sampling groundwater monitoring wells (16 total, Figure 5) throughout the landfill area. Trenching and drilling were not conducted in either of the adjacent wetland DUs; however, multi-increment MI) surface sediment and surface water samples were collected from the wetland DUs. The magnitude and extent of COPCs in soil and groundwater in the landfill, and in surface sediment and surface water in the adjacent wetland were evaluated by collecting and analyzing the appropriate samples. Landfill soil gases were evaluated in several locations within and along the perimeter of the landfill using hand-held meters. The landfill boundary was confirmed by various investigation surveys (i.e., geophysical survey, topographic survey, soil borings, trenching, and review of previous investigations and historical documents) (Figure 6).

The volume of debris (Figure 7) within the Quarry Pit Landfill was estimated to be approximately 90,400 cubic yards, with an average debris thickness of 5 feet, a maximum debris thickness of 8.5 feet, and a minimum debris thickness of zero feet. The debris layer at the Quarry Pit Landfill was predominately composed of a wide array of household debris with small amounts of industrial and medical / debris mixed with sandy to silty clay.

The lateral and vertical extent of the soil cap (Figure 8) was evaluated by excavating trenches and installing soil borings throughout the landfill. Debris was not observed in about 25 of the 150 individual soil borings. In the soil borings where debris was encountered, a relatively thin soil cap thickness (as thin as 13 inches) was measured and recorded in 27 boreholes, most of which were located in DU-1 and DU-2. Figure 4 shows the variations of the thickness of the soil cap based on stratigraphic data collected from the soil borings. Areas of the landfill colored red indicate a soil cover thickness that is less than 2 feet (an estimated area of 2.72 acres). The nature of the soil cap material consists primarily of dry to moist, brown to dark brown clays, sandy or silty clays, and clayey sands.

Screening Human Health Risk Assessment: The risks presented in the screening human health risk assessment (sHHRA) (McDaniel Lambert, Inc. [MLI] in E2 2012) are based on soil and sediment MI samples that are representative of each DU, assuming that potential receptors will not be spending a large amount of time in any specific area. The sHHRA results for the two use scenarios evaluated under Concept #1 (Physical Training Area and Recreational Area - Park or Playfield), which MCB Hawaii has indicated are the most likely future uses, are summarized here.

The physical training use (adult) cancer risks are within the EPA risk management range for the landfill DU-1 through DU-5.

The park/playfield recreational use (adult and child) cancer risks are within the EPA risk management range for the main portion of the landfill, which are DU-1 through DU-4. The cancer risks for DU-5, which is the berm area between the landfill and the adjacent wetlands, exceed the upper end of the risk management range ($1x10^{-4}$). However, the exposure risk calculation for DU-5 is considered conservative because it assumes that receptors would only be spending time within DU-5, which is unlikely since it is a bermed area that will likely not be used. Due to elevated levels of PCBs in discrete trench locations in DU-1 through DU-4, future use as a playground area or any other type of recreational use concentrated in small portions of the landfill would require further characterization.

The sHHRA also evaluated risks to potential receptors within DU-6 and DU-7. The conceptual site model determined that the exposure pathways from soil and surface water (contaminants found in wetland sediment/surface water via runoff/erosion) were incomplete for onsite users and construction workers, but potentially complete for wetland maintenance workers. The exposure risks to maintenance workers were determined to be within acceptable risk levels and no further action for the wetland area was recommended.

Screening Level Ecological Risk Assessment: The screening-level ecological risk assessment (SLERA) (MLI in E2 2012) incorporated site-specific information from the biological survey and provided an evaluation of potential ecological risks from contamination in the wetland area, which serves as a filter for pollutants in runoff from the Motor Pool parking lot and the surrounding areas. Results for ecological receptors are varied; complete pathways exist for plants and invertebrates (via dermal contact/uptake), and birds (via ingestion/biotic uptake). Based on the RI findings and risk assessment, no further action for the Quarry Pit Landfill is required at this time due to ecological risk concerns.

2.4 Current and Potential Future Site Land Use

The central portion of the landfill was left undeveloped from 1976 to 2000. Starting in 2000, Paintball Hawaii & Pacific AirSoft, a commercial paintball operation, used the southern two-thirds of the area as a paintball recreational facility (FAI 2011). Paintball operations closed in January 2012, and this area is now vacant.

There is one temporary structure (a Sprung) located in the southern portion of the landfill, which is reportedly used for storage. The floor of the Sprung consists of impermeable, interlocking rubber tiles.

A parking structure has recently been constructed over a small portion of the landfill (west-central side) near the former lemon lot.

The remainder of the landfill is currently unused and is overgrown with vegetation; however, the site has potential for use by the Hawaiian Stilt for foraging. Potential future land uses include: recreational uses as a park/playfield; multi-purpose troop training area; or industrial/commercial uses; and maintaining as an open green space in its natural state.

2.5 Remedy in Place

The areas where LUCs will be implemented at the site are shown on Figure 2, and legal descriptions of these LUC boundaries are provided in Appendix B. Implementation of LUCs will require the performance of CERCLA five-year reviews to evaluate the continued effectiveness of the remedy; reporting of the inspection and evaluation results; and notification to regulators of any changes in risk, remedy, or land use. The inspections and reporting requirements described herein will be effective immediately upon concurrence with this LUCP by the Navy and DOH. Once put into effect, the requirements set forth in this document will remain applicable to the current landowner and all subsequent landowners until the LUCs are no longer needed and are terminated.

Section 3 Land Use Control Performance Objectives

Generally stated, the LUC performance objectives for the site are to: 1) protect human health; 2) prevent the disturbance of debris and/or contaminated soil remaining on-site, and; 3) restrict land use to activities compatible with the final remedy at the areas where LUCs apply. Specific LUC performance objectives are described below.

3.1 Land Use Restrictions

- Protect human health by reducing rates of exposure to debris and/or contaminated soils left in place at the LUC area.
- Ensure that site soil is not disturbed, excavated, or removed unless done in accordance with special handling procedures and with the prior consent of the Navy, MCB Hawaii, and DOH.
- Ensure no unauthorized development and use of the LUC area for residential housing, elementary or secondary schools, and child care facilities.
- Ensure that land use restrictions are maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure, or until LUCs are no longer needed due to changes in site conditions.

3.2 Notice

- Ensure that all future site users and environmental regulators are aware that contamination is present in certain areas at the site at concentrations that may pose a risk under certain exposure scenarios.
- Ensure that all future site users and environmental regulators are aware that land use restrictions are imposed at the site to protect human health.
- Ensure that legal notice of site contamination and LUCs is provided in multiple documents where a person would normally look for such notice.
- Ensure that legal notices of LUCs are maintained in perpetuity or until they are no longer needed due to changes in site conditions.

3.3 Land Use Control Maintenance and Reporting

- Monitoring and Maintenance
  - Ensure that the two-foot vegetated soil cap remains functional and is maintained in good condition and that the debris and/or contaminated soil left in place have not been disturbed.
  - Ensure that LUCs remain in place, effective, and protective of human health and site conditions through five-year reviews.

- Compliance Reporting
  - Ensure that LUC monitoring is being conducted.
  - Facilitate Navy and DOH oversight and response action, if required.
  - Ensure that specific points of contact for reporting are designated.

- Mitigation and Enforcement
  - Ensure landowner compliance with LUCs.
  - Ensure well-defined enforcement processes and measures that can be conducted without long delays.
  - Ensure that costs associated with LUC enforcement is covered by the party in breach.

Lastly, the responsibilities of interested parties to maintain, provide notice of, monitor, report on, and enforce LUCs are designated in Section 5.

Section 4 Land Use Controls

LUCs can consist of Engineering Controls (ECs) and/or Institutional Controls (ICs). The following section identifies the areas intended for LUCs and the ECs and ICs that have been or will be implemented to meet the LUC performance objectives. LUCs will remain in effect at the LUC area at the site until site conditions allow unrestricted land use and unlimited exposure. The use of several mechanisms provides a layering strategy that significantly increases the likelihood that site users and regulatory agencies will receive notice of the site contamination, LUCs, their associated rights, and responsibilities for maintaining the LUCs.

4.1 Restricted Use Areas

The areas at the site where LUCs are to be implemented are summarized in Table 1 and are described below.

Table 1: Summary of Restricted Use Areas

Chemical	DOH Tier 1 EAL for Unrestricted Use	Maximum Concentration	Depth of Maximum Exceedance
Soil			
PAHs	1.5 mg/kg	5.3 mg/kg	Landfill surface
PCBs	1.1 mg/kg	40 mg/kg	Trench surface
SVOCs	0.037 mg/kg	0.17 mg/kg	Trench subsurface
Barium	750 mg/kg	921 mg/kg	Trench surface
Arsenic	20 mg/kg	31.5 mg/kg	Trench subsurface
Groundwater			
Nickel	5 μg/L	17.7 μg/L	On-site groundwater
Selenium	5 μg/L	7.3 μg/L	On-site groundwater
Zinc	22 μg/L	35 μg/L	On-site groundwater
Silver	1 μg/L	1.8 μg/L	Down-gradient groundwater
Mercury	0.047 μg/L	0.068 μg/L	Wetland surface water

Notes:
mg/kg = milligram per kilogram
μg/L = microgram per liter

4.2 Engineering Controls

ECs are physical controls that are constructed to reduce exposure pathways or protect the integrity of the remedy at a site. Examples of ECs include fencing, security lighting, and soil caps. The following ECs have been implemented at the LUC area:

- A vegetative soil cap constructed of at least 2-feet of clean soil covers the soil and debris left in place at the LUC area with COCs exceeding action levels, preventing direct exposure.
- Heavy vegetation and wetland surround the northern and eastern boundaries of the site, preventing access on these sides.

- Buildings surround the western and southern boundaries of the site, restricting access on these sides.

4.3 Institutional Controls

ICs are administrative and/or legal controls that provide notice of contamination, limit land uses, and/or require actions to be taken to protect human health at a site. Examples of ICs include deed notices and restrictions (easements and covenants), government LUC registries, zoning restrictions, and permits. The following ICs will be implemented at the LUC area:

- MCB Hawaii permit review and approval processes
- Monitor the institutional (legal) controls with geographic information systems (GIS) applications and project reviews

4.3.1 Construction Permit Process

To preclude the excavation and removal of soils with contamination from the LUC area to any other location, MCB Hawaii will add the coordinates of the LUC area into their GIS database. The MCB Hawaii will review all civil plans prepared for a project and will query the database to determine if potential construction will impact a LUC-restricted parcel. Land use at the site is restricted to recreational, training, and industrial/commercial use only. No residential use is allowed. If playgrounds are to be constructed, additional surface soil sampling at the specific playground location will be required to determine if additional protection measures will be required. In the event a plan is reviewed and determined to potentially impact a site, the MCB Hawaii will notify the builder and/or utility company of the LUC restrictions associated with the site and refer the builder to DOH for review and approval. The MCB Hawaii will coordinate with the builder, Navy, and DOH on any actions to be taken and either deny or permit the work to be conducted. This process will be reviewed during the five-year review to determine if any changes need to be implemented.

Excavation Permit. A copy of the MCB Hawaii excavation permit is provided in Appendix C. Prior to conducting intrusive activities, all Contractors are required to contact the Contracting Officer 30 calendar days in advance so the Facilities Department can implement and process permits for excavation activities. The Facilities Department will review CAD/GIS files of the construction site to identify existing utilities within the vicinity, but the contractor will be responsible for toning and locating all existing underground utilities or utilities encased in pier structures prior to intrusive activities.

In addition, effective July 2004, the Hawaii One Call Center (HOCC) was put into operation, requiring mandatory participation by excavators (contractors) and operators (public utilities). The One Call Center system will provide advanced warning to excavators of the location of underground lines before they begin digging. This mandatory "Call Before You Dig" program will provide excavators with a single phone number to call for locating and marking underground lines, including lines for electric, gas, telecommunications, cable, water and sewer facilities. The HOCC can be reached at (866) 423-7287.

Section 5 Responsibilities for Implementing and Maintaining LUCs

The MCB Hawaii will retain the "Landowner Responsibilities".

5.1 Notice Requirements

5.1.1 Landowner Responsibilities

Notice of Existing Contamination. The landowner shall provide notice to all regular site users (e.g., lessees, permanent occupants, etc.) of the LUC area with site contamination, human health risks associated with this contamination, land use restrictions, and LUC boundaries.

Notice of Changes to Site Conditions. The landowner shall be required to notify the Navy and DOH of any construction work that is planned to take place within the LUC area or that may impact soil and/or debris within the LUC area at least 60 days prior to commencing such construction activities. The landowner shall be required to immediately notify the Navy and DOH of any disturbance or removal of soils and/or debris from within the LUC area, and of any suspected or known new release of chemicals on the site.

The landowner will notify the Navy and DOH as soon as practicable after discovery of any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs. The landowner shall provide documentation of notification of the breach, and of how the activity that was inconsistent with the IC objectives or use restrictions was or will be addressed. Lessees of the site should be required to notify the landowner of any disturbance or removal of soils and/or debris from within the LUC area and any suspected or known new release of chemicals to the environment at the site.

Prior to seeking approval from DOH, the recipient of the property must notify and obtain approval from the Navy of any proposals for a land use change at the site inconsistent with the use restrictions and assumptions described in this LUCP.

5.1.2 Navy Responsibilities

Notice of Existing Contamination. The Navy will provide notice of site contamination and associated risks to the DOH in various environmental documents.

Notice of Changes to Site Conditions. Should the Navy discover any activity on the site that is inconsistent with the IC objectives or use restrictions or any other action that may interfere with the effectiveness of the ICs, the Navy shall notify DOH of the discovery. The Navy will then work with DOH and the MCB Hawaii to correct the problem(s) discovered. This notice requirement does not preclude the Navy from taking immediate action pursuant to its CERCLA authorities to prevent any actual or perceived risk(s) to human health at any of the LUC area or adjacent property.

