Analysis of Brownfield Cleanup Alternatives

Rock Creek Terrace
3080 SE River Road
Hillsboro, Washington 97213

Draft

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The material and data in this report were prepared under the supervision and direction of the undersigned.

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Abbreviations

ABCA	Analysis of Brownfield Cleanup Alternatives
bgs	below ground surface
CFR	Code of Federal Regulations
City	City of Hillsboro
COC	chemicals of concern
CSM	conceptual site model
CWA	Clean Water Act
dioxins	dioxins/furans
DSL	Department of State Lands
EPA	U.S. Environmental Protection Agency
ESA	environmental site assessment
ESCP	erosion- and sediment-control plan
JPA	joint permit application
LOF	locality of facility
MFA	Maul Foster & Alongi, Inc.
NMFS	National Marine Fisheries Service
OAR	Oregon Administrative Rules
ORS	Oregon Revised Statute
Permapost	Permapost Products, Inc.
PRG	preliminary remediation goal
Property	Washington County Tax Lot 1S209BC01100
railroad	RR
RBC	risk-based criteria
USFWS	U.S. Fish and Wildlife Service
USACE	U.S. Army Corps of Engineers

1 Introduction

Maul Foster & Alongi, Inc. (MFA), has prepared this Analysis of Brownfield Cleanup Alternatives (ABCA) report for the Rock Creek Terrace property (the Property; see Figure 1-1), located at 3080 SE River Road in Hillsboro, Washington (Washington County Tax Lot 1S209BC01100).

The Property is owned by the City of Hillsboro (City) and is undeveloped. Current vegetative cover includes mature trees, bushes, and significant invasive species cover (Himalayan blackberry). The Property includes floodplain habitat and some low-lying intermittently ponded areas. During rain events, stormwater from a railroad (RR) drainage ditch just northeast of the Property discharges onto a drainage cut on the Property and during very high flow conditions, stormwater overflows to areas south of the drainage cut. Due to historical stormwater discharges and other sources such as treated timbers, approximately 3.5 acres of the Property show elevated dioxins/furans (dioxins) and metals which require remediation. Rock Creek is located immediately west; the creek is a small tributary of the Tualatin River and provides habitat for fish including threatened and endangered species.

This ABCA focuses on the remediation of impacted Property soils which are identified as posing an unacceptable risk, primarily to ecological receptors (Permapost 2019).

1.1 Purpose and Objectives

MFA completed this ABCA to meet the requirements of the U.S. Environmental Protection Agency (EPA) Brownfield Cleanup Grants program. This ABCA report includes the following:

- Information about the Property and planned restoration activities for improved ecological and community benefit, including protection of ecological and human health
- Summary of previous investigations and known contaminants and applicable regulations and cleanup standards
- Evaluation of effectiveness, long-term reliability, implementability, implementation risk, and cost of the cleanup alternatives, as well as climate change and sustainability considerations
- Selection of a preferred cleanup alternative

2 Background

The Property background and physical setting information summarized below has been obtained from previous investigations (Permapost 2019).

2.1 Site Description

The Property consists of one 15.2-acre parcel (Washington County Tax Lot 1S209BC01100) and is currently vacant and undeveloped (see Figures 1-1 and 2-1). The Property was pasture until sometime between 1975 and 1981, after which trees and brush were noted in historical aerials. The Property's current vegetative cover includes small but well-established deciduous trees; tree density is higher on the west side of the Property. Significant invasive species that limit access are present, primarily Himalayan blackberry, throughout the Property. Property surroundings include Rock Creek to the west, the Tualatin Valley Highway and a RR line to the north including a treated timber trestle over Rock Creek, and the D&G Industrial Park and Permapost Products, Inc. (Permapost) to the east. Historically, stormwater from Permapost entered the RR ditch via two outfalls. Since 2000, treated permitted stormwater enters the ditch via one outfall. The RR drainage ditch conveys flows to a drainage cut that crosses the Property just south of the railroad line and ultimately to Rock Creek. Under high flow conditions, stormwater from the RR ditch and drainage cut likely overflowed onto other portions of the Property. Approximately 3.5 acres of the northern portion of the Property show elevated concentrations of dioxins and metals that require remediation, whereas Rock Creek is not impacted with contamination. Potential sources include historical discharges from Permapost operations, treated wooden RR ties, and other common anthropogenic sources such as vehicle combustion.

The Hillsboro comprehensive plan designates the Property as floodplain land use (City 2017). The Property is further identified as a clean water services sensitive area; is part of the 100-year floodplain; and is designated a habitat benefit area. See the Appendix for a FEMA National Flood Hazard map. The Property and Rock Creek are also part of a City Significant Natural Resource overlay which requires a Level of Protection 2, under which, according to the Hillsboro Planning Department, property development will be limited.

Native and nonnative plant species are present across the Property, including by not limited to the following:

- Cattails (*Typha latifolia*) (primarily found on the eastern side),
- Grasses (*Phragmites communis and Phalaris arundinacea*),
- Snowberry (*Symphoricarpos albus*),
- Oregon ash (*Fraxinus latifolia*),
- Pacific willow (*Salix lucida*),
- Balsam poplar (*Populus balsamifera*),
- Himalayan blackberry (*Rubus discolor*),
- Cat's ear/flatweed (*Hyporchoeris radicata*),
- Scotch broom (*Cytisus scoparius*), and
- Horsetail (*Equisetum hyemale*) (primarily observed on the northern side of the Property).

A variety of mammals utilize the Property. Scat from deer (likely black-tailed deer, *Odocoileus hemionus*) and paw prints of a raccoon (*Procyon lotor*) were observed during site visits. Coyote

(*Canis latrans*) scat (tentatively identified) was also observed. Other common but smaller riparian species (e.g., mink, opossum, and mice) also likely utilize the area.

Common birds were observed included song sparrows (*Melospiza melodia*), and a western scrub-jay (*Aphelocoma californica*) observed flying overhead. Ducks (species unknown) have been observed in pooled water in the central area of the Property during rainy periods. Mallard ducks (*Aras platyrhynchus*) and Canada geese (*Branta canadensis*) have also been observed in the nearby Valley Memorial Park Cemetery. These and other species of waterfowl may utilize the area as stopover sites in the rainy season.

Rock Creek to the west is a small tributary of the Tualatin River with headwaters in the Tualatin Mountains (West Hills) to the north. The creek is approximately 15 feet wide, and water levels fluctuate several feet seasonally. The banks are typically steep and overgrown, dropping approximately 5 to 10 feet, and access is relatively limited due to lack of trails and significant invasive species.

2.2 Geology, Hydrogeology, and Surface Water

The Property is generally flat with a slight decrease in slope to the west. The Property is located in the Willamette River - Puget Sound Lowland physiographic province. This province is a level, elongated alluvial plain set in a structural downwarp between the Coast Range on the west and the Cascade Range on the east. The Willamette River Basin, comprising an area of approximately 11,200 square miles, is the major component of the southern portion of the Willamette River - Puget Sound Lowland. The Tualatin Mountains, a structurally controlled northwest-to-southeast trending topographic high, defines the boundary between the Willamette River Basin and the Tualatin River Sub-Basin. Bedrock in the vicinity of the Property includes flood basalts of the Columbia River Basalt Group. Between 17 and 6 million years ago (Ma) these flood basalts erupted from fractures in northeast Oregon. The basalts spread over large areas of northern Oregon and central/eastern Washington, reaching a maximum thickness of approximately 3 miles. The basalt flows are well exposed in the Tualatin Mountains approximately 12 miles northeast of the Property.

Three primary hydrogeologic units comprise the Willamette Basin. From stratigraphically lowest to highest, these include the Columbia River Basalt Unit, Basin-Fill Sediment Unit, and the Willamette Silt Unit.

There are no current groundwater uses on the Property. Potable water in the vicinity is sourced from the Hillsboro municipal water supply. Groundwater in the vicinity has been documented to flow northwest and ranges from approximately 4 to 16 feet below ground surface (bgs). The groundwater use is not likely to change in the future, since any additional growth will most likely be serviced with City-supplied water, not groundwater.

2.3 Sensitive Environments

Sensitive environments, as defined in Oregon Administrative Rule (OAR) 340-122-115(50), are areas of particular environmental value where a hazardous substance could pose a greater threat than in other, nonsensitive areas. According to the OAR, sensitive environments include but are not limited to: critical habitat for federally listed endangered or threatened species; national parks; monuments; national marine sanctuaries; national recreational areas; national wildlife refuges; national forest

campgrounds; recreational areas; game management areas; wildlife management areas; designated federal wilderness areas; wetlands (freshwater, estuarine, or coastal); wild and scenic rivers; state parks; state wildlife refuges; habitat designated for state-listed endangered species; fishery resources; state-designated natural areas; county or municipal parks; and other significant open spaces and natural resources protected under Goal 5 of Oregon's Statewide Planning Goals.

