

Temporary Debris Storage (TDS) Site Monitoring
U.S. Army Corps of Engineers and County of Maui Department of Environmental Management
June 21, 2024

The Temporary Debris Storage (TDS) area located in West Maui was designed and is underlain by a thick (80 mil or 0.08 inches) plastic liner to be protect the soil, groundwater, and ocean. The entire TDS site is being monitored closely by USACE, County of Maui, and Hawai'i Department of Health (DOH) to ensure no impacts to the surrounding area or the marine environment from the ash and debris, along with any leachate or rainwater run-off generated.

Leachate is a liquid, usually rainwater, which percolates through the ash and debris within the lined area of the TDS working boundaries. Though most of this water is either absorbed into the waste mass or evaporates into the air, some may pass through the ash and debris, and may pick up contaminants present within the ash, such as heavy metals (i.e., arsenic, lead and cobalt) as detected by Hawai'i DOH in samples of the ash taken in Lahaina. Leachate is different than rainwater or surface water run-off which is diverted around the TDS working area from the surrounding hills. Stormwater is intentionally diverted around the TDS to minimize the generation of leachate. All leachate collected within the TDS area is drained by gravity to a low spot in the TDS working area called a sump, where it is drained via a drainpipe to a leachate basin. This leachate basin is located directly below the TDS working area and is constructed with the same thick liner underneath it to prevent any infiltration into the underlying soils.

The leachate basin has a design capacity of 1.375 million gallons, which is much more than is ever expected to be collected, even in the most significant rain event in West Maui. For example, during a rainstorm in early January during which over 3" of rain fell in less than 24 hours, the leachate basin successfully collected all rainwater which fell directly into the TDS working area as well as its surroundings, as construction had yet to be completed on the stormwater diversion canals around the TDS working area. The leachate basin filled with approximately 500,000 gallons of rainwater, which only caused it to reach just over 1/3 of its total capacity. A subsequent storm event in early April, during which approximately 2" of rain fell in less than 24 hours, resulted in the leachate basin filling with 100,000 gallons of leachate. The quantity is substantially less because the TDS working area now contains a substantial amount of soil, ash and debris which absorbed most of the water.

The leachate generated in the TDS is utilized within the limits of the lined TDS working area where the storage of ash and debris is taking place. It is being applied via wet spray atop the debris as a means to control dust generation. During this process, most of the liquid evaporates. The water spray is applied several times throughout the workday, especially on drier days. In mid-March, all of the leachate which accumulated during the January rain event had been utilized for dust control. The leachate basin had been for the most part empty for the past several weeks, with fresh water is being used for dust control, until the early April rain event. Leachate basin level monitoring results are presented in Table 1.

Date	Level	Gallons (est)
1/11/2024	33%	480,000
2/15/2024	5'	100,000
2/22/2024	< 1'	2,000
3/14/2024	< 1'	2,000
3/24/2024	empty	0
4/15/2024	5'	100,000
5/15/2024	5'	100,000
5/23/2024	2'	40,000
6/20/2024	2'	40,000

Table 1. Leachate basin monitoring levels.

A percolation basin is located below the TDS site, designed to receive rainwater run-off, which is diverted around the TDS working area, which does not come into contact with any ash or debris. The purpose of the percolation basin is to allow rainwater run-off to percolate into the natural soils and not run down the roadway or drainage channels. A Stormwater Pollution Prevention Plan (SWPPP) was developed to prevent contamination of the surrounding area from site operations which complies with applicable state and federal requirements.

On January 21, 2024, the County of Maui approved Ordinance #5596, also known as “Bill #120.” Among other recordkeeping, operational and planning requirements, the ordinance required the following specific monitoring at the TDS:

- 1) Leachate quantity, quality and treatment processes, if required
- 2) Run-off, including nearby waterways
- 3) Air quality for toxins and contaminants

The data from this monitoring must be made publicly available, which is the purpose of this section. A report providing details on the first 90 days (January 21, 2024 – April 19, 2024) was submitted to the County Maui Council and is posted on the <https://mauirecovers.org/debris-containment> website.

