2 Background

The C-EHMP applies to the property shown in Figure 1. The property is also identified by the following.

Address	Nanue Bridge, Hawaii Belt Rd (Route 19) Hawaii County, HI
TMK #	(TMK) (3) 3-2-001 Parcel 008, and (3) 3-2-001:001
Latitude/Longitude	19.927035°, -155.156125°

Site Conditions

Distance to Nearest Surface Water Body	Project is adjacent to Nanue Stream
Approximate Depth to Groundwater	0 to 286 ft below ground surface. Expected groundwater elevation varies based on elevation.
Is the Property Above or Below UIC Line	Above – but not a source due to proximity of shoreline
Is the first-encountered groundwater classified as a potential source of drinking water in the Mink & Lau Aquifer Identification and Classification Report?	Yes. Hakalau Aquifer in the East Mauna Kea Section.
Current Property Use Type (Residential, Commercial, Zoning, etc.)	Right of Way for repairs to bridge.
Proposed/Future Property Use Type (Residential, Commercial, Mixed-Use Zoning, etc.)	Right of Way
Typical Soil Profile from Surface to Groundwater (Include Depth Range, Lithology)	Hilo Rock outcrop, with slopes of 35 to 100 percent. These are typical of gulches in lava flows and consist of hydrous silty clay loam over basalt.
Utilities Serving Site (e.g., Storm Drains, Electrical, Gas, Water, Sewer [specify- C&C, Cesspool, Septic, Other])	None.

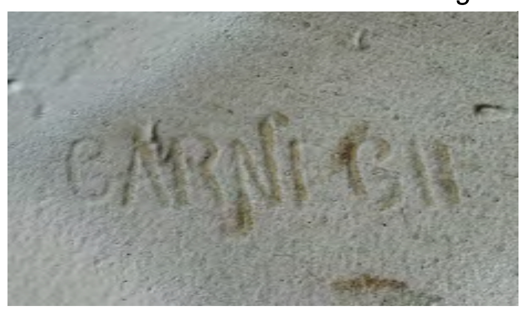
2.1 Existing Environmental Conditions

The Nanue Bridge project site is located in Ninole, Hawaii County, Hawaii, approximately 16 miles north of Hilo and approximately 500 ft west of the Pacific Ocean. It is the right of way for the Nanue Bridge on Hawaii Belt Road (Route 19). The Tax Map Key (TMK) parcels are (3) 3-2-001 Parcel 008 and (3) 3-2-001:001 and it is owned and managed by the HDOT (Figure 1). The northern ROW is approximately 27,500 square feet (sq. ft.) (0.6 acres) and the southern ROW is approximately 33,300 sq. ft. (0.76 acres).

The site is a steep gulch with a 78% grade and vertical drops between bridge footings. There is no road or identifiable site access except for two sloped ladders set along the hill nearest the bridge deck. On the southwest side, a swale funnels water from the highway to the stream and has been scouring out the lower bank on the southern side. The area is heavily overgrown and is not used by the public.

The bridge is the tallest one in Hawaii (286 ft) and was originally constructed in 1911/1912 for the Hilo Railroad Company to access the sugar plantations along the coast (Historic Hawaii 2014). Multiple supporting steel beams are original to the bridge and marked with the Carnegie Steel (US Steel) Logo that was in use from the late 1890s throughout the 1910s (Historic Bridges 2024).

Steel Girder Detail at Nanue Bridge



The former sugarcane camp town of Hinohina was located southwest of the bridge (1910s – 1960s), but today only the cemetery remains, west of the bridge (Hakalau Home 2023). Roadside rubbish from the upper elevation was found in the swale along the southwest bank of Nanue Bridge. Nanue Bridge survived the 1946 tsunami. The railroad was rebuilt in 1953 as a highway and lead paint was applied to the steel girders at that time (Honolulu Advertiser 1953). In 1997, the lead-based paint was abated from the bridge in conjunction with abatement at other Hamakua Coast bridges (EnviroQuest 2023).