Threatened or endangered species that may occur on the Property were identified and based on species database reviews. Three listed bird species may occur in the region but are unlikely to utilize the Property:

- Marbled murrelet (*Brachyramphus marmoratus*): The IPaC database identified the marbled murrelet as potentially present. The marbled murrelet is listed by the federal government and the State of Oregon as threatened. Marbled murrelets range along the entire Pacific coast from Alaska to California. They feed primarily on fish and invertebrates in nearshore marine waters and nest in mature and old-growth coastal forests, which are not present near the Property. According to the ORBIC database, the marbled murrelet has not been observed near the Property. According to the IPaC database, designated critical habitat for this species is not present near the Property.
- Northern spotted owl (*Strix occidentalis caurina*): The IPaC database identified the northern spotted owl as potentially present. The northern spotted owl is listed by the federal government and the State of Oregon as threatened. Northern spotted owls range along the Pacific coast from northern California to Canada. They nest primarily in mature and old-growth forests, which are not present near the Property. According to the ORBIC database, the northern spotted owl has not been observed near the Property. According to the IPaC database, designated critical habitat for this species is not present near the Property.
- Streaked horned lark (*Eremophila alpestris strigata*): The IPaC database identified the streaked horned lark as potentially present. The streaked horned lark is listed by the federal government and the State of Oregon as threatened. Streaked horned larks range along the Pacific coast from central Oregon to Canada. They nest in wide open, sparsely vegetated spaces with no trees or few shrubs; such spaces are not present near the Property. According to the ORBIC database, the streaked horned lark has not been observed near the Property. According to the IPaC database, designated critical habitat for this species is not present near the Property.

Other ecologically important species include migratory birds that utilize the middle Tualatin Basin. This includes the bald eagle, protected under the Bald and Golden Eagle Protection Act. According to the ORBIC database, a bald eagle breeding site is located within two miles of the Property.

One listed insect species is known to occur in the region:

- Fender's blue butterfly (*Icaricia icarioides fenderi*): The IPaC database identified the Fender's blue butterfly as potentially present. The Fender's blue butterfly is listed by the federal government and the State of Oregon as endangered. Fender's blue butterflies range west of the Cascades in Oregon. They are typically found in native upland prairies and their larvae feed on lupine plant species. According to the ORBIC database, the Fender's blue butterfly has not been observed near the Property. According to the IPaC database, designated critical habitat for this species is not present near the Property.

The IPaC database identified five federally listed plant species known to occur in the region but unlikely to be present at the Property. According to the ODFW and USFWS species profiles, Bradshaw's desert parsley (*Lomatium bradshawii*) is limited to a few sites in Lane, Marion, and Benton counties. Kincaid's lupine (*Lupinus sulphureus ssp. Kincaidii*) typically requires dry, fescue

prairies, which are not present at the Property. Nelson's checkermallow (*Sidalcea nelsoniana*) is typically found in open prairie or meadow remnants along the margins of streams and ditches and along roadsides at stream crossings where nonnative plants are also present; suitable habitat may be present near the Property, but Nelson's checkermallow populations are generally concentrated near Corvallis and Salem. There are no extant known occurrences of water howellia (*Howellia aquatilis*) in Oregon. The current known range of the Willamette daisy (*Erigeron decumbens var. decumbens*) does not extend north of Grand Ronde, Oregon. According to the ORBIC database, none of these species have been observed near the Property. According to the IPaC database, designated critical habitat for these species is not present near the Property or critical habitat has not been designated.

2.3.1 Rock Creek

Rock Creek in this area is a meandering, low-gradient, and slow-moving stream. Rock Creek joins the Tualatin River approximately 3,000 feet south southwest. The creek is approximately 15 feet wide. Native emergent vegetation was not observed in the creek; the steep banks of the creek are vegetated with nonnative reed canary grass and other grasses and shrubs. The identified current beneficial surface water uses for Tualatin Basin (located in the Willamette Basin) streams such as Rock Creek are: salmon and trout rearing and migration, water supply (public domestic, private domestic, industrial, irrigation, livestock watering), fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, and hydropower (OAR 340-041-0340). Hillsboro Planning Department maps and the current U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory map did not identify any designated wetlands in the Property; wetlands were identified in other areas along Rock Creek and intermittently ponded areas are present on the Property.

Two ESA-listed fish species likely occur in the section of Rock Creek adjacent to the Property:

- Steelhead (*Oncorhynchus mykiss*): The section of Rock Creek adjacent to the Property may be included in the migration pathway for winter steelhead. Steelhead trout, which are federally listed as threatened, are known to occur in waterways in the region (observed in Rock Creek and its tributaries) in summer/fall months. ODFW district fish biologist Tom Murtagh notes that small numbers of winter steelhead may use this portion of Rock Creek as part of their migratory pathway (Murtagh 2019).
- Coho salmon (Oncorhynchus kisutch): The section of Rock Creek adjacent to the Property may be utilized by coho salmon in summer/fall months. ODFW district fish biologist Tom Murtagh notes that small numbers of coho salmon use this section of Rock Creek for migration and rearing at certain times of the fall, winter, and spring (Murtagh 2019); coho typically spend a year rearing before outmigrating to the ocean.

Steelhead trout are native to the middle Tualatin Basin, whereas coho salmon were first introduced in the 1920s and have since become naturalized. In addition to these two federally listed fish species, Pacific lamprey (*Entosphenus tridentatus*) could be found as ammocoetes in the sediments of lower Rock Creek in reaches with abundant gravel. Ammocoetes (a larval stage lasting approximately four years) prefer muddy substrates and then migrate to stream reaches with fast flow and gravel substrate before outmigrating to the ocean as adults. Coastal cutthroat trout (*Oncorhynchus clarkii*) may also intermittently inhabit this section of Rock Creek; cutthroat spawning on lower Rock Creek near the Property is not expected. Native nonsalmonid species present in streams in the middle Tualatin Basin include sculpin, lamprey, dace, coarsescale sucker, and

redside shiner; and nonnative warm water species, including smallmouth bass, largemouth bass, bluegill, and bullhead, are present.

2.4 Previous Investigations

Several investigations have been completed at the Property including a remedial investigation (RI) completed under Oregon Department of Environmental Quality (DEQ) oversight. Investigations include the following:

- A Phase 1 Environmental Site Assessment (ESA) (June 7, 2010) and Phase 2 ESA (July 6, 2010) completed by Assessment Associates, Inc on behalf of the City. Based on Recognized Environmental Conditions identified in the Phase 1, Phase 2 including soil investigation for metals and pentachlorophenol. Based on the results, AAI recommended no further soil investigation at the time and noted that ecological risk assessment was beyond the scope of investigation.
- A remedial investigation completed in 2019 by Permapost, which included soil sampling at the Property, Rock Creek sediment sampling, and human health and ecological risk assessment. (Permapost 2019). Investigation activities included collection of soil via incremental sampling methods and discrete deeper samples to determine the lateral and vertical extent of soil contamination. The results of this investigation identified dioxins in shallow soil as the primary chemical of concern (COC) on the Property.
- A supplemental soil investigation conducted in 2021 at the Property to refine lateral and vertical extent of soil contamination (MFA 2022).
- A technical memorandum that incorporates the 2021 data to provide an updated conceptual site model (CSM) and other updates to complete the RI, including an updated human health and ecological risk assessment (MFA 2023).

2.4.1 Areas of Concern

Previous investigations have identified an approximately 3.5 acre area of contamination and COCs at the Property, based on sampling activities conducted (MFA 2023). See Figure 2-2 for areas of interest including the contamination footprint on the Property. Figure 2-3 summarizes soil sample locations and COC exceedances.

Drainage cut area. The drainage cut (approximately 0.5 acres) contained the highest concentrations of dioxins by an order of magnitude relative to all concentrations within the Property. Soil results exceeded the ecological screening criteria for dioxins, arsenic, chromium, and copper. The elevated concentrations in the drainage cut support stormwater deposition as a primary transport mechanism. The vertical extent of dioxins in the drainage cut portion has not been fully delineated.

Terrace area. South of the drainage cut, approximately 3 acres of the Rock Creek Terrace shows elevated shows elevated dioxin concentrations that exceed ecological screening criteria for dioxins. The elevated concentrations in the low-lying areas of the terrace support stormwater overflow from the drainage cut and deposition as a primary transport mechanism. The extent of COCs has been delineated.

2.4.2 Chemicals of Concern

The following COCs were identified during site investigations, as approved by the DEQ (see Table 2-1):

- Soil
  - Metals (including arsenic, chromium, and copper)
  - Dioxins

Based on the frequency and magnitude of exceedances, dioxins are identified as the primary COC to guide remediation efforts.

2.5 Conceptual Site Model

A CSM was developed to describe release mechanisms, environmental transport processes, exposure routes, and receptors for sources of contamination identified on the Property and approved by DEQ (MFA 2023). The primary purpose of a CSM is to identify potential pathways by which human and ecological receptors could be exposed to site-related chemicals. A complete exposure pathway consists of four necessary elements: (1) a source and mechanism of chemical release to the environment; (2) an environmental transport medium for a released chemical; (3) a point of potential contact with the impacted medium (referred to as the exposure point); and (4) an exposure route (e.g., soil ingestion) at the exposure point. The CSM is based on information collected during previous investigations and understanding of the proposed future use of the Property.

