Electronic Copy

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Southwest Region Office
PO Box 47775 • Olympia, WA 98504-7775 • 360-407-6300

January 5, 2023

Kip and Nancy Kalbrener
Ridgetop Golf
4820 24th Street NW
Gig Harbor, WA 98335
kip@ridgetopgolf.com

Re: Opinion on the Proposed Cleanup of a Property associated with the Asarco Tacoma Smelter Site

Site name:	Ridgetop Golf
Property address:	3134 14th Ave NW, Gig Harbor, Pierce County, WA 98335
Facility/Site ID:	99997366
Cleanup Site ID:	16638
VCP Project No.:	SW1777

Dear Kip and Nancy Kalbrener:

The Washington State Department of Ecology (Ecology) received your request for an opinion on your proposed independent cleanup of a Property associated with the Asarco Tacoma Smelter Site (Asarco Site). This letter provides our opinion. We are providing this opinion under the authority of the Model Toxics Control Act (MTCA),[1] chapter 70A.305 Revised Code of Washington (RCW).[2]

Opinion

Ecology has determined that no further remedial action will likely be necessary at the Property to clean up contamination associated with the Asarco Site.

Ecology has determined that further remedial action will likely still be necessary elsewhere at the Asarco Site, but no further remediation will be necessary for the Property.

[1] https://apps.ecology.wa.gov/publications/SummaryPages/9406.html
[2] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.305

This opinion is based on an analysis of whether the remedial action meets the substantive requirements of MTCA, chapter 70A.305 RCW, and its implementing regulations, Washington Administrative Code (WAC) chapter 173-340[3] (collectively "substantive requirements of MTCA"). The analysis is provided below.

Property Description

This opinion applies only to the Property described below within Asarco Site. This opinion does not apply to any other sites that may affect the Property. Any such sites, if known, are identified separately below.

The Property includes the following tax parcel in Pierce County, which was affected by the Asarco Site and will be addressed by your cleanup:

- 0221213045

Enclosure A includes a legal description of the Property and details of the Property as currently known to Ecology.

Site Description

The Asarco Site is defined by the nature and extent of contamination associated with the following releases:

- Arsenic into the Soil.
- Lead into the Soil.

Those releases have affected more than one parcel of real property, including the parcel identified above.

Enclosure B includes a detailed description and diagram of the Asarco Site, as currently known to Ecology.

Identification of Other Sites that may affect the Property

A parcel of real property can be affected by multiple sites. At this time, we have no information that the Property is affected by other sites.

[3] https://apps.leg.wa.gov/WAC/default.aspx?cite=173-340

Basis for the Opinion

This opinion is based on the information contained in the following documents:

1. Lombardini Geological Services LLC (Lombardini), *Cleanup Action Plan Ridgetop Golf Construction Headquarters, 3134 14th Avenue Northwest, Gig Harbor, WA*, June 3, 2022.

2. GeoResources, *Soils Investigation Report Proposed Contractor Yard, xxx – 14th Avenue Northwest, Pierce County, Washington, PN: 022113045*, June 25, 2021.

3. Pierce County Planning & Public Works, *Determination of Nonsignificance (DNS) Conditional Use Permit*, May 4, 2020.

This opinion is based on the information in the documents listed above. You can request these documents by filing a records request.[4] For help making a request, contact the Public Records Officer[5] at or call 360-407-6040. Before making a request, check whether the documents are available on Ecology's Cleanup Site Search web page.[6]

This opinion is void if any information contained in those documents is materially false or misleading.

Analysis of the Cleanup

Cleanup of the Property located within the Asarco Site.

Ecology has concluded that, upon completion of your proposed cleanup, **no further remedial action** will likely be necessary at the Property to clean up contamination associated with the Asarco Site. That conclusion is based on the following analysis:

Characterization of the Asarco Site.

The Asarco Site is described in **Enclosure B**.

Ridgetop Golf property (Property) is located west of Highway 16 in a mixed use (residential and light industrial) area of Gig Harbor, Washington (Figure 1).

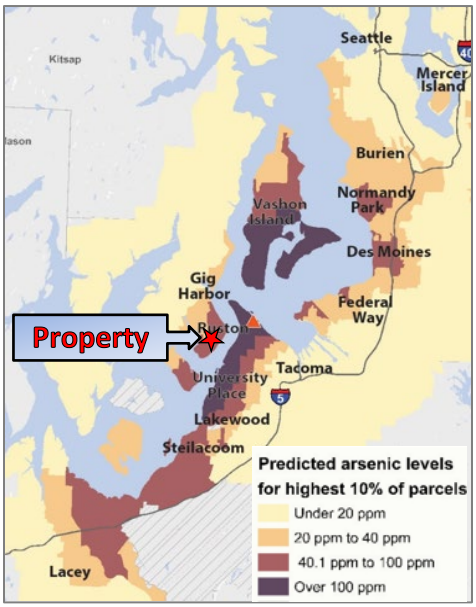


Figure 1. Vicinity Map

[4] https://ecology.wa.gov/About-us/Accountability-transparency/Public-records-requests
[5] publicrecordsofficer@ecy.wa.gov
[6] https://apps.ecology.wa.gov/gsp/Sitepage.aspx?csid=16638

The Property is situated on one, 3.77-acre Pierce County parcel. Commercial developments border the Property to the south, 14th Avenue NW to the east, SR 16 to the west, and the Cushman Trail to the north. The Property is currently undeveloped and forested with dense understory of ferns and salal. There is a wetland and a wetland buffer in the southern end of the Property (Figure 2). For more information about the Property, refer to **Enclosure A**.

Ridgetop Golf Construction Headquarters (Ridgetop) plans to develop this Property into a contractor yard with associated parking, landscaping, and utilities. Ridgetop will leave portions of the Property undeveloped to comply with Pierce County setback and critical area regulations. The wetland, wetland buffer, western border, and a portion of an eastern border of the Property will remain undeveloped.

As part of the planned development, Ridgetop contracted GeoResources to characterize the Tacoma Smelter Plume (TSP) contamination on the Property. The part of the Property that will be developed was designated as DU1. The areas that will remain undeveloped were designated as DU2 (Figure 2).

On September 23, 2020, GeoResources collected 41 discrete soil samples from 32 sampling locations on the Property (Figure 3). They collected 32 soil samples from 0 to 6 inches below ground surface (bgs): 20 samples from DU1 and 12 samples from DU2. GeoResources also collected nine soil samples from 6 to 12 inches bgs: five samples from DU1 and four samples from DU2. Additionally, GeoResources collected four, six-point composite duff samples from the Property.

Figure 2. Approximate Locations of Characterization Samples

GeoResources submitted all the samples to Spectra Laboratories in Tacoma, Washington for arsenic and lead analysis with Environmental Protection Agency (EPA) Method 6010D.

Soil Sampling Results

Table 1 displays the summary of the characterization sampling on the Property. **Enclosure C** contains the comprehensive results of the characterization sampling on the Property.

