HALEY ALDRICH

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**PUBLIC REVIEW DRAFT REPORT ON**

# FORMER KOSMOS MILL REMEDIAL INVESTIGATION
# KOSMOS FLATS AREA
# MORTON, WASHINGTON

by
Haley & Aldrich, Inc.
Seattle, Washington

for
Tacoma Power
Tacoma, Washington

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November 11, 2025



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# SIGNATURE PAGE FOR

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MORTON, WASHINGTON

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TACOMA POWER
TACOMA, WASHINGTON

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## List of Abbreviations and Acronyms

| | |
|---|---|
| AEC | Anderson Environmental Contractors |
| AIRO | AIRO Environmental Services |
| AO | Agreed Order |
| APE | area of potential effect |
| bgs | below ground surface |
| BMPs | Best Management Practices |
| BTEX | benzene, toluene, ethylbenzene, and xylenes |
| CEC | contaminants of ecological concern |
| COC | contaminant of concern |
| COPC | contaminant of potential concern |
| cPAH | carcinogenic polycyclic aromatic hydrocarbon |
| CSM | conceptual site model |
| CUL | cleanup level |
| DAHP | Department of Archaeology and Historic Preservation |
| DOWL | DOWL Engineers |
| DCAP | draft Cleanup Action Plan |
| DSR | Data Summary Report |
| Ecology | Washington State Department of Ecology |
| EcoSSLs | Ecological Soil Screening Levels |
| EHD | Environmental Health Disparities |
| EIM EDAT | Environmental Information Management Data Analysis Tool |
| EJ | Environmental Justice |
| EM61 | time-domain electromagnetic |
| EPA | U.S. Environmental Protection Agency |
| EPH | extractable petroleum hydrocarbons |
| ERTS | Environmental Report Tracking System |
| FS | feasibility study |
| GPR | ground penetrating radar |
| Haley & Aldrich | Haley & Aldrich, Inc. |
| IRA | independent remedial action |
| ISM | incremental sampling methodology |

| | |
|---|---|
| LUST | leaking underground storage tank |
| µg/L | microgram per liter (also parts per billion - ppb) |
| mg/kg | milligram per kilogram (also parts per million - ppm) |
| mg/L | milligrams per liter |
| MTCA | Model Toxics Control Act |
| NAPL | non-aqueous phase liquid |
| NAVD 88 | North American Vertical Datum of 1988 |
| NRHP | National Register of Historic Places |
| PAH | polycyclic aromatic hydrocarbon |
| PCBs | polychlorinated biphenyls |
| PCUL | preliminary cleanup level |
| PCE | tetrachloroethene |
| PLP | potential liable person |
| POC | points of compliance |
| PQL | practical quantitation limit |
| RCW | Revised Code of Washington |
| RI | remedial investigation |
| RIWP | Remedial Investigation Work Plan |
| SCO | sediment cleanup objective |
| SL | screening level |
| SPP | solidified petroleum product |
| Tacoma Power | City of Tacoma, Power Division |
| TCE | trichloroethene |
| TCL | Tacoma City Light |
| TCLP | toxicity characteristic leaching procedure |
| TEE | terrestrial ecological evaluation |
| TEQ | toxic equivalent concentration for cPAHs |
| TOC | total organic carbon |
| TPH-D | diesel-range total petroleum hydrocarbon |
| TPH-G | gasoline-range total petroleum hydrocarbon |
| TPH-O | oil-range total petroleum hydrocarbon |
| TSS | total suspended solids |
| UST | underground storage tank |

| | |
|---|---|
| VOC | volatile organic compound |
| VPH | volatile petroleum hydrocarbons |
| WAC | Washington Administrative Code |
| WCRA | Willamette Cultural Resource Associates, Ltd. |
| WQPP | Water Quality Protection Plan |

# 1. Introduction

On behalf of The City of Tacoma, Power Division (Tacoma Power), Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this remedial investigation (RI) report to characterize the nature and extent of environmental impacts at the former Kosmos Mill (Site). The Site is located approximately 7.3 miles southeast of Morton, Washington (tax parcel number 030775001000) and is accessible off State Route 12 via Kosmos Road, followed by Champion Haul Road (Figure 1).

A seep of petroleum hydrocarbons was discovered along the bank of Rainey Creek near the Site (Figure 2a). Tacoma Power began investigations and implemented measures to mitigate risks to human and environmental health once the seep was discovered. The Site currently includes parts of the former Kosmos Lumber Mill and the bank of Rainey Creek, shown within the area of potential effect (APE) in Figure 2b. The following is a detailed summary of events at the Site.

**Seep Discovery:**

- April 2019 - The first seep was discovered and reported to the Washington State Department of Ecology (Ecology). On April 26, 2019, Ecology spills response staff received a report (Environmental Report Tracking System [ERTS] no. 688792) of "black oily liquid" coming out of the hill slope and into Rainey Creek. Ecology completed a Site visit on April 27, 2019 and confirmed the presence of a black oily liquid seeping from the bank and layered in sediment along Rainey Creek, a tributary to Riffe Lake. Sampling of the seep material indicated the presence of an oil hydrocarbon, identified by the laboratory as Bunker C. The laboratory analytical report for the seep sample (Bank#2) provided by Ecology is included in Appendix A of the Data Summary Report (DSR), dated February 19, 2021 (Haley & Aldrich, 2021a). Since Bunker C is a heavy oil hydrocarbon, future samples were analyzed for diesel- and oil-range total petroleum hydrocarbons (TPH; TPH-D and TPH-O, respectively).
- May/June 2019 - Ecology requested periodic visual inspections of the Site by Tacoma Power. In mid- to late-May 2019, the water levels in Riffe Lake and Rainey Creek rose above the petroleum seep elevation. In a Rainey Creek water quality sample collected on June 5, 2019 near the seep, TPH-D, TPH-O, and volatile organic compounds (VOCs) were not detected at or above laboratory reporting limits. The laboratory report for the water quality sample (Rainey Creek) provided by Tacoma Power is included in Appendix A of the 2021 DSR.

**Remedial Investigation Begins:**

- July 2019 - Tacoma Power selected Haley & Aldrich (formerly known as Hart Crowser) as the environmental consultant to conduct a remedial investigation and feasibility study (RI/FS) for this project.

  Tacoma Power updated the Kosmos Town and Mill Site archaeology site form (45LE529) and submitted to the Department of Archaeology and Historic Preservation (DAHP), requesting concurrence that the Site not be eligible for inclusion in the National Register of Historic Places. Tacoma Power received agreement from DAHP in September 2019, after a cultural resources survey was completed (see September 2019 bullet below).
- August 2019 - During a pre-investigation Site visit on August 9, 2019, material observed with tar-like consistency and petroleum-like odor was discovered in the upland area (labeled as "oil boils" in Figures 2A and 2B). Tacoma Power collected a sample from the northern oil boil for

chemical analysis and confirmed it contained TPH-O. The laboratory report for the oil boil sample (Kosmos-Upland) is included in Appendix A of the 2021 DSR.

- September 2019 - Tacoma Power's archaeological consulting firm, Willamette Cultural Resource Associates, Ltd. (WCRA), completed an archaeological survey of the proposed Site for permitting the APE. The APE was identified based on the archaeological survey. Haley & Aldrich reviewed Tacoma Power's historical documents and completed an online records review of Ecology's documents and environmental database Site assessment reports.

**Sheen and Additional Seeps Discovered:**

- October 2019 - Water elevations of Riffe Lake and Rainey Creek decreased, and a sheen was observed in the creek on October 4, 2019. Tacoma Power immediately deployed Best Management Practices (BMPs) within the creek and along the bank and shoreline to prevent additional petroleum-impacted material from entering the creek. BMPs included oil-adsorbing pom poms, sweeps, pads, and booms in addition to plastic sheeting covering the bank.

  On October 10, 2019, Tacoma Power collected a sample of the seep material and the results confirmed the presence of TPH-D, TPH-O, and polycyclic aromatic hydrocarbons (PAHs) in the sample. The laboratory analytical report for the seep sample (Kosmos Seep) is also included in Appendix A of the 2021 DSR.

- November 2019 - Tacoma Power declared an emergency in order to quickly implement an independent remedial action (IRA) to address the exposed seeps before the water levels in Riffe Lake rose and inundated the seep areas.

  Additional petroleum-like seeps were observed along Rainey Creek's bank, south of the original seep and at a lower elevation, near the toe of the creek bank (Figure 2a).

**Site Investigation and Emergency Independent Remedial Action:**

- November 2019 - A geophysical survey was conducted in advance of preparing the Remedial Investigation Work Plan (RIWP), which was completed on December 6, 2019 (Hart Crowser, 2019). The geophysical survey included the use of ground penetrating radar (GPR) and a time-domain electromagnetic (EM61) system that is included in Appendix E of the 2021 DSR.

  Anderson Environmental Contractors (AEC) mobilized their equipment on-site in preparation for the emergency IRA and protective cap installation activities.

- December 2019 - The APE was expanded, a protective engineered cap was designed, the bank was excavated for the cap installation (which included excavation of impacted material), the cap was installed, and the RIWP was completed (dated December 6, 2019) and implemented. The 2019 RIWP included conducting test pits, drilling borings, collecting soil samples, and collecting grab groundwater samples from boreholes. The 2021 DSR details the initial investigation of the Site and describes emergency IRA (including soil removal, soil sampling on the bank, cap placement, surface water sampling in Rainey Creek during and after the IRA, and surface water sampling in ponded water in the upland area) conducted at the Site.
  - For the APE expansion, all newly proposed areas where soil would be disturbed were archaeologically surveyed. WCRA prepared a memorandum for Tacoma Power stating that the planned areas in the newly proposed APE were all within the historical Kosmos Mill Site, which was determined to be ineligible for listing on the National Register of Historic Places (NRHP). No new feature areas were observed and WCRA recommended

Tacoma Power utilize their Inadvertent Discovery Plan and spot check sub-surface profile exposures moving forward.

- Haley & Aldrich designed the protective engineered cap to be placed on the bank to help reduce the potential for petroleum to discharge to Rainey Creek. The protective cap material and design documents are provided in Appendices I and J of the 2021 DSR.
- After the protective cap design was completed, AEC, under the direction of Tacoma Power, excavated the bank and installed the protective cap. As part of the protective cap construction effort, surface water quality samples were collected at the request of Tacoma Power to comply with their 401 Water Quality Certification for the Cowlitz Project. Following the excavation for the protective cap area, soil samples were collected along the bank and the edge and bottom of the bank to characterize soil that would remain in-place. All excavated petroleum-impacted soil was placed on plastic and stockpiled on-site for future disposal, which was completed in February 2020.
- While the creek bank was being excavated, test pit and drilling explorations were performed in general accordance with the 2019 RIWP. Soil samples and grab groundwater samples were collected, selected for chemical analysis, and submitted to the laboratory.
- Excavation activities were completed on December 18, 2019, and Tacoma Power continued the surface water sampling and analysis from December 19, 2019 through March 3, 2020.

- January 2020 - Ecology issues a potential liable person (PLP) status letter to Tacoma Power dated January 7, 2020, pursuant to Revised Code of Washington (RCW) 70.105D.040(2) and Washington Administrative Code (WAC) 173-340-500. Based on this change, the RI/FS was placed on hold to follow the Agreed Order (AO) process.
- February 2020 - As part of the emergency IRA and in conformance with Tacoma Power's Water Quality Protection Plan (WQPP), provided in Appendix D of the 2021 DSR, approximately 186,200 gallons of rainwater that was impacted by the oil seeps during the construction of the cap was pumped into holding treatment tanks and then disposed of at the City of Morton's, PRS Group's, and the City of Tacoma's wastewater treatment facilities. Additionally, approximately 10,956 tons of impacted soil previously excavated and stockpiled on plastic as part of the emergency IRA was disposed of off site at the Cowlitz County Headquarters Landfill and Hillsboro Landfill. Following stockpile removal, the emergency IRA was completed as of February 8, 2020.
- March through December 2020 - Beginning in March 2020, Tacoma Power observed a petroleum-like sheen on ponded water in the former stockpile area. A surface water sample was collected on March 3, 2020 (SOP 1) and the analytical data was summarized in Table 6 of the 2021 DSR. The sheen was believed to be a result of some residual material from the former stockpile and test pits were proposed in that location for the 2021 RIWP.

  Tacoma Power conducted routine follow-up inspections and observed the ponded surface water dissipating. The area was seeded in April 2020 to promote vegetation growth and stabilize the Site.

  Additional petroleum-like sheens were observed by Tacoma Power in ponded surface water at the stockpile area in June, July, August, October, and December 2020. Oil absorbent pads were placed in areas with sheen in December 2020. No ponded surface water left the stockpile area in 2020.

- Summer 2020 - Tacoma Power observed that the vegetation struggled to establish in the former stockpile area, especially in the areas of ponded water. This water remained late into the summer. The area continued to be monitored by Tacoma Power and was graded and reseeded for vegetation.
- August 2020 - An AO (DE 16955) with Ecology was executed on August 19, 2020 requiring preparation and submittal of a DSR and RIWP, execution of an RI/FS and preparation and submittal of report(s), and preparation and submittal of a draft Cleanup Action Plan (DCAP). The RI work is to identify the type and extent of contamination at the Site. The Ecology Facility Site identification number is 61559576.
- January to November 2021 - Petroleum-like sheens were observed by Tacoma Power in ponded surface water at the stockpile area in January, February, March, July, and October of 2021. Tacoma Power placed oil absorbent pads in areas with observable sheen.

  In July and August 2021, Rainey Creek water levels rose and inundated the south end of the protective cap and the solidified petroleum product (SPP) ledge. Two surface water samples (Debris_Ravine_20210713 and SPP_Ledge_20210713) were collected on July 13, 2021 from the creek. Only sample Debris_Ravine_20210713 slightly exceeded the indicator level for copper and zinc and exceeded for TPH-O; however, the laboratory reported that the sample contains heavy oil range organics that do not resemble heavy oil reference patterns. Two additional surface water samples (20210804_Debris_Outlet and 20210804_Debris_Ravine) were collected on August 4, 2021 from the creek and the sample results did not exceed indicator levels for TPH-D or TPH-O and one sample (20210804_Debris_Ravine) exceeded the indicator level for copper and zinc.