The Navy will also review advances in scientific knowledge associated with contaminants that remain at the site during the five-year review process as required by CERCLA. The Navy will notify DOH and the MCB Hawaii if calculated site risks to human health change due to changes

in scientific knowledge (i.e., toxicity values, EALs). This notification can be made by providing the landowner a copy of the five-year CERCLA report (discussed below).

5.1.3 DOH Responsibilities

Notice of Changes to Site Conditions. DOH is encouraged to provide the Navy prompt notice of any known or suspected changes in site conditions, releases of chemicals to the site, or off-site contaminant migration that it learns of independently (e.g., through DOH site inspections, landowner reports, anonymous tips, permit reviews, etc.).

5.2 Inspection and Monitoring Requirements

5.2.1 Landowner Responsibilities

Frequent Inspections. The landowner shall be required to frequent and continually inspect the site to ensure that LUCs are being maintained and remain effective, unless and until LUCs are terminated. The landowner shall also note any evidence of site soil migrating off-site or new releases of chemicals that have occurred after transfer of the property. Any transfer deed containing LUCs should also impose on the subsequent landowners a duty to notify the Navy immediately (i.e., within 5 days) of the following:

(1) any known or suspected releases of the identified substances, and/or

(2) any known or anticipated violation of any land use control.

Right of Access. The landowner shall also provide unencumbered rights of access to the DOH, or their designated agents, to: (1) inspect the property for environmental conditions and compliance with land use restrictions; (2) mitigate site conditions that present a risk to human health (if the landowner has failed to take appropriate action), and; (3) enforce land use restrictions if necessary.

5.2.2 Navy Responsibilities

Five-year Inspections. The Navy shall physically inspect the property at a minimum of every five years to ensure that LUCs are being maintained and remain effective, unless and until LUCs are terminated. Data will be collected during these inspections to meet the CERCLA five-year reporting requirements (discussed below).

5.2.3 DOH Responsibilities

Conditional Inspections. DOH may inspect the property in the event LUCs are breached or if releases of chemicals occur or are suspected to have occurred at any of the LUC area. The purpose of this inspection is to aid in formulating an appropriate response action.

5.3 Compliance Reporting Requirements

5.3.1 Landowner Responsibilities

Annual Reporting. The landowner shall submit LUC inspection and monitoring information and a signed compliance certification (Appendix D) to the Navy and DOH on an annual basis. If applicable, the landowner will identify any LUC compliance deficiency(ies) and the mitigating measures that have or will be taken to address those deficiencies. The annual report should also discuss any permitted land modifications and the manner in which debris and/or

contaminated soil was handled and/or disposed of to protect human health and the environment and comply with all applicable laws. The need and requirements for annual site inspections and certification will be re-evaluated every five years by the Navy and DOH.

Monitoring of the environmental use restrictions and controls will be conducted annually by the landowner. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to the Navy and DOH. The annual monitoring reports will be used in preparation for the Navy's five-year review to evaluate the effectiveness of the remedy.

The annual monitoring report, submitted to the Navy and DOH by the landowner, will evaluate the status of the ICs and how any IC deficiencies or inconsistent uses have been addressed. The annual evaluation will address whether the use restrictions and controls referenced above were communicated in the deed(s), whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed to such restrictions and controls.

5.3.2 Navy Responsibilities

CERCLA Five-year Compliance Reporting. The Navy will provide DOH and the landowner with five-year review reports for the site as required by CERCLA Section 120(c) and in accordance with EPA's "*Comprehensive Five-Year Review Guidance"* (EPA 2001). This report shall review site conditions; site uses and users (i.e., lessees); compliance with LUC restrictions and objectives; any mitigating and/or enforcement measures taken or required at the site; advances in scientific knowledge or changes in law that require re-evaluation of the remediation goals and final remedy identified in the DD; and any conveyance of the property interests. The Five-Year Review Checklist and Report Template are provided in Appendix E.

The five-year review period will begin with the approval of the DD, which selects the final remedy for the site. The Final DD for the site was approved on June 3, 2014. Five-year reviews will be conducted until LUCs are no longer needed because the contaminant concentrations have been reduced to levels that allow unrestricted land use or site conditions have changed.

5.3.3 DOH Responsibilities

Compliance Reporting. DOH will be responsible for project oversight, reviewing all submittals, including compliance reports and providing comments, and where appropriate, approval or denial to requests and proposals in a timely manner. DOH has no compliance reporting responsibilities, but is encouraged to report to the Navy any enforcement actions taken or contemplated to ensure landowner compliance with applicable LUCs.

5.4 Mitigation and Enforcement Requirements

5.4.1 Landowner Responsibilities

Mitigation Measures. Upon discovery, the landowner will be required to promptly take any mitigation measures necessary to address non-compliance with LUCs or releases of potentially harmful chemicals at the site. Any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs will be

addressed by the landowner as soon as practicable after the landowner has become aware of the breach.

5.4.2 Navy Responsibilities

Mitigation Measures. Although the landowner is directly responsible for mitigating non-compliance issues for the LUC area at the site, the Navy remains ultimately responsible for ensuring that the landowner promptly takes all required actions necessary to address LUC non-compliance issues and that the LUCs remain effective. Any activity that is inconsistent with the IC objectives or use restrictions or any other action that may interfere with the effectiveness of the ICs will be addressed by the landowner as soon as practicable after the landowner becomes aware of the breach.

Additional Response Action. The Navy will remain responsible for addressing unacceptable risks to human health associated with contamination left in the LUC area in accordance with CERCLA section 120(h)3. For example, future Navy response action may be required if the selected remedy, as designed, is no longer protective of site receptors (e.g., based on new toxicity information) or if new contamination is discovered at the site that is attributed to past Navy operations. The Navy is not required to address increases in site risks resulting in actions of the landowner, lessees, site users, or trespassers.

Enforcement Action. Should the LUC portion of the remedy reflected in this LUCP fail to protect human health and the environment, the Navy will coordinate with DOH to ensure that appropriate actions are taken to reestablish its protectiveness. These actions may range from informal resolutions with the landowner or violator of a LUC provision(s) as described in this LUCP, to the institution of judicial action under the auspices of Hawaii property law or CERCLA. Should the Navy become aware that any owner or use of the property has violated any LUC requirement over which a local agency may have independent jurisdiction, the Navy will notify these agencies of such violation(s) and work cooperatively with them to re-achieve owner/user compliance with the LUCs.

5.4.3 DOH Responsibilities

Enforcement Action. The DOH as authorized by CERCLA, is responsible for implementing regulatory enforcement actions required to ensure compliance with LUCs at the site. Enforcement measures that may be taken include, but are limited to, notices of non-compliance, court orders, or fines.

Section 6 Termination of LUCs

Based on the results of the CERCLA five-year reviews, the Navy may determine, with DOH concurrence, that one or more of the LUCs are no longer needed for protection of human health and the environment at the LUC area at the site (i.e., site conditions are appropriate for unrestricted reuse and unlimited exposure). At that time, the Navy may recommend to MCB Hawaii that the LUC boundaries in their GIS database be amended or file another appropriate legal instrument to add the CERCLA section 120(h)3 covenant and to remove the LUC provisions. In addition, annual and CERCLA five-year reviews will no longer be required once the site can be used for unrestricted reuse. However, the MCB Hawaii should periodically review EPA health criteria (e.g., current DOH EALs, etc.) to ensure that the property remains safe.

The MCB Hawaii shall not modify or terminate LUCs or implementation actions, nor modify land use without approval by the Navy and DOH. The MCB Hawaii shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

The MCB Hawaii, Navy, and DOH should also update their land registries to reflect changes to the future status of LUCs on the site.

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Section 7 LUCP Distribution

Within 30 days of receiving DOH approval and MCB Hawaii Environmental Branch agreement of this LUCP, the Navy will undertake the following specific actions:

1. Send a copy of the LUCP to the DOH, the recipient of the subject parcels, at the following address:

   State of Hawaii, Department of Health, HEER Office
   919 Ala Moana Boulevard, Suite 206
   Honolulu, Hawaii 96814
   Telephone: (808) 586-0955
   Fax: (808) 586-7537

2. Send a copy of the LUCP to the MCB Hawaii Environmental Branch at the following address:

   MCB Hawaii Environmental Branch
   P.O. Box 2977
   Kaneohe, Hawaii 96744
   Telephone: (808) 257-7001

   A letter should be sent with the LUCP requesting that: (1) MCB Hawaii not re-zone the site for residential use without prior concurrence from the Navy, and; (2) the Navy and DOH be notified if construction activities are planned that will impact the subject site.

3. Place a copy of the LUCP to the Navy Administrative Record File located at:

   Naval Facilities Engineering Command, Hawaii
   400 Marshall Road
   JBPHH Hawaii 96860-3139

4. Place a copy of the LUCP to the Navy information repository located at the following university and public libraries:

   University of Hawaii's Hamilton Library
   2550 McCarthy Mall
   Honolulu, Hawaii 96822
   Telephone: (808) 956-7203

   Kailua Public Library
   239 Kuulei Road
   Kailua, Hawaii 96734
   Telephone: (808) 266-9911

   Kaneohe Public Library
   45-829 Kamehameha Highway
   Kaneohe, Hawaii 96744
   Telephone: (808) 233-5676

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Section 8 Points of Contact

Correspondence, inquiries, and LUC monitoring reports should be sent to the following points of contact:

Navy:
Department of the Navy
NAVFAC Hawaii
400 Marshall Road
JBPHH Hawaii 96860-3139
Telephone: (808) 471-1171

MCB Hawaii:
Marine Corps Base Hawaii
Environmental Branch
P.O. Box 2977
Kaneohe, Hawaii 96744
Telephone: (808) 257-7001

DOH:
State of Hawaii
Department of Health
HEER Office
919 Ala Moana Boulevard, Suite 206
Honolulu, Hawaii 96814
Telephone: (808) 586-0955

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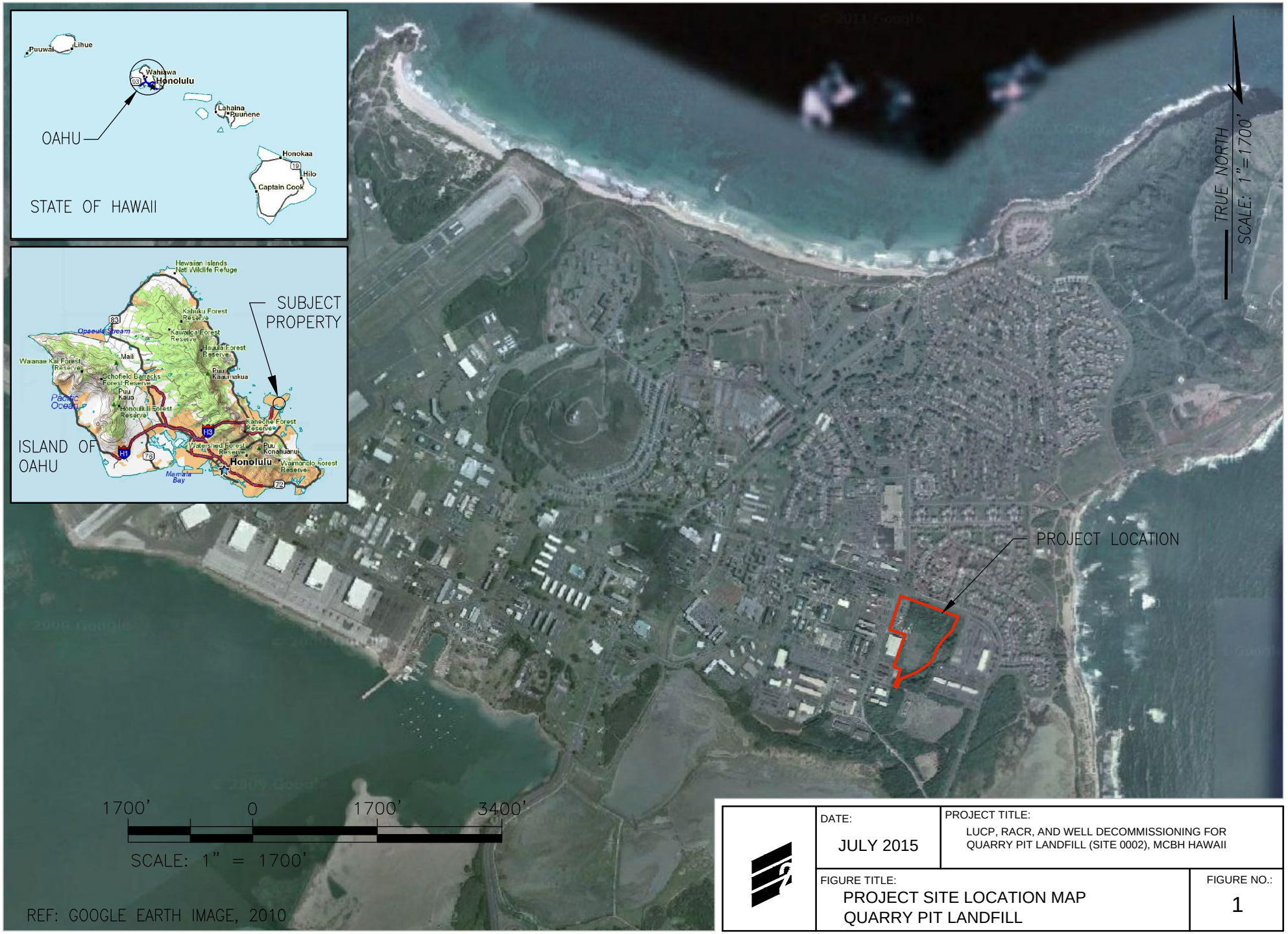
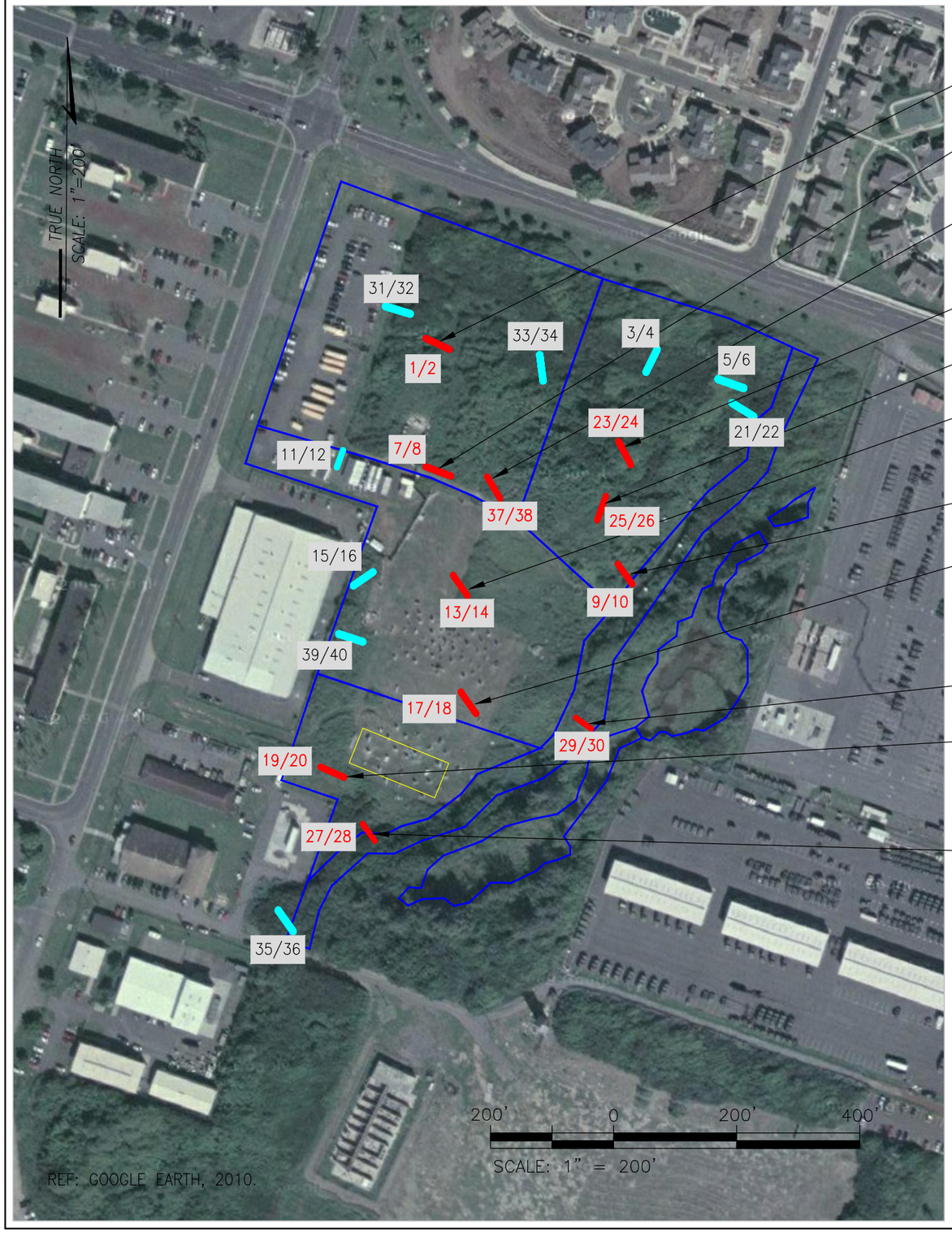
Naval Energy and Environmental Support Activity (NEESA). 1984. *Initial Assessment Study of Marine Corps Air Station Kaneohe Bay, Hawaii*. April.