Entire Property – samples collected from 0 to 6 inches bgs: Arsenic exceeded the MTCA Method A cleanup level of 20 milligrams per kilogram (mg/kg) in 20 samples (Figure 2). Eight samples exceeded the maximum allowable concentration for a single soil sample or twice the cleanup level for arsenic (40 mg/kg). The arsenic concentrations ranged from 4.4 mg/kg to 117 mg/kg. The average arsenic concentration was 31 mg/kg. None of the soil samples exceeded the MTCA Method A cleanup level of 250 mg/kg for lead. Lead concentrations ranged from 6.3 mg/kg to 126 mg/kg. The average lead concentration was 44.8 mg/kg.

Entire Property – samples collected from 6 to 12 inches bgs: Five soil samples exceeded the cleanup level of 20 mg/kg for arsenic. None of the samples exceeded the maximum allowable concentration for a single soil sample of 40 mg/kg for arsenic. The arsenic concentrations ranged from 11.7 mg/kg to 29 mg/kg. The average arsenic concentration was 20.1 mg/kg. None of the soil samples exceeded the cleanup level of 250 mg/kg for lead. Lead concentrations ranged from 13.3 mg/kg to 43.6 mg/kg. The average lead concentration was 27.5 mg/kg.

Entire Property – duff layer: Three composite soil samples exceeded the cleanup level of 20 mg/kg for arsenic. Arsenic concentrations ranged from 10.3 mg/kg to 32.1 mg/kg. The average arsenic concentration was 25.25 mg/kg. None of the lead concentrations exceeded the cleanup level of 250 mg/kg. Lead concentrations ranged from 42.6 mg/kg to 50.9 mg/kg. The average lead concentration was 45.4 mg/kg.

DU1 – samples collected from 0 to 6 inches bgs: Arsenic exceeded the MTCA Method A cleanup level of 20 mg/kg in 13 samples (Figure 3). Five samples exceeded the maximum allowable concentration for a single soil sample for arsenic (40 mg/kg). The arsenic concentrations ranged from 7.8 mg/kg to 117 mg/kg. The average arsenic concentration was 34.22 mg/kg. None of the samples exceeded the MTCA Method A cleanup level of 250 mg/kg for lead. Lead concentrations ranged from 9.3 mg/kg to 126 mg/kg. The average lead concentration was 46.9 mg/kg.

DU1 – samples collected from 6 to 12 inches bgs: Four soil samples exceeded the cleanup level of 20 mg/kg for arsenic, but none exceeded the maximum allowable concentration for a single soil sample (40 mg/kg). The arsenic concentrations ranged from 13.2 mg/kg to 29 mg/kg. The average arsenic concentration was 22.7 mg/kg. None of the soil samples exceeded the cleanup level of 250 mg/kg for lead. Lead concentrations ranged from 14.7 mg/kg to 43.6 mg/kg. The average lead concentration was 31.8 mg/kg.

DU2 – samples collected from 0 to 6 inches bgs: Arsenic exceeded the MTCA Method A cleanup level of 20 mg/kg in seven samples (Figure 3). Three samples exceeded the maximum allowable concentration for a single soil sample or twice the cleanup level for arsenic (40 mg/kg). The arsenic concentrations ranged from 4.9 mg/kg to 49.8 mg/kg. The average arsenic concentration was 25.6 mg/kg. None of the samples exceeded the MTCA Method A cleanup level of 250 mg/kg for lead. Lead concentrations ranged from 6.3 mg/kg to 90 mg/kg. The average lead concentration was 41.35 mg/kg.

DU2 – samples collected from 6 to 12 inches bgs: One sample exceeded the cleanup level of 20 mg/kg for arsenic, but it did not exceed the maximum allowable concentration for a single soil sample (40 mg/kg). The arsenic concentrations ranged from 11.7 mg/kg to 21.9 mg/kg. The average arsenic concentration was 16.95 mg/kg. None of the soil samples exceeded the cleanup level of 250 mg/kg for lead. Lead concentrations ranged from 13.3 mg/kg to 30.3 mg/kg. The average lead concentration was 22.1 mg/kg.

Ridgetop will not develop DU2, leaving it in its current condition. Ecology conducted a Net Environmental Benefit Analysis (NEBA) to weigh the benefits of active soil cleanup versus living it un-remediated (see **Enclosure D**).

Ridgetop contracted Lombardini Environmental Services (Lombardini) to collect additional samples in DU2 near the three locations where arsenic exceeded the cleanup level of 40 mg/kg. They collected the additional samples for the Terrestrial Ecological Evaluation (TEE) to satisfy the requirements of NEBA (Figure 3). On May 26, 2022, Lombardini collected additional samples from four depth intervals:

- Three samples from 0 to 6 inches bgs.
- Three samples from 6 to 12 inches bgs.
- Three samples from 12 to 24 inches bgs.
- Three samples from 24 to 36 inches bgs.

Lombardini submitted the samples to Friedman & Bruya, Inc. Environmental Chemists in Seattle, Washington for arsenic analysis with EPA Method 6020B. Lombardini did not analyze the samples for lead, because all the lead characterization samples were below the cleanup level of 250 mg/kg.

Ecology calculated the Receptor Adjusted Arsenic concentration for arsenic to satisfy the requirements of TEE and NEBA.

Table 1. Summary of the Characterization Sampling on the Property

Decision Unit	Depth (inches)	Arsenic (mg/kg)			Lead (mg/kg)		
		Minimum	Maximum	Average	Minimum	Maximum	Average
Entire Property	0-6	4.4	**117**	**31**	6.3	6	44.8
	6-12	11.7	**29**	**20.1**	13.3	43.6	27.5
DU1	0-6	7.8	**117**	**34.22**	9.3	126	46.9
	6-12	13.2	**29**	**22.7**	14.7	43.6	31.8
DU2	0-6	4.9	**49.8**	**25.6**	6.3	90	41.35
	6-12	11.7	**21.9**	16.95	13.3	30.3	22.1
Duff	–	10.3	**32.1**	**25.25**	42.6	50.9	45.4
MTCA Cleanup Level			40	20		500	250

Bold values represent concentrations above the MTCA Method A cleanup level.
Bold red values represent concentrations twice the MTCA Method A cleanup level.

Additional Soil Sampling Results

Table 2 displays the summary of the additional sampling on the Property. Table 3 displays the results of Receptor Adjusted Arsenic concentrations for TEE in DU2. **Enclosure C** contains the comprehensive results of the additional sampling on the Property.

DU2 – samples collected from 0 to 6 inches bgs: Arsenic concentrations were below the cleanup level of 20 mg/kg. The arsenic concentrations ranged from 3.65 mg/kg to 16.1 mg/kg. The average arsenic concentration was 10.2 mg/kg.