  In October and early November 2021, organic-like sheens were observed in Rainey Creek and three surface water samples (20211004_Rainey_Creek, 20211013_Rainey_Creek, and 20211108_Bank_Cap) were collected on October 4, 2021, October 13, 2021, and November 8, 2021, respectively, from the creek. Only sample 20211004_Rainey_Creek contained concentrations that exceeded the indicator level of TPH-O.

  In late November 2021, a sheen was observed in the stockpile area and two surface water samples were collected on November 23, 2021 with one sample from the stockpile area (Stockpile) and one sample from Rainey Creek near the conveyance outfall (Conveyance). The sample results did not exceed indicator levels for TPH-D or TPH-O and one sample (Conveyance) slightly exceeded the indicator level for copper. No ponded surface water left the stockpile area in 2021.

  Tacoma Power's surface water sample results are summarized in Table 1 and analytical laboratory reports are provided in Appendix A.
- February 2021 - In accordance with the AO, a DSR was prepared to document and summarize the initial investigation of the Site performed to-date and to describe the emergency IRA conducted in association with the petroleum seeps. The DSR, dated February 19, 2021, was approved by Ecology on February 24, 2021 and indicated several areas where additional data would be needed to fully assess the Site. Additional Site details and environmental investigations to date are provided in the 2021 DSR.
- April/May 2021 - A layer of SPP was observed as a ledge on the east bank of Rainey Creek on the north side of the ravine and as a partially exposed SPP layer in the ravine east of the SPP ledge. Additional information is provided in Section 3.1.3 of the 2021 RIWP (Haley & Aldrich, 2021b).

- Summer and Fall 2021 - Tacoma Power personnel continued to note the SPP locations and to collect the SPP debris as it was discovered and dispose of it off Site as refuse at the local landfill.
- October 2021 - Tacoma Power collected and removed the visible metal debris in the ravine and graded the area by moving some soil from the edges of the ravine to fill in the lower depressed areas to prevent exposure to surface water. Additionally, the SPP layer located north of the ravine was removed approximately 4 feet toward the east and disposed of off Site at Hillsboro Landfill. Ecology's Water Quality Program approved the plan and oversaw construction.
- December 2021 - The RIWP, dated December 30, 2021, was finalized and approved by Ecology on January 11, 2022. The 2021 RIWP was intended to develop the framework to further characterize the nature and extent of environmental impacts and address the data gaps identified in the 2021 DSR. The 2021 RIWP included conducting a GPR survey; soil borings and test pits; installing temporary and permanent groundwater monitoring wells; collecting soil, groundwater, surface water, and sediment samples for chemical analysis; visually inspecting the Site and the banks of Rainey Creek; and inventorying areas of SPP and debris. Data gaps identified in the RIWP are listed below and additional details can be found in the RIWP:
  - Extent of Contamination in the Upland Area,
  - Extent of Contamination along the Creek Bank,
  - Extent of the Pipe Network,
  - Abandoned Culvert and Drainage Ravine, and
  - Elevated Metals in Groundwater.
- January to April 2022 - Organic-like sheens were observed by Tacoma Power in ponded surface water at the stockpile area in January, February, March, and April of 2022. Four surface water samples (SH1-22 Sample 1, SH4-22 Sample 2, SH5-22 Sample 3, and SH2-22 Sample 4) were collected between January and March 2022 and sample results did not exceed indicator levels for TPH-D or TPH-O. One or more samples exceeded indicator levels for cadmium, chromium, copper, lead, and zinc; however, the samples had elevated turbidity, which most likely skewed the metal analytical results high. No ponded surface water left the stockpile area in 2022. Tacoma Power's surface water sample results are summarized in Table 1 and analytical laboratory reports are provided in Appendix A.
- 2022 to present - Implementation of the 2021 RIWP, including conducting a copper background study in June 2025, and preparation of this RI report. Sheens on ponded water were not observed or reported since April 2022.

The purpose of the RI is to collect data necessary to adequately characterize the Site for developing and evaluating cleanup action alternatives. This information will be used to develop, select, and implement a cleanup action. The RI was conducted in accordance with the Model Toxics Control Act (MTCA)—WAC 173-340-350. The results of this RI will be used to prepare a FS report and DCAP. The cleanup outlined in the DCAP, if approved by Ecology and after public comment, will be implemented at the Site under a separate AO with Ecology.

# 2. Site Background

The background and physical setting information summarized below are based on Site visits and review of prior environmental data and documents.

Historically, the Site was established as a lumber mill in 1904. The former mill included railroad lines/tracks, several buildings, and a log pond (Figure 2b). The City of Tacoma purchased the former Kosmos townsite and lumber mill in the 1960s and the inhabitants were relocated. The land was acquired to create the Riffe Lake reservoir for recreational use and power generation. The lumber mill facility was abandoned and demolished prior to the 1968 completion of Mossyrock Dam. Riffe Lake is currently a component of the Cowlitz River Hydroelectric Project operated by Tacoma Power. Additional Site background and description information are provided in the 2021 DSR.

## 2.1 SITE DESCRIPTION

Tacoma Power's property (Property) is located in Rainey Valley, within the Riffe Lake reservoir, in an area referred to as Kosmos Flats and was purchased by the City of Tacoma in the 1960s. Rainey Creek bounds the Property to the north and west, Champion Haul Road to the east, and Riffe Lake to the south.

The Site is located within the Property with Rainey Creek to the west, the former log pond area to the south, an old mill road and the former stockpile area from the emergency IRA to the east, and the north bank of the ravine and old mill road to the north (Figure 2a and 2b). The Site topography generally slopes to the south toward Riffe Lake, but the local topography gradually slopes to the northwest, toward Rainey Creek in the area near the identified petroleum seeps which were covered by a protective cap under the emergency IRA in 2019 (and described in the 2021 DSR).

The Kosmos Flats is a plateau and is referred to in this RI report as the upland area. This area was formerly the location of the Kosmos lumber mill. The building foundation, railroad rails, metal, and concrete debris from the former mill can be seen in the upland area. The former mill location is on the east bank, above an outside bend of Rainey Creek channel. Other Site features include a surface water conveyance ditch and a former log pond dike. There is approximately a 38-foot elevation difference between the top and bottom of the creek's bank and the bank ranges from 1 horizontal to 1 vertical (1H:1V) to 3H:1V slope along the Site. Downstream of the protective cap, the bank is generally at a 2H:1V slope. At the protective cap, the bank's slope is generally at a 3H:1V slope. Upstream of the protective cap, the bank steepens to 1H:1V with almost vertical portions for an approximate 300-foot length before the slope becomes less steep. Near the cap on the upstream side is a ravine that trends from the creek's bank to the east toward the upland area of the Site. This ravine contained metal and other debris from historical mill operation; however, most of the visible debris was removed by Tacoma Power in October 2021.

### 2.1.1 Site Elevations

All elevations discussed in this report are taken from the Tacoma City Light (TCL) datum, which is 3.96 feet below North American Vertical Datum of 1988 (NAVD 88).

The spillway at Mossyrock Dam is at an elevation of 728.5 feet. Historically, spring rainfall and snowmelt inundated the Site up to a maximum dam safety design elevation of 781.2 feet. From June to August (or July, if it is a dry summer), the water levels in the reservoir are higher and closer to full-pool levels. The reservoir's normal full-pool elevation is approximately 778.5 feet, which is the regulated Ordinary High Water Line and would submerge the upland portion of the Site.

In recent years, the reservoir's full-pool water levels have been maintained at an approximate elevation of 749 feet due to seismic safety concerns with the Mossyrock Dam spillway piers. This has prevented inundation and allowed the Site to be exposed for extended durations and for vegetation to grow.

The Site's ground surface elevation ranges from approximately 718 feet near the petroleum seep area at the toe of Rainey Creek to approximately 758 feet in the upland area at the top of the bank near the old lumber mill foundations. Rainey Creek's bed is at an approximate elevation of 716 feet adjacent to the protective cap. During the 2019 investigation and protective cap construction, Rainey Creek water elevation was approximately 719 feet. During a storm event in the winter of 2019/2020, high inflows led to a rise in Rainey Creek and Riffe Lake's water levels. The associated backwatering resulted in the entire Site being inundated on February 8, 2020. After about a week, the water receded, and the upland area was again visible. As of the date of this report, the Site has not been inundated since February 2020.

### 2.1.2 Property Uses

The Property is currently vacant with temporary signage and jersey barriers along the eastern side of the Site. The future Property uses are to be available to the public as a recreational wildlife area when accessible. Tacoma Power intends to return to a normal full-pool elevation of approximately 778.5 feet where the Site would be inundated during portions of the year for public recreation and water storage.

**Parcel and Property Description:**

The Site is within parcel number 030775001000 and located in the southwest quarter of Section 28, Township 12N, Range 05E.

Property legal description is ALL SECTION 28 LESS PART NW4 & PART SECTION 29 LESS N2 NE4 & PART TO NORTHERN PACIFIC RAILROAD COMPANY 28/29-12-5E.

Property use code is 48 Utilities.

**Ecology Site Identifications:**

- Facility/Site ID is 61559576
- Cleanup Site ID is 9890
- Underground Storage Tank (UST) ID is 200555
- Cleanup Site Name is Riffe Lake

**Ecology Oversight:**

- The Site is currently in an AO (DE 16955) with Ecology's Toxics Cleanup Program overseeing the remediation process, including this RI and the future FS and DCAP.

- Tacoma Power also has a 401 Water Quality Certification permit (order no. 11-2001) for their hydroelectric project on Riffe Lake that Ecology's Water Quality Program oversees.

## 2.2 PREVIOUS INVESTIGATIONS AND INTERIM REMEDIAL ACTIONS

### 2.2.1 Underground Storage Tank Removal

Two underground storage tanks (USTs) related to the lumber mill were discovered at the Site in 1992, which were subsequently removed by AIRO Environmental Services (AIRO). The first underground storage tank (UST) was a 500-gallon steel tank, located south of the observed seeps and found partially exposed along an earthen bank of Rainey Creek, labeled Site D in Figure 3. It was filled with lake water and did not exhibit a sheen or other indicators for the presence of petroleum products. Sampling results were not detected at or above laboratory reporting limit of 0.01 milligrams per liter (mg/L) for polychlorinated biphenyls (PCBs) or 10 mg/L for total halogens (AIRO, 1993).

The second UST, a 5,000-gallon tank, was located below ground level near the remaining mill facility foundations, labeled Site A in Figure 2a. The UST contained petroleum product with the presence of halogenated hydrocarbons. Soil containing heavy oil-range petroleum at concentrations exceeding MTCA Method A soil cleanup levels (CULs) surrounded the 5,000-gallon UST. A total volume of 87 cubic yards of contaminated soil was removed and disposed of at the Kitsap County Landfill (AIRO, 1993). The 1993 report is provided in Appendix B of the 2021 DSR.

Ten additional USTs were discovered at the former Kosmos townsite, located approximately one-third of a mile to the northeast of the Site and north of Rainey Creek (Figure 1). Approximately 25,900 tons of contaminated soil was excavated from the townsite, remediated in that location using thermal desorption, and used as backfill for the excavations. Analytical results of groundwater samples collected by DOWL Engineers (DOWL) within the former townsite indicated that contaminants did not migrate away from the UST perimeter set by the monitoring wells, but concentrations above MTCA Method A CULs were detected in the suspected central area of the contaminated plume (DOWL, 1993). As the former Kosmos townsite is located one-third of a mile northeast from the Site, the DOWL 1993 report was not included as an appendix to the 2021 DSR.

### 2.2.2 2019 Initial Site Investigation and Emergency Independent Remedial Action

In 2019 and 2020, following the observation of the seep in April 2019, an initial investigation and emergency IRA were conducted at the Site (Figure 2a). In November and December 2019, twelve test pits (TP-2, TP-3, TP-5 through TP-8, and TP-10 through TP-15) were excavated to depths of 5 to 20 feet below ground surface (bgs) and ten sonic borings (borings B-1 through B-10) were advanced to depths of 40 to 50 feet bgs in the upland area of the Site. Grab groundwater samples were collected from four of the borings (B-4, B-6, B-7, and B-9).

Analytical results from soil samples collected from borings and test pits indicate the presence of gasoline-range total petroleum hydrocarbons (TPH-G), TPH-D, TPH-O, and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) in soil at concentrations above CULs, primarily in the upper 10 to 15 feet of soil in the upland area of the Site during the 2019 investigation. An isolated area near the former Site A (5,000-gallon UST) was found to contain petroleum-contaminated soil in the upper 2.5 feet bgs. Additionally, TPH-D, TPH-O, and cPAHs were found in soil above CULs on the edge of the creek bank and bottom as well as the creek bank underneath the protective cap.

Two groundwater samples were analyzed for and contained total metals (arsenic, cadmium, chromium, and lead) above CULs; however, the samples also contained high levels of turbidity and total suspended solids (TSS).

As part of the emergency IRA, AEC, Tacoma Power's selected contractor, temporarily diverted the flow of Rainey Creek away from the work area in order to excavate the surface and subsurface contamination. During this flow diversion, non-aqueous phase liquid (NAPL) was observed (brown, oil-like, and heavy sheen) at the edge of the bank and creek bottom directly adjacent to the location of the petroleum seeps on the bank. After excavation in the area where the protective cap was to be installed, one soil sample was collected from the exposed edge of the bank and next to the creek bottom (sample Creekbed 1 on Figure 2a) at an approximate elevation of 717 feet, three additional soil samples were collected from the lower bank (samples LB-1 through LB-3) at an approximate elevation of 719 to 718 feet, and three soil samples were collected from the upper bank (samples UB-1 through UB-3) at an approximate elevation of 746 to 745 feet. The samples were analyzed for TPH-G, TPH-D, TPH-O, metals, PAHs, and VOCs. TPH-D, TPH-O, and cPAHs were detected at concentrations above MTCA Method A CULs in soil samples Creekbed 1 and LB-2, all other analytes were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable MTCA Method A CULs.