Figures



	DATE: JULY 2015	PROJECT TITLE: LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCBH HAWAII
	FIGURE TITLE: PROJECT SITE LOCATION MAP QUARRY PIT LANDFILL	FIGURE NO.: 1

	DATE: JULY 2015	PROJECT TITLE: LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCBH HAWAII
	FIGURE TITLE: SITE VICINITY MAP QUARRY PIT LANDFILL	FIGURE NO.: 2



1/2	SURFACE (0-3.5')	SUBSURFACE (3.5'-7.6')	PROJECT ACTION LEVEL	ACCEPTED BACKGROUND
BARIUM	744	***793***	750	690

7/8	(0-1.3')	(1.3'-8.25')		
AROCLOR-1242	ND	***2.1***	1.1	NA
TOTAL PCBs	0.11	***2.1***	1.1	NA

37/38	(0-2.5')	(2.5'-6.5')		
DIMETHYL PHTHALATE	ND	***0.094***	0.035	NA
AROCLOR-1260	***2.3***	0.54	1.1	NA
TOTAL PCBs	***2.3***	0.54	1.1	NA

23/24	(0-2')	(2'-6.5')		
ARSENIC	4.7	***31.5***	20	24

25/26	(0-1.5')	(1.5'-6.5')		
DIMETHYL PHTHALATE	ND	***0.17***	0.035	NA

13/14	(0-1.5')	(1.5'-7')		
BENZO(A)PYRENE	***0.15***	***1.9***	0.15	NA
BENZO(B)FLUORANTHENE	0.26	***2.3***	1.5	NA
DIBENZ(A,H)ANTHRACENE	0.026	***0.42***	0.15	NA

9/10	(0-2.5')	(2.5'-6.5')		
BENZO(A)PYRENE	***0.27***	0.096	0.15	NA

17/18	(0-2.0')	(2'-9.7')		
BENZO(A)ANTHRACENE	***2***	0.033	1.5	NA
BENZO(A)PYRENE	***2.5***	0.059	0.15	NA
BENZO(B)FLUORANTHENE	***3.2***	0.1	1.5	NA
DIBENZ(A,H)ANTHRACENE	***0.51***	0.014	0.15	NA
INDENO(1,2,3-CD)PYRENE	***3.2***	0.071	1.5	NA

29/30	(0-1')	(1'-7')		
BARIUM	***921***	***830***	750	690

19/20	(0-2')	(2'-4.5')		
1,4-DICHLOROBENZENE	ND	***0.12***	0.037	NA
BENZO(A)PYRENE	0.0044	***0.36***	0.15	NA
AROCLOR-1260	***40***	***14***	1.1	NA
TOTAL PCBs	***40***	***14***	1.1	NA

27/28	(0-2')	(2'-6')		
AROCLOR-1260	***18***	***1.9***	1.1	NA
TOTAL PCBs	***18***	***1.9***	1.1	NA

LEGEND

- DU BOUNDARY
- LANDFILL TRENCH WITH EXCEEDANCES
- LANDFILL TRENCH WITH NO EXCEEDANCES
- 29/30 TRENCH NUMBER
- SPRUNG

NOTES:
1) ***BOLD*** INDICATES RESULT IS IN EXCEEDENCE OF THE PAL AND BACKGROUND LEVELS
2) ALL RESULTS ARE IN [mg/kg]
3) TRENCHES WITH EXCEEDANCES ARE NUMBERED IN RED
4) ALL OTHER TRENCHES (IN BLUE) HAVE NO EXCEEDANCES
5) ND – NON DETECT
6) NA – NOT APPLICABLE

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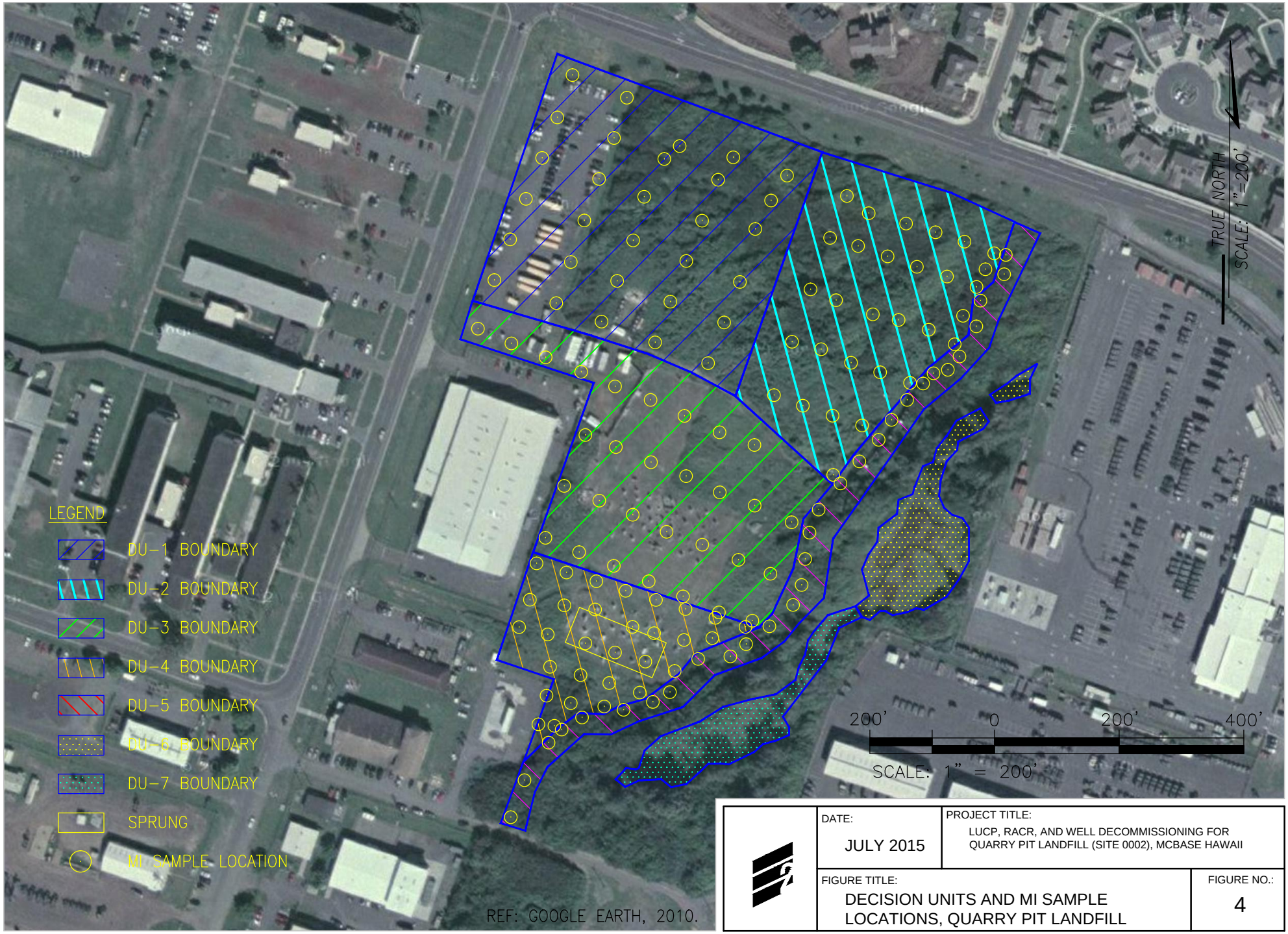
PROJECT TITLE:
LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCB HAWAII

FIGURE TITLE:
LANDFILL TRENCHES MI SOIL SAMPLE ANALYTICAL RESULTS [mg/kg] EXCEEDING PALs

DATE: JULY 2015

FIGURE NO.: 3



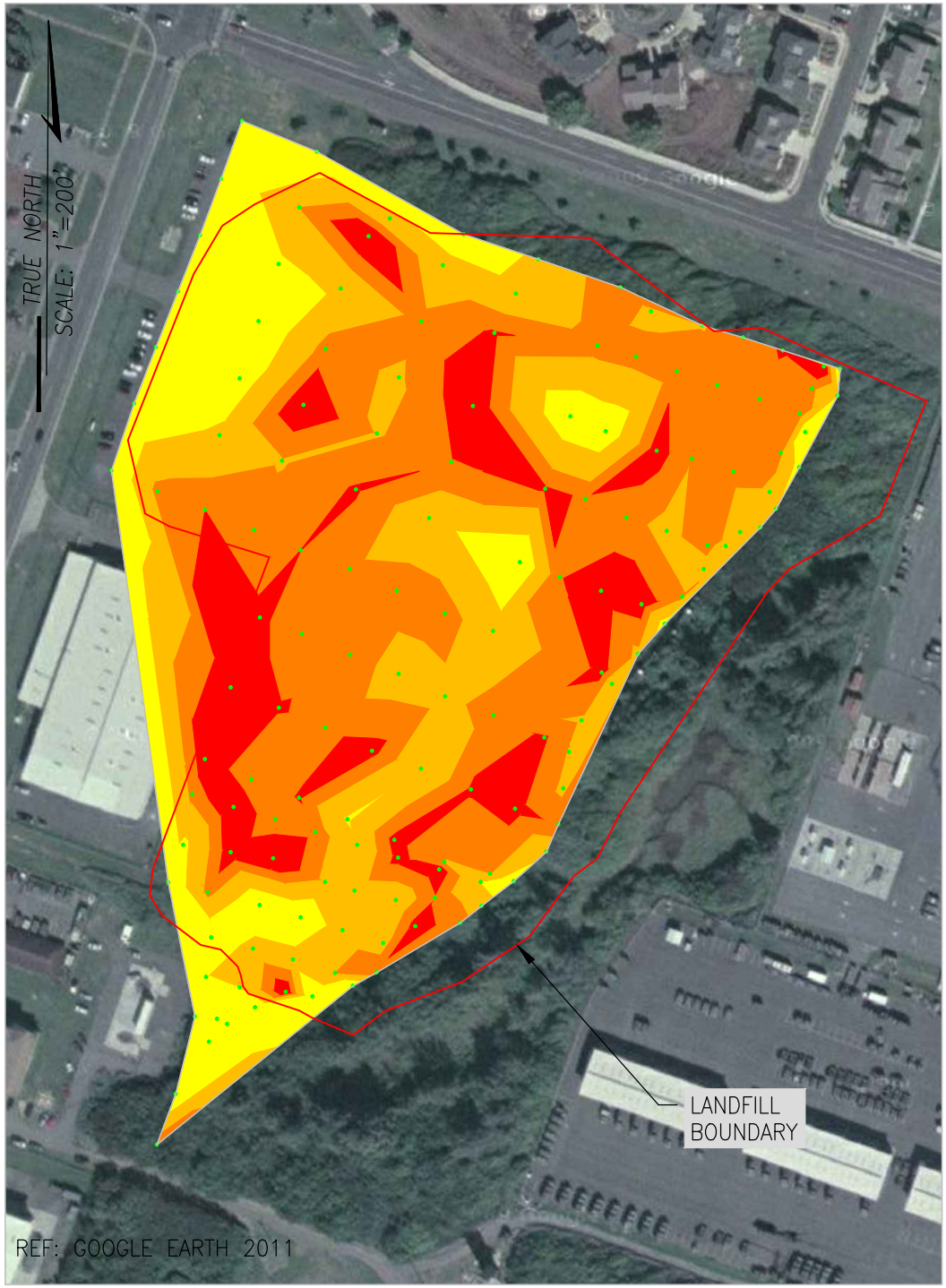
	DATE: JULY 2015	PROJECT TITLE: LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCBASE HAWAII
	FIGURE TITLE: DECISION UNITS AND MI SAMPLE LOCATIONS, QUARRY PIT LANDFILL	FIGURE NO.: 4

