DRAFT SITE INVESTIGATION REPORT

PU'ULOA RANGE TRAINING FACILITY SHORELINE

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List of Acronyms and Abbreviations

bgs	below ground surface
C/I	commercial/industrial
COPC	chemical of potential concern
DoD	Department of Defense
DQO	data quality objective
DU	decision unit
EAL	Environmental Action Level
ECPD	Environmental Protection and Compliance Division
EPA	United States Environmental Protection Agency
GIS	Geographic Information System
HDOH	State of Hawaii Department of Health
HDOT	Hawaii Department of Transportation
HEER	Hazard Evaluation and Emergency Response Office
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
mc	munitions constituents
MCBH	Marine Corps Base Hawaii
mg/kg	milligrams per kilogram
mm	millimeter
MIS	multi-increment sample
MS	matrix spike
MSD	matrix spike duplicate
ORC	operational range clearance
PHNDSA	Pearl Harbor Naval Defensive Sea Area
PRTF	Pu'uloa Range Training Facility
QA	quality assurance
QC	quality control
REVA	Range Environmental Vulnerability Assessment
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
UIC	Underground Injection Control
USMC	United States Marine Corps

Section 1. Introduction and Purpose

1.1 Project Identification

Project Name and Location:	Pu'uloa Range Training Facility Shoreline Sampling
	Ewa Beach, Oahu, Hawaii
Project Owner:	Marine Corps Base Hawaii
Date of Issue:	August 2024

1.2 Introduction and Purpose

The United States Marine Corps (USMC), Marine Corps Base Hawaii (MCBH), Environmental Compliance & Protection Division (ECPD) has prepared this Site Investigation Report (SIR) to summarize sampling activities conducted at the Pu'uloa Range Training Facility (PRTF), also referred to as "the range." Sampling of the soils and sand was conducted in accordance with the Sampling and Analysis Plan (SAP), prepared by MCBH ECPD and concurred with by the Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response Office (HEER).

The primary goal of this sampling event is to delineate concentrations of metals throughout the approximate 3,000-foot-long shoreline. This SIR describes the sample plan design, sample collection and handling procedures, field observations, laboratory analyses, data assessment, and summarizes the data collected during the sampling event. In addition to following the scope of work in the SAP, all work was conducted in general accordance with the following HDOH-HEER guidance:

- *HDOH 2008 Technical Guidance Manual for the Implementation of the Hawai'i State Contingency Plan, Interim Final.*
- *HDOH 2017 Guidance for Soil Stockpile Characterization and Evaluation of Imported and Exported Fill Material.*

Section 2. Background

2.1 Site Description

PRTF is located on the south-central shore of Oahu, west of the Pearl Harbor entrance channel, between the Kapilina residential area (formerly Iroquois Point Family Housing) to the Range's east, and the off-base residential community of Ewa Beach to the west of the Range. (See Figure 1 and Figure 2)

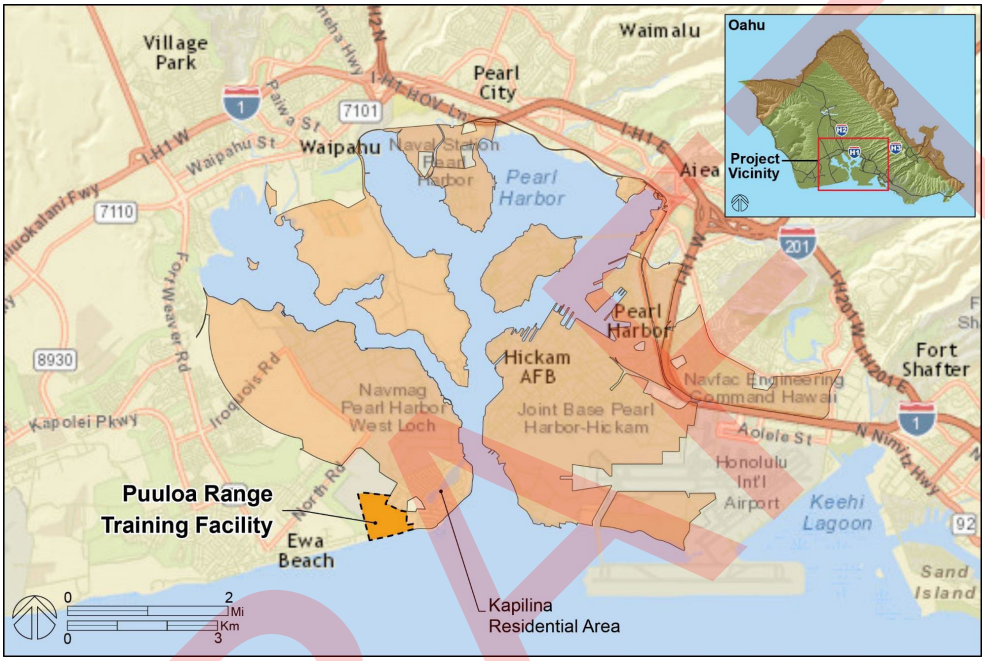

Figure 1: Location Map

Figure 2: Range Location Diagram

The ocean area directly adjacent to the PRTF shoreline is located within the Pearl Harbor Naval Defensive Sea Area (PHNDSA). The 165-acre range extends along about 3,000 feet of sandy shoreline and consists of six small-arms ranges (pistols, rifles up to 7.62 millimeter (mm), and shotguns) of different distances. (See Figure 3)

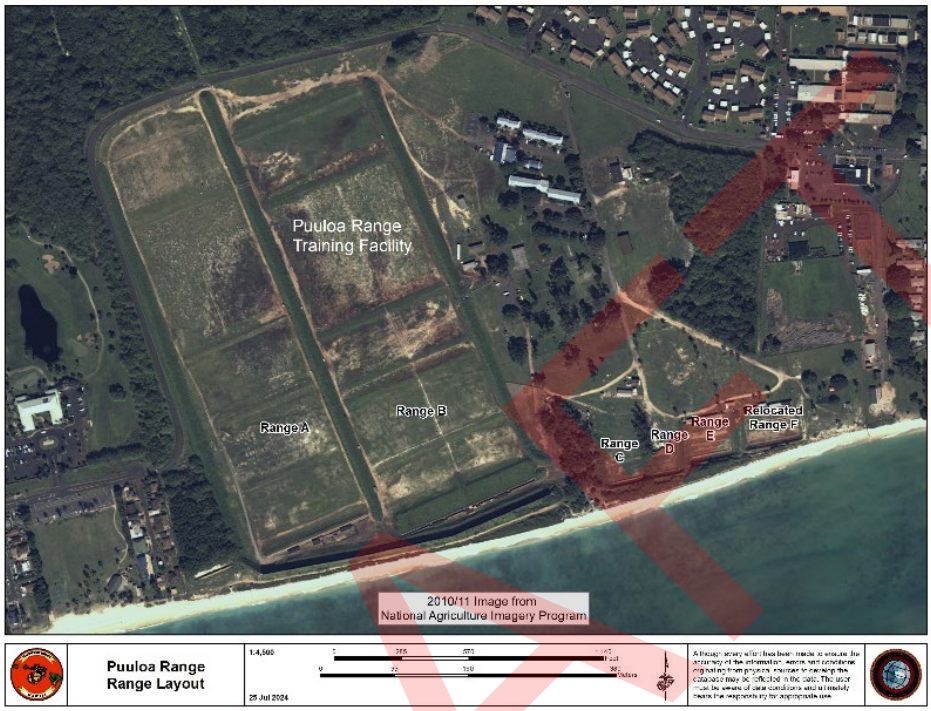

Figure 3: Range Layout

The coastline at PRTF generally follows a typical beach profile that is defined (moving inland from the ocean) by the nearshore (*i.e.,* submerged shoaling/surf zones), foreshore (*i.e.,* swash zone and dune face), backshore (*i.e.,* overwash dune crest and backside) and coastal plain. (See Figure 4)

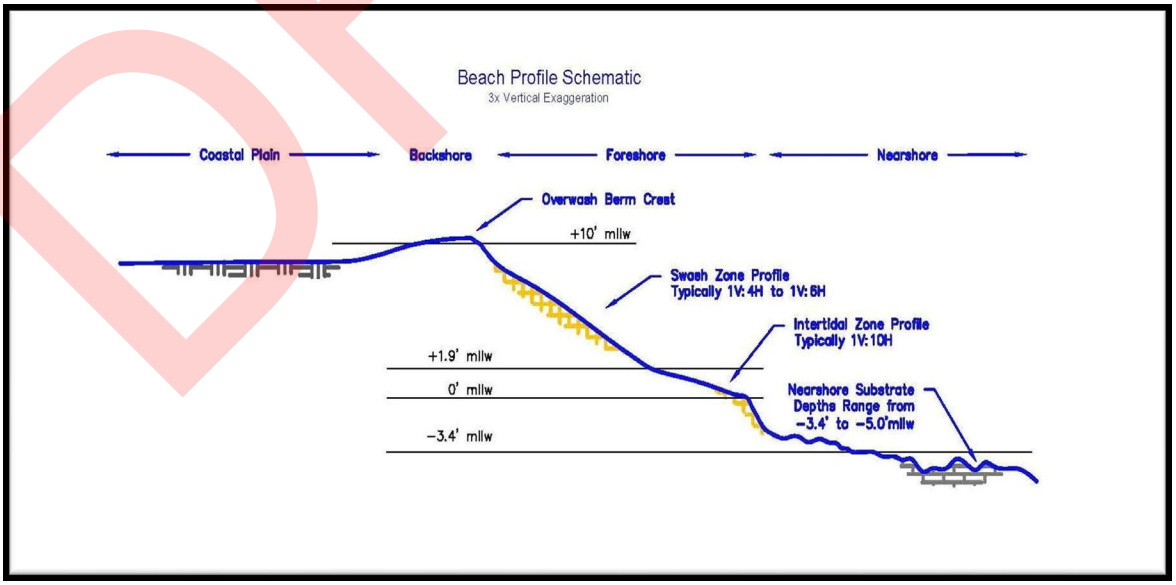

Figure 4: Beach Profile Schematic

At PRTF, the six small arms ranges (Alpha through Foxtrot) are constructed with an inland firing position, where munitions are fired toward the ocean (*i.e.,* fire to the south). Each firing range includes an earthen firing berm that was constructed in the backshore zone, and partially covers the existing, natural dune.

For this report, "Firing Berm" refers to the earthen berm intended to collect munition constituents (MC) associated with range operations. The sampling effort described in this report focused on soils located between the firing berm crest and the vegetated foreshore zone, which are all within boundaries of the range. (See Figure 5)

Figure 5: Decision Unit Sampling Map

Soils within this area of the range include a mix of naturally occurring foreshore material and soil used to construct the firing berms. In the case of Foxtrot Range, the firing berm has been moved approximately 40 yards inland, away from the natural dune and sampling was limited to the area between the natural over wash dune crest and the vegetated foreshore zone. The movement of Foxtrot berm is described in greater detail in Section 2.2.

The eastern- and western-most extents of PRTF are beyond the boundaries of Alpha and Foxtrot Ranges. These areas follow the typical beach profile described above, but do not have firing berms. Sampling efforts in these areas of the range included areas further inland from the over wash dune crest (*i.e.,* portions of the coastal plain zone). Additional description of the sampling locations is included in Sections 4 and 6.

For consistency, this report refers to the sampling area as that portion of the range which consists of the vegetated foreshore zone which includes a portion of firing berm backsides and is comprised of a mix of sand, silt, and clay materials. Sampling of the foreshore zone without vegetation and comprised of only sand on PRTF was done at the eastern and western most extents of the PRTF coastline boundaries because these areas are adjacent to where the public can access the beach.

2.1.1 Climate

The climate of Pu'uloa can be characterized as hot and dry. Annual rainfall averages only 17 inches. Daily temperature range between 62- and 86-degrees Fahrenheit. Prevailing winds vary between predominant northeast trades and upslope winds generated by heating of the land surface. Light and variable "Kona" winds occasionally replace this pattern, most often in winter.

2.1.2 Surface Water

The range is located within the Pearl Harbor watershed, a 110-square mile watershed subdivided into nine sub-watersheds. These sub-watersheds contain the headwaters of nine streams that drain into Pearl Harbor. The range is located within the Honouliuli sub-watershed of the Pearl Harbor watershed, approximately 3.7 miles to the southwest of Honouliuli Stream. Honouliuli is the westernmost sub-watershed within the Pearl Harbor Watershed. Annual rainfall ranges from an average of 47 inches at the Waianae Mountain peaks to 24 inches near the H-1 Freeway. There are no surface waters or wetlands within the PRTF property boundary; however, the southern property boundary of PRTF is defined by the Pacific Ocean shoreline.

2.1.3 Groundwater

On Oahu, groundwater occurs principally as either basal water (a lens of fresh to brackish water that floats on seawater) or high-level water (freshwater that does not rest on seawater). Basal water is the most abundant form of groundwater on Oahu. The site is located below the HDOH defined Underground Injection Control (UIC) line. Areas above the UIC line denote potential underground drinking water sources. Areas below the UIC line generally denote groundwater that is unsuitable for drinking water purposes. Consequently, the groundwater underlying PRTF would not be considered a potential drinking water source due to the location below the UIC and general proximity to the ocean. The depth to groundwater is anticipated at approximately seven feet below ground surface (bgs).

2.2 Historic and Current Site Use & Conditions

PRTF has been in operation since 1915. PRTF is required for maintenance of small-arms proficiency by all U.S. Armed Forces personnel, as well as other local, state, and federal agencies including the Federal Bureau of Investigation, Honolulu Police Department, and the Hawaii Division of Conservation and Resources Enforcement. It is the only range of its kind on Oahu (USMC, 2019).

Ranges A and B on the west are long-distance ranges (up to 1,000 yards) perpendicular to the ocean and their ocean end consists of large earthen firing berms with concrete barrier walls on top. Ranges C, D, E

and F are shorter rifle, pistol, and shotgun ranges from 150 to 250 feet long with earthen firing berms on the ocean side of the range. The entire range extends along about 3,000 feet of sandy shoreline. (See Figure 5 noted above).

This shoreline is directly exposed to southern swell, refracted trade wind waves, Kona storm waves, and the infrequent hurricane. The morphology, orientation, and exposure of the beach fronting the firing range is similar to, and connected with, the beach system fronting the Ewa Beach residential neighborhood. The beach has a relatively steep slope for a south facing Hawaiian shoreline and has a narrow, over wash dune that is intermittent along the coastline. Generally, where the over wash dune is present it is lightly vegetated with low-lying, salt tolerant, ground cover such as the non-native Pickleweed (Batis maritima), Akiaki grass (Sporobolus virginicus), Naupaka Kahakai (Scaevola taccada), or Pohuehue/Morning Glory (Ipomoea pes-caprae subsp. Brasiliensis). Kiawe (Prosopis pallid) shrubs are present along sections of the over wash dune. Inland of the over wash dune is the Ewa Plain, which is relatively flat and dominated by carbonate sediments, with the exception of improved areas such as the firing range facilities, including earthen support features (NAVFAC HI, 2015).

The construction of the Iroquois Point beach nourishment and stabilization project was completed in 2013 It consists of nine rock rubble-mound T-head groins along 4,200 feet of shoreline, with beach fill in the cells between the groins. The western-most groin, located about 500 feet east of the Range boundary, now acts as a terminal groin for the vicinity of the east end of the rifle range, trapping the prevailing west to east longshore transport of sand and preventing its loss from the Range shoreline. Shoreline profiles surveyed one-year post-construction indicate accretion and a seaward movement of the shoreline east of the Range. (NAVFAC HI, 2015).

In February of 2023, the Foxtrot firing berm was moved inland approximately 40 yards to mitigate erosion effects on the berm. The soils of the firing berm were processed, and 19 tons of lead and copper were removed and recycled. The soil has been moved 100 feet back from its original position and will be re-used to build new firing berms.

USMC ranges, including PRTF, are governed by Department of Defense (DoD) Instruction 4715.14 (Operational Range Assessments) which prescribes procedures to assess the potential human health and environmental impacts from the use of military munitions on operational ranges in the United States in accordance with the authority in DoD Directives (DoDDs) 4715.1E, 5134.01, and 6055.09E, MCO 5090.2 Volume 21, and the Deputy Secretary of Defense Memorandum of July 13, 2018 (see references).

USMC ranges conduct Operational Range Clearance (ORC) to remove munitions constituents and target debris to maintain range functionality. ORC scheduling is dependent on range use frequency. Typical ORC execution at PRTF includes processing soil from the firing berm faces through mechanized screens to remove projectiles and debris. Dust control activities are utilized for this process. Sifted soil is then used to reestablish firing berm faces with a compacted and stable 1:1 slope. Firing berms are covered with jute matting and hydroseeded to promote regrowth of vegetation and stabilize the firing berm slopes. Debris that are recovered from the firing berms are removed and safely disposed (NAVFAC HI, 2020).

2.3 Previous Environmental Studies

In April 2015, the Pu'uloa Shoreline Erosion Study was conducted to investigate coastal processes on PRTF and the condition and characteristics of the shoreline, determine historical shoreline changes, analyze wave induced sand transport mechanisms, and develop possible erosion control alternatives. The profile

measurements showed small shoreline/beach changes that would be expected for this area, and no significant long-term change in the shoreline position fronting the Range over the 10-year period from 2003 to 2014 (NAVFAC HI, 2015).

In August 2019, an Environmental Assessment for Shoreline Stabilization at Pu'uloa Range Training Facility, Oahu, Hawaii was completed. The Proposed Action was to initiate measures to mitigate coastal erosion from wave action associated with sea-level rise and potential seismic-wave events at PRTF. The preferred alternative of the Environmental Assessment included retreating ranges C – F, installing protective sheet pile along the fast land boundary of ranges A – B, and revegetation (USMC, 2019).

In November 2020, the MCBH Range Environmental Vulnerability Assessment (REVA) periodic review was conducted to ensure continued sustainability and usability of USMC training ranges. Under the REVA program, per DoD Instruction 4715.14, the USMC evaluates whether there is a release or substantial threat of a release of munitions constituents (MC) from an operational range to off range areas. If a release is identified, the evaluation determines if it creates an unacceptable risk to human health or the environment. The 2020 REVA periodic review indicated that there is no known off-range MC migration that presents a potential unacceptable risk to human health or the environment.

In November 2022, MCBH coordinated with the HDOH-HEER office to conduct limited sampling in response to concerns of potential contamination along the shoreline of PRTF. Results of that limited sampling effort warranted additional investigation, which led to the development of the SAP and this SIR.

2.4 Chemicals of Potential Concern

Chemicals of Potential Concern (COPCs) identified in the SAP are the metals lead, antimony, and copper as they are commonly associated with small arms munitions.

Section 3. Data Quality Objectives

The data quality objective (DQO) for this project was to collect soil samples from the vegetated foreshore zone (*i.e.*, southern side of the firing berms) and analyze them for lead, antimony, and copper. Guidance used in the development of the project specific DQO is included in the United States Environmental Protection Agency (EPA) 2006 *Guidance for the Data Quality Objectives Process* and 2000 *Guidance for Data Quality Assessment*.

3.1 Problem Statement

Based on the objective of this project, the following problem statement was applied:

The soils in the vegetated foreshore zone, including portions of some firing berms (ocean-side only) at Pu'uloa Range Training Facility will be sampled and characterized in accordance with HDOH *MULTI-INCREMENT* soil sampling guidance to identify any areas of concern for lead, antimony, and copper release.

3.2 Objectives

As identified in the SAP, the primary objective of this project was to answer the following questions:

1. Is lead present in the vegetated foreshore zone soil and shoreline? If so, is it at levels exceeding guidance levels for commercial/industrial land uses?
2. Is antimony present in the vegetated foreshore zone soil and shoreline? If so, is it at levels exceeding guidance levels for commercial/industrial land uses?
3. Is copper present in the vegetated foreshore zone soil and shoreline? If so, is it at levels exceeding guidance levels for commercial/industrial land uses?

3.3 Decision Inputs

3.3.1 Analysis of *MULTI-INCREMENT* Soil Samples

MULTI-INCREMENT®[1] soil samples (MIS) from the shoreline soil and sand Decision Units (DUs) were analyzed by FQ Labs in Honolulu, Hawaii for total lead, antimony, and copper using EPA SW-846 method 6020B, and pH using EPA SW-846 method 9045.

3.3.2 Soil Screening Criteria

The results of the sample analysis were compared to HDOH Tier 1 Environmental Action Levels (EAL) for commercial/industrial land use, for sites where groundwater is not a current or potential drinking water source and surface water is located less than 150 meters from the site. Although the HDOH Tier 1 EAL for unrestricted land use does not apply to the range, which is considered commercial/industrial land use, at the request of HDOH the samples were also compared to Tier 1 EALs for unrestricted land use associated with residential use. The HDOH Tier 1 EALs are non-enforceable guidelines for assessing the need for additional actions.

3.4 Characterize Soil

The shoreline of PRTF is approximately 3,000 feet long. DU size was set at 150 feet long and 50 feet wide. In most DUs, the width of the soil sloping towards the ocean was narrower than 50 feet. For these narrower

[1] MULTI INCREMENT® *is a registered trademark of EnviroStat, Inc.*

DUs, the 100 collected increments came from the part of the DU where soil is present. The depth of all Decision Unit MULTI-INCREMENT Samples (DU-MIS) were from the top 4 to 6 inches of soil bgs. (As noted earlier, Figure 4 depicts the typical beach profile schematic for PRTF)

3.5 Limiting Decision Error

Errors are possible in any sampling event due to a variety of variables, including but not limited to site conditions, unknown subsurface conditions, influence from adjacent sites, and sample locations. To limit errors, a sampling methodology (DU-MIS) was selected reduce error associated with compositional and distributional heterogeneity by collecting an adequate mass of material and from a large number of points within the targeted volume of material (State of Hawaii Department of Health, 2008).

3.6 Project Boundaries

The sampling project boundaries are limited to the approximate 3,000-foot-long shoreline at PRTF. (See Figures 5, 6, and 7)

Figure 5 - Decision Unit Sampling Map
(*For Reference Only - Identical to Page 3*)

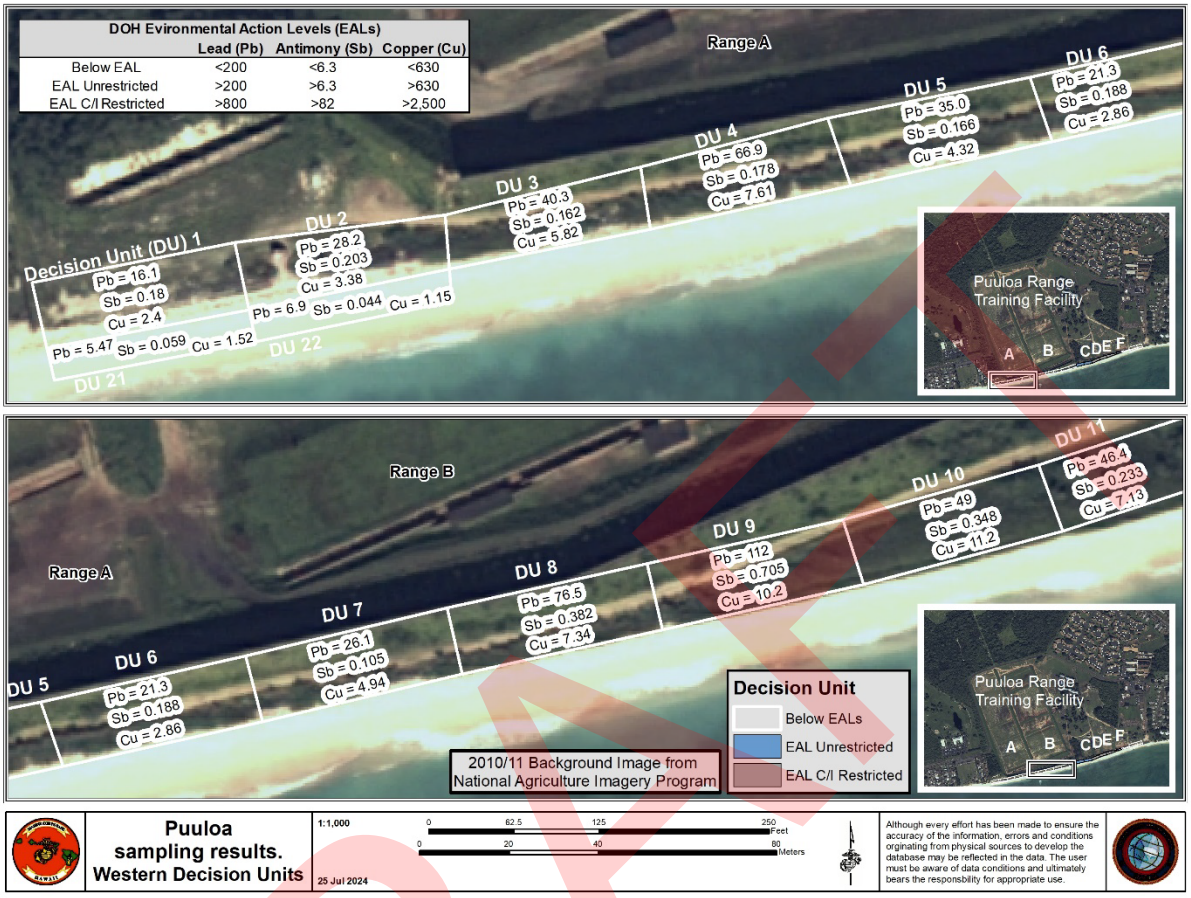

Figure 6: Decision Unit Sampling Map: Units 1 -11, 21, 22 with Results

Section 4. Field Activities

Fieldwork and sample collection was conducted of over a three-day period (February 13-15, 2024) with close coordination between the HDOH-HEER office and stakeholders. Fieldwork was completed primarily by MCBH ECPD, with support from the MCBH Geographic Information System (GIS) and Base Safety Offices. The fieldwork was observed by independent third parties from the University of Hawaii and Brigham Young University. Additional third parties were invited to observe sampling fieldwork including: Hawaii State Representatives, news media outlets, and concerned citizens (including representatives from the Ewa Beach Community Board).

4.1 Selection of DUs

The shoreline of PRTF is approximately 3,000 feet long. The soil and sand in the vegetated foreshore zone were characterized by establishing 24 DUs (Figures 5, 6 and 7). Twenty of the DUs (DU-1 through DU-20) were delineated by the transition between soils and sand in the foreshore which was observed to generally correlate with vegetative growth on the surface. Each DU was set at 150-feet-long and 50-feet-wide. For multiple DUs, 50-feet from the soil/sand transition point was greater than the distance to the top of the firing berm. For these instances, the DU-MIS samples were collected only where soil was present. DU boundaries did not extend inland beyond the crest of the earthen firing berm, as those areas are part of the firing range impact zones.

DU boundaries were established on February 13, 2024, by MCBH field personnel. Measurements were taken by first delineating the soil/sand transition point and flagging each ocean-side DU corner on 150-foot increments. Perpendicular transects were established from each flagged corner, by measuring 50-feet inland (or less in many cases as described above) and flagging the inland corner for each DU. After the DU boundaries were established, precise location data was collected by MCBH GIS personnel. (As noted earlier, established DUs are depicted in Figures 5, 6, and 7). All sampling DUs were within the boundaries of PRTF. Photographs of each DU are also included in Appendix A.

4.2 Surface Soil Sampling Activities

MIS were collected on February 14 and 15, 2024 by MCBH field personnel in accordance with HDOH-HEER Office guidance and the Sampling and Analysis Plan. Each DU-MIS consisted of 100 individual increments taken in a systematic random manner throughout the respective DU. MCBH field personnel collected individual increments using disposable scoops from a depth ranging from 4 to 6 inches bgs. Sampling personnel worked in teams to ensure an accurate count and location for each increment collected. Each increment collected approximately 15-grams, for a total MIS mass of approximately 1.5-kilograms (kg).

To ensure that sufficient sample material was available for analysis, each DU-MIS was sieved using a No. 5 (4.00 mm) screen to remove larger debris. Any projectile fragments or unidentifiable metal objects that were sieved from the DU-MISs were logged and reported. After sieving, DU-MISs were placed directly into a resealable freezer bag and prepped for shipping to the laboratory for analysis.

Field sample triplicates (noted as "# Dup" and "# Trip") were collected at DUs 1, 17, 18, 20, 21, and 24 as a quality control measure. DUs 1, 20, 21, and 24 were chosen because they show the greatest proximity to the public. DUs 17 and 18 were chosen in the field based on their perceived potential for the presence of munitions constituents as this was the area where Foxtrot berm was previously located. All replicate

samples were collected from increments off-set roughly 12-inches from the primary increments and processed in accordance with standard soil sample collection efforts.

Section 5. Sample Control Procedures

Prior to sampling, the Project Manager inspected all supplies and consumables to ensure that they were acceptable for use. Sample containers and equipment were used only if they have been certified pre-cleaned or if their packaging or seals have not been broken. Sampling and sample handling procedures were designed to ensure that samples were consistently collected, labeled, preserved, and transported in a manner that maintained their integrity for their intended purposes. Copies of the SAP and appropriate field procedures were carried by field personnel during field data collection. Prior to sampling, the Project Manager provided a daily briefing to all sampling personnel to ensure a consistent and compliant sampling effort was maintained.

5.1 Sample Containers and Preservation

Upon collection, samples were labeled and bagged in individual resealable plastic bags, following industry standards. Samples were placed on ice, packed into coolers, and transported to the analytical laboratory for analysis following all State of Hawaii Department of Transportation (HDOT) regulations for packaging and transporting samples.

5.2 Chain of Custody

Chain-of-custody forms were placed inside sealable plastic storage bags inside the sample coolers prior to transporting to the laboratory for analysis. Copies of the executed chain-of-custody forms are included in Appendix B.

5.3 Laboratory Analytical Methods

DU-MIS samples from the shoreline soil and sand DUs were analyzed by FQ Labs in Honolulu, Hawaii for total lead, antimony, and copper using EPA SW-846 method 6020B, and pH using EPA SW-846 method 9045.

Section 6. Field Observations During Sampling

Sampling was conducted in accordance with the procedures outlined in the SAP and described above in Section 5. All efforts were made to collect the 100 individual increments in a systematic random manner throughout each DU; however, in some cases, portions of a respective DU were inaccessible due to topographical features such as steep and heavily vegetated terrain, and fluctuating tides. Through consultations with HDOH-HEER representatives, when a portion of the DU was inaccessible, the 100 individual increments would be collected from accessible portions of the DU and any deviations would be noted. A summary of sampling conditions for each DU is presented below:

Table 1: Decision Unit Sampling Conditions

DU	Remarks
1, 2, 12 – 20	No deviations
3 – 11	Minor deviations. The northern portion of the DU had limited accessibility due to the steep embankment and thick vegetative cover.
21 – 24	Minor deviations. The full 50-foot DU width could not be accessed based on water levels. However, samples were collected at low tide to maximize the width of the DU sampled.

Photographs of each DU that depict general site conditions and accessibility limitations are included as Appendix A for reference.

As prescribed in the SAP, samples were sieved using a No. 5 (4.00 mm) screen to remove debris and ensure that sufficient sample material was available for analysis. Any suspected projectile fragments that were sieved from the DU-MISs were logged and reported. A summary of sieved material for each DU-MIS is presented below:

Table 2: Sieved Material Description

DU	Description of Sieved Material
1	Organic debris.
1 Dup	Organic debris.
1 Trip	Organic debris.
2	Organic debris.
3	Organic debris.
4	Organic debris.
5	Organic debris.
6	Organic debris.
7	Organic debris.
8	Organic debris. 3 suspected projectiles. Unidentified metals.

9	Organic debris. 5 suspected projectiles. Unidentified metals.
10	Organic debris.
11	Organic debris. Unidentified metals.
12	Organic debris. Unidentified metals.
13	Organic debris.
14	Organic debris.
15	Organic debris. 34 suspected projectiles. Unidentified metals.
16	Organic debris. 37 suspected projectiles. Unidentified metals.
17	Organic debris. 4 suspected projectiles.
17 Dup	Organic debris. 4 suspected projectiles.
17 Trip	Organic debris. 4 suspected projectiles.
18	Organic debris. 2 suspected projectiles. Unidentified metals.
18 Dup	Organic debris. 2 suspected projectiles. Unidentified metals.
18 Trip	Organic debris. 2 suspected projectiles. Unidentified metals.
19	Organic Debris
20	Organic Debris
20 Dup	Organic Debris
20 Trip	Organic Debris
21	Organic Debris
21 Dup	Organic Debris
21 Trip	Organic Debris
22	Organic Debris
23	Organic Debris
24	Organic Debris
24 Dup	Organic Debris
24 Trip	Organic Debris

Photographs of sifted material (organic debris and metals) for each DU-MIS are included as Appendix A for reference.

In addition to sample collection, efforts were made to assess the shoreline for obvious indicators of erosion during field work. General shoreline recession was apparent based on the extent of undercutting at the North and South border fencing. However, there were no obvious indicators of erosion impacting the firing berms with the exception of the Foxtrot firing berm, which was noted in previous environmental reports

and was recently addressed by moving the berm back from the shoreline. A significant area adjacent to the Bravo and Charlie ranges (DUs 10, 11, 12, and 13) included a small swale in the foreshore zone that appears to act as a settling basin during periods of wave inundation.

Section 7. Data Quality

Data from an investigation should be of sufficient accuracy and precision to evaluate any potential hazards and develop future mitigation measures if warranted. Laboratory quality combined with field sampling quality ensure that the data can be relied on for decision making.

7.1 Laboratory Quality Control

FQ Labs has a quality assurance/quality control (QA/QC) program in place. All analyses were conducted according to the guidance outlined in EPA SW-846. Laboratory equipment maintenance was conducted in accordance with the approved laboratory QA program and as specified by the analytical method employed for sample analyses. The calibration certificate is included in Appendix B.

MCBH identified transcription errors between the laboratory's raw data and certificate of analysis. The laboratory corrected the errors via a Corrective Action Form and issued a new certificate analysis for the affected samples. The transcription errors occurred in DUs with results below TIER 1 unrestricted EALs associated with residential use. A copy of the Corrective Action Form is included with the laboratory analytical results in Appendix B.

7.1.1 Surface Soil Samples

QC checks were conducted concurrently with the samples collected during this investigation. No deviations were noted for the analytical methods specified in this plan. Laboratory QC checks included the following QC samples:

- Method blanks and reagent blanks
- Matrix spike (MS) samples
- Matrix spike duplicate (MSD) samples
- Laboratory Control Sample / Lab Control Sample Duplicate (LCS / LCSD)

7.2 Field Quality Control

QA of samples collected in the field was ensured using trained sampling personnel, documented and standardized procedures, and second-party review of field logs and notes. Independent third parties from University of Hawaii and Brigham Young University observed all portions of field work, including equipment preparation, sample collection, sample processing and documentation, and completion of chain of custody forms. A representative from the HDOH-HEER office also observed field work.

Prior to sampling, the Project Manager inspected all supplies and consumables to ensure that they were acceptable for use. Sample containers were new resealable freezer bags. Scoops were individually sealed and used once per DU. New gloves were used for each DU sampling effort as well as for each DU sample processing and sealing. The sieve was washed in potable water with phosphate free detergent scrub and double rinsed in potable water. Wash and rinse water were routinely replaced. All samples were consistently collected, labeled, preserved, and transported in a manner that maintains their integrity for their intended purposes. As noted earlier, field triplicates were collected for field quality control purposes at six DUs.