The primary mechanisms likely to influence the fate and transport of chemicals on the Property include natural biodegradation of organic chemicals, sorption of chemicals to soil, and physical dispersion of adsorbed chemicals, for example, suspension of chemicals in stormwater and subsequent deposition. The properties of the soil and stormwater dynamics also affect contaminant fate and transport.

The Property is undeveloped land with some mature trees, bushes, and significant (blackberry) non-native vegetation. The soil-to-groundwater pathway is insignificant based on hydrophobicity of COCs, depth to groundwater (inaccessible to ecological receptors), and no drinking water use. The RI also established no significant groundwater pathway for contaminants to Rock Creek. Volatile contaminants in soil have the potential to partition to the vapor phase, which could result in impacts to air quality. However, the COCs do not readily volatilize, and no building construction is planned. The indoor and outdoor air pathways are therefore insignificant. Historically stormwater discharges conveyed flows to the drainage cut that crosses the Property and under high flow conditions, stormwater likely overflowed onto other portions of the Property where sampling activities identified contamination in shallow soils (see Figure 2-4). Based on sampling conducted in Rock Creek and declining concentrations towards the west end of the drainage cut, significant contaminant stormwater transport to Rock Creek did not occur and the creek is not impacted above typical background conditions. Other potential anthropogenic sources to Rock Creek include treated wood used to construct the RR trestle, as well as common sources such as vehicle traffic and emissions. Contamination in shallow soils on the Property present a complete exposure pathway.

2.5.1 Potential Receptors

Future plans for the Property include habitat restoration for ecological benefit and increased accessibility through invasive species removal and promoting future trails. Currently, access is limited due to severely overgrown invasive species vegetation and no formal access areas. Therefore, transient persons are considered current receptors and potential future receptors are recreationists. In addition, terrestrial and riparian ecological receptors (birds, mammals, and plants) are considered current and future potential receptors since the Property will remain undeveloped.

2.5.2 Potentially Complete Exposure Routes

Based on the current or future potentially complete exposure scenarios and potential human and ecological receptors to contaminated media described above, the potentially complete exposure pathways for the Property are transient receptor exposure to surface soil and ecological receptor exposure to surface soil.

- Humans may come into contact with surface soil (<3 feet bgs) via ingestion, dermal contact, or inhalation. The potential for transient exposure on portions of the Property was identified, primarily in the drainage cut, where localized areas with elevated concentrations of dioxins are present (see Figure 2-3). This area is relatively inaccessible because of overgrowth and steep banks; however, transient use has been intermittently observed. Except for the drainage cut, all dioxin results were below the site-specific risk-based criteria (RBC) for transient receptors of 960 ng/kg. No COCs were identified for the other portions of the Property considering representative human health exposure concentrations. The soil exposure pathway is currently considered potentially complete but is limited due to accessibility constraints to the Property.
- Ecological receptors may come into contact with surface soil via ingestion, dermal contact, or inhalation. There is potential for unacceptable ecological risk due to dioxins and metals (arsenic, total chromium, and copper) and these substances were identified as ecological COCs. Risk management decisions should focus on addressing significantly elevated concentrations in the drainage cut portion of the Property.

2.6 Planned Reuse and Restoration

The planned reuse for the Property includes preserving and restoring habitat for community benefit and natural space. The Property requires a Level of Protection 2, under which, according to the Hillsboro Planning Department, site development will be limited. Restoration plans include removal of invasive species and improvements to existing habitat. As part of the planned cleanup activities, mature trees and bushes would be retained, invasive species cleared, and over 3 acres of area would be replanted to restore habitat.

2.7 Regional and Site Vulnerabilities

According to the *Fourth National Climate Assessment* (May, et al. 2018), climate trends for the northwest region of the U.S. include: increased temperatures during all seasons under all future scenarios; decreased snowpack; increased wildfires and insect infestations; decreased rainfall and water availability during the dry season; increased flooding during the wet season; a rising sea level; increased storm surge events; more frequent heat waves; and increased risk of landslide and

erosion. The most applicable climate related vulnerability to the cleanup of the Property are increased temperatures resulting in increased wildfires.

According to the Climate Mapping for Resilience and Adaptation tool[1], Washington County, Oregon is expected to experience increased wildfire danger, increased temperatures during the summer and winter seasons resulting in a reduced snowpack and more drought, and more frequent heavy magnitude precipitation events resulting in increased streamflow volumes and flooding. Where applicable, the design for reuse and remediation of the Property will include measures to mitigate climate change impacts. Based on the nature of the Property and its proposed reuse, other climate change impacts are not likely to significantly affect the Property.

3 Applicable Regulations and Cleanup Standards

The following federal and state laws and regulations and local requirements were determined to be applicable or relevant and appropriate requirements.

3.1 Federal

3.1.1 Joint Permit Application

The joint permit application (JPA) is administered by the U.S. Army Corps of Engineers (USACE) to facilitate application for federal and state permits for projects impacting waters of the U.S. and state waters. The regulations relevant to cleanup at the Property are summarized in the following subsections.

3.1.2 USACE Section 404 Permit

USACE requires that a permit be obtained for the discharge of dredged or fill materials in waters of the U.S., consistent with the Clean Water Act (CWA). The permit also requires that the state issue a water quality certification for the project under CWA Section 401. Discharges of dredged or fill materials are not permitted unless there is no practicable alternative that will have less adverse impact on the aquatic ecosystem.

Effect on Design

If waters of the U.S. are determined to be present on the Property in areas requiring remediation, the City will prepare permit documents fulfilling the requirements of CWA Section 404. It is expected if the permit is required, that the proposed work would be permitted under Nationwide Permit 38—Cleanup of Hazardous and Toxic Waste. This general action permit provides for a streamlined effort for specific activities required to affect the containment, stabilization, or removal of hazardous or

[1] https://livingatlas.arcgis.com/assessment-tool/home/

toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority.

3.1.3 Endangered Species Act

USACE permitting, if determined applicable, may prompt an Endangered Species Act determination by USACE and subsequent consultation (informal concurrence or formal consultation) with the U.S. Fish and Wildlife Service (USFWS) for northern spotted owl, marbled murrelet, and streaked horn lark and with the National Marine Fisheries Service (NMFS) for Steelhead (*Oncorhynchus mykiss*) and Coho salmon (*Oncorhynchus kisutch*).

These consultations would result in biological opinions and the USFWS and/or NMFS would document their opinion as to whether an action is likely to jeopardize the existence of an Endangered Species Act-listed species or to result in the destruction or improper modification of the habitat of that species.

Effect on Design

If USACE permitting is required, the City will prepare a biological evaluation to be submitted with the JPA, to evaluate whether adverse or negative impacts to endangered species and their critical habitats during or resulting from site remediation should be anticipated.

Alternatively, USACE may directly evaluate whether the proposed in-water project or action is likely to jeopardize the existence of a species recorded on the Endangered Species Act list or to result in the destruction or improper modification of the habitat of that protected species. USACE may then ask the USFWS and/or NMFS for concurrence with their evaluation (an informal consultation).

3.1.4 CWA Section 401 Certification

The CWA requires the development of regulations to protect the quality of the nation's waters. Section 401 requires that applicants for a federal license or permit to conduct work that may result in discharges into waters of the U.S provide the licensing or permitting agency a certification from the state that the discharge will comply with the applicable provisions of Sections 301, 302, 303, 306, and 307 of the CWA. This program has been delegated to the State of Oregon.

The objective of the CWA (33 U.S. Code 1251-1376 and 40 Code of Federal Regulations [CFR] 129 and 131) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Sections 303 and 304 of the CWA require the EPA to issue ambient surface water quality criteria for the protection of aquatic life and human health. The federal water quality criteria, as specified in Title 40 Part 131 of the CFR, are unenforceable guidelines to be used by states to set water quality standards for surface water. Federal water quality criteria, based on chronic and acute effects to aquatic life, have been developed for 120 priority toxic pollutants and 45 nonpriority pollutants for marine waters and freshwaters.

Effect on Design

If USACE permitting is required, the City will prepare a pre-filing request to allow DEQ to determine whether a pre-filing meeting is required at least 30 days prior to submitting the JPA to DEQ's 401 program. Following notification of whether a pre-filing meeting is required, the City and DEQ will either attend a pre-filing meeting or, if a meeting is not required, submit the application for the 401

certification. A project-specific water quality plan and monitoring plan will be prepared, as necessary, following feedback from DEQ's 401 program.

3.1.5 Cultural Resources

The National Historic Preservation Act, passed in 1966 (16 U.S. Code 470 et seq.), established a national policy for the protection of important historic buildings and archaeological sites and outlined responsibilities for federal and state governments. Under Section 106 of the National Historic Preservation Act, each agency must consult with Oregon State Historic Preservation Office and Indian Tribes to ensure that cultural resources are identified, and to obtain the formal opinion of the office on each site's significance and the impact of its action on the Property. The responsibilities of all parties in the Section 106 review process are set forth in federal regulations developed by the Advisory Council on Historic Preservation as 36 CFR 800. Section 106 compliance is required, as activities requiring a permit from USACE will be conducted.