DU2 – samples collected from 6 to 12 inches bgs: None of the samples exceeded the cleanup level of 20 mg/kg for arsenic. The arsenic concentrations ranged from 1.74 mg/kg to 3.23 mg/kg. The average arsenic concentration was 2.7 mg/kg.

Figure 3. Approximate Locations of the Additional Samples

DU2 – samples collected from 12 to 24 inches bgs: None of the samples exceeded the cleanup level of 20 mg/kg for arsenic. The arsenic concentrations ranged from 1.93 mg/kg to 3.2 mg/kg. The average arsenic concentration was 2.35 mg/kg.

DU2 – samples collected from 24 to 36 inches bgs: None of the samples exceeded the cleanup level of 20 mg/kg for arsenic. The arsenic concentrations ranged from 1.15 mg/kg to 3.42 mg/kg. The average arsenic concentration was 2.39 mg/kg.

The adjusted arsenic concentrations were below the cleanup level of 20 mg/kg. The adjusted arsenic concentrations ranged from 8.4 mg/kg to 16.77 mg/kg.

Table 2. Summary of Additional Sampling

Depth (inches)	Arsenic (mg/kg)		
	Minimum	Maximum	Average
0-6	3.65	16.1	10.2
6-12	1.74	3.23	2.7
12-24	1.93	3.2	2.35
24-36	1.15	3.42	2.39
MTCA Cleanup Level		40	20

Table 3. Depth Weighted Receptor Adjusted Values for Arsenic and Lead

Sample #	Sample Depth (inches)	Arsenic (mg/kg)	Receptor Adjustment	Adjusted Arsenic (mg/kg)	Arsenic Final (mg/kg)
N1 (Sample HA6)	0 to 6	**44***	0.3	13.2	
	6 to 12	1.7	0.55	0.96	
	12 to 24	1.9	0.1	0.19	
	24 to 36	3.4	0.05	0.17	
					14.52
N2 (Sample 25)	0 to 6	**48.7***	0.3	14.61	
	6 to 12	3.11	0.55	1.71	
	12 to 24	3.2	0.1	0.32	
	24 to 36	2.6	0.05	0.13	
					16.77
N3 (Sample 26)	0 to 6	21.1*	0.3	6.33	
	6 to 12	3.2	0.55	1.77	
	12 to 24	1.9	0.1	0.19	
	24 to 36	1.2	0.05	0.06	
					8.4

*Values from the original characterization samples HA6, HA25, and HA26 collected from 0 to 6 inches bgs.
Bold values represent concentrations above the MTCA Method A cleanup level.
Bold red values represent concentrations twice the MTCA Method A cleanup level.

Setting cleanup standards for the Site.

Ecology has determined the cleanup levels and points of compliance established for the Asarco Site will likely meet the substantive requirements of MTCA.

As part of the Interim Action Plan for the Asarco Tacoma Smelter Site (June 2012) (IAP), Ecology completed a terrestrial ecological evaluation for properties with only Tacoma Smelter Plume contamination. Ecology determined the MTCA Method A cleanup levels for both arsenic and lead were protective of both human health and the environment. The MTCA Method A cleanup levels for soil are as follows:

- Arsenic is 20 mg/kg.
- Lead is 250 mg/kg.

The IAP determined that the soil and duff cleanup levels are protective of human health and the environment for properties within the Asarco Tacoma Smelter Site are the following:

- Average arsenic detected in the soil is less than 20 mg/kg.
- Average lead detected in the soil is less than 250 mg/kg.
- Duff composite sample is less than 20 mg/kg for arsenic.
- Duff composite sample is less than 250 mg/kg for lead.
- No single soil sample has arsenic above 40 mg/kg.
- No single soil sample has lead above 500 mg/kg.

Selecting the cleanup action for the Property.

Ecology has determined the cleanup you proposed for the Property will likely meet the substantive requirements of MTCA and the IAP. Your proposed cleanup meets the minimum cleanup requirements and will not exacerbate conditions or preclude reasonable cleanup alternatives elsewhere at the Asarco Site.

Ecology proposed four model remedies in the IAP:

- Excavation and removal.
- Mixing.

- Capping in place.

- Consolidation and capping.

Ridgetop decided to use mixing for the Property.

Property Cleanup

Ridgetop will conduct the soil cleanup on the Property in conjunction with its development. On June 3, 2022, on behalf of Ridgetop, Lombardini developed a Cleanup Action Plan (CAP) for the Property. The CAP described the use of the selected model remedy: soil mixing in DU1 as a way to remediate the TSP contamination on the Property. Ecology based this opinion letter on the information provided in this CAP.

The cleanup in the two decision units will consist of:

- **DU1** – The area that of a future contractor yard with associated road and utilities is approximately 1.9 acres. Ridgetop will remediate DU1 by mixing soil in place to a depth of at least 18 inches bgs. Prior to soil mixing, the contractor will remove all the trees and vegetation from DU1. They will inspect the tree roots and shake them if necessary to ensure the removal of the contaminated soil. They will dispose of the vegetation at a regular yard waste disposal facility.

- **DU2 –** The area with a wetland buffer, and a 50-foot wide buffer area on the west side of the Property consisting of mature and native vegetation. This unit will remain forested and un-remediated. Three samples exceeded twice the cleanup level of 20 mg/kg for arsenic in DU2. The average arsenic concentration was also above the cleanup level of 20 mg/kg.

  For the protection of the habitat, wildlife, and plants, Ecology conducted NEBA. Following a visit to the Property, Ecology assessed this area as potentially Especially Valuable Habitat (EVH). Assessed as EVH, this area can use NEBA to weigh the benefits of active cleanup versus leaving it un-remediated. Typical soil remediation involves disturbance to soil and removal of vegetation. Removing valuable habitat is likely to cause significant ecological damage and it would take decades to recover.

  All the final depth-weighted concentrations of arsenic and lead were below their respective cleanup levels of 20 mg/kg and 250 mg/kg, indicating that leaving the habitat un-remediated will not cause significant harm to the wildlife and habitat.

For the protection of human life in DU2, Ridgetop will implement institutional and engineering controls:

1. Install at least three Dirt Alert signs between DU1 from DU2 according to Ecology's specifications. Ecology will inspect the installed signs prior to the issuance of a no further action (NFA) determination.

2. File an environmental covenant with the appropriate local jurisdiction. Send a copy of the draft covenant to the local jurisdiction with Ecology's contact information. The covenant will include restriction on intrusive activities in areas where arsenic concentrations remain above the MTCA cleanup level in DU2. Ecology will review the draft covenant. Ecology will not approve the covenant unless the local jurisdiction has been consulted.

3. Upon Ecology's approval, obtain the signatures of all grantors of the covenant and obtain subordination agreements with any persons holding an interest in the real property subject to the covenant who are not signing the covenant as grantor.

4. Submit the signed covenant to Ecology for signatures as the grantee.

5. Record the signed covenant in every county where the real property subject to the covenant is located. For detailed recording instructions, please refer to chapter 65.04 RCW.