7.3 Field Replicates Analyses and Summary

Statistical evaluation of replicate sample data precision was conducted by calculating and evaluating the Relative Standard Deviation (RSD) of the chemical concentrations for the data set. The data precision validation (replicate samples only) is provided below:

Table 3: Replicate Data Evaluation

DU 1						
Analyte	1	1 Dup	1 Trip	Mean	SD	RSD
Copper	2.5	2.29	2.46	2.4	0.112	4.61
Antimony	0.19	0.192	0.158	0.2	0.019	10.6
Lead	16.5	16.9	14.8	16.1	1.12	6.94

DU 17						
Analyte	17	17 Dup	17 Trip	Mean	SD	RSD
Copper	40.2	41.1	37.3	39.5	1.99	5.02
Antimony	1.75	2.07	2.5	2.1	0.376	17.9
Lead	326	299	459	361.3	85.7	23.7

DU 18						
Analyte	18	18 Dup	18 Trip	Mean	SD	RSD
Copper	17.6	13.9	15.9	15.8	1.85	11.7
Antimony	0.567	0.577	0.389	0.5	0.106	20.7
Lead	149	94	98.7	113.9	30.5	26.8

DU 20						
Analyte	20	20 Dup	20 Trip	Mean	SD	RSD
Copper	2.93	4.19	3.96	3.7	0.671	18.2
Antimony	0.063	0.074	0.068	0.1	0.006	8.06
Lead	9.46	8.63	9.32	9.1	0.444	4.86

DU 21						
Analyte	21	21 Dup	21 Trip	Mean	SD	RSD
Copper	1.59	1.45	1.53	1.5	0.070	4.61
Antimony	0.064	0.061	0.052	0.1	0.006	10.6
Lead	5.75	5.31	5.36	5.5	0.241	4.40

DU 24						
Analyte	24	24 Dup	24 Trip	Mean	SD	RSD
Copper	2.04	1.96	1.47	1.8	0.309	16.9
Antimony	0.064	0.051	0.052	0.1	0.007	13.0
Lead	7.79	7.58	7.5	7.6	0.150	1.96

7.4 Field Data Quality Assessment

Data quality was assessed by evaluating the precision, accuracy, representativeness, completeness, and comparability parameters both qualitatively and quantitatively. Data from the MIS provides estimates of the concentrations of lead, antimony, and copper for each DU. As the DU-MIS process must estimate the concentrations, a measure of the variation from the mean is required to understand how well it represents the area. The standard deviations and means for lead, antimony, and copper were calculated and used to develop an RSD.

The data quality assessment from the SAP was set at the following:

a. An RSD for replicate sample data ≤35 percent suggests that the sampling method has good reproducibility and, assuming the samples were properly collected and processed, the data can be used for reliable decision making.

b. An RSD >35 percent but ≤50 percent indicates less reliable but still acceptable data for decision making, given the typical safety factor built into risk-based action levels.

c. An RSD >50 percent but ≤100 percent indicates poor data precision.

The RSD for the six field replicates met the data quality objective of ≤35% as outlined in the SAP, thus, data for DUs where replicate samples were not collected can be assumed to be representative without adjustment. The DU Data Quality Evaluation process was performed using Figure 8, where all requirements were met.

7.5 Data Quality Conclusions

The overall review of the laboratory quality control and field quality control indicated that the data can be relied upon to make decisions about the site conditions and contaminant levels.

Section 8. Analytical Results

DU-MIS samples were sent to FQ Labs in Honolulu, HI for analysis. Sample results were compared to the HDOH EALs per paragraph 3.3.2 Soil Screening Criteria. Copies of the laboratory results and executed chain-of-custodies are included as Appendix B.

Table 4: Analytical Results

DU-MIS Sample ID	Sample Date	Copper (mg/kg)	Antimony (mg/kg)	Lead (mg/kg)	pH
1[1]	2/14/2024	2.42	0.18	16.07	8.9
2	2/14/2024	3.38	0.203	28.2	8.8
3	2/14/2024	5.82	0.162	40.3	8.6
4	2/14/2024	7.61	0.178	66.9	8.6
5	2/14/2024	4.32	0.166	35	8.8
6	2/14/2024	2.86	0.188	21.3	8.8
7	2/15/2024	4.94	0.105	26.1	8.7
8	2/15/2024	7.34	0.382	76.5	8.7
9	2/14/2024	10.2	0.705	112	8.2
10	2/14/2024	11.2	0.348	49.0	8.3
11	2/15/2024	7.13	0.233	46.4	8.1
12	2/14/2024	39.3	2.20	**344**	8.1
13	2/15/2024	30.7	2.54	**357**	8.4
14	2/14/2024	112	4.04	**1946**	7.8
15	2/14/2024	138	**46.5**	**5375**	8.4
16	2/15/2024	69.5	**7.60**	**937**	8.2
17[1]	2/14/2024	39.5	2.11	**361**	8.4
18[1]	2/14/2024	15.8	0.511	114	8.6
19	2/14/2024	2.87	0.086	10.5	9.1
20[1]	2/14/2024	3.69	0.068	9.14	8.7
21[1]	2/14/2024	1.52	0.059	5.47	8.8
22	2/14/2024	7.13	0.233	46.4	9.2
23	2/15/2024	1.94	0.254	9.17	9.3
24[1]	2/14/2024	1.82	0.056	7.62	9.2
Tier I EAL Unrestricted		630	6.3	200	n/a
Tier I EAL Restricted (C/I)		2,500	82	800	n/a
		Exceeds Tier I EAL Unrestricted			
		Exceeds Tier I EAL Restricted (C/I)			

[1] Arithmetic mean of triplicates used for concentrations per HDOH-HEER TGM guidance.

Section 9. Summary of Results

DU-MIS sampling results indicate six DUs (12, 13, 14, 15, 16, 17) contain lead concentrations above Tier 1 Unrestricted (Residential) EALs and three DUs (14, 15, 16) contain lead concentrations above Tier 1 Commercial/Industrial EALs.

DU-MIS sampling results indicate two DUs (15, 16) contain antimony concentrations above Tier 1 Unrestricted (Residential) EALs. No DU-MIS samples exceeded antimony Tier 1 Commercial/Industrial EALs.

No DU-MIS samples exceed Tier 1 Unrestricted (Residential) or Commercial/Industrial EALs for copper.

Lead, antimony, and copper identified above respective Tier 1 EALs for either residential or commercial/industrial uses (12, 13, 14, 15, 16, 17) are contained to the areas immediately behind Charlie, Delta, Echo, and Foxtrot ranges, as well as the small access road area between Bravo and Charlie ranges. The highest concentrations of lead and antimony were identified in DUs 14, 15, and 16, which are located immediately behind Charlie, Delta, and Echo ranges. Figures depicting DU-boundaries and measured concentrations of lead, antimony, and copper are included as Figures 5, 6, and 7.

As presented in Section 6, significant quantities of sifted metals (i.e., suspected projectile fragments) were identified in the material sifted from DUs 15 and 16. No metals were identified in the material sifted from DU 14.

Section 10. Conclusions

10.1 Conclusions

The primary objective of this project was to answer the following questions:

1. Is lead present in the vegetated foreshore zone soil and shoreline? **Yes.** If so, is it at levels exceeding guidance levels for commercial/industrial land use? **Yes, for DUs 14, 15, 16. Additionally, it is present in DUs 12, 13, and 17 at levels exceeding Unrestricted/Residential uses.**
2. Is antimony present in the vegetated foreshore zone soil and shoreline? **Yes.** If so, is it at levels exceeding guidance levels for commercial/industrial land use? **No, for all DUs; however, it is present in DUs 15 and 16 at levels exceeding Unrestricted/Residential uses.**
3. Is copper present in the vegetated foreshore zone soil and shoreline? **Yes.** If so, is it at levels exceeding guidance levels for commercial/industrial land use? **No, for all DUs for both Commercial/Industrial uses and Unrestricted/Residential uses.**

The results of MCBH's site investigation confirm the presence of lead and antimony above Tier 1 EALs for commercial/Industrial land use, and in some instances Unrestricted (Residential) uses, in soils located within the boundary of PRTF. As PRTF is an active training range, the presence of lead and antimony is expected within the range. The results of this investigation also found lead, antimony, and copper in the soil behind the firing berms, where active firing does not occur, but still in an area located within the range. The presence of metals in this area can likely be attributed to historic firing berm and shoreline maintenance activities (stabilization, sifting, etc.), as evidenced by suspected projectile fragments identified in DU-MIS samples.

During the site investigation, the PRTF shoreline was observed for obvious indicators of erosion. Consistent with the 2015 Shoreline Erosion Study, and the 2019 Shoreline Stabilization EA, the area immediately behind the former Foxtrot firing berm showed the greatest potential for shoreline creep. The presence of sand within the former Foxtrot firing range indicates inward movement of beach dunes and potential for future inundation.

There were no obvious indicators of erosion observed behind Alpha, Bravo, Charlie, Delta, and Echo firing berms during fieldwork conducted for the site investigation. A significant area adjacent to the Bravo and Charlie ranges (DUs 10, 11, 12, and 13) included a small swale in the vegetated foreshore zone that appears to act as a settling basin during periods of wave inundation.

10.2 Next Steps

As Pu'uloa Range is an active firing range, and closed to the public, no further immediate action is warranted at this time. However, the results of this site investigation indicate long-term monitoring and management practices are warranted to regularly observe conditions of the firing berms and coastline system.

Concurrent to conducting this site investigation, MCBH requested the Navy and Marine Corps Force Health Protection Command (NMCFHPC) to perform an evaluation to determine the risk associated with potential exposure to MC (*i.e.,* antimony, copper, and lead), in the vegetated foreshore zone and shoreline of PRTF. The NMCFHPC Health Risk Evaluation is included as Appendix C.

Section 11. References

AECOM Technical Services Inc. 2020. *Range Environmental Vulnerability Assessment (REVA) Periodic Review Documentation of Findings for Marine Corps Base (MCB) Hawaii*.

Deputy Secretary of Defense Memorandum, "Establishment of the Office of the Under Secretary of Defense for Research Engineering and the Office of the Under Secretary of Defense for Acquisition and Sustainment," July 13, 2018.

DoD Directive 4715.1E, "Environment, Safety, and Occupational Health (ESOH)," March 19, 2005.

DoD Directive 5134.01, "Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L))," December 9, 2005, as amended.

DoD Directive 6055.09E, "Explosives Safety Management (ESM)," November 8, 2016, as amended.

Marine Corps Order 5090.2, Environmental Compliance and Protection Program

Naval Facilities Engineering Command (NAVFAC) HI 2015. *Pu'uloa Shoreline Erosion Study. Ewa Beach, Oahu.*

NAVFAC HI, 2020. *After Action Report, Operational Range Clearance and Maintenance, Pu'uloa Range Training Facility, Marine Corps Base Hawaii.*

State of Hawaii Department of Health, 2008. *Interim Final Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan.*

USMC 2019. *Environmental Assessment for Shoreline Stabilization at Pu'uloa Range Training Facility, Oahu, Hawaii.*

ATTACHMENTS

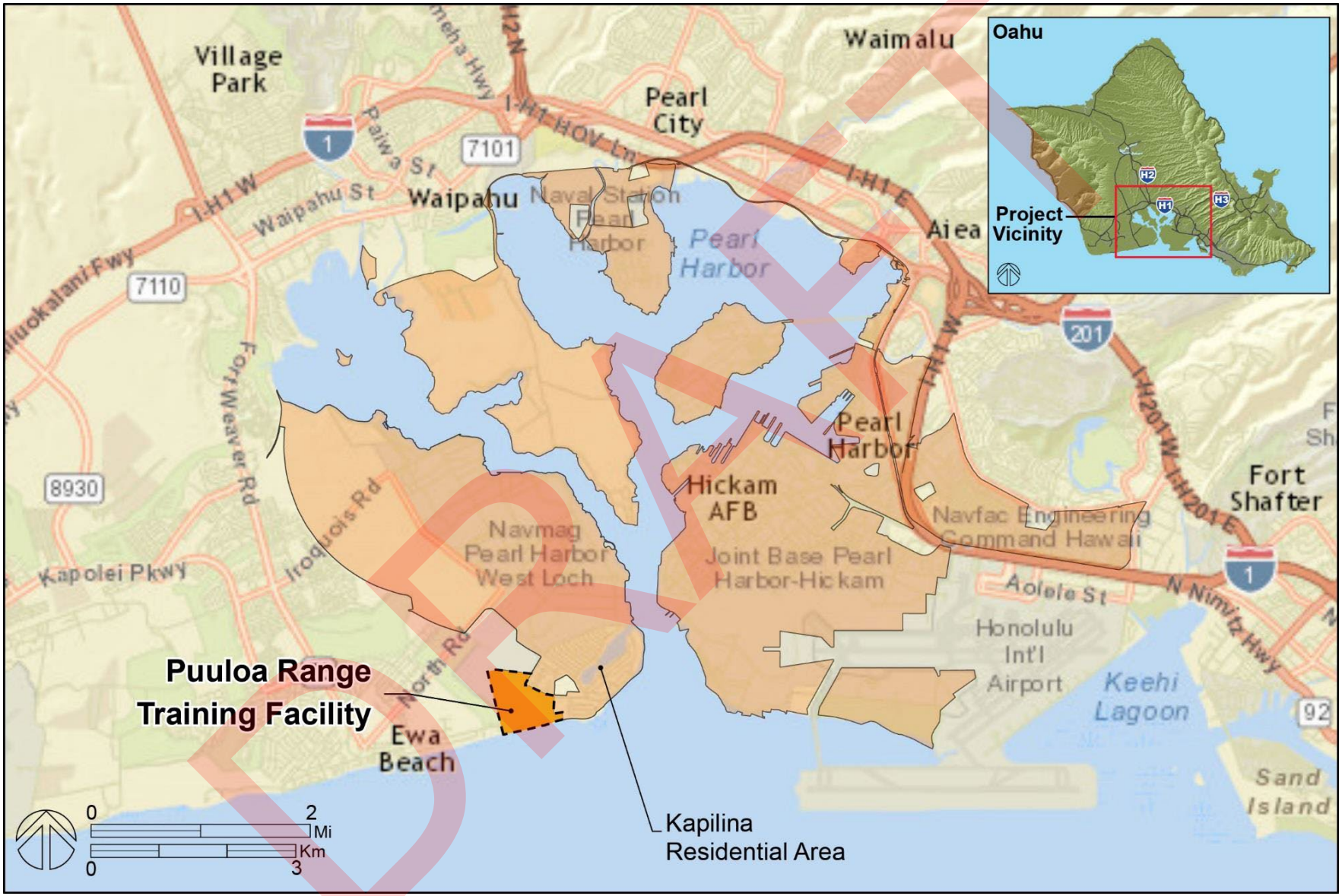

Figure 1: Location Map
(USMC, 2019)

Figure 2: Range Location Diagram
(USMC 2019)

Figure 3: Range Layout

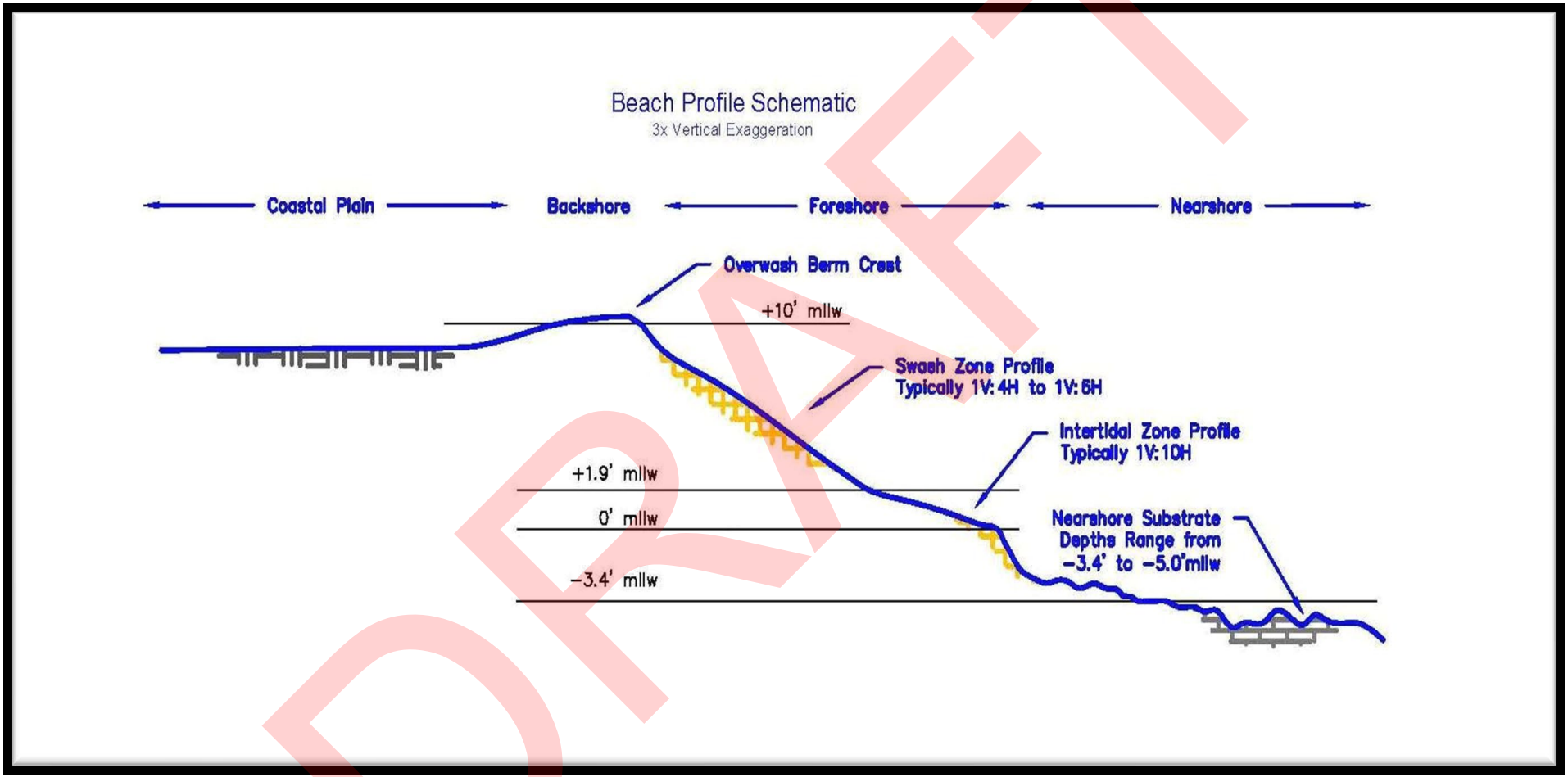

Figure 4: Beach Profile Schematic
(USMC 2019)

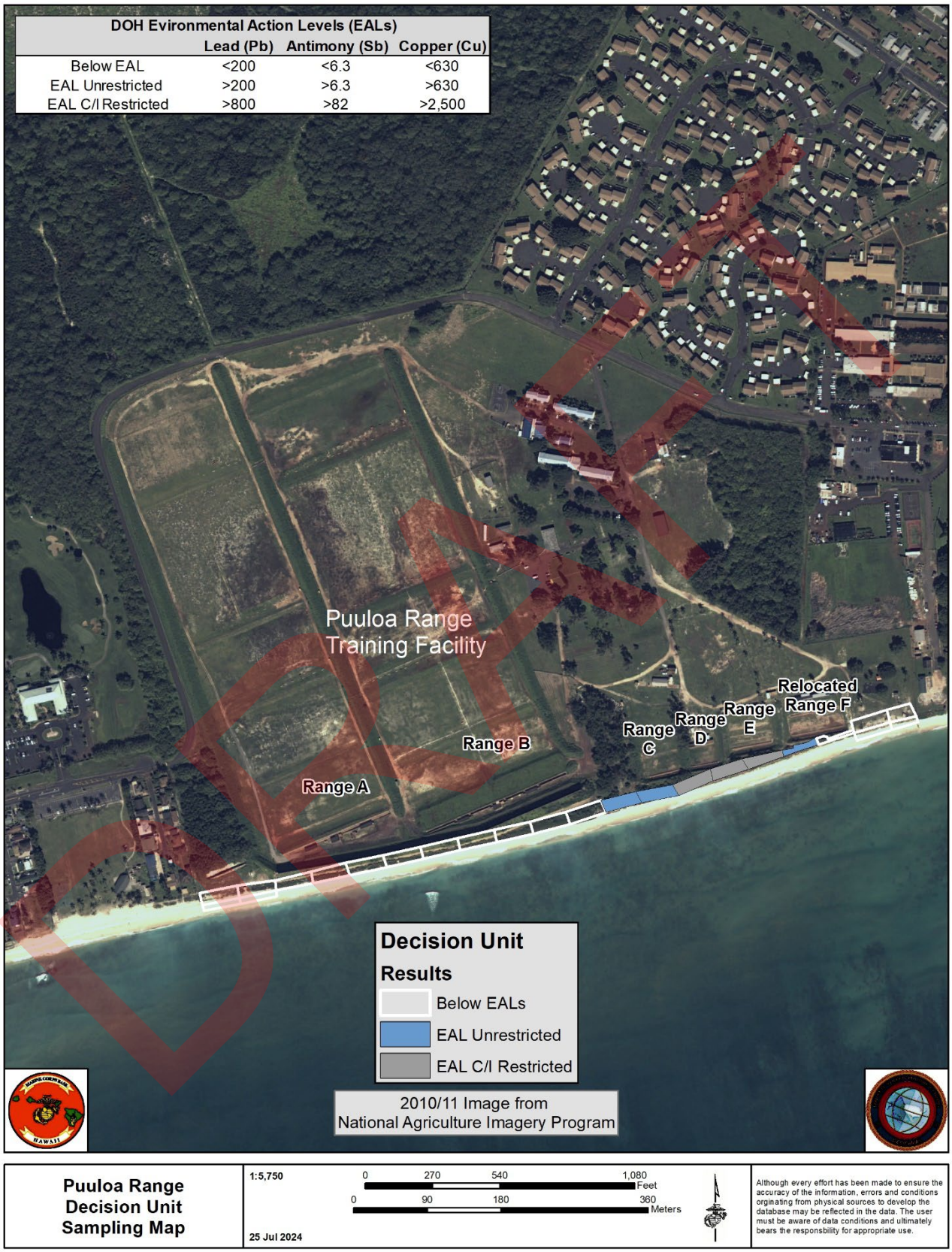

Figure 5: Decision Unit Sampling Map

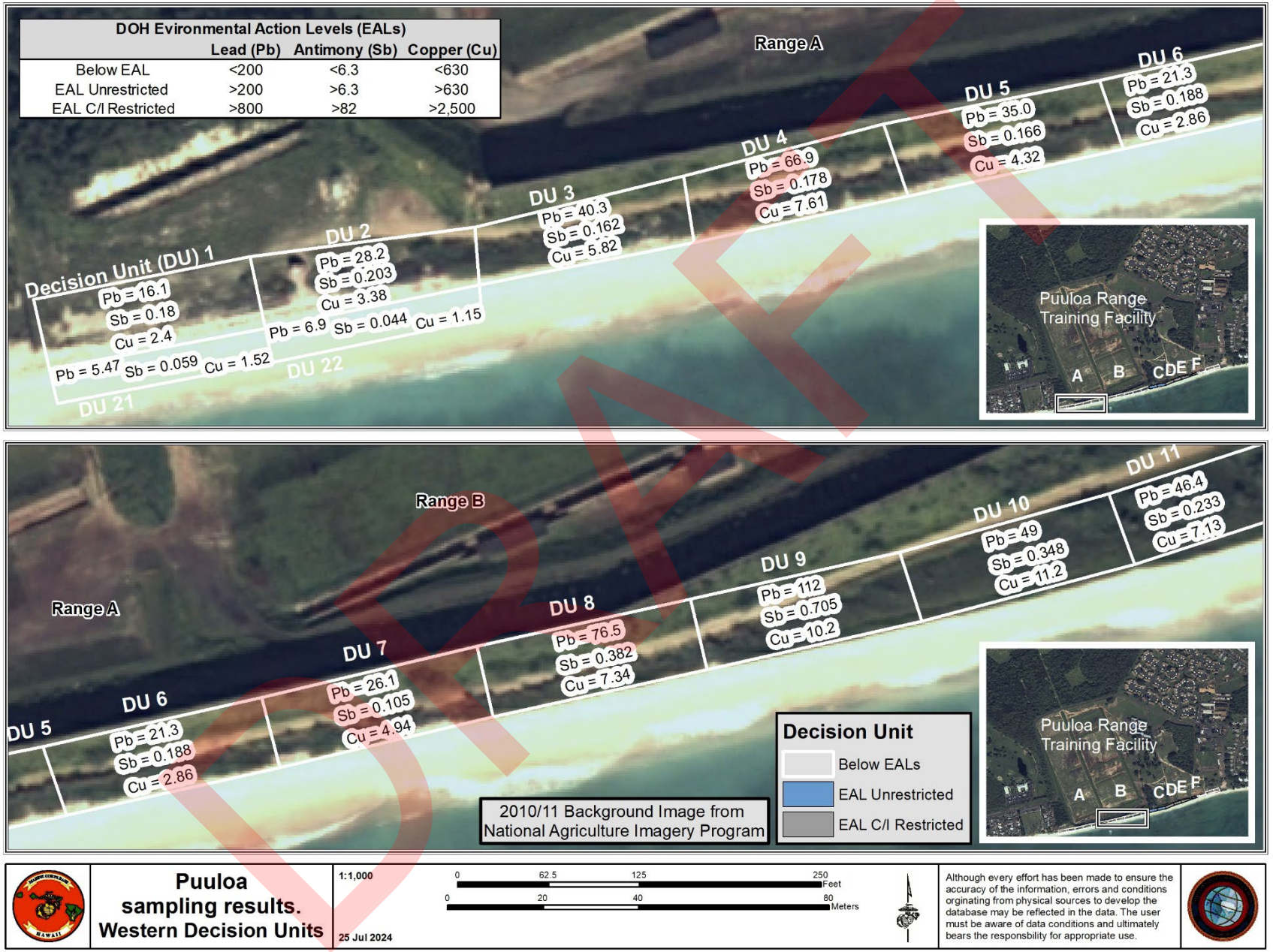

Figure 6: Decision Unit Sampling Map: Units 1 - 11, 21, 22 with Results

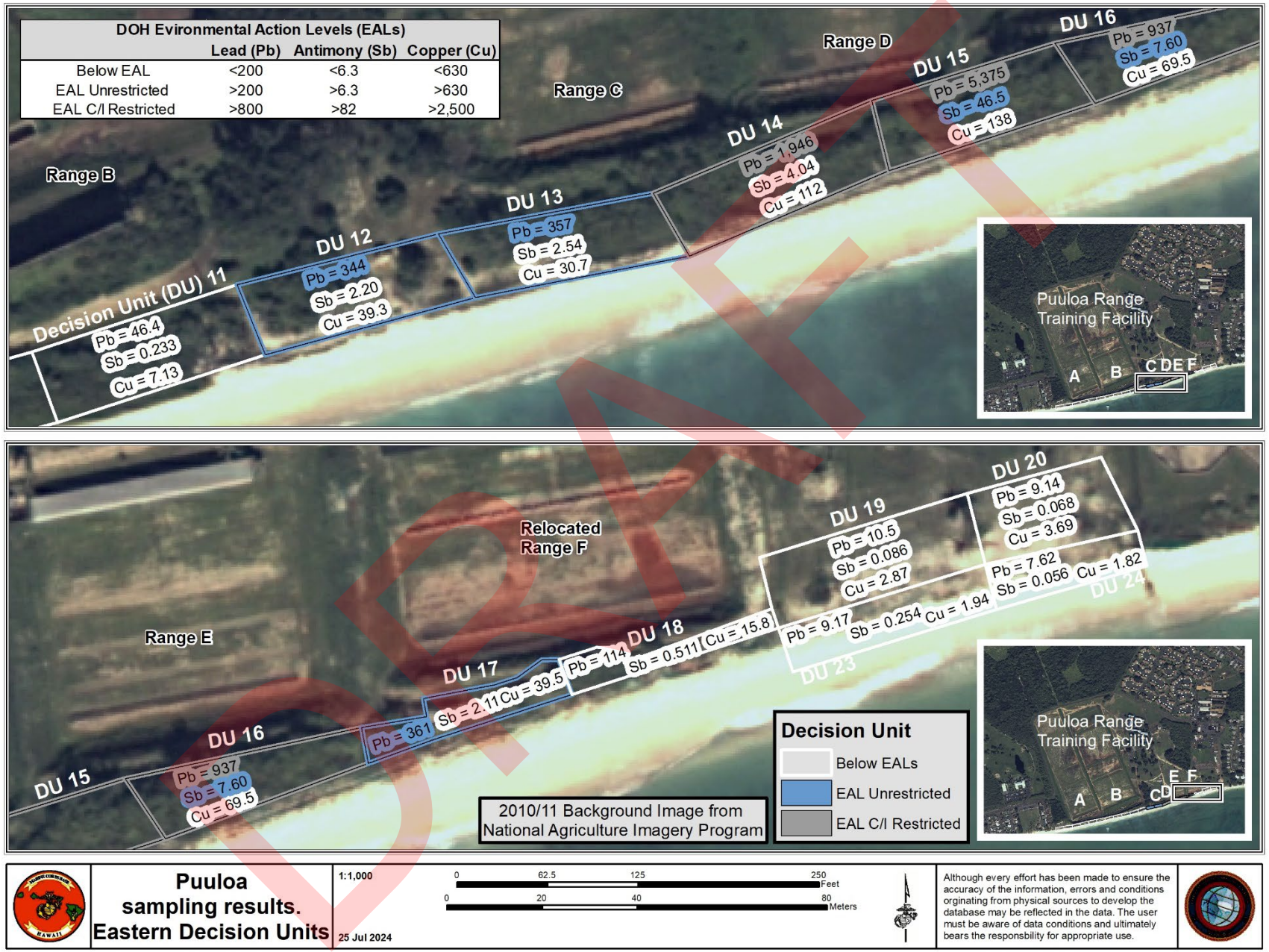

Figure 7: Decision Unit Sampling Map: Units 11 - 20, 23, 24 with Results

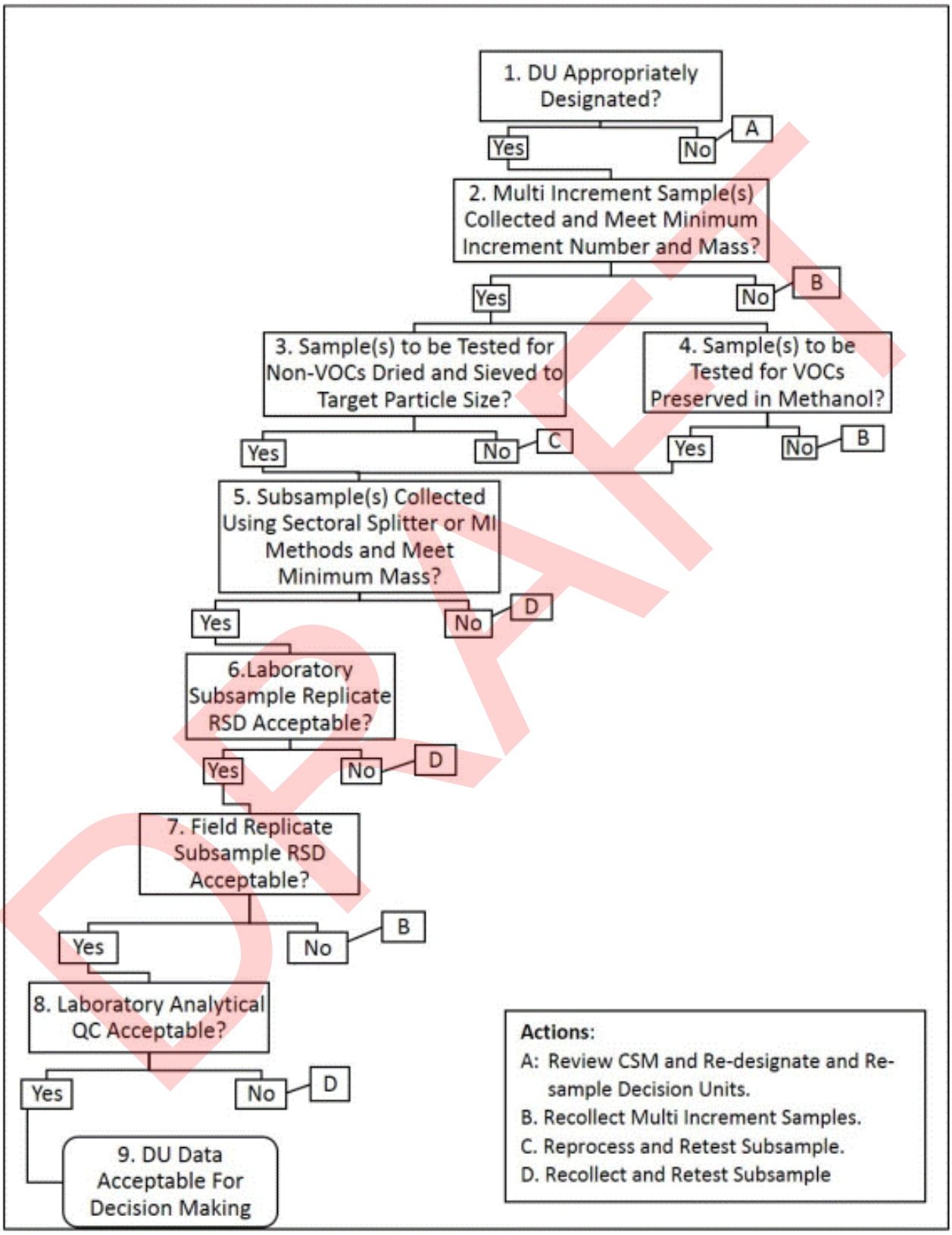

Figure 8: Decision Unit Data Quality Evaluation Process
(HDOH-HEER 2024)