Effect on Design

Prior to initiating ground-disturbing activities or submitting the JPA (if required), the City will subcontract with a cultural resources firm to provide an assessment of potential cultural resources within the remedial action areas. This assessment will include an inadvertent discovery plan should cultural resources be disturbed/encountered during cleanup implementation.

3.2 State

3.2.1 Cleanup Oversight and Regulations

DEQ is responsible for overseeing cleanup at the Property. The Property is part of the locality of facility (LOF) that Permapost has investigated subject to a RCRA Permit (Permapost Products Hazardous Waste Post-Closure Permit ORD 009 041 187, effective September 17, 2008 until September 17, 2018; application for renewal is on hold until a Record of Decision is issued by Oregon DEQ and Permapost is therefore currently under interim status (RCRA part 265 as opposed to 264). Documents prepared for the Property are submitted to DEQ under state Environmental Cleanup Site Information number 0148. The Property is expected to be governed under Oregon Revised Statute (ORS) 465 which outlines requirements for dealing with Hazardous Waste and Materials in Oregon. ORS 465.315 sets out standards for the degree of cleanup required under Oregon law. These rules require that any removal or remedial action address a release or threat of release of hazardous substances in a manner that assures protection of present and future public health, safety, and welfare and the environment. The rules also provide a framework for the development of RBCs to which concentrations of contaminants are compared to evaluate the need for remediation.

Effect on Design

All elements of the remedial design and remedial action will comply with Oregon standards.

3.2.2 National Pollutant Discharge Elimination System 1200-C Permit Program

The National Pollutant Discharge Elimination System 1200-C permit is administered by DEQ to regulate construction activities that disturb one or more acres of land through clearing, grading, excavating, or stockpiling of fill material and where the possibility exists that stormwater could run off the Property into surface waters or conveyance systems leading to surface waters of the state during construction. To obtain a permit, applicants must prepare an erosion- and sediment-control plan (ESCP) and incorporate best management practices into their land-disturbing construction work. A complete application packet includes an application form, Land Use Compatibility Statement, and the ESCP.

Effect on Design

National Pollutant Discharge Elimination System 1200-C permits are required for construction sites of 1 acre or larger or for smaller sites with known soil and/or groundwater contamination. The City will apply for and receive coverage under the construction stormwater general permit.

3.2.3 Oregon Removal/Fill Law

Oregon Revised Statute 196.795-990 requires that a permit be obtained from Oregon Department of State Lands (DSL) for removal of material from or the placement of fill within waters of the state; this permit will be applied for as part of the JPA if necessary for the project. DSL will review the application for completeness and, if so, initiate a public review period. Following completion of the public comment period and the resolution of any technical issues, DSL will evaluate the entire record against the criteria for permit issuance and either approve or deny the application.

OAR 141-145 provides the rules governing "the granting and renewal of access authorizations, leases, and easements issued to facilitate remediation conducted pursuant to an order issued by DEQ or EPA and habitat restoration activities in, on, under, or over state-owned submerged and submersible land." This OAR requires that an easement be obtained for the construction of a sediment cap. It is expected that the proposed work will require a removal/fill permit and access authorization from DSL.

Effect on Design

If the proposed work will require a removal/fill permit and access authorization from DSL, the City will prepare a JPA to address this requirement concurrent with USACE permit requirements.

3.3 Local

ORS 465.315(3) exempts qualifying cleanup activities from the requirement to obtain state and local permits, licenses, and authorizations. The Property is in the City of Hillsboro in Washington County. Implementation of the remedial action must meet appropriate requirements of construction requirements and/or be documented by an exempt review process as required by the Hillsboro Municipal Code.

Effect on Design

The City will identify which permits will be required and obtain those required permits prior to implementing remedial actions on the Property. For example, if remediation of the Property requires grading within the regulatory floodway or Rock Creek, then a no-rise certification, prepared by a Professional Engineer registered in the State of Oregon, will be required to document that the proposed work will not increase base flood elevations in Rock Creek.

4 Evaluation of Cleanup Alternatives

The purpose of this ABCA is to identify and evaluate the most relevant remedial alternative that reduces contaminant exposure to levels that are protective of human health and the environment. This ABCA was completed in general accordance with EPA guidelines for conducting an ABCA. This document is a draft and will be presented for public comment.

The remedial action area consists of soil with elevated chemicals of concern exceeding preliminary remediation goals (PRGs) provided in Table 4-1.

4.1 Remedial Alternatives Considered

Typically, remedial alternatives are evaluated using the following criteria:

- Effectiveness
- Long-term reliability
- Implementability
- Implementation risk
- Reasonableness of cost

The above factors are discussed below in the sections below, along with a discussion of climate change and sustainability related to resilience per EPA guidance (EPA 2014, 2024).

The objective of the remedial alternatives is to mitigate risk from chemical concentrations present at a site, such that any potential exposures do not exceed levels protective of human health and the environment. Contamination on the Property is shown on Figure 2-3. The nature of contamination is described in Table 2-1 and PRGs are provided in Table 4-1. Exposure to contamination is assumed to be restricted to shallow soil in the Property (i.e., less than 3 feet bgs). Contamination in the drainage cut portion of the Property extends to between 2 to 2.5 feet bgs. Data collected at depth confirm the low mobility of the COCs as concentrations decrease rapidly with depth in soil. It is assumed that concentrations exceed applicable PRGs to 3 feet bgs.

4.1.1 Alternative 1—No Action

This alternative is included as a baseline condition only and is not considered a long-term solution for remediation of the Property. This alternative would not include any activities to remove, treat, monitor, or manage site contamination. If impacted soil is left in place, human and ecological

exposure to soil is likely and the potential for contaminant migration would remain. This alternative is not protective of human health and the environment, and reduction of contaminant concentrations below cleanup levels would not be achieved. This alternative is not evaluated further.

4.1.2 Alternative 2— Excavation, Landfill Disposal, and Restoration

Under Alternative 2 the following remedial actions are included:

- Excavate soil exceeding PRGs and hot spot criteria to depth of 3 feet bgs up to the embankment along Rock Creek.
    - Based on potential receptor exposure depths and mobility of the COCs, it is assumed this depth will effectively remove all COCs above applicable PRGs in the Property.
- Transport and dispose of all excavated soil at a licensed disposal facility. When generated for off-site disposal, shallow soil would be classified as non-hazardous with disposal at Chemical Waste Management of the Northwest or Columbia Ridge in Arlington, Oregon, located 160 miles from the Property or as non-hazardous with disposal at the Hillsboro Landfill in Hillsboro, Oregon, located 3 miles from the Property, depending on chemical concentration.
- Backfill excavation areas to grade using clean imported soil.
    - The top six inches of backfill in the non-drainage cut areas (R1, R2, S1, S2, F1a, F1b, F2a, F2b1, F2b2, and F2b3) would include topsoil for habitat restoration.
    - Surface restoration (upper 1 foot) within the drainage cut (D1 and D2) would include coarse grained material (e.g., rip rap) to minimize surface water erosion. If concentrations of PRGs are removed, the final grade of the drainage cut (D1 and D2) may be reduced below the original grade.
- Replanting and reseeding over 3 acres of area to restore habitat conditions.

4.1.3 Alternative 3—Targeted Excavation, Off-Site Disposal, Carbon Amendment, and Restoration

Under Alternative 3 the following elements are included:

- Excavate soil exceeding hot spot criteria in the drainage cut (D1 and D2, see Figure 2-3) up to depth of 3 feet bgs. Excavate soil exceeding hot spot criteria in other areas (F1a and F2b2) up to depth of 1 feet bgs. Transport and dispose off-site at the Permapost facility where soil would be contained under an engineered cap. Assumes the excavation would extend up to the embankment along Rock Creek.
    - Based on potential receptor exposure depths and mobility of the COCs, it is assumed this depth will effectively remove all COCs above applicable PRGs in the drainage cut.
    - Based on low volume of soil generated, off-site disposal and capping is assumed.
- Backfill the excavation area using clean backfill to grade.
    - Surface restoration within the drainage cut (D1 and D2) would include coarse grained material (e.g., rip rap) to minimize surface water erosion.
- Amend soil exceeding PRGs in other portions of the Property with activated carbon. Assumes the following:
    - Till carbon amendment into the PRG exceedance areas.

    - Large vegetation (i.e., large diameter trees) would remain in place and the carbon-amended area would be reseeded/planted to encourage revegetation.

- Replanting and reseeding over 3 acres of area to restore habitat conditions.
- Perform monitoring at the amended locations to assess contaminant stability and bioavailability annually for five years in areas of carbon application to evaluate total organic carbon concentrations throughout the Property.