6. Return the original singed and recorded covenant to Ecology and each person who signed the covenant or holding a recorded interest in the subject property.

Confirmational Sampling

Lombardini will collect confirmational samples following soil mixing in DU1. They will collect soil samples at 20 locations in 6-inch depth intervals throughout the mixing depth. They will submit the samples to an analytical laboratory for arsenic analysis only because all the lead concentrations were below the cleanup level of 250 mg/kg for lead.

If any of the samples exceeds twice the cleanup level of 20 mg/kg for arsenic or if the average arsenic concentration exceeds 20 mg/kg, the contractor will conduct an additional round of mixing. Lombardini will resample the mixed areas as described above.

As a reminder, in accordance with WAC 173-340-840(5) and Ecology Toxics Cleanup Program Policy 840[7] (Data Submittal Requirements), data generated for Independent Remedial Actions shall be submitted simultaneously in both a written and electronic format. For additional information regarding electronic format requirements, see the Ecology's Environmental Information Management (EIM) website.[8]

Be advised that according to the policy, any reports containing sampling data submitted for Ecology review are considered incomplete until the electronic data has been entered. Please ensure that data generated during on-site activities is submitted pursuant to this policy.

Data must be submitted to Ecology in this format for Ecology to issue an NFA determination. Please be sure to submit all soil data collected to date, as well as any future data, in this format.

Cleanup of the Asarco Site as a Whole.

Ecology has concluded that **further remedial action** will still be necessary elsewhere within the ASARCO Site (Asarco Tacoma Smelter Site) upon completion of your proposed cleanup. In other words, while your proposed cleanup may constitute the final action for the Property, it will constitute only an **"interim action"** for the Asarco Site as a whole.

[7] https://apps.ecology.wa.gov/publications/SummaryPages/1609050.html
[8] http://www.ecy.wa.gov/eim

Limitations of the Opinion

Opinion does not settle liability with the state.

Liable persons are strictly liable, jointly and severally, for all remedial action costs and for all natural resource damages resulting from the release or releases of hazardous substances at the Property. This opinion does not:

- Change the boundaries of the Asarco Site.
- Resolve or alter a person's liability to the state.
- Protect liable persons from contribution claims by third parties.

To settle liability with the state and obtain protection from contribution claims, a person must enter into a consent decree with Ecology under RCW 70A.305.040(4).

Opinion does not constitute a determination of substantial equivalence.

To recover remedial action costs from other liable persons under MTCA, one must demonstrate that the action is the substantial equivalent of an Ecology-conducted or Ecology-supervised action. This opinion does not determine whether the action you performed is substantially equivalent. Courts make that determination. See RCW 70A.305.080 and WAC 173-340-545.

Opinion is limited to proposed cleanup.

This letter does not provide an opinion on whether further remedial action will actually be necessary at the Property upon completion of your proposed cleanup. To obtain such an opinion, you must submit a report to Ecology upon completion of your cleanup and request an opinion under the Voluntary Cleanup Program (VCP).

State is immune from liability.

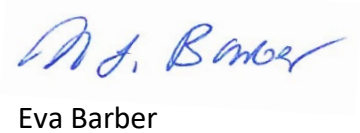
The state, Ecology, and its officers and employees are immune from all liability, and no cause of action of any nature may arise from any act or omission in providing this opinion.
See RCW 70A.305.170(6).

Contact Information

Thank you for choosing to clean up your Property under the VCP. As you conduct your cleanup, please do not hesitate to request additional services. We look forward to working with you.

For more information about the VCP and the cleanup process, please visit our Voluntary Cleanup Program webpage.[9] If you have any questions about this opinion, please contact me at 360-999-9593 or eva.barber@ecy.wa.gov.

Sincerely,



Eva Barber
Technical Assistance Coordinator
Toxics Cleanup Program
Southwest Region Office

EB/tm

Enclosures: A – Legal and General Description Property Descriptions
B – Asarco Tacoma Smelter Site Description
C – Soil Characterization and Additional Soil Sampling Results
D – NEBA

cc by email: Shawn Lombardini, Lombardini Geological Services, shawnlombardini@hotmail.com
Andrew Van Gordon, Pierce County, andrew.vangordon@piercecountywa.gov
Marian L. Abbett, PE, Ecology, marian.abbett@ecy.wa.gov
Jerome Lambiotte, Ecology, jerome.labiotte@ecy.wa.gov
Ecology Site File

[9] http://www.ecy.wa.gov/vcp.

Enclosure A

Legal and General Property Descriptions

This page intentionally left blank.

Legal Property Description

Parcel 0221213045: Section 21 Township 21 Range 02 Quarter 34 : ALL THAT POR L 17 GIG HARBOR ABANDONED MILITARY RESERVE LY SWLY OF SLY LI TACOMA LAKE CUSHMAN TRANS LI & E OF STATE HWY #14 & W OF JOHN REID CO RD IN SE OF SW 21-21-02E EXC POR CYD TO ST OF WA PER ETN W1045408 TOG/W EASE & RESTR OF REC OUT OF 3-007 SEG T-0352 SG ES DC/BL06-18-01BL

General Property Description

Ridgetop Golf property (Property) is located west of Highway 16 in a mixed use (residential and light industrial) area of Gig Harbor, Washington (Figure 1). The Property is situated on one, 3.77-acre Pierce County parcel. Commercial developments border the Property to the south, 14th Avenue NW to the east, SR 16 to the west, and the Cushman Trail to the north. The Property is currently undeveloped and forested with dense understory of ferns and salal. There is a wetland and a wetland buffer in the southern end of the Property. Access is provided by a crushed rock trail/driveway that extends west from 14th Avenue NW.

The ground surface at the Property is gently to moderately sloping towards the center of the property. The ground surface at the Property slopes at between 5 and 20 percent, the steeper areas to the south and east. Localized areas of 20 to 35 percent slope occur in the extreme south portion of the Property, adjacent to a localized wetland area south of the Property. The steeper slope areas are probably related to historic grading, i.e., cut slopes, at the Property. The vertical height of the steeper slopes ranges from approximately 10 feet to 16 feet in height. No areas steeper than 40 percent are present at the Property or the immediate adjacent areas.

There is no evidence of significant erosion, surficial sloughing, or soil movement at the Property. Minor surface water was observed in the extreme south portion of the Property and the adjacent area. No groundwater seepage was observed in the explorations the Property. The general topography of the Property indicates that it drains towards the south.

The USDA Natural Resource Conservation Service (NRCS) Web Soil Survey indicates that the Property is underlain by Harstine gravelly ashy sandy loam (16C). The Harstine soils are derived from sandy glacial till and form on slopes of 6 to 15 percent. These soils have a “moderate” erosion hazard when exposed and are included in hydrologic soils group C.