1) Leachate

Due to the dry conditions in West Maui, ‘baseline’ sampling of run-off water was collected directly from the leachate basin two days after a significant storm event on January 9, 2024. Approximately 3” of rain fell over 24 hours during this storm event, generating approximately 500,000 gallons of run-off, which was collected in the leachate basin. At the time of the storm, no ash or debris had been placed in the TDS working area, so the run-off represented typical precipitation run-off un-impacted by waste, therefore considered typical of what normally runs off the natural soils present in the area.

Since the preliminary, baseline sampling event, USACE has sampled the leachate basin periodically, and plans to continue sampling leachate monthly directly from the leachate basin if a 1” or greater storm event occurs within that month.

Table 2 shows the analytes and parameters analyzed by FQ Laboratories or Eurofins Laboratories, along with the results from samplings conducted by USACE to date. Not all parameters shown below were analyzed for by the laboratory during each event, as additional parameters were added at the request of Hawai’i DOH and the Maui County after the baseline sampling event on January 11, 2024.

Table 2. Leachate monitoring analytes and parameters.

Parameter	Method*	1/11/2024 (Baseline)	1/30/2024	2/8/2024	2/13/2024	2/20/2024	4/15/2024	5/20/2024	Units
TSS	SM 2540D	316	46	32	8	-	39	23	mg/L
TDS	EPA 2540C	NS	NS	289	315	-	670	730	mg/L
TOC	EPA 5310C	NS	NS	7.96	9.16	-	7.0	11	mg/L
COD	EPA 410.4	NS	NS	15.5	12	-	38	59	mg/L
Turbidity	EPA 180.1	650	103	NS	NS	-	80	11	NTU
Total Alkalinity	EPA 2320B	NS	NS	69.9	74.1	-	44	42	mg/L
Nitrogen-Total	EPA 351.2	NS	NS	15.9	16.5	-	22	21	mg/L
Nitrates	EPA 353.2	NS	10.1	14.4	15	-	21	15	mg/L
Nitrites	EPA 353.2	NS	0.369	0.74	0.59	-	0.32	1.5	mg/L
Oil & Grease	EPA 1664B	< 5.0	3.9	< 5.0	9	-	1.5	1.4	mg/L
TPH	EPA 1664B	< 5.0	NS	NS	NS	-	4.1	4.0	mg/L
DRO (C10-28)	EPA 8015D	NS	NS	NS	NS	-	250	290	µg/L
Chlorine	EPA 330.4	NS	< 0.01	0.317	0.283	-	ND	ND	mg/L
Hex Chromium	EPA 218.6	NS	0.185	NS	NS	-	NS	NS	mg/L
Cyanide-Total	EPA 9012A	NS	NS	NS	NS	-	0.021	ND	mg/L
Carbonate		NS	NS	1.2	5	-	6	5.6	mg/L
Ammonia	EPA 4500	NS	NS	NS	NS	-	ND	0.11	mg/L
Sulfide	EPA 9034	NS	NS	0.057	0.058	-	ND	ND	mg/L
Sulfate	EPA 300.0	NS	NS	107	121	-	230	240	mg/L
Dioxins / Furans (2,3,7,8-TCDD)	8290A	NS	-	-	< 1.9	< 2.0	ND	2.1	pg/L
PCBs (total)	8082A	NS	NS	ND	ND	ND	ND	ND	ug/L
Herbicides (2,4-D)	8151A	NS	NS	NS	ND	ND	0.78	ND	µg/L
Pesticides	8081B	NS	-	-	NS	ND	ND	< LOQ	µg/L
VOCs	8260D	NS	ND	-	ND	ND	ND	ND	µg/L
SVOCs	8270D/E	NS	-	-	NS	ND	ND	ND	µg/L
DO	EPA 360.1	NS	NS	9.53	9.91	-	6.5	5.0	mg/L
pH	EPA 9040C	NS	NS	8.21	8.88	-	7.4	8.5	
Total Metals (ICP)	6010D								
Beryllium		< 0.010	0.00048	-	< 0.0015	0.030	ND	ND	mg/L
Vanadium		0.13	0.019	-	0.013	0.92	0.017	0.011	mg/L
Chromium		0.136	0.013	-	0.0075	0.56	0.024	0.0055	mg/L
Cobalt		0.026	0.0033	-	0.0019	0.4	0.0028	0.0020	mg/L
Nickel		0.078	0.011	-	0.0063	0.38	0.0085	ND	mg/L
Copper		0.042	0.007	-	0.0047	0.23	ND	ND	mg/L
Zinc		< 0.100	0.017	-	0.0052	0.49	0.0048	ND	mg/L
Arsenic		< 0.010	0.0027	-	0.0027	< 0.16	ND	ND	mg/L
Selenium		< 0.010	< 0.005	-	< 0.025	< 0.16	ND	ND	mg/L
Molybdenum		< 0.010	0.0021	-	0.0024	< 0.02	0.0074	0.0061	mg/L
Silver		< 0.010	NS	-	< 0.008	< 0.04	ND	ND	mg/L
Cadmium		< 0.010	NS	-	< 0.0035	< 0.01	ND	ND	mg/L
Antimony		< 0.010		-	< 0.0011	< 0.16	ND	ND	mg/L
Barium		0.251	0.04	-	0.025	2.6	0.037	0.025	mg/L
Mercury	7470A	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.085	0.14	ND	mg/L
Thallium		< 0.010	NS	-	NS	< 0.12	ND	ND	mg/L
Lead		< 0.010	0.00096	-	0.0042	< 0.071	ND	ND	mg/L