Surface water samples of Rainey Creek were collected in general accordance with Tacoma Power's WQPP, to monitor the effectiveness of the BMPs that Tacoma Power had implemented during earthwork activities during the emergency IRA. Surface water sample analytical results showed elevated TPH-O, TPH-D, copper, and zinc in areas adjacent to the construction area, but not downstream of the protective cap area, indicating the effectiveness of the BMPs.

Surface water samples were collected by Tacoma Power from ponded water in or near the stockpile during the emergency IRA in December 2019 and January 2020. Water from heavy rains and surface runoff around the stockpile had to be diverted to keep the stockpile from becoming saturated. A surface water sample (Stockpile #1) was collected within the stockpile area and the analytical results were above indicator levels for pH, turbidity, TPH-D, and TPH-O. Surface water from the diversion trench was sampled (T1 and T2) multiple times in January and February 2020. The analytical results were below the indicator levels, except for pH for the February event.

To remove the stockpiles in an expedited manner, Tacoma Power had to maintain a low water level in the area. Due to heavy rains and surface runoff, the volume of water was increasing in the stockpile area, requiring Tacoma Power to intermittently discharge to the log pond area for infiltration for approximately 8 hours on February 8, 2020. Two surface water samples (Log Pond #1 and Log Pond #2) were collected. The sample results were above the indicator levels for pH and turbidity (Log Pond #2 only), and were below indicator levels for TPH-D and TPH-O.

Ponded water was observed in the former stockpile area and near the former building foundations. These areas were sampled (SOP 1 and COP 1, respectively) on March 3,2020. The samples contained concentrations of pH, turbidity, copper, and zinc above the indicator levels. Sample SOP 1 contained elevated concentrations of TPH-D and TPH-O above indicator levels.

There were no releases of the ponded water tested in March 2020 outside of the stockpile area. The stockpile area was seeded in April 2020 to promote vegetation growth. The vegetation struggled to establish within the stockpile area, especially in the depressed areas where water ponded. Additional

petroleum-like sheens were observed, and in September 2020, Tacoma Power submitted a plan to Ecology that was reviewed and approved to cover the stockpile area with bioretention soil and biofiltration seed. This temporary measure is to further stabilize the stockpile area, fill in the depressed areas to promote drainage, and to promote further vegetation growth.

More details about the initial investigation of the Site, the emergency IRA, analytical results, and sample locations are described in the 2021 DSR.

### 2.2.3 2021 Site Investigation by Ecology and Debris Removal by Tacoma Power

During a March 2021 on-site visit by Ecology's Water Quality Program, a layer of SPP was observed as a ledge on the east bank of Rainey Creek on the north side of the ravine (Figure 3). The layer is resistant to erosion as it is observed to be sand and gravel cemented in a hard petroleum matrix and was overhanging the stream bank along the bank top (i.e., the soil beneath the SPP had been eroded). The ledge of the SPP is approximately 16 feet long by 2 feet wide and 3 to 7 inches thick, and the eastern portion is covered with alluvium.

On April 16, 2021, Ecology sampled the SPP ledge and submitted for chemical analysis of TPH-D; TPH-O; TPH-G; total metals (arsenic, cadmium, chromium, hexavalent chromium, copper, lead, nickel, zinc, and mercury); PAHs; benzene, toluene, ethylbenzene, and xylene (BTEX); and extractable and volatile petroleum hydrocarbons (EPH and VPH, respectively). Analytical results indicated concentrations in soil exceed MTCA Method A CULs for TPH-D, TPH-O, and cPAHs. There were detectable concentrations of some metals below applicable MTCA Method A CULs. There were no detectable concentrations in the VPH range or for BTEX compounds. There were detectable concentrations in the EPH range. Since this Site can be submerged during high reservoir levels, leach testing was performed on the SPP ledge soil sample to determine if there was a risk to surface water quality. The leaching test was completed using distilled water in a modified toxicity characteristic leaching procedure (TCLP) and the leachate (labeled as Rinsate in the laboratory report) was analyzed for TPH-D, TPH-O, and metals. Results show TPH-D, TPH-O, and copper levels exceed WQPP indicator levels. The laboratory report for the Ecology samples were provided in Appendix D of the 2021 RIWP.

In May 2021, Tacoma Power personnel observed a partially exposed SPP layer in the ravine east of the SPP ledge. It is not known if this is connected to the SPP ledge. The eastern portion of this layer is also covered by alluvium.

SPP debris was found scattered on the Site's upland surface and Rainey Creek bank. Tacoma Power personnel are continuing to note the location and collect this debris as it is discovered and dispose of it off Site. As of early 2024, Tacoma Power inspects the Site on a bi-weekly basis.

On October 4 and 5, 2021, Tacoma Power collected and removed the visible metal debris in the ravine and graded the area by moving non-impacted soil from the edges of the ravine to fill in the lower, depressed areas to prevent exposure to surface water. Additionally, the SPP layer located north of the ravine was removed approximately 4 feet toward the east and disposed of off Site to Hillsboro Landfill. Ecology's Water Quality Program approved the plan and oversaw construction.

## 2.3 GEOLOGY AND HYDROGEOLOGY

Our understanding of Site geology and hydrogeology is based on explorations and wells completed by Haley & Aldrich in 2019, 2022, and 2025 and historical investigation activities completed by AIRO.

### 2.3.1 Geology

The Site is located along Rainey Creek in the Cowlitz River watershed. During the late Pleistocene, the Cowlitz glacier extended from its source on Mount Rainier roughly to the town of Salkum, Washington, west of the Site. During this Epoch, the Cowlitz glacier advanced and retreated on at least four distinct occurrences. These glaciations produced three distinct outwash deposits. The earliest deposit was the Wingate Hill outwash, followed by the Hayden Creek drift, and most recently the Evans Creek outwash.

In the Rainey Creek valley, glacial deposits are represented as the Hayden Creek drift. The Hayden Creek drift is dominantly composed of outwash deposits expressed as poorly graded gravel deposits and localized till deposits. It is also common to find loess deposits up to 3 feet thick in the Hayden Creek formation. The entire Hayden Creek formation is described as heavily oxidized to depths up to 30 feet.

Soil from borings and test pits conducted by Haley & Aldrich (during the 2019 initial investigation of the Site and 2022 RI) are generally consistent with expected outwash deposits of the Hayden Creek formation. Soil in the upland area generally consisted of sandy silts to silty sands with gravel in the upper 5 to 15 feet and silty gravel with sand and some cobbles to poorly graded coarse sand below 15 feet. Additionally, localized fine-grained organic deposits of silt and clay were found in low-lying vegetated areas in the upper 5 feet during the 2019 initial investigation of the Site and 2022 RI. Topsoil consisting of soil material with high organic content was generally encountered in the first couple of feet. Shallow soil encountered during the 2025 copper background study was consistent with the 2019 and 2022 investigations and consisted of sandy silts to silty sands with varying amounts of gravel, cobbles, and organics. Fill material was also encountered in the upper 5 to 10 feet containing concrete, wood, and metal debris. Silts and/or clay with sand and gravel was generally encountered below the topsoil and was observed up until approximately 5 to 15 feet bgs. Fill also contains TPH-like staining below 28 feet bgs to 35 feet bgs in exploration B-2 (petroleum analytical results from soil sample collected at a depth of 30 to 35 feet bgs were not detected at or above laboratory reporting limits for TPH-G, TPH-D, and TPH-O). The outwash deposits were encountered below the fill. Till-like material was only observed in the bank samples taken on the west side of Rainey Creek, opposite of the Site. Based on observations during the emergency IRA construction and sediment samples collected along Rainey Creek, the sediment material generally consists of gray clayey sand with gravel and cobbles.

Generalized subsurface cross-sections A-A’ and B-B’ are illustrated in Figures 4 and 5, respectively.

### 2.3.2 Hydrogeology

In 1992, groundwater was encountered during the excavation of Site A at approximately 10 to 11 feet bgs (AIRO, 1993). In 1993, at the former townsite (located to the northeast of the Site) groundwater was encountered during the assessment at approximately 6 to 11 feet bgs and flowed to the southwest, toward Riffe Lake, and that depth to groundwater varies seasonally (DOWL, 1993).

During the Site investigations, deeper groundwater in the upland area was generally encountered from 36 to 47 feet bgs (an approximate elevation of 710 to 721 feet), and shallower groundwater was

generally encountered from 5 to 15 feet bgs (an approximate elevation of 741 to 754 feet). The elevation of Riffe Lake reservoir during the time of the investigations ranged from approximately 692.5 to 747.7 feet (Figure 6; U.S. Geological Survey, 2023). Figures 7a and 7b illustrate the shallow and deep groundwater elevations collected from the investigations and compared with the published Riffe Lake reservoir elevations, respectively. Groundwater measurements collected during the RI activities by Tacoma Power and Haley & Aldrich staff are presented in Table 2.

Based on the historical groundwater information and groundwater conditions found at the time of the investigations, deep groundwater levels are inferred to be tied to the reservoir levels, as we observed a stable deep groundwater elevation (around 717 to 720 feet) when lake levels are low and then an increase in deep groundwater elevations when the reservoir levels rise. The shallow groundwater levels have more seasonal variation in the winter and spring months (Figure 7b); however, there does seem to be some comparison to shallow groundwater elevations to reservoir levels, specifically in MW-3S (Figure 7a). Groundwater elevations may fluctuate as water is retained and released from the Mossyrock Dam. The depth to shallow groundwater generally ranged between 5 and 15 feet bgs (approximate elevation of 754 and 741 feet TCL). Based on the groundwater measurements at the Site, saturated soil was conservatively assumed to be at a depth of 5 feet bgs (approximate elevation of 752feet TCL). Groundwater elevation contours for shallow and deep wells are illustrated in Figures 8 and 9, respectively.

## 2.4 ENVIRONMENTAL JUSTICE

The objective of this section is to understand what Environmental Justice (EJ) concerns may exist for the Site and to anticipate potential EJ concerns related to the Site and the adjacent communities. This effort is required by Ecology, per the newly updated WAC 173-340-350(6). In order to meet this new requirement, we utilized multiple tools to evaluate various indicators for this Site, as they relate to EJ.

The U.S. Environmental Protection Agency (EPA) has developed a new EJ screening and mapping tool (EJScreen), that uses standard and nationally consistent data to identify and highlight places that may have higher environmental burdens and more vulnerable populations (EPA EJScreen, 2023). These maps provide data for mapped regions in percentile format for a variety of indexes, such as pollution measures (e.g., particulate matter and ozone), as well as potentially hazardous substances (e.g., lead paint and USTs).

Our review of the EJScreen tool for the Site shows that the area within a 5-mile radius around the Site is below the 80th percentile for the thirteen EJ pollution and sources indices, compared to other populations across the state and the nation. For reference, anything above the 80th percentile is generally considered to be more despaired than other communities on a national average. The Site appears to exceed the 80th percentile for several socioeconomic indicators, including supplemental demographic index, unemployment rate, less than high school education, over age 64, and low life expectancy. A summary table of Environmental and socioeconomic indicators data compared to state and national percentiles is provided at the end of the EJScreen community report and additional screening details specific to this Site, including socioeconomic indices, are provided in Appendix B.

### 2.4.1 Washington Environmental Health Disparities Mapping

The Washington State Department of Health also has an EJ mapping tool. The Washington Environmental Health Disparities (EHD) Map (WSDH, 2023) is an interactive mapping tool that compares communities across our state for environmental health disparities. The community identified by the

census tract in which the Site is located has relatively low overall cumulative environmental health impacts in the state, with a rank of 2 out of 10 overall risk ranking. However, the area around the Site has a rank of 8 out of 10 for socioeconomic factors and 6 out of 10 for sensitive populations.

Furthermore, the Site census track ranks amongst the highest for ozone concentration, lead risk from housing, no high school diploma percentage, population living in poverty, transportation expense, unemployment percentage, and cardiovascular disease. Additional outputs from the EHD mapping tool are also provided in Appendix B and Table B-1.

These screening results should not be used as a definitive representation of conditions in the community or an assessment of individual risk, but rather as one line of evidence to characterize potential community environmental health burdens and social vulnerability.

## 2.5 CLIMATE CHANGE

As part of the new WAC 173-340-350(6)(f) requirements which went into effect January 1, 2024, details on the current and projected climatological characteristics for this Site are included; however, this will be further evaluated during the FS. The objective of this section is to understand what climate change concerns may exist for the Site and to anticipate how potential climate change concerns may affect the migration of contaminants of concern (COCs).

It is generally agreed upon that this region has been experiencing a higher frequency of wildfires and flooding events due to increased temperatures caused by climate change. Large and severe fires in the Pacific Northwest are associated with warm and dry conditions, and such conditions will likely occur with increasing frequency in a warming climate (Halofsky, Peterson, and Harvey, 2020). The nearby Chehalis River Basin has documented increases in peak seasonal flood levels. For decades, peak seasonal flood levels have been rising, with five of the basin's largest historical floods occurring during the last 30 years (Ecology, 2023a). Key climate change impacts in the region are generally expected to include increased temperatures, more frequent extreme heat events paired with urban heat islands, increased drought risk, invasive plant species, pests and pathogens, sea-level rise, changes in hydrology leading to changes in forests and salmon habitats, increased precipitation resulting in increased stormwater runoff and erosion, and more frequent and intense precipitation events that may lead to prominent flooding (Rutledge and Brandt, 2022). Based off data provided and analyzed by the University of Washington, the average precipitation for Lewis County will increase by 1.8 percent and the frequency of 2-year to 100-year storm events will increase between approximately 10 to 25 percent in the area around the Site (University of Washington, 2023). However, an increase in precipitation and extreme storm events would likely have little impact on the Site, because the area has historically been inundated. Water levels at the Site are also controlled by Tacoma Power through the Riffe Lake Reservoir system; therefore, an increase in surface water levels is not expected to be a significant concern. However, this will be further evaluated in the FS and considered during the development of any cleanup alternatives proposed for the Site.