According to the draft *Geologic Map of the Gig Harbor 7.5-minute Quadrangle Pierce County, Washington* by Troost, K.G., Booth, D.B., and Wells, R.E. (in review), the Property is in an area underlain by recessional outwash (Qvr) and glacial till (Qvt).

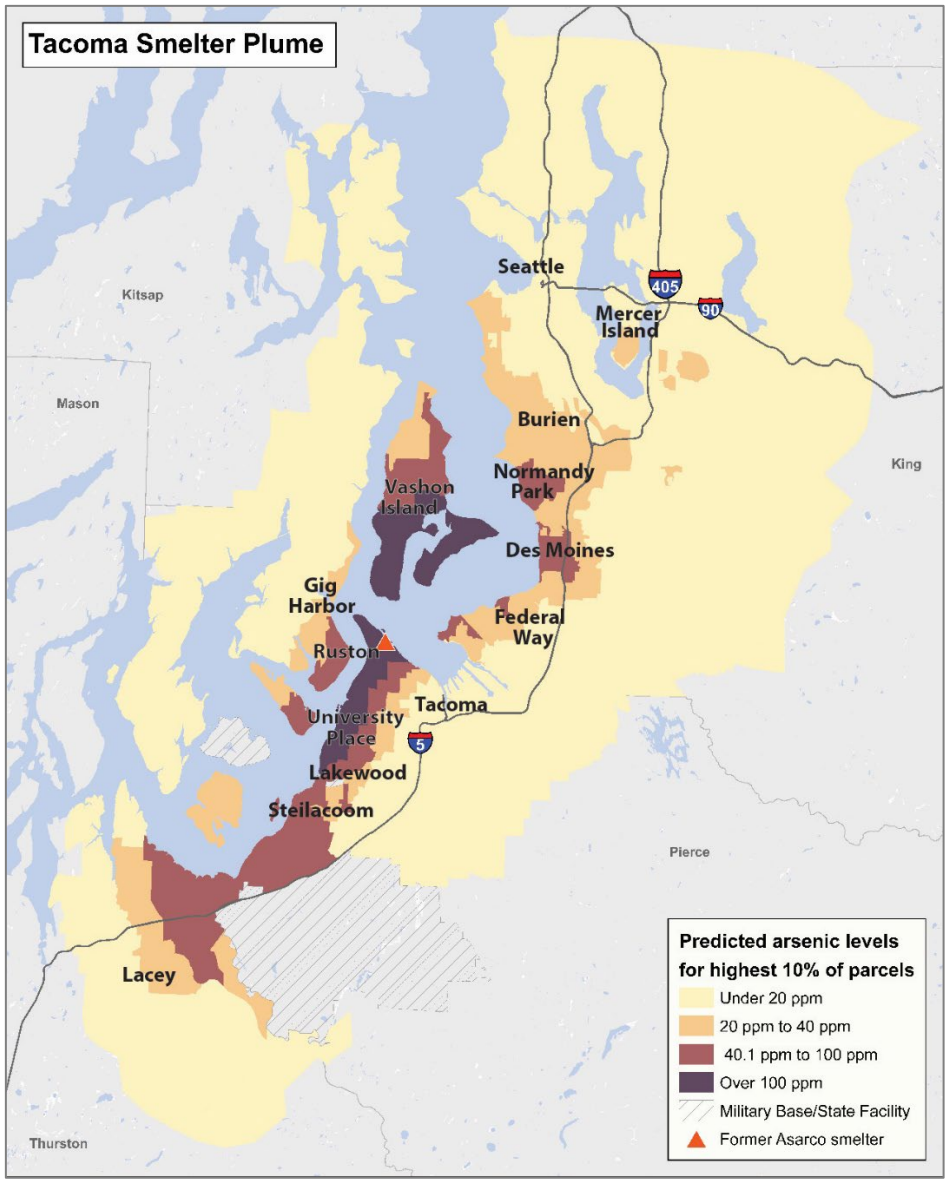
These soils were generally deposited during the most recent Vashon Stade of the Fraser Glaciation, some 12,000 to 15,000 years ago. Recessional outwash typically consists of poorly stratified mixtures of sand and gravel that were deposited by meltwaters emanating from the retreating ice mass. Glacial till typically consists of a heterogeneous mixture of clay, silt, sand, and gravel that was deposited at the base of the continental ice mass and is typically encountered overridden by the ice mass. As such, it is considered overconsolidated and in a very dense condition and exhibits high strength and low compressibility characteristics where undisturbed. Recessional outwash is considered normally consolidated.

Enclosure B

Asarco Tacoma Smelter Site Description

This page intentionally left blank.

Asarco Tacoma Smelter Site



An interactive color map can be found at: https://dirtalert.info/

For almost 100 years, the Asarco Company operated a copper smelter in Tacoma. Air pollution from the smelter settled on the surface soil over a vast region—more than 1,000 square miles of the Puget Sound basin. Elevated levels of contamination are found as far south as the Nisqually Ridge and as far north as Seattle (West Seattle). Additionally, elevated levels of contamination are found as far west as the Kitsap Peninsula and as far east as Kent and Bellevue. Arsenic, lead, cadmium, and other heavy metals are still in the soil as a result of this pollution. The area has elevated levels of arsenic, lead, and cadmium in the soil due to air emissions from the Asarco smelter.

This page intentionally left blank.

Enclosure C

Soil Characterization and Additional Soil Sampling Results

This page intentionally left blank.

Soil Characterization Results

Decision Unit	Sample ID	Sample Date	Sample Depth (inches)	Arsenic (mg/kg)	Lead (mg/kg)
DU1	HA 21	9/23/2020	0-6	7.8	13.5
DU1	HA 22	9/23/2020	0-6	11.3	22.8
DU1	HA 17	9/23/2020	0-6	12.8	21
DU1	HA 5	9/23/2020	0-6	15.3	9.3
DU1	HA 31	9/23/2020	0-6	15.5	19.6
DU1	HA 3	9/23/2020	0-6	18.7	30.1
DU1	HA 24	9/23/2020	0-6	18.8	35
DU1	HA 11	9/23/2020	0-6	**21.8**	42.8
DU1	HA 23	9/23/2020	0-6	**22.3**	20.4
DU1	HA 4	9/23/2020	0-6	**22.9**	90.1
DU1	HA 19	9/23/2020	0-6	**24.5**	51.7
DU1	HA 32	9/23/2020	0-6	**30.3**	44.4
DU1	HA 15	9/23/2020	0-6	**32.4**	44.4
DU1	HA 20	9/23/2020	0-6	**34.3**	51.8
DU1	HA 14	9/23/2020	0-6	**34.4**	61.8
DU1	HA 27	9/23/2020	0-6	**52.5**	40.8
DU1	HA 8	9/23/2020	0-6	**54.6**	61.7
DU1	HA 13	9/23/2020	0-6	**64.1**	126
DU1	HA 7	9/23/2020	0-6	**73.1**	73.2
DU1	HA 10	9/23/2020	0-6	**117**	78.4
DU2	HA 28	9/23/2020	0-6	4.4	6.3
DU2	HA 18	9/23/2020	0-6	9.1	18.3
DU2	HA 12	9/23/2020	0-6	11.8	18.7
DU2	HA 30	9/23/2020	0-6	9.6	21
DU2	HA 6	9/23/2020	0-6	**44**	22.6
DU2	HA 16	9/23/2020	0-6	16	25
DU2	HA 29	9/23/2020	0-6	**21.1**	29.3
DU2	HA 26	9/23/2020	0-6	**21.1**	41
DU2	HA 9	9/23/2020	0-6	**37.9**	56
DU2	HA 2	9/23/2020	0-6	**34.2**	71
DU2	HA 25	9/23/2020	0-6	**48.7**	97
DU2	HA 1	9/23/2020	0-6	**49.8**	90
DU1	HA 8	9/23/2020	6-12	13.2	14.7
DU1	HA 4	9/23/2020	6-12	**21.1**	41.2
DU1	HA 32	9/23/2020	6-12	**23.2**	43.6
DU1	HA 24	9/23/2020	6-12	**27**	28.1
DU1	HA 20	9/23/2020	6-12	**29**	31.5
DU2	HA 28	9/23/2020	6-12	11.7	13.3
DU2	HA 16	9/23/2020	6-12	15.9	21.6
DU2	HA 1	9/23/2020	6-12	18.3	30.3
DU2	HA 12	9/23/2020	6-12	**21.9**	23.2