Note: Lab methods may vary. Data from parameters included in the baseline event not sampled in subsequent sampling events is not included.

Abbreviations & Symbols:

<: less than

COD: chemical oxygen demand

EPA: United States Environmental Protection Agency

ND: nondetect or below detection limit

NTU: nephelometric turbidity unit

SVOC: semivolatile organic compound

TOC: total organic carbon

TPH: total petroleum hydrocarbons – oil

VOC: volatile organic compound

µg/L: micrograms per liter

pg/L: picograms per liter

mg/L: milligrams per liter

NS: not sampled

PCB: polychlorinated biphenyl

TCDD: Tetrachlorodibenzo-P-dioxin

TDS: total dissolved solids

TSS: total suspended solids

LOQ: limit of quantitation

2) Nearby Waterways

Because there have been no observable releases of leachate from the TDS site, there has been no need to sample surface water in creeks or drainage ditches adjacent to the TDS; however, DOH reviewed coastal water quality data from the University of Hawai'i and the Surfrider Foundation Maui. From the review, DOH affirms that these data show that there are no ash- or fire-related chemicals present in the surface water at concentrations that threaten human health.

DOH is initiating a water quality monitoring program that will cover nearshore monitoring and include eight locations from Olowalu to Kaanapali. Results will be available on the DOH website as well as the webpage for debris containment.

3) Air Quality

There are several air monitoring stations (a.k.a. 'PurpleAir Sensors' and 'Dustrak' monitors) in the vicinity of the TDS, which are operated, maintained, and monitored by either Hawai'i DOH and a contractor to USACE. The air monitoring equipment provides data for both Particulate Matter (PM) 2.5 and 10, which correspond to the size of the particulate matter in micrometers (or microns), which represent one millionth of a meter. The measurement units for PM are expressed in micrograms/cubic meter, or $\mu\text{g}/\text{m}^3$, which is basically the weight of the total dust particles (in micrograms) in a defined area of space (one cubic meter). The smaller the particle (i.e., 2.5 microns), the deeper into the respiratory tract and lungs the particles can penetrate and either cause or exacerbate existing respiratory health problems. More information on the health effects of particulate matter pollution can be found at: <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>.