# 3. 2022 Through 2025 Site Investigation and Characterization

Site investigation was limited to the APE identified by Tacoma Power for cultural resource protection purposes during the RI (Figure 2B). The APE is approximately 12.77 acres and is located directly to the east and southeast of Rainey Creek, as well as along the west bank of Rainey Creek.

Activities performed in the 2019 initial investigation of the Site are summarized in the 2021 DSR and Site investigation activities conducted in 2022 and 2023 for the RI generally followed the 2021 RIWP and included conducting GPR; soil borings and test pits; installing temporary and permanent groundwater monitoring wells; collecting soil, groundwater, surface water, and sediment samples for chemical analysis; visually inspecting the Site and the banks of Rainey Creek; and inventorying areas of SPP and debris.

## 3.1 DEVIATIONS FROM THE WORK PLAN

In general, there were very few deviations from the 2021 RIWP. Figure 3 shows the final exploration locations.

After the potholing subcontractor, River's Edge Environmental Services, visited the Site, it was determined that the potholes could be completed with an excavator rather than a vacuum-truck. The potholes were excavated between May 2 and 6, 2022 and were renamed as test pits (TP-40 through TP-54).

Based on encountered field conditions, four additional test pit locations (TP-36B, and TP-56 through TP-58) were added. TP-36B was added to characterize soil near TP-36 where a pipe was encountered. The pipe contained water that was observed to have a petroleum-like odor and soil directly near the pipe was also observed to have a petroleum-like odor. TP-57 was added to characterize soil to the southwest of TP-51 because petroleum-like impacts were observed. TP-56 and TP-58 were added to characterize soil to the northeast of the Site after petroleum-like impacts were observed in contingency test pits TP-55 and TP-59.

Boring locations B-12 and B-13 were inadvertently switched from the 2021 RIWP proposed locations during field activities. Both borings were completed according to the 2021 RIWP.

For the groundwater monitoring events, deep wells were not monitored in June 2022 since only the shallow monitoring wells were installed at the time of the event. Shallow wells were not monitored during the November 2022 and August 2023 events due to low water levels. Shallow groundwater was only monitored for three events, as opposed to four events; however, Haley & Aldrich believe that these three events give sufficient information to prepare the RI, FS, and DCAP reports.

## 3.2 2022 THROUGH 2023 FIELD INVESTIGATION ACTIVITIES AND OBSERVATIONS

Prior to any ground-disturbing activities for the investigation, private and public utility locate services were performed at the Site. Site exploration locations are shown in Figure 3. Field screening results are summarized in Table 3. Field exploration and sampling methods, and exploration logs are provided in Appendix C.

### 3.2.1 Ground-Penetrating Radar and Visual Inspections

As part of the initial investigation of the Site in 2019, a GPR survey was conducted by Global Geophysics LLC around the former foundations and roadways on the Site and identified multiple areas of metal and/or dense object anomalies and multiple pipes were encountered during the 2019 exploration effort, as identified in green on Figure 2a.

An additional GPR survey was conducted in March 2022, which included the use of GPR and an time-domain electromagnetic (EM61) system. The survey was conducted in areas where known and unknown pipes left in-place were observed during the initial investigation of the Site and cap construction activities. Additional anomalies were observed indicative of pipes or metal debris remaining in-place, identified in green on Figure 3. The anomalies were not indicative of a UST. A copy of the GPR report is provided in Appendix D.

A visual inspection of the cap, upland area, and creek bank was also performed at the same time as the geophysical survey. No obvious signs of environmental impacts, including SPP layers and/or debris, or damage to the cap was observed during the visual inspection.

### 3.2.2 Test Pit, Soil Boring Explorations, and Monitoring Well Installation

The 2019 initial investigation of the Site and emergency IRA identified petroleum-contaminated soil in the upland area (from explorations B-5, B-6, TP-5, TP-6, TP-7, TP-12, and TP-15) and along Rainey Creek's east bank (soil samples Creekbed 1 and LB-2; Figure 2A).

Between May 2 and 6, 2022, 46 test pits (TP-16 through TP-61) were excavated to depths of 10 to 20 feet bgs in the upland area of the Site and along the Rainey Creek bank (Figure 3). Haley & Aldrich collected soil samples generally from between 2- and 5-foot intervals for soil classification and potential chemical analysis.

Piping or pipe debris was encountered in eight test pits, ranging between 1 and 12 inches in diameter. In three of the test pits (TP-34, TP-36, and TP-48), a petroleum-like odor was observed in water in the pipes and/or the soil in the test pit. While excavating two test pits (TP-43 and TP-48), impacted material was observed on one or more sidewalls of the excavation, but was not observed on opposite sidewalls. Samples were collected from each sidewall of the test pits to characterize the potentially impacted and non-impacted material.

On June 27 and 28, 2022, four shallow borings were advanced to depths of 20 feet bgs and completed as monitoring wells (MW-1S through MW-4S). Between 24 and 31 of October 2022, eleven borings were advanced using a sonic mobile rig to depths of 50 to 60 feet bgs, with four borings completed as deep monitoring wells (B-11 through B-17 and MW-1D through MW-4D). Soil samples were collected at 2.5- to 5-foot intervals and grab groundwater samples were collected from borings B-11 through B-17.

The monitoring wells are constructed of 2-inch-diameter Schedule 40 polyvinyl chloride with 10-foot screens in the shallow wells and 20-foot screens in the deep wells. Following completion of the monitoring wells, each well was mechanically developed by surging and then pumping until the groundwater showed minor presence of fine sediments and was not overly cloudy or dark. Table 2 provides the monitoring well construction details.

Soil samples were field screened using sheen tests, visual and olfactory observations, and/or a photoionization detector to detect VOCs in the headspace. Elevated headspace detections (greater than 2 parts per million) were noted in samples collected from test pits TP-21, TP-24, TP-34, TP-36, TP-43, TP-44, TP-48, TP-49, TP-51, TP-55, and TP-59 and borings MW-2D, MW-3S, and MW-3D. Additionally, a petroleum-like odor and/or sheen was observed from test pits TP-21, TP-22, TP-24, TP-25, TP-26, TP-29, TP-34, TP-36, TP-42, TP-43, TP-44, TP-47, TP-48, TP-49, TP-51, TP-55, and TP-59 and borings B-11, B-12, MW-1S, MW-2S, MW-2D, MW-3S, and MW-3D. Field screening results are summarized in Table 3 and provided in the exploration logs in Appendix C.

Per the 2021 RIWP, the selection of samples for analysis was based on observed potential impacts, field screening results, previous investigation sample results, and sample location and depth. Soil analytical results are provided in Table 4.

### 3.2.3 Grab Groundwater Samples

Grab groundwater samples were collected from seven boring locations (B-11 through B-17) in the upland area of the Site (Figure 3). The top of a 5-foot temporary prepacked well screen was set approximately 1- to 2-feet above the observed water table and groundwater was sampled approximately 1- to 2-feet below the observed water table. Samples were collected per the procedures established in the 2021 RIWP. Water quality parameters and depth to water were measured prior to groundwater sample collection and can be found in Table 5. No sheen, NAPL, or odor were observed during grab groundwater sampling.

### 3.2.4 Groundwater Monitoring

Groundwater monitoring was conducted on the eight monitoring wells (MW-1S through MW-4S and MW-1D through MW-4D) on a quarterly basis, except for the following:

- Deep wells were not monitored in June 2022, as only the shallow monitoring wells were installed at the time of the event.
- Due to low water levels in November 2022 and August 2023, the shallow wells were not monitored during these events.

Shallow wells were sampled a total of three times and deep wells were sampled a total of four times. Haley & Aldrich believe these groundwater monitoring events give sufficient information to prepare the RI, FS, and DCAP reports.

Samples were collected per the procedures established in the 2021 RIWP. Water quality parameters and depth to water were measured prior to groundwater sample collection and summarized in Table 5. A petroleum-like odor and sheen were observed in MW-2S and MW-3S during the three sampling events. A sheen or odor were not observed in MW-1S or the deep monitoring wells during the sampling events.

### 3.2.5 Surface Water Sampling

Surface water samples were collected during the 2019 initial investigation of the Site and emergency IRA by Haley & Aldrich. Additional surface water samples were collected after installation of the protective cap and in the upland area in ponded areas by Tacoma Power from December 2019 to February 2022. Based on the surface water samples in the creek during construction of the protective cap, any potential impacts to surface water appeared to be contained by the BMPs. The surface water samples collected

post-construction contained elevated concentrations of copper, zinc, and TPH-O most likely due to increased precipitation and runoff as the upstream sample of the cap area had metals and TPH-O concentrations exceeding the WQPP's indicator levels.

Ponded surface water sample, SOP 1, collected on March 3, 2020 in the upland area near the stormwater diversion trench and the former stockpile area, contained elevated copper, zinc, TPH-D, and TPH-O; these elevated concentrations were most likely due to elevated turbidity in the sample (analytical results are provided in the 2021 DSR). This could have been due to residual impacts from the former stockpile area that was used for the emergency IRA; however, no obvious environmental impacts were observed in soil samples collected from test pits near ponded water sample SOP 1 (TP-37, TP-38, and TP-39). Additionally, soil samples collected from these nearby test pits were not detected at or above laboratory reporting limits for TPH-D and TPH-O. Copper and zinc were detected in the test pit samples with concentrations ranging from 38.2 to 48.4 milligrams per kilogram (mg/kg) and 31.3 to 45.8 mg/kg, respectively.

Tacoma Power observed additional petroleum-like sheens in the stockpile area in June, July, August, October, and December 2021, and organic-like sheens from January to April 2022. Additional samples were collected by Tacoma Power in 2021 (Stockpile) and in 2022 (SH1-22 Sample 1, SH4-22 Sample 2, SH5-22 Sample 3, and SH2-22 Sample 4). The sample results did not exceed indicator levels for TPH-D or TPH-O; however, some samples had metals above indicator levels (Table 1). Most likely, metal results were skewed high due to elevated turbidity in the sample. No sheens were observed in 2023.

In 2022, surface water samples were collected for the remedial investigation from Rainey Creek upstream of the ravine, adjacent to the protective cap, and downstream of the protective cap during two sampling events conducted during the seasonal high and low surface water levels. Surface water samples were collected using a pole with a bottle sampler attached and were collected by submerging the container at the water's surface. Field parameters (turbidity and pH) were also collected at each sampling location during both events and summarized in Table 6. No obvious environmental impacts were observed in the samples collected.

### 3.2.6 Sediment Sampling

Sediment sampling was not conducted during the 2019 initial investigation of the Site or emergency IRA; however, petroleum-contaminated soil was observed in soil samples Creekbed 1 and LB-2, and sediment quality was considered a data gap in the 2021 DSR.

Sediment sampling was performed in April 2022 and October 2022. In April, Rainey Creek was rapidly flowing, and the water depths were observed to be approximately 0.5 to 2.5 feet. Haley & Aldrich representatives were able to collect samples from five locations (SS-1, SS-4, SS-7, SS-8, and SS-11; Figure 3); however, the representatives were unable to collect samples from the other locations due to the water depths being too high and water flowing too quickly for manual collection methods. Generally, refusal was met at 0.5 feet below the creek bottom and sediment consisted of cobbles with sands and gravel. No obvious signs of environmental impacts were observed in the samples collected.

During the October sampling event, water depths were observed to be approximately 0.25 to 0.5 feet. Haley & Aldrich representatives were able to collect samples from all 12 locations. One location (SS-7) was moved from the original location, with Tacoma Power's approval, because refusal was met at 3 inches bgs and an organic, white sheen was observed, most likely from the natural organic matter in

the sediment. Refusal was generally met at approximately 0.5 feet below the creek bottom, except for location SS-4 where refusal was met at approximately 1.5 feet below the creek bottom. Field screening results are summarized in Table 3. No obvious environmental impacts were observed in the samples collected.

### 3.3 2025 COPPER BACKGROUND STUDY

Between June 2 and 5 and on June 11, 2025, fifteen soil samples and one duplicated sample were collected as part of the natural background study to develop Site-specific background soil concentrations for copper. Samples were collected using hand tools between 1 and 5 feet bgs. Per the Copper Background Study Work Plan (Haley & Aldrich, 2025), soil samples were collected from each sample location using incremental sampling methodology (ISM). Thirty sub-samples were collected from each location, except for BSS-13, from randomized sample depths based on the total depth of the boring. BSS-13 met refusal at 14 inches bgs and the soil recovery length from BSS-13 was collected instead of collecting soil subsets. Boring logs related to the background study and a figure (Figure E-1) showing the sample are provided in Appendix E.

Copper was detected between 15 and 50 mg/kg. Using the Ecology MTCA Statistic Environmental Information Management Data Analysis Tool (EIM EDAT) the background concentration was calculated to be 52.15 mg/kg. The analytical results and the results of the MTCA Statistics are provided in Tables E-1 and E-2, respectively.

#### 3.3.1 Deviations from the Copper Background Study Work Plan

Seven sample areas (BSS-2, BSS-10, BSS-11, and BSS-12 through BSS-15) had to be relocated due to access restrictions to the originally planned sample areas or because evidence of the exclusion criteria listed in the Background Study Work Plan were observed. Also, sample BSS-13 was not included in the statistical analysis because the sample was collected from 0 to 14 inches bgs, which deviated from the work plan sampling procedures. Several locations were advanced near BSS-13 proposed location; however, due to the cobbly terrain, the deepest boring was only able to be advanced to 14 inches bgs.

# 4. Chemical Analytical Results

Under standard chain-of-custody procedures, samples were submitted to Friedman and Bruya, Inc. (a Washington State accredited laboratory) for chemical analysis. EPH, VPH, and/or chromium VI sample analyses were sent by Friedman and Bruya, Inc. to Alliance Technical Group (formerly Fremont Analytical, Inc. and a Washington State accredited laboratory) or Onsite Environmental, Inc. (a Washington State accredited laboratory).