	DATE: JULY 2015	PROJECT TITLE: LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCB HAWAII
	FIGURE TITLE: GROUNDWATER SAMPLE ANALYTICAL RESULTS [ug/L] EXCEEDING PALs	FIGURE NO.: 5

100' 0 100' 200'

SCALE: 1" = 200'

	DATE: JULY 2015	PROJECT TITLE: LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCB HAWAII
	FIGURE TITLE: LANDFILL BOUNDARY CONFIRMED BY INVESTIGATION SURVEYS	FIGURE NO.: 6



LANDFILL DEBRIS					
NUMBER	MINIMUM THICKNESS (FEET)	MAXIMUM THICKNESS (FEET)	AREA (ACRES)	VOLUME (CUBIC YARDS)	COLOR
1	0.0	2.5	2.19	4,400	
2	2.5	5.0	3.50	21,000	
3	5.0	6.5	5.11	47,000	
4	6.5	8.5	1.53	18,000	

TOTAL VOLUME: 90,400 CUBIC YARDS

200' 0 200' 400'

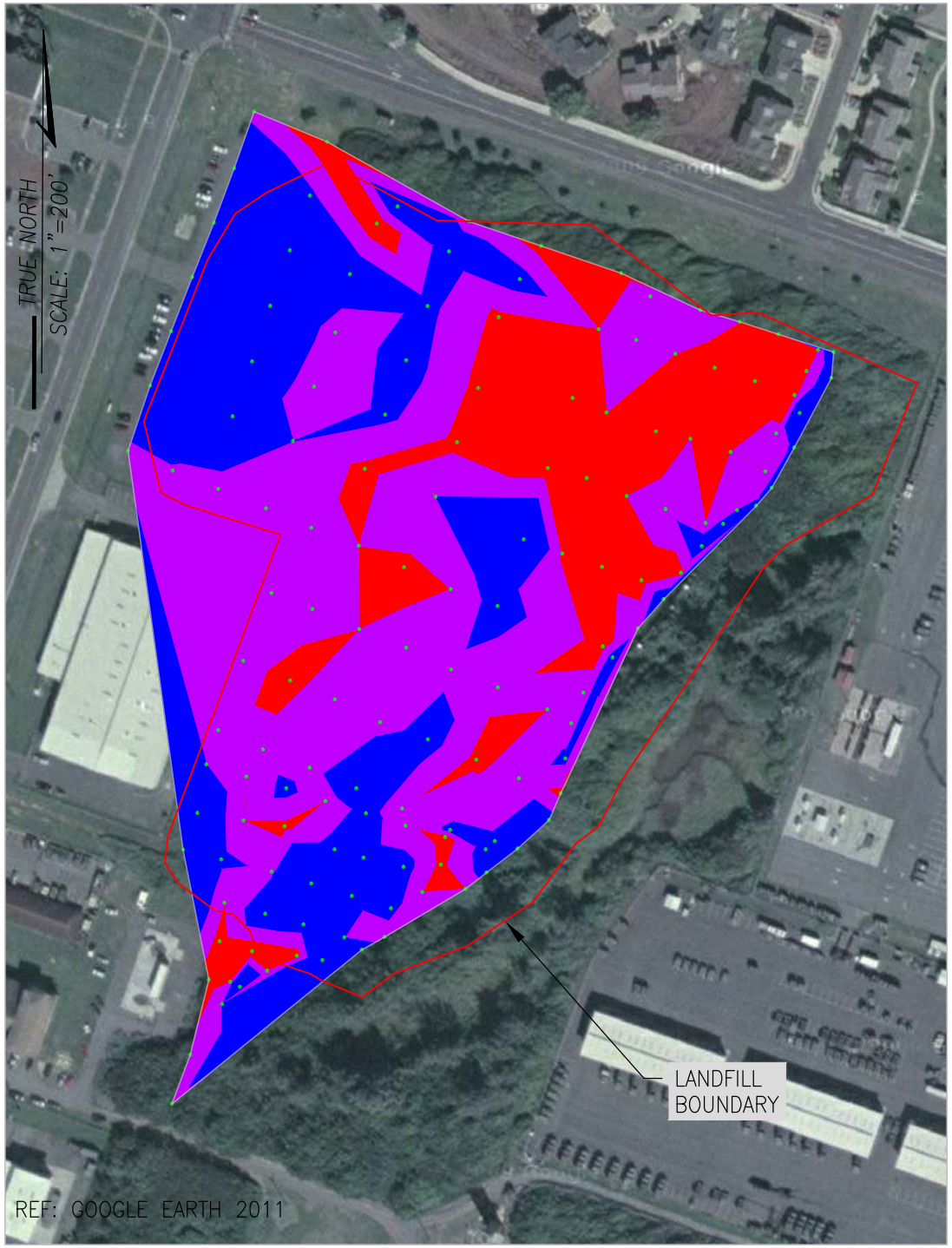
SCALE: 1" = 200'

DATE: JULY 2015

PROJECT TITLE: LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCB HAWAII

FIGURE TITLE: BURIED DEBRIS THICKNESS QUARRY PIT LANDFILL

FIGURE NO.: 7



LANDFILL CAP THICKNESS				
NUMBER	MINIMUM THICKNESS (FEET)	MAXIMUM THICKNESS (FEET)	AREA (ACRES)	COLOR
1	0.0	2.0	2.72	
2	2.0	4.0	5.96	
3	4.0	10.0	3.67	

200' 0 200' 400'

SCALE: 1" = 200'

DATE: JULY 2015

PROJECT TITLE: LUCP, RACR, AND WELL DECOMMISSIONING FOR QUARRY PIT LANDFILL (SITE 0002), MCB HAWAII

FIGURE TITLE: LANDFILL CAP THICKNESS QUARRY PIT LANDFILL

FIGURE NO.: 8

Appendix A
Draft LUCP Comments and Responses

Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002), Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:		December 12, 2014 (provided to E2 on December 16, 2014)	**Reviewer:** Mr. Eric Sadoyama, State of Hawaii Department of Health	**E2 Response:** Ryan Yamauchi and Bernice Balete	
Comment Number	**Section Number**	**Rating[1] (High or Low)**	**Issue**	**Comment**	**Response**
COMMENTS					
1.				No comments.	**E2 Response:** Comment noted.
END OF COMMENTS					

[1] H = High Rating: Issue identified must be addressed in order to facilitate a clearer document and understanding L= Low Rating: Issue identified has limited impact, and resolution is at project personnel discretion.

Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002), Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:			September 30, 2014 (provided to E2 on October 8, 2014) January 12, 2015 (provided to E2 on January 12, 2015)	**Reviewer:** Mr. Lance Bookless, Senior Natural Resources Manager, MCB Hawaii, Environmental Department	**E2 Response:** Mr. Ryan Yamauchi and Ms. Bernice Balete
Comment Number	**Section Number**	**Rating[2] (High or Low)**	**Issue**	**Comment**	**Response**
COMMENTS					
1.	Page 1, Section 1, 6th paragraph, 1st bullet			Multi-purpose training is not a Recreational activity, I recommend stating " . . . Recreation use, e.g. park/playfield, Training (non-ground disturbing), or Industrial/commercial use with lands use restrictions".	**E2 Response:** The requested change was made.
2.	Page 6, Wetland Boundary Delineations, last paragraph			We have annually operated the AAVs in the "Motor Pool wetland" area to keep it open for drainage, control invasive grasses, and provide foraging area for endangered waterbirds.	**E2 Response:** This clarification will be made.

[2] H = High Rating: Issue identified must be addressed in order to facilitate a clearer document and understanding L= Low Rating: Issue identified has limited impact, and resolution is at project personnel discretion.

Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002), Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:			September 30, 2014 (provided to E2 on October 8, 2014) January 12, 2015 (provided to E2 on January 12, 2015)	**Reviewer:** Mr. Lance Bookless, Senior Natural Resources Manager, MCB Hawaii, Environmental Department	**E2 Response:** Mr. Ryan Yamauchi and Ms. Bernice Balete
Comment Number	**Section Number**	**Rating[2] (High or Low)**	**Issue**	**Comment**	**Response**
3.	Page 9, Site Reconnaissance			Regarding the 20-ft buffer, if the area needs to be cleared to permit freedom of movement of construction equipment, this buffer can be removed; however, new vegetation would need to be planted in its place, preferably native. I have one change that I missed the first time around. . . on Page 9, Site Reconnaissance, please change the wetland stand-off distance from 20-ft to "30m/100ft" to keep it consistent with other projects we have reviewed for proposed construction projects near our wetlands. The stand-off as stated would virtually allow construction to occur right on the edge of the wetland.	**E2 Response:** This requirement will be added. The requested change was made.
4.	Page 10, 1st paragraph, 1st sentence (carried over from Page 9)			It is stated that the Motor Pool wetland "appeared to be relatively dry with some areas of standing water"; appearances are deceiving. Every year when we run the AAVs through this area, a fair amount of standing water appears that attracts birdlife.	**E2 Response:** This clarification will be made.

Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002), Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:			September 30, 2014 (provided to E2 on October 8, 2014) January 12, 2015 (provided to E2 on January 12, 2015)	**Reviewer:** Mr. Lance Bookless, Senior Natural Resources Manager, MCB Hawaii, Environmental Department	**E2 Response:** Mr. Ryan Yamauchi and Ms. Bernice Balete
Comment Number	**Section Number**	**Rating[2] (High or Low)**	**Issue**	**Comment**	**Response**
5.	Page 10, RI/FS and Page 11, Screening Level Ecological Risk Assessment			Page 10, RI/FS: This paragraph indicates that no drilling was "conducted in the either of the adjacent wetland DUs"; this is something that should be performed to determine if any contaminants/hazardous material is leaching into the wetlands that support foraging by T&E and other migratory waterbirds. On Page 11, Screening Level Ecological Risk Assessment, it states that "Based on RI findings, no further action is required due to ecological risks. This is important as we annually operate AAVs in this wetland to maintain its viability. This is a big concern because of RI findings at the Salvage Yard wetland, AAVs can no longer operate in a portion of the wetland due to hazardous materials. If the wetland was never tested, there is an absence of information to base taking no further action. This needs to be discussed.	**E2 Response:** No drilling in the wetland was conducted; however, sediment and surface water sampling from the wetland were completed to determine if runoff and/or leaching from the Quarry Pit Landfill has impacted the wetland. The sample results indicate that the wetland sediments and surface water have not been impacted by the Quarry Pit Landfill. Groundwater sampling was also completed throughout the project area and the results do not indicate that leaching to the wetland is occurring. The screening level ecological risk assessment determined that the risk to ecological receptors at the site were within acceptable risk ranges. Therefore, AAVs can operate in the wetland. However, the AAVs should not be allowed to damage the existing soil cap on the Quarry Pit Landfill and the berm separating the landfill from the wetland.
6.	Page 16, Section 4.3.1, Construction			It is stated that "Land use at the site is restricted to recreational and industrial/commercial use only. No residential	**E2 Response:** The sentence will be changed to read "Land use at the site is restricted to recreational, training, and

Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002), Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:			September 30, 2014 (provided to E2 on October 8, 2014) January 12, 2015 (provided to E2 on January 12, 2015)	**Reviewer:** Mr. Lance Bookless, Senior Natural Resources Manager, MCB Hawaii, Environmental Department	**E2 Response:** Mr. Ryan Yamauchi and Ms. Bernice Balete
Comment Number	**Section Number**	**Rating[2] (High or Low)**	**Issue**	**Comment**	**Response**
	Permit Process, lines 4-6			use and playgrounds are allowed"; these sentences appear to contradict one another.	industrial/commercial use only. No residential use is allowed. If playgrounds are to be constructed, additional surface soil sampling at the specific playground location will be required to determine if additional protection measures will be required."
7.	Page 16, Excavation permit, lines 4-5			It states that the Facilities Dept would conduct the toning for projects on this site. Did Facilities agree to this, because in my experience it has always fallen to the contractor working on site to perform this responsibility? Facilities normally only does a CAD/GIS review of the site.	**E2 Response:** The text will be changed to clarify that Facilities will do a CAD/GIS review of the site, but that the contractor will be responsible for toning of the site.
END OF COMMENTS					