Site Investigation Report
Pu'uloa Range Training Facility Shoreline

Appendix A

Site Photographs

Photo 1: Decision Unit 1

Photo 2: Decision Unit 2

Photo 3: Decision Unit 3

Photo 4: Decision Unit 4

Photo 5: Decision Unit 5

Photo 6: Decision Unit 6

Photo 7: Decision Unit 7

Photo 8: Decision Unit 8

Photo 9: Decision Unit 9

Photo 10: Decision Unit 10

Photo 11: Decision Unit 11

Photo 12: Decision Unit 12

Photo 13: Decision Unit 13

Photo 14: Decision Unit 14

Photo 15: Decision Unit 15

Photo 16: Decision Unit 16

Photo 17: Decision Unit 17

Photo 18: Decision Unit 18

Photo 19 Decision Unit 19

Photo 20: Decision Unit 20

Photo 21: Decision Unit 21

Photo 22: Decision Unit 22

Photo 23: Decision Unit 23

Photo 24: Decision Unit 24

Photo 25: Decision Unit 1 – Sifted Material

Photo 26: Decision Unit 1 (Duplicate) – Sifted Material

Photo 27: Decision Unit 1 (Triplicate) – Sifted Material

Photo 28: Decision Unit 2 – Sifted Material

Photo 29: Decision Unit 3 – Sifted Material

Photo 30: Decision Unit 4 – Sifted Material

Photo 31: Decision Unit 5 – Sifted Material

Photo 32: Decision Unit 6 – Sifted Material

Photo 33: Decision Unit 7 – Sifted Material

Photo 34: Decision Unit 8 – Sifted Material

Photo 35: Decision Unit 9 – Sifted Material

Photo 36: Decision Unit 9 – Sifted Metals

Photo 37: Decision Unit 10 – Sifted Material

Photo 38: Decision Unit 11 – Sifted Material

Photo 39: Decision Unit 11 – Sifted Metals

Photo 40: Decision Unit 12 – Sifted Material

Photo 41: Decision Unit 13 – Sifted Material

Photo 42: Decision Unit 14 – Sifted Material

Photo 43: Decision Unit 15 – Sifted Material

Photo 44: Decision Unit 15 – Sifted Metals

Photo 45: Decision Unit 16 – Sifted Material

Photo 46: Decision Unit 16 – Sifted Metals

Photo 47: Decision Unit 17 – Sifted Material

Photo 48: Decision Unit 17 – Sifted Metals

Photo 49: Decision Unit 17 (Duplicate) – Sifted Material

Photo 50: Decision Unit 17 (Duplicate) – Sifted Metals

Photo 51: Decision Unit 17 (Triplicate) – Sifted Material

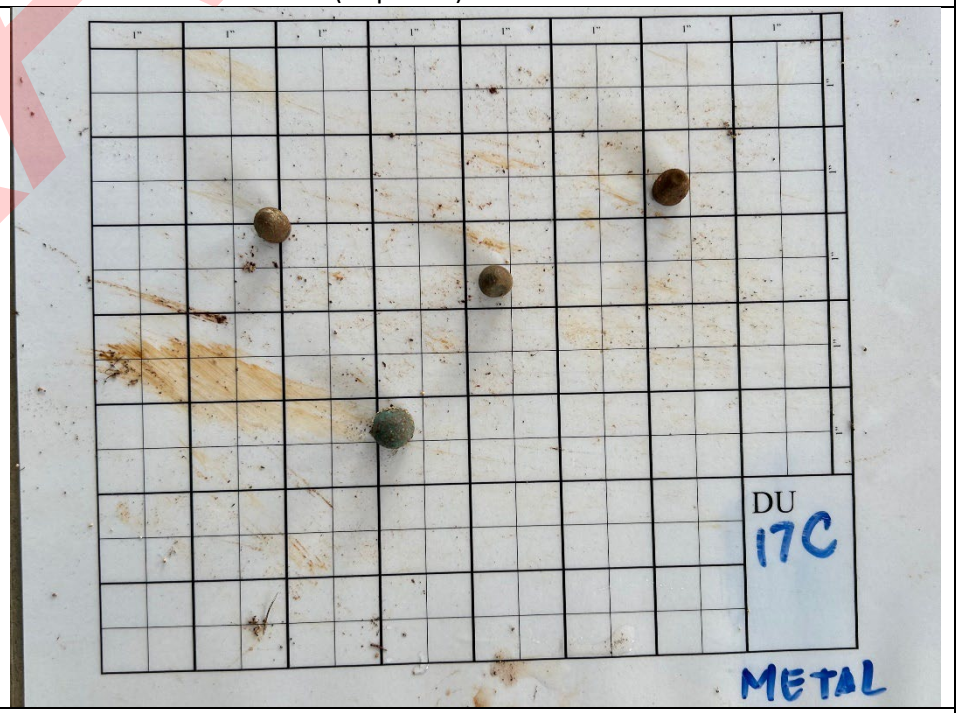

Photo 52: Decision Unit 17 (Triplicate) – Sifted Metals

Photo 53: Decision Unit 18 – Sifted Material

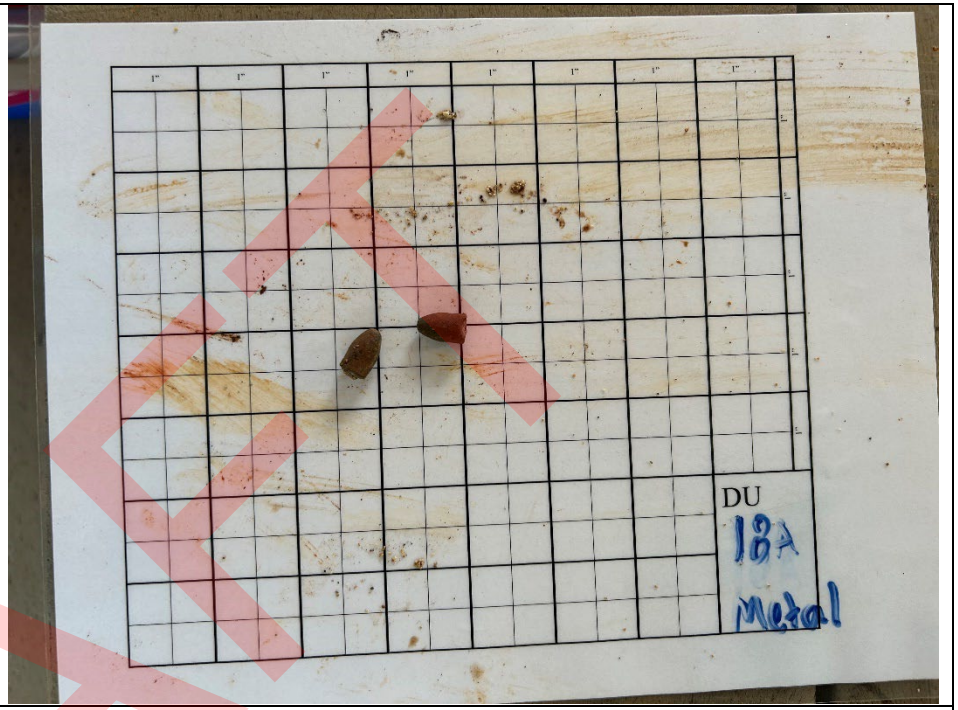

Photo 54: Decision Unit 18 – Sifted Metals

Photo 55: Decision Unit 18 (Duplicate) – Sifted Material

Photo 56: Decision Unit 18 (Duplicate) – Sifted Metals

Photo 57: Decision Unit 18 (Triplicate) – Sifted Material

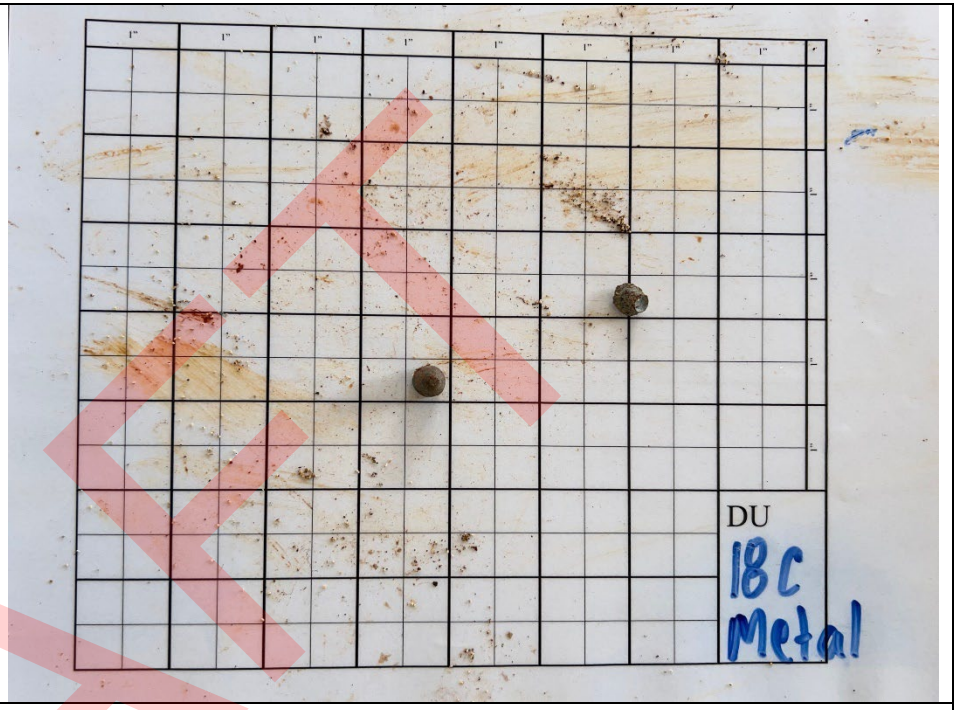

Photo 58: Decision Unit 18 (Triplicate) – Sifted Metals

Photo 59: Decision Unit 19 – Sifted Material

Photo 60: Decision Unit 20 – Sifted Material

Photo 61: Decision Unit 20 (Duplicate) – Sifted Material

Photo 62: Decision Unit 20 (Triplicate)– Sifted Material

Photo 63: Decision Unit 21 – Sifted Material

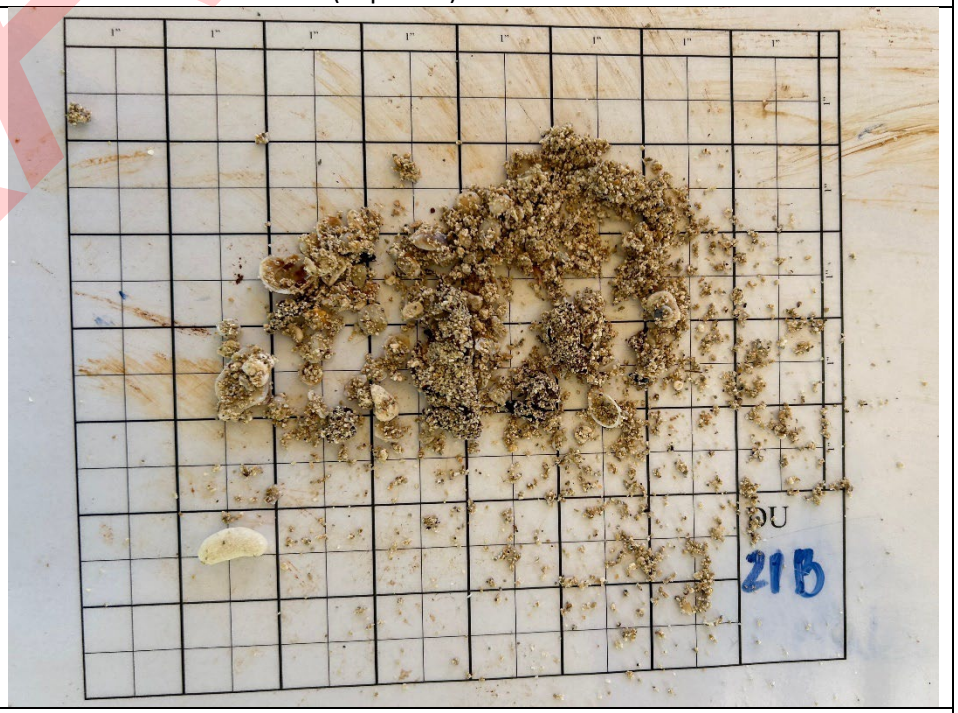

Photo 64: Decision Unit 21 (Duplicate) – Sifted Material

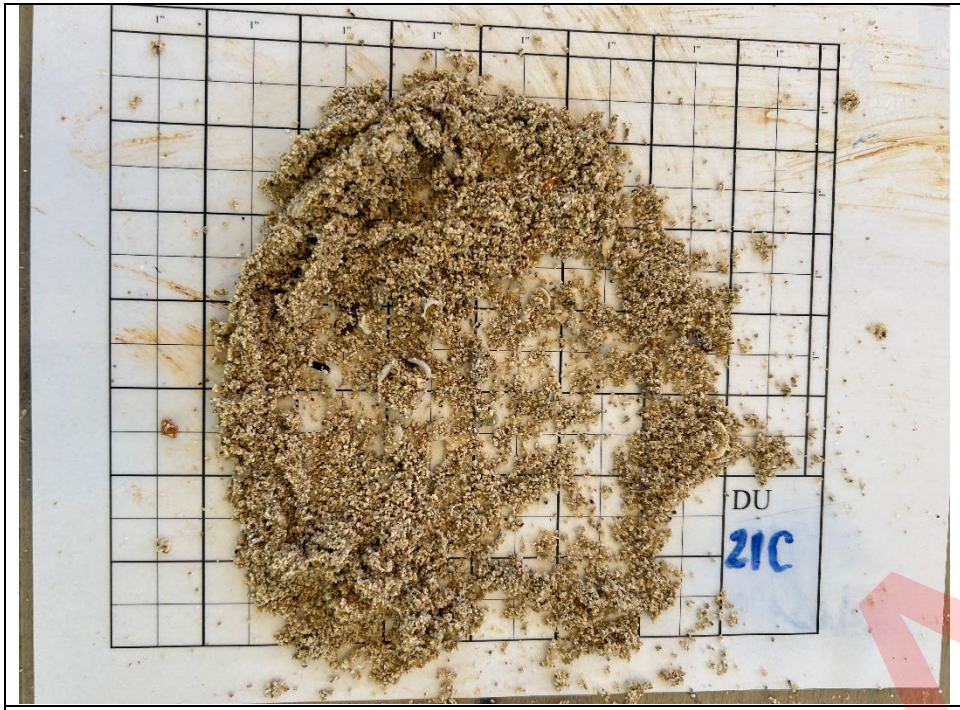

Photo 65: Decision Unit 21 (Triplicate) – Sifted Material

Photo 66: Decision Unit 22 – Sifted Material

Photo 67: Decision Unit 23 – Sifted Material

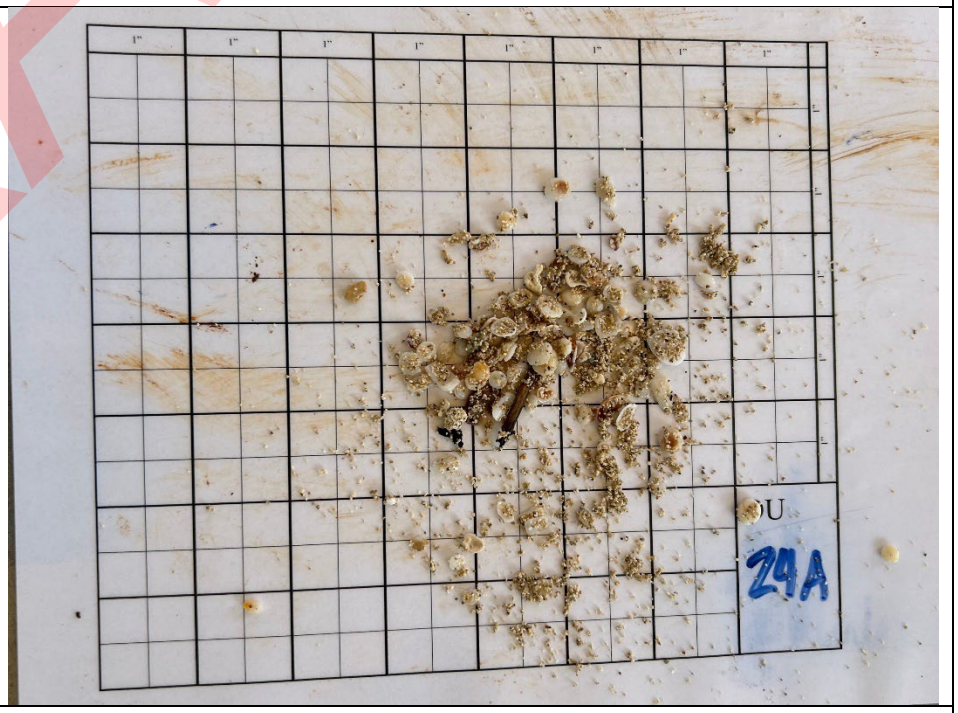

Photo 68: Decision Unit 24 – Sifted Material

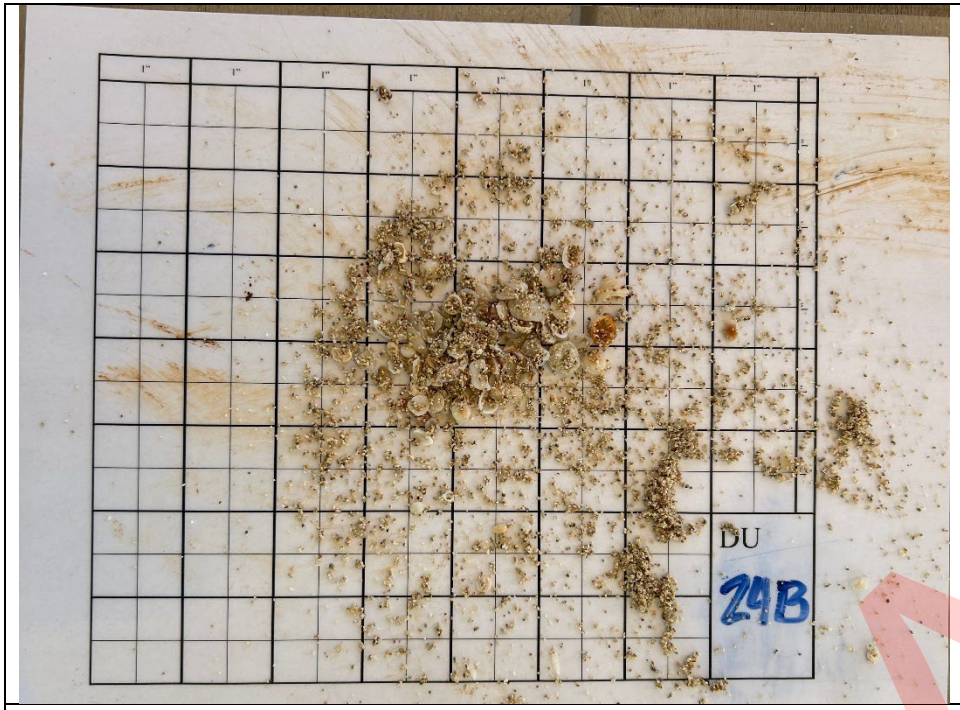

Photo 69: Decision Unit 24 (Duplicate) – Sifted Material

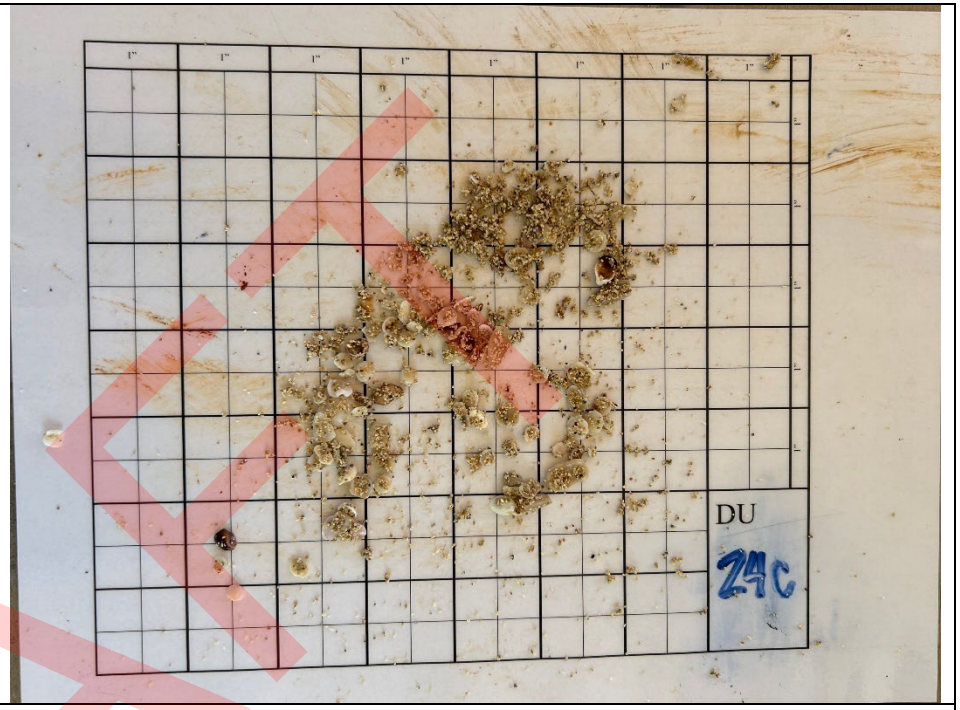

Photo 70: Decision Unit 24 (Triplicate) – Sifted Material

Site Investigation Report
Pu'uloa Range Training Facility Shoreline

Appendix B

Laboratory Data Sheets and Executed Chain of Custodies

FQLabs
Analysts of Excellence
3170-A Ualena Street • Honolulu, HI 96819 • Tel: (808) 839-9444 • Fax: (808) 839-9744 • fql@fqlab.com
FOOD, WATER, SOIL & ENVIRONMENTAL TESTING & CONSULTING

3/25/2024

Case Narrative
Project: MCBH Soil
Project #: 240214-2677-012

Twenty-seven (27) soil samples received by FQLabs on 02/14/2024. The samples were collected on 02/14/24. The temperature of the cooler was 16.9 degrees Celsius upon receipt.
Nine (9) soil samples received on 02/15/24. The samples collected on 02/15/24. The temperature of the cooler was 1.0 degrees Celsius upon receipt.
The samples received on the two different dates were analyzed together for Total Metals (EPA 3051/6020B), per submitted by Marine Corps Base Chain of Custody, pH (SM 4500-H) was added on 02/26/24 @ 9:49 a.m.

The holding time and analytical criteria were met for the above mentioned.

Metals
Samples were digested and analyzed on 03/08/24 @ 18:25 and completed on 03/09 @ 04:45.
Initial calibration (03/08/24)- The RSD % for Copper (100%), Antimony (95.6%) and Lead (93.7%).
The linearity conditions for the multi-analyte methods were met as specified in EPA Method 6010D.

Please feel free to contact me if there are any questions.

Kind regards,

Tai Khan
Lab Director

FQLabs
Analysts of Excellence
3170-A Ualena Street • Honolulu, HI 96819 • Tel: (808) 839-9444 • Fax: (808) 839-9744 • fql@fqlab.com
FOOD, WATER, SOIL & ENVIRONMENTAL TESTING & CONSULTING

5/6/2024

Corrective Action Report

Issue Identified:

Incorrect results were reported for four samples due to a software glitch; Soil testing was done for Marine Corps Base Hawaii on March 8th2024.

Root Cause Analysis:

Upon review of raw data, it was found that a glitch in the software caused the incorrect reporting of four samples:

I. Unit 21, Lab #65
II. Unit 21.1, Lab #66
III. Unit 21.2, Lab #67
IV. Unit 22, Lab #68

It pulled the results from the following samples, Unit 24.1, Lab #70 as Unit 21, Unit 24.2, Lab #71 as 21.1, Unit 7, Lab #72 as Unit 21.2 and Unit 11, Lab #73 as Unit 22.

Corrective Action Taken:

1. **Software Glitch Identification**: The software glitch was identified which caused incorrect reporting of the soil test results.
2. **Software Correction**: The identified glitch in the software was corrected to ensure accurate reporting of the soil test results.
3. **Data Correction**: The incorrect soil test results were corrected based on the corrected software output.

Preventive Measures:

1. **Software Testing**: Regular software testing will be conducted to identify and rectify any glitches in a timely manner.
2. **Data Verification**: A data verification step will be added to ensure the accuracy of the reported test results.

Conclusion:

The software glitch has been corrected and the incorrect soil test results have been rectified. Preventive measures have been put in place to avoid such issues in the future.

FQLabs
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FOOD, WATER, SOIL & ENVIRONMENTAL TESTING & CONSULTING

Certificate of Analysis

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240214-2677-012

Received: 02/14/24 @ 16:20
Completed: 03/09/24 @ 04:45
Sampler: Katherine Smith

ANALYTE	**Results**	**Units**	***RDL***	**Test Method**	Analyzed	By
Sample ID: Decision Unit 21, Total Metal. Lab #65						Sampled: 02/14/24 @ 15:15
Copper	1.59	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Antimony	0.064	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Lead	5.75	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Sample ID: Decision Unit 21 Dup, Total Metal. Lab #66						Sampled: 02/14/24 @ 15:17
Copper	1.45	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Antimony	0.061	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Lead	5.31	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Sample ID: Decision Unit 21 Trip, Total Metal. Lab #67						Sampled: 02/14/24 @ 15:20
Copper	1.53	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Antimony	0.052	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Lead	5.36	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Sample ID: Decision Unit 22, Total Metal. Lab #68						Sampled: 02/14/24 @ 15:22
Copper	1.15	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Antimony	0.044	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Lead	6.90	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Sample ID: Decision Unit 24, Total Metal. Lab #69						Sampled: 02/14/24 @ 15:25
Copper	2.04	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Antimony	0.064	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Lead	7.79	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Sample ID: Decision Unit 24 Dup, Total Metal. Lab #70						Sampled: 02/14/24 @ 15:27
Copper	1.96	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Antimony	0.051	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Lead	7.58	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Sample ID: Decision Unit 24 Trip, Total Metal. Lab #71						Sampled: 02/14/24 @ 15:29
Copper	1.47	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK
Antimony	0.052	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK
Lead	7.50	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK

NA = Not Applicable
ND = Not Detected
RDL=Reporting detection limit.

Approved by: .....
Date: 5/6/2024
Revised

FQ Labs

3170 Ualena Street, Unit A
Honolulu, HI 96819
Phone: 808-839-9444, Fax: 808-839-9744

Marine Corps Base Hawaii
Box 64122, Building 3B, Room 326
CAMP H.M. SMITH, HI, 96861-4211
Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/14/2024 @ 4:20 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 15.6 °C

Sample ID: 240214-2677-012-01 | **Soil Sample- Lab # 45** Decision Unit 1 | **Sampled: 2/14/2024 @ 2:13 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.84	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-02 | **Soil Sample- Lab # 46** Decision Unit 1 Duplicate | **Sampled: 2/14/2024 @ 2:17 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.79	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-03 | **Soil Sample- Lab # 47** Decision Unit 1 Triplicate | **Sampled: 2/14/2024 @ 2:20 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.91	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-04 | **Soil Sample- Lab # 48** Decision Unit 2 | **Sampled: 2/14/2024 @ 2:09 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.77	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-05 | **Soil Sample- Lab # 49** Decision Unit 3 | **Sampled: 2/14/2024 @ 2:50 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.58	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-06 | **Soil Sample- Lab # 50** Decision Unit 4 | **Sampled: 2/14/2024 @ 1:57 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.55	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-07 | **Soil Sample- Lab # 51** Decision Unit 5 | **Sampled: 2/14/2024 @ 2:31 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.76	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Marine Corps Base Hawaii
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CAMP H.M. SMITH, HI, 96861-4211
Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/14/2024 @ 4:20 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 15.6 °C

Sample ID: 240214-2677-012-08 | **Soil Sample- Lab # 52 Decision Unit 6** | **Sampled: 2/14/2024 @ 1:55 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.80	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-09 | **Soil Sample- Lab # 53 Decision Unit 10** | **Sampled: 2/14/2024 @ 2:25 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.33	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-10 | **Soil Sample- Lab # 54 Decision Unit 14** | **Sampled: 2/14/2024 @ 2:54 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	7.84	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-11 | **Soil Sample- Lab # 55 Decision Unit 17** | **Sampled: 2/14/2024 @ 2:35 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.34	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-12 | **Soil Sample- Lab # 56 Decision Unit 17 Duplicate** | **Sampled: 2/14/2024 @ 2:40 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.40	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-13 | **Soil Sample- Lab # 57 Decision Unit 17 Triplicate** | **Sampled: 2/14/2024 @ 2:46 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.52	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-14 | **Soil Sample- Lab # 58 Decision Unit 18** | **Sampled: 2/14/2024 @ 2:57 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.64	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-15 | **Soil Sample- Lab # 59 Decision Unit 18 Duplicate** | **Sampled: 2/14/2024 @ 3:01 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.48	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

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Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/14/2024 @ 4:20 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 20.2 °C

Sample ID: 240214-2677-012-16 | **Soil Sample- Lab # 60** Decision Unit 18 Triplicate | **Sampled: 2/14/2024 @ 3:03 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.60	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-17 | **Soil Sample- Lab # 61** Decision Unit 19 | **Sampled: 2/14/2024 @ 3:06 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.09	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-18 | **Soil Sample- Lab # 62** Decision Unit 20 | **Sampled: 2/14/2024 @ 3:09 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.75	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-19 | **Soil Sample- Lab # 63** Decision Unit 20 Duplicate | **Sampled: 2/14/2024 @ 3:12 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.65	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-20 | **Soil Sample- Lab # 64** Decision Unit 20 Triplicate | **Sampled: 2/14/2024 @ 3:14 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.68	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-21 | **Soil Sample- Lab # 65** Decision Unit 21 | **Sampled: 2/14/2024 @ 3:15 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.63	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-22 | **Soil Sample- Lab # 66** Decision Unit 21 Duplicate | **Sampled: 2/14/2024 @ 3:17 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.60	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-23 | **Soil Sample- Lab # 67** Decision Unit 21 Triplicate | **Sampled: 2/14/2024 @ 3:20 PM** | **Sampler: Katerine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.30	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

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Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/14/2024 @ 4:20 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 16.9 °C

Sample ID: 240214-2677-012-24 | **Soil Sample- Lab # 68** Decision Unit 22 | **Sampled: 2/14/2024 @ 3:22 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	9.23	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240214-2677-012-25 | **Soil Sample- Lab # 69** Decision Unit 24 | **Sampled: 2/14/2024 @ 3:25 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	9.17	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240214-2677-012-26 | **Soil Sample- Lab # 70** Decision Unit 24 Duplicate | **Sampled: 2/14/2024 @ 3:27 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	9.05	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240214-2677-012-27 | **Soil Sample- Lab # 71** Decision Unit 24 Triplicate | **Sampled: 2/14/2024 @ 3:29 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	9.26	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Approved By: Imelda Q. Awarts
Tuesday, March 12, 2024

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P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240214-2677-012

Received: 02/14/24 @ 16:20
Completed: 03/09/24 @ 04:45

Sampler: Katherine Smith

ANALYTE	**Results**	**Units**	***RDL***	**Test Method**	Analyzed	By
Sample ID: Decision Unit 17, Total Metal. Lab #55					Sampled: 02/14/24 @ 14:35	
Copper	40.2	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:48:15 PM	FK
Antimony	1.75	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:48:15 PM	FK
Lead	326	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:48:15 PM	FK
Sample ID: Decision Unit 17 Dup, Total Metal. Lab #56					Sampled: 02/14/24 @ 14:40	
Copper	41.1	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:56:05 PM	FK
Antimony	2.07	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:56:05 PM	FK
Lead	299	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:56:05 PM	FK
Sample ID: Decision Unit 17 Trip, Total Metal. Lab #57					Sampled: 02/14/24 @ 14:46	
Copper	37.3	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 12:01:55 AM	FK
Antimony	2.50	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 12:01:55 AM	FK
Lead	459	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 12:01:55 AM	FK
Sample ID: Decision Unit 18, Total Metal. Lab #58					Sampled: 02/14/24 @ 14:57	
Copper	17.6	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:05:42 AM	FK
Antimony	0.567	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:05:42 AM	FK
Lead	149	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:05:42 AM	FK
Sample ID: Decision Unit 18 Dup, Total Metal. Lab #59					Sampled: 02/14/24 @ 15:01	
Copper	13.9	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:10:53 AM	FK
Antimony	0.577	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:10:53 AM	FK
Lead	94.0	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:10:53 AM	FK
Sample ID: Decision Unit 18 Trip, Total Metal. Lab #60					Sampled: 02/14/24 @ 15:03	
Copper	15.9	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:15:40 AM	FK
Antimony	0.389	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:15:40 AM	FK
Lead	98.7	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:15:40 AM	FK
Sample ID: Decision Unit 19, Total Metal. Lab #61					Sampled: 02/14/24 @ 15:06	
Copper	2.87	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:01:08 AM	FK
Antimony	0.086	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:01:08 AM	FK
Lead	10.5	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:01:08 AM	FK
Sample ID: Decision Unit 20 Total Metal. Lab #62					Sampled: 02/14/24 @ 15:09	
Copper	2.93	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:05:17 AM	FK
Antimony	0.063	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:05:17 AM	FK
Lead	9.46	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:05:17 AM	FK
Sample ID: Decision Unit 20 Dup, Total Metal. Lab #63					Sampled: 02/14/24 @ 15:12	
Copper	4.19	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:23:26 AM	FK
Antimony	0.074	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:23:26 AM	FK
Lead	8.63	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:23:26 AM	FK
Sample ID: Decision Unit 20 Trip, Total Metal. Lab #64					Sampled: 02/14/24 @ 15:14	
Copper	3.96	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:27:11 AM	FK
Antimony	0.068	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:27:11 AM	FK
Lead	9.32	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:27:11 AM	FK

NA = Not Applicable
ND = Not Detected
RDL=Reporting detection limit.