Selected soil samples and grab sediment samples were analyzed for one or more of the following analyses:

- TPH-D and TPH-O by Ecology Method NWTPH-Dx;
- TPH-G by Ecology Method NWTPH-Gx;
- EPH by Ecology Method NWEPH;
- VPH by Ecology Method NWVPH;
- PAHs by EPA Method 8270E;
- VOCs by EPA Method EPA 8260D;
- Total metals (arsenic, barium, cadmium, chromium III, copper, lead, mercury, nickel, selenium, silver, and zinc) by EPA Methods 6020B/1631E;
- Chromium VI by EPA Method 7196 or SM 3500 Cr B; and
- Total organic carbon (TOC) (sediment only) by EPA Method 9060/SM 5310.

All groundwater samples were analyzed for the following analyses:

- TPH-D and TPH-O by Ecology Method NWTPH-Dx;
- TPH-G by Ecology Method NWTPH-Gx;
- EPH by Ecology Method NWEPH;
- VPH by Ecology Method NWVPH;
- PAHs by EPA Method 8270E;
- VOCs by EPA Method EPA 8260D;
- Total and dissolved metals (arsenic, barium, cadmium, chromium III, copper, lead, mercury, nickel, selenium, silver, and zinc) EPA Methods 6020B/1631E;
- Chromium VI by EPA 7196 or SM 3500 Cr B; and
- TSS by SM 2540D.

All grab surface water samples were analyzed for the following analyses:

- TPH-D and TPH-O by Ecology Method NWTPH-Dx;
- TPH-G by Ecology Method NWTPH-Gx;
- cPAHs by EPA Method 8270E/625.1 Mod;

- BTEX by EPA Method EPA SW 846/8260D;
- Total metals (arsenic, cadmium, copper, lead, nickel, and zinc) EPA Methods 6020B/200.8;
- Trace-level mercury by EPA Method 1631E; and
- Chromium VI by EPA SM 3500 Cr-B.

Analytical data and the laboratory's internal quality assurance and quality control data were reviewed to assess whether they meet project-specific data quality objectives. This review was performed consistent with accepted EPA procedures for evaluating laboratory analytical data and appropriate laboratory and method-specific guidelines (EPA, 2004, 2008b). The chemical data review summarizing data evaluation procedures, usability of data, and deviations from specific field data and/or laboratory methods for the investigation data are presented in Appendix F. The data are considered acceptable for their intended use, with the appropriate data qualifiers assigned. Sample results are presented in the following section.

## 4.1 SOIL

During the 2022 investigation, 193 soil samples were analyzed for one or more of the analytes listed above and analytical results are presented in Table 4. Detected values and sample locations for COCs discussed in Section 6.2 are shown in Figures 10, 11, and 12.

Soil analytical results were compared to Site-specific MTCA Method B screening levels, the most conservative screening levels for the protection of potable water, sediment via groundwater, and surface water via groundwater in the vadose or saturated zones, MTCA Ecological Indicator Soil Concentration for the Protection of Wildlife (Wildlife Criteria), sediment cleanup objectives (SCOs) for the protection of the Benthic population, and/or natural background concentrations (Ecology, 1994). Screening levels for the protection of the potable water, sediment via groundwater, and surface water via groundwater in the vadose or saturated zones were calculated for a variety of environmental transport and exposure pathways (Ecology, 2024) and are derived from the February 2025 preliminary cleanup level (PCUL) worksheet for South Lake Union. SCOs were applied up to a depth of 1-foot bgs, which is the approximate biotic zone for a lentic body of water (EPA, 2015). Screening levels used at the Site are discussed further in Section 6.3.

### 4.1.1 Total Petroleum Hydrocarbons

Site-specific MTCA Method B Screening levels for the protection of groundwater quality through the leaching pathway in vadose and saturated zone soils were calculated using the MTCA TPH 12.0 tool.

After evaluating EPH and VPH results, three different areas were identified where gasoline-range petroleum hydrocarbons appeared to be the primary constituent. Gasoline-range petroleum hydrocarbons generally fall within the C5-C13 carbon ranges and middle to heavy fuels/oils generally fall within the C8 C34 carbon ranges.

Site-specific screening levels of 1,000 mg/kg for the vadose zone using sample TP-49-S2 and 30 mg/kg[1] for the saturated zone using sample TP-49-S4, were calculated for the areas where gasoline-range

[1] A Site-specific MTCA Method B TPH screening level for the protection of groundwater of 18 mg/kg in the saturated zone was calculated by the evaluation of EPH and VPH results using the MTCA TPH 12.0 tool. However,

petroleum hydrocarbons were the primary constituents. Site-specific screening levels of 1,000 mg/kg for the vadose zone using samples TP-24-S1 and TP-42-S1, and 550 mg/kg for the saturated zone using samples TP-42-S1 and TP-43-S4 were calculated for the areas where gasoline-range petroleum hydrocarbons were not the primary constituents. The calculation spreadsheets and the basis of the selected screening levels are provided in Appendix G.

TPH-D and TPH-O were analyzed in all 193 soil samples and TPH-G was analyzed in 153 soil samples and the following was observed:

- TPH (the sum of TPH-D, TPH-O, and TPH-G) was detected in 42 samples at or above laboratory reporting limits. Thirty-two samples were detected above the Site-specific screening levels.
- TPH-D and/or TPH-O were detected in eight samples collected between 0 and 1 foot bgs at or above the SCO screening level for the protection of the benthic population and/or the terrestrial ecological evaluation (TEE) screening level for the protection of wildlife.
- Most of the soil samples appear to contain petroleum hydrocarbon distributions similar to weathered Bunker C fuel. In areas dominated by gasoline-range hydrocarbons, the hydrocarbon distributions are more representative of a weathered mineral spirit-like product(s).

### 4.1.2 VOCs

VOCs or BTEX were analyzed in 126 soil samples and the following was observed:

- 1,2,4-Trimethylbenzene was detected in seven samples at or above laboratory reporting limits, with five samples containing detectable concentrations above applicable screening levels.
- 1,3,5-Trimethylbenzene was detected in six samples at or above laboratory reporting limits, with five sample containing detectable concentrations above applicable screening levels.
- 2-Chlorotoluene was detected in four samples at or above laboratory reporting limits, with two samples containing detectable concentrations above applicable screening levels.
- 2-Phenylbutane (sec-Butylbenzene) was detected in 16 samples at or above laboratory reporting limits, with one sample containing a detectable concentration above applicable screening levels.
- 4-Chlorotoluene was detected in three samples at or above laboratory reporting limits, with one sample containing detectable concentrations above applicable screening levels.
- Benzene was detected in 15 samples at or above laboratory reporting limits, with 10 samples containing detectable concentrations above the most conservative screening level for the protection of potable water, sediment via groundwater, and surface water via groundwater in the vadose or saturated zones.
- Cymene (p-Isopropyltoluene) was detected in seven samples at or above laboratory reporting limits, with three samples containing detectable concentrations above applicable screening levels.
- Ethylbenzene was detected in 26 samples at or above laboratory reporting limits, with 12 samples containing detectable concentrations above applicable screening levels.

the MTCA Method A TPH soil screening levels were used because the Site-specific screening level was lower than the corresponding MTCA Method A screening level (Ecology, 2023b).

- Hexane was detected in two samples at or above laboratory reporting limits, with one sample containing a detectable concentration above applicable screening levels.
- Isopropylbenzene (Cumene) was detected in 10 samples at or above laboratory reporting limits, with two samples containing detectable concentrations above applicable screening levels.
- Methylene chloride was detected in 33 samples above applicable screening levels. However, the detections were flagged as being due to laboratory contamination, as methylene chloride is frequently used for cleaning laboratory equipment.
- n-Propylbenzene was detected in 11 samples at or above laboratory reporting limits, with three samples containing detectable concentrations above applicable screening levels.
- Tetrachloroethene (PCE) was detected in six samples at or above laboratory reporting limits, with two samples containing detectable concentrations above applicable screening levels.
- Trichloroethene (TCE) was detected in six samples at or above laboratory reporting limits, with all six samples containing detectable concentrations above applicable screening levels.
- Total xylene was detected in 30 samples at or above laboratory reporting limits, with seven samples containing detectable concentrations above applicable screening levels.
- All other VOCs were either not detected at or above laboratory reporting limits or were detected at concentration below applicable screening levels.

### 4.1.3 PAHs

PAHs were analyzed in 128 samples. One or more PAH was detected in 19 of the samples analyzed, and the cPAH-total toxic equivalent concentration (TEQ) was calculated for the samples with detected cPAH analytes.

- 1-Methylnaphthalene was detected in 17 samples at or above laboratory reporting limits, with 14 samples containing detectable concentrations above applicable screening levels.
- 2-Methylnaphthalene was detected in 17 samples at or above laboratory reporting limits, with seven samples containing detectable concentrations above applicable screening levels.
- Benzo(a)anthracene was detected in eight samples, with all eight samples containing detectable concentrations above applicable screening levels.
- Benzo(a)pyrene was detected in four samples, with all four samples containing detectable concentrations above applicable screening levels.
- Fluoranthene was detected in eight samples, with six samples containing detectable concentrations above applicable screening levels.
- Benzo(b)fluoranthene was detected in five samples, with all five samples containing detectable concentrations above applicable screening levels.
- Chrysene was detected in 16 samples, with 12 samples containing detectable concentrations above applicable screening levels.
- The calculated cPAH-TEQ was calculated and detected in 16 samples, with four samples containing detectable concentrations above applicable screening levels.
- Dibenz(a,h)anthracene was detected in one sample above applicable screening levels.

- Fluoranthene was detected in six samples, with five samples containing detectable concentrations greater than applicable screening levels.
- Fluorene was detected in 16 samples, with seven samples containing detectable concentrations above appliable screening levels.
- Indeno(1,2,3-cd)pyrene was detected in three samples, with two samples containing detectable concentrations above applicable screening levels.
- Total naphthalene was detected in 22 samples, with six samples containing detectable concentrations greater than applicable screening levels.
- Pyrene was detected in 20 samples, with 19 samples containing detectable concentrations above the PCUL for the protection of potable water in the vadose or saturated zone.
- All other PAHs were either not detected at or above laboratory reporting limits or were detected at concentration below applicable screening levels.

### 4.1.4 Total Metals

Arsenic, barium, cadmium, chromium (total and/or hexavalent), copper, lead, mercury, nickel, and zinc were detected in one or more samples at or above laboratory reporting limits. Selenium and silver were not detected in the samples analyzed at or above laboratory reporting limits.

- Arsenic was detected above applicable screening levels and the Ecology-derived natural background concentration in one sample.
- Barium was detected above the Wildlife Criteria of 102 mg/kg in 13 samples. Barium was not detected above the Ecology-derived natural background concentration of 255 mg/kg.
- Hexavalent chromium was detected above applicable screening levels in seven samples.
- Copper was detected above applicable screening levels and the Site-specific natural background concentrations in 40 samples.
- Lead was detected above applicable screening levels in six samples.
- Nickel was detected above applicable screening levels and the Ecology-derived natural background concentrations in two samples.
- Zinc was detected above the applicable screening levels in 10 samples.

## 4.2 GROUNDWATER

During the 2022 to 2023 investigation, seven grab groundwater and 24 monitoring well groundwater samples were analyzed for one or more of the analytes listed above in Section 4 and the analytical results are presented in Table 5. Groundwater analytical results were compared to the most conservative screening levels for the protection of drinking water, surface water, and sediment. TPH values and sample locations are shown in Figure 13.

### 4.2.1 Grab Groundwater Sampling

During the October 2022 investigation, seven grab groundwater samples were collected from temporary wells installed in borings advanced at the Site (B-11 through B-17). VOCs, PAHs, TPH-G, TPH-D, TPH-O, and total petroleum hydrocarbons in the diesel and oil range (TPH-D+O) were either not detected at or

above laboratory reporting limits or were detected at concentrations below screening levels. Total copper, lead, and/or mercury were detected at concentrations above their respective PCULs for the Protection of Potable Water in four samples (B-11-W, B-13-W, B-16-W, and B-17-W). Dissolved copper, lead, and mercury were only detected above their respective PCULs for the Protection of Potable Water in one sample (B-11-W); however, the field measurements of turbidity were elevated at 250 nephelometric turbidity unit (NTU), likely resulting in positive bias for the metals concentrations.

### 4.2.2 Groundwater Samples

Groundwater samples were collected from the four shallow wells in June 2022, from the four deep wells in November 2022 and August 2023, and from all eight wells in February and May 2023. TPH-D and TPH-O detections from the shallow monitoring wells were flagged that the sample chromatographic pattern does not resemble the fuel standard used for quantitation. The TPH results are discussed further in Section 5.2.

- During the June 2022 monitoring event, TPH-D+O were detected at concentrations above applicable screening levels for the protection of groundwater and surface water in all four shallow monitoring well samples analyzed. Pyrene was detected above applicable screening levels in MW-2S and MW-3S. 1-Methylnaphthalene and fluoranthene were detected above their respective applicable screening levels in MW-3S. All other analytes were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable PCUL for the protection of Potable Water.
- During the November 2022 monitoring event, all analytes for the four deep monitoring wells sampled were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable screening levels.
- During the February 2023 monitoring event where all eight monitoring wells were sampled, TPH-D+O was detected at concentrations above the applicable screening levels in monitoring wells MW-1S, MW-2S, and MW-3S. Pyrene was detected above applicable screening levels in MW-2S and MW-3S. 1-Methylnaphthalene and fluoranthene were also detected above their respective applicable screening levels in MW-3S. All other samples and analytes were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable screening levels.
- During the May 2023 monitoring event, where all eight monitoring wells were sampled, TPH-D+O was detected at concentrations above applicable screening levels in monitoring wells MW-2S, MW-3S, and MW-4S. TPH-O was detected at concentrations above applicable screening levels in monitoring wells MW-1S, MW-2S, MW-3S, and MW-4S. Total copper was detected above applicable screening levels in MW-1S. Total lead was detected above applicable screening levels in MW-3S. Pyrene was detected above applicable screening levels MW-2S and MW-3S. 1-Methylnaphthalene and fluoranthene were also detected above their respective applicable screening levels in MW-3S. All other samples and analytes were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable screening levels.
- During the August 2023 monitoring event, only total copper and lead were detected in MW-4D above their respective applicable screening levels. Pyrene was detected above applicable screening levels in MW-2S and MW-3S. 1-Methylnaphthalene and fluoranthene were also detected above their respective applicable screening levels in MW-3S. All other analytes for the four deep monitoring wells sampled were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable screening levels.