2.2 Evaluation of Contaminants of Potential Concern in Site Media

Lead based paint was used for decades on the Nanue Bridge and other bridges along the Hamakua Coast and lead in the soil beneath these bridges has previously been identified as a COC (e.g., Hakalau, Kolekole, and Umauma). The bridge components were first constructed in the early 20th century and lead-based paint was applied throughout the century until removal in 1997. Maintenance of the bridges for the major portion of the last century included the removal of corrosion and lead-based paint.

Since there had been no previous evaluation of COPCs at Nanue Bridge, a soil investigation was conducted in March 2024 and later a paint chip investigation was conducted in August 2024 to evaluate the nature and magnitude of lead and other suspected COCs present at the site and where and may be encountered during planned bridge repairs.

2.2.1 Bridge Coating Sampling and Analysis

The bridge is currently painted gray with no visible color or application difference. Five paint chip samples were collected from the steel superstructure in two areas that correlated to the DUs names established during the soil investigation that had occurred prior to sampling the paint on the beams. Paint from two general areas on the southern embankment (DU 9 and DU10) at footings/cross beams and from eastern, middle, and western supports and trusses. Five paint chip samples were also collected from DU2 and DU3 on the northern embankment (Figure 2, Appendix C).

The paint sampling investigation was conducted to determine if lead-based or lead-containing paint is still present on the girders. This was important in understanding potential exposure risks to the workers conducting upcoming bridge repairs where they may be cutting away individual steel members and replacing them with new material.

Lead paint analysis in August 2024 identified the current gray paint as LCP. LCP is paint where the lead detected in the sample is greater than the laboratory analytical detection limit but less than 0.5% lead by weight. All of the samples were classified as LCP under this scenario (Table 2-1).

The bridge underwent lead paint remediation in 1997. During sampling of the paint with a chisel, only gray paint was observed. It is known that in the 1950s red and black lead-based paint had been applied to the bridge. This was visible as drops on exposed rock, but not on the bridge.

Paint samples were collected to bare metal. The paint film samples were analyzed by NIOSH Method 7082m *Lead by Flame* Atomic Absorption Spectrophotometry. Based on the laboratory analytical results, none of the 10 samples exceeded the EPA guidelines for lead-based paint. All the samples were identified as lead-containing paint.

Table 2-1: Lead Paint Chip Samples Nanue Bridge

Sample No.	Sample Location/Description	Result (wt. %)	LBP[1] (Y/N)	LCP[2] (Y/N)
NAN_Pb_DU2a	N. Embankment, DU2, eastern support girder	0.14	N	Y
NAN_Pb_DU2b	N. Embankment, DU2, middle	0.041	N	Y
NAN_Pb_DU2c	N. Embankment, DU2, western support	0.021	N	Y
NAN_Pb_DU3a	N. Embankment, DU3, middle	0.0087	N	Y
NAN_Pb_DU3b	N. Embankment, DU3, western beam	0.066	N	Y
NAN_Pb_DU9	S. Embankment, DU9, southeastern footing	0.019	N	Y
NAN_Pb_DU10a	S. Embankment, DU10, southeastern footing	0.094	N	Y
NAN_Pb_DU10a2	S. Embankment, DU10, southwestern footing	0.047	N	Y
NAN_Pb_DU10b	S. Embankment, DU10, northeastern footing	0.055	N	Y
NAN_Pb_DU10b2	S. Embankment, DU10, northwestern footing	0.031	N	Y

LBP = >0.5% lead by weight
LCP = >laboratory detection limit but <0.5%

Every DU in the HDOT ROW exceeded the HDOH Tier 1 EAL for unrestricted land use (200 mg/kg) for lead (Table 2-2, Appendix A1). All but one DU (DU1 at 6 to 9 inches bgs) exceeded the construction/trench worker safety of 800 mg/kg of total lead. Almost all of the DUs exceeded gross contamination of 1000 mg/kg. The southern embankment HDOT ROW (DU10 at 3 to 6 inches bgs) contained the highest lead concentration sample results (9700 mg/kg).

2.2.2 Soil Sampling and Analysis

COPCs that were investigated in 2024 included RCRA8 metals and PCBs. PCB analysis was requested by the HDOH Hazard Evaluation and Emergency Response (HEER) office, who were concerned that it may have been used in the bridge expansion joints. PCBs were determined to not be a COC (Appendix A).