Approved by: .....
Date: 3/11/2024

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Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240214-2677-012

Received: 02/14/24 @ 16:20
Completed: 03/09/24 @ 04:45

Sampler: Katherine Smith

ANALYTE	**Results**	**Units**	***RDL***	**Test Method**	Analyzed	By
Sample ID: Decision Unit 21, Total Metal. Lab #65						Sampled: 02/14/24 @ 15:15
Copper	1.96	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Antimony	0.051	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Lead	7.58	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Sample ID: Decision Unit 21 Dup, Total Metal. Lab #66						Sampled: 02/14/24 @ 15:17
Copper	1.47	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Antimony	0.052	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Lead	7.50	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Sample ID: Decision Unit 21 Trip, Total Metal. Lab #67						Sampled: 02/14/24 @ 15:20
Copper	4.94	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Antimony	0.105	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Lead	26.1	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Sample ID: Decision Unit 22, Total Metal. Lab #68						Sampled: 02/14/24 @ 15:22
Copper	7.13	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Antimony	0.233	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Lead	46.4	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Sample ID: Decision Unit 24, Total Metal. Lab #69						Sampled: 02/14/24 @ 15:25
Copper	2.04	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Antimony	0.064	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Lead	7.79	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Sample ID: Decision Unit 24 Dup, Total Metal. Lab #70						Sampled: 02/14/24 @ 15:27
Copper	1.96	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Antimony	0.051	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Lead	7.58	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Sample ID: Decision Unit 24 Trip, Total Metal. Lab #71						Sampled: 02/14/24 @ 15:29
Copper	1.47	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK
Antimony	0.052	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK
Lead	7.50	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK

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Approved by: .....
Date: 3/11/2024

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Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240214-2677-012

Received: 02/14/24 @ 16:20
Completed: 03/09/24 @ 04:45
Sampler: Katherine Smith

ANALYTE	**Results**	**Units**	***RDL***	**Test Method**	Analyzed	By
Sample ID: Decision Unit 1, Total Metal. Lab #45					Sampled: 02/14/24 @ 14:13	
Copper	2.50	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 9:58:20 PM	FK
Antimony	0.190	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 9:58:20 PM	FK
Lead	16.5	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 9:58:20 PM	FK
Sample ID: Decision Unit 1 Dup, Total Metal. Lab #46					Sampled: 02/14/24 @ 14:17	
Copper	2.29	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:27:51 PM	FK
Antimony	0.192	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:27:51 PM	FK
Lead	16.9	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:27:51 PM	FK
Sample ID: Decision Unit 1 Trip, Total Metal. Lab #47					Sampled: 02/14/24 @ 14:20	
Copper	2.46	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:31:35 PM	FK
Antimony	0.158	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:31:35 PM	FK
Lead	14.8	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:31:35 PM	FK
Sample ID: Decision Unit 2, Total Metal. Lab #48					Sampled: 02/14/24 @ 14:09	
Copper	3.38	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:35:19 PM	FK
Antimony	0.203	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:35:19 PM	FK
Lead	28.2	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:35:19 PM	FK
Sample ID: Decision Unit 3, Total Metal. Lab #49					Sampled: 02/14/24 @ 14:50	
Copper	5.82	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:39:03 PM	FK
Antimony	0.162	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:39:03 PM	FK
Lead	40.3	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:39:03 PM	FK
Sample ID: Decision Unit 4, Total Metal. Lab #50					Sampled: 02/14/24 @ 13:57	
Copper	7.61	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:42:47 PM	FK
Antimony	0.178	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:42:47 PM	FK
Lead	66.9	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:42:47 PM	FK
Sample ID: Decision Unit 5, Total Metal. Lab #51					Sampled: 02/14/24 @ 14:31	
Copper	4.32	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:51:07 PM	FK
Antimony	0.166	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:51:07 PM	FK
Lead	35.0	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:51:07 PM	FK
Sample ID: Decision Unit 6, Total Metal. Lab #52					Sampled: 02/14/24 @ 13:55	
Copper	2.86	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:54:52 PM	FK
Antimony	0.188	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:54:52 PM	FK
Lead	21.3	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:54:52 PM	FK
Sample ID: Decision Unit 10, Total Metal. Lab #53					Sampled: 02/14/24 @ 14:25	
Copper	11.2	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:58:37 PM	FK
Antimony	0.348	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:58:37 PM	FK
Lead	49.0	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:58:37 PM	FK
Sample ID: Decision Unit 14, Total Metal. Lab #54					Sampled: 02/14/24 @ 14:54	
Copper	112	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 11:02:23 PM	FK
Antimony	4.04	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 11:02:23 PM	FK
Lead	1946	mg/kg dry wt.	0.100	3051/6020B	3/8/2024 11:02:23 PM	FK

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Approved by: .....
Date: 3/11/2024

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Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing

Date Analyzed	3/8/2024 9:07:27 PM	*3/8/2024 9:11:16 PM*			*3/8/2024 9:18:49 PM*			3/8/2024 9:58:20 PM	3/9/2024 12:53:09 AM
ANALYTE	**Blank mg/L**	***RDL mg/L***	*RSD*	*% Recovery*	***LFB mg/L***	*RSD*	*% Recovery*	**Matrix Spikes (%Rec.)**	**Matrix Duplicates (RSD)**
Copper	<0.001	0.001	1.09	100	0.049	2.04	98.6	101	0.533
Antimony	<0.001	0.001	0.485	95.6	0.047	1.64	94.9	103	0.995
Lead	<0.001	0.001	1.33	93.7	0.049	1.08	98.5	100	1.08

NA = Not Applicable
ND = Not Detected
RDL=Reporting detection limit.

FQ Labs

3170 Ualena Street, Unit A
Honolulu, HI 96819
Phone: 808-839-9444, Fax: 808-839-9744

Marine Corps Base Hawaii
Box 64122, Building 3B, Room 326
CAMP H.M. SMITH, HI, 96861-4211
Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/15/2024 @ 2:00 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240215-2677-013
Temperature: 1.0 °C

Sample ID: 240215-2677-013-01 | **Soil Sample- Lab # 72** Decision Unit 7 | **Sampled: 2/15/2024 @ 12:30 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.66	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240215-2677-013-02 | **Soil Sample- Lab # 73** Decision Unit 11 | **Sampled: 2/15/2024 @ 12:32 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.11	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240215-2677-013-03 | **Soil Sample- Lab # 74** Decision Unit 13 | **Sampled: 2/15/2024 @ 12:35 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.41	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240215-2677-013-04 | **Soil Sample- Lab # 75** Decision Unit 16 | **Sampled: 2/15/2024 @ 12:40 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.17	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240215-2677-013-05 | **Soil Sample- Lab # 76** Decision Unit 15 | **Sampled: 2/15/2024 @ 12:47 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.42	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240215-2677-013-06 | **Soil Sample- Lab # 77** Decision Unit 12 | **Sampled: 2/15/2024 @ 12:55 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.13	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240215-2677-013-07 | **Soil Sample- Lab # 78** Decision Unit 23 | **Sampled: 2/15/2024 @ 12:59 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.31	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Marine Corps Base Hawaii
Box 64122, Building 3B, Room 326
CAMP H.M. SMITH, HI, 96861-4211
Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/15/2024 @ 2:00 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240215-2677-013
Temperature: 1.0 °C

Sample ID: 240215-2677-013-08 | **Soil Sample- Lab # 79** Decision Unit 8 | **Sampled: 2/15/2024 @ 1:06 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.71	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240215-2677-013-09 | **Soil Sample- Lab # 80** Decision Unit 9 | **Sampled: 2/15/2024 @ 1:10 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.21	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Approved By: Imelda Q. Duarte
Tuesday, March 12, 2024

FQLabs
Analysts of Excellence
3170-A Ualena Street • Honolulu, HI 96819 • Tel: (808) 839-9444 • Fax: (808) 839-9744 • fql@fqlab.com
FOOD, WATER, SOIL & ENVIRONMENTAL TESTING & CONSULTING

Certificate of Analysis

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240215-2677-013

Received: 02/15/24 @ 14:00
Completed: 03/09/24 @ 04:45
Sampler: Patrick Crile

ANALYTE	**Results**	**Units**	***RDL***	**Test Method**	Analyzed	By
Sample ID: Decision Unit 7, Total Metal. Lab #72						Sampled: 02/15/24 @ 12:30
Copper	4.94	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:21:41 AM	FK
Antimony	0.105	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:21:41 AM	FK
Lead	26.1	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:21:41 AM	FK
Sample ID: Decision Unit 11, Total Metal. Lab #73						Sampled: 02/15/24 @ 12:32
Copper	7.13	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:25:25 AM	FK
Antimony	0.233	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:25:25 AM	FK
Lead	46.4	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:25:25 AM	FK
Sample ID: Decision Unit 13, Total Metal. Lab #74						Sampled: 02/15/24 @ 12:35
Copper	30.7	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:43:28 AM	FK
Antimony	2.54	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:43:28 AM	FK
Lead	357	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:43:28 AM	FK
Sample ID: Decision Unit 16, Total Metal. Lab #75						Sampled: 02/15/24 @ 12:40
Copper	69.5	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:32:55 AM	FK
Antimony	7.60	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:32:55 AM	FK
Lead	937	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 2:32:55 AM	FK
Sample ID: Decision Unit 15, Total Metal. Lab #76						Sampled: 02/14/24 @ 12:47
Copper	138	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 2:52:40 AM	FK
Antimony	46.5	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 2:52:40 AM	FK
Lead	5375	mg/kg dry wt.	1.00	3051/6020B	3/9/2024 2:52:40 AM	FK
Sample ID: Decision Unit 12, Total Metal. Lab #77						Sampled: 02/15/24 @ 12:55
Copper	39.3	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 3:14:15 AM	FK
Antimony	2.20	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 3:14:15 AM	FK
Lead	344	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 3:14:15 AM	FK
Sample ID: Decision Unit 23, Total Metal. Lab #78						Sampled: 02/15/24 @ 12:59
Copper	1.94	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 3:43:38 AM	FK
Antimony	0.254	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 3:43:38 AM	FK
Lead	9.17	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 3:43:38 AM	FK
Sample ID: Decision Unit 8, Total Metal. Lab #79						Sampled: 02/15/24 @ 13:06
Copper	7.34	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:05:49 AM	FK
Antimony	0.382	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:05:49 AM	FK
Lead	76.5	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:05:49 AM	FK
Sample ID: Decision Unit 9, Total Metal. Lab #80						Sampled: 02/14/24 @ 13:10
Copper	10.2	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:12:54 AM	FK
Antimony	0.705	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:12:54 AM	FK
Lead	112	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:12:54 AM	FK

NA = Not Applicable
ND = Not Detected
RDL=Reporting detection limit.

Approved by: .....
Date: 3/11/2024

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FOOD, WATER, SOIL & ENVIRONMENTAL TESTING & CONSULTING

METAL QC

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing

Date Analyzed	3/8/2024 9:07:27 PM	*3/8/2024 9:11:16 PM*			*3/8/2024 9:18:49 PM*			3/8/2024 9:58:20 PM	3/9/2024 12:53:09 AM
ANALYTE	**Blank mg/L**	***RDL mg/L***	*RSD*	*% Recovery*	***LFB mg/L***	*RSD*	*% Recovery*	**Matrix Spikes (%Rec.)**	**Matrix Duplicates (RSD)**
Copper	<0.001	0.001	1.09	100	0.049	2.04	98.6	101	0.533
Antimony	<0.001	0.001	0.485	95.6	0.047	1.64	94.9	103	0.995
Lead	<0.001	0.001	1.33	93.7	0.049	1.08	98.5	100	1.08

NA = Not Applicable
ND = Not Detected
RDL=Reporting detection limit.

FQLabs

3170-A Ualena Street
Honolulu, HI 96819

Invoice

Date	Invoice #
3/12/2024	30498

Bill To
Marine Corps Base Hawaii P.O. Box 63002 Kaneohe Bay, HI 96863 Attn: Peter Evans

P.O. No.	Terms	Contract #	Lab #
M0031824P0002	Due on receipt		45-80

Description	Qty	Rate	Amount
Project Name: Metals Testing-soil			
Notice of Award #: M0031824P0002			
Total Metals-- Cu, Pb. Sb (EPA Method 6020B)	36	210.00	7,560.00T
pH - in soil	36	50.00	1,800.00T
TAT: 10-15 working days			
CC handling fee is 3%			

Make Check Payable To:FQLabs

Subtotal	$9,360.00
Sales Tax (0.0%)	$0.00
Total	$9,360.00

FQLabs
3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST

DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil

ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863

PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:

PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:

SAMPLER NAME: (Printed) KatherineSmith (Signature)

TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal

CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:

COOLER NO:

TEMPERATURE: 15.6°C

REMARKS:

SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX WATER	MATRIX OTHER	CONTAINER #	CONTAINER TYPE	GRAB/ COMP	Lead	Antimony	Copper
45	2/14/24	1413	Decision Unit 1			1	soil		✓	✓	✓
46	2/14/24	1417	Decision Unit 1 Duplicate			1	soil		✓	✓	✓
47	2/14/24	1420	Decision Unit 1Triplicate			1	soil		✓	✓	✓
48	2/14/24	1409	Decision Unit 2			1	soil		✓	✓	✓
49	2/14/24	1450	Decision Unit 3			1	soil		✓	✓	✓
50	2/14/24	1357	Decision Unit 4			1	soil		✓	✓	✓
51	2/14/24	1431	Decision Unit 5			1	soil		✓	✓	✓
52	2/14/24	1355	Decision Unit 6			1	soil		✓	✓	✓
~~53~~	~~2/14/24~~		~~Decision Unit 7~~			1	soil		✓	✓	✓
~~54~~	~~2/14/24~~		~~Decision Unit 8~~			1	soil		✓	✓	✓

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
KatherineSmith	2/14/24	1530	MEL ANDRES	2/14/24	1530
Mel Andres	2/14/24	1620	Renee Hom	2/14/24	1620

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:

1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

FQLabs
3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST

DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil

ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863

PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:

PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:

SAMPLER NAME: (Printed) KatherineSmith (Signature)

TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal

CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:

COOLER NO:

TEMPERATURE: 16.9C

REMARKS:

SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX WATER	MATRIX OTHER	CONTAINER #	CONTAINER TYPE	GRAB/ COMP	Lead	Antimony	Copper
[illegible]	[illegible]		Decision Unit 9			1	soil		✓	✓	✓
53	2/14/24	1425	Decision Unit 10			1	soil		✓	✓	✓
[illegible]	2/14/24		Decision Unit 11			1	soil		✓	✓	✓
[illegible]	2/14/24		Decision Unit 12			1	soil		✓	✓	✓
[illegible]	[illegible]		Decision Unit 13			1	soil		✓	✓	✓
54	2/14/24	1454	Decision Unit 14			1	soil		✓	✓	✓
[illegible]	2/14/24		Decision Unit 15			1	soil		✓	✓	✓
[illegible]	[illegible]		Decision Unit 16			1	soil		✓	✓	✓
55	2/14/24	1435	Decision Unit 17			1	soil		✓	✓	✓
56	2/14/24	1440	Decision Unit 17 Duplicate			1	soil		✓	✓	✓

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
KatherineSmith	2/14/24	1530	Mel Andres	2/14/24	1530
Mel Andres	2/14/24	1620	[illegible]	2/14/24	1620

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:

1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

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CHAIN OF CUSTODY AND ANALYSIS REQUEST

DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil

ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863

PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:

PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:

SAMPLER NAME: (Printed) Katherine Smith (Signature)

TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal

CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:

COOLER NO:

TEMPERATURE: 20.2°C

REMARKS:

SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX WATER	MATRIX OTHER	CONTAINER #	CONTAINER TYPE	GRAB/ COMP	Lead	Antimony	Copper					
57	2/14/24	1446	Decision Unit 17 Triplicate			1	soil		✓	✓	✓					
58	2/14/24	1457	Decision Unit 18			1	soil		✓	✓	✓					
59	2/14/24	1501	Decision Unit 18 Duplicate			1	soil		✓	✓	✓					
60	2/14/24	1503	Decision Unit 18 Triplicate			1	soil		✓	✓	✓					
61	2/14/24	1506	Decision Unit 19			1	soil		✓	✓	✓					
62	2/14/24	1509	Decision Unit 20			1	soil		✓	✓	✓					
63	2/14/24	1512	Decision Unit 20 Duplicate			1	soil		✓	✓	✓					
64	2/14/24	1514	Decision Unit 20 Triplicate			1	soil		✓	✓	✓					
65	2/14/24	1515	Decision Unit 21			1	soil		✓	✓	✓					
66	2/14/24	1517	Decision Unit 21 Duplicate			1	soil		✓	✓	✓					

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
Katherine Smith	2/14/24	1530	MEL ANDRES	2/14/24	1530
MEL ANDRES	2/14/24	1620	Prince Hiya	2/14/24	1620
Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:

1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

FQLabs
3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST

DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil

ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863

PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:

PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:

SAMPLER NAME: (Printed) KatherineSmith (Signature)

TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal

CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:

COOLER NO:

TEMPERATURE: 16.9°C

REMARKS:

SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX WATER	MATRIX OTHER	CONTAINER #	CONTAINER TYPE	CONTAINER GRAB/ COMP	Lead	Antimony	Copper				
67	2/14/24	1520	Decision Unit 21 Triplicate			1	soil		✓	✓	✓				
68	2/14/24	1522	Decision Unit 22			1	soil		✓	✓	✓				
	2/14/24		Decision Unit 23			1	soil		✓	✓	✓				
69	2/14/24	1525	Decision Unit 24			1	soil		✓	✓	✓				
70	2/14/24	1527	Decision Unit 24 Duplicate			1	soil		✓	✓	✓				
71	2/14/24	1529	Decision Unit 24 Triplicate			1	soil		✓	✓	✓				

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
KatherineSmith	2/14/24	1530	MEL ANDRES	2/14/24	1530
Mel Andres	2/14/24	1620	Renee Hinz	2/14/24	1620

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:

1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

FQLabs
3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST

DATE: _____ PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil
ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863
PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:
PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:
SAMPLER NAME: (Printed) PATRICK CRILE (Signature)
TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal
CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:
COOLER NO:
TEMPERATURE: 16.0°C
REMARKS:
SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX: WATER	MATRIX: OTHER	CONTAINER: #	CONTAINER: TYPE	CONTAINER: GRAB/ COMP	Lead	Antimony	Copper					
72	2/15/24	1230	Decision Unit 7		Soil	1			✓	✓	✓					
73	2/15/24	1232	Decision Unit 11		Soil	1			✓	✓	✓					
74	2/15/24	1235	Decision Unit 13		Soil	1			✓	✓	✓					
75	2/15/24	1240	Decision Unit 16		Soil	1			✓	✓	✓					
76	2/15/24	1247	Decision Unit 15		Soil	1			✓	✓	✓					
77	2/15/24	1255	Decision Unit 12		Soil	1			✓	✓	✓					
78	2/15/24	1259	Decision Unit 23		Soil	1			✓	✓	✓					
MS 79	2/15/24	1306	Decision Unit 8		Soil	1			✓	✓	✓					
MSD 80	2/15/24	1310	Decision Unit 9		Soil	1			✓	✓	✓					

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
PATRICK CRILE	2/15	1311	MEL ANDRES	2/15/24	1311
MEL ANDRES	2/15/24	1400		2/15/24	1400

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:
1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

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QTEGRA

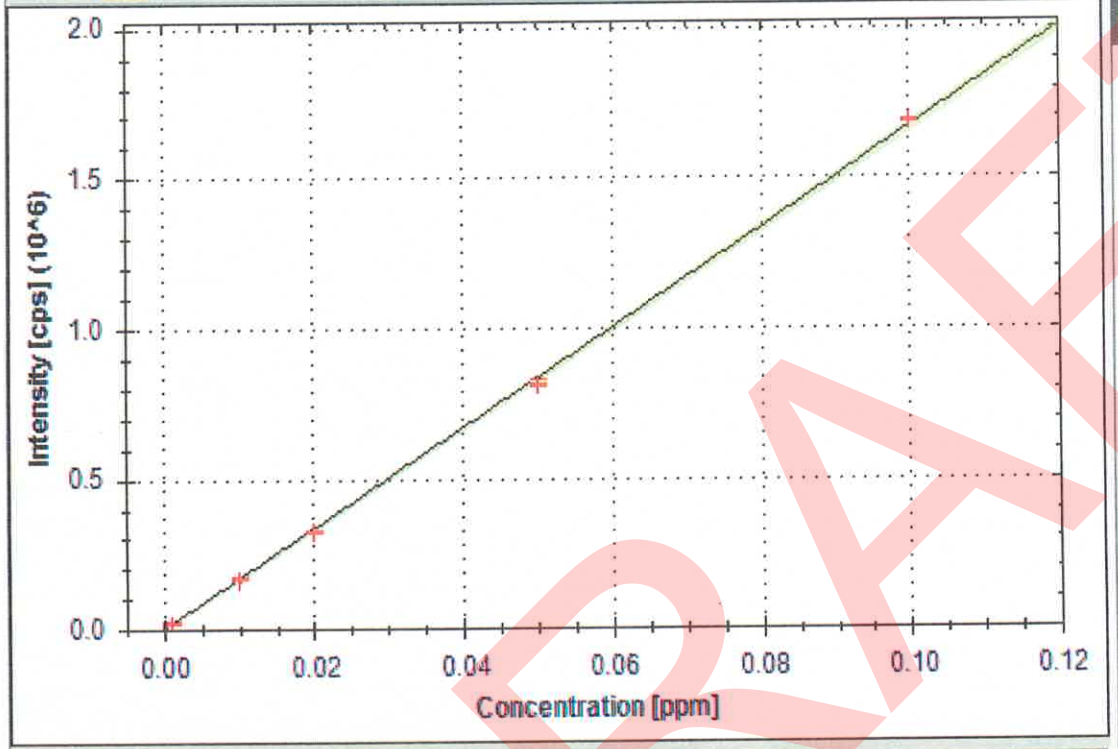
SampleList SampleId	SampleList SampleLine	StartTime	ExtCal.Average 0 63Cu (KED) Y (ppm)	ExtCal.Average 0 121Sb (KED) Y (ppm)	ExtCal.Average 0 208Pb (KED) Y (ppm)
20	Method Blank	2024-03-08 21:45:09	-6.32038E-06	1.21949E-06	5.84313E-07
21	MCBH Decision Unit 1 45 TMDW 5X	2024-03-08 21:58:20	2.497144585	0.190156465	16.48476489
22	MCBH Decision Unit 1 45 TMDW 5X Dup	2024-03-08 22:06:27	2.459760212	0.186439603	16.06603672
23	MCBH Decision Unit 1 45 TMDW 5X Spike	2024-03-08 22:19:01	45.26424009	43.80704409	59.07519129
24	MCBH Decision Unit 1 45 TMDW 5X Spike Dup	2024-03-08 22:23:45	45.00741386	43.85245535	58.1957737
25	MCBH Decision Unit 1 46 TMDW 5X Dup	2024-03-08 22:27:51	2.288747194	0.191816718	16.88936199
26	MCBH Decision Unit 1 47 TMDW 5X Trip	2024-03-08 22:31:35	2.46145274	0.157698238	14.8112459
27	MCBH Decision Unit 2 48 TMDW 5X	2024-03-08 22:35:19	3.376877232	0.202587369	28.22617945
28	MCBH Decision Unit 3 49 TMDW 5X	2024-03-08 22:39:03	5.823843118	0.161675955	40.31565978
29	MCBH Decision Unit 4 50 TMDW 5X	2024-03-08 22:42:47	7.612548911	0.178307822	66.93037307
30	MCBH Decision Unit 5 51 TMDW 5X	2024-03-08 22:51:07	4.315178253	0.165668333	34.96514265
31	MCBH Decision Unit 6 52 TMDW 5X	2024-03-08 22:54:52	2.856778033	0.188333699	21.33388408
32	MCBH Decision Unit 10 53 TMDW 5X	2024-03-08 22:58:37	11.15800669	0.348133775	49.02780534
33	MCBH Decision Unit 14 54 TMDW 5X	2024-03-08 23:02:23	111.7024285	4.044010136	1802.738793
34	CCV	2024-03-08 23:14:26	0.018986491	0.018935233	0.017700001
35	CCB	2024-03-08 23:19:01	-7.49726E-06	4.95108E-06	2.37709E-05
36	RL1	2024-03-08 23:22:45	0.000999021	0.000978326	0.000937445
37	MCBH Decision Unit 14 54 TMDW 100X	2024-03-08 23:27:08	147.7806657	4.751326618	1945.676395
38	MCBH Decision Unit 17 55 TMDW 5X	2024-03-08 23:38:24	35.55982362	1.246555579	264.4375174
39	MCBH Decision Unit 17 55 TMDW 20X	2024-03-08 23:48:15	40.20233072	1.754672558	325.7972304
40	MCBH Decision Unit 17 56 TMDW 20X Dup	2024-03-08 23:56:05	41.08369216	2.07111214	298.6349069
41	MCBH Decision Unit 17 57 TMDW 20X Trip	2024-03-09 00:01:55	37.29706164	2.497273869	458.541551

42	MCBH Decision Unit 18 58 TMDW 10X	2024-03-09 00:05:42	17.58090269	0.56728176	149.3282935
43	MCBH Decision Unit 18 59 TMDW 10X Dup	2024-03-09 00:10:53	13.85049347	0.57671117	93.96240096
44	MCBH Decision Unit 18 60 TMDW 10X Trip	2024-03-09 00:15:40	15.91438795	0.389247405	98.66934334
45	MCBH Decision Unit 19 61 TMDW 10X	2024-03-09 00:22:09	2.542871876	0.074664656	10.86287254
46	MCBH Decision Unit 20 62 TMDW 10X	2024-03-09 00:27:57	3.201024041	0.055432535	9.681566968
47	CCV	2024-03-09 00:34:40	0.019586295	0.019258934	0.018880255
48	CCB	2024-03-09 00:39:19	-6.97994E-06	5.49809E-06	6.13941E-06
49	Method Blank	2024-03-09 00:45:39	-9.57416E-06	3.93444E-07	3.55669E-06
50	RL1	2024-03-09 00:49:24	0.000948234	0.000947192	0.000928705
51	LCS	2024-03-09 00:53:09	0.048474557	0.049601821	0.049928001
52	LCSD	2024-03-09 00:57:23	0.048439545	0.049694393	0.049804132
53	MCBH Decision Unit 19 61 TMDW 5X	2024-03-09 01:01:08	2.86691079	0.085927163	10.45623645
54	MCBH Decision Unit 20 62 TMDW 5X	2024-03-09 01:05:17	2.927468325	0.0634797	9.460343614
55	MCBH Decision Unit 20 62 TMDW 5X Dup	2024-03-09 01:11:03	2.860016046	0.065740647	9.164353884
56	MCBH Decision Unit 20 62 TMDW 5X Spike	2024-03-09 01:15:55	46.72015167	46.28029845	52.25777849
57	MCBH Decision Unit 21 62 TMDW 5X Spike Dup	2024-03-09 01:19:41	48.25785203	47.3885509	52.86903184
58	MCBH Decision Unit 20 63 TMDW 5X Dup	2024-03-09 01:23:26	4.187512599	0.073569523	8.631283464
59	MCBH Decision Unit 20 64 TMDW 5X Trip	2024-03-09 01:27:11	3.9618925	0.067579238	9.318676593
60	MCBH Decision Unit 21 65 TMDW 5X	2024-03-09 01:30:57	1.586716447	0.06404001	5.748341159
61	MCBH Decision Unit 21 66 TMDW 5X Dup	2024-03-09 01:34:42	1.453192346	0.060785511	5.3116426
62	MCBH Decision Unit 21 67 TMDW 5X Trip	2024-03-09 01:38:28	1.528597191	0.052445853	5.358356517
63	MCBH Decision Unit 22 68 TMDW 5X	2024-03-09 01:42:15	1.149156627	0.044221284	6.897925504
64	MCBH Decision Unit 24 69 TMDW 5X	2024-03-09 01:46:01	2.036300572	0.064288356	7.785027843
65	MCBH Decision Unit 24 70 TMDW 5X Dup	2024-03-09 01:49:48	1.958287217	0.050861223	7.577292534
66	CCV	2024-03-09 01:57:03	0.019436703	0.019230479	0.018333148
67	CCB	2024-03-09 02:00:49	-5.65274E-06	1.00716E-05	4.83801E-06
68	Method Blank	2024-03-09 02:04:34	-7.79295E-06	2.31077E-06	2.85456E-06
69	RL1	2024-03-09 02:08:18	0.000929943	0.00090615	0.000880547
70	MCBH Decision Unit 24 71 TMDW 5X Trip	2024-03-09 02:14:02	1.469359536	0.052255329	7.501301768
71	MCBH Decision Unit 7 72 TMDW 5X	2024-03-09 02:21:41	4.939590785	0.104998467	26.11882231
72	MCBH Decision Unit 11 73 TMDW 5X	2024-03-09 02:25:25	7.133870834	0.232815286	46.37603974
73	MCBH Decision Unit 13 74 TMDW 10X	2024-03-09 02:29:10	29.0273837	2.268388793	298.6468385

74	MCBH Decision Unit 16 75 TMDW 20X	2024-03-09 02:32:55	69.45522031	7.596671764	1011.988576
75	MCBH Decision Unit 13 74 TMDW 20X	2024-03-09 02:43:28	30.6609003	2.540209367	357.1452726
76	MCBH Decision Unit 16 75 TMDW 50X	2024-03-09 02:47:14	68.58166889	7.079652908	937.4256056
77	MCBH Decision Unit 15 76 TMDW 50X	2024-03-09 02:52:40	137.7883592	46.53333525	5519.271296
78	MCBH Decision Unit 15 76 TMDW 1000X	2024-03-09 03:06:57	146.7670233	45.80296549	5375.280868
79	MCBH Decision Unit 12 77 TMDW 50X	2024-03-09 03:14:15	39.34200677	2.202467982	343.5605814
80	CCV	2024-03-09 03:20:58	0.019587551	0.019368283	0.018670482
81	CCB	2024-03-09 03:24:44	-7.75287E-06	1.00878E-05	9.65402E-06
82	Method Blank	2024-03-09 03:28:29	-1.0089E-05	1.16084E-06	6.74195E-06
83	RL1	2024-03-09 03:31:44	0.00109647	0.001045957	0.000994136
84	LCS	2024-03-09 03:36:06	0.051986458	0.051775037	0.051506652
85	LCSD	2024-03-09 03:39:52	0.051431029	0.051509751	0.0519978
86	MCBH Decision Unit 23 78 TMDW 5X	2024-03-09 03:43:38	1.94157037	0.253906317	9.171190902
87	MCBH Decision Unit 23 78 TMDW 5X Dup	2024-03-09 03:47:32	1.829818278	0.275781812	8.452783666
88	MCBH Decision Unit 23 78 TMDW 5X Spike	2024-03-09 03:51:18	50.10966544	50.3730632	60.86972572
89	MCBH Decision Unit 23 78 TMDW 5X Spike Dup	2024-03-09 03:58:16	47.39399153	48.30922003	58.47533182
90	MCBH Decision Unit 23 78 TMDW 5X PDS	2024-03-09 04:02:02	49.07704684	50.49443828	53.63613728
91	MCBH Decision Unit 8 79 TMDW 5X	2024-03-09 04:05:49	7.339848735	0.382231783	76.53456019
92	MCBH Decision Unit 9 80 TMDW 5X	2024-03-09 04:12:54	10.21235469	0.705336105	112.055114
93	MCBH Decision Unit 1 45 TMDW 5X	2024-03-09 04:16:39	1.998857028	0.129375858	14.36449886
94	MCBH Decision Unit 1 46 TMDW 5X Dup	2024-03-09 04:20:24	2.086639422	0.12351556	15.99996586
95	Wash Blank	2024-03-09 04:24:09	3.84553E-06	4.08521E-07	2.57141E-05
96	CCV	2024-03-09 04:27:58	0.018885218	0.018708264	0.018229736
97	CCB	2024-03-09 04:31:43	-7.49514E-06	1.14097E-05	1.07661E-05
98	RL 1 ppb	2024-03-09 04:35:28	0.001035892	0.000963745	0.000978504

Details

121Sb (KED) - IS Interpolation:115In (KED) - 159Tb (KED)



Calibration Properties

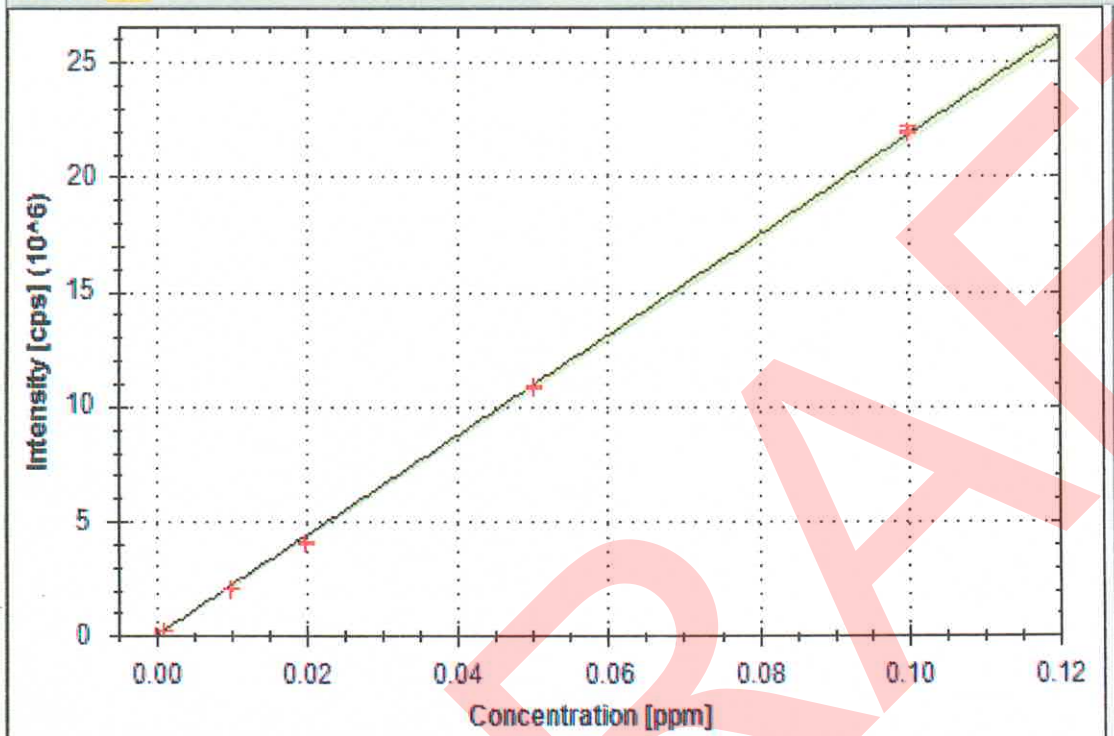
FitType	Linear
Weighting	None
Forcing	Blank
Use for SemiQuant	Yes

$f(x) = b^*x + a$

Parameter	Value	Confidence Delta	StdErr	Rel. StdErr
b	16,673,184.218	+/-164,914.622	111,738.34	0.670
a	55.482	+/-0.000	0.000	0.000
R^2	1.000			
BEC	0.000 ppm			
IDL(LOD)	0.0000023 ppm			

Details

208Pb (KED) - IS Interpolation:165Ho (KED) - 209Bi (KED)



Calibration Properties

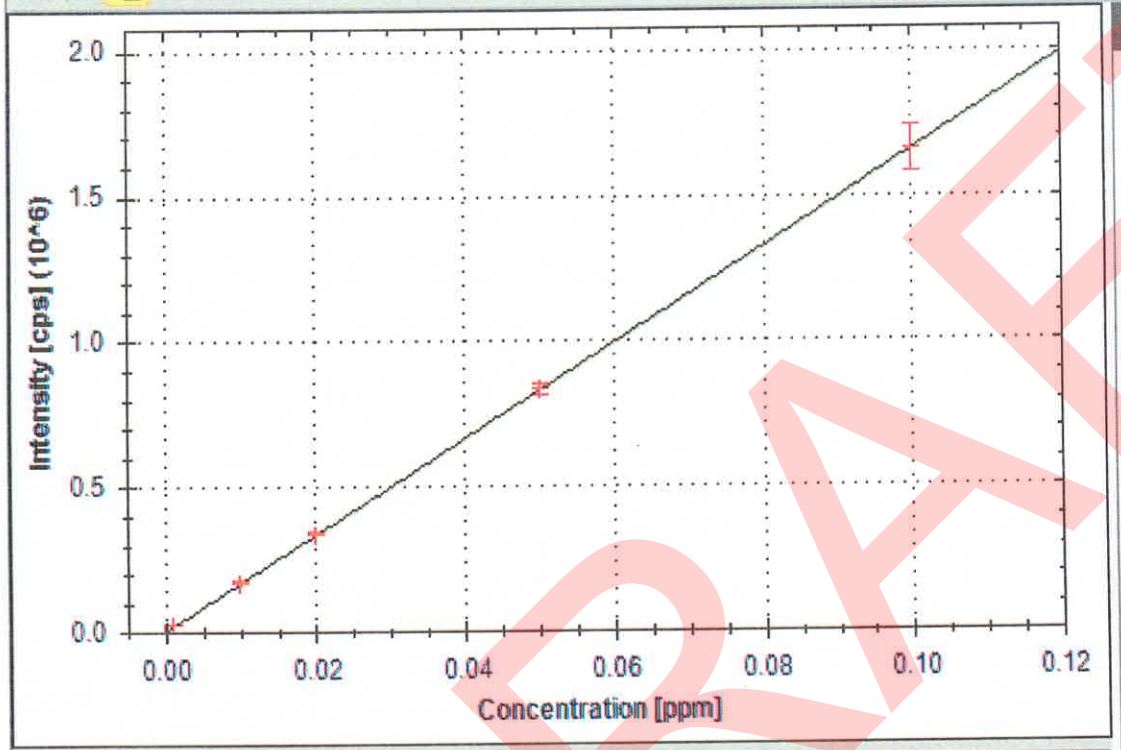
FitType	Linear
Weighting	None
Forcing	Blank
Use for SemiQuant	Yes

f(x) = b*x + a

Parameter	Value	Confidence Delta	StdErr	Rel. StdErr
b	218,091,933.569	+/-2,381,516.038	1,613,602.5	0.740
a	419.918	+/-0.000	0.000	0.000
R^2	1.000			
BEC	0.000 ppm			
IDL(LOD)	0.0000007 ppm			

Details

63Cu (KED) - IS Interpolation:45Sc (KED) - 89Y (KED)



Calibration Properties

FitType	Linear
Weighting	None
Forcing	Blank
Use for SemiQuant	Yes

f(x) = b*x + a

Parameter	Value	Confidence Delta	StdErr	Rel. StdErr
b	16,536,394.509	+/-34,963.267	23,689.455	0.143
a	607.888	+/-0.000	0.000	0.000
R^2	1.000			
BEC	0.000 ppm			
IDL(LOD)	0.0000081 ppm			

Site Investigation Report
Pu'uloa Range Training Facility Shoreline

Appendix C

Navy Marine Corps Force Health Protection Command Health Risk Evaluation

Health Risk Evaluation

Pu'uloa Range Training Facility Shoreline
June 2024

Executive Summary

The Navy and Marine Corps Force Health Protection Command (NMCFHPC) was requested by Marine Corps Base Hawai'i (MCBH) to perform an evaluation to determine the risk associated with potential exposure to munitions constituents (i.e., antimony, copper, and lead), in the oceanside berms/shoreline of the Pu'uloa Range Training Facility (PRTF) in O'ahu, Hawai'i. Although the shoreline adjacent to the PRTF is closed to the public, trespassing has been known to occur on the beach when there are no live fire exercises occurring. NMCFHPC evaluated representative soil sample results for each of the 24 Decision Units (DUs) extending across the PRTF Shoreline perimeter, to assess the potential risk related to current and future adult and child trespassers (Figure 1).