## 4.3 SURFACE WATER SAMPLING

During the 2022 investigation, six surface water samples were collected. Three samples were collected during the high-water level monitoring event in June 2022, and three samples were collected during the low-water level monitoring event in November 2022. The analytical results are summarized in Table 6.

- During the June 2022 monitoring event, analytes in surface water samples were not detected at or above laboratory reporting limits in the three samples and below the WQPP indicator levels.
- During the November 2022 monitoring event, TPH-D was detected in SW-2 at a concentration of 50 micrograms per liter (µg/L), below the WQPP's indicator level of 250 µg/L. Total chromium was detected in SW-1 and SW-3 at concentrations of 1.01 and 1.30 µg/L, well below the WQPP's indicator level of 259 µg/L. All other analytes were not detected at or above laboratory reporting limits.

## 4.4 SEDIMENT SAMPLING

During the first sediment sampling attempt in April 2022, five sediment samples were collected for chemical analysis (SS-1-S1, SS-4-S1, SS-7-R-S1, SS-8-S1, and SS-11-S1) and results were compared against Ecology's SCO for freshwater sediments. Detected TPH, BTEX, and cPAH values and sample locations are shown in Figure 14 and all analytical results are summarized in Table 7.

- TPH-O was detected in two samples, SS-1-S1 and SS-7-R-S1, at concentrations of 150 and 110 mg/kg, respectively. Results from both samples were below the SCO value for freshwater sediment of 3,600 mg/kg.
- Chrysene was also detected in one sample, SS-8-S1, at a concentration of 0.0053 mg/kg, below the total PAH SCO value for freshwater sediment of 17 mg/kg.
- Arsenic, barium, chromium, copper, lead, nickel, selenium, and silver were also detected in the samples analyzed at concentrations below applicable SCO values for freshwater sediment.
- Mercury was detected in one sample, SS-1-S1, at a concentration of 0.051 mg/kg, below the SCO value for freshwater sediment of 0.66 mg/kg.
- All other analytes were not detected at or above laboratory reporting limits in the samples analyzed.

During the second sediment sampling attempt in October 2022, 12 sediment samples were collected for chemical analysis (SS-1 through SS-6, SS-7a, and SS-8 through SS-12) and compared against the SCO. The following was observed:

- PAHs were detected in three samples (SS-8-0.5, SS-9-0.5, and SS-10-0.5) at concentrations below the total PAH SCO value for freshwater sediment of 17 mg/kg.
- Arsenic, barium, chromium, copper, lead, nickel, selenium, and silver were also detected in the samples analyzed at concentrations below applicable SCO values for freshwater sediment.
- All other analytes were not detected at or above laboratory reporting limits in the samples analyzed.

# 5. Conceptual Site Model

This section presents a conceptual site model (CSM) for the Site based on the data collected during the initial investigation of the Site, emergency IRA, and RI activities for the Site. The CSM identifies potential sources of contamination, contaminant fate and transport mechanisms/pathways, and potential receptor groups (human and ecological) and exposure pathways. Development of a CSM is dynamic and iterative and may be refined as additional information becomes available. The CSM is the basis for developing technically feasible cleanup alternatives and selecting a final cleanup as part of the FS process. The current CSM for the Site is discussed below and depicted in Figure 15.

### 5.1.1 Contaminant Sources and Release Mechanisms

Possible contaminant sources are from historical usage of petroleum products during the lumber mill operation from 1904 to sometime in the 1960s; unknown and former known leaking USTs (LUSTs), unknown and known UST piping, and petroleum-impacted soil associated with the former USTs; and possible unknown sources. During the 2019 initial investigation of the Site and emergency IRA protective cap excavation and construction, pipes and NAPL were discovered and appeared to be running in the direction of the seep areas. Additional pipes were discovered during RI activities near the location of the former UST site A and scattered throughout the area of the former lumber mill. An abandoned culvert with petroleum-like odor was observed in the drainage ravine directly to the north of the cap location during the emergency IRA. An additional SPP ledge and layer were observed north of the ravine and within the ravine, respectively.

## 5.2 CONTAMINANT FATE, TRANSPORT, AND EXPOSURE ROUTES

Possible contaminant transport routes from the Site were identified in the previous 2021 DSR. The primary transport mechanisms include leaching of chemicals in soil to groundwater, groundwater flow to surface water and sediment, stormwater runoff to soils and/or sediments, and soil erosion. The transport pathways could possibly result in exposures to ecological receptors within Rainey Creek and Riffe Lake, and potential human receptors via fish consumption and direct contact with contaminated soil or sediments. The following sections focus on the possible transport pathways and exposure routes from the Site.

The primary mechanisms likely to influence the fate and transport of chemicals at the Site include natural biodegradation of organic chemicals; sorption to soil and sediment; advection and dispersion in groundwater; volatilization of volatile chemicals from soil or groundwater to air; leaching of chemicals from soil to groundwater; and discharge of chemically impacted soil, groundwater, and sediment to surface water. The relative importance of these processes varies depending on the chemical and physical properties of the released contaminant. The properties of soil, sediment, and the dynamics of groundwater flow also affect contaminant fate and transport.

The fate and transport processes of heavy fuel oil depend on the composition of the contaminant and the environment affected by the contaminant. In general, when heavy fuel enters the environment, the individual products comprising the fuel partition to various environmental compartments according to their own physical-chemical properties (American Petroleum Institute, 2012).

The Site is partially vegetated and mostly unpaved, except for former mill structure concrete foundation slabs that are still visible. Therefore, the soil-to-groundwater migration pathway is complete for some analytes because of the potential for infiltration of precipitation through unpaved areas and through cracks in the former foundations into the vadose-zone soil. Leaching of near-surface soil impacts during precipitation events could result in impacts to shallow groundwater at the Site. In addition, transport parameters change dramatically when the Site is fully submerged. Lighter-than-water contamination will move vertically upward toward the water's surface when soil is fully saturated.

COCs identified to be present on the Site and discussed in Section 6.2 and their characteristics include the following:

- **TPH** refers to any mixture of hydrocarbons originating from crude oil. The mixture could include lighter fractions, such as gasoline and/or mineral spirits, as well as heavier fractions, such as diesel oils, hydraulic fluids, and lubricating oils. Most of the soil samples appear to contain petroleum hydrocarbon distributions similar to weathered Bunker C fuel. In areas dominated by gasoline-range hydrocarbons, the hydrocarbon distributions are more representative of a weathered mineral spirit-like product(s). Gasoline-range hydrocarbons generally fall within the C5-C13 carbon ranges and middle to heavy fuels/oils generally fall within the C8-C34 carbon ranges. After reviewing the EPH/VPH data (or historical TPH data), TPH detected in samples collected from locations TP-5, TP-44, TP-48, TP-49, TP-51, TP-55, and TP-59 appear to be heavily influenced by gasoline-range hydrocarbons. TPH can adsorb to soil particles, volatilize, and leach to and migrate in groundwater.
  - TPH results in shallow groundwater were flagged as not resembling the fuel standards used for quantitation and are likely associated with polar constituents such as petroleum metabolites (primarily from the aerobic biodegradation of petroleum) and natural organics. TPH-D and TPH-O were reported at concentrations exceeding typical aqueous solubilities for middle distillate fuels (e.g., diesel) or residual fuel oils (e.g., Bunker C). Given that the groundwater samples generally did not show any evidence of petroleum sheen or elevated turbidities, it is unlikely that the reported TPH-D and TPH-O detections in groundwater can be derived from middle to high molecular weight hydrocarbons. Furthermore, hydrocarbon concentrations reported in the EPH analyses, which utilize separation procedures that minimize the presence of polar constituents (silica gel cleanup), were typically much lower than the reported TPH-D+O concentrations. Individual PAHs and VOCs typically associated with petroleum products were also generally not encountered in the groundwater samples. The reported TPH detections (particularly in the diesel- and oil-ranges) are likely polar petroleum metabolites (e.g., organic acids, alcohols) and potentially natural organics.
- **Metals** occur naturally and can be deposited in the environment by anthropogenic means. They are dense compared to other common materials and are persistent in the environment. They do not degrade into nontoxic forms; however, they may be transformed into insoluble and biologically unavailable forms. Metals are transported primarily by being adsorbed on or absorbed in suspended particulate matter; therefore, soils and sediments are the most significant sink for metals. Certain metals (e.g., arsenic, lead, and mercury) can be bioaccumulative.
- **PAHs** are a group of organic compounds that are ubiquitous in the environment and are often associated with TPH. In general, PAHs do not dissolve easily in water and, because of their low solubilities, typically partition into sediments and soils versus into groundwater. Solubility and bioaccumulation potential vary among different PAH compounds.

## 5.3 POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

For a contaminant to present a risk to human health and/or the environment, the pathway from the contaminant to the receptor must be complete. A complete exposure pathway consists of four necessary elements: (1) a source and mechanism of chemical release; (2) a transport or retention medium for released chemical(s); (3) a point of potential contact with the impacted medium (referred to as exposure point); and (4) an exposure route (e.g., soil ingestion) at the exposure point. The potential receptors and exposure pathways are presented below.

The sediment pathway is currently incomplete; however, because the Site may be seasonally submerged in the future, potential pathways are present. Potential transport pathways are as follows.

**Soil**

- Direct contact of soil exposure pathway (complete);
- Soil leaching-to-groundwater transport pathway (complete);
- Soil leaching-to-groundwater-to-sediment transport pathway (currently incomplete, could be complete in the future); and
- Soil leaching-to-groundwater-to-surface water transport pathways (currently incomplete, could be complete in the future).
- Stormwater runoff to surface water/sediment transport pathway (currently incomplete, could be complete in the future).

**Groundwater**

- Groundwater-ingestion exposure pathway (currently incomplete, could be complete in the future);
- Groundwater-to-surface water transport pathway (currently incomplete, could be complete in the future); and
- Groundwater-to-sediment water transport pathway (currently incomplete, could be complete in the future).

**Sediment**

- Ingestion by humans of contaminated fish and shellfish exposed to contaminated sediment. Direct contact with and incidental ingestion of sediment by humans during shoreline recreation, clam-digging, net-fishing, etc.
- Benthic Community. Exposure of benthic species (species living in or on the sediment, including shellfish) through contact with, ingestion of, or filtration of contaminated sediment (currently incomplete, could be complete in the future).

### 5.3.1 Potential Exposure Scenarios

The primary purpose of the human health CSM is to identify potential receptor groups and to describe pathways by which those populations may be exposed to Site-related chemicals in the environment. Populations that may be exposed to contaminants at a Site and pathways by which these populations may come into contact with contaminants are identified. A complete pathway requires:

- A source and mechanism for release of constituents,
- A transport or retention medium,
- A potential environmental contact (exposure point) with the affected medium, and
- An exposure route at the exposure point.

The Property is currently vacant with signage and jersey barriers east of the Site; however, the Site will be accessible to the public as a recreational wildlife area, and this is expected to continue into the foreseeable future. The Site will be seasonally submerged in the future for recreation and to generate power at the Mossyrock Hydroelectric Dam, potentially changing the pathways for exposure and release.

Rainey Creek and Riffe Lake, which are directly adjacent to the Site and approximately 1,500 feet to the southwest, respectively, as well as the land on and around the Site provide habitat that have attracted recreational visitors in the past and most likely will in the future as well. Given the close proximity of Rainey Creek to the Site, there is potential for the COPCs to migrate downgradient of the suspected source area and impact sediment and surface water via stormwater runoff. However, COCs were not detected at concentrations above applicable screening levels in samples collected from the surface water and sediment in Rainey creek, this pathway is currently incomplete at the Site.

The CSM presented in this report is developed to ensure that all potentially significant pathways and receptors under current and reasonable future Site scenarios are evaluated. Based on the current (and potential future) Property use, the anticipated receptors may include construction workers and recreational users (including hunters and anglers). The following pathways are potentially complete for human exposure:

**Construction Workers** - Construction workers could potentially be exposed to chemicals in environmental media on the Site by the following pathways:

- Direct skin contact with or incidental ingestion of chemically impacted soil, sediment, or groundwater during excavations on the Site.
- Inhalation of wind-borne particulates on or migrating off Site from chemically impacted soil being handled or exposed on Site during excavations on the Site.
- Inhalation of outdoor air vapors emanating from soil, sediment, or groundwater with volatile chemical impacts on Site or migrating off the Site.

**Recreational Visitors and Anglers** - The Property and the surrounding area is currently closed with signs to recreational visitors stating “Area Closed, No Trespassing” indicating that the area is closed to the public and no trespassing is allowed with violators being subject to prosecution under RCW 9A.52.080. Property roads are gated and not readily accessible by vehicles; however, pedestrians could access the area. Riffe Lake is still accessible to the general public, who could be exposed to chemicals migrating to the water or from the subsurface soils by the following potential pathways:

- Direct skin contact with and incidental ingestion of surface water or sediment from Rainey Creek or Riffe Lake that has been chemically impacted via discharges of chemically impacted groundwater migrating off the Site.
- Ingestion of chemicals bioaccumulated in the tissue of fish from chemically impacted surface water or sediment in Rainey Creek and Riffe Lake. Anglers may fish near the Site by boat or from

accessible shoreline. Fish may be caught for personal consumption; fish tissue may bioaccumulate any chemicals present in sediment and surface water.

- Ingestion of chemicals bioaccumulated in terrestrial plants and/or animals from impacted soil at the Site.
- Direct skin contact with and/or incidental ingestion of chemically impacted soil near the seepage area.
- Inhalation of wind-borne particulates on or migrating off the Site from chemically impacted soil.
- Inhalation of outdoor air vapors emanating from soil or groundwater with volatile chemical impacts on or migrating off the Site.