Multi-increment soil samples were collected from five decision units (DUs) along the southern embankment and three DUs from the northern embankment at three depth profiles – 0 to 3 inches, 3 to 6 inches, and 6 to 9 inches below ground surface (bgs). Fifty increments were collected per sample (EQI 2024). Steep slopes and bare rock limited the number of DUs along the northern side as there was not adequate soil to sample. DUs covered approximately 30% of the northern embankment and 60% of the southern embankment. They were primarily located below the bridge deck to reflect the proposed work and repair area.

Samples were analyzed for Resource Conservation and Recovery Act (RCRA8) metals and PCBs as recommended by HDOH (See Appendix A1 and Appendix A2 for complete results).

Areas with concentrations exceeding the EALs are depicted in Figures 3a, 3b, and 3c.

RCRA 8 Methods

Arsenic	EPA* 6020B
Barium	EPA 6020B
Cadmium	EPA 6020B
Chromium	EPA 6020B
Lead	EPA 6020B
Mercury	EPA 7471A
Selenium	EPA 6020B
Silver	EPA 6020B

* *United States Environmental Protection Agency*

Polychlorinated Biphenyls (PCBs)

PCB-1016	EPA 8082A/3546
PCB-1221	EPA 8082A/3546
PCB-1232	EPA 8082A/3546
PCB-1242	EPA 8082A/3546
PCB-1248	EPA 8082A/3546
PCB-1254	EPA 8082A/3546
PCB-1260	EPA 8082A/3546

2.2.3 Results - Identified as Media Containing COC

<u>Lead in Soil:</u>

COC	Concentration Range	EAL[2]
Lead	577 mg/kg – 9700 mg/kg[1]	200 mg/kg – Unrestricted 800 mg/kg – Construction/ Industrial

[1]Adjusted Results in accordance with HDOH Technical Guidance Manual (TGM), Section 4.2.8 Evaluation of Data Representativeness
[2] EAL for Unrestricted Use and Commercial/Industrial Use > 150m from surface water; above drinking water
mg/kg=milligram per kilogram
EAL=Environmental Action Level
COC=Chemical of Concern

Table 2-2: Nanue Bridge Lead Soil Sample Results 2024

(yellow)	Lead results above HDOH Tier 1 EAL Unrestricted Land Use (200 mg/kg), but below Construction/Trench Worker Scenario (800 mg/kg) (HDOH 2012)
(red)	Lead results above HDOH Tier 1 EAL above Construction/Trench Worker Scenario (800 mg/kg), but below gross contamination (1,000 mg/kg)
(dark red)	Lead results above gross contamination (1,000 mg/kg)

DU ID	Depth (in)	Lead Results (mg/kg)	Sq. Ft	CY	Description
DU1	0-3	1133	1722	16	Northern Embankment highest elevation
	3-6	930	1722	16	
	6-9	577	1722	16	
DU2	0-3	1200	1985	18.4	Northern Embankment Mid elevation
	3-6	1000	1985	18.4	
	6-9	1400	1985	18.4	
DU3	0-3	1200	4413	41	Northern Embankment Lowest DU on north, very steep.
	3-6	1200	4413	41	
	6-9	1500	4413	41	
DU8	0-3	4300	2161	20	Southern Embankment Highest elevation
	3-6	3100	2161	20	
	6-9	2900	2161	20	
DU9	0-3	6400	2843	26	Southern Embankment Second Highest elevation
	3-6	6200	2843	26	
	6-9	6000	2843	26	
DU10	0-3	8500	3848	37	Southern Embankment Steep slope, heavily vegetated
	3-6	9700	3848	37	
	6-9	8100	3848	37	
DU11	0-3	4300	3498	32	Southern Embankment Steepest slope
	3-6	6400	3498	32	
	6-9	6000	3498	32	
DU12	0-3	6300	7185	67	Southern Embankment Lowest elevation – at stream. Relatively flat
	3-6	7900	7185	67	
	6-9	6500	7185	67	