The locations of the PurpleAir monitors operated by DOH are found in Figure 1. Monitoring data from the PurpleAir monitors can be viewed at <https://fire.airnow.gov> and <https://map.purpleair.com/>.

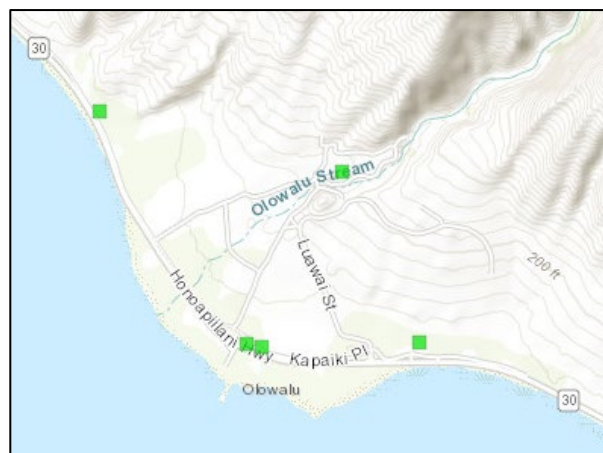


Figure 1. Locations of air monitors near the TDS site.

In addition, a contractor to USACE is collecting air monitoring samples following a Hawai'i DOH-approved plan that includes all debris removal work zones as well as the TDS. A summary of data collected to date at various locations around the TDS site (monitors are not always placed in the same location depending on wind conditions) can be found in the table below:

DATE	Average PM10 (ug/m ³)	Average PM2.5 (ug/m ³)	Monitor ID #s
23-Jan	10.62	8.42	4,5,11
28-Jan	16.55	13.49	9,10,11
2-Feb	9.74	7.6	1,10,11
3-Feb	7.46	5.52	9
8-Feb	7.53	2.64	6,11,13
28-Feb	9.46	7.36	3,4
6-Mar	4.33	6.06	3,8
13-Mar	14.24	11.78	1,4
14-Mar	5.75	3.24	1,11
20-Mar	8.54	6.62	4,10
27-Mar	10.24	8.35	5,10
3-Apr	4.42	3.23	8,14
10-Apr	8.87	6.95	8,14
17-Apr	11.54	8.52	1,6
24-Apr	5.18	3.89	11,14
1-May	8.76	5.72	4,12
8-May	12.26	9.53	1,13
15-May	9.47	8.87	9,10
22-May	11.27	8.64	10,11
5-Jun	14.61	12.62	6,9
12-Jun	6.08	5.74	6,15
19-Jun	7.95	6.84	9,14

Table 3. Air monitoring data collected around the TDS site.

USACE has established an 'Action Level' of 35 for Particulate Matter, which means that engineering and/or operating controls such as water sprays and limiting truck speed are implemented in the event of an exceedance of an Action Level.

Finally, USACE conducts personnel air monitoring according to an Air Monitoring Sampling Plan (AMSP) using personal air cartridges directly on-site workers. The results are evaluated against criteria based on the Occupational Safety and Health Administration (OSHA) Permissible Exposure Levels (PELs) and/or the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). All sampling results collected from excavator operators and laborers to date have not found any exceedances of these health-based criteria.

4) Groundwater

To comply with Bill 120, FEMA directed USACE to install temporary groundwater detection monitoring wells around the TDS site. In response, one upgradient (uphill) and one downgradient (downhill) are currently being installed as shown in figures 2 & 3 below.