**Surface Water and Sediment** - The Site and the surrounding area will be submerged in the future, creating new exposure pathways and receptors. When Riffe Lake submerges the Site, aquatic ecosystems and the general public could be exposed to chemicals migrating to the water or sediment by the following potential pathways:

- Human direct contact with surface water and sediment by recreational users and subsistence fishers.
- Direct contact with Riffe Lake surface water and sediment by aquatic ecological receptors (e.g., fish, invertebrates such as shellfish, birds, amphibians).
- Uptake of surface water/sediment contaminants into aquatic ecological species such as fish and shellfish (i.e., aquatic organism bioaccumulation), which then would be consumed as prey by humans.
- Uptake of surface water/sediment contaminants into aquatic ecological species, which then would be consumed as prey by upper-tropic-level aquatic ecological receptors.

**Terrestrial Wildlife** - There is potential for terrestrial wildlife to access the Property and be exposed to chemicals in the shallow surface soils by the following potential pathways:

- Direct contact with and/or ingestion of contaminated soil, sediments, or surface water through portions of the body contacting the ground, bathing, or through incidental contact with fugitive dust emissions from impacted areas.
- Inhalation of wind-borne particulates from chemically impacted soil.

## 5.4 TERRESTRIAL ECOLOGICAL EVALUATION

The TEE process is required at all MTCA sites where there has been a release or threatened release of a hazardous substance that may pose a threat to human health or the environment. The purpose of the TEE is to systematically organize and evaluate data, assumptions, and uncertainties to help understand and characterize potential risks to terrestrial biota that may be exposed to site-related constituents in a manner that supports decision-making.

For the purpose of this RI, the initial step of the TEE process to determine whether a site qualifies for a *TEE exclusion* was completed. If a site meets at least one of the four exclusionary criteria described in WAC 173-340-7491, then no further evaluation of ecological risk is necessary.

The four exclusionary criteria are:

1. *Exclusion 1: Contamination below the point of compliance*. This means all soil contamination shall be below the standard point of compliance of 15 feet bgs, or below the conditional point of compliance of 6 feet bgs. The conditional point of compliance may only be used in conjunction with institutional controls which would prevent excavation of deeper soils.
2. *Exclusion 2: Incomplete exposure pathway*. The primary pathway to soil for ecological receptors would be direct contact and ingestion. The pathway could be considered incomplete if there were barriers for plants or animals to contact soils (e.g., pavement, buildings, or protective cap).
3. *Exclusion 3: Type of contamination and proximity to ecological receptors*. For sites contaminated with hazardous substances other than those specified in WAC 173-340-7491, there must be less than 1.5 acres of contiguous undeveloped land on the site or within 500 feet of any area located on the site.
4. *Exclusion 4: Concentrations below background levels*. For certain naturally occurring contaminants, or for contaminated sites found in urban areas, there may be contamination that is not directly attributable to the site.

Evaluation of Exclusions:

1. Exclusion 1 does not apply to the Site. TPH and other constituents were detected between 0 and 15 feet bgs.
2. Exclusion 2 does not apply to the Site. While there are some former foundations, concrete slabs associated with the former mill operations at the Site, the physical barriers are discontinuous. Large areas of undeveloped lands are located at the Site.
3. Exclusion 3 does not apply to the Site. There is undeveloped land within 500 feet of the Site and the undeveloped land is greater than 1.5 acres.
4. Exclusion 4 does not apply to the Site. Some of the contaminants found in soils at the Site are not naturally occurring and are unlikely to be present from other sources.

The Site evaluated under this RI Report does not qualify for the exclusions under WAC 173 340. Once it has been established that none of the exclusionary criteria apply, either a simplified or Site-specific TEE is required. Chapter 173 340 7492 of the MTCA specifically refers to the process of determining the type of evaluation that is required (simplified or Site-specific) as “Applicability of a Simplified Terrestrial Ecological Evaluation”.

### 5.4.1 Applicability of a Simplified TEE

WAC 173-340-7492 lists out criteria that are to be used to determine whether a simplified TEE can be used. If any of the below criteria apply, then a Site-specific TEE is necessary. Those criteria are as follows:

1. *Natural area.* The Site is located on, or directly adjacent to, an area where management or land use plans will maintain or restore native or semi-native vegetation.
2. *Vulnerable species.* The Site is used by a threated or endangered species; a wildlife species classified by the Washington Department of Fish and Wildlife as a “priority species” or “species of concern” under Title 77 RCW; or a plant species classified by the Washington State Department of Natural Resources natural heritage program as “endangered,” “threatened,” or

"sensitive" under Title 79 RCW. For plants, "used" means that a plant species grows at the Site or has been found growing at the Site. For animals, "used" means that individuals of a species have been observed to live, feed, or breed at the Site.

3. *Extensive habitat.* The Site is located on a Property that contains at least 10 acres of native vegetation within 500 feet of the Site, not including vegetation beyond the Property boundaries.
4. *Risk to significant wildlife populations.* The department determines that the Site may present a risk to significant wildlife populations.

A simplified TEE is not appropriate for the Site since the Site is vegetated and the expected land use plans will maintain vegetation. Trees and understory vegetation are likely comprised of plants native to Washington state. Given that the Site is in a natural area that provides extensive habitat, a Site-specific TEE is required.

### 5.4.2 Site-Specific TEE

The Site-specific TEE process is designed to assess ecological risk at any site and to provide the basis for a CUL protective of terrestrial ecological receptors at the site, including sites with protected status species. Under WAC 173-340-7493, a site-specific TEE shall include the following steps:

- Problem formulation;
- Selection of appropriate evaluation method(s);
- Conducting the evaluation; and
- Establishing ecologically protective soil concentration.

For the purpose of this RI, as part of the problem-formulation step, the contaminants of ecological concern (CEC) were determined by comparing soil analytical data for the Site that is representative of current conditions (i.e., all data for soil that is currently in place) to ecological screening levels (SLs) presented in Table 749-3 of the MTCA regulation. Table 5.1, included in the Ecology's Draft Terrestrial Ecological Evaluation guidance document (Ecology, 2017), provides SL values for plants, soil biota, and wildlife for a group of selected analytes. In accordance with WAC 173 340-7493, for constituents that do not have a value published in Table 749-3, values from the literature should be obtained. Therefore, screening levels for soil biota, plants, and wildlife were obtained from the EPA Region 4 ecological soil screening level table (EPA, 2018). The Region 4 values are based on EPA Ecological Soil Screening Levels (EcoSSLs) and Department of Energy Laboratories (Los Alamos National Laboratory and Oak Ridge National Laboratory). MTCA specifically identifies the Oak Ridge National Laboratory values as values to be considered in the identification of screening levels.

Table H-1 (Appendix H) presents the analytical data for soil from 0 to 15 feet bgs and identifies individual concentrations that exceed the lowest screening level based on terrestrial wildlife protection. Although there is some uncertainty regarding future land use, it is anticipated that the Site will continue to be used for industrial purposes. Per WAC 173-340-7490 (3)(b), only terrestrial wildlife protection exposures need to be evaluated for commercial and industrial properties.

Table H-2 provides a summary of statistics for and comparison of maximum detected concentrations of constituents in soil 0 to 15 feet bgs to the screening levels. Table H-3 provides a summary of statistics for and comparison of maximum detected concentrations of constituents in soil 0 to 6 feet bgs to the

screening levels. Constituents detected at maximum concentrations above the SLs were initially retained as potential CECs. The full soil data set is reported in Table 4 of the RI Report.

As indicated in Tables H-2 and H-3, potential CECs based on terrestrial wildlife protection include cPAHs, phthalates, benzoic acid, TPH, and three metals. Because phthalates and benzoic acid detections were relatively infrequent and at estimated low concentrations that may be associated with sample handling, they were not retained as CECs.

One of the objectives of this RI is to analyze Site data to support an evaluation of potential cleanup actions. The comparison of soil data to ecological screening concentrations indicates widespread impacts of multiple CECs through the Site. Petroleum and metal exceedances of TEE-based screening levels will likely drive the need and scope of soil remediation.

# 6. Identification of Contaminants of Concern and Proposed Cleanup Standards

The following sections describe how contaminants of potential concern (COPCs) and Site COCs were identified, establishment of proposed cleanup standards, the distribution of COCs in soil and groundwater relative to proposed cleanup standards, and identification of data gaps.

## 6.1 CONTAMINANTS OF POTENTIAL CONCERN IDENTIFICATION PROCESS

### 6.1.1 Identification of Chemicals of Potential Concern

Identification of COPCs involved comparing the concentrations of the constituents to conservative, risk-based screening levels. Screening levels for each medium and constituent reflect concentrations that are protective for the possible transport and exposure pathways identified in the CSM (*Section 5*). Screening levels are shown in Tables 4 through 7.

Those constituents whose concentration in a sample from the supplemental RI data set exceeded their corresponding screening levels were identified as COPCs.

#### *6.1.1.1 Soil*

Soil screening levels were based on the following.

- Direct contact, vadose or saturated zone soil leaching to potable groundwater, soil leaching to groundwater followed by transport to surface water, soil leaching to groundwater followed by partitioning to sediment, and erosion of contaminated soil directly to sediment or soil carried by soil directly to sediment or soil carried by surface runoff and deposited to sediment.
- SCOs for the protection of Benthic organisms.
- MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Animals (Table 749-3).
- In cases where the practical quantitation limit (PQL) is higher than the direct contact, leaching, or ecological levels, the PQL is used as the screening level in accordance with WAC 173-340-740(5)(c).

Table 4 shows the comparisons of the concentrations in soil for each constituent to the lowest applicable screening level and identifies those constituents where there is an exceedance (i.e., those constituents that are COPCs). The following constituents were identified as COPCs in soil:

- TPH
- 1,2,4-Trimethylbenzene
- 1,3,5-Trimethylbenzene
- 2-Chlorotoluene
- 2-Phenylbutane (sec-Butylbenzene)
- 4-Chlorotoluene

- Benzene
- Cymene (p-Isopropyltoluene)
- Ethylbenzene
- Hexane
- Isopropylbenzene (Cumene)
- Methylene chloride (Dichloromethane)
- n-Propylbenzene
- PCE
- TCE
- Xylene (Total)
- 1-Methylnaphthalene
- 2-Methylnaphthalene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Chrysene
- cPAHs-TEQ
- Dibenz(a,h)anthracene
- Fluoranthene
- Fluorene
- Indeno(1,2,3-cd)pyrene
- Naphthalene, Total
- Pyrene
- Arsenic
- Cadmium
- Chromium VI (Hexavalent)
- Copper
- Lead
- Mercury
- Nickel
- Zinc

#### *6.1.1.2 Groundwater*

Groundwater screening levels were based on the following.

- Protection of groundwater water calculated by identifying maximum contaminant levels and calculating screening levels per MTCA Equations 720-1 and 720-2, (WAC 173-340-720[4][b][iii][A] and -720[4][b][iii][B]) and Equations 730-1 and 730-2 (WAC 173-340-730[3][b][iii][A] and -720[3][b][iii][B]) using the toxicity values in Ecology's online CULs and risk calculation database (Ecology, 2025). Screening levels that were based on maximum contaminant levels or other applicable state or federal laws were then adjusted as needed so that the total excess cancer risk does not exceed one in one hundred thousand and the hazard index does not exceed one in accordance with WAC 173-340-720(7)(b).

Table 5 shows the comparisons of the concentration in groundwater for each constituent to the lowest applicable screening level and identifies those constituents where there is an exceedance (i.e., those constituents that are COPCs). The following constituents were identified as COPCs in groundwater:

- TPH-D+O
- 1-Methylnaphthalene
- Fluoranthene
- Pyrene
- Lead
- Copper

### 6.2 IDENTIFICATION OF CONTAMINANTS OF CONCERN

COCs comprise the subset of COPCs that will be utilized for establishing cleanup requirements for the Site and evaluating cleanup alternatives in the FS. Those COPCs that contribute little or nothing to the overall risk to human health and the environment are screened out from consideration and the remaining constituents are identified as COCs for purposes of defining Site cleanup requirements.

Factors that were considered when identifying COCs include a constituent's toxicity, mobility in the environment, natural background concentration, and prevalence at the Site (e.g., frequency of detection).

#### *6.2.1.1 Soil*

Of the soil COPCs identified in Section 6.1.1, the following constituents are **not** retained as COCs for soil:

- 1,2,4-Trimethylbenzene
- 1,3,5-Trimethylbenzene
- 2-Chlorotoluene
- 2-Phenylbutane (sec-Butylbenzene)
- 4-Chlorotoluene
- Benzene

- Cymene (p-Isopropyltoluene)
- Ethylbenzene
- Hexane
- Isopropylbenzene (Cumene)
- Methylene chloride
- n-Propylbenzene
- PCE
- TCE
- Xylene (Total)
- 2-Methylnaphthalene
- Benzo(a)anthracene
- Benzo(b)fluoranthene
- Chrysene
- Dibenz(a,h)anthracene
- Fluorene
- Fluoranthene
- Indeno(1,2,3-cd)pyrene
- Arsenic
- Cadmium
- Chromium VI (Hexavalent)
- Copper
- Mercury
- Nickel

**1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 2-chlorotoluene, 2-phenylbutane (sec-butylbenzene), 4-chlorotoluene, benzene, cymene (p-isopropyltoluene), ethylbenzene, hexane, isopropylbenzene (cumene), n-propylbenzene, and xylene (total).** These constituents were identified as COPCs because their maximum concentrations exceeded their respective screening levels for the protection of potable groundwater, surface water via groundwater, and/or sediment via groundwater in the saturated or vadose zones. However, they are not retained as COCs in soil because they were not detected in groundwater at or above laboratory reporting limits or were detected at concentrations below their respective applicable screening levels indicating that the soil-to-groundwater pathway is not complete for these constituents.

**PCE and TCE.** PCE and TCE were identified as a COPC because their maximum concentration exceeded the screening levels for the protection of potable groundwater, surface water via groundwater, and/or sediment via groundwater in the saturated or vadose zones. However, they are not retained as a proposed COC in soil because there is no known source of PCE and TCE at the Site and they were not

detected in groundwater, indicating that the soil-to-groundwater pathway is not complete for these constituents.