4.2 Evaluation of Cleanup Alternatives

4.2.1 Effectiveness

Both Alternative 2 and Alternative 3 are judged to be effective, as they would eliminate the exposure of contaminated soil to human and ecological receptors. Alternative 2 is effective at reducing the risk from COCs to potential human and ecological receptors because the removal of soil above hot spot and PRG criteria eliminates the exposure route (e.g., direct contact) with contaminated soil and the transport of contaminated soils to off-site areas. Excavation is a proven technology that can be implemented in a timely manner. In addition, no engineering or institutional controls are used to manage residual risk. Alternative 3 is effective at reducing the risk from COCs to human and ecological receptors because the removal of soil above hot spot and PRG criteria within the drainage ditch and terrace eliminates the exposure route (e.g., direct contact) with contaminated soil and the transport of contaminated soils to off-site areas. Amendment of soil above PRG criteria in the terrace with carbon reduces the bioavailability of COCs to human and ecological receptors and transport to off-site areas. Excavation and carbon amendment applications are proven technologies and are protective with the appropriate loading and mixing of the carbon into the dioxin-contaminated soil. Monitoring is required to ensure the effectiveness of carbon amendment application.

4.2.2 Long-Term Reliability

Alternative 3 requires soil treatment in a portion of the Property that will require monitoring to ensure long-term reliability. Further, placement of excavated soil at a landfill will not require long-term monitoring and maintenance or restriction of future site uses. Based on long-term monitoring needs and treatment Alternative 3 is judged to be reliable but less so than Alternative 2.

Alternative 2 would remove all contaminated soil from the Property and would not rely on either institutional controls or engineering controls. No monitoring or maintenance is required to ensure long-term reliability and future site uses are not restricted. Alternative 2 is judged to be more reliable in the long term.

4.2.3 Implementability

Both proposed alternatives are considered implementable, as they rely on common construction practices. Alternative 3 is judged to be slightly more implementable given the smaller proposed area and volume of soil planned for excavation relative to Alternative 2.

4.2.4 Implementation Risk

Alternative 2 has a moderate implementation risk given the proposed area/volume of soil planned for excavation, which is associated primarily with potential worker exposure to impacted soil and

standard construction safety hazards. Potential impacts to the community are associated primarily with fugitive dust emissions related to excavation and the significant number of truck trips on local roads and highways. Environmental impacts are associated primarily with potential short-term releases of soil during excavation, significant disturbance of established vegetation in excavation areas, and impacts related transport and disposal. Procedures during construction and environmental remediation will be necessary to minimize implementation risk.

Alternative 3 has a lower implementation risk given the smaller proposed area and volume of soil planned for excavation relative to Alternative 2, which reduces the risk of worker exposure and significantly fewer truck trips associated with disposal and restoration. Potential impacts to the community are associated primarily with fugitive dust emissions related to excavation. Environmental impacts are associated primarily with potential short-term releases of soil during excavation and placement of amended carbon. The potential issues are manageable through proper design, planning, and implementation. Standard procedures used in the construction and environmental remediation industries can be employed to minimize implementation risk.

4.2.5 Climate Change Concerns

The Property is located in an area with anticipated increased fire danger, increased temperatures, reduced precipitation events in the summer, and more frequent storm events due to climate change. Both alternatives would remove highly contaminated soil from the Property in areas receiving stormwater flow and hydraulically connected to Rock Creek (the drainage cut). Alternative 2 would remove all contaminated material from the site and remove the potential for mobilization of contamination in soil from heavy precipitation events. While some contaminated soil would remain on site under Alternative 3, it would be treated; immobilization of dioxins in soil by sorption onto added carbon would effectively immobilize and bind dioxin contamination and reduce exposure. The greatest risk would be if contaminated soil remaining on site under Alternative 3 was not appropriately monitored for efficacy. Therefore, Alternative 2 ranks higher than Alternative 3 related to climate change resiliency.

4.2.6 Sustainability

Alternative 3 is judged to be slightly more sustainable than Alternative 2, as it would require significantly less trucking of material off site. Alternative 2 would require trucking of all contaminated soil to a permitted landfill and trucking in any backfill materials. The soil treatment included in Alternative 3 is expected to require periodic monitoring in the long term, whereas no periodic monitoring and associated travel and material usage would be required with Alternative 2. There would be greater greenhouse gas emissions from hauling material to the landfill during construction of Alternative 2 versus Alternative 3.

4.2.7 Cost

The conceptual-level cost estimate to implement Alternative 2 is approximately $6,247,000 (see Table 4-2). The conceptual-level cost estimate to implement Alternative 3 is approximately $1,944,000 (see Table 4-3).

4.2.8 Public Participation

The ABCA process mandates that public comments and concerns be addressed during the selection of a cleanup alternative. This ABCA report will be included in the EPA grant application to be presented for public comment. Additional public comment period(s) will be included during permitting of the cleanup action.

5 Preferred Cleanup Alternative

The preferred cleanup alternative to remediate soil with concentrations of contaminants PRGs is Alternative 3. Alternative 1 cannot be recommended since it does not address site risks. Alternative 3 ranks slightly higher in sustainability, cost, implementability, and implementability risk than Alternative 2. Alternative 3 reduces risk of exposure by removing soils with COC concentrations above hot spot criteria in the drainage cut and treats hot spot areas as well as areas with COC concentrations above PRGs. The risks associated with implementation of Alternative 3 can be mitigated through use of standard best management practices. Alternative 3 has a significantly lower cost than Alternative 2 due to reduced excavation area and disposal volumes. For Alternative 3 to remain effective, ongoing monitoring of the carbon amendment will be required to ensure reduction in mobility of COC concentrations. Alternatives 2 and 3 are similarly reliable. Alternative 2 ranks higher for long-term reliability and climate change risk, however the increase in costs is considered disproportionate to the benefits.

For these reasons, Alternative 3 is the preferred alternative.

References

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Limitations

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

Figures

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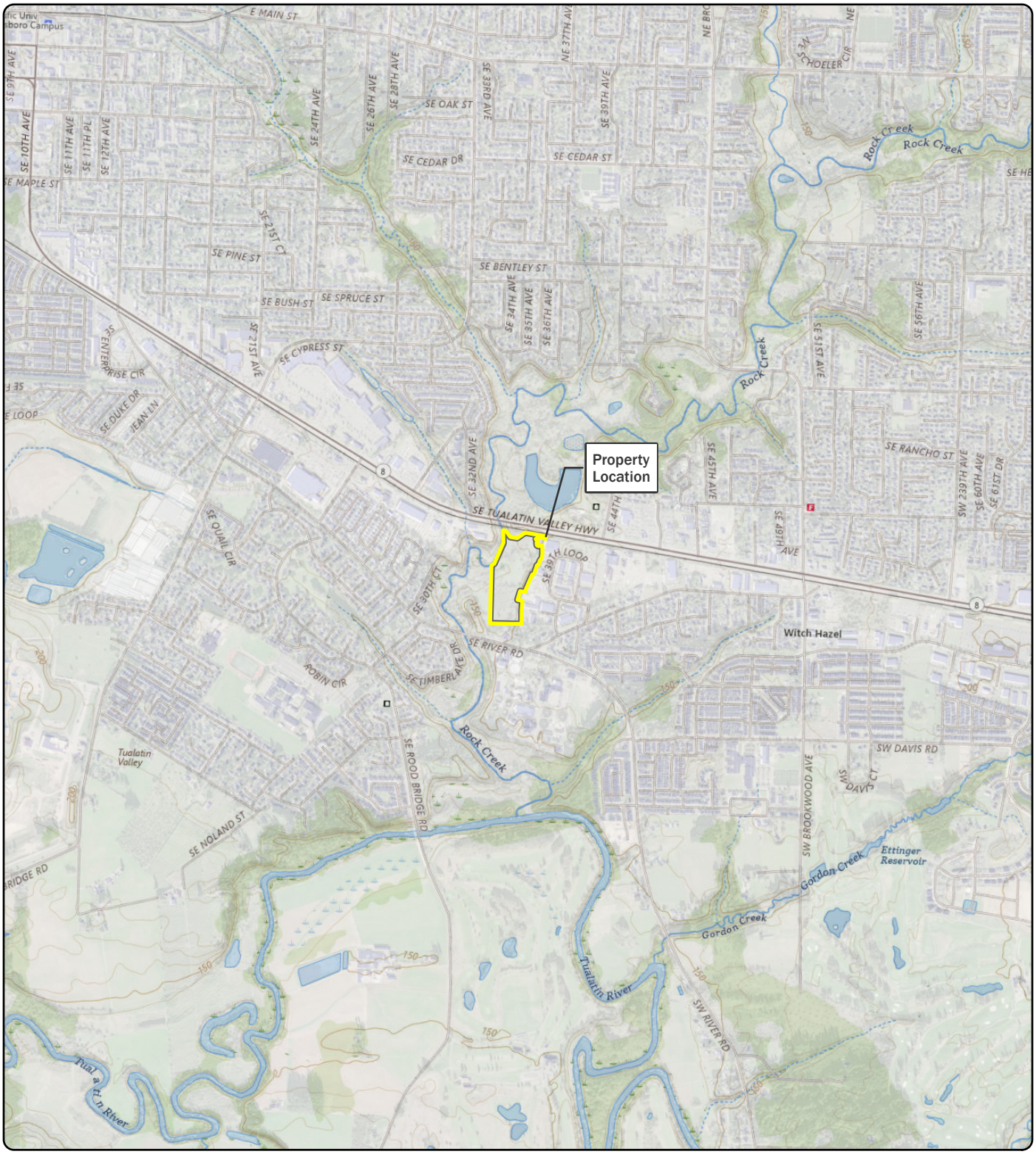

Notes
U.S. Geological Survey 7.5-minute topographic quadrangle (2020): Hillsboro and Scholls.
Township 1 south, range 2 west, section 9.