Values in **bold** represent concentrations above the MTCA Method A cleanup level for unrestricted land use.
Values in **bold red** represent concentrations that are twice the MTCA Method A cleanup level for unrestricted land use.

Additional Soil Sampling Results

Characterization Sample	Sample ID	Sample Date	Sample Depth (inches)	Arsenic (mg/kg)
HA6	N1	5/26/2022	0-6	3.65
HA6	N1	5/26/2022	6-12	1.74
HA6	N1	5/26/2022	12-24	1.93
HA6	N1	5/26/2022	24-36	3.42
HA25	N2	5/26/2022	0-6	16.1
HA25	N2	5/26/2022	6-12	3.11
HA25	N2	5/26/2022	12-24	3.2
HA25	N2	5/26/2022	24-36	2.6
HA26	N3	5/26/2022	0-6	10.9
HA26	N3	5/26/2022	6-12	3.23
HA26	N3	5/26/2022	12-24	1.93
HA26	N3	5/26/2022	24-36	1.15

Enclosure D

Net Environmental Benefit Analysis

This page intentionally left blank.

DEPARTMENT OF ECOLOGY
State of Washington

Ridgetop Golf Property:
Preliminary Habitat Assessment JUNE 30, 2022

This memorandum represents a Department of Ecology recommendation specific to the Ridgetop Golf Property – Proposed Contractor Yard – new development, located at 3134 14th Ave NW, Gig Harbor, , Pierce County, WA.

Determination:

The proposed non-developed area can be designated as especially valuable habitat and as such qualifies for non-remediation of the soil with elevated arsenic (As) levels. If the property owner does decide to propose non-remediation in the those areas of elevated contamination, a Net Environmental Benefit Analysis (NEBA) is recommended.

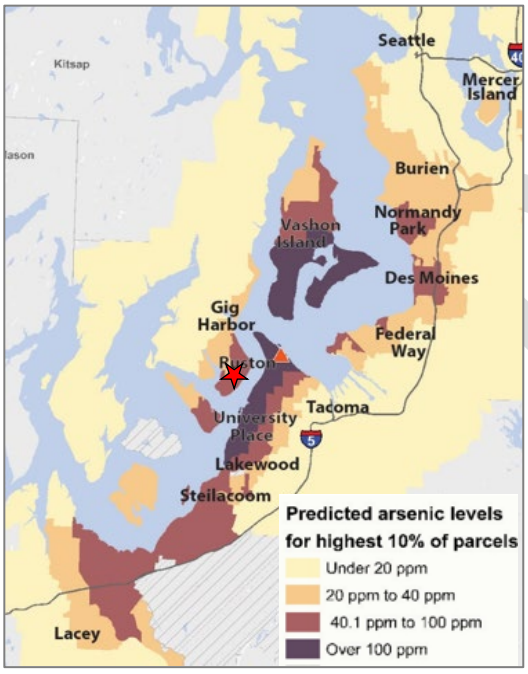


Figure 1. Vicinity Map

This memorandum specifically pertains to Ecological Risk Assessment and the Terrestrial Ecological Evaluation (TEE) under the Tacoma Smelter Plume Model Remedy (Ecology, 2019), and MTCA (WAC 173-340-7490 through 7494) (Ecology, 2013). An initial site visit was made June 16, 2022.

For questions regarding this memorandum, please contact:

Eva Barber
Phone: (360) 999-9593
Email: eva.barber@ecy.wa.gov

Background

The Ridgetop Gol fProperty is the site of a proposed future commercial development in Pierce County, WA. It is approximate 3.77 acres, and is currently undeveloped. In September 2020, GeoResources sampled 32 locations in the upper 12 inches of soil. Based on the sampling, it appears there are elevated arsenic levels (As) on the property (Mean = 31 mg/kg, Max = 117 mg/kg) (Figure 2). The elevated arsenic concentrations in the soil are from the air emissions from an old Asarco smelter in north Tacoma. The area-wide contamination as a result of this pollution is known as the Tacoma

Smelter Plume (TSP). Figure 1 shows the location of the Property within the TSP. While cleanup is expected in the developed areas, it has been proposed to evaluate the effects of the contamination on the receptors/habitat in the undeveloped areas (see figure 3).
Based on the amount of proposed undeveloped area, Ecology conducted a site visit to make a

Figure 2. Ridgetop Golf Property - Approximate Locations of Characerization Sampling

preliminary determination regarding the quality of the habitat. As a result of the visit, it was determined that the proposed undeveloped area does have potentially valuable habitat and that further evaluation is recommended prior to making a decision on whether or not the habitat would provide protection to upland ecological receptors despite those elevated concentrations of arsenic.

Preliminary Assessment of Habitat in Proposed Undeveloped Area

On June 16, 2022 Ecology conducted a field visit at the site. The site was accessed at Cushman trail parking area.

The first location visited was at sampling location HA1 (Figure 3). Arsenic concentration at this

location was 49.8 mg/kg. This area appears to be dominated almost entirely by native species (douglas fir, cedars, ferns, etc.).

Figure 3. Area in the Vicinity of Sampling Locaion HA1

The second location visited was near sampling location HA25. Arsenic concentration concentration at this location was 48.7 mg/mkg. This area appears to be dominated almost entirely by native species (salall, cedars, douglas fir, ferns, etc.)

Figure 4. Area in the Vicinity of Sampling Location HA25

Figure 5. Area in the Vicinty of Sampling Location HA26.