**2-methylnaphthalene, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, dibenz(a,h)anthracene, fluorene, and indeno(1,2,3-cd)pyrene.** These constituents were identified as COPCs because their maximum concentrations exceeded the screening levels for the protection of potable groundwater, surface water via groundwater, and/or sediment via groundwater in the saturated or vadose zones. However, they are not retained as COCs in soil because they were not detected in groundwater or were detected at concentrations below their respective applicable screening levels, indicating that the soil-to-groundwater pathway is not complete for these constituents.

**Methylene chloride.** Methylene chloride was identified as a COPC because its maximum concentration exceeded the most stringent PCUL for the protection of potable groundwater in the vadose zone. However, it is not retained as a proposed COC in soil because the detections were flagged as being due to laboratory contamination (methylene chloride is frequently used for cleaning equipment in the laboratory).

**Hexavalent chromium.** Hexavalent chromium was identified as a COPC because its maximum concentration exceeded the most stringent PCUL for the protection of potable groundwater in the vadose zone. However, it is not retained as a proposed COC in soil because there is no known source of hexavalent chromium at the Site and it was not detected in groundwater, indicating that the soil-to-groundwater pathway is not complete for this constituent. In addition, total chromium concentrations were within soil natural background indicating that there are no significant anthropogenic sources of chromium at the Site.

**Arsenic, cadmium, and nickel.** These constituents were identified as COPCs because their maximum concentrations exceeded applicable soil screening levels. However, they are not retained as COCs in soil because they were detected at concentrations exceeding the natural background concentration in less than 10 percent of the samples analyzed and the maximum detected concentrations were less than two times the natural background concentration (WAC 173-340-720).

**Copper.** Copper was identified as a COPC because its maximum concentration exceeded applicable soil screening levels. Copper was not retained as a Site COC for the following reasons.

- There is no known (or likely) source of copper based on reviewing historical data and Site use.
- No obvious copper hotspots have been observed at the Site (i.e., heterogenous distribution with no apparent plume to delineate).
- Copper concentrations in B-15 exceed background levels from 12.5 to 40 feet bgs. There is no evidence historical operations impacted soil that deep.
- The soil to groundwater and soil to groundwater to surface water pathways are incomplete because dissolved copper was not detected in any of the groundwater samples collected from the monitoring wells during the quarterly groundwater sampling; therefore, the more stringent screening levels (the protection of potable groundwater and surface water via groundwater) are not applicable.
- The next most conservative applicable soil screening level is for the protection of wildlife, which has a screening level of 217 mg/kg. The maximum soil copper concentration of 116 mg/kg is well below this screening level.

Based on the evaluations presented above, the COCs for soil are:

- TPH
- 1-Methylnaphthalene
- Benzo(a)pyrene
- cPAH-TEQ
- Fluoranthene
- Pyrene
- Lead
- Zinc

#### *6.2.1.2 Groundwater*

Of the groundwater COPCs identified in *Section 6.1.2*, the following constituents are **not** retained as COCs for groundwater:

- Copper
- Lead

**Copper.** This constituent is not retained as a proposed COC because it does not pose a significant risk. This is based on the findings that it had a very low frequency of exceedance (total copper was detected at concentrations exceeding in only two groundwater samples [MW-1S from May 2023, MW-3S from May 2023, and MW-4D from August 2023]), a low exceedance factor (less than two times the most stringent screening level). Dissolved copper was not detected at or above laboratory reporting limits in any of the samples analyzed from the monitoring wells. Furthermore, copper was detected at concentrations less than applicable MTCA screening levels in soil, indicating there is no release at the Site and elevated concentrations in some samples are due to natural concentrations.

**Lead.** This constituent is not retained as a proposed COC because it does not pose a significant risk. This is based on the findings that it had a very low frequency of exceedance (exceeded in only three groundwater samples [MW-1D from August 2023, MW-3S from May 2023, and MW-4D from August 2023]), and a generally low exceedance factor (average of 1.5 times the most stringent screening level). The sample collected from MW-3S was detected at a concentration greater than two times the most stringent screening level; however, the turbidity measured was measured at 100.3 nephelometric turbidity units prior to collecting, indicating the sample may be positively biased due to the presence of particulates. Dissolved lead was not detected at or above laboratory reporting limits in any of the samples analyzed from the monitoring wells.

Based on the evaluations presented above, the COCs for groundwater are:

- TPH-D+O
- 1-Methylnaphthalene
- Fluoranthene
- Pyrene

## 6.3 PROPOSED CLEANUP LEVELS

For the purposes of this RI, COCs comprise the subset of COPCs that will be utilized for establishing cleanup requirements for the Site and evaluating cleanup alternatives in the FS. Proposed cleanup standards for COCs by media are shown on Tables 8 and 9, below.

The MTCA Method B CULs for the protection of direct contact and the most stringent cleanup level for the protection of potable groundwater, surface water via groundwater, and sediment via groundwater are used. Metals were compared to the Ecology derived natural background concentrations, if the natural background concentrations exceeded the most stringent applicable cleanup level. TPH was compared to MTCA Method B soil cleanup level for the protection of groundwater quality: leaching pathway. Because the Site does not qualify for a TEE exclusion and will likely be used for utility/commercial uses in the future, MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Animals (Table 749-3) are also used as proposed CULs. Furthermore, because the Site will be submerged for part of the year in the future, soil COCs were also compared to freshwater sediment management standards. For groundwater COCs, MTCA Method B CULs for the protection of drinking water, surface water, and sediment are used.

Proposed points of compliance (POC) for this Site are the standard points of compliance for soil and groundwater in accordance with WAC 173-340-740(6) and WAC 173-340-720(8)(b), which are described in the following section.

Tables 8 and 9 summarize the proposed soil and groundwater cleanup levels, respectively, selected for the Site COCs.

| Table 8 - Proposed Soil Cleanup Standards in mg/kg | | | | | | |
|---|---|---|---|---|---|---|
| **Contaminant of Concern** | **Proposed Site Cleanup Levels** | **Most Stringent Cleanup Level for the Protection of Potable Groundwater, Surface Water via Groundwater, and Sediment via Groundwater in Vadose/Saturated Zone Soil** | **Direct Contact** | **Site-Specific Terrestrial Ecological Evaluation (Commercial/ Industrial)** | **SMS Lower Tier Freshwater Benthic SCOs** | **Natural Background Concentrations** |
| TPH[1] | 1,000/550[2] | 1,000/550 | 2,200 | NA | NA | NA |
| TPH[1] | 1,000/30 | 1,000/30[3] | 1,500 | NA | NA | NA |
| TPH-D | 340 | NA | NA | 6,000 | 340 | NA |
| Benzo(a)pyrene | 0.1875[4] | 0.0003/0.000015 | 0.1875 | 12 | NA | NA |
| fluoranthene | 0.02/0.001 | 0.02/0.0010 | 3,200 | NA | NA | NA |
| pyrene | 0.02/0.0015 | 0.02/0.0010 | 2,400 | NA | NA | NA |
| 1-Methylnapht halene | 0.0468/0.0024 | 0.0468/0.0024 | 19.6 | NA | NA | NA |
| cPAH-TEQ | 0.19[4] | 0.084/0.0042 | 0.19 | NA | NA | NA |
| Lead[4] | 118 | 250/21 | 250 | 118 | 360 | 10.9 |
| Zinc[4] | 360 | 29.9/1.49 | 24,000 | 360 | 3,200 | 85.6 |

***Notes:***

1. *TPH value is the sum of TPH-G, TPH-D, and TPH-O*
2. *The proposed cleanup level is the calculated Site-Specific Screening Level for soil where mixed-range petroleum hydrocarbons are the primary constituent.*
3. *The proposed cleanup level is the calculated Site-Specific Screening Level for soil where gasoline-range petroleum hydrocarbons are the primary constituent*
4. *The soil to groundwater pathway is incomplete, thus the next most stringent applicable cleanup level is listed.*

| Table 9 - Proposed Groundwater Cleanup Standards in µg/L | |
|---|---|
| **Contaminant of Concern** | **Project Cleanup Levels[1]** |
| TPH-D+TPH-O | 500 |
| fluoranthene | 0.02 |
| pyrene | 0.015 |
| 1-Methylnaphthalene | 1.5 |

***Notes:***

1. *The Project Cleanup Levels are the most stringent values for the protection of groundwater, sediment, and surface water.*

## 6.4 NATURE AND EXTENT OF CONTAMINATION

This section describes the apparent extent of contaminated media discovered at the Site in soil and groundwater and is illustrated in Figures 16 and 17, respectively.

### 6.4.1 Soil

Analytical results from samples collected from soil borings and test pits to date indicate that COCs were detected above applicable screening levels up to 18 feet bgs. TPH exceeding Site-specific CUL was generally observed in the upper 5 to 18 feet bgs to the east of the cap and along the concrete pad

leading away from the concrete foundations to the west of Site A from the 1992 cleanup (Figure 17). Furthermore, EPH and VPH results indicated that there are three areas where soil is primarily impacted by petroleum hydrocarbons in the gasoline-range and differed from the rest of the Site (Figure 16). TPH was not detected at or above the Site-specific CUL in soil samples collected at or below 20 feet bgs. TPH detections and exceedances are shown in Figure 10.

Select PAHs were detected above applicable screening levels and were generally observed in the upper 5 to 10 feet where TPH exceedances were also observed. PAH COC detections and exceedances are shown in Figure 12 and were generally observed in the upper 5 to 18 feet bgs, along corresponding TPH detections exceeding the Site-specific CUL.

Zinc and/or lead concentrations detected above applicable screening levels and the Ecology-derived natural background concentrations were generally observed in the upper 5 to 10 in the drainage ravine area, around the former site 'A', and to the west of the former site 'A'.

### 6.4.2 Groundwater

Exceedances above proposed cleanup levels were observed in the shallow monitoring wells only (groundwater was generally observed between 5 to 15 feet bgs in the upland area). TPH-D+O was detected above the proposed cleanup level in the shallow wells sampled during the June 2022 (all four monitoring wells exceeded for TPH-D and TPH-O), February 2023 (MW-1S, MW-2S, and MW-3S exceeded for TPH-D and TPH-O), and May 2023 (MW-2s and MW-3S exceeded for TPH-D and TPH-O; and MW-1S and MW-4S exceeded TPH-O only) monitoring events. Other analytes were not detected at or above laboratory reporting limits or were detected at concentrations below applicable screening levels.

As discussed in Section 5.2, the TPH-D and TPH-O detections and exceedances in shallow groundwater appear to be heavily influenced by polar metabolites and may also be influenced by natural organics. As petroleum biodegrades in groundwater and moves away from the source, the percentage of polar metabolites tends to increase, and the toxicity of the overall mixture tends to decrease (Ecology, 2023c). Because silica cleanup was not applied to samples, the whole petroleum mixture is compared to screening levels. Additional characterization of the relative contributions of polar petroleum metabolites and natural organics could be evaluated as part of future pre-remedial design investigations.

For the deep monitoring wells and the grab groundwater samples collected in 2022 (groundwater was generally observed between 36 and 47 feet bgs in the upland area), the analytes were either not detected at or above laboratory reporting limits or were detected below applicable proposed CULs.

### 6.4.3 Sediment

Sediment samples were only collected and analyzed during the 2022 investigation and did not exceed applicable SCOs (Table 7, Figure 14).

Two soil samples from the creek bank (Creekbed1 and LB-2) exceeded applicable cleanup levels for TPH-D, TPH-O, and cPAHs, and the analyses from the sediment samples collected in 2022 were either not detected at or above laboratory reporting limits or were detected below applicable SCOs, indicating that the protective cap is functioning as intended.

# 7. Summary and Conclusions

Results of soil and groundwater sampling conducted in the upland area at the Site during the 2019 initial investigation and 2022 through 2025 RI indicate the presence of TPH, cPAHs, benzo(a)pyrene, fluoranthene, pyrene, 1-methylnaphthalene, and zinc in soil at concentrations above proposed CULs primarily in near-surface soils (generally in the upper 10 to 18 feet bgs).

Petroleum associated with historic Bunker C and mineral spirit-like product impacted near-surface soils across an area of approximately 1 acre, generally within the upper 10 feet bgs. However, petroleum impacts associated with historic Bunker C and/or mineral-spirit like product has been detected up to 14 feet bgs in one test pit. Petroleum associated with gasoline-range petroleum hydrocarbons impacted soils across an area of approximately 0.3 acres, up to a depth of approximately 18 feet bgs.

TPH-D+O, fluoranthene, pyrene, 1-methylnaphthalene were detected in shallow groundwater above proposed CULs; COCs were either not detected or detected at concentrations below applicable CULs in all groundwater samples collected in deeper wells and in the grab-groundwater samples, except for the grab groundwater sample collected from B-11 and total copper, lead, and/or mercury during the August 2023 sampling event. However, dissolved metals were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable screening levels.

Groundwater impacts appear to be generally limited to polar petroleum metabolites that resulted from the degradation of historic petroleum releases. The highest concentrations of petroleum and polar metabolites were generally observed in monitoring wells MW-2S and MW-3S. To determine the extent of petroleum versus polar metabolite concentrations and natural organics in shallow groundwater, additional groundwater samples could be collected and analyzed for NWTPH-Dx with and without silica gel cleanup. The additional data can be used to potentially revise the proposed TPH groundwater cleanup levels to adjust for the presence of natural organics and establish cleanup levels for petroleum hydrocarbons and polar metabolites.

All constituents analyzed in sediment and surface water samples in 2022 were not detected at or above laboratory reporting limits or were detected at concentrations below applicable CULs or benchmark levels.

The data, multiple lines of evidence, and conclusions presented in this report are sufficient to complete a FS and select a proposed cleanup alternative for the draft cleanup action plan. The primary objective for the FS and draft cleanup action plan is to identify and evaluate the most relevant remedial alternative that reduces contaminant exposure to levels that are protective to human health and the environment posed by the COCs. This will be addressed in a future FS report.

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