Data Source
Property boundary obtained from Oregon Metro (2024).

Legend

Property Boundary

Figure 1-1
Vicinity Map

Rock Creek Terrace Property
Hillsboro, OR

0 2,000
Feet

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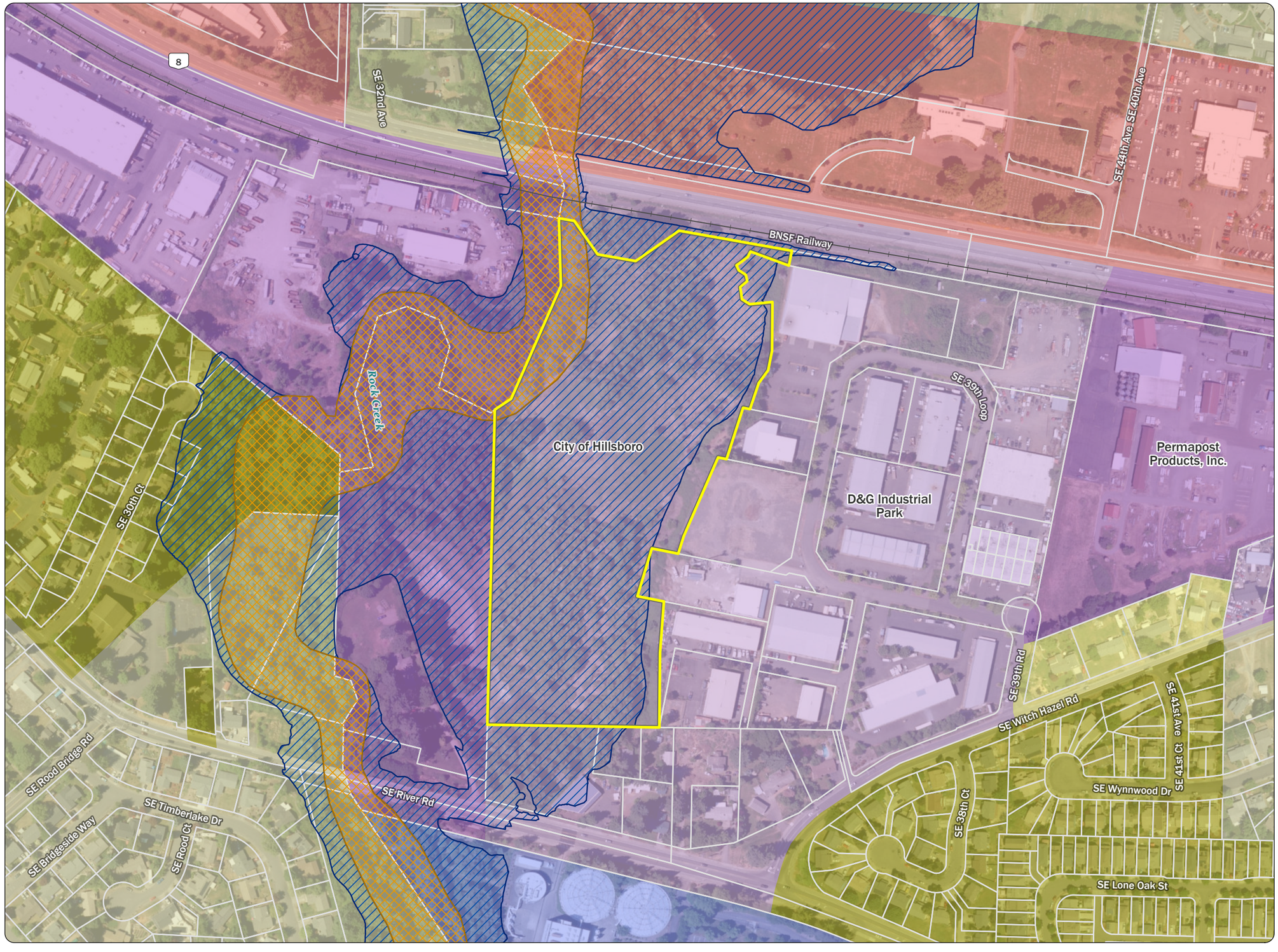
Print Date: 10/23/2024
Reviewed By: pwiescher
Produced By: jroberts
Project: M8012.01.001

Figure 2-1
Property Lines and Ownership

Rock Creek Terrace Property
Hillsboro, OR



Legend

- FEMA Floodway
- FEMA Special Flood Hazard Area (100-year)

Zoning

- Commercial - General
- Industrial - General
- Industrial Park
- Public Institution
- Multi-Family Residential 1
- Single Family Residential 10
- Single Family Residential 7
- Property Boundary
- Tax Lot
- Railroad

0 200
Feet

Data Sources
Aerial photograph (2023) obtained from City of Portland; tax lot data (2024) obtained from Oregon Metro; flood zone data (2024) obtained from the Federal Emergency Management Agency (FEMA).

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Project: M8012.01.001 Produced By: jroberts Reviewed By: pwiescher Print Date: 10/23/2024

RC-1
RAILROAD TRESTLE
SE TUALATIN VALLEY HIGHWAY
RAILROAD TRACK
RAILROAD DITCH
PERMAPOST STORMWATER DISCHARGE (002)
FORMER PERMAPOST STORMWATER OUTFALL (001)
RC-2
RC-3
RC-4
RC-5
RC-6
D2
DI
TERRACE
DRAINAGE CUT
ROCK CREEK
NW HYDRAULICS
ALOHA PROPERTY
AOI-3
ALOHA WELDING
D&G INDUSTRIAL PARK
APPROX. PROPERTY LINE
SE WITCH HAZEL ROAD
140
150
160
130
PL

LEGEND

- Engineered Cap
- APPROXIMATE PROPERTY BOUNDARY
- UNION PACIFIC RAILROAD TRACKS
- Rock Creek Terrace Affected Area
- Aloha Property
- Permapost Property
- Railroad Ditch

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0 150' 300'

NOTE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE ACCORDINGLY.

Figure 2-2
Areas of Interest
Hillsboro, Oregon

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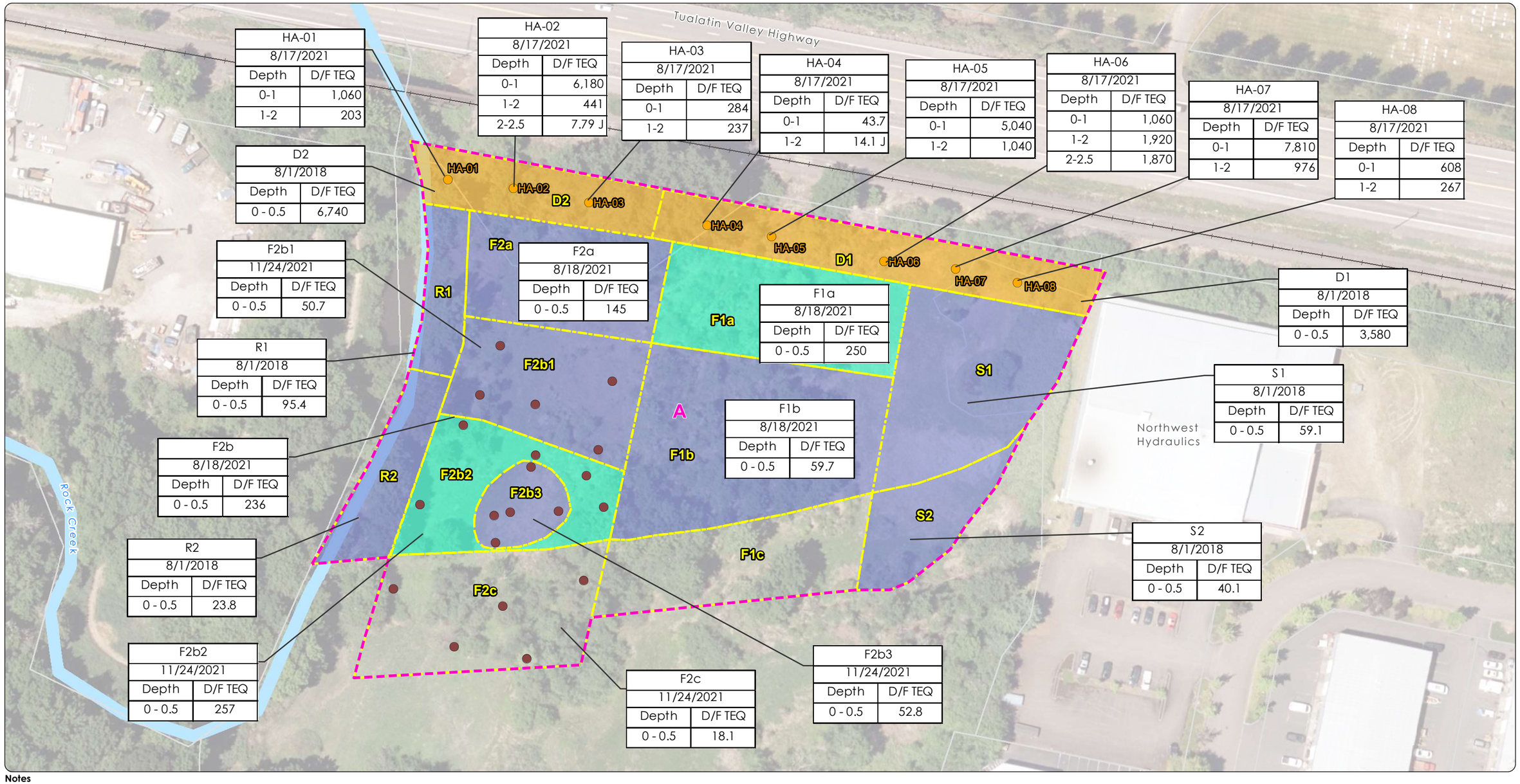

Notes
All D/F TEQ values are shown in picograms per gram (pg/g).
All depths are shown in feet below ground surface.
Depths are shown relative to feet below ground surface.
AOI = area of interest.
D/F TEQ = dioxin furan toxic equivalency.
PRG = preliminary remediation goal.