Sample results were compared to the Tier 1 State of Hawai'i Department of Health (DOH) Environmental Action Levels (EALs) for Residential (i.e., unrestricted) Land Use and the Tier 1 DOH EALs for Commercial/ Industrial (i.e., restricted) Land Use (DOH 2024). As a result of this screening, only antimony and lead were identified as constituents of potential concern (COPCs) at the PRTF oceanside berms/shoreline; therefore, antimony and lead were carried forward in this health risk evaluation.

The PRTF oceanside berms are largely overgrown with dense vegetation, namely long-thorn kiawe, making the berms generally inaccessible for a trespasser (see Figure 3 and Attachment 3). However, for the purposes of this evaluation, it was assumed that an adult/child trespasser would remain at a DU for one full day per week for 52 weeks per year. This exposure assumption is considered very conservative as trespassers are (1) likely to traverse only short distances along the shore and (2) are unlikely to venture into densely vegetated DUs.

Risks for an adult/child trespasser associated with exposure to antimony in soil were calculated using the United States Environmental Protection Agency (USEPA) Regional Screening Level (RSL) Calculator (USEPA 2024a). Risks for adult and child trespassers, which includes a pregnant trespassing woman's fetus, associated with exposure to lead in soil were calculated using two USEPA lead models: the Integrated Exposure Uptake Biokinetic (IEUBK) Model (USEPA 2021) and the Adult Lead Methodology (ALM) Model (USEPA 1996 and 2017).

ENCLOSURE (1)

Conclusion

The following summarizes the results of this health risk evaluation:

- Soil antimony concentrations in DU.15 and DU.16 exceed the Tier 1 EAL for Residential Land Use of 6.3 ug/g (Figure 1).
- Soil lead concentrations at DU.14, DU.15, and DU.16 exceed the Tier 1 EAL for Residential Land Use of 200 ug/g, and the Tier 1 EAL for Commercial/Industrial Land Use of 800 ug/g (Figure 2).
- Soil lead concentrations at DU.12, DU.13, and DU.17 exceed the Tier 1 EAL for Residential Land Use of 200 ug/g (Figure 2).
- The noncancer hazard indices (HIs) calculated for the adult and child trespasser under current and potential future site conditions were below the USEPA benchmark of 1 at the PRTF shoreline, indicating noncancer health effects are not expected.[1]
- Lead risks for a child trespasser under current site conditions are below levels of concern (i.e., < 5% probability of exceeding 5 ug/dL blood lead level [BLL]) for all DUs at the PRTF oceanside berms/shoreline.
- Lead risks for a child trespasser under potential future site conditions in **DU.15** are **above** levels of concern (i.e., > 5% probability of exceeding 5 ug/dL BLL).
- Lead risks for a trespassing pregnant woman's fetus under current and potential future site conditions are below levels of concern (i.e., < 5% probability of exceeding 5 ug/dL BLL) for all DUs at the PRTF oceanside berms/shoreline.
- Lead risks for an adult trespasser under current and potential future site conditions are below levels of concern (i.e., projected BLLs < 5 ug/dL) for all DUs at the PRTF oceanside berms/shoreline.

Recommendations

Based on the results of this health risk evaluation, the NMCFHPC recommends:

Implementing a Long-Term Monitoring Program

It is recommended that a long-term monitoring (LTM) program be developed and implemented based on the conclusions presented in this health risk evaluation. The purpose of the LTM program is to regularly evaluate the condition of the PRTF oceanside berms and shoreline. The LTM Program should include visual observations of the berms and shoreline, noting any changes to vegetation, signs of erosion, and evidence of trespassing (e.g., footprints, trash or debris left behind, or other signs of recreational use). The PRTF oceanside berms run parallel to the shoreline, and it is, therefore, critical that the berms do not become

[1] Due to limited established toxicity values for antimony and lead, only noncancer HIs were calculated for Antimony, and no risk values were calculated for lead (see Uncertainty).

susceptible to erosion. If it is determined that the trespassing frequency likely exceeds the frequency assumed in this evaluation (i.e., one day per week), the results of this health risk evaluation should be re-evaluated. Implementing additional institutional controls and/or engineering controls (e.g., additional signage/fencing) may need to be considered to reduce risk to human health.

Reevaluation of Risk in the Event of Future Changes in Site Conditions in DU.15

The highest lead concentration in soil was reported for DU.15. Exposure to soils in DU.15 can potentially result in an unacceptable risk to child trespassers, based on the results of the BLL evaluation for a child trespasser under potential future site conditions. DU.15 is not currently considered accessible to child trespassers due to heavy vegetation, but changes in future site conditions within this DU (e.g., reduced vegetative cover, erosion) can potentially result in increased accessibility and exposure to concentrations of munitions constituents in this DU. The results of this health risk evaluation should be reevaluated in the event of future changes in site conditions in DU.15.

Introduction

The Navy and Marine Corps Force Health Protection Command (NMCFHPC) conducted this health risk evaluation to determine the potential risk to human health if exposed to munitions constituents (i.e., antimony, copper, lead) in soil along the southern oceanside berms/shoreline of the Pu'uloa Range Training Facility (PRTF) in O'ahu, Hawai'i. On 20 March 2024, the United States (U.S.) Marine Corps Base Hawai'i (MCBH) requested assistance from the NMCFHPC in the review of soil sampling data for human health risk findings associated with potential exposure to munition constituents (i.e., antimony, copper, lead) in the southern oceanside berms/shoreline of the PRTF. The analytical results of soil samples collected in February and March 2024 from the oceanside berms/shoreline of the PRTF by the MCBH's Environmental Compliance Protection Division serve as the basis of this evaluation (Table 1; Attachment 1).

Purpose

The purpose of this technical memorandum is to present the results of the health risk evaluation and to determine if there is an unacceptable risk to human health associated with potential exposure to munition constituents (i.e., antimony, copper, lead) at the southern oceanside berms/shoreline of the PRTF.

Background

The PRTF is located on the south-central shore of O'ahu, Hawai'i, west of the Pearl Harbor entrance channel, between the Kapilina residential area (formerly the Iroquois Point Family Housing) to the east of the PRTF, and the off-base residential community of Ewa Beach to the west of the PRTF (Figure 1; MCBH 2023). The ocean area directly south of the PRTF shoreline is located within the Pearl Harbor Naval Defensive Sea Area. The 165-acre range consists of six small-arms ranges (i.e., Ranges A through F). Ranges A and B on the west are long-distance ranges (up to 1,000 yards) and their ocean end consists of large earthen berms with concrete barrier walls along the tops of the berms. Ranges C, D, E and F are shorter rifle, pistol, and shotgun ranges from 150 to 250 feet long with earthen berms along the beach. The PRTF ranges extend along about 3,000 feet of sandy shoreline (Figure 1; MCBH 2023).

Based on correspondence with the MCBH, the shoreline adjacent to the PRTF ranges is closed to the public and "RESTRICTED AREA" signs are posted at each end of the PRTF shoreline. Guards are posted at each end of the beach to secure against unauthorized access during live fire events. However, no guards are manning the beach when there is no live fire at the ranges, and therefore, trespassing onto the beach is possible during these times. Though little evidence is available of ongoing trespassing occurring at the PRTF shoreline, coals/ash pits, broken fishing poles, fish scales, and bait portions have been observed. The number of days

per year that the individual firing ranges (i.e., Ranges A to F) are in use varies per range.[2] The entire PRTF shoreline is guarded against unauthorized access any time at least one of the ranges is in use. However, the overlap in range use is not available. As a result, the exact number of days the beach is unguarded is not known. The MCBH estimates that the beach is closed for live fire events three to four days per week, which leaves the beach unguarded for potential trespass the remaining three to four days per week.

Data Evaluation and Reduction

The purpose of the data evaluation and reduction process is to provide an overview of available data and identify the data retained for further evaluation in the health risk evaluation. This section summarizes the rationale used to evaluate and reduce the dataset for the health risk evaluation.

Data Overview

Representative soil samples were collected from 24 designated decision units (DUs) along the ocean side of PRTF berms and shoreline in February and March 2024 (Figure 1).[3,4] Samples were collected and analyzed for munitions constituents (i.e., antimony, copper, and lead) in accordance with the PRTF Sampling and Analysis Plan (SAP; MCBH 2023). A summary of soil sample results is presented in Table 1, while the full laboratory report and chains of custody are included in Attachment 1.

Data Reduction

An initial screening of sample data was performed to identify DUs that could potentially pose an unacceptable risk to human health. Sample results were compared to the Tier 1 State of Hawai'i Department of Health (DOH) Environmental Action Levels (EALs) for Residential (i.e., unrestricted) Land Use and the Tier 1 DOH EALs for Commercial/Industrial (i.e., restricted) Land Use (DOH 2024).[5] A DU was carried forward in this health risk evaluation if at least one constituent result exceeded either one or both the Tier 1 DOH EAL for Residential and/or Commercial/Industrial Land Use. A summary of the results of this initial screening are provided below:

[2] Over a three-year average, Ranges A, B, C, D, and E were in use 31, 96, 54, 71, and 103 days per year, respectively. The average annual use of Range F is not available. The overlap in schedules of use for the ranges is not available.
[3] Soil samples were collected from the ocean side berm areas of DU.1 to DU20, while sand samples were collected from the shore areas of DU.21 to DU24. For brevity, sample media is referred to as soil throughout this evaluation.
[4] Replicate samples were collected from several DUs. The highest lead concentration sample result was used in this evaluation for DUs where multiple sample results were available (Table 1).
[5] DOH EALs were retrieved from the following site: https://health.hawaii.gov/heer/guidance/ehe-and-eals/.

Antimony

- Antimony concentrations exceeding the Tier 1 DOH EAL for Residential Land Use of 6.3 ug/g were reported for DU.15 and DU.16, with concentrations of 47 and 7.6 ug/g, respectively (Figure 1). The DUs with the highest concentrations of Antimony (i.e., DU.15 and DU.16) were located immediately south of Ranges C, D, and E, which are short rifle, pistol, and shotgun ranges (MCBH 2023).
- Antimony concentrations in the remaining 22 DUs (i.e., DU.1 to DU.14 and DU.17 to DU.24) were below the Tier 1 DOH EAL for Commercial/Industrial Land Use of 82 ug/g, and below the Tier 1 DOH EAL for Residential Land Use of 6.3 ug/g, with a maximum concentration of 4.0 ug/g in DU.14 (Figure 1).

Copper

- Copper concentrations in all 24 DUs (i.e., DU.1 to DU.24) were below the Tier 1 DOH EAL for Commercial/Industrial Land Use of 2,500 ug/g, and below the Tier 1 DOH EAL for Residential Land Use of 630 ug/g, with a maximum concentration of 138 ug/g in DU.15.

Lead

- Lead concentrations exceeding the Tier 1 DOH EAL for Residential Land Use of 200 ug/g were reported for DU.12 (344 ug/g), DU.13 (357 ug/g), DU.14 (1,946 ug/g), DU.15 (5,375 ug/g), DU.16 (937 ug/g), and DU.17 (459 ug/g; Figure 2).
- Lead concentrations for DU.14, DU.15, and DU.16, with concentrations of 1,946, 5,375, and 937 ug/g, respectively, also exceeded the Tier 1 DOH EAL for Commercial/Industrial Land Use of 800 ug/g (Figure 2). The DUs with the highest concentrations of lead (i.e., DU.14, DU.15, and DU.16) were located immediately south of Ranges C, D, and E, which are short rifle, pistol, and shotgun ranges (MCBH 2023).
- Lead concentrations in the remaining 18 DUs (i.e., DU.1 to DU.11 and DU.18 to DU.24) were below the Tier 1 DOH EAL for Commercial/Industrial Land Use of 800 ug/g, and below the Tier 1 DOH EAL for Residential Land Use of 200 ug/g, with a maximum concentration of 149 ug/g in DU.18 (Figure 2).

Antimony and lead concentrations in soil exceeded the Tier 1 DOH EALs for Commercial/Industrial and/or Residential Land Use in six DUs (i.e., DU.12 through DU.17); therefore, antimony and lead were identified as constituents of potential concern (COPCs) at the PRTF oceanside berms/shoreline. Consequently, antimony and lead were carried forward in this health risk evaluation. Copper concentrations in all DUs (i.e., DU.1 to DU.24) were below the Tier 1 DOH EAL for both Commercial/Industrial and Residential Land Use, and therefore, were not retained for further evaluation. A summary of the reported concentrations of munitions constituents (i.e., antimony, copper, lead) is presented in Table 1.

Exposure Assessment

The purpose of the exposure assessment is to identify site-specific exposure parameters for receptors evaluated in this health risk evaluation. The shoreline adjacent to the PRTF is closed to the public and "RESTRICTED AREA" signs are posted at each end of the PRTF shoreline. During live fire events, guards are posted at each end of the beach to secure against unauthorized access. The beach is unguarded against unpermitted entry for up to four days of the remainder of the week. Based on current and future land use at the PRTF, the adult/child trespasser was considered for further evaluation at the PRTF shoreline.

Exposure Parameters

It was assumed that unpermitted entry would occur 25% of the maximum number of days the beach is unguarded (i.e., one of four days per week).[6] This results in an exposure frequency (EF) of one day per week to munitions-impacted soils at the PRTF shoreline. The adult/child trespasser scenario represents the potential for an adult or child to be exposed to munition constituents (i.e., antimony, copper, lead) in soil via direct contact (i.e., incidental ingestion, dermal contact, and inhalation of particulates) while trespassing onto the PRTF shoreline. This evaluation was performed assuming an exposure duration (ED) of 26 years. The ED was based on the United States Environmental Protection Agency (USEPA) default assumption for a recreator exposure scenario and is representative of residents living near the PRTF shoreline who may trespass for beach access (USEPA 2011). The ED represents the reasonable maximum exposure (RME) duration and is protective of all receptors who trespass onto the PRTF shoreline. An adult/child trespasser was evaluated for an exposure time (ET) of eight hours per event because this represents a trespasser remaining a full day on-site per event, and is consistent with the exposure assumptions made in the blood lead level (BLL) evaluation conducted as part of this health risk evaluation.[7] The ET of eight hours is protective of all receptors who trespass onto the PRTF shoreline for up to eight hours per event.

Evaluation of Site Conditions and Site Accessibility

The western-most (i.e., DU.1, DU.2, DU.21, and DU.22) and eastern-most (i.e., DU.19, DU.20, DU.23, and DU.24) extents of the PRTF shoreline are the DUs most likely to be accessed by a trespasser. These DUs are relatively flat with minimal vegetation and are located near the fences where a trespasser would enter the restricted shoreline (see Figure 3 and Attachment 3). The DUs adjacent to Ranges A and B (i.e., DU.3 to DU.12) are partially vegetated with low-lying ground cover and are partially overgrown with dense vegetation, namely long-thorn kiawe. Though it is extremely unlikely that a trespasser would venture into areas overgrown with

[6] The 25% occurrence rate of unpermitted entry was based on the limited evidence available of ongoing trespassing occurring at the restricted PRTF shoreline (discussed in Background), and is considered a conservative estimate (see Uncertainty).
[7] A weighted soil lead concentration was calculated for each DU with the assumption that a trespasser would be exposed to soil lead concentrations at the PRTF one full day per week (see Blood Lead Level Evaluation).

long-thorn kiawe, areas of low-lying ground cover are considered accessible; therefore, DU.3 to DU.12 are considered accessible to adult and child trespassers under current site conditions.

The DUs adjacent to Ranges C, D, E, and F (i.e., DU.13 to DU.18) are overgrown with dense vegetation (i.e., long-thorn kiawe) and contain steep slopes in some portions of the berms (see Figure 3 and Attachment 3). Consequently, DU.13 to DU18 are considered inaccessible for children, and therefore, these DUs were not included in the health risk evaluation for the child trespasser under current site conditions. However, changes in future site conditions within these DUs (e.g., reduced vegetative cover, erosion) can potentially result in increased accessibility for children and exposure to concentrations of munitions constituents in these DUs. Therefore, a child trespasser was evaluated for risk based on exposure under current site conditions (i.e., accessibility to DU.1 to DU.12 and DU.19 to DU.24) and based on exposure under potential future site conditions (i.e., accessibility to all DUs). The adult trespasser was evaluated for current and potential future site conditions based on accessibility to all DUs (i.e., DU.1 to DU.24) in both site condition scenarios. The following summarizes the scenarios evaluated in this health risk evaluation.

- Adult Trespasser
  - Current and Potential Future Site Conditions: Accessibility to DU.1 to DU.24
- Child Trespasser
  - Current Site Conditions: Accessibility to DU.1 to DU.12 and DU.19 to DU.24
  - Potential Future Site Conditions: Accessibility to DU.1 to DU.24

Risk Characterization

The risk characterization was performed using the USEPA Regional Screening Level (RSL) Calculator (USEPA 2024a) to evaluate the risk for the adult/child trespasser receptor scenario. This section presents the results of the risk calculations. The inputs and outputs of the RSL Calculator are included in Attachment 2. The USEPA RSL Calculator assesses both cancer risks and noncancer hazard quotients (HQs) for all constituents used as input parameters. However, there are no toxicity values (i.e., cancer slope factor [CSF] and noncancer reference dose [RfD]) established for lead; therefore, no values are presented for risk associated with exposure to lead at the PRTF shoreline. The USEPA uses a blood lead level (BLL) modeling approach to assess potential health risks in children and pregnant women's fetuses associated with exposure to lead (see the Blood Lead Level Evaluation). Additionally, the USEPA has not classified antimony for carcinogenicity, and there is no established CSF for antimony; therefore, the RSL Calculator risk outputs are only presented for noncancer hazards associated with exposure to antimony in soil at the PRTF shoreline.

The risk calculations were performed on a DU-by-DU basis. This is a very conservative approach because it assumes potentially exposed populations would spend all their time within the same DU and be exposed to maximum detected concentrations. DUs were evaluated sequentially, starting with the DU with the highest constituent concentrations, followed by the DU with the next highest concentrations, and so on, until noncancer hazard indices (HIs) were less than the USEPA noncancer benchmark of 1.[8]

Noncancer Hazards

Adult Trespasser Scenario Under Current and Potential Future Site Conditions

The adult trespasser under current and potential future site conditions was evaluated for exposure to soil antimony starting with DU.15 because this is the DU with the highest reported concentration of soil antimony among the DUs determined to be accessible to an adult under current and potential future site conditions. The reported concentration of soil antimony in DU.15 represents the maximum concentration an adult trespasser could potentially be exposed to while at the PRTF shoreline under current and potential future site conditions. The total noncancer HI for the adult trespasser was calculated as 0.0063, which is below the USEPA noncancer benchmark of 1. Antimony concentrations in the remaining DUs were less than those reported in DU.15; therefore, the noncancer HI in these DUs for the adult trespasser would be less than that for DU.15, and below the USEPA benchmark of 1. The results from the RSL Calculator for the adult trespasser under current and potential future site conditions are presented in the following table (see Attachment 2 for all inputs and outputs).

Maximum Noncancer HQs Calculated for the Adult Trespasser (Results from RSL Calculator)

Constituent	Adult Noncancer HQ			
	Ingestion	Dermal	Inhalation	Total (HI)
Antimony	0.0063	-	0.0000055	0.0063

Notes:

-: Indicates no toxicity values available for risk calculations.

Noncancer HQs were calculated for DU.15 because this is the DU with the highest reported concentration of antimony in soil among DUs determined to be accessible to an adult under current and potential future site conditions. RSL Calculator inputs and outputs are provided in Attachment 2.

[8] The HI is the sum of the HQs calculated for each exposure pathway (i.e., ingestion, dermal contact, and inhalation) for a receptor.

Child Trespasser Scenario Under Current Site Conditions

The child trespasser under current site conditions was evaluated for exposure to soil antimony starting with DU.12 because this is the DU with the highest reported concentration of soil antimony among the DUs determined to be accessible to a child trespasser under current site conditions (Figure 3). The reported concentration of soil antimony in DU.12 represents the maximum concentration a child trespasser could potentially be exposed to while at the PRTF shoreline under current site conditions. The total noncancer HI for the child trespasser was calculated as 0.0042, which is below the USEPA noncancer benchmark of 1. Antimony concentrations in the remaining DUs were less than those reported in DU.12; therefore, the noncancer HI in these DUs for the child trespasser would be less than that for DU.12, and below the USEPA benchmark of 1. The risk results from the RSL Calculator for the child trespasser under current site conditions are presented in the following table.

Maximum Noncancer HQs Calculated for the Child Trespasser Under Current Site Conditions (Results from RSL Calculator)

	Child Noncancer HQ			
Constituent	Ingestion	Dermal	Inhalation	Total (HI)
Antimony	0.0042	-	0.00000026	0.0042

Notes:

-: Indicates no toxicity values available for risk calculations.

Noncancer HQs were calculated for DU.12 because this is the DU with the highest reported concentration of antimony in soil among DUs determined to be accessible to a child under current site conditions. RSL Calculator inputs and outputs are provided in Attachment 2.

Child Trespasser Scenario Under Potential Future Site Conditions

The child trespasser under potential future site conditions was evaluated for exposure to soil antimony starting with DU.15 because this is the DU with the highest reported concentration of soil antimony among the DUs considered potentially accessible to a child trespasser under potential future site conditions. The reported concentration of soil antimony in DU.15 represents the maximum concentration a child trespasser could potentially be exposed to while at the PRTF shoreline under potential future site conditions. The total noncancer HI for the child trespasser was calculated as 0.0089, which is below the USEPA noncancer benchmark of 1. Antimony concentrations in the remaining DUs were less than those reported in DU.15; therefore, the noncancer HI in these DUs for the child trespasser would be less than that for DU.15, and below the USEPA benchmark of 1. The risk results from the RSL Calculator for the child trespasser under potential future site conditions are presented in the following table.

Maximum Noncancer HQs Calculated for the Child Trespasser Under Potential Future Site Conditions (Results from RSL Calculator)

Constituent	Child Noncancer HQ			
	Ingestion	Dermal	Inhalation	Total (HI)
Antimony	0.0089	-	0.0000055	0.0089

Notes:

-: Indicates no toxicity values available for risk calculations.

Noncancer HQs were calculated for DU.15 because this is the DU with the highest reported concentration of antimony in soil among DUs determined to be accessible to a child under potential future site conditions. RSL Calculator inputs and outputs are provided in Attachment 2.

Blood Lead Level Evaluation

Lead is regulated based on blood lead concentration (PbB; USEPA 2024b). A BLL evaluation was performed as part of this PRTF shoreline health risk evaluation. Though lead is a naturally occurring element, industrial activity and human-made products can increase the amount of lead people are exposed to in the workplace and at home – potentially impacting human health. Lead exposure is of particular concern to children and pregnant adult females, as an elevated BLL can result in health complications in a child or fetus. A BLL of five micrograms per deciliter (5 ug/dL) is the USEPA threshold level of concern, requiring intervention if a child's BLL reaches or exceeds this concentration (USEPA 2024b). The USEPA set a post-remediation goal that the likelihood of a child having an elevated BLL (5 ug/dL or greater) should be no more than five percent (USEPA 2024b).

The BLL evaluation was performed using two USEPA lead models: the Integrated Exposure Uptake Biokinetic (IEUBK) Model and the Adult Lead Methodology (ALM) Model. The IEUBK Model was used to evaluate lead risk in a child trespasser (USEPA 2021). The ALM model was used to evaluate BLLs in an adult trespasser and to evaluate the risks to a trespassing adult pregnant woman's fetus (USEPA 1996 and 2017). The modeling results are presented in the following subsections. The inputs and outputs for each model are included in Attachment 2. The BLL evaluation was performed on a DU-by-DU basis; this is a very conservative evaluation approach as it assumes potentially exposed populations would spend all their time within a single DU with maximum detected lead concentrations. DUs were evaluated sequentially, starting with the DU with the highest lead concentration, followed by the DU with the next highest concentration, and so on, until model outputs were below the USEPA level of concern (i.e., < 5% probability of > 5 ug/dL BLL).

Weighted Soil Lead Concentrations

The IEUBK and ALM models simulate soil lead exposure at a single location of concern and do not integrate variable or intermittent exposure to lead concentrations. However, exposure to lead concentrations at the PRTF oceanside berms/shoreline is not expected to occur on a consistent basis (i.e., exposure would only

occur in an intermittent trespassing scenario). To account for intermittent exposure, weighted soil lead concentrations were calculated for each DU, consistent with the USEPA guidance on Assessing Intermittent or Variable Exposures at Lead Sites (USEPA 2003). The site-specific parameters and the equation used to calculate weighted soil lead concentrations are presented in this subsection.

Based on the results of the Exposure Assessment, an EF of one day per week was identified for the PRTF shoreline. This results in an EF of one day per week to lead-impacted soil at the PRTF shoreline and an EF of six days per week to naturally occurring lead in soil off-site. According to the DOH Hawai'ian Islands Soil Metal Background Evaluation Report, naturally occurring lead in Hawai'i soils ranges from 0.76 to 380 ug/g, with a 95% upper confidence limit (UCL) of 21.3 ug/g (DOH 2012). This concentration of naturally occurring lead is considered "natural background" soil lead and represents the concentration individuals are exposed to when not at the PRTF shoreline (i.e., when off-site). EFs and lead concentrations are used to derive DU-specific weighted soil lead concentrations as input parameters for the two USEPA lead models. The equation used to calculate weighted soil lead concentrations for individual DUs is:

$$CPb_{DU} = \frac{(C_{PRTF\ DU})(EF_{PRTF\ DU}) + (C_{background})(EF_{background})}{7\ days\ per\ week}$$

Where,

Parameter	Definition
CPb_{DU}	Weighted soil lead concentration for individual DU (ug/g)
$C_{PRTF\ DU}$	Soil lead concentration at DU (DU-specific, see Table 2; ug/g)
$EF_{PRTF\ DU}$	Exposure frequency to PRTF DU lead concentrations (1 day per week)
$C_{background}$	Background (i.e., naturally occurring lead concentrations in Hawai'i soils) soil lead concentration (21.3 ug/g)
$EF_{background}$	Exposure frequency to background soil lead concentrations (6 days per week)

The weighted soil lead concentration represents the overall soil lead concentration a trespasser is expected to be exposed to on an ongoing basis, assuming intermittent exposure to soil lead concentrations at the PRTF. Weighted soil lead concentrations calculated for this BLL evaluation are presented in Table 2.

Lead Exposure Evaluation for the Child Trespasser Under Current Site Conditions

The IEUBK Model evaluates potential lead exposure risks for children aged 6 months to 7 years. The IEUBK Model was run using USEPA default parameters except for the DU-specific weighted lead concentration in soil

and the off-site (i.e., residential) indoor dust lead concentration.[9] The DU-specific weighted soil lead concentrations used in the IEUBK Model are summarized in Table 2. The child trespasser under current site conditions was evaluated for exposure to soil lead starting with DU.12 because this is the DU with the highest reported concentration of soil lead among the DUs determined to be accessible to a child trespasser under current site conditions.

Based on the weighted soil lead concentration in DU.12, there is a 0.24% probability of a BLL exceeding the 5 ug/dL level of concern for a child trespasser under current site conditions in DU.12, which is below the USEPA threshold level of concern. The likelihood of a BLL exceeding the USEPA threshold level of concern for a child trespasser is less than 0.24% in the remaining DUs evaluated for the child trespasser under current site conditions (i.e., DU.1 to DU.11 and DU.19 to DU.24) because lead concentrations in these DUs were less than the lead concentration reported for DU.12. IEUBK Model input parameters and outputs for DU.12 are available in Attachment 2. The results from the IEUBK Model for the BLL of a child trespasser under current site conditions are presented in the following table.

Probability of a BLL Exceedance for a Child Trespasser Under Current Site Conditions (Results from IEUBK Model)

Decision Unit	Probability of Child BLL > 5 ug/dL	Decision Unit	Probability of Child BLL > 5 ug/dL
DU.1	< 0.24%	DU.13	Inaccessible[1]
DU.2	< 0.24%	DU.14	Inaccessible[1]
DU.3	< 0.24%	DU.15	Inaccessible[1]
DU.4	< 0.24%	DU.16	Inaccessible[1]
DU.5	< 0.24%	DU.17	Inaccessible[1]
DU.6	< 0.24%	DU.18	Inaccessible[1]
DU.7	< 0.24%	DU.19	< 0.24%
DU.8	< 0.24%	DU.20	< 0.24%
DU.9	< 0.24%	DU.21	< 0.24%
DU.10	< 0.24%	DU.22	< 0.24%
DU.11	< 0.24%	DU.23	< 0.24%
DU.12	**0.24%**	DU.24	< 0.24%

Notes:

[1] This DU was determined to be inaccessible to a child trespasser because this DU is generally overgrown with dense vegetation (Figure 3; Attachment 3).

[9] The IEUBK Model assumes a tracked-in indoor dust lead concentration. This dust lead concentration is directly related to soil lead concentrations expected immediately outside of the child's residence, and is not related to soil lead concentrations at the PRTF shoreline. Therefore, the Hawai'i soils natural background lead concentration (i.e., 21.3 ug/g) was used as the input parameter for the indoor dust lead concentration.

Bold indicates these results were calculated using the IEUBK Model. All remaining DU lead concentrations were less than that reported for DU.12, and therefore, would result in probabilities of BLL exceedances less than that calculated for DU.12. IEUBK model inputs and outputs are provided in Attachment 2.

Lead Exposure Evaluation for a Child Trespasser Under Potential Future Site Conditions

The IEUBK Model was run using USEPA default parameters except for the DU-specific weighted lead concentration in soil and the off-site (i.e., residential) indoor dust lead concentration. The DU-specific weighted soil lead concentrations used in the IEUBK Model are summarized in Table 2. The child trespasser under potential future site conditions was evaluated for exposure to soil lead starting with DU.15 because this is the DU with the highest reported concentration of soil lead among the DUs considered potentially accessible to a child trespasser under potential future site conditions. Based on the weighted soil lead concentration for DU.15, there is a 24% probability of a BLL exceeding the 5 ug/dL level of concern for a child in DU.15 under potential future site conditions, which exceeds the USEPA threshold level of concern. There is a 3.1% probability of a BLL exceeding the 5 ug/dL threshold level of concern for a child trespasser in DU.14 under potential future site conditions, which is below the USEPA threshold level of concern. The likelihood of a BLL exceeding the USEPA threshold level of concern for a child trespasser under potential future site conditions is less than 3.1% in DU.13, DU.16, DU.17, and DU.18, because lead concentrations in these DUs were less than the lead concentration reported for DU.14. IEUBK Model input parameters and outputs for DU.14 and DU.15 are available in Attachment 2. The results from the IEUBK Model for the BLL of a child under potential future site conditions are presented in the following table.

Probability of a BLL Exceedance for a Child Under Potential Future Site Conditions (Results from IEUBK Model)

Decision Unit	Probability of Child BLL > 5 ug/dL	Decision Unit	Probability of Child BLL > 5 ug/dL
DU.1 to DU.12[1]	≤ 0.24%	DU.16	< 3.1%
DU.13	< 3.1%	DU.17	< 3.1%
DU.14	**3.1%**	DU.18	< 3.1%
DU.15	**24%**	DU.19 to D.24[1]	≤ 0.24%

Notes:

Exceeds the USEPA level of concern (i.e., ≥ 5% probability of reaching or exceeding a child BLL of 5 ug/dL).

[1] The probability of exceeding the USEPA threshold level of concern was calculated as ≤ 0.24% for each of DU.1 to DU.12 and DU.19 to DU.24 in the BLL evaluation for a child trespasser under current site conditions.

Bold indicates these results were calculated using the IEUBK Model. All remaining DU lead concentrations were less than that reported for DU.14, and therefore, would result in probabilities of BLL exceedances less than that calculated for DU.14. IEUBK model inputs and outputs are provided in Attachment 2.

Lead Exposure Evaluation for the Adult Trespasser and for a Trespassing Pregnant Woman's Fetus Under Current and Potential Future Site Conditions

The ALM Model evaluates projected adult BLLs and potential lead exposure risks for pregnant women's fetuses. The ALM Model was run using USEPA default parameters except for the DU-specific weighted lead concentration in soil. The DU-specific inputs for the ALM Model are summarized in Table 2. The adult trespasser and the trespassing pregnant woman's fetus under current and potential future site conditions were evaluated for exposure to soil lead starting with DU.15 because this is the DU with the highest reported concentration of soil lead among the DUs determined to be accessible to an adult trespasser under current and potential future site conditions. Based on the weighted soil lead concentrations, adults are projected to have BLLs of less than 5 ug/dL in all DUs, with the highest BLL calculated as 1.7 ug/dL for DU.15 (see ALM Model outputs in Attachment 2). A less than 5% probability of a BLL exceeding the 5 ug/dL threshold level of concern for a trespassing pregnant woman's fetus was calculated for DU.15 and DU.14 (i.e., 2.4% and 0.20%, respectively). The likelihood of a BLL exceeding the USEPA level of concern for a trespassing pregnant woman's fetus is less than 0.20% in the remaining DUs (i.e., DU.1 to DU.13 and DU.16 to DU.24) because lead concentrations in these DUs were less than the lead concentration reported for DU.14. The results from the ALM Model for the BLL of a trespassing pregnant woman's fetus are presented in the following table.