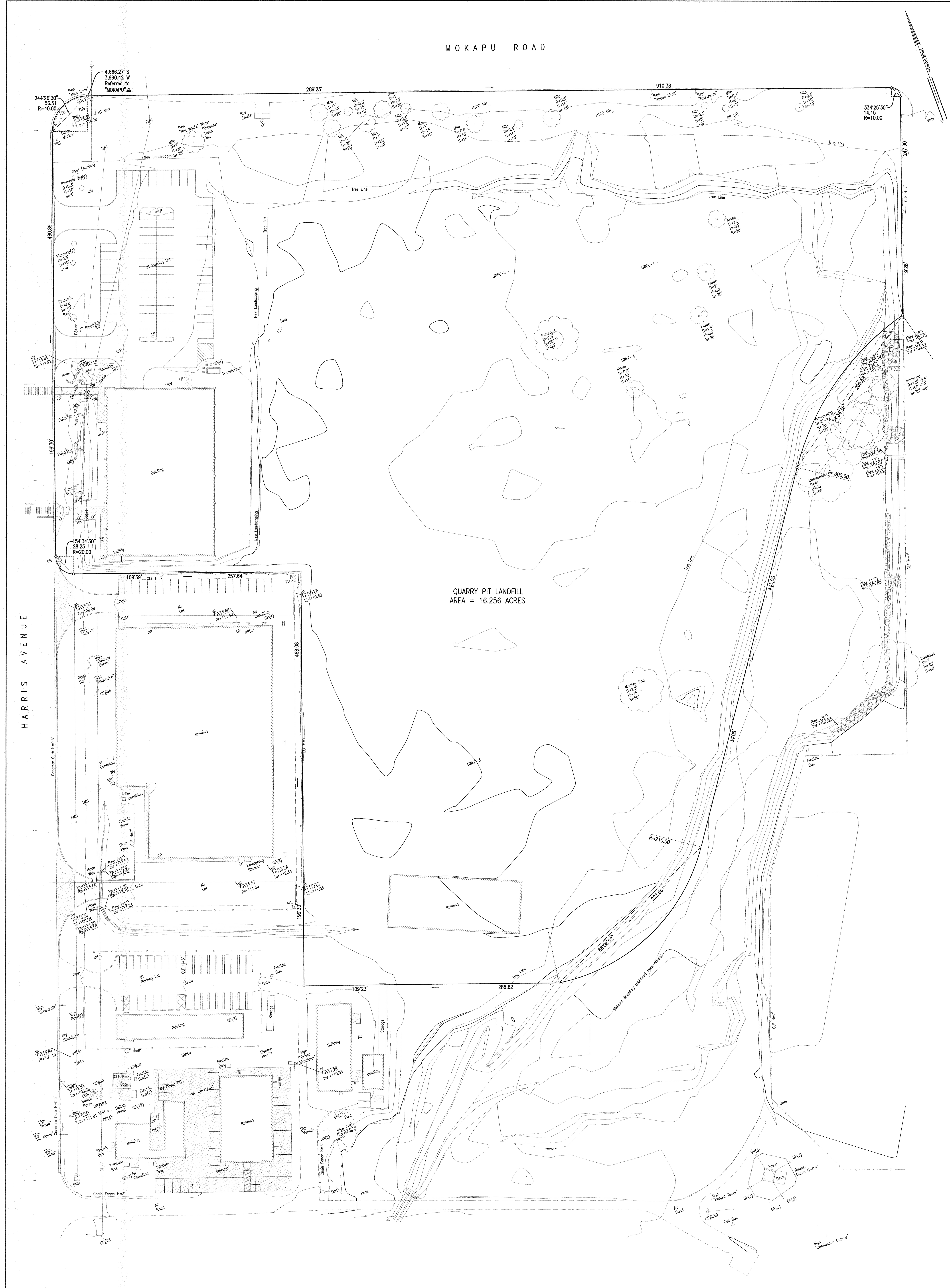
Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002) Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:			October 15, 2014	**Reviewer(s):** MCB Hawaii Mr. Brett Chambers (BC) and Mr. Randall Hu (RH)	**E2 Response:** Mr. Ryan Yamauchi and Ms. Bernice Balete
Comment Number	**Section Number**	**Rating[3] (High or Low)**	**Issue**	**Comment**	**Response**
GENERAL COMMENTS					
1.			General Comment	The base is referred to as "MCBH Hawaii" in some sections of the LUCP. Change to "MCB Hawaii" and make sure it is consistent throughout the document.	**E2 Response:** The requested global change will be made throughout the LUCP.
SPECIFIC COMMENTS					
1.	Section 1 (Page 1)		LUC Monitoring	It states "Periodic monitoring of LUC effectiveness and compliance reporting" is required. How often is "periodic"? Is it consistent with frequency for the H-3 Landfill LUCP?	**E2 Response:** The LUCP will be made consistent with the H-3 Landfill LUCP, requiring only "periodic inspections", i.e., five-year reviews. Annual inspections
2.	Section 2.3 (Page 11)		Screening Human Health Risk Assessment	The park/playfield recreational use scenario has an exceedence in DU-5 (the bermed area). Do there need to be additional controls on the berm (i.e., vegetating the berm)?	**E2 Response:** Although the exposure risk calculation exceeds the upper end of the risk management range, no additional controls are recommended because the bermed area will likely not be used.

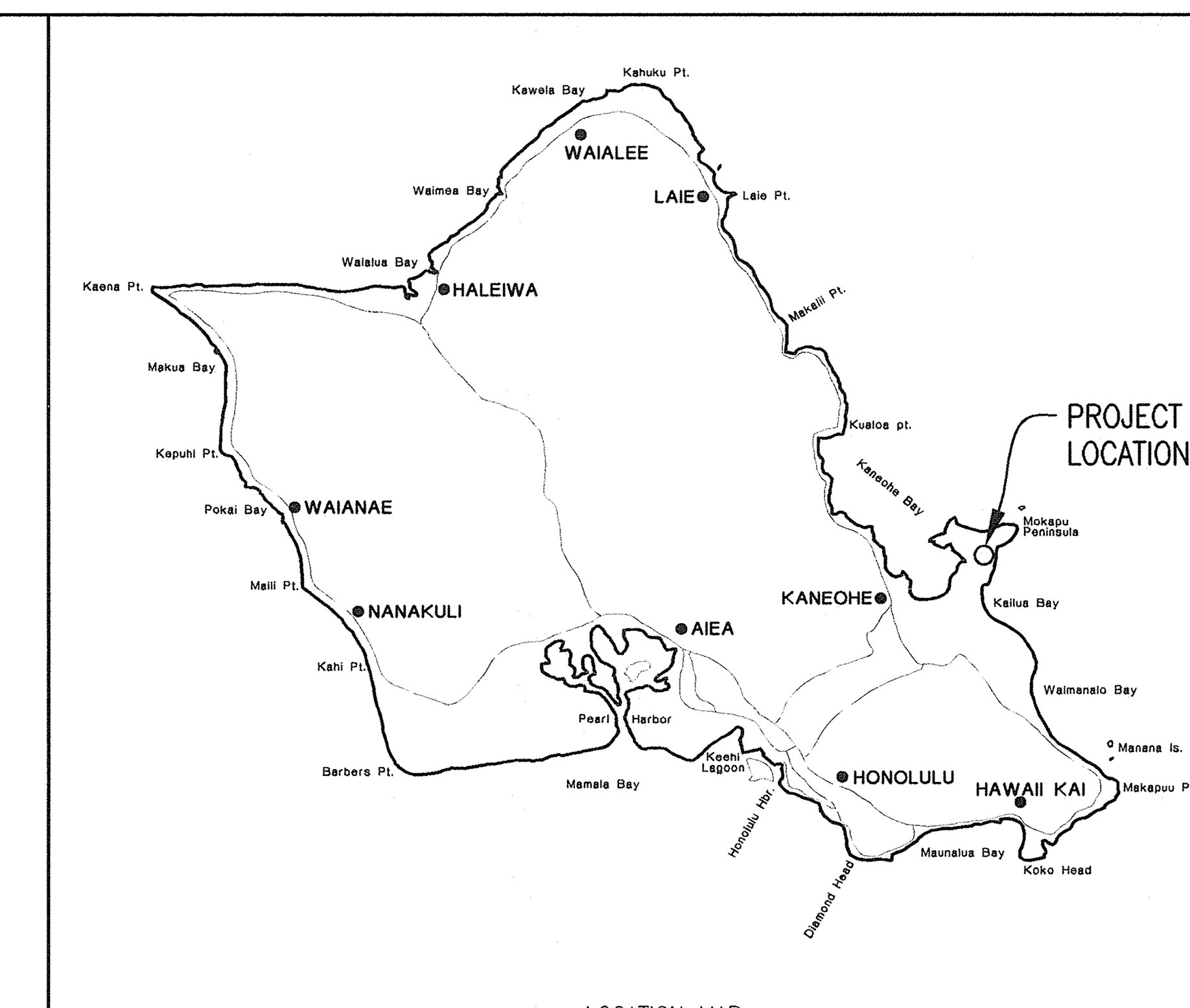
[3] H = High Rating: Issue identified must be addressed in order to facilitate a clearer document and understanding L= Low Rating: Issue identified has limited impact, and resolution is at project personnel discretion.

Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002) Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:			October 15, 2014	**Reviewer(s):** MCB Hawaii Mr. Brett Chambers (BC) and Mr. Randall Hu (RH)	**E2 Response:** Mr. Ryan Yamauchi and Ms. Bernice Balete
Comment Number	**Section Number**	**Rating[3] (High or Low)**	**Issue**	**Comment**	**Response**
3.	Section 3.2 (Page 13)		Notice	This section seems to indicate that putting signs (legal notice of site contamination, LUC boundary delineation, etc.) around the site is required. I thought we agreed there would not be signs posted. Please clarify.	**E2 Response:** To clarify that there are no physical signage posted at the site, the section was revised as follows: 1) delete "at multiple locations and/or" from the 3rd bullet; 2) delete the 4th bullet; and 3) delete "and physical" from the 5th bullet.
4.	Section 4.3 (Page 16)		Institutional Controls	Check with the MCBH Facilities Department to see if the paragraph that begins with "In addition, effective July 2004, the Hawaii One Call Center…." should still be included in this report. Contact person is Phil Lum: 257-6900	**E2 Response:** Mr. Phil Lum was contacted. The Hawaii One Call process is accepted on MCB Hawaii. The paragraph was left in.
5.	Section 5.1.2 (Page 17)		Notice of Changes to Site Conditions	"…the Navy shall notify DOH within ten days of the discovery." Is this a regulatory requirement?	**E2 Response:** The time requirement "within ten days" was deleted.

Document Name			**DRAFT Land Use Control Plan for Quarry Pit Landfill (MCBH Site 0002) Marine Corps Base Hawaii, Kaneohe, Oahu, Hawaii, August 2014**		
Requestor:			Ms. Kelly Akamine, NAVFAC HI, Environmental Restoration, Remedial Project Manager		
Review Completion Date:			October 15, 2014	**Reviewer(s):** MCB Hawaii Mr. Brett Chambers (BC) and Mr. Randall Hu (RH)	**E2 Response:** Mr. Ryan Yamauchi and Ms. Bernice Balete
Comment Number	**Section Number**	**Rating[3] (High or Low)**	**Issue**	**Comment**	**Response**
6.	Section 5.2.2 (Page 18)		Conditional Inspections and Compliance Reporting Requirements	Is there a regulatory requirement to conduct ANNUAL inspections and submit the monitoring reports to the DOH? The recent Draft H-3 Landfill LUCP only requires "periodic inspections" and we would prefer to make the two LUCPs consistent with each other. Would NAVFAC be funding these inspections/reports? There is also mention of inspecting the site "every six months" in an earlier paragraph – is this consistent with the Draft H-3 Landfill LUCP?	**E2 Response:** The LUCP (this section and Section 5.2.1) will be made consistent with the H-3 Landfill LUCP, requiring only "periodic inspections", i.e., five-year reviews. Therefore the section in question was deleted.
7.	Section 5.4.3 (Page 20)		DOH Responsibilities	This section and others seem to be written with the assumption that the public has easy access to the base.	**E2 Response:** The section will be re-written.
END OF COMMENTS					

Appendix B
Legal Descriptions





LOCATION MAP

SCALE: NTS

LEGAL DESCRIPTION

Being a portion of Kaneohe Marine Corps Base Hawaii

Situate at Kaneohe Bay, Oahu, Hawaii

Beginning at the North corner of this parcel of land, the coordinates of said point of beginning referred to Government Survey Triangulation Station "MOKAPU" being 4,666.27 feet South and 3,990.42 feet West and running by azimuths measured from clockwise from True South:

1. 289° 23' 910.38 feet;
2. Thence, on a curve to the right with radius of 10.00 feet, the chord azimuth and distance being:
   334° 25' 30" 14.15 feet;
3. 19° 28' 247.90 feet;
4. Thence, on a curve to the left with a radius of 300.00 feet, the chord azimuth and distance being:
   54° 34' 38" 209.58 feet;
5. 34° 23' 910.38 feet;
6. Thence, on a curve to the left with radius of 210.00 feet, the chord azimuth and distance being:
   66° 08' 52" 222.66 feet;
7. 109° 23' 288.62 feet;
8. 199° 30' 468.08 feet;
9. 109° 39' 257.64 feet;
10. Thence, on a curve to the right with a radius of 20.00 feet, the chord azimuth and distance being:
    154° 34' 30" 209.58 feet;
11. 199° 30' 480.89 feet;
12. Thence, on a curve to the right with a radius of 40.00 feet, the chord azimuth and distance being:
    244° 26' 30" 56.51 feet;

to the point of beginning and containing an area of 16.256 Acres, more or less.