Data Source
Aerial photograph obtained from Portland Maps.

Legend

- Composite Sample
- Boring (up to 2.5 feet below ground surface)
- Creek
- Railroad
- Decision Unit A
- Decision Unit
- Drainage Cut Hot Spot Area (> 10x hot spot criteria)
- Non-Drainage Cut Hot Spot Area (> hot spot criteria)
- PRG Exceedance
- Tax Lot

Figure 2-3
Chemical Exceedance Areas
Rock Creek Terrace Property
Hillsboro, OR

0 25 50 100
Feet

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Print Date: 10/23/2024
Approved By: pwiescher
Produced By: jroberts
Project: M8012.01.001

SE TUALATIN VALLEY HIGHWAY

RAILROAD TRACK

NEW RAILROAD DITCH

CULVERT TO NORTH SIDE OF RAILROAD

MW - P-19

OUTFALL 002 (POST TREATMENT)

FIG. 3

DRAINAGE CUT

TERRACE

ROCK CREEK

NW HYDRAULICS

ALOHA WELDING

D&G INDUSTRIAL PARK

APPROX. PROPERTY LINE

SE WITCH HAZEL ROAD

140 150 160 130 140 150 160 130 160

PL

LEGEND

- Engineered Cap
- APPROXIMATE PROPERTY BOUNDARY
- UNION PACIFIC RAILROAD TRACKS
- SURFACE DRAINAGE, NORTH SIDE OF RAILROAD TRACK
- SURFACE DRAINAGE, SOUTH SIDE OF RAILROAD TRACK DISCHARGES TO STORMWATER POOLING AREA AND ROCK CREEK
- SURFACE DRAINAGE, SOUTH SIDE OF RAILROAD TRACK DISCHARGES TO NORTH SIDE OF RAILROAD
- RAILROAD IMPROVEMENT AREA, 2017
- D&G INDUSTRIAL PARK DISCHARGE LOCATIONS TO TERRACE
- AREA OF STORMWATER POOLING

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Figure 2-4
Conceptual Site Model-Stormwater Flow

Hillsboro, Oregon

Tables

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Table 2-1
Soil Screening Results
Hillsboro, Oregon

Location:	Tier I RBC[a]		Site-specific Human Health RBC for Transient Receptors[1]	Regional Background[b]	Decision Unit A	Subunit S1	Subunit S2	Subunit D1	Subunit D2	Subunit R1	Subunit R2	Subunit F1a	Subunit F1b	Subunit F2a	Subunit F2b1	Subunit F2b2
Area of Interest:					AOI-1											
Metals (mg/kg)																
Arsenic	6.8	Inverts	NV	8.8	16.4	2.81	2.72	41.9	45.2	3.73	2.58	NV	NV	NV	NV	NV
Chromium, Hexavalent	0.34	Inverts	NV	--	0.4 U	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Chromium, Total	73	Bird	NV	76	41.1	NV	NV	NV	109	12.1	12.3	NV	NV	NV	NV	NV
Copper	43	Bird	NV	34	28.8	NV	NV	NV	52.2	9.9	7.89	NV	NV	NV	NV	NV
Phenols (mg/kg)																
Pentachlorophenol	3.6	Bird	NV	NV	0.62	NV	NV	NV	0.34	0.013	0.01 U	NV	NV	NV	NV	NV
2,3,4,6-Tetrachlorophenol	NV	NV	NV	NV	0.071	NV	NV	NV	0.019	0.01 U	0.01 U	NV	NV	NV	NV	NV
2,4,5-Trichlorophenol	4[c]	Plant	NV	NV	0.01 U	NV	NV	NV	0.01 U	0.01 U	0.01 U	NV	NV	NV	NV	NV
2,4,6-Trichlorophenol	10[c]	Plant	NV	NV	0.01 U	NV	NV	NV	0.01 U	0.01 U	0.01 U	NV	NV	NV	NV	NV
2,4-Dichlorophenol	20[c]	Plant	NV	NV	0.01 U	NV	NV	NV	0.02 U	0.02 U	0.02 U	NV	NV	NV	NV	NV
2-Chlorophenol	3.9	Bird	NV	NV	0.01 U	NV	NV	NV	0.01 U	0.01 U	0.01 U	NV	NV	NV	NV	NV
Phenol	0.79	Plant	NV	NV	0.01 U	NV	NV	NV	0.01 U	0.01 U	0.01 U	NV	NV	NV	NV	NV
Dioxins (pg/g)																
2,3,7,8-TCDD TEQ	0.25	Mammal	960	NV	790	59.1	40.1	3,580	6,740	95.4	23.8	250	59.7	145	50.7	257

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Table 2-1
Soil Screening Results
Hillsboro, Oregon

Location:	Tier I RBC[a]		Site-specific Human Health RBC for Transient Receptors[1]	Regional Background[b]	Subunit F2b3	Subunit F2c	HA-01		HA-02			HA-03	
							HA-01-0-1	HA-01-1-2	HA-02-0-1	HA-02-1-2	HA-02-2-2.5	HA-03-0-1	HA-03-1-2
Area of Interest:					AOI-1								
Metals (mg/kg)													
Arsenic	6.8	Inverts	NV	8.8	NV	NV	NV	NV	NV	NV	NV	NV	NV
Chromium, Hexavalent	0.34	Inverts	NV	--	NV	NV	NV	NV	NV	NV	NV	NV	NV
Chromium, Total	73	Bird	NV	76	NV	NV	NV	NV	NV	NV	NV	NV	NV
Copper	43	Bird	NV	34	NV	NV	NV	NV	NV	NV	NV	NV	NV
Phenols (mg/kg)													
Pentachlorophenol	3.6	Bird	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,3,4,6-Tetrachlorophenol	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,4,5-Trichlorophenol	4[c]	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,4,6-Trichlorophenol	10[c]	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,4-Dichlorophenol	20[c]	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2-Chlorophenol	3.9	Bird	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Phenol	0.79	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Dioxins (pg/g)													
2,3,7,8-TCDD TEQ	0.25	Mammal	960	NV	52.8	18.1	1,060	203	6,180	441	7.79	284	237

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Table 2-1
Soil Screening Results
Hillsboro, Oregon

Location:	Tier I RBC[a]		Site-specific Human Health RBC for Transient Receptors[1]	Regional Background[b]	HA-04		HA-05		HA-06			HA-07		HA-08	
					HA-04-0-1	HA-04-1-2	HA-05-0-1	HA-05-1-2	HA-06-0-1	HA-06-1-2	HA-06-2-2.5	HA-07-0-1	HA-07-1-2	HA-08-0-1	HA-08-1-2
Area of Interest:					AOI-1		AOI-1								
Metals (mg/kg)															
Arsenic	6.8	Inverts	NV	8.8	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Chromium, Hexavalent	0.34	Inverts	NV	--	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Chromium, Total	73	Bird	NV	76	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Copper	43	Bird	NV	34	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Phenols (mg/kg)															
Pentachlorophenol	3.6	Bird	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,3,4,6-Tetrachlorophenol	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,4,5-Trichlorophenol	4[c]	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,4,6-Trichlorophenol	10[c]	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2,4-Dichlorophenol	20[c]	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
2-Chlorophenol	3.9	Bird	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Phenol	0.79	Plant	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Dioxins (pg/g)															
2,3,7,8-TCDD TEQ	0.25	Mammal	960	NV	44	14.1	5,040	1,040	1,060	1,920	1,870	7,810	976	608	267

Table 2-1
Soil Screening Results
Hillsboro, Oregon

NOTES:
-- = not applicable.
DEQ = Oregon Department of Environmental Quality.
J = estimated value.
mg/kg = milligram per kilogram.
NV = no value.
pg/g = picograms per gram.
TEQ = toxicity equivalent.
U = Compound analyzed, but not detected above detection limit.
UJ = Compound analyzed, but not detected above estimated detection limit.
[a]Minimum non-T&E value presented in Table 1a/1b in DEQ (2020).
[b]DEQ, Background Level in Soils for Cleanups (March 2013).
[c]DEQ, Guidance for Ecological Risk Assessment Level II Screening Level Values for Soils and Terrestrial Receptors (December 2001).
REFERENCES:
[1]MFA. 2019. Expanded screening level human health risk assessment, Permapost Products, Inc. Maul Foster & Alongi, Inc. Portland, Oregon. May 1.