Probability of a BLL Exceedance for a Trespassing Pregnant Woman's Fetus (Results from ALM Model)

Decision Unit	Projected Adult BLL (ug/dL)	Probability of Fetus BLL > 5 ug/dL	Decision Unit	Projected Adult BLL (ug/dL)	Probability of Fetus BLL > 5 ug/dL
DU.1	< 1.0	< 0.20%	DU.13	< 1.0	< 0.20%
DU.2	< 1.0	< 0.20%	**DU.14**	**1.0**	**0.20%**
DU.3	< 1.0	< 0.20%	**DU.15**	**1.7**	**2.4%**
DU.4	< 1.0	< 0.20%	DU.16	< 1.0	< 0.20%
DU.5	< 1.0	< 0.20%	DU.17	< 1.0	< 0.20%
DU.6	< 1.0	< 0.20%	DU.18	< 1.0	< 0.20%
DU.7	< 1.0	< 0.20%	DU.19	< 1.0	< 0.20%
DU.8	< 1.0	< 0.20%	DU.20	< 1.0	< 0.20%
DU.9	< 1.0	< 0.20%	DU.21	< 1.0	< 0.20%
DU.10	< 1.0	< 0.20%	DU.22	< 1.0	< 0.20%
DU.11	< 1.0	< 0.20%	DU.23	< 1.0	< 0.20%
DU.12	< 1.0	< 0.20%	DU.24	< 1.0	< 0.20%

Notes:

Bold indicates these results were calculated using the ALM Model. All remaining DU lead concentrations were less than that reported for DU.14. This results in ALM model outputs less than those calculated for DU.14. ALM model outputs for DU.14 and DU.15 are provided in Attachment 2.

Uncertainty

The purpose of the uncertainty section is to evaluate sources of uncertainty and variability that can influence the results of the BLL evaluation. A risk evaluation is not meant to predict actual health risks for specific individuals; rather, it is a tool for understanding where potentially harmful exposures may potentially exist and deciding what, if any, actions are needed. This section describes some of the uncertainty and variability associated with the data used in the BLL evaluation to provide decision-makers, and other users, information about how specific assumptions and parameters influence the risk results.

Uncertainty refers to a lack of data or an incomplete understanding of factors used in a risk evaluation (e.g., lack of information about environmental concentrations). Uncertainty in estimating exposures can be reduced or eliminated with additional, more comprehensive data (USEPA 2024c).

Variability refers to the inherent variation of data used in a risk evaluation (e.g., how much time people spend at a location). Variability cannot be reduced with more sampling or data; however, it can be characterized qualitatively or quantitatively (USEPA. 2024b)

Uncertainty Analysis

Key sources of uncertainty identified in this health risk evaluation and professional judgment regarding the potential impacts on the health risk evaluation are presented in the table below.

Key Sources of Uncertainty Identified and the Potential Impact to the BLL Evaluation

Key Source of Uncertainty	Potential Impact to the BLL Evaluation
Exposure Frequency	Over a three-year average, Ranges A, B, C, D, and E were in use 31, 96, 54, 71, and 103 days per year, respectively, which results in a cumulative use of 355 days per year.[10] The entire PRTF shoreline is guarded against unauthorized access any time at least one of the ranges is in use. However, the overlap in range use is not available; as a result, the exact number of days the beach is unguarded is not known. The MCBH estimates that the beach is closed for live fire events three to four days per week (i.e., 156 to 208 days per year). This estimate is significantly less than the cumulative use of 355 days per year. For the purposes of this evaluation, the maximum number of potentially unguarded days was assumed (i.e., four days per week). This is a conservative value and potentially results in an overestimate of risk at the PRTF shoreline.
Soil Lead Sample Results	Replicate samples were collected from several DUs (see Table 1 and Attachment 1). The highest soil concentration sample result was used in this evaluation for DUs where multiple sample results were available. This is a very conservative evaluation approach because it assumes a receptor would be exposed to the maximum constituent concentration in each DU for the entire exposure duration. The use of the maximum soil constituent concentration for the health risk evaluation potentially results in an overestimate of risk at the PRTF shoreline.

[10] The average annual use of Range F is not available.

Key Source of Uncertainty	Potential Impact to the BLL Evaluation
Toxicity Values	Cancer risks and noncancer HQs were calculated using toxicity values from the USEPA's May 2024 RSL tables (USPEA 2024a). While these values are the most up-to-date scientific information, toxicity values may be modified later and the risk evaluation could be affected. Additionally, limited toxicity values were available for the constituents evaluated: • There is no established CSF available for either of the two COPCs (i.e. antimony and lead) identified at the site; therefore, no cancer risks were calculated. • There is no established noncancer RfD available for lead; therefore, no noncancer HQ was calculated for lead. Excluding lead from the noncancer HQ calculations could potentially result in an underestimate of the total risk.
Natural Background Lead Concentration	Industrial activity and human-made products can increase the amount of lead people are exposed to in the workplace and at home. However, lead is a naturally occurring element found throughout the environment. In order to evaluate a receptors overall exposure to lead, it is important to evaluate exposure to site-specific soil lead concentrations as well as exposure to off-site soil lead concentrations. Off-site, a receptor is expected to be exposed to naturally occurring (i.e., background) lead. Background lead concentrations vary throughout the environment, and can be lower or higher than lead concentrations at a site with known lead contamination. According to the DOH Hawai'ian Islands Soil Metal Background Evaluation Report, naturally occurring lead in Hawai'i soils ranges between 0.76 to 380 ug/g, with a 95% UCL of 21.3 ug/g (DOH 2012). The 95% UCL represents the upper soil lead concentration limit of 95% of all Hawai'i soils sampled (i.e., only 5% of Hawai'i soil samples exceeded this value). The 95% UCL was used as the natural background lead concentration in this evaluation, and represents the RME concentration a receptor is expected to encounter off-site (DOH 2012). Though this concentration is based on measured background lead concentrations in Hawai'i soils, actual concentrations encountered by the individual will vary, and are likely to be lower than this value. For example, several of the DUs located at either end of PRTF shoreline, where soil lead concentrations are least likely to be impacted by PRTF operations, reported soil lead concentrations that were less than the Hawai'i soils natural background concentration (Figure 2). DU lead concentrations that were below natural background concentrations are summarized here: • DU.1, DU.21, and DU.22, which are located at the western end of the PRTF shoreline, reported soil lead concentrations of 17, 5.7, and 6.9 ug/g, respectively. • DU.19, DU.20, and DU.24, which are located at the eastern end of the PRTF shoreline, reported soil lead concentrations of 10, 9.5, and 7.8 ug/g, respectively. Using the 95% UCL as the natural background lead concentration potentially results in an overestimate of risk.

Key Source of Uncertainty	Potential Impact to the BLL Evaluation
Default Lead Parameters in the IEUBK Model	The IEUBK Model was used to evaluate potential risk to children from 6 months to 7 years of age. The IEUBK Model evaluates risk resulting from exposure to site-specific soil lead concentrations and from exposure to off-site environmental lead concentrations (i.e., exposure to typical concentrations of lead present in food, air, and water). To calculate risk resulting from environmental lead concentrations, the IEUBK Model also assumes typical age-related ingestion rates for each of these media (i.e., food, air, and water). While the default USEPA lead concentration and ingestion rate parameters are based on the most up-to-date scientific information, values may be modified later and the BLL evaluation could be affected. If these parameters are modified in the future, the projected BLL values calculated for a child could increase or decrease, depending on the updated information.

Conservative assumptions were used in this health risk evaluation to ensure risks were not underestimated. The uncertainties in the health risk evaluation are more likely to overestimate than underestimate risks.

Results and Recommendations

This health risk evaluation was performed to evaluate the potential risk to human health associated with exposure to munitions constituents (i.e., antimony, copper, lead) in soil at the PRTF oceanside berms/shoreline. Lead was identified as the primary constituent of concern (COC) at the PRTF. This evaluation was performed using available soil data collected by the MCBH Environmental Compliance Protection Division (MCBH 2023). Risks were calculated using the USEPA RSL Calculator using default exposure parameters unless otherwise stated (USEPA 2024a; see Exposure Assessment). In addition to calculating risk, a BLL evaluation was conducted using the IEUBK Model and the ALM Model. The following summarizes the results of this health risk evaluation:

- Soil antimony concentrations in DU.15 and DU.16 exceed the Tier 1 EAL for Residential Land Use of 6.3 ug/g (Figure 1).
- Soil lead concentrations at DU.14, DU.15, and DU.16 exceed the Tier 1 EAL for Residential Land Use of 200 ug/g, and the Tier 1 EAL for Commercial/Industrial Land Use of 800 ug/g (Figure 2).
- Soil lead concentrations at DU.12, DU.13, and DU.17 exceed the Tier 1 EAL for Residential Land Use of 200 ug/g (Figure 2).
- The noncancer HIs calculated for the adult and child trespasser under current and potential future site conditions were below the USEPA benchmark of 1 at the PRTF shoreline, indicating noncancer health effects are not expected.[11]

[11] Due to limited established toxicity values for antimony and lead, only noncancer HIs were calculated for Antimony, and no risk values were calculated for lead (see Uncertainty).

- Lead risks for a child trespasser under current site conditions are below levels of concern (i.e., < 5% probability of exceeding 5 ug/dL blood lead level [BLL]) for all DUs at the PRTF oceanside berms/shoreline.
- Lead risks for a child trespasser under potential future site conditions in **DU.15** are **above** levels of concern (i.e., > 5% probability of exceeding 5 ug/dL BLL).
- Lead risks for a trespassing pregnant woman's fetus under current and potential future site conditions are below levels of concern (i.e., < 5% probability of exceeding 5 ug/dL BLL) for all DUs at the PRTF oceanside berms/shoreline.
- Lead risks for an adult trespasser under current and potential future site conditions are below levels of concern (i.e., projected BLLs < 5 ug/dL) for all DUs at the PRTF oceanside berms/shoreline.

Recommendations

This section summarizes the recommendations for the PRTF shoreline based on the results presented in this health risk evaluation.

Implementing a Long-Term Monitoring Program

It is recommended that a long-term monitoring (LTM) program be developed and implemented based on the conclusions presented in this health risk evaluation. The purpose of the LTM program is to regularly evaluate the condition of the PRTF oceanside berms and shoreline. The LTM Program should include visual observations of the berms and shoreline, noting any changes to vegetation, signs of erosion, and evidence of trespassing (e.g., footprints, trash or debris left behind, or other signs of recreational use). The PRTF oceanside berms run parallel to the shoreline, and it is, therefore, critical that the berms do not become susceptible to erosion. If it is determined that the trespassing frequency likely exceeds the frequency assumed in this evaluation (i.e., one day per week), the results of this health risk evaluation should be re-evaluated. Implementing additional institutional controls and/or engineering controls (e.g., additional signage/fencing) may need to be considered to reduce risk to human health.

Reevaluation of Risk in the Event of Future Changes in Site Conditions in DU.15

The highest lead concentration in soil was reported for DU.15. Exposure to soils in DU.15 can potentially result in an unacceptable risk to child trespassers, based on the results of the BLL evaluation for a child trespasser under potential future site conditions. DU.15 is not currently considered accessible to child trespassers due to heavy vegetation, but changes in future site conditions within this DU (e.g., reduced vegetative cover, erosion) can potentially result in increased accessibility and exposure to concentrations of munitions constituents in this DU. The results of this health risk evaluation should be reevaluated in the event of future changes in site conditions in DU.15.

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Figures

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PIONEER TECHNOLOGIES CORPORATION

Antimony in Soil Sample Results
Pu'uloa Range Training Facility
O'ahu Hawai'i

Figure 1

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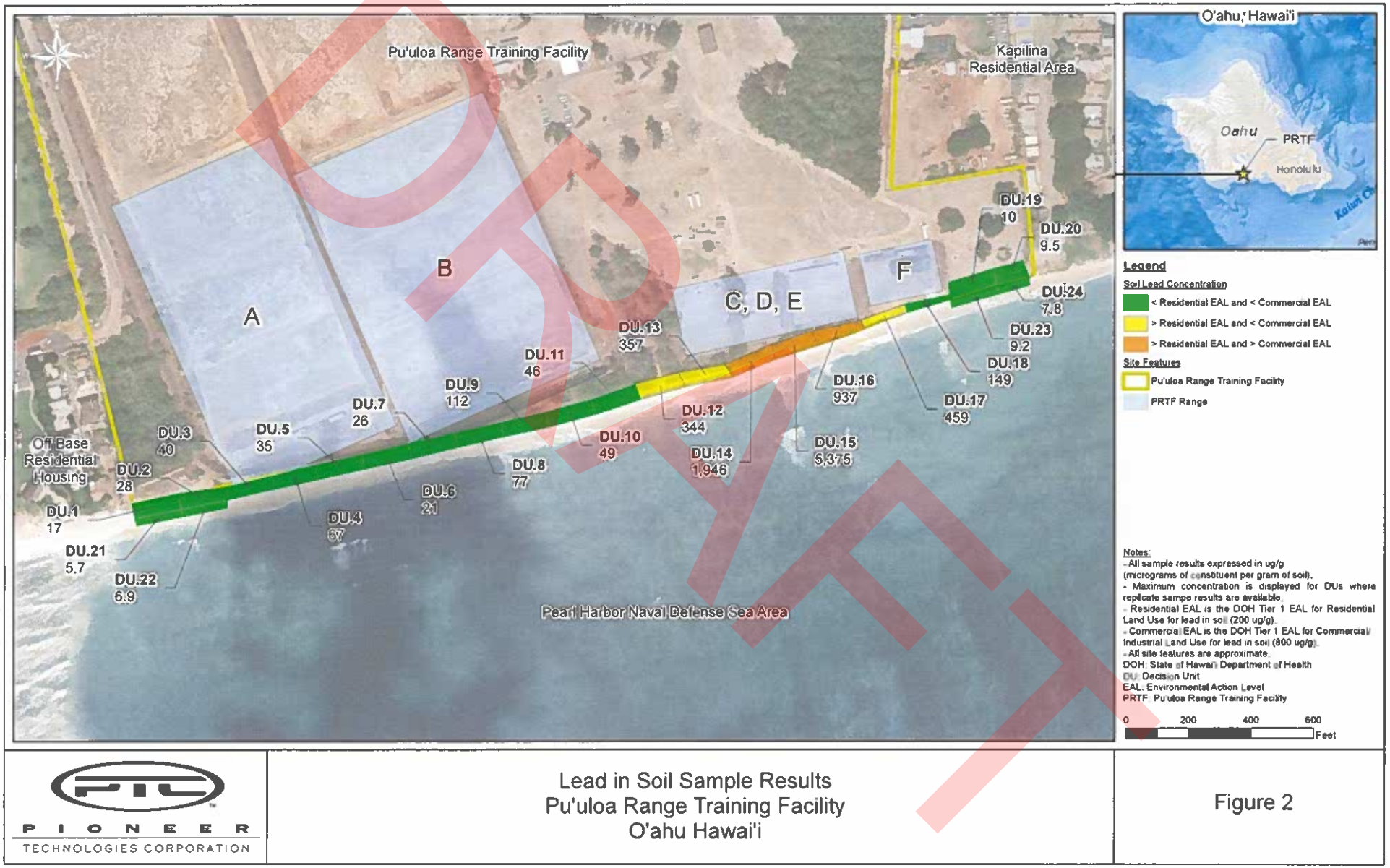

PIONEER TECHNOLOGIES CORPORATION

Lead in Soil Sample Results
Pu'uloa Range Training Facility
O'ahu Hawai'i

Figure 2

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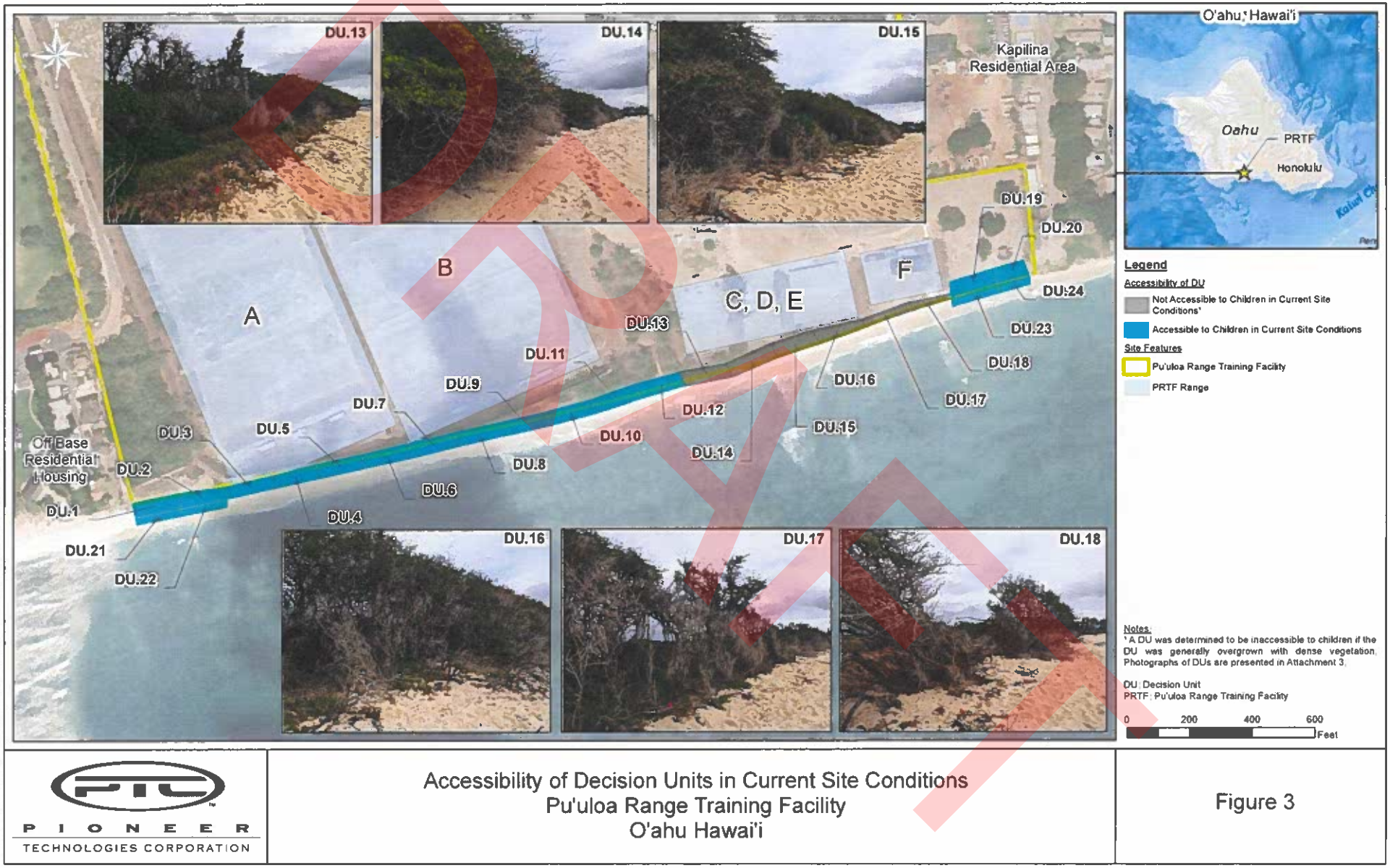

PIONEER TECHNOLOGIES CORPORATION

Accessibility of Decision Units in Current Site Conditions
Pu'uloa Range Training Facility
O'ahu Hawai'i

Figure 3

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Tables

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Table 1: Soil Sample Results

Decision Unit	Constituent Concentration in Soil (ug/g)		
	Antimony	Copper	Lead
DU.1[1]	0.19	2.5	17
DU.2	0.20	3.4	28
DU.3	0.16	5.8	40
DU.4	0.18	7.6	67
DU.5	0.17	4.3	35
DU.6	0.19	2.9	21
DU.7	0.11	4.9	26
DU.8	0.38	7.3	77
DU.9	0.71	10	112
DU.10	0.35	11	49
DU.11	0.23	7.1	46
DU.12	2.2	39	344
DU.13	2.5	31	357
DU.14	4.0	112	1,946
DU.15	47	138	5,375
DU.16	7.6	69	937
DU.17[1]	2.5	41	459
DU.18[1]	0.58	18	149
DU.19	0.086	2.9	10
DU.20[1]	0.074	4.2	9.5
DU.21[1]	0.064	1.6	5.7
DU.22	0.044	1.1	6.9
DU.23	0.25	1.9	9.2
DU.24[1]	0.064	2.0	7.8
Tier 1 DOH EAL Residential Land Use	6.3	630	200
Tier 1 DOH EAL Commercial/Industrial Land Use	82	2,500	800

Notes:

Constituent concentration exceeds Tier 1 DOH EAL for Residential (i.e., Unrestricted) Land Use

Constituent concentration exceeds Tier 1 DOH EAL Commercial/Industrial (i.e., Restricted) Land Use

[1] The maximum constituent concentration is shown where replicate sample results are available.

DOH: State of Hawai'i Department of Health

DU: Decision Unit

EAL: Environmental Action Level

ug/g: micrograms of constituent per gram of soil

Table 2: Weighted Lead Concentrations

Decision Unit	Weighted Lead Concentration (ug/g)
DU.1	21
DU.2	22
DU.3	24
DU.4	28
DU.5	23
DU.6	21
DU.7	22
DU.8	29
DU.9	34
DU.10	25
DU.11	25
DU.12[1]	67
DU.13[1]	69
DU.14[1]	296
DU.15[1]	786
DU.16[1]	152
DU.17[1]	84
DU.18[1]	40
DU.19	20
DU.20	20
DU.21	19
DU.22	19
DU.23	20
DU.24	19

Notes:

[1] The DU is not accessible to children in current site conditions. A DU was determined to be inaccessible to children if the DU was generally overgrown with dense vegetation (see Figure 3 and Attachment 3).

DU: Decision Unit

ug/g: micrograms of constituent per gram of soil

Attachment 1

Laboratory Analytical Results

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FOOD, WATER, SOIL & ENVIRONMENTAL TESTING & CONSULTING

3/25/2024

Case Narrative
Project: MCBH Soil
Project #: 240214-2677-012

Twenty-seven (27) soil samples received by FQLabs on 02/14/2024. The samples were collected on 02/14/24. The temperature of the cooler was 16.9 degrees Celsius upon receipt.
Nine (9) soil samples received on 02/15/24. The samples collected on 02/15/24. The temperature of the cooler was 1.0 degrees Celsius upon receipt.
The samples received on the two different dates were analyzed together for Total Metals (EPA 3051/6020B), per submitted by Marine Corps Base Chain of Custody, pH (SM 4500-H) was added on 02/26/24 @ 9:49 a.m.

The holding time and analytical criteria were met for the above mentioned.

Metals
Samples were digested and analyzed on 03/08/24 @ 18:25 and completed on 03/09 @ 04:45.
Initial calibration (03/08/24)- The RSD % for Copper (100%), Antimony (95.6%) and Lead (93.7%).
The linearity conditions for the multi-analyte methods were met as specified in EPA Method 6010D.

Please feel free to contact me if there are any questions.

Kind regards,

Tai Khan
Lab Director

FQ Labs

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Marine Corps Base Hawaii
Box 64122, Building 3B, Room 326
CAMP H.M. SMITH, HI, 96861-4211
Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/14/2024 @ 4:20 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 15.6 °C

Sample ID: 240214-2677-012-01 | **Soil Sample- Lab # 45** | **Decision Unit 1** | **Sampled: 2/14/2024 @ 2:13 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.84	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-02 | **Soil Sample- Lab # 46** | **Decision Unit 1 Duplicate** | **Sampled: 2/14/2024 @ 2:17 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.79	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-03 | **Soil Sample- Lab # 47** | **Decision Unit 1 Triplicate** | **Sampled: 2/14/2024 @ 2:20 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.91	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-04 | **Soil Sample- Lab # 48** | **Decision Unit 2** | **Sampled: 2/14/2024 @ 2:09 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.77	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-05 | **Soil Sample- Lab # 49** | **Decision Unit 3** | **Sampled: 2/14/2024 @ 2:50 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.58	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-06 | **Soil Sample- Lab # 50** | **Decision Unit 4** | **Sampled: 2/14/2024 @ 1:57 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.55	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-07 | **Soil Sample- Lab # 51** | **Decision Unit 5** | **Sampled: 2/14/2024 @ 2:31 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.76	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

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Received: 02/14/2024 @ 4:20 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 15.6 °C

Sample ID: 240214-2677-012-08 | **Soil Sample- Lab # 52 Decision Unit 6** | **Sampled: 2/14/2024 @ 1:55 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.80	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-09 | **Soil Sample- Lab # 53 Decision Unit 10** | **Sampled: 2/14/2024 @ 2:25 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.33	pH unit	0.10	EPA 9045 D	02/23/2024 3:28 PM	AA

Sample ID: 240214-2677-012-10 | **Soil Sample- Lab # 54 Decision Unit 14** | **Sampled: 2/14/2024 @ 2:54 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	7.84	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-11 | **Soil Sample- Lab # 55 Decision Unit 17** | **Sampled: 2/14/2024 @ 2:35 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.34	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-12 | **Soil Sample- Lab # 56 Decision Unit 17 Duplicate** | **Sampled: 2/14/2024 @ 2:40 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.40	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-13 | **Soil Sample- Lab # 57 Decision Unit 17 Triplicate** | **Sampled: 2/14/2024 @ 2:46 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.52	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-14 | **Soil Sample- Lab # 58 Decision Unit 18** | **Sampled: 2/14/2024 @ 2:57 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.64	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-15 | **Soil Sample- Lab # 59 Decision Unit 18 Duplicate** | **Sampled: 2/14/2024 @ 3:01 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.48	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

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Received: 02/14/2024 @ 4:20 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 20.2 °C

Sample ID: 240214-2677-012-16 | **Soil Sample- Lab # 60** Decision Unit 18 Triplicate | **Sampled: 2/14/2024 @ 3:03 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.60	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-17 | **Soil Sample- Lab # 61** Decision Unit 19 | **Sampled: 2/14/2024 @ 3:06 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.09	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-18 | **Soil Sample- Lab # 62** Decision Unit 20 | **Sampled: 2/14/2024 @ 3:09 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.75	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-19 | **Soil Sample- Lab # 63** Decision Unit 20 Duplicate | **Sampled: 2/14/2024 @ 3:12 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.65	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-20 | **Soil Sample- Lab # 64** Decision Unit 20 Triplicate | **Sampled: 2/14/2024 @ 3:14 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.68	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-21 | **Soil Sample- Lab # 65** Decision Unit 21 | **Sampled: 2/14/2024 @ 3:15 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.63	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-22 | **Soil Sample- Lab # 66** Decision Unit 21 Duplicate | **Sampled: 2/14/2024 @ 3:17 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.60	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-23 | **Soil Sample- Lab # 67** Decision Unit 21 Triplicate | **Sampled: 2/14/2024 @ 3:20 PM** | **Sampler: Katerine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.30	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

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Completed: 03/09/2024 @ 4:45 AM
Project Number: 240214-2677-012
Temperature: 16.9 °C

Sample ID: 240214-2677-012-24 | **Soil Sample- Lab # 68 Decision Unit 22** | **Sampled: 2/14/2024 @ 3:22 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.23	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-25 | **Soil Sample- Lab # 69 Decision Unit 24** | **Sampled: 2/14/2024 @ 3:25 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.17	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-26 | **Soil Sample- Lab # 70 Decision Unit 24 Duplicate** | **Sampled: 2/14/2024 @ 3:27 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.05	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240214-2677-012-27 | **Soil Sample- Lab # 71 Decision Unit 24 Triplicate** | **Sampled: 2/14/2024 @ 3:29 PM** | **Sampler: Katherine Smith**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	9.26	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Approved By: Imelda Q. Awarts
Tuesday, March 12, 2024

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Project Name: Soil Metal Testing
Project number: 240214-2677-012

Received: 02/14/24 @ 16:20
Completed: 03/09/24 @ 04:45

Sampler: Katherine Smith

ANALYTE	Results	Units	*RDL*	Test Method	Analyzed	By
Sample ID: Decision Unit 17, Total Metal. Lab #55					Sampled: 02/14/24 @ 14:35	
Copper	40.2	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:48:15 PM	FK
Antimony	1.75	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:48:15 PM	FK
Lead	326	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:48:15 PM	FK
Sample ID: Decision Unit 17 Dup, Total Metal. Lab #56					Sampled: 02/14/24 @ 14:40	
Copper	41.1	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:56:05 PM	FK
Antimony	2.07	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:56:05 PM	FK
Lead	299	mg/kg dry wt.	0.020	3051/6020B	3/8/2024 11:56:05 PM	FK
Sample ID: Decision Unit 17 Trip, Total Metal. Lab #57					Sampled: 02/14/24 @ 14:46	
Copper	37.3	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 12:01:55 AM	FK
Antimony	2.50	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 12:01:55 AM	FK
Lead	459	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 12:01:55 AM	FK
Sample ID: Decision Unit 18, Total Metal. Lab #58					Sampled: 02/14/24 @ 14:57	
Copper	17.6	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:05:42 AM	FK
Antimony	0.567	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:05:42 AM	FK
Lead	149	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:05:42 AM	FK
Sample ID: Decision Unit 18 Dup, Total Metal. Lab #59					Sampled: 02/14/24 @ 15:01	
Copper	13.9	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:10:53 AM	FK
Antimony	0.577	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:10:53 AM	FK
Lead	94.0	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:10:53 AM	FK
Sample ID: Decision Unit 18 Trip, Total Metal. Lab #60					Sampled: 02/14/24 @ 15:03	
Copper	15.9	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:15:40 AM	FK
Antimony	0.389	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:15:40 AM	FK
Lead	98.7	mg/kg dry wt.	0.010	3051/6020B	3/9/2024 12:15:40 AM	FK
Sample ID: Decision Unit 19, Total Metal. Lab #61					Sampled: 02/14/24 @ 15:06	
Copper	2.87	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:01:08 AM	FK
Antimony	0.086	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:01:08 AM	FK
Lead	10.5	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:01:08 AM	FK
Sample ID: Decision Unit 20 Total Metal. Lab #62					Sampled: 02/14/24 @ 15:09	
Copper	2.93	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:05:17 AM	FK
Antimony	0.063	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:05:17 AM	FK
Lead	9.46	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:05:17 AM	FK
Sample ID: Decision Unit 20 Dup, Total Metal. Lab #63					Sampled: 02/14/24 @ 15:12	
Copper	4.19	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:23:26 AM	FK
Antimony	0.074	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:23:26 AM	FK
Lead	8.63	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:23:26 AM	FK
Sample ID: Decision Unit 20 Trip, Total Metal. Lab #64					Sampled: 02/14/24 @ 15:14	
Copper	3.96	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:27:11 AM	FK
Antimony	0.068	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:27:11 AM	FK
Lead	9.32	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:27:11 AM	FK

NA = Not Applicable
ND = Not Detected
RDL=Reporting detection limit.