**DU1 results are the mean of the primary sample, duplicate, and triplicate.*

2.2.4 Lead Mobility and Toxicity Evaluation:

<u>Lead Synthetic Precipitation Leaching Procedure (SPLP):</u>
To assess the potential environmental/groundwater leaching pathway, the Synthetic Precipitation Leaching Procedure (SPLP) analysis was conducted on a soil sample collected from DU1 at 0 to 3 inches bgs, DU3 at 6 to 9 inches bgs, DU8 at 0 to 3 inches bgs, DU10 at 3 to 6 inches bgs, DU11 at 3 to 6 inches bgs and DU12 at 3 to 6 inches bgs. Total lead results varied from 1133 mg/kg at DU1 to the highest total lead result of 9700 mg/kg at DU10. The SPLP value varied from 0.08 mg/L to 8 mg/L respectively (Appendix B1). The limit of quantification is 0.030 mg/L.

The SPLP assists in the determination of the mobility of both organic and inorganic analytes present in liquids, solids, and wastes. The results of the SPLP test are used to determine the Desorption Partitioning Coefficient (Kd), which is important to understanding how mobile the lead in the soil is and whether it poses a potential risk to ecological receptors in the vicinity of the stream (e.g., vertebrate and invertebrate organisms). EPA Method 1312 SPLP West extraction procedure was used on the Nanue soil samples identified in Appendix B1. West refers to the pH of the extraction fluid that is made by adding 60/40 weight percent of sulfuric and nitric acids to reagent water until the pH is 5.00 +/- 0.05 used to determine the leachability of a site that is west of the Mississippi River. This method’s pH is higher than the EPA methods extraction fluid for sites east of the Mississippi River (4.20 +/- 0.05) (b 2023).

The result of the SPLP was inputted in the Batch Test Leaching Model (HDOH, 2007 revised 2011), and used to determine the relative mobility of lead in the soil. Batch tests involve placing a small amount of the soil in buffered, de-ionized water, agitating the mixture for a set period and measuring the fraction of the contaminant that desorbs from the soil and goes into solution. The ratio of the mass of a contaminant that remains sorbed to the mass that goes into solution, adjusted to the test method, is referred to the contaminant’s “desorption coefficient” or “Kd” value (HDOH 2007 revised 2011).

If the calculated desorption coefficient is greater than 20 (Kd>20), the contaminant is considered not significantly mobile and is unlikely to pose a leaching hazard to groundwater. If it is less than 20, then an estimated concentration in groundwater should be calculated and compared to the HDOH Tier 1 EAL. The Kd value uses micrograms/L and when calculated by this model for the soil samples Kd coefficient varied from 1193 to 14,143, all significantly greater than a Kd value of 20 (Appendix B-1).

This result demonstrates that the lead present in the soil is strongly bound to the soil and is considered immobile (soil is weathered volcanic alluvial sediments including gravel, sand, and clay). Thus, there is a low likelihood that the lead concentrations in the soil pose a risk to ecological receptors (e.g., aquatic organisms) as a result of lead leaching from the soil into rainwater and sediments or impacting the groundwater below the site.

<u>Lead Toxicity Characteristic Leaching Procedure (TCLP)</u>:
A subset of the DU ISM samples collected below Nanue Bridger were analyzed by TCLP to determine if the soil could be disposed of at a landfill. The Environmental Protection Agency (EPA) regulatory limit for lead is 5 milligrams per liter (mg/L). TCLP soil samples were chosen based on previous analysis at Hakalau Bridge where total lead results above 5000 mg/kg failed TCLP (Kealamahi Pacific Consultants [KPC] 2022).

At Nanue, TCLP results for lead varied from 0.6 mg/L to 23 mg/L. Three of the samples at DU10, DU11, and DU12 failed TCLP. Total lead results from these DU samples varied from 6400 to 9700 mg/kg. Soil from these samples would be classified as hazardous waste. It is likely that additional DUs would also fail TCLP if tested (Appendix B2)

2.2.5 Arsenic in Soil

Arsenic was detected at concentrations at or slightly above the HDOH Tier 1 EAL for unrestricted land use (24 mg/kg) in three of the DUs (DU1, DU8, and DU9). These DUs were all close to bridge deck and the most protected from rainfall. The highest concentration was 32 mg/kg in DU8 at 6 to 9 mg/kg (Table 2-3, Figure 4).