Legend:

AC	Asphalt Concrete
BFP	Backflow Preventor
CB/CBMH	Catch Basin Manhole
CLF	Chain Link Fence
CO	Clean Out
D	Diameter
EB	Electrical Box
EMH	Electrical Manhole
GP	Gate Post
H	Height
HW	Headwall
HT	Hawaiian Telecom
HTCO MH	Hawaiian Telephone Company Manhole
ICV	Irrigation Control Valve
Inv.	Invert
LP	Light Pole
S	Spread
SLB	Street Light Box
SMH	Sewer Manhole
TMH	Telephone Manhole
T	Top
TS	Top Stem
TL	Traffic Light
TSL	Traffic Signal Box
UP	Utility Pole
WMH	Water Manhole
WV	Water Valve

Symbols:

- ○ MH (CBMH, WMH, SDMH, etc.)
- ∘ Valve/Cleanouts (WV, ICV, CO)
- ▭ Box (Utilities, Valves)
- ✡ LP
- Fence
- Gate

NOTES:

Azimuths and Coordinates referred to Government Triangulation Station "MOKAPU" △.
Date of Survey: August 6, 2015

Quarry Pit Landfill Land Use Control Area Map
Kaneohe Marine Corps Base Hawaii
At Kaneohe Bay, Oahu, Hawaii

GRAPHIC SCALE

40 0 20 40 80

1 INCH = 40 FEET

RYAN M. SUZUKI
LICENSED PROFESSIONAL LAND SURVEYOR
No. 10059
HAWAII, U.S.A.

This work was prepared by me or under my direct supervision

Ryan M. Suzuki Exp.: 4/30/16
Licensed Professional Land Surveyor
Certificate Number 10059

TMK: 4-4-009: 003 (Por.)

R. M. TOWILL CORPORATION
SINCE 1930

2024 N. King Street Suite 200
Honolulu, Hawaii 96819

Appendix C
Digging Work Clearance Permit

DIGGING WORK CLEARANCE REQUEST

MCBH Kaneohe Bay, Facilities Department

Project Title:	FOR FACILITIES USE ONLY **DWCR NO:**

The Digging Work Clearance Request ***(DWCR)*** is required for any excavation work that may disrupt utility services, vehicular or aircraft traffic flow, protection provided by fire and intrusion alarm systems, or routine activities of Marine Corps Base Hawaii, Kaneohe Bay. The clearance process tries to identify, as much as practicable, any known, potentially hazardous work condition and is to help prevent accidents. It also informs key Base activities of the digging work and coordinates the required work with these activities to keep customer inconvenience to a minimum. ***The DWCR and CATEX must be approved prior to the start of work.***

1. INSTRUCTIONS:

The contractor/excavating activity shall complete blocks 2 thru 15 below. Submit this ORIGINAL MS Word Document with plans or drawings showing the location, width, and depth of excavation in an *Electronic Format* to MCBH Kaneohe Bay, Facilities Department via the Contracting Officer and/or Project Manager. Allow at least **20 Working Days** before commencement of work for clearance review by Facilities Department. Upon receipt of the approved and signed DWCR, the contractor/excavating activity may proceed with the excavation and shall follow all precautionary notes and directions as provided.

2. Required Documents prior to APPROVING this Dig Permit.

(a) An SOP for FMSS *(Appendix C)* has been received and approved by LFPE ☐ **yes** ☐ **no**

(b) An Environmental Category Exclusion (*CATEX*) has been submitted and approved. ☐ **yes** ☐ **no** ***(Please Include)***

If No, explain why:

This DWCR will not be approved without an Approved CATEX

3. SITE LOCATION: *(Include a Site Map)*	**4. PROJECT TARGET START DATE:**
5. PROJECT MANAGER (MCBH): **POC:**	**6. PHONE NO:**
7. CONTRACTOR: **POC:**	**8. COMPANY PH.#:** **FAX #:** **ADDRESS:**
9. CONTRACT NO.:	**10. WORK ORDER/JOB NO.:**

11. TYPE OF WORK INVOLVED: (*check items that apply*)

UNDERGROUND UTILITIES: ☐ WATER ☐ SEWER ☐ DRAIN ☐ ELECTRICAL ☐ TELEPHONE ☐ FIBEROPTIC

EXCAVATION: ☐ TRENCHING ☐ FOUNDATION/SLAB ☐ DE-WATERING ☐ SOIL BORING/TEST PIT

☑ OTHER:

12. DESCRIPTION OF WORK: ***(Required)***

* **Provide a work description including the method of excavation** *(use of hand tools or type of powered equipment)*

* **Provide description of any precautionary measures to be followed and safety devices to be used such as shoring.**

* **Provide drawings or sketch showing the depth, width and length of the excavation and any known utilities that may interfere with the work.** (*If more space is required, attach separate sheet*)

The area involved ☐ **has not** ☐ **has been staked or clearly marked.**

Attached sketch: ☐ **no** ☐ **yes**

Project Title:	FOR FACILITIES USE ONLY **DWCR NO:**

13. The contractor/excavating activity shall perform a general site survey prior to any excavation. You are ***Required*** to ***Tone Area***; The activity will make every effort to locate unknown utilities posing a conflict with their work insofar as these utilities fall with the proposed excavation limits and are detectable by industry-standard underground utility locating equipment. If water valves; sewer, drain, or electrical manholes; recent trenching scars; or pavement trench patches are found where no utility line is shown on the drawings/sketches provided, the contractor/unit shall contact the undersigned prior to any excavation._____. **Initial/Date**

14. There are known existing primary utilities shown for the area in question ☐ **yes** ☐ **no**

_____. **Initial/Date**

15. The equipment operator shall closely monitor the excavated material for significant changes in color, size (gradation) and type of material. Such changes may indicate the presence of an unmarked utility. If such changes are noted, the contractor/unit shall cease all excavation by equipment and probe by hand. If any questions arise, contact the undersigned. _____. **Initial/Date**

The contractor/excavating activity shall have an approved Digging Work Clearance Request at the work site at all times during excavation.

The Digging Work Clearance Request does NOT relieve the contractor/excavating activity from responsibility for any damage to underground utilities encountered during excavation.

All known existing primary utilities are shown on the attached sketches/drawings. Those not shown in the original sketches/drawings were added. The contractor/excavating activity shall locate each intersecting line and all other lines in the general vicinity of the excavation prior to any excavation. The utility lines shown on the drawings/sketches represents approximate locations only.

In case of emergency, contact Mr. Lee Stebbins, Facilities Department, Maintenance Division, phone 257-2171, ext. 280.

NOTE:
If the actual work differs from the written Description of Work (Item No. 12 above)., this DWCR will be voided and MUST be Resubmitted.
This Dig Permit shall be TERMINATED 180 days after the signed approval date below unless otherwise noted.

Digging Work Clearance Request No.# _____ is hereby: ☐ Approved.
☐ Disapproved

_____.
LCDR Lance Lee, **LFP / Date**
FACILITIES DEPARTMENT,
257-2171, Ext. 223

CLEARANCE REVIEW

(To be filled out by MCBH Departments)

Project Title:	FOR FACILITIES USE ONLY **DWCR NO:**

	ORGANIZATION	**SPECIAL INSTRUCTIONS**	**SIGNATURE / DATE**
9. FACILITIES DEPT	**A. WATER LINES** WATER DRAINAGE LINES ***Phil Lum***, 257-2171 ext.**246**		
	B. SEWER DRAINAGE LINES ***Phil Lum***, 257-2171 ext.**246**		
	C. ELECTRICAL LINES ***Ron Hochbrueckner***, 257-2171 ext.**250**		
	D. FIBER OPTIC SYSTEM ***Ron Hochbrueckner***, 257-2171 ext.**250**		
10. PHYSICAL SECURITY LAN/FIBER SYSTEM ***GySgt Scrabeck***, 257-8556, (or current POC)			
11. MILITARY POLICE TRAFFIC CONTROL ***Sgt Petty***, 257-1146 (or current POC)			
12. FUELS DIVISION (***Henry Puulei, Ed Campbell*** 257-3187)		Fuel Lines: ☐ Active ☐ Non Active	
13. AT&T TELEPHONE HAWAIIAN TELEPHONE ***Sgt Saxe,*** 457-2323 ext.**226** (or current POC)			
14. CABLE TELEVISION OCEANIC (***L. Iha*** , 625-8443 Fax:625-5888)			
15. ENVIRONMENTAL (***Ron Yamada*** 257-6920 ext.**229**) (***J. Cleghorn***, 257-6920 ext.**254**)		☐ E.A. ☐ CATEX ☐ Other **Comments:**	
16. SAFETY (***Clayton Lihilihi***, 257-1830)			
17. EXPLOSIVE SAFETY (***Clayton Lihilihi*** , 257-1830)			
18. OTHER (Specify)			

Appendix D
Annual LUC Compliance Certificates and Checklists

Annual LUC Compliance Certificate
Quarry Pit Landfill, Hawaii

The purpose of this compliance certificate is to ensure that Land Use Controls (LUCs) are properly maintained at the Quarry Pit Landfill property (hereinafter referred to as the "site"). LUCs are necessary to protect human health due to the presence of low concentrations of contaminants in surface and subsurface soil at the site. LUCs implemented at the site are discussed in the *Land Use Control Plan* (August 2014).

The landowner is required to ensure and annually certify that LUCs continue to be maintained at the site. The landowner is encouraged to inspect the property frequently to fulfill this duty.

The questionnaire that follows the certification statement is designed to help ensure that LUCs remain protective and that site conditions have not changed such that they adversely impact the integrity of the selected remedy for the site. This certification and questionnaire form shall be completed on an annual basis and submitted to the Navy and DOH (contact information is provided below). To properly certify LUC compliance on the property, the landowner should:

- Review relevant LUC documentation
- Review property records (e.g., construction permits, etc.)
- Physically inspect the site
- Interview tenants and regular site users
- Photograph site conditions

Following submittal of this form, the landowner may be asked to meet with the Navy and DOH representatives to discuss and clarify the inspection results. It is the intent of the Navy and DOH that the annual review process be a cordial and cooperative effort to ensure that site conditions remain protective of human health and the environment.

Property Owner: _____

Property Address: _____

This evaluation covers the period from 1 January through 31 December _____ (year).

Site Inspection Date: _____

Annual LUC Compliance Certificate
Quarry Pit Landfill, Hawaii

Property Owner: _____

Property Address: _____

Is the evaluation for all or a portion of the Quarry Pit Landfill? _____

If evaluating only a portion of the site, attach a figure identifying the portion being evaluated.

This evaluation covers the period from 1 January through 31 December _____(year)

Certification Checklist

	In Compliance	Non-Compliance	See Comment
1. Vegetative soil cap is in-place and in good condition.	☐	☐	☐
2. Site development is restricted to recreational training and industrial/commercial uses only.	☐	☐	☐
3. Construction is limited to those projects that have been reviewed and approved.	☐	☐	☐
4. No excavation and uncontrolled removal of soil and debris from the Site.	☐	☐	☐

I, the undersigned, hereby certify that I am an authorized representative of the U.S. Navy and that the above-described Land Use Controls have been complied with for the period noted.

_____ _____ _____

Signature Title Date

Representing: _____

Mail completed form(s) to:

State of Hawaii Department of Health
HEER Office
919 Ala Moana Boulevard, Suite 206
Honolulu, Hawaii 96818

Department of the Navy
Naval Facilities Engineering Command, Hawaii
400 Marshall Road
JBPHH Hawaii 96860-3139

Five-Year Review Site Inspection Checklist

Purpose of the Checklist

The site inspection checklist provides a useful method for collecting important information during the site inspection portion of the five-year review. The checklist serves as a reminder of what information should to be gathered and provides the means of checking off information obtained and reviewed, or information not available or applicable. The checklist is divided into sections as follows:

I. Site Information
II. Interviews
III. On-site Documents & Records Verified
IV. O&M Costs
V. Access and Institutional Controls
VI. General Site Conditions
VII. Landfill Covers
VIII. Vertical Barrier Walls
IX. Groundwater/Surface Water Remedies
X. Other Remedies
XI. Overall Observations

Some data and information identified in the checklist may or may not be available at the site depending on how the site is managed. Sampling results, costs, and maintenance reports may be kept on site or may be kept in the offices of the contractor or at State offices. In cases where the information is not kept at the site, the item should not be checked as "not applicable," but rather it should be obtained from the office or agency where it is maintained. If this is known in advance, it may be possible to obtain the information before the site inspection.

This checklist was developed by EPA and the U.S. Army Corps of Engineers (USACE). It focuses on the two most common types of remedies that are subject to five-year reviews: landfill covers, and groundwater pump and treat remedies. Sections of the checklist are also provided for some other remedies. The sections on general site conditions would be applicable to a wider variety of remedies. The checklist should be modified to suit your needs when inspecting other types of remedies, as appropriate.

The checklist may be completed and attached to the Five-Year Review report to document site status. Please note that the checklist is not meant to be completely definitive or restrictive; additional information may be supplemented if the reviewer deems necessary. Also note that actual site conditions should be documented with photographs whenever possible.

Using the Checklist for Types of Remedies

The checklist has sections designed to capture information concerning the main types of remedies which are found at sites requiring five-year reviews. These remedies are landfill covers (Section VII of the checklist) and groundwater and surface water remedies (Section IX of the checklist). The primary elements and appurtenances for these remedies are listed in sections which can be checked off as the facility is inspected. The opportunity is also provided to note site conditions, write comments on the facilities, and attach any additional pertinent information. If a site includes remedies beyond these, such as soil vapor extraction or soil landfarming, the information should be gathered in a similar manner and attached to the checklist.

Considering Operation and Maintenance Costs

Unexpectedly widely varying or unexpectedly high O&M costs may be early indicators of remedy problems. For this reason, it is important to obtain a record of the original O&M cost estimate and of annual O&M costs during the years for which costs incurred are available. Section IV of the checklist provides a place for documenting annual costs and for commenting on unanticipated or unusually high O&M costs. A more detailed categorization of costs may be attached to the checklist if available. Examples of categories of O&M costs are listed below.

Operating Labor - This includes all wages, salaries, training, overhead, and fringe benefits associated with the labor needed for operation of the facilities and equipment associated with the remedial actions.