The third location visited was near sampling location HA26. Arsenic concentration concentration at this location was 21.1 mg/mkg. This area appears to be dominated almost entirely by native species (salall, alder, douglas fir, ferns, etc.).

Net Environmental Benefit Analysis

Net environmental benefits are the ecological gains as a result of remediation or ecological restoration, minus the environmental injuries caused by those actions (Efroymson et al., 2003). Ecosystems and natural resources (including wild animal and plant populations) can be thought of as environmental assets which provide people with a range of "services" which directly or indirectly contribute to our well-being. Decisions where there may be ecological tradeoffs, for example, clearing a vegetated site to access contaminated soil, needs to be balanced with the potential damage caused to the habitat, or "ecosystem" and the wider services that it provides (Deacon et al., 2010). Therefore, a Net Environmental Benefit Analysis (NEBA) would be the procedure of weighing the advantages of active cleanup (remediation) versus the impact that cleanup might have on potentially valuable ecological receptor habitat. Terrestrial ecological evaluation procedures should not create an incentive to cause harm through the destruction of habitat. As a result, WAC 173-340-7490 (5): "Additional measures. The department may require additional measures to evaluate potential threats to terrestrial ecological receptors notwithstanding the provisions in this and the following sections (when based upon a site – specific review), the department determines that such measures are necessary to protect the environment." (Ecology, 2013).

Limitations: As stated in WAC 173-340-7490 (1) (c): "These procedures [Terrestrial Ecological Evaluation] are not intended to be used to evaluate potential threats to ecological receptors in sediments, surface water, or wetlands. Procedures for sediment evaluations are described in WAC 173-340-760, and for surface water evaluations in WAC 173-340-730. Procedures for wetland evaluations shall be determined by the department on a case-by-case basis." In addition, WAC 173-340 also defines Terrestrial ecological receptors as "plants and animals that live primarily or entirely on land." (Ecology, 2013). As a result, the intent of this NEBA section is to clarify procedures that would further protect especially valuable habitat that supports terrestrial ecological receptors that would otherwise require remediation to attain cleanup levels. It is not the intent of this NEBA section to delineate between upland, surface water, sediment, and wetland environments.

Procedures

Step 1: This is the Responsibility of Ecology:

Initial Determination

The proposed non – remediated area needs to be designated as Especially Valuable Habitat (EVH). EVH can be designated by one of the below proposed methods (Method 1 or Method 2):

Method 1: Site can be designated "especially valuable habitat" if:

- The site is used by a threatened or endangered species protected under the Federal Endangered Species Act, or;

- The site is used by a "priority species" or "species of concern" designated under Title 77 RCW, or;
- The site is used by a plant species classified as "endangered," "threatened," or "sensitive" under Title 79 RCW, or;
- Wetlands and Fish and Wildlife habitat conservation areas designated as critical areas under Chapter 36.70A.170 RCW. Other critical areas that might be found on the property, such as recharge areas, frequently flooded areas, geologically hazardous areas, steep slopes, and aquatic areas, are not immediately designated as "especially valuable habitat" unless they meet one of the previous criteria. These other types of critical areas must follow the Method 2 process.

Note: For animals, "used" means that individuals of a species have been observed to live, feed or breed at the site. For plants, "used" means that a plant species grows at the site or has been found growing at the site (Ecology, 2013).

Method 2: Site can be designated "especially valuable habitat" if:

- An experienced field biologist must visit the site and document that:
  - The site can be potentially used by a threatened or endangered species protected under the Federal Endangered Species Act, or;
  - The site can be potentially used by a "priority species" or "species of concern" designated under Title 77 RCW, or;
  - The site can be potentially used by a plant species classified as "endangered," "threatened," or "sensitive" under Title 79 RCW

Discussion and Recommendation for Preliminary Habitat Assessment:

Ecology has completed Step 1. The results of the field visit/evaluation indicate that the proposed undeveloped area appears healthy, is well established, and dominated by native species. It could be designated as "especially valuable habitat" under Method 2:

- The area can be potentially used by a threatened or endangered species protected under the Federal Endangered Species Act, or;

- The area can be potentially used by a "priority species" or "species of concern" designated under Title 77 RCW, or;

- The area can be potentially used by a plant species classified as "endangered," "threatened," or "sensitive" under Title 79 RCW.

Step 2: This is the Responsibility of the Property Owner

Biological Survey and Depth Weighted Exposure Adjustment

If the property owner proposes non-remediation in the areas of elevated contamination, they must hire an experience field biologist (or other department approved individual) to document types of flora and fauna and signs of excessive uptake of the specific contaminants (see Table 1 – for an example). The biological survey should provide empirical (site-specifc) information, and is focused in those areas of concern with elevated contaminant levels. This will help establish habitat sustainability and whether or not native species are present.

- Document the species of plant (as per: *Natural Vegetation of Oregon and Washington* – Franklin and Dyrness, 1988), soil biota, and wildlife found at the specific site
  - Differentiate between those that are native and those that are invasive
- Document if native plant life is well-established (i.e. primary or secondary growth)
- Document if plant life show signs of contaminant uptake including (but not limited to) signs of:
  - Wilting
  - Chlorosis (pale, yellow or white plant tissue)
  - Browning
  - Excess mortality
  - Reduced growth, photosynthesis, mitosis, or water absorption (dehydration)
- Document any signs of contaminant uptake in soil biota including (but not limited to):
  - Limited numbers
  - Species diversity
- Document any signs of contaminant uptake in wildlife including (but not limited to):
  - Muscular incoordination
  - Debility
  - Slowness
  - Jerkiness
  - Falling
  - Hyperactivity
  - Fluffed feathers
  - Drooped eyelids
  - Seizures

Table 1: Example - Documented plant species that have been observed in the proposed undeveloped area (note: the same tables should be provided for soil biota and wildlife).

Common Name	Scientific Name	Native (Y/N)?	Well Established (Y/N)?	Signs of Contaminant Uptake (Y/N)?
Douglas Fir	*Pseudotsuga menziesii*	Y	Y	N
Pacific Madrone	*Arbutus menziesii*	Y	Y	N
Salal	*Gaultheria shallon*	Y	Y	N
Oregon Grape	*Berberis aquilfolium*	Y	Y	N
Red Alder	*Alnus rubra*	Y	Y	N
Big Leaf Maple	*Acer macrophyllum*	Y	Y	N
Black Cottonwood	*Populus trichocarpa*	Y	Y	N
Salmonberry	*Rubus spectabilis*	Y	Y	N
Sword Fern	*Polystichum munitum*	Y	Y	N
Himalayan Blackberry	*Rubus discolor*	N	Y	N
Trailing Blackberry	*Rubus ursinus*	Y	Y	N
Indian Plum	*Osmaronia cerasiformis*	Y	Y	N
Red Huckleberry	*Vaccinium parvifolium*	Y	Y	N

Depth Weighted Exposure Adjustement:

In addition to the biolgical survey, it is the responsibility of the property owner to provide some additional smapling information. Sampling (in addition to the previous 0 – 12" bgs sampling) and a depth weighted receptor adjustment is made at sampling points 4, 20, 47, and 49 (see figure 2) is also required at this site. This additional information should allow for a better understanding of upland ecological receptor exposure to contamination. Depths recommended at each sampling point are:

- 0 – 6" bgs
- 6 – 12" bgs
- 12 – 24" bgs
- 24 – 36" bgs

Depth Weighted Receptor Adjustment Equation:

$$C_{ea} = (C_{c\,(1)} \times P_{r\,(1)}) + (C_{c\,(2)} \times P_{r\,(2)}) + (C_{c\,(i)} \times P_{r\,(i)})$$

Where:

C_{ea} = Exposure adjusted contaminant concentration
$C_{c\,(1)}$ = Soil contaminant concentration at sample depth 1 (i.e. 0 – 6")
$C_{c\,(i)}$ = Soil contaminant concentration at sample depth (i)
$P_{r\,(1)}$ = Proportion of Receptor found at sample depth 1 (i.e. 0 – 6")
$P_{r\,(i)}$ = Proportion of Receptor found at sample depth (i)

The following is an example of a Depth – Weighted Receptor Exposure Adjustment:

For sample XXXX (As):

1. The soil contaminant concentration at sample depth (0 – 6”) is 113 mg/kg
2. The depth weighted receptor adjustment is 0.3
3. The adjusted As level at sample depth (0 – 6”) is 33.9 mg/kg
4. Repeat steps for sample depth (6 – 12”, 12 – 24”, and 24 – 36”)
5. Add the four adjusted sample depth concentrations for a Depth – Weighted Receptor Exposure Adjustment total of 34.8 mg/kg (As)

The resulting Depth - Weighted Exposure Adjustment Concentration for (As) is 34.8 mg/kg.

Justification for Exposure Adjustments

- Adjustment of 0.55 for sample depth 6 to 12”

Soil development is rarely uniform and processes such as erosion and deposition can influence the vertical distribution of biological activity across landscapes. Sampling strategies where a constant depth is collected may not accurately reflect site-specific exposures of environmental contamination to the soil biota. A horizon may not accurately represent contaminant exposure to soil biota, resulting in inaccurate risk estimates. If constant depths are utilized, [our] results suggest that samples should be collected to a depth of approximately 25 – 30 cm as opposed to shallower depths (USEPA, 2015). Result: the majority of receptor exposure to contamination is expected to be at sample depth of 6 to 12” (0.55 or 55%).

- Adjustment of 0.3 for sample depth 0 to 6”

The organic matter which provides the food base for the earthworm community is vitally important in determining their distribution and abundance, and soil organic matter content can sometimes be a good predictor of earthworm abundance. For example, Hendrix et al. (1992) reported a highly significant correlation between earthworm density and soil organic C content over a range of sites in Georgia, U.S.A., including a wide variety of soil and vegetation types and management histories (Curry, 1998). Result: it is assumed that the increased organic matter found at shallower depths (0 to 6”) would be the second most abundant vertical horizon for soil biota (0.3 or 33%).

- Adjustment of 0.1 for 12 to 24” and 0.05 for 24 to 36”

The main source or the organic matter on which earthworms feed is litter from above-ground plant parts in most ecosystems, although dead roots and rhizodeposition can also be important

sources (Curry, 1998). Result: As depth increases, receptor exposure should decrease, so at 12 to 24" (0.1 or 10%) and at 24 to 36" (0.05 or 5%).

Important Note: If non-remediation is chosen as a cleanup action for "especially valuable habitat," then:

- Institutional controls are required that would:
  - Demonstrably limit or prohibit activities that may interfere with an interim action or cleanup action or result in exposure to hazardous substances at the site. The purpose of institutional controls would be to reduce the risks of current human and/or future land use, and;
  - Demonstrably reduce the risk of present or future releases or migration of the hazardous substance located at the site.

Summary: The intent of the institutional controls would be to preserve the "especially valuable habitat" by restricting future development and human activities in those designated areas. If those institutional controls are proposed to be lifted, then the original cleanup levels assigned to the site would apply.

Step 3: This is the Responsibility of Ecology

Final Determination

After the field biologist visit and depth weighter exposure adustments have been completed and submitted to Ecology, the Ecology Site Manager (or designee) will then make a final determination as to whether or not the proposed non – remediated area appears to be established, sustainable, and native habitat. In granting the request of non – remediation, the Ecology Site Manager (or designee) should consider the following factors prior to making a final decision:

- The rarity of the habitat for the geographic area in which the site is located.
- The size of the habitat.
- Whether the habitat functions as a wildlife corridor.
- Whether the habitat functions as a refuge or feeding area for migratory species.
- The structural diversity of the habitat.
- Surrounding habitat and land uses.
- Whether the habitat is manmade or natural.
- Whether the cleanup would significantly disturb the ecological functions of the habitat.
- The level of human activity in the area.
- The length of time for recovery of the habitat after cleanup.

References:

Curry, J.P. (1998). *Factors Affecting Earthworm Abundance in Soil.* In: Earthworm Ecology. St Lucie Press. Pgs. 37 – 64.

Deacon, Goddard, and Eury (2010). *Assessing Risks to Ecosystems Using a Net Environmental Benefit Analysis Framework to Assist with Environmental Decision-making.* http://www.environcorp.com/EnvironCorp/media/environ/Files/NEBA_Deacon.pdf

Ecology. (2013). *Model Toxics Control Act Regulation and Statute, Chapter 173-340 WAC.* (Ecology Publication No. 94-06). Lacey, WA: Washington State Department of Ecology, Toxics Cleanup Program.

Ecology (2019). Tacoma Smelter Plume Model Remedies Guidance: Sampling and cleanup of arsenic and lead contaminated soils. Washington State Department of Ecology. Pub. No. 19-09-101.

Efroymson, Nicollette, and Suter (2003). *A Framework for Net Environmental Benefit Analysis for Remediation or Restoration of Petroleum –Contaminated Sites.* http://www.esd.ornl.gov/programs/ecorisk/documents/NEBA-petrol-s-report-RE.pdf

Franklin, J.F., and C.T. Dyrness. (1988). *Natural Vegetation of Oregon and Washington.* Originally published by the U.S. Forest Service in 1973. Reprinted with new bibliographic supplement by the OSU Press in 1988.

GeoResources. (2021). *Soil Investigation Report: Proposed Residential Development.* Completed for Garrette Custom Homes.

WDFW. (2022). *Priority Habitats and Species (PHS): PHS on the Web.* https://wdfw.wa.gov/mapping/phs/

USEPA. (2015). *Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic Ecological Risk Assessments.* Cincinnati, OH: United States Environmental Protection Agency. Publication No. EPA/600/R-15/176.