Approved by: .....
Date: 3/11/2024

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FOOD, WATER, SOIL & ENVIRONMENTAL TESTING & CONSULTING

Certificate of Analysis

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240214-2677-012

Received: 02/14/24 @ 16:20
Completed: 03/09/24 @ 04:45
Sampler: Katherine Smith

ANALYTE	Results	Units	*RDL*	Test Method	Analyzed	By
Sample ID: Decision Unit 21, Total Metal. Lab #65						Sampled: 02/14/24 @ 15:15
Copper	1.59	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Antimony	0.064	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Lead	5.75	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:30:57 AM	FK
Sample ID: Decision Unit 21 Dup, Total Metal. Lab #66						Sampled: 02/14/24 @ 15:17
Copper	1.45	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Antimony	0.061	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Lead	5.31	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:34:42 AM	FK
Sample ID: Decision Unit 21 Trip, Total Metal. Lab #67						Sampled: 02/14/24 @ 15:20
Copper	1.53	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Antimony	0.052	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Lead	5.36	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:38:28 AM	FK
Sample ID: Decision Unit 22, Total Metal. Lab #68						Sampled: 02/14/24 @ 15:22
Copper	1.15	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Antimony	0.044	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Lead	6.90	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:42:15 AM	FK
Sample ID: Decision Unit 24, Total Metal. Lab #69						Sampled: 02/14/24 @ 15:25
Copper	2.04	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Antimony	0.064	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Lead	7.79	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:46:01 AM	FK
Sample ID: Decision Unit 24 Dup, Total Metal. Lab #70						Sampled: 02/14/24 @ 15:27
Copper	1.96	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Antimony	0.051	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Lead	7.58	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 1:49:48 AM	FK
Sample ID: Decision Unit 24 Trip, Total Metal. Lab #71						Sampled: 02/14/24 @ 15:29
Copper	1.47	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK
Antimony	0.052	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK
Lead	7.50	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:14:02 AM	FK

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ND = Not Detected
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Approved by: .....
Date: 5/6/2024
Revised

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Certificate of Analysis

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240214-2677-012

Received: 02/14/24 @ 16:20
Completed: 03/09/24 @ 04:45
Sampler: Katherine Smith

ANALYTE	Results	Units	RDL	Test Method	Analyzed	By
Sample ID: Decision Unit 1, Total Metal. Lab #45					Sampled: 02/14/24 @ 14:13	
Copper	2.50	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 9:58:20 PM	FK
Antimony	0.190	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 9:58:20 PM	FK
Lead	16.5	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 9:58:20 PM	FK
Sample ID: Decision Unit 1 Dup, Total Metal. Lab #46					Sampled: 02/14/24 @ 14:17	
Copper	2.29	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:27:51 PM	FK
Antimony	0.192	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:27:51 PM	FK
Lead	16.9	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:27:51 PM	FK
Sample ID: Decision Unit 1 Trip, Total Metal. Lab #47					Sampled: 02/14/24 @ 14:20	
Copper	2.46	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:31:35 PM	FK
Antimony	0.158	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:31:35 PM	FK
Lead	14.8	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:31:35 PM	FK
Sample ID: Decision Unit 2, Total Metal. Lab #48					Sampled: 02/14/24 @ 14:09	
Copper	3.38	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:35:19 PM	FK
Antimony	0.203	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:35:19 PM	FK
Lead	28.2	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:35:19 PM	FK
Sample ID: Decision Unit 3, Total Metal. Lab #49					Sampled: 02/14/24 @ 14:50	
Copper	5.82	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:39:03 PM	FK
Antimony	0.162	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:39:03 PM	FK
Lead	40.3	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:39:03 PM	FK
Sample ID: Decision Unit 4, Total Metal. Lab #50					Sampled: 02/14/24 @ 13:57	
Copper	7.61	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:42:47 PM	FK
Antimony	0.178	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:42:47 PM	FK
Lead	66.9	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:42:47 PM	FK
Sample ID: Decision Unit 5, Total Metal. Lab #51					Sampled: 02/14/24 @ 14:31	
Copper	4.32	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:51:07 PM	FK
Antimony	0.166	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:51:07 PM	FK
Lead	35.0	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:51:07 PM	FK
Sample ID: Decision Unit 6, Total Metal. Lab #52					Sampled: 02/14/24 @ 13:55	
Copper	2.86	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:54:52 PM	FK
Antimony	0.188	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:54:52 PM	FK
Lead	21.3	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:54:52 PM	FK
Sample ID: Decision Unit 10, Total Metal. Lab #53					Sampled: 02/14/24 @ 14:25	
Copper	11.2	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:58:37 PM	FK
Antimony	0.348	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:58:37 PM	FK
Lead	49.0	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 10:58:37 PM	FK
Sample ID: Decision Unit 14, Total Metal. Lab #54					Sampled: 02/14/24 @ 14:54	
Copper	112	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 11:02:23 PM	FK
Antimony	4.04	mg/kg dry wt.	0.005	3051/6020B	3/8/2024 11:02:23 PM	FK
Lead	1946	mg/kg dry wt.	0.100	3051/6020B	3/8/2024 11:02:23 PM	FK

NA = Not Applicable
ND = Not Detected
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Approved by: .....
Date: 3/11/2024

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METAL QC

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing

Date Analyzed	3/8/2024 9:07:27 PM	*3/8/2024 9:11:16 PM*			*3/8/2024 9:18:49 PM*			3/8/2024 9:58:20 PM	3/9/2024 12:53:09 AM
ANALYTE	**Blank mg/L**	***RDL mg/L***	*RSD*	*% Recovery*	***LFB mg/L***	*RSD*	*% Recovery*	**Matrix Spikes (%Rec.)**	**Matrix Duplicates (RSD)**
Copper	<0.001	0.001	1.09	100	0.049	2.04	98.6	101	0.533
Antimony	<0.001	0.001	0.485	95.6	0.047	1.64	94.9	103	0.995
Lead	<0.001	0.001	1.33	93.7	0.049	1.08	98.5	100	1.08

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Marine Corps Base Hawaii
Box 64122, Building 3B, Room 326
CAMP H.M. SMITH, HI, 96861-4211
Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/15/2024 @ 2:00 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240215-2677-013
Temperature: 1.0 °C

Sample ID: 240215-2677-013-01 | **Soil Sample- Lab # 72** | **Decision Unit 7** | **Sampled: 2/15/2024 @ 12:30 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.66	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240215-2677-013-02 | **Soil Sample- Lab # 73** | **Decision Unit 11** | **Sampled: 2/15/2024 @ 12:32 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.11	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240215-2677-013-03 | **Soil Sample- Lab # 74** | **Decision Unit 13** | **Sampled: 2/15/2024 @ 12:35 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.41	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240215-2677-013-04 | **Soil Sample- Lab # 75** | **Decision Unit 16** | **Sampled: 2/15/2024 @ 12:40 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.17	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240215-2677-013-05 | **Soil Sample- Lab # 76** | **Decision Unit 15** | **Sampled: 2/15/2024 @ 12:47 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.42	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240215-2677-013-06 | **Soil Sample- Lab # 77** | **Decision Unit 12** | **Sampled: 2/15/2024 @ 12:55 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	8.13	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Sample ID: 240215-2677-013-07 | **Soil Sample- Lab # 78** | **Decision Unit 23** | **Sampled: 2/15/2024 @ 12:59 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed		By
Total Metals	See Attached						FK
pH	9.31	pH unit	0.10	EPA 9045 D	02/26/2024	9:06 AM	AA

Marine Corps Base Hawaii
Box 64122, Building 3B, Room 326
CAMP H.M. SMITH, HI, 96861-4211
Attn: Peter Evans
Project Name: Soil Metal Testing

CERTIFICATE OF ANALYSIS

Received: 02/15/2024 @ 2:00 PM
Completed: 03/09/2024 @ 4:45 AM
Project Number: 240215-2677-013
Temperature: 1.0 °C

Sample ID: 240215-2677-013-08 | **Soil Sample- Lab # 79 Decision Unit 8** | **Sampled: 2/15/2024 @ 1:06 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.71	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Sample ID: 240215-2677-013-09 | **Soil Sample- Lab # 80 Decision Unit 9** | **Sampled: 2/15/2024 @ 1:10 PM** | **Sampler: Patrick Crile**

Analysis	Results	Units	MDL	Test Method	Analyzed	By
Total Metals	See Attached					FK
pH	8.21	pH unit	0.10	EPA 9045 D	02/26/2024 9:06 AM	AA

Approved By: Imelda Q. Guarte
Tuesday, March 12, 2024

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Certificate of Analysis

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing
Project number: 240215-2677-013

Received: 02/15/24 @ 14:00
Completed: 03/09/24 @ 04:45

Sampler: Patrick Crile

ANALYTE	Results	Units	*RDL*	Test Method	Analyzed	By
Sample ID: Decision Unit 7, Total Metal. Lab #72						Sampled: 02/15/24 @ 12:30
Copper	4.94	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:21:41 AM	FK
Antimony	0.105	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:21:41 AM	FK
Lead	26.1	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:21:41 AM	FK
Sample ID: Decision Unit 11, Total Metal. Lab #73						Sampled: 02/15/24 @ 12:32
Copper	7.13	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:25:25 AM	FK
Antimony	0.233	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:25:25 AM	FK
Lead	46.4	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 2:25:25 AM	FK
Sample ID: Decision Unit 13, Total Metal. Lab #74						Sampled: 02/15/24 @ 12:35
Copper	30.7	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:43:28 AM	FK
Antimony	2.54	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:43:28 AM	FK
Lead	357	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:43:28 AM	FK
Sample ID: Decision Unit 16, Total Metal. Lab #75						Sampled: 02/15/24 @ 12:40
Copper	69.5	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:32:55 AM	FK
Antimony	7.60	mg/kg dry wt.	0.020	3051/6020B	3/9/2024 2:32:55 AM	FK
Lead	937	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 2:32:55 AM	FK
Sample ID: Decision Unit 15, Total Metal. Lab #76						Sampled: 02/14/24 @ 12:47
Copper	138	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 2:52:40 AM	FK
Antimony	46.5	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 2:52:40 AM	FK
Lead	5375	mg/kg dry wt.	1.00	3051/6020B	3/9/2024 2:52:40 AM	FK
Sample ID: Decision Unit 12, Total Metal. Lab #77						Sampled: 02/15/24 @ 12:55
Copper	39.3	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 3:14:15 AM	FK
Antimony	2.20	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 3:14:15 AM	FK
Lead	344	mg/kg dry wt.	0.050	3051/6020B	3/9/2024 3:14:15 AM	FK
Sample ID: Decision Unit 23, Total Metal. Lab #78						Sampled: 02/15/24 @ 12:59
Copper	1.94	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 3:43:38 AM	FK
Antimony	0.254	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 3:43:38 AM	FK
Lead	9.17	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 3:43:38 AM	FK
Sample ID: Decision Unit 8, Total Metal. Lab #79						Sampled: 02/15/24 @ 13:06
Copper	7.34	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:05:49 AM	FK
Antimony	0.382	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:05:49 AM	FK
Lead	76.5	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:05:49 AM	FK
Sample ID: Decision Unit 9, Total Metal. Lab #80						Sampled: 02/14/24 @ 13:10
Copper	10.2	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:12:54 AM	FK
Antimony	0.705	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:12:54 AM	FK
Lead	112	mg/kg dry wt.	0.005	3051/6020B	3/9/2024 4:12:54 AM	FK

NA = Not Applicable
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RDL=Reporting detection limit

Approved by: .....
Date: 3/11/2024

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METAL QC

Marine Corps Base Hi
P.O. Box 63002
Kaneohe, Hawaii 96863
Attn: Peter Evans
Project Name: Soil Metal Testing

Date Analyzed	3/8/2024 9:07:27 PM	*3/8/2024 9:11:16 PM*			*3/8/2024 9:18:49 PM*			3/8/2024 9:58:20 PM	3/9/2024 12:53:09 AM
ANALYTE	**Blank mg/L**	***RDL mg/L***	*RSD*	*% Recovery*	***LFB mg/L***	*RSD*	*% Recovery*	**Matrix Spikes (%Rec.)**	**Matrix Duplicates (RSD)**
Copper	<0.001	0.001	1.09	100	0.049	2.04	98.6	101	0.533
Antimony	<0.001	0.001	0.485	95.6	0.047	1.64	94.9	103	0.995
Lead	<0.001	0.001	1.33	93.7	0.049	1.08	98.5	100	1.08

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Honolulu, HI 96819

Invoice

Date	Invoice #
3/12/2024	30498

Bill To
Marine Corps Base Hawaii P.O. Box 63002 Kaneohe Bay, HI 96863 Attn: Peter Evans

P.O. No.	Terms	Contract #	Lab #
M0031824P0002	Due on receipt		45-80

Description	Qty	Rate	Amount
Project Name: Metals Testing-soil Notice of Award #: M0031824P0002			
Total Metals-- Cu, Pb, Sb (EPA Method 6020B)	36	210.00	7,560.00T
pH - in soil	36	50.00	1,800.00T
TAT: 10-15 working days			
CC handling fee is 3%			

Make Check Payable To:FQLabs

Subtotal	$9,360.00
Sales Tax (0.0%)	$0.00
Total	$9,360.00

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Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST

DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil

ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863

PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:

PROJECT MANAGER: Peter Evans PHONE NO: 808-4956748 FAX NO:

SAMPLER NAME: (Printed) KatherineSmith (Signature)

TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N = Normal

CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:

COOLER NO:

TEMPERATURE: 15.6C

REMARKS:

SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX: WATER	MATRIX: OTHER	CONTAINER: #	CONTAINER: TYPE	CONTAINER: GRAB/ COMP	Lead	Antimony	Copper					
45	2/14/24	1413	Decision Unit 1			1	soil		✓	✓	✓					
46	2/14/24	1417	Decision Unit 1 Duplicate			1	soil		✓	✓	✓					
47	2/14/24	1420	Decision Unit 1Triplicate			1	soil		✓	✓	✓					
48	2/14/24	1409	Decision Unit 2			1	soil		✓	✓	✓					
49	2/14/24	1450	Decision Unit 3			1	soil		✓	✓	✓					
50	2/14/24	1357	Decision Unit 4			1	soil		✓	✓	✓					
51	2/14/24	1431	Decision Unit 5			1	soil		✓	✓	✓					
52	2/14/24	1355	Decision Unit 6			1	soil		✓	✓	✓					
~~[illegible]~~	~~[illegible]~~		~~Decision Unit 7~~			1	soil		✓	✓	✓					
~~[illegible]~~	~~[illegible]~~		~~Decision Unit 8~~			1	soil		✓	✓	✓					

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
KatherineSmith	2/14/24	1525	MEL ANDRES	2/14/24	1520
Mel Andres	2/14/24	1620	[illegible]	2/14/24	1620
Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:

1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

FQLabs
3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST
DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil
ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863
PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:
PROJECT MANAGER: Peter Evans PHONE NO: 808-4985719 FAX NO:
SAMPLER NAME: (Printed) KatherineSmith (Signature)
TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal
CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:
COOLER NO:
TEMPERATURE: 16.9C
REMARKS:
SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX: WATER	MATRIX: OTHER	CONTAINER: #	CONTAINER: TYPE	CONTAINER: GRAB/ COMP	Lead	Antimony	Copper				
[illegible]	[illegible]		Decision Unit 9			1	soil		✓	✓	✓				
53	2/14/24	1425	Decision Unit 10			1	soil		✓	✓	✓				
[illegible]	2/14/24		Decision Unit 11			1	soil		✓	✓	✓				
[illegible]	2/14/24		Decision Unit 12			1	soil		✓	✓	✓				
[illegible]	[illegible]		Decision Unit 13			1	soil		✓	✓	✓				
54	2/14/24	1454	Decision Unit 14			1	soil		✓	✓	✓				
[illegible]	2/14/24		Decision Unit 15			1	soil		✓	✓	✓				
[illegible]	[illegible]		Decision Unit 16			1	soil		✓	✓	✓				
55	2/14/24	1435	Decision Unit 17			1	soil		✓	✓	✓				
56	2/14/24	1440	Decision Unit 17 Duplicate			1	soil		✓	✓	✓				

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
KatherineSmith	2/14/24	1530	MEL ANDRES	2/14/24	1530
Mel Andres	2/14/24	1620	[illegible]	2/14/24	1620
Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:
1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days
By _____ Date _____

FQLabs
3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST
DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil
ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863
PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:
PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:
SAMPLER NAME: (Printed) Katherine Smith (Signature)
TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal
CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:
COOLER NO:
TEMPERATURE: 20.7°C
REMARKS:
SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX WATER	MATRIX OTHER	CONTAINER #	CONTAINER TYPE	CONTAINER GRAB/ COMP	Lead	Antimony	Copper					
57	2/14/24	1446	Decision Unit 17 Triplicate			1	soil		✓	✓	✓					
58	2/14/24	1457	Decision Unit 18			1	soil		✓	✓	✓					
59	2/14/24	1501	Decision Unit 18 Duplicate			1	soil		✓	✓	✓					
60	2/14/24	1503	Decision Unit 18 Triplicate			1	soil		✓	✓	✓					
61	2/14/24	1506	Decision Unit 19			1	soil		✓	✓	✓					
62	2/14/24	1509	Decision Unit 20			1	soil		✓	✓	✓					
63	2/14/24	1512	Decision Unit 20 Duplicate			1	soil		✓	✓	✓					
64	2/14/24	1514	Decision Unit 20 Triplicate			1	soil		✓	✓	✓					
65	2/14/24	1515	Decision Unit 21			1	soil		✓	✓	✓					
66	2/14/24	1517	Decision Unit 21 Duplicate			1	soil		✓	✓	✓					

Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
Katherine Smith	2/14/24	1530	MEL ANDRES	2/14/24	1530
MEL ANDRES	2/14/24	1620	Prince Hong	2/14/24	1620
Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:
1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

FQLabs
3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST
DATE: 2/14/2024 PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil
ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863
PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:
PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:
SAMPLER NAME: (Printed) KatherineSmith (Signature)
TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal
CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:
COOLER NO:
TEMPERATURE: 16.9°C
REMARKS:
SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX WATER	MATRIX OTHER	CONTAINER #	CONTAINER TYPE	CONTAINER GRAB/ COMP	Lead	Antimony	Copper
67	2/14/24	1520	Decision Unit 21 Triplicate			1	soil		✓	✓	✓
68	2/14/24	1522	Decision Unit 22			1	soil		✓	✓	✓
	2/14/24		Decision Unit 23			1	soil		✓	✓	✓
69	2/14/24	1525	Decision Unit 24			1	soil		✓	✓	✓
70	2/14/24	1527	Decision Unit 24 Duplicate			1	soil		✓	✓	✓
71	2/14/24	1529	Decision Unit 24 Triplicate			1	soil		✓	✓	✓

Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date:	Time:
KatherineSmith	2/14/24	1530	MEL ANDRES	2/14/24	1530
Mel Andres	2/14/24	1620	[illegible]	2/14/24	1620
Relinquished By: (Signature and Printed Name)	Date:	Time:	Received By: (Signature and Printed Name)	Date	Time

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:
1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days
By _____ Date _____

FQLabs

3170-A Ualena St.
Honolulu, HI 96819
Tel: 808-839-9444 Fax: 808-839-9744

CHAIN OF CUSTODY AND ANALYSIS REQUEST

DATE: _____ PAGE _____ OF _____
CUSTOMER NO. _____ LAB NO. _____

CLIENT NAME: Marine Corps Base Hawaii EMAIL: peter.evans@usmc.mil

ADDRESS: P.O. Box 63002, Kaneohe Bay, HI 96863

PROJECT NAME: Soil Metal Testing PROJECT NO: P.O. NO:

PROJECT MANAGER: Peter Evans PHONE NO: 808-4965719 FAX NO:

SAMPLER NAME: (Printed) PATRICK CRILE (Signature)

TAT (Analytical Turn Around Time) 0 = Same day; 1 = 24 Hour; 2 = 48 Hour; (Etc.) N= Normal

CONTAINER TYPES: B = Brass, G = Glass, P = Plastic, V = VOA Vial, O = Other:

ANALYSES REQUESTED

AIRBILL NO:

COOLER NO:

TEMPERATURE: 1.0°C

REMARKS:

SAMPLE CONDITION/ COMMENTS:

LAB USE ONLY SAMPLE NO.	DATE SAMPLED	TIME SAMPLED	SAMPLE DESCRIPTION	MATRIX: WATER	MATRIX: OTHER	CONTAINER: #	CONTAINER: TYPE	CONTAINER: GRAB/ COMP	Lead	Antimony	Copper					
72	2/15/24	1230	Decision Unit 7		soil	1			✓	✓	✓					
73	2/15/24	1232	Decision Unit 11		soil	1			✓	✓	✓					
74	2/15/24	1235	Decision Unit 13		soil	1			✓	✓	✓					
75	2/15/24	1240	Decision Unit 16		soil	1			✓	✓	✓					
76	2/15/24	1247	Decision Unit 15		soil	1			✓	✓	✓					
77	2/15/24	1255	Decision Unit 12		soil	1			✓	✓	✓					
78	2/15/24	1259	Decision Unit 23		soil	1			✓	✓	✓					
MS 79	2/15/24	1306	Decision Unit 8		soil	1			✓	✓	✓					
MSD 80	2/15/24	1310	Decision Unit 9		soil	1			✓	✓	✓					

Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
PATRICK CRILE	2/15	1311	MEL ANDRES	2/15/24	1311
MEL ANDRES	2/15/24	1400		2/15/24	1400
Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time

SPECIAL INSTRUCTIONS:

SAMPLE DISPOSITION:

1. Samples returned to client? YES NO
2. Samples will not be stored over 30 days, unless additional storage time is requested.
3. Storage time requested: _____ days

By _____ Date _____

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Attachment 2

USEPA RSL Calculator and
Lead Model Inputs and Outputs

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RSL Calculator Inputs / Outputs

Decision Unit 15

Soil Antimony Concentration: 47 ug/g

Soil Lead Concentration: 5,375 ug/g

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Variable	Recreator Soil Default Value	Site-Specific Value	Variable	Recreator Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302	$ED_{6\text{-}16}$ (exposure duration) year	10	10
A (VF Dispersion Constant)	11.911	11.911	$ED_{16\text{-}26}$ (exposure duration) year	10	10
A (VF Dispersion Constant - mass limit)	11.911	11.911	$ED_{rec\text{-}c}$ (exposure duration - child) years	6	6
B (PEF Dispersion Constant)	18.7762	18.7762	EF_{rec} (exposure frequency) days/year	0	52
B (VF Dispersion Constant)	18.4385	18.4385	$EF_{0\text{-}2}$ (exposure frequency) days/year	0	52
B (VF Dispersion Constant - mass limit)	18.4385	18.4385	$EF_{2\text{-}6}$ (exposure frequency) days/year	0	52
City (PEF Climate Zone) Selection	Default	Default	$EF_{6\text{-}16}$ (exposure frequency) days/year	0	52
City (VF Climate Zone) Selection	Default	Default	$EF_{16\text{-}26}$ (exposure frequency) days/year	0	52
C (PEF Dispersion Constant)	216.108	216.108	$EF_{rec\text{-}a}$ (exposure frequency - adult) days/year	0	52
C (VF Dispersion Constant)	209.7845	209.7845	$EF_{rec\text{-}c}$ (exposure frequency - child) days/year	0	52
C (VF Dispersion Constant - mass limit)	209.7845	209.7845	ET_{rec} (exposure time - recreator) hours/day	0	8
foc (fraction organic carbon in soil) g/g	0.006	0.006	$ET_{0\text{-}2}$ (exposure time) hours/day	0	8
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194	$ET_{2\text{-}6}$ (exposure time) hours/day	0	8
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396	$ET_{6\text{-}16}$ (exposure time) hours/day	0	8
p_b (dry soil bulk density) g/cm^3	1.5	1.5	$ET_{16\text{-}26}$ (exposure time) hours/day	0	8
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5	$ET_{rec\text{-}a}$ (adult exposure time) hours/day	0	8
PEF (particulate emission factor) m^3/kg	1359344438	1.36E+09	$ET_{rec\text{-}c}$ (child exposure time) hours/day	0	8
p_s (soil particle density) g/cm^3	2.65	2.65	THQ (target hazard quotient) unitless	0.1	1
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77	$IFS_{rec\text{-}adj}$ (age-adjusted soil ingestion factor) mg/kg	0	2054
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18	$IFSM_{rec\text{-}adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	0	9654.667
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18	$IRS_{0\text{-}2}$ (soil intake rate) mg/day	0	80
A_s (PEF acres)	0.5	0.5	$IRS_{2\text{-}6}$ (soil intake rate) mg/day	0	80
A_s (VF acres)	0.5	0.5	$IRS_{6\text{-}16}$ (soil intake rate) mg/day	0	30
A_s (VF mass-limit acres)	0.5	0.5	$IRS_{16\text{-}26}$ (soil intake rate) mg/day	0	30
$AF_{0\text{-}2}$ (skin adherence factor) mg/cm^2	0	0.2	$IRS_{rec\text{-}a}$ (soil intake rate - adult) mg/day	0	30
$AF_{2\text{-}6}$ (skin adherence factor) mg/cm^2	0	0.2	$IRS_{rec\text{-}c}$ (soil intake rate - child) mg/day	0	80
$AF_{6\text{-}16}$ (skin adherence factor) mg/cm^2	0	0.07	LT (lifetime - recreator) years	70	70
$AF_{16\text{-}26}$ (skin adherence factor) mg/cm^2	0	0.07	$SA_{0\text{-}2}$ (skin surface area) cm^2/day	0	2373
$AF_{rec\text{-}a}$ (skin adherence factor - adult) mg/cm^2	0	0.07	$SA_{2\text{-}6}$ (skin surface area) cm^2/day	0	2373
$AF_{rec\text{-}c}$ (skin adherence factor - child) mg/cm^2	0	0.2	$SA_{6\text{-}16}$ (skin surface area) cm^2/day	0	6032
AT_{rec} (averaging time)	365	365	$SA_{16\text{-}26}$ (skin surface area) cm^2/day	0	6032
$BW_{0\text{-}2}$ (body weight) kg	15	15	$SA_{rec\text{-}a}$ (skin surface area - adult) cm^2/day	0	6032
$BW_{2\text{-}6}$ (body weight) kg	15	15	$SA_{rec\text{-}c}$ (skin surface area - child) cm^2/day	0	2373
$BW_{6\text{-}16}$ (body weight) kg	80	80	TR (target risk) unitless	0.000001	0.000001
$BW_{16\text{-}26}$ (body weight) kg	80	80	T_w (groundwater temperature) Celsius	25	25
$BW_{rec\text{-}a}$ (body weight - adult) kg	80	80	$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$BW_{rec\text{-}c}$ (body weight - child) kg	15	15	$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
$DFS_{rec\text{-}adj}$ (age-adjusted soil dermal factor) mg/kg	0	15360.8	T (exposure interval) s	819936000	8.2E+08
$DFSM_{rec\text{-}adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	0	63627.2	T (exposure interval) yr	26	26
ED_{rec} (exposure duration - recreator) years	26	26	U_m (mean annual wind speed) m/s	4.69	4.69
$ED_{0\text{-}2}$ (exposure duration) year	2	2	U_t (equivalent threshold value)	11.32	11.32
$ED_{2\text{-}6}$ (exposure duration) year	4	4	V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 15MAY2024:18:38:28

Site-specific **Recreator Risk for Soil** Output generated 15MAY2024:18:38:28

Chemical	SF_o(mg/kg-day)$^{-1}$	SF_oRef	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS
Antimony (metallic)	-		-		4.00E-04	I	3.00E-04	A	1.50E-01	-
Lead and Compounds	-		-		-		-		1.00E+00	-
*Total Risk/HI	-		-		-		-		-	-

Chemical	RBA	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref
Antimony (metallic)	1.00E+00	-	-	-	4.50E+01	-	-		1.91E+03	PHYSPROP
Lead and Compounds	1.00E+00	-	-	-	9.00E+02	-	-		2.02E+03	CRC
*Total Risk/HI	-	-	-	-	-	-	-		-	

Chemical	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor UnlimitedReservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)
Antimony (metallic)	5.07E+03	YAWS	INORGANIC	-	-	-	1.36E+09	-	-	-
Lead and Compounds	5.40E+03	YAWS	INORGANIC	-	-	-	1.36E+09	-	-	-
*Total Risk/HI	-			-	-	-	-	-	-	-

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcinogenic Risk
Antimony (metallic)	47	-	-	-	-
Lead and Compounds	5,380	-	-	-	-
*Total Risk/HI	-	-	-	-	-

Chemical	Ingestion Child HQ	Dermal Child HQ	Inhalation Child HQ	Noncarcinogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarcinogenic Adult HI
Antimony (metallic)	8.93E-02	-	5.47E-06	8.93E-02	6.28E-03	-	5.47E-06	6.28E-03
Lead and Compounds	-	-	-	-	-	-	-	-
*Total Risk/HI	*8.93E-02*	-	*5.47E-06*	*8.93E-02*	*6.28E-03*	-	*5.47E-06*	*6.28E-03*

RSL Calculator Inputs / Outputs

Decision Unit 12

Soil Antimony Concentration: 2.2 ug/g

Soil Lead Concentration: 344 ug/g

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Variable	Recreator Soil Default Value	Site-Specific Value	Variable	Recreator Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302	$ED_{6\text{-}16}$ (exposure duration) year	10	10
A (VF Dispersion Constant)	11.911	11.911	$ED_{16\text{-}26}$ (exposure duration) year	10	10
A (VF Dispersion Constant - mass limit)	11.911	11.911	$ED_{rec\text{-}c}$ (exposure duration - child) years	6	6
B (PEF Dispersion Constant)	18.7762	18.7762	EF_{rec} (exposure frequency) days/year	0	52
B (VF Dispersion Constant)	18.4385	18.4385	$EF_{0\text{-}2}$ (exposure frequency) days/year	0	52
B (VF Dispersion Constant - mass limit)	18.4385	18.4385	$EF_{2\text{-}6}$ (exposure frequency) days/year	0	52
City (PEF Climate Zone) Selection	Default	Default	$EF_{6\text{-}16}$ (exposure frequency) days/year	0	52
City (VF Climate Zone) Selection	Default	Default	$EF_{16\text{-}26}$ (exposure frequency) days/year	0	52
C (PEF Dispersion Constant)	216.108	216.108	$EF_{rec\text{-}a}$ (exposure frequency - adult) days/year	0	52
C (VF Dispersion Constant)	209.7845	209.7845	$EF_{rec\text{-}c}$ (exposure frequency - child) days/year	0	52
C (VF Dispersion Constant - mass limit)	209.7845	209.7845	ET_{rec} (exposure time - recreator) hours/day	0	8
foc (fraction organic carbon in soil) g/g	0.006	0.006	$ET_{0\text{-}2}$ (exposure time) hours/day	0	8
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194	$ET_{2\text{-}6}$ (exposure time) hours/day	0	8
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396	$ET_{6\text{-}16}$ (exposure time) hours/day	0	8
p_b (dry soil bulk density) g/cm^3	1.5	1.5	$ET_{16\text{-}26}$ (exposure time) hours/day	0	8
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5	$ET_{rec\text{-}a}$ (adult exposure time) hours/day	0	8
PEF (particulate emission factor) m^3/kg	1359344438	1.36E+09	$ET_{rec\text{-}c}$ (child exposure time) hours/day	0	8
p_s (soil particle density) g/cm^3	2.65	2.65	THQ (target hazard quotient) unitless	0.1	1
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77	$IFS_{rec\text{-}adj}$ (age-adjusted soil ingestion factor) mg/kg	0	2054
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18	$IFSM_{rec\text{-}adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	0	9654.667
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18	$IRS_{0\text{-}2}$ (soil intake rate) mg/day	0	80
A_s (PEF acres)	0.5	0.5	$IRS_{2\text{-}6}$ (soil intake rate) mg/day	0	80
A_s (VF acres)	0.5	0.5	$IRS_{6\text{-}16}$ (soil intake rate) mg/day	0	30
A_s (VF mass-limit acres)	0.5	0.5	$IRS_{16\text{-}26}$ (soil intake rate) mg/day	0	30
$AF_{0\text{-}2}$ (skin adherence factor) mg/cm^2	0	0.2	$IRS_{rec\text{-}a}$ (soil intake rate - adult) mg/day	0	30
$AF_{2\text{-}6}$ (skin adherence factor) mg/cm^2	0	0.2	$IRS_{rec\text{-}c}$ (soil intake rate - child) mg/day	0	80
$AF_{6\text{-}16}$ (skin adherence factor) mg/cm^2	0	0.07	LT (lifetime - recreator) years	70	70
$AF_{16\text{-}26}$ (skin adherence factor) mg/cm^2	0	0.07	$SA_{0\text{-}2}$ (skin surface area) cm^2/day	0	2373
$AF_{rec\text{-}a}$ (skin adherence factor - adult) mg/cm^2	0	0.07	$SA_{2\text{-}6}$ (skin surface area) cm^2/day	0	2373
$AF_{rec\text{-}c}$ (skin adherence factor - child) mg/cm^2	0	0.2	$SA_{6\text{-}16}$ (skin surface area) cm^2/day	0	6032
AT_{rec} (averaging time)	365	365	$SA_{16\text{-}26}$ (skin surface area) cm^2/day	0	6032
$BW_{0\text{-}2}$ (body weight) kg	15	15	$SA_{rec\text{-}a}$ (skin surface area - adult) cm^2/day	0	6032
$BW_{2\text{-}6}$ (body weight) kg	15	15	$SA_{rec\text{-}c}$ (skin surface area - child) cm^2/day	0	2373
$BW_{6\text{-}16}$ (body weight) kg	80	80	TR (target risk) unitless	0.000001	0.000001
$BW_{16\text{-}26}$ (body weight) kg	80	80	T_w (groundwater temperature) Celsius	25	25
$BW_{rec\text{-}a}$ (body weight - adult) kg	80	80	$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$BW_{rec\text{-}c}$ (body weight - child) kg	15	15	$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
$DFS_{rec\text{-}adj}$ (age-adjusted soil dermal factor) mg/kg	0	15360.8	T (exposure interval) s	819936000	8.2E+08
$DFSM_{rec\text{-}adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	0	63627.2	T (exposure interval) yr	26	26
ED_{rec} (exposure duration - recreator) years	26	26	U_m (mean annual wind speed) m/s	4.69	4.69
$ED_{0\text{-}2}$ (exposure duration) year	2	2	U_t (equivalent threshold value)	11.32	11.32
$ED_{2\text{-}6}$ (exposure duration) year	4	4	V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 23MAY2024:16:18:14

Site-specific **Recreator Risk for Soil** Output generated 23MAY2024:16:18:14

Chemical	SF_o(mg/kg-day)$^{-1}$	SF_oRef	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS
Antimony (metallic)	-		-		4.00E-04	I	3.00E-04	A	1.50E-01	-
Lead and Compounds	-		-		-		-		1.00E+00	-
*Total Risk/HI	-		-		-		-		-	-

Chemical	RBA	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref
Antimony (metallic)	1.00E+00	-	-	-	4.50E+01	-	-		1.91E+03	PHYSPROP
Lead and Compounds	1.00E+00	-	-	-	9.00E+02	-	-		2.02E+03	CRC
*Total Risk/HI	-	-	-	-	-	-	-		-	

Chemical	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor UnlimitedReservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)
Antimony (metallic)	5.07E+03	YAWS	INORGANIC	-	-	-	1.36E+09	-	-	-
Lead and Compounds	5.40E+03	YAWS	INORGANIC	-	-	-	1.36E+09	-	-	-
*Total Risk/HI	-			-	-	-	-	-	-	-

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcinogenic Risk
Antimony (metallic)	2.2	-	-	-	-
Lead and Compounds	344	-	-	-	-
*Total Risk/HI	-	-	-	-	-

Chemical	Ingestion Child HQ	Dermal Child HQ	Inhalation Child HQ	Noncarcinogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarcinogenic Adult HI
Antimony (metallic)	4.18E-03	-	2.56E-07	4.18E-03	2.94E-04	-	2.56E-07	2.94E-04
Lead and Compounds	-	-	-	-	-	-	-	-
*Total Risk/HI	*4.18E-03*	-	*2.56E-07*	*4.18E-03*	*2.94E-04*	-	*2.56E-07*	*2.94E-04*

IEUBK Model Inputs / Outputs

Decision Unit 12

Weighted Soil Lead Concentration: 67 ug/g

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LEAD MODEL FOR WINDOWS Version 2.0

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==========

Model Version: 2.0 Build1
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Month	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
6-12	1.000	3.216	32.000	0.100
12-24	2.000	4.970	32.000	0.100
24-36	3.000	6.086	32.000	0.100
36-48	4.000	6.954	32.000	0.100
48-60	4.000	7.682	32.000	0.100
60-72	4.000	8.318	32.000	0.100
72-84	4.000	8.887	32.000	0.100

****** Diet ******

Month	Diet Intake(µg/day)
6-12	2.660
12-24	5.030
24-36	5.210
36-48	5.380
48-60	5.640
60-72	6.040
72-84	5.950

****** Drinking Water ******

Water Consumption:

Month	Water (L/day)
6-12	0.400
12-24	0.430
24-36	0.510
36-48	0.540
48-60	0.570
60-72	0.600
72-84	0.630

Drinking Water Concentration: 0.900 µg Pb/L

****** Soil & Dust ******

Month	Soil (µg Pb/g)	House Dust (µg Pb/g)
6-12	67.000	21.300
12-24	67.000	21.300
24-36	67.000	21.300
36-48	67.000	21.300
48-60	67.000	21.300
60-72	67.000	21.300
72-84	67.000	21.300

****** Alternate Intake ******

Month	Alternate (µg Pb/day)
6-12	0.000
12-24	0.000
24-36	0.000
36-48	0.000
48-60	0.000
60-72	0.000
72-84	0.000

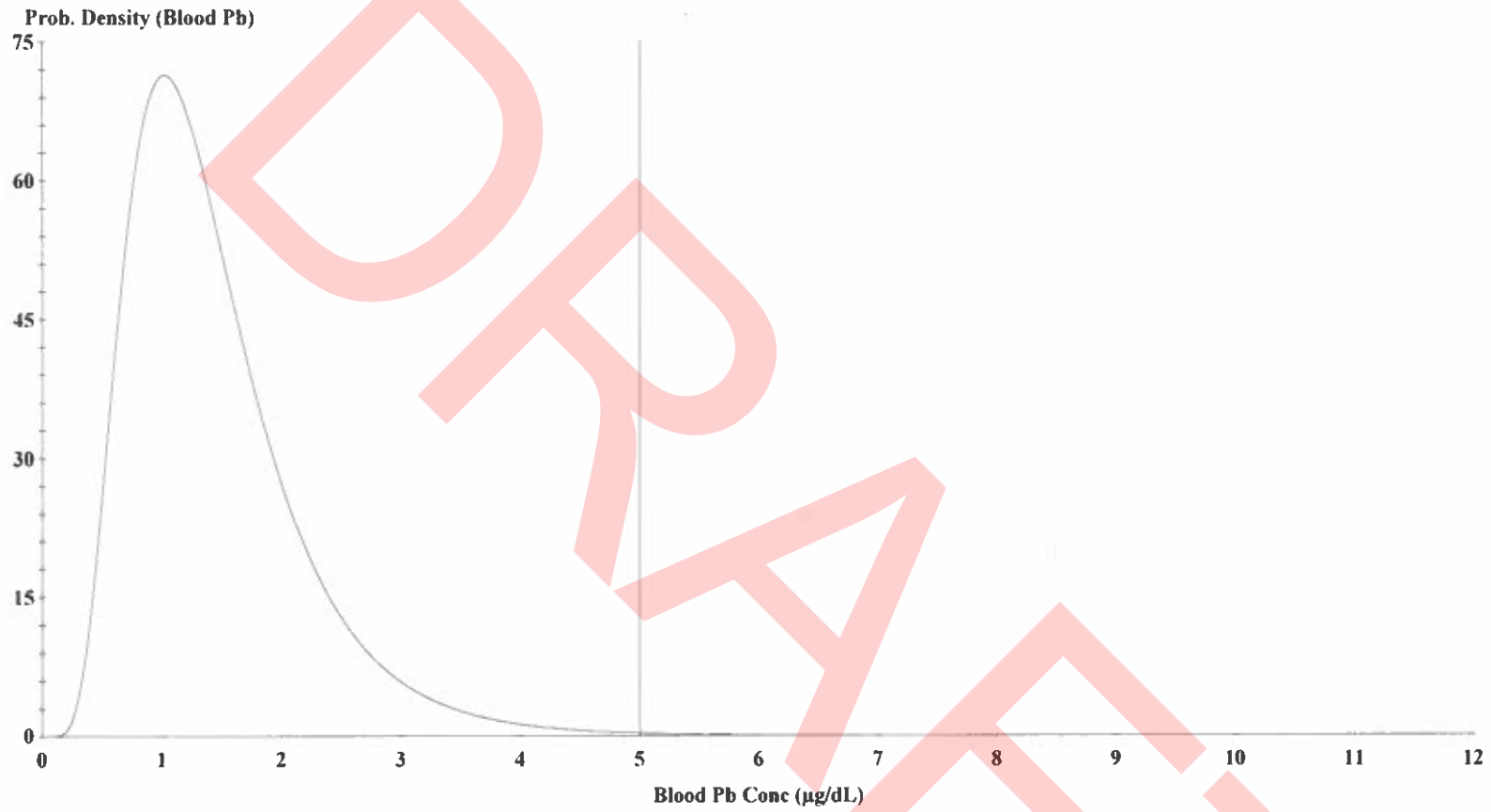
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 0.540 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Month	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
6-12	0.034	1.293	0.000	0.175
12-24	0.057	2.434	0.000	0.187
24-36	0.075	2.537	0.000	0.224
36-48	0.093	2.629	0.000	0.237
48-60	0.102	2.762	0.000	0.251
60-72	0.111	2.964	0.000	0.265
72-84	0.118	2.924	0.000	0.279