Table 4-1
Preliminary Remediation Goals
Hillsboro, Oregon

COCs					
Soil	PRG	Pathway and Basis	Scale	Depth	Rock Creek Terrace
Metals (mg/kg)					
Arsenic	8.8	Regional Background	Area-wide	0-3 ft	**x**
Chromium	76	Regional Background	Area-wide	0-3 ft	**x**
Copper	43	Tier I RBC (Birds)	Area-wide	0-3 ft	**x**
Dioxins (ng/kg)					
Dioxin TEQ	20	Site-specific Tier II RBC	Area-wide	0-3 ft	**x**

NOTES:
x = PRG selected.

COC = chemical of concern.
mg/kg = milligrams per kilogram.
ng/kg = nanogram per kilogram.
PRG = preliminary remedial goal.

ALT 2: ENGINEER'S PRELIMINARY OPINION OF PROBABLE COST

Table 4-2:	**Alternative 2**	
Project:	Feasibility Study	
Prepared By:	K. Krippaehne-Stein	KKS
Checked By:	J. Elliott	JCE
Date:	10/22/2024	
Revision No.:	0	

MAUL FOSTER ALONGI
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Cost Estimate Summary—Alternative 2

Schedule A—	Mobilization and Site Preparation	$ 197,000
Schedule B—	Excavation, Landfill Disposal, and Restoration	$ 4,771,000
Schedule C—	Design and Permitting	$ 224,000
Schedule D—	Administrative Costs	$ 209,000
Schedule E—	Contingency	$ 810,000
	Total:	**$ 6,211,000**

Assumptions:

1. Mobilization is 8% of the remediation total minus transportation and disposal at landfill costs.
2. Soil is disposed of at a Subtitle D landfill.
3. The excavation area is excavated to 3 feet below ground surface and backfilled with topsoil to current grade.
4. The drainage ditch is lined with 1 foot of rip rap.
5. Design is 12% of the remediation total minus transportation and disposal at landfill costs.
6. Permitting is 3% of the remediation total minus transportation and disposal at landfill costs.
7. Project management is 6% of the remediation total minus transportation and disposal at landfill costs.
8. Construction management is 8% of the remediation total minus transportation and disposal at landfill costs.
9. Contingency is 15%.

ENGINEER'S PRELIMINARY OPINION OF PROBABLE COST

Table 4-2: Alternative 2

Schedule A							
Mobilization and Site Preparation		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
A.1	Mobilization	1	LS	$	110,650	$	110,650
A.2	Stabilized Construction Entrance	1	LS	$	20,000	$	20,000
A.3	Erosion and Sediment Control	1	LS	$	25,000	$	25,000
A.4	Clearing and grubbing	3.68	AC	$	11,300	$	41,600
					Subtotal Schedule A:	**$**	**197,250**
Schedule B							
Excavation, Landfill Disposal, and Restoration		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
B.1	On-Site Excavation and Handling	17,817	BCY	$	8	$	142,540
B.2	Transportation and Disposal at Landfill (Non-Hazardous)	26,725	TON	$	130	$	3,474,250
B.3	Purchase and Import of Soil Fill	25,320	TON	$	35	$	886,200
B.4	Placement and Compaction of Fill	21,100	LCY	$	5	$	105,500
B.5	Purchase and Import of Rip Rap	1,405	TON	$	65	$	91,340
B.6	Placement of Rip Rap	1,171	LCY	$	8	$	9,370
B.7	Hydroseeding	15,006	SY	$	1	$	15,010
B.8	Re-Planting	3.10	AC	$	15,000	$	46,510
					Subtotal Schedule B:	**$**	**4,770,720**
Schedule C							
Design and Permitting		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
C.1	Remedial Design	1	LS	$	179,300	$	179,300
C.2	Permitting	1	LS	$	44,900	$	44,900
					Subtotal Schedule C:	**$**	**224,200**
Schedule D							
Administrative Costs		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
D.1	Project Management/Community Outreach	1	LS	$	89,700	$	89,700
D.2	Construction Management	1	LS	$	119,500	$	119,500
					Subtotal Schedule D:	**$**	**209,200**
Schedule E							
Contingency		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
E.1	Contingency	1	LS	$	810,300	$	810,300
					Subtotal Schedule E:	**$**	**810,300**

ALT 3: ENGINEER'S PRELIMINARY OPINION OF PROBABLE COST

Table 4-3:	**Alternative 3**	
Project:	Feasibility Study	
Prepared By:	K. Krippaehne-Stein	KKS
Checked By:	J. Elliott	JCE
Date:	10/22/2024	
Revision No.:	0	

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Cost Estimate Summary—Alternative 3

Schedule A—	Mobilization and Site Preparation	$	157,000
Schedule B—	Targeted Excavation, Off-Site Disposal, Carbon Amendment, and Restoration	$	1,128,000
Schedule C—	Design and Permitting	$	166,000
Schedule D—	Administrative Costs	$	195,000
Schedule E—	Monitoring	$	44,000
Schedule F—	Contingency	$	254,000
	Total:	**$**	**1,944,000**

Assumptions:

1. Mobilization is 8% of the remediation total minus transportation and disposal costs.
2. Soil is disposed of at a off-site location.
3. The excavation area is excavated to 1 to 3 feet below ground surface and backfilled with topsoil to current grade.
4. The drainage ditch is lined with 1 foot of rip rap.
5. Carbon amendment is tilled into the upper 6 inches of soil.
6. Carbon is applied at a rate of 3% by weight.
7. Design is 12% of the remediation total minus transportation and disposal costs.
8. Permitting is 3% of the remediation total minus transportation and disposal costs.
9. Construction management is 8% of the remediation total minus transportation and disposal costs.
10. Project management is 6% of the remediation total minus transportation and disposal costs.
11. Carbon amendment monitoring is conducted annually for five years.
12. Contingency is 15%.

ENGINEER'S PRELIMINARY OPINION OF PROBABLE COST

Table 4-3: Alternative 3

Schedule A							
Mobilization and Site Preparation		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
A.1	Mobilization	1	LS	$	82,110	$	82,110
A.2	Stabilized Construction Entrance	1	LS	$	20,000	$	20,000
A.3	Erosion and Sediment Control	1	LS	$	25,000	$	25,000
A.4	Clearing and grubbing	3.68	AC	$	8,000	$	29,450
					Subtotal Schedule A:	**$**	**156,560**
Schedule B							
Targeted Excavation, Off-Site Disposal, Carbon Amendment, and Restoration		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
B.1	On-Site Excavation and Handling	3,917	BCY	$	8	$	31,340
B.2	Transportation and Disposal Off-Site	5,875	TON	$	30	$	176,270
B.3	Purchase and Import of Soil Fill	4,470	TON	$	35	$	156,460
B.4	Placement and Compaction of Fill	3,725	LCY	$	5	$	18,630
B.5	Purchase and Import of Rip Rap	1,405	TON	$	65	$	91,340
B.6	Placement of Rip Rap	1,171	LCY	$	8	$	9,370
B.7	Purchase and Import of Carbon Amendment	88	TON	$	4,200	$	368,120
B.8	Carbon Amendment Application	11,686	SY	$	20	$	233,730
B.9	Hydroseeding	15,006	SY	$	1	$	15,010
B.10	Re-Planting	3.10	AC	$	9,000	$	27,910
					Subtotal Schedule B:	**$**	**1,128,180**
Schedule C							
Design and Permitting		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
C.1	Remedial Design	1	LS	$	133,100	$	133,100
C.2	Permitting	1	LS	$	33,300	$	33,300
					Subtotal Schedule C:	**$**	**166,400**
Schedule D							
Administrative Costs		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
D.1	Project Management/Community Outreach	1	LS	$	66,600	$	66,600
D.2	Construction Management	1	LS	$	88,700	$	88,700
D.3	Preparation of Environmental Covenant	1	LS	$	15,000	$	15,000
D.4	Preparation of Site Management Plan	1	LS	$	25,000	$	25,000
					Subtotal Schedule D:	**$**	**195,300**
Schedule E							
Monitoring		*Quantity*	*Unit*		*Unit Cost*		*Net Present Value*
E.1	Annual Carbon Amendment Monitoring	5	YR	$	10,000	$	43,820
					Subtotal Schedule E:	**$**	**43,820**
Schedule F							
Contingency		*Quantity*	*Unit*		*Unit Cost*		*Total Cost*
F.1	Contingency	1	LS	$	253,600	$	253,600
					Subtotal Schedule F:	**$**	**253,600**

Appendix – FEMA Flood Map

MAUL
FOSTER
ALONGI

National Flood Hazard Layer FIRMette

FEMA

122°57'8"W 45°30'16"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

122°56'31"W 45°29'51"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/23/2024 at 2:50 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.