Maintenance Equipment and Materials - This includes the costs for equipment, parts, and other materials required to perform routine maintenance of facilities and equipment associated with a remedial action.

Maintenance Labor - This includes the costs for labor required to perform routine maintenance of facilities and for equipment associated with a remedial action.

Auxiliary Materials and Energy - This includes items such as chemicals and utilities which can include electricity, telephone, natural gas, water, and fuel. Auxiliary materials include other expendable materials such as chemicals used during plant operations.

Purchased Services - This includes items such as sampling costs, laboratory fees, and other professional services for which the need can be predicted.

Administrative Costs - This includes all costs associated with administration of O&M not included under other categories, such as labor overhead.

Insurance, Taxes and Licenses - This includes items such as liability and sudden and accidental insurance, real estate taxes on purchased land or right-of-way, licensing fees for certain technologies, and permit renewal and reporting costs.

Other Costs - This includes all other items which do not fit into any of the above categories.

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Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name:	**Date of inspection:**
Location and Region:	**EPA ID:**
Agency, office, or company leading the five-year review:	**Weather/temperature:**

Remedy Includes: (Check all that apply)

☐ Landfill cover/containment
☐ Access controls
☐ Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls
☐ Other_____

_____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

7. **Groundwater Monitoring Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☐ N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks_____
_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks_____
_____

3. **Land use changes off site** ☐ N/A
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks_____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____
_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____
   _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   ☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

_____
_____
_____
_____
_____
_____
_____
_____
_____

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Appendix E
Five-Year Review Checklist and Report Template

Five-Year Review Report Template

This appendix provides a suggested checklist and a format for Five-Year Review reports. The checklist appears first, followed by the report template. You are encouraged to follow the template to ensure national consistency in the structure of Five-Year Review reports. However, each report should take into account site-specific circumstances, and you should modify the report format and content accordingly. For example, in some cases the report may be clearer if organized by operable unit (OU), or you may need to include site-specific questions that do not appear in this appendix.

The suggested format for Five-Year Review reports includes three main components: cover material, summary information, and the report body. Templates for each of these components follow. These templates provide suggested standard formats, boilerplate text, subheadings, checklists, example tables, and protectiveness statements. Suggested boilerplate text is presented in text boxes. Within the boilerplate section, text enclosed in brackets ("[ ]") should be added as appropriate, and *italicized* text denotes discussions that the reviewer should add.

You should use both the checklist and report template as guides for the types of information that should appear in the different sections of your Five-Year Review report. You should include information that is relevant to your site and needed to ensure that the rationale behind the protectiveness determination is adequately documented.

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Content Checklist For Five-Year Review Reports

This checklist may be used by you, your managers, etc., to verify that you have included all of the appropriate information in your Five-Year Review report. Depending on site-specific circumstances, some items may not be applicable. For example, a report for a site just beginning construction will generally contain less data than for a site that has reached construction completion.

General Report Format

- □ Signed concurrence memorandum (as appropriate)
- □ Title page with signature and date
- □ Completed five-year review summary form (page E-15)
- □ List of documents reviewed
- □ Site maps (as appropriate)
- □ List of tables and figures
- □ Interview report (as appropriate)
- □ Site inspection checklist
- □ Photos documenting site conditions (as appropriate)

Introduction

- □ The purpose of the five-year review
- □ Authority for conducting the five-year review
- □ Who conducted the five-year review (lead agency) and when
  - □ Organizations providing analyses in support of the review (*e.g.*, the contractor supporting the lead agency)
  - □ Other review participants or support agencies
- □ Review number (*e.g.*, first, second)
- □ Trigger action and date
- □ Number, description, and status of all operable units at the site
- □ If review covers only part of a site, explain approach
  - □ Define which areas are covered in the five-year review
  - □ Summarize the status of other areas of the site that are not covered in the present five-year

Site Chronology

- □ List all important site events and relevant dates (*e.g.*, date of initial discovery of problem, dates of pre-NPL responses, date of NPL listing, etc.)

Background

- □ General site description (*e.g.*, size, topography, and geology)
- □ Former, current, and future land use(s) of the site and surrounding areas
- □ History of contamination
- □ Initial response (*e.g.*, removals)
- □ Basis for taking remedial action (*e.g.*, contaminants)

Remedial Actions

- □ Regulatory actions (*e.g.*, date and description of Records of Decision, Explanations of Significant Difference, Administrative Orders on Consent, Consent Decrees and Action Memorandum)
- □ Remedial action objectives
- □ Remedy description
- □ Remedy implementation (*e.g.*, status, history, enforcement actions, performance)
- □ Systems operations/Operations & Maintenance
  - □ Systems operations/O&M requirements
  - □ Systems operations/O&M operational summary (*e.g.*, history, modifications, problems, and successes)
  - □ Summary of costs of system operations/O&M effectiveness (*i.e.*, are requirements being met and are activities effective in maintaining the remedy?)

Progress Since Last Five-Year Review (if applicable)

- □ Protectiveness statements from last review
- □ Status of recommendations and follow-up actions from last review
- □ Results of implemented actions, including whether they achieved the intended effect
- □ Status of any other prior issues

Five-Year Review Process

- □ Administrative Components
  - □ Notification of potentially interested parties of initiation of review process
  - □ Identification of five-year review team members (as appropriate)
  - □ Outline of components and schedule of your five-year review
- □ Community Involvement
  - □ Community notification (prior and post review)
  - □ Other community involvement activities (*e.g.*, notices, fact sheets, etc., as appropriate)
- □ Document review
- □ Data review
- □ Site inspection
  - □ Inspection date
  - □ Inspection participants

Five-Year Review Process, cont'd.

- □ Site inspection scope and procedures
- □ Site inspection results, conclusions
- □ Inspection checklist

□ Interviews
- □ Interview date(s) and location(s)
- □ Interview participants (name, title, etc.)
- □ Interview documentation
- □ Interview summary

Technical Assessment

□ Answer Question A: Is the remedy functioning as intended by the decision documents?
- □ remedial action performance (*i.e.*, is the remedy operating as designed?)
- □ system operations/O&M
- □ cost of system operations/O&M
- □ opportunities for optimization
- □ early indicators of potential issues
- □ implementation of institutional controls and other measures

□ Answer Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
- □ changes in standards, newly promulgated standards, TBCs
- □ expected progress towards meeting RAOs
- □ changes in exposure pathways
- □ changes in land use
- □ new contaminants and/or contaminant sources
- □ remedy byproducts
- □ changes in toxicity and other contaminant characteristics
- □ risk recalculation/assessment (as applicable)

□ Answer Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
- □ new or previously unidentified ecological risks
- □ natural disaster impacts
- □ any other information that could call into question the protectiveness of the remedy

□ Technical Assessment Summary

Issues

□ Issues identified during the technical assessment and other five-year review activities

□ Determination of whether issues affect current or future protectiveness

Issues, cont'd.

- □ A discussion of unresolved issues raised by support agencies and the community (States, Tribes, other Federal agencies, local governments, citizens, PRPs, other interested parties), if applicable

Recommendations and Follow-up Actions

- □ Required/suggested improvements to identified issues or to current site operations
- □ Note parties responsible for actions
- □ Note agency with oversight authority
- □ Schedule for completion of actions related to resolution of issues

Protectiveness Statements

- □ Protective statement(s) for each OU (If the remedy is not protective of human health and/or the environment, have you provided supporting discussion and information in the report to make this determination, such as current threats or level of risk?)
- □ Comprehensive protectiveness statement covering all of the remedies at the site (if applicable)

Next Review

- □ Expected date of next review
- □ If five-year reviews will no longer be done, provide a summary of that portion of the technical analysis presented in the report that provides the rationale for discontinuation of five-year reviews

Five-Year Review Report

(First, Second, etc.) Five-Year Review Report

for

Site Name

City

County, State

Month, Year

PREPARED BY:

Lead Agency
Name and
Location

Approved by: Date:

[Name]
[Title]
[Affiliation]

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Five-Year Review Report

The following Table of Contents notes typical major divisions and subheadings for Five-Year Review reports. Subheadings can be included as appropriate for a given review report. This is only a general example.

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Table 8 - Recommendations and Follow-up Actions

Attachments

Site Maps (if not included in the body of the report)
List of Documents Reviewed
Tables and Figures documenting Remedy Performance and Changes in Standards (if not included in the body of the report)
Interview Report (as appropriate)
Photos Documenting Site Conditions

Appendix

Comments received from Support Agencies and/or the Community

List of Acronyms

You should include a list of acronyms used in the report here.

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Executive Summary

You should include an Executive Summary at the beginning of the report. The Executive Summary should be brief, and should include a reiteration of the protectiveness statements included in Section X of the Five-Year Review report.

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Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN)*:

EPA ID *(from WasteLAN)*:

Region:	**State:**	**City/County:**

SITE STATUS

NPL status: ☐ Final ☐ Deleted ☐ Other (specify) _____

Remediation status (choose all that apply): ☐ Under Construction ☐ Operating ☐ Complete

Multiple OUs?* ☐ YES ☐ NO	**Construction completion date:** ___ / ___ / _____

Has site been put into reuse? ☐ YES ☐ NO

REVIEW STATUS

Lead agency: ☐ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

Author name:

Author title:	**Author affiliation:**

Review period:** ___ / ___ / _____ to ___ / ___ / _____

Date(s) of site inspection: ___ / ___ / _____

Type of review:

☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion

Review number: ☐ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) _____

Triggering action:

☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#____
☐ Construction Completion ☐ Previous Five-Year Review Report
☐ Other (specify) _____

Triggering action date *(from WasteLAN)*: ___ / ___ / _____

Due date *(five years after triggering action date)*: ___ / ___ / _____

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

Summarize issues (see Chapter 3).

Recommendations and Follow-up Actions:

Summarize recommendations and follow-up actions (see Chapter 3).

Protectiveness Statement(s):

Include individual operable unit protectiveness statements. For sites that have reached construction completion and have more than one OU, include an additional and comprehensive protectiveness statement covering all of the remedies at the site (see Chapter 4).

Other Comments:

Make any other comments here.

Five-Year Review Report

I. Introduction

Provide a synopsis of "who, what, where, when, and why." Detail the following:

- *The purpose of the review;*
- *The authority for conducting the five-year review;*
- *Who conducted the review, when, and for what site or portion of the site;*
- *Whether it is the first review or a subsequent review at the site;*
- *What action triggered the review; and*
- *A brief status of areas of a site not addressed in the current review and/or the status of five-year reviews for other areas of the entire site.*

Further explanation and boilerplate text are provided below. Additional explanation on the following topics is provided in Chapter 1.

The Purpose of the Review

State the purpose of the five-year review specific to the site or portion of the site addressed in the review.

The purpose of five-year reviews is to determine whether the remedy at a site [is/is expected to be] protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

Authority for Conducting the Five-Year Review

The Agency is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states: *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104]*

> *or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*
>
> The agency interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR §300.430(f)(4)(ii) states:
>
> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Who Conducted the Five-Year Review

If the U.S. Army Corps of Engineers (USACE) or a contractor has conducted an analysis in support of a five-year review, you should include their name and the date of the analysis. When a contractor for a potentially responsible party (PRP) conducts analyses or provides information in support of a five-year review, you should identify the a contractor and their affiliation with the PRP in the Five-Year Review report. You should also identify who conducted the site inspection.

Boilerplate text for the explanation of who conducted the review is provided in the box below. This text is written as though EPA is the lead agency and should be adapted when another agency or department serves as the lead agency.

> The United States Environmental Protection Agency (EPA) Region [number] has conducted a five-year review of the remedial actions implemented at the [name] site in [location]. This review was conducted from [month, year] through [month, year]. This report documents the results of the review. [Please identify any party providing an analysis in support of the five-year review; also indicate the contractual arrangements under which this was done.]

Other Review Characteristics

State whether the review is the first or a subsequent five-year review for the site, what action or event "triggered" the review, and the date of this action. See Chapter 1, Section 1.2 of this guidance for a discussion of triggering events for the five-year review and indicate in your report whether the trigger for the current five-year review has been met.

Boilerplate text for the explanation of other review characteristics is provided in the box below. Select text from brackets as appropriate.

This is the [first/second/etc.] five-year review for the [name] site. The triggering action for this review is the date of the [triggering action], as shown in EPA's WasteLAN database: [date]. [This discussion should also mention what is specifically activating the review, *i.e.*, that hazardous substances, pollutants, or contaminants are or will be left on site above levels that allow for unlimited use and unrestricted exposure.]

In addition, if separate five-year reviews are conducted for different areas of a site, you should include the following in this section:

- *An explanation of this approach;*
- *A description of which areas are covered by this five-year review; and*
- *A brief synopsis of the remedial activities and the status of remedial measures and/or five-year reviews for other areas.*

II. Site Chronology

List all important site events and relevant dates in the site chronology, such as those shown in Table 1. The identified events are illustrative, not comprehensive.

Table 1: Chronology of Site Events

Event	Date
Initial discovery of problem or contamination	
Pre-NPL responses	
NPL listing	
Removal actions	
Remedial Investigation/Feasibility Study complete	
ROD signature	
ROD Amendments or ESDs	
Enforcement documents (CD, AOC, Unilateral Administrative Order)	
Remedial design start	
Remedial design complete	

Table 1: Chronology of Site Events

Event	Date
Superfund State Contract, Cooperative Agreement, or Federal Facility Agreement signature	
Actual remedial action start	
Construction dates (start, finish)	
Construction completion date	
Final Close-out Report	
Deletion from NPL	
Previous five-year reviews	

III. Background

Describe the fundamental aspects of the site, providing a clear, succinct description of site characteristics. The purpose of this section is to identify the threat posed to the public and environment at the time of the ROD, so that the performance of the remedy can be easily compared with the site conditions the remedy was intended to address. Include all major site activities prior to the signing of the ROD. In addition to text, you may use site maps to help clarify the discussion. The following checklist may assist you in developing the text for this section.