The other DUs did not have any sample results above 24 mg/kg (Table 2-3; Appendix A1 and A2). All results were below the construction/trench worker EAL of 95 mg/kg and are not identified as a site-specific COC for the C-EHMP as the site is not and will not be accessible to public. As the total arsenic levels were relatively low and below construction/trench worker EALs, bioaccessible arsenic analysis was not conducted.

Table 2-3: Nanue Bridge Arsenic Soil Sample Results 2024

Green	Arsenic results below HDOH Tier 1 EAL Unrestricted Land Use (24 mg/kg)
Light tan	Arsenic results at the Unrestricted Land Use (24 mg/kg).
Yellow	Arsenic results above HDOH Tier 1 EAL Unrestricted Land Use (24 mg/kg), but below Construction/Trench Worker Scenario (95 mg/kg)

DU ID	Depth (in)	Arsenic Results (mg/kg)	Sq. Ft	CY	Description
DU1	0-3	26	1722	16	Northern Embankment highest elevation
	3-6	23	1722	16	
	6-9	17	1722	16	
DU8	0-3	20	2161	20	Southern Embankment Highest elevation
	3-6	20	2161	20	
	6-9	32	2161	20	
DU9	0-3	24	2843	26	Southern Embankment Second Highest elevation
	3-6	25	2843	26	
	6-9	24	2843	26	

No other RCRA8 metals were detected in any of the surface soil samples at concentrations above the HDOH Unrestricted Land Use EALs (Appendix A1).

2.2.6 PCBs in Soil

In their approval letter for the Nanue Bridge Sampling and Analysis Plan, HDOH had requested that EnviroQuest analyze some of the samples for PCBs, particularly in samples with the highest lead hits. PCBs have a shorter hold time (14 days from the sampling date) and due to transportation and sample analysis time, it was not possible to have all the total lead results in time to meet the hold time. Therefore, DUs with the highest lead levels were estimated.

In DU10 and DU11 orange paint flakes (anticipated to be lead-based or lead containing) were visible at the site in the 3-6 inches interval. These DUs were chosen for PCB analysis. The upper 0–3-inch layer at DU10 was also analyzed for PCBs to verify if the orange paint flakes correlated with higher lead levels.

The PCB congener PCB-1254 was present in all three samples D at concentrations ranging from 0.037 mg/kg to 0.20 mg/kg, which is well below the HDOH Tier 1 EAL for unrestricted land use. PCBs were not identified as COC at the site (Appendix A1).

2.2.7 Chemicals of Concern and Construction Materials

Construction materials will be steel members that will be fabricated to match existing members that have been identified as beyond their design safety tolerances. Activities will include removing a number of the existing members and replacing them with new steel members. If a coating is used it will not be a lead-based paint.

Question	Yes	No
Are storm drains (including interceptors) or will storm drains be present at the site?		X
Will any portion of a storm drain (including interceptors) be present at an elevation that is potentially in contaminated groundwater?		X
Will any portion of a utility corridor be present at an elevation that is potentially in contaminated groundwater?		X
Will a portion of any other utility or subsurface structure (other than foundations) extend potentially into contaminated groundwater?		X
Are any potentially flammable or explosive COCs present at the site (e.g., methane, total petroleum hydrocarbons as gasoline, etc.)?		X
Will any electrical lines/utility corridors be subsurface?		X
Are any COCs in vapors present at or above 10 % of the LEL?		X
Will any elevator shafts or escalator pits, potentially extend into contaminated groundwater?		X

* LEL=Lower explosive limit
COC=Chemical of Concern

Construction Materials Assessment

Construction Material in Contact with Contaminated Media	COC, Concentration and Media	Proposed Material to be used	Material Safe with COC	
			Yes*	**No**
Tools, Replacement metal members, and PPE	Lead in surface and near surface soil.	Metal, Concrete, and Fill	X	
	Lead-containing paint	Metal	X	

* Documentation that material is safe to use, and will remain functional, in the presence of the identified contamination should be included as an attachment to the C-EHMP.
COC=Chemical of Concern