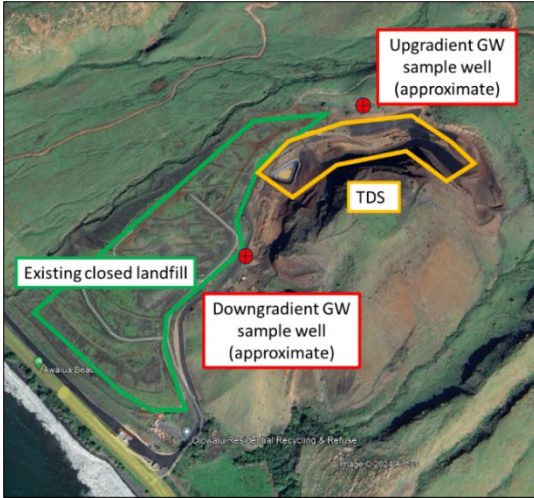


Figure 2. Approximate locations of groundwater monitoring wells.



Figure 3. Groundwater monitoring well installation.

Once monitoring wells are installed, samples will be collected quarterly (every 3 months) for laboratory analysis. This is a typical frequency for waste storage and disposal facilities. It is anticipated the analysis performed will include the following analytes and parameters found in the table below, which include the most mobile constituents present in the ash and debris placed in the TDS.

Major cations & anions	Symbol
Magnesium	Mg
Sodium	Na
Calcium	Ca
Potassium	K
Chlorine	Cl
Carbonate	CO ₃
Sulfate	SO ₄
Bicarbonate	HCO ₃
Major Leachate Indicators	
Total Dissolved Solids	TDS
Total Organic Carbon	TOC
Total Alkalinity	
Nitrogen-Ammonia	
Chlorine	Cl
Iron	Fe
Field Parameters	
Electrical conductance	
pH	
Temperature	
Turbidity	
Metals	
Arsenic	As
Lead	Pb
Antimony	An
Cobalt	Co
Copper	Cu

Table 4. Proposed analytes and parameters for groundwater samples.

As soon as groundwater monitoring data is being generated, it will be shared in this section. Results will be available on the webpage for debris containment.

Background Soils

A preconstruction assessment divided the TDS site into five decision units—or set areas—to analyze preexisting soil conditions for contaminants. Analytical results from this assessment, summarized in the below table, will be used once debris has been removed from the site, as the soil will be sampled at similar locations for the analysis of constituents; the preassessment measurements will serve as a data comparison. Both the preconstruction and postconstruction data will be evaluated by the County of Maui and DOH to conclude whether any action is necessary prior to grading the TDS area.

Constituent (mg/kg)	DU-1 (mg/kg)	DU-2 (mg/kg)	DU-3 (mg/kg)	DU-4 (mg/kg)	DU-5 (mg/kg)
Antimony	0.18	0.19	0.19	0.19	0.19
Arsenic	1.4	1.5	0.73	0.584	0.94
Barium	15	15	32	40	39
Beryllium	0.56	0.66	0.6	0.75	0.66
Cadmium	0.093	0.13	0.094	0.099	0.1
Chromium	0.81	1	0.84	0.53	7
Cobalt	1.1	1.4	1.2	1.2	3
Copper	1.6	4.9	1.6	0.86	4.9
Lead	2.1	1	1.1	0.97	2.2
Molybdenum	0.51	0.54	0.5	0.67	0.9
Nickel	0.79	1	0.92	0.53	9
Selenium	4.9	5.4	3.6	3.2	3.7
Silver	0.046	0.021	0.047	0.048	0.047
Thallium	0.14	0.15	0.14	0.14	0.14
Vanadium	1.2	1.4	1.2	1.0	8.5
Zinc	48	51	44	49	52
Mercury	0.010	0.011	0.0096	0.010	0.011
Oil Range Organics	18	26	30	29	30
Gasoline Range Organics	2.9	1.1	1.6	1.7	1.5
Diesel Range Organics	32	33	28	30	16

Abbreviations:

DU: decision unit
 mg/kg: milligrams per kilogram