	Background Checklist
Physical Characteristics *Present the site's location and characteristics, including the following:*	
	Area of site, relation to parcel(s), extent and location of sources
	Whether site is located in a populated area or is near populated areas
	Whether site is located in an environmentally sensitive area or is near environmentally sensitive areas, where applicable
Land and Resource Use *Discuss the following:*	
	Former, current and projected land uses for the site, as identified in the ROD or other decision document
	Current and projected land uses for the area surrounding the site, at the time of the five-year review
	Human and ecological past, present and known future use of resources (*e.g.*, groundwater or surface water as a drinking water supply) and any other current uses of the site not already addressed, as applicable

	Background Checklist
History of Contamination *Discuss the following:*	
	The historical activities that caused contamination, including the type of activity or process, when it took place, the specific type of hazardous substances, and their volumes/proportions, if known
	How contamination was discovered and problems resulting from contamination
Initial Response *Describe any pre-ROD cleanup activities at the site:*	
	CERCLA removal actions, non-CERCLA removals/responses, closures, the ceasing of operations, as well as governing agreements and parties involved in these activities
Basis for Taking Action *Describe the contaminants found at the site by appropriate media type (soil, groundwater, surface water, air). Note the effect or potential effect of the contamination on people, resources they use, or the environment. Examples of elements of this discussion include the following:*	
	Contaminated media and structures (summary of remedial investigation)
	Resources/targets that have been or could potentially be affected, results of risk assessments, determination of primary health threat

IV. Remedial Actions

Discuss initial plans, implementation history, and current status of the remedy. Explain events identified in the chronology, and generally include discussions of remedy selection, remedy implementation, remedy performance, and system operations/O&M. Present – accurately, adequately, and concisely – relevant site activities from the signing of the ROD to the present. You should delineate all remedial measures, for instance, include monitoring, fencing, and institutional controls. Discuss any changes to or problems with remedial components. The following checklist may assist you in developing the text for this section.

	Remedial Actions Checklist
Remedy Selection *Describe the remedial action objectives and the selected remedy. This discussion should explain the following:*	
	Scope and role of actions including definition of OUs related to each ROD and how they relate to each other
	Source documents listing remedial action objectives and the remedy (*e.g.*, RODs, ESDs), including signature/filing date
	Statement of remedial action objectives, related to each OU or ROD
	Description of remedial actions/remedy, related to each OU or ROD, noting media addressed; all components of the remedy, including engineering controls, access controls, institutional controls, cleanup measures, treatment types, and required monitoring should be described

	Remedial Actions Checklist
Remedy Implementation *Discuss the history of and plans for implementation of the remedy. Discuss enforcement actions if applicable. The text may be presented either chronologically or by OU, and should include the following:*	
	Dates when remedial designs were started and completed
	Difficulties or changes that occurred during remedial design
	Dates when remedial actions were started and completed
	The performance of each remedial action since implementation
	Enforcement agreements, and parties involved in these agreements
	CERCLA removal actions or non-CERCLA removals/responses since the ROD
System Operations/O&M *Describe system operations/O&M requirements, activities to date, any problems that have arisen, and costs:*	
	System operations/O&M requirements, as noted in the system operations/O&M plan, system operations/O&M manual, enforcement documents, and monitoring plans
	System operations/O&M activities to date
	Problems in the implementation of system operations/O&M
	Originally estimated annual O&M costs
	Actual annual O&M costs over the review period
	Reasons for any unanticipated or unusually high O&M costs

A table, such as Table 2, should be used to document total annual system operations/O&M costs during the period preceding the current five-year review. In the text, you should discuss significant variations from anticipated costs or between operating years.

Table 2: Annual System Operations/O&M Costs

Dates		**Total Cost rounded to nearest $1,000**
From	**To**	

At the end of the remedial actions section, it is sometimes helpful for you to add a brief discussion of the current status of each of the components of the remedy. This discussion can be particularly helpful for large, complex sites.

V. Progress Since the Last Review

Progress since the last review should be discussed when follow-up actions which impact protectiveness were noted in the previous Five-Year Review report. The following checklist may assist you in developing the text for this section.

	Progress Since the Last Review Checklist
Describe progress toward accomplishing recommendations and follow-up actions since the last five-year review was completed. Include the following:	
	Protectiveness statements from the last review
	Status of recommendations and follow-up actions from last review
	Results of implemented actions, including whether they achieved the intended effect
	Status of any other prior issues

Table 3 below presents one approach for providing information on the recommendations and follow-up actions stated in the past review and subsequent actions. The accompanying text should also discuss why any recommendations and follow-up actions have not been implemented if that is the case, and whether implemented actions achieved desired results.

Table 3: Actions Taken Since the Last Five-Year Review

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action

VI. Five-Year Review Process

Describe activities performed during the five-year review process and provide a summary of findings when appropriate. The following checklist may assist you in developing the text for this section.

	Five-Year Review Process Checklist
Administrative Components of the Five-Year Review Process	
	Notify potentially interested parties of start of five-year review
	Identify members of the review team
	Develop a review schedule

	Five-Year Review Process Checklist
Community Notification and Involvement	
	Community notification
	Other community involvement activities
Document Review See Appendix B for a full discussion of the document review	
	What documents were reviewed
	Identify document source of RAOs, ARARs and cleanup levels
Data Review *Discuss and present the following:*	
	What data were reviewed
	Relevant trends and levels, noting levels which are not currently compliant and whether future compliance can be expected without additional action
	Tables summarizing monitoring and sampling data
	Increase and/or decrease or non-presence of specific chemical compounds and recommended changes for future monitoring programs
Site Inspection *Summarize the site inspection and site conditions:*	
	Date of site inspection (if more than one inspection was conducted to allow for monitoring or further inspection, list all inspections and activities conducted, and the reasons for conducting each inspection)
	Who conducted and/or attended the inspection
	Activities conducted (scope and procedures)
	Summary of site conditions, inspection results, conclusions
Interviews *Discuss the following:*	
	Interviews conducted (name, title, organization, date, location(S))
	Interview documentation
	Interview summary
	Successes/problems in the implementation of access and institutional controls
	Successes/problems with the construction of the remedy
	Successes/problems with system operations/O&M
	Unusual situations or problems at the site

VII. Technical Assessment

Discuss how each of the three questions asked in the technical assessment were answered (e.g., yes, yes, no or a variation of this) and provide the information that presents the basis for each answer as a framework for your protectiveness determination(s). Explain the conclusions of

your review, based on the information presented in the previous section. As explained in Chapter 4, the assessment should focus on answering three key questions:

- *Question A: Is the remedy functioning as intended by the decision documents?*
- *Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?*
- *Question C: Has any other information come to light that could call into question the protectiveness of the remedy?*

Each question, and the associated information to be discussed, is presented in its own checklist which may assist you in developing the text for this section. Checklist items shown may be supplemented or modified based on site-specific circumstances.

	Checklist for Question A: Is the remedy functioning as intended by the decision documents?
Remedial Action Performance *Discuss the following:*	
	Whether the remedial action continues to be operating and functioning as designed
	Whether the remedial action is performing as expected and cleanup levels are being achieved
	Whether containment is effective
System Operations/O&M *Discuss the following:*	
	Whether operating procedures, as implemented, will maintain the effectiveness of response actions
	Whether large variances in O&M costs could indicate a potential remedy problems or remedy issues
Opportunities for Optimization *Discuss the following:*	
	Whether opportunities exist to improve the performance and/or reduce costs of monitoring, sampling, and treatment systems
Early Indicators of Potential Issues *Discuss the following:*	
	Whether frequent equipment breakdowns or changes indicate a potential issue
	Whether issues or problems could place protectiveness at risk
Implementation of Institutional Controls and Other Measures *Discuss the following:*	
	Whether access controls are in place and prevent exposure (*e.g.*, fencing and warning signs)
	Whether institutional controls are in place and prevent exposure
	Whether other actions (*e.g.*, removals) necessary to ensure that immediate threats have been addressed are complete

	Checklist for Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?
Changes in Standards and TBCs *Discuss the following:*	
	Whether standards identified in the ROD have been revised and call into question the protectiveness of the remedy
	Whether newly promulgated standards call into question the protectiveness of the remedy
	Whether TBCs used in selecting cleanup levels at the site have changed and could affect the protectiveness of the remedy
Changes in Exposure Pathways *Discuss the following:*	
	Whether land use or expected land use on or near the site changed
	Whether human health or ecological routes of exposure or receptors have been newly identified or changed in a way that could affect the protectiveness of the remedy
	Whether there are newly identified contaminants or contaminant sources
	Whether there are unanticipated toxic byproducts of the remedy not previously addressed by the decision documents
	Whether physical site conditions or the understanding of these conditions have changed in a way that could affect the protectiveness of the remedy
Changes in Toxicity and Other Contaminant Characteristics *Discuss the following:*	
	Whether toxicity factors for contaminants of concern at the site have changed in a way that could affect the protectiveness of the remedy
	Whether other contaminant characteristics have changed in a way that could affect the protectiveness of the remedy
Changes in Risk Assessment Methods *Discuss the following:*	
	Whether standardized risk assessment methodologies have changed in a way that could affect the protectiveness of the remedy
Expected Progress Towards Meeting RAOs	
	Whether the remedy is progressing as expected

When a standard or requirement has changed, a table can be used to record the nature of the change. Tables 4, 5, and 6 below demonstrate potential ways for you to note changes in chemical-specific, action-specific, or location-specific requirements, respectively.

Table 4: Changes in Chemical-Specific Standards

Contaminant	Media	Cleanup Level	Standard		Citation/Year
Chemical A	*e.g.*, groundwater	*e.g.*, 0.XX mg/L	Previous	*e.g.*, 0.XX mg/L	*e.g.*, SDWA 1988
			New	*e.g.*, 0.YY mg/L	*e.g.*, SDWA 1995
Chemical B			Previous		
			New		

Table 5: Changes in Action-Specific Requirements

Action	Requirement		Prerequisite	Citation/Year
Action A (*e.g.*, landfill)	Previous	Include original ARAR here; if none applies, state "None"		
	New			

Table 6: Changes in Location-Specific Requirements

Location	Requirement		Prerequisite	Citation/Year
Location A (*e.g.*, critical habitat upon which endangered or threatened species depend)	Previous	Include original ARAR here; if none applies, state "None"		
	New			

	Checklist for Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Other Information *Discuss the following:*	
	Whether newly identified ecological risks been found
	Whether there are impacts from natural disasters
	Whether any other information has come to light which could affect the protectiveness of the remedy

Technical Assessment Summary

Discuss how each of the three questions were answered and provide the information that presents the basis for each answer as a framework for your protectiveness determination(s).

VIII. Issues

Detail issues related to current site operations, conditions, or activities, noting which issue, if any, currently prevent the remedy from being protective. You may use a table such as Table 7 to note the issues identified.

Table 7: Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)

IX. Recommendations and Follow-up Actions

Specify the required and suggested improvements to current site operations, activities, remedy, or conditions. Note the parties responsible for actions, milestone dates, and which agencies have oversight authority. At a minimum, address all issues that currently affect current and/or future protectiveness. Table 8 illustrates one way to include the necessary information.

Table 8: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future

X. Protectiveness Statement(s)

Include a protectiveness statement for each OU at which a remedial action has begun. For sites that have reached construction completion and have more than one OU, you should develop and include an additional comprehensive site-wide protectiveness statement covering all of the remedies at the site. You should not include this additional protectiveness statement until construction completion because, until then, all remedies at the site have not necessarily been selected and constructed.

In order to promote consistency, you are strongly encouraged to model your protectiveness statements on the sample protectiveness statements provided in Chapter 4, Exhibits 4-6 and 4-7. Your Five-Year Review report should present the protectiveness statements at the beginning of a

discussion that should explain and provide the supporting rationale of the protectiveness determination.

Suggested statements are as follows:

If the remedial action at the OU is under construction, then use this statement:

Protective or will be protective:

"The remedy at OU X is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."

Not protective:

"The remedy at OU X is not protective because of the following issues [describe the issue(s)]. The following actions need to be taken [describe the actions needed to ensure protectiveness]."

Protectiveness deferred:

"A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions [describe the actions]. It is expected that these actions will take approximately [insert time frame] to complete, at which time a protectiveness determination will be made."

If the remedial action at the OU is operating or completed:

Protective:

"The remedy at OU X is expected to be or is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."

Protective in the short-term:

"The remedy at OU X currently protects human health and the environment because [describe the elements of the remedy that protect human health and the environment in the short term]. However, in order for the remedy to be protective in the long-term, the following actions need to be taken [describe the actions needed to ensure long-term protectiveness]."

Not protective:

"The remedy at OU X is not protective because of the following issue(s) [describe the issue(s)]. The following actions need to be taken [describe the actions needed to ensure protectiveness].

Protectiveness deferred:

"A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions [describe the actions]. It is expected that these actions will take approximately [insert time frame] to complete, at which time a protectiveness determination will be made."

For Sites That Have Reached Construction Completion:

If the remedy(s) is/are protective then use:

"Because the remedial actions at all OUs are protective, the site is protective of human health and the environment."

If the remedy is not protective then use:

"The remedial actions at OUs X and Y are protective. However, because the remedial action at OU Z is not protective, the site is not protective of human health and the environment at this time. The remedial action at OU Z is not protective because of the following issue(s) [describe the issue(s)]. The following actions need to be taken [describe the actions needed to ensure protectiveness]."

XI. Next Review

Discuss whether another five-year review will be conducted and the date on which that report will be due. If no additional five-year reviews are to be conducted, explain why and provide a justification for discontinuation of reviews.

Attachments

Site Maps (if not included in the body of the report)
List of Documents Reviewed
Tables and Figures Documenting Remedy Performance and Changes in Standards
(If not included in the body of the report)
Interview Report (as appropriate)
Photos Documenting Site Conditions

Appendix

Comments received from Support Agencies and/or the community