Month	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
6-12	1.050	2.551	1.4
12-24	1.143	3.821	1.6
24-36	0.820	3.655	1.4
36-48	0.773	3.732	1.3
48-60	0.824	3.939	1.3
60-72	0.641	3.981	1.2
72-84	0.679	4.000	1.1



Cutoff = 5.000 µg/dl
Geo Mean = 1.325
GSD = 1.600
% Above = 0.237
% Below = 99.763

Age Range = 6 to 84 months

Run Mode = Research

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Potential Future Site Conditions Scenario

IEUBK Model Inputs / Outputs

Decision Unit 15

Weighted Soil Lead Concentration: 786 ug/g

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==========

Model Version: 2.0 Build1
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Month	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
6-12	1.000	3.216	32.000	0.100
12-24	2.000	4.970	32.000	0.100
24-36	3.000	6.086	32.000	0.100
36-48	4.000	6.954	32.000	0.100
48-60	4.000	7.682	32.000	0.100
60-72	4.000	8.318	32.000	0.100
72-84	4.000	8.887	32.000	0.100

****** Diet ******

Month	Diet Intake(µg/day)
6-12	2.660
12-24	5.030
24-36	5.210
36-48	5.380
48-60	5.640
60-72	6.040
72-84	5.950

****** Drinking Water ******

Water Consumption:

Month	Water (L/day)
6-12	0.400
12-24	0.430
24-36	0.510
36-48	0.540
48-60	0.570
60-72	0.600
72-84	0.630

Drinking Water Concentration: 0.900 µg Pb/L

****** Soil & Dust ******

Month	Soil (µg Pb/g)	House Dust (µg Pb/g)
6-12	786.000	21.300
12-24	786.000	21.300
24-36	786.000	21.300
36-48	786.000	21.300
48-60	786.000	21.300
60-72	786.000	21.300
72-84	786.000	21.300

****** Alternate Intake ******

Month	Alternate (µg Pb/day)
6-12	0.000
12-24	0.000
24-36	0.000
36-48	0.000
48-60	0.000
60-72	0.000
72-84	0.000

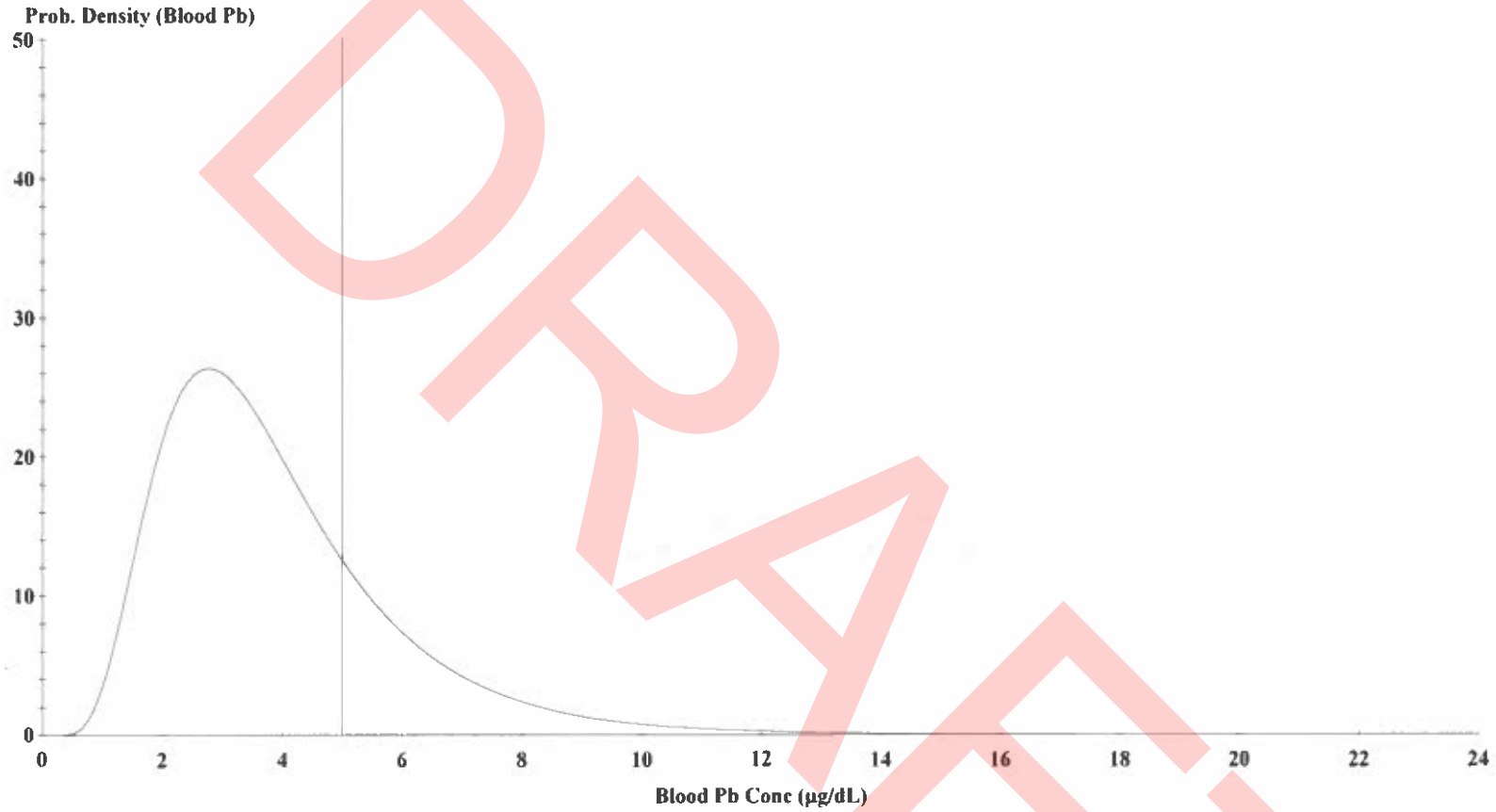
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 0.540 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Month	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
6-12	0.034	1.189	0.000	0.161
12-24	0.057	2.267	0.000	0.174
24-36	0.075	2.427	0.000	0.214
36-48	0.093	2.536	0.000	0.229
48-60	0.102	2.671	0.000	0.243
60-72	0.111	2.896	0.000	0.259
72-84	0.118	2.859	0.000	0.272

Month	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
6-12	8.425	9.808	5.2
12-24	9.290	11.788	5.0
24-36	6.843	9.559	3.8
36-48	6.511	9.368	3.3
48-60	6.958	9.974	3.2
60-72	5.467	8.733	2.8
72-84	5.794	9.044	2.6



Cutoff = 5.000 µg/dl
Geo Mean = 3.592
GSD = 1.600
% Above = 24.084
% Below = 75.916

Age Range = 6 to 84 months

Run Mode = Research

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Potential Future Site Conditions Scenario

IEUBK Model Inputs / Outputs

Decision Unit 14

Weighted Soil Lead Concentration: 296 ug/g

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==========

Model Version: 2.0 Build1
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Month	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
6-12	1.000	3.216	32.000	0.100
12-24	2.000	4.970	32.000	0.100
24-36	3.000	6.086	32.000	0.100
36-48	4.000	6.954	32.000	0.100
48-60	4.000	7.682	32.000	0.100
60-72	4.000	8.318	32.000	0.100
72-84	4.000	8.887	32.000	0.100

****** Diet ******

Month	Diet Intake(µg/day)
6-12	2.660
12-24	5.030
24-36	5.210
36-48	5.380
48-60	5.640
60-72	6.040
72-84	5.950

****** Drinking Water ******

Water Consumption:

Month	Water (L/day)
6-12	0.400
12-24	0.430
24-36	0.510
36-48	0.540
48-60	0.570
60-72	0.600
72-84	0.630

Drinking Water Concentration: 0.900 µg Pb/L

****** Soil & Dust ******

Month	Soil (µg Pb/g)	House Dust (µg Pb/g)
6-12	296.000	21.300
12-24	296.000	21.300
24-36	296.000	21.300
36-48	296.000	21.300
48-60	296.000	21.300
60-72	296.000	21.300
72-84	296.000	21.300

****** Alternate Intake ******

Month	Alternate (µg Pb/day)
6-12	0.000
12-24	0.000
24-36	0.000
36-48	0.000
48-60	0.000
60-72	0.000
72-84	0.000

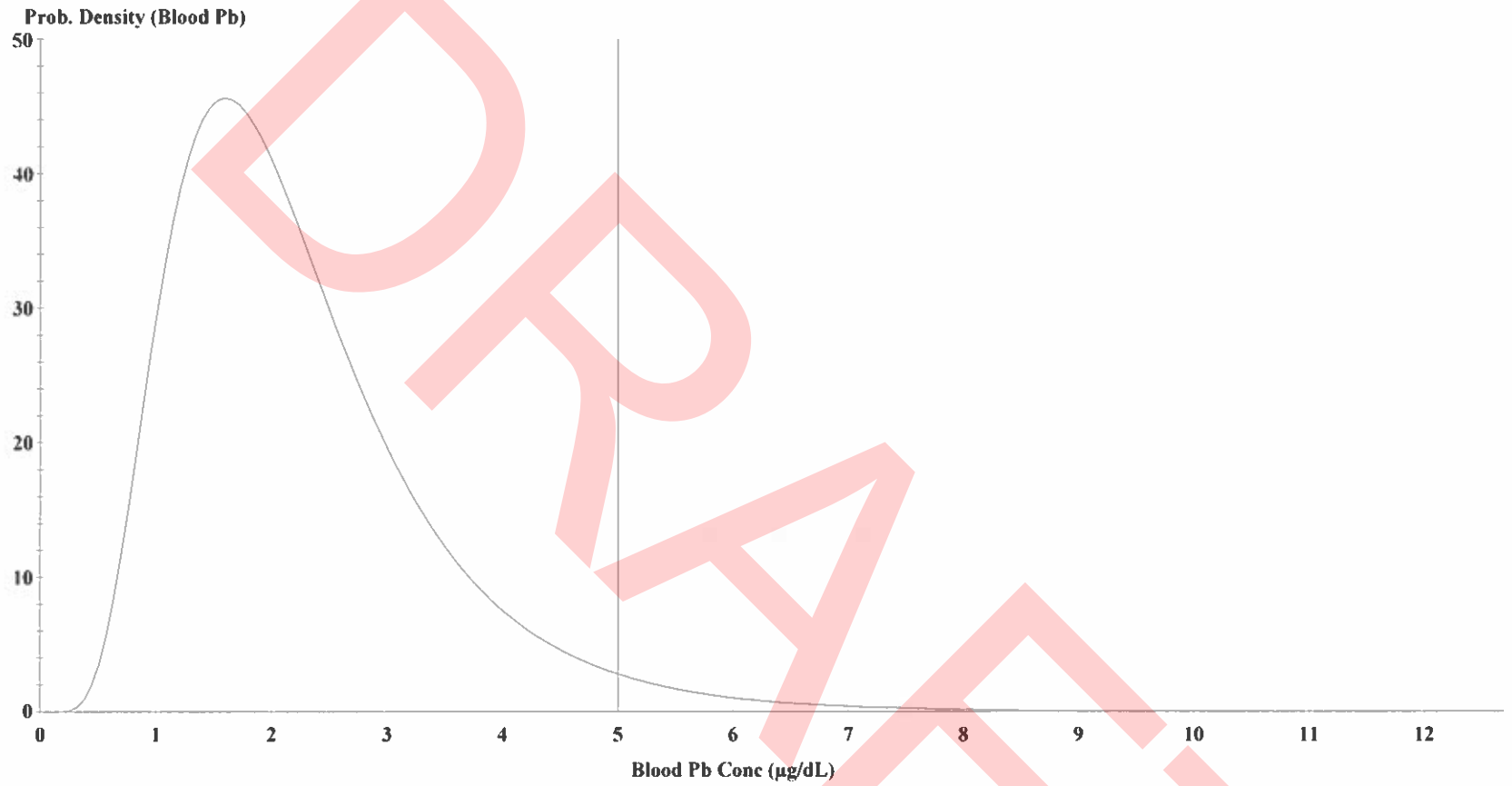
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 0.540 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Month	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
6-12	0.034	1.257	0.000	0.170
12-24	0.057	2.378	0.000	0.183
24-36	0.075	2.501	0.000	0.220
36-48	0.093	2.598	0.000	0.235
48-60	0.102	2.732	0.000	0.249
60-72	0.111	2.942	0.000	0.263
72-84	0.118	2.903	0.000	0.277

Month	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
6-12	3.534	4.995	2.7
12-24	3.863	6.481	2.7
24-36	2.796	5.592	2.2
36-48	2.646	5.571	2.0
48-60	2.822	5.905	1.9
60-72	2.202	5.518	1.8
72-84	2.333	5.632	1.6



Cutoff = 5.000 µg/dl
Geo Mean = 2.076
GSD = 1.600
% Above = 3.075
% Below = 96.925

Age Range = 6 to 84 months

Run Mode = Research

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ALM Model Inputs / Outputs

Decision Units 15 and 14

Weighted Lead Concentrations: 786 and 296 ug/g

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Attachment 3

Photographs of Decision Units

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Calculations of Blood Lead Concentrations (PbBs) and Risk in Nonresidential Areas
U.S. EPA Technical Review Workgroup for Lead

Version date 06/14/2017

			Decision Unit	
			DU.15	DU.14
Variable	**Description of Variable**	**Units**	**GSDi and PbBo from Analysis of NHANES 2009-2014**	**GSDi and PbBo from Analysis of NHANES 2009-2014**
PbS	Soil lead concentration	µg/g or ppm	786	296
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	0.6	0.6
IR_S	Soil ingestion rate	g/day	0.030	0.030
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S,D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S,D}$	Exposure frequency (same for soil and dust)	days/yr	365	365
$AT_{S,D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.7**	**1.03**
$PbB_{fetal,0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	4.1	2.4
PbB_t	Target PbB level of concern (e.g., 2-8 ug/dL)	µg/dL	**5.0**	**5.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB exceeds target PbB, assuming lognormal distribution**	**%**	**2.4%**	**0.20%**

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Calculations of Preliminary Remediation Goals (PRGs) for Soil in Nonresidential Areas
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 06/14/2017

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 2009-2014
$PbB_{fetal,\ 0.95}$	Target PbB in fetus (e.g., 2-8 µg/dL)	µg/dL	5
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	0.6
IR_S	Soil ingestion rate	g/day	0.030
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days/yr	52
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days/yr	365
PRG in Soil for no more than 5% probability that fetal PbB exceeds target PbB		**ppm**	**7,373**

Photographs of Individual Decision Units

The following photographs were captured in February and March 2024,
during the soil sampling activities conducted by the
Marine Corps Base Hawai'i (MCBH)
Environmental Compliance Protection Division.
The photographs present each individual Decision Unit (DU).

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Photo 1: Decision Unit 1

Photo 2: Decision Unit 2

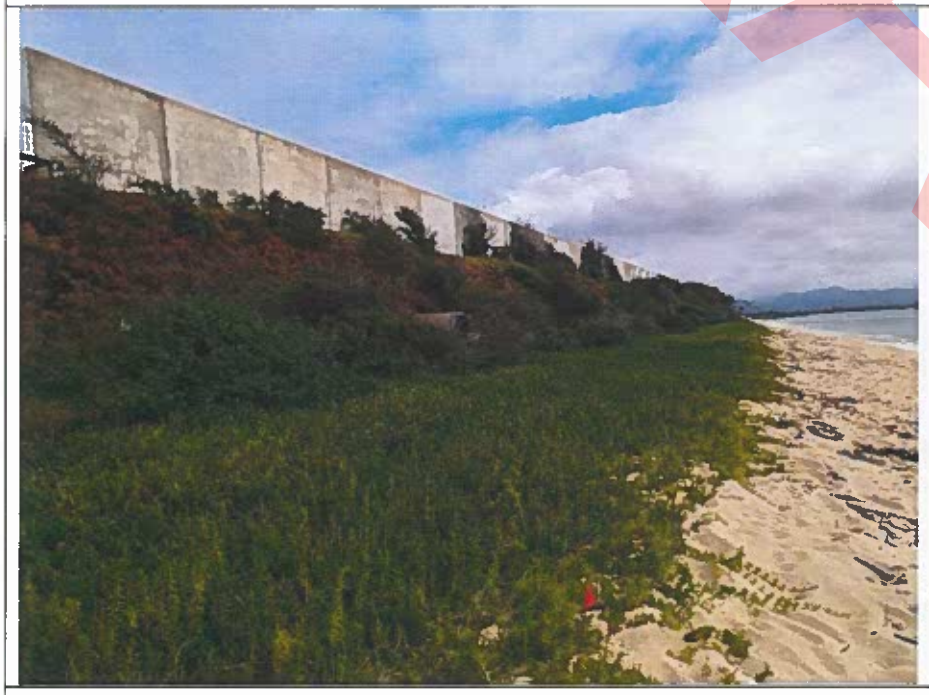

Photo 3: Decision Unit 3

Photo 4: Decision Unit 4

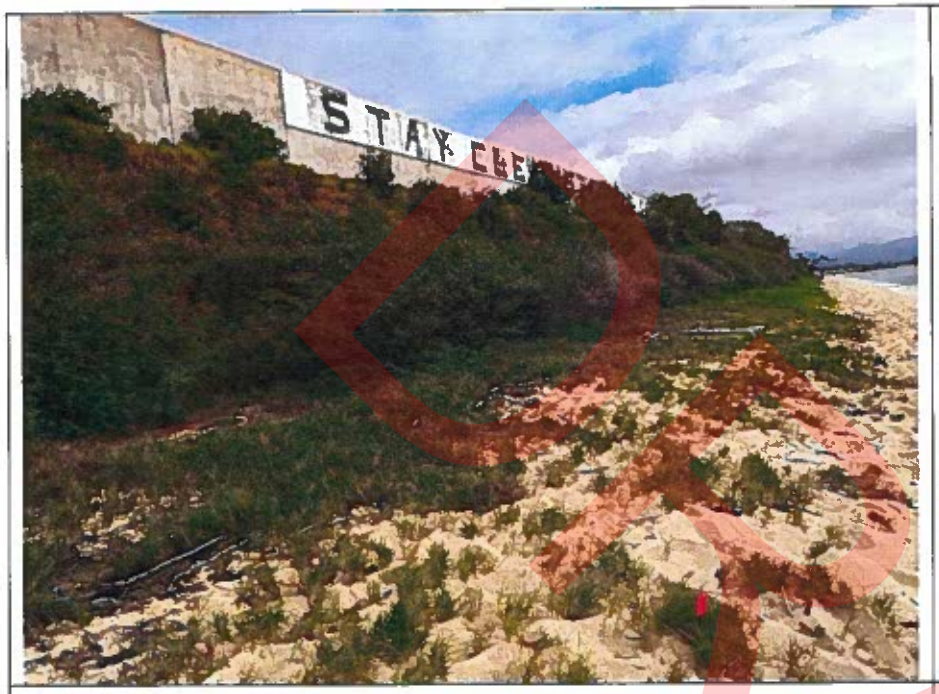

Photo 5: Decision Unit 5

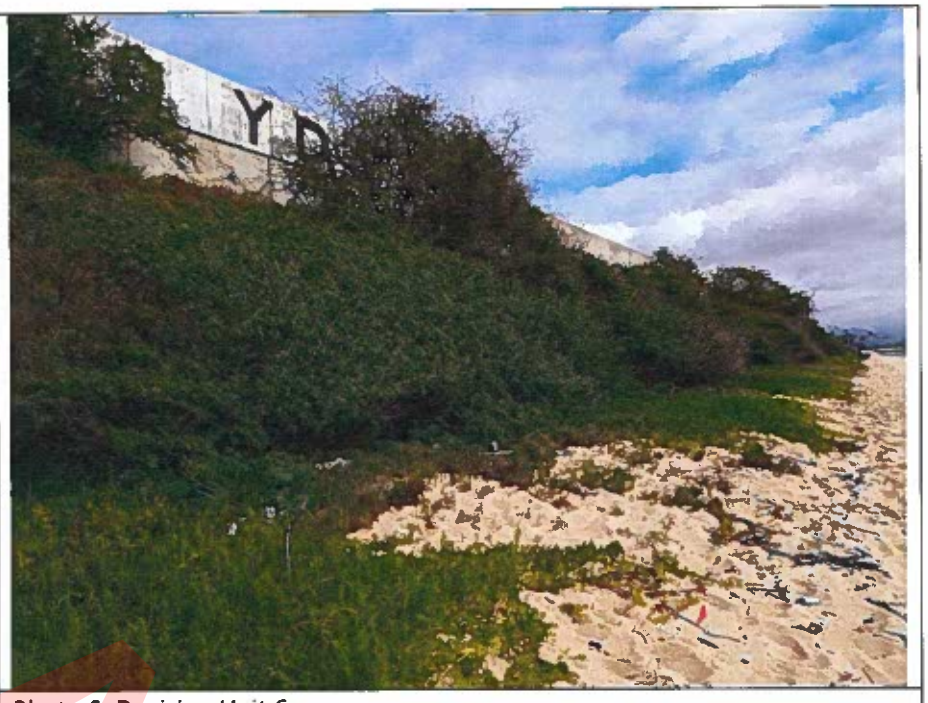

Photo 6: Decision Unit 6

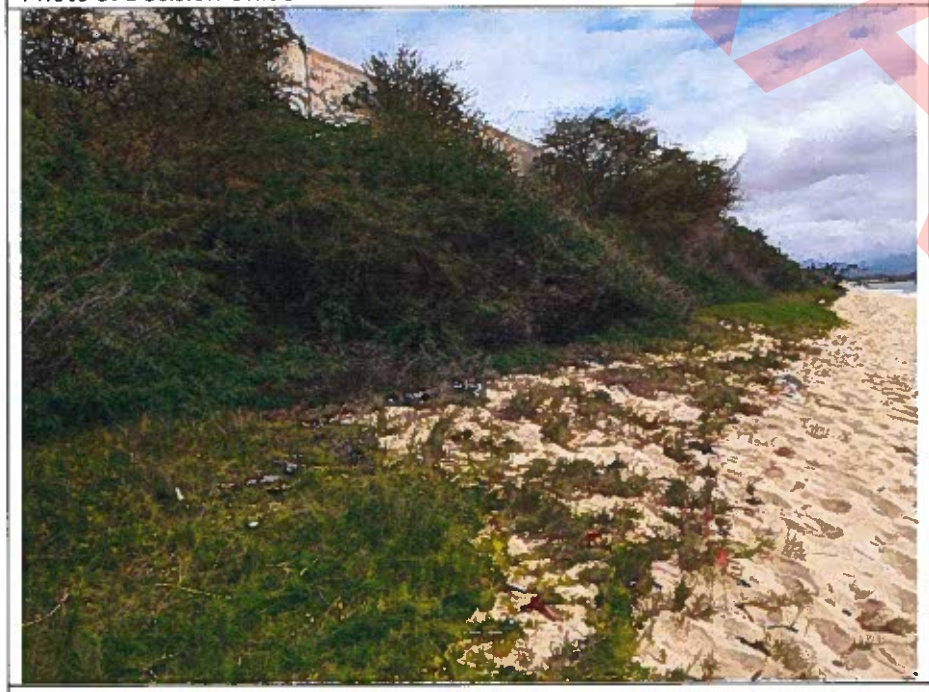

Photo 7: Decision Unit 7

Photo 8: Decision Unit 8

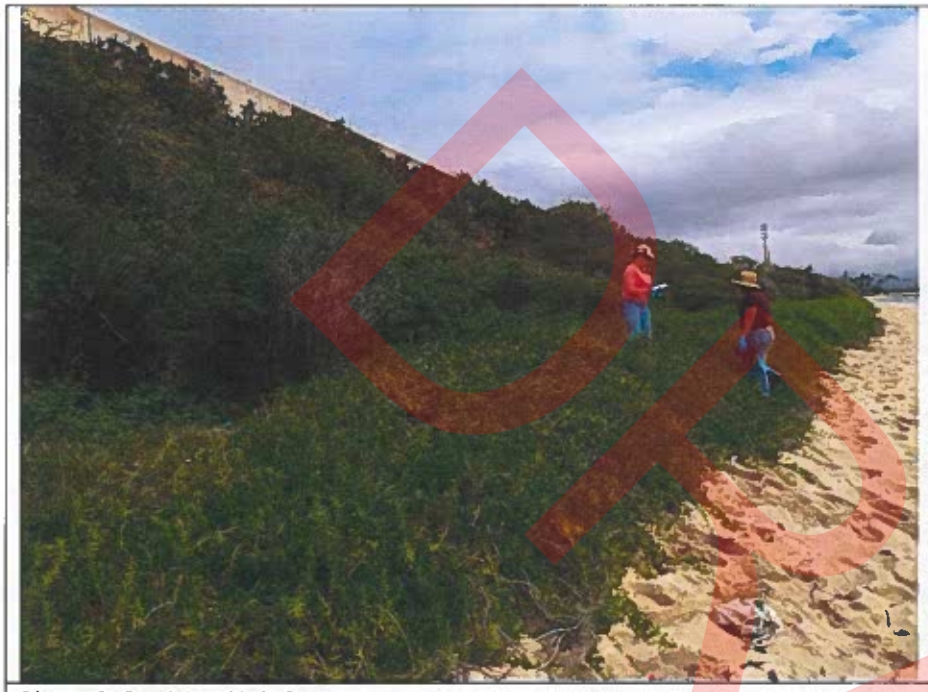

Photo 9: Decision Unit 9

Photo 10: Decision Unit 10

Photo 11: Decision Unit 11

Photo 12: Decision Unit 12

Photo 13: Decision Unit 13

Photo 14: Decision Unit 14

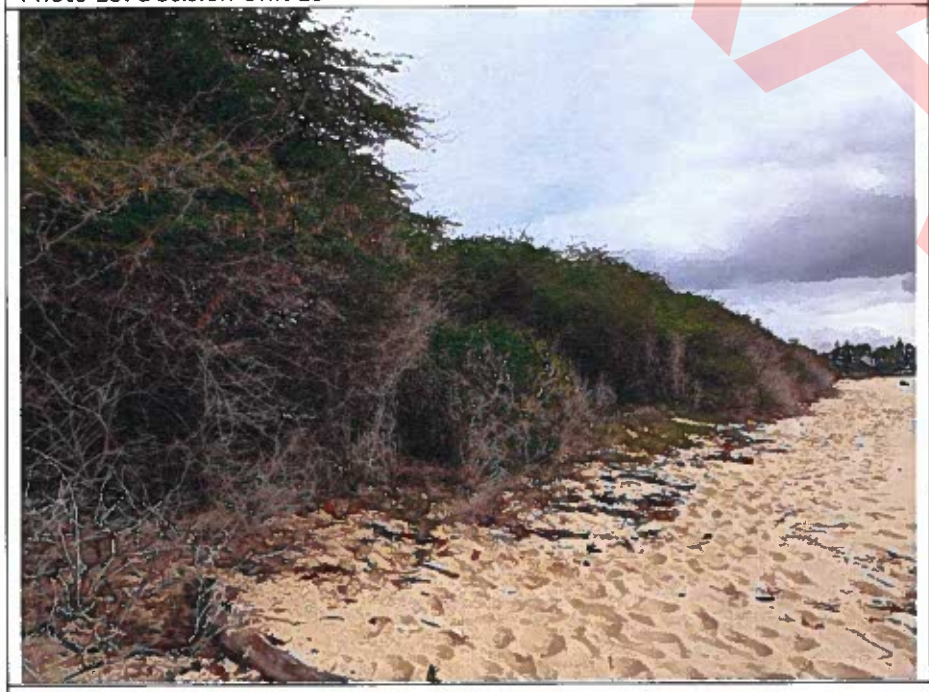

Photo 15: Decision Unit 15

Photo 16: Decision Unit 16

Photo 17: Decision Unit 17

Photo 18: Decision Unit 18

Photo 19 Decision Unit 19

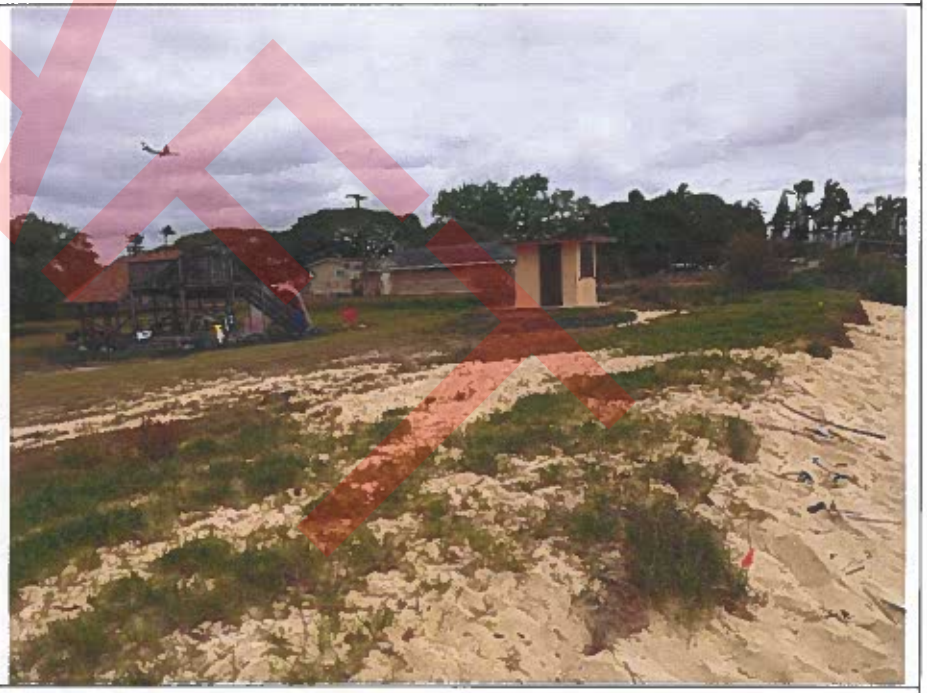

Photo 20: Decision Unit 20

Photo 21: Decision Unit 21

Photo 22: Decision Unit 22

Photo 23: Decision Unit 23

Photo 24: Decision Unit 24

Supplemental Photographs

The following photographs present closer views of the vegetated areas of the oceanside berms at the PRTF Shoreline.

This page has been left blank intentionally to allow for double-sided printing.

Photo 1: Eastern property boundary from atop DU-19

Photo 2: Shoreline, facing west from atop DU-19

Photo 3: Typical kiawe thorn size

Photo 4: Shoreline showing typical slope, facing west from atop DU-18

Photo 5: DU-18, facing west

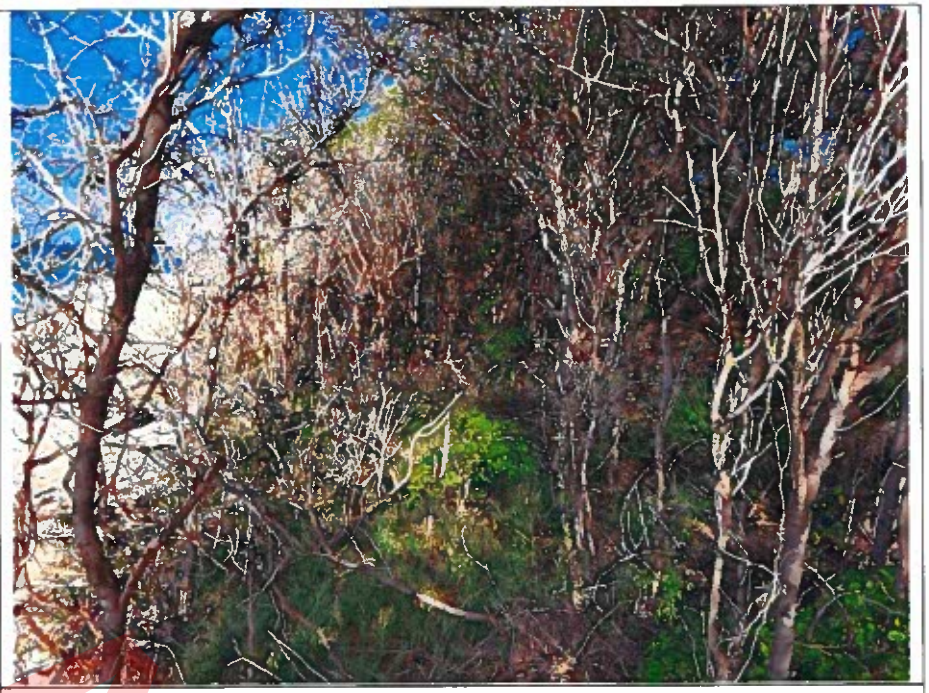

Photo 6: DU-17 vegetation, facing west

Photo 7: DU-17 vegetation, facing north

Photo 8: DU-16/17 vegetation, facing northwest

Photo 9: DU-16 vegetation, facing north

Photo 10: DU-15 vegetation, facing northeast

Photo 11: Small opening in DU-15 vegetation, facing north

Photo 12: DU-15 vegetation, facing east from opening in Photo 11

Photo 13: Northern extent of DU-15 boundary, facing Delta/Echo berm

Photo 14: DU 13, facing north

Photo 15: Evidence of fishing near DU-12/13

Photo 16: DU-13 vegetation

Photo 17: Access Road near DU-12

Photo 18: Shoreline, facing west from DU-12

Photo 19: Kiawe thorns in sandals after walking into brush

Photo 20: Sandals after walking into brush

Photo 21: Kiawe thorn in foot.