MEMORANDUM

Project No.: 150074-001

January 17, 2016

To: Andrew Smith, PE, LHG, UST/Technical Services Unit Supervisor, Washington State Department of Ecology

cc: Craig Gregory, PE, Public Works Director, City of Shelton

From:

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Re: **Final Chemicals of Potential Concern and Screening Levels Technical Memorandum**
Shelton C Street Landfill, Mason County, Washington

This technical memorandum has been prepared by Aspect Consulting, LLC (Aspect) on behalf of the City of Shelton (City) for the Shelton C Street Landfill as the first deliverable required under Agreed Order No. DE 12929. The Agreed Order has been entered, pursuant to the Model Toxics Control Act Cleanup Regulation (MTCA), by the Washington State Department of Ecology (Ecology) and the City to perform a Remedial Investigation (RI) and Feasibility Study (FS) and prepare a draft Cleanup Action Plan for the Shelton C Street Landfill. The Agreed Order was effective as of September 30, 2016.

The purpose of this memorandum is to present the chemicals of potential concern (COPCs) and proposed site screening levels (Site SLs) for the RI and FS. The memorandum provides a summary of the current conditions and history of the landfill property, presents the list of COPCs based on the historical information, and summarizes the current and potential future exposure pathways and receptors as a basis for developing the proposed Site SLs.

1 Site Description and Background

This section presents a brief description of the property setting, current site use, and operational history; a summary of ownership history; and the regulatory history, as summarized through review of available historical documents.

1.1 Description and Current Setting

The Shelton C Street Landfill is a former municipal waste landfill located on a 16.7-acre parcel of land, owned by the City, at the west end of West C Street, just west of the overpass over US Highway 101 in Mason County, Washington (Figure 1). The footprint of the landfill and the extent of the MTCA 'Site'[1], are currently unknown but will be defined as part of the RI. The City acquired the property in 1928 and began to use it as a municipal waste landfill for disposal of solid waste generated within the City limits and the surrounding areas. Prior to this, it was owned by private property owners and mined for sand and gravel aggregate, resulting in a surface pit that created a logical place for disposal of solid waste.

The property is currently vacant, undeveloped land, covered by shrub vegetation and trees. The property is located outside of the city limits but within the Shelton Urban Growth Area and is zoned Public Institutional, for which permitted uses include government buildings, cultural facilities, churches, public utilities and parks or open space. A 250-foot wide strip of land along the eastern edge of the property is a utility right-of-way and includes transmission towers and overhead electrical transmission lines. The surface topography indicates a 20+ foot, bowl-like depression at the approximate center of the property (not including the transmission line easement) that is suspected to correspond to the limits of historical aggregate mining and subsequent disposal of solid waste. Public access to the property is restricted by a locking gate on West C Street and signage indicating restricted access.

The landfill property is bound to the west and south by active gravel mining operations of the Miles Sand & Gravel Shelton Plant and Pit, to the east by Washington State Department of Transportation right-of-way and US Highway 101, beyond which is more active mining land owned by Miles Sand & Gravel, and to the north by vacant forest land. Most land surrounding the landfill property is zoned Industrial.

The nearest surface water body is Goldsborough Creek, which flows to the west and south of the property, beyond the adjacent gravel mining operations, and drains into Oakland Bay approximately 2 miles east of the property (Figure 1). The uppermost groundwater aquifer, identified as Unit A in hydrogeologic studies and reports for the Shelton area, consists of sand and gravel ranging up to 120 feet in thickness that may locally interact with surface water bodies (GeoEngineers, 2013). The groundwater flow direction within Unit A, in the property vicinity, is estimated to be towards the southeast (GeoEngineers, 2013). Goldsborough Creek is located at a distance of approximately 0.4-mile from the landfill property in the downgradient direction.

[1] Any area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located (WAC 173-340-200).

1.2 Ownership History

The Shelton C Street Landfill property was purchased by the City from private property owners in May 1928, including both the parcel and a perpetual easement for access. In July 1931, the City sold the property to Rainier Pulp and Paper Company but retained the right to continue to use the land as a garbage dump. Rayonier, Incorporated, successor of Rainier Pulp and Paper Company, sold the property back to the City in July 1949 except for a 250-foot wide strip for which Rayonier granted an easement to the Bonneville Power Administration (BPA) in August 1949. An additional transmission line easement, consisting of 62.5 feet on the west side of the BPA easement, was conveyed from the City to the United States of America in 1956. In 1972, the City transferred 1.44 acres of property, that was located on the east side of the BPA easement, to the State of Washington for highway improvements/public rights of way.

1.3 Regulatory History

The landfill received municipal solid waste between approximately 1928 and the early- to mid-1980s and included occasional open burning of garbage throughout the operations. Between 1931 and 1934, the landfill received by-products from the Rainier Pulp and Paper Company pulp mill in Shelton. Between 1931 and 1974, the landfill reportedly received waste from the Rayonier Research laboratory, demolition debris from decommissioning of the Rayonier pulp mill, and sludge from a Port of Shelton Imhoff tank (a chamber used for reception and processing of sewage). An incinerator constructed on the landfill property in the mid-1950s reportedly burned garbage for approximately 10 years before it was demolished. Between 1951 and 1981, the landfill was reportedly used for disposal of wastewater treatment plant sludge. When stack air emission controls were imposed on the Simpson Timber Company Shelton timber mill in 1976, the light, fly-ash baghouse dust, generated by a wood-burning, boiler power plant, was mixed with water and sent to the City's wastewater treatment plant. The processed wastewater sludge containing the fly-ash material was disposed of in the landfill between 1976 and 1981. Additional details pertaining to historical ownership and regulatory activities are summarized below.

In September 1973, the United States Environmental Protection Agency (EPA) notified Ecology of an August 1973 inspection of the 'Shelton dump site' in which they found it to be in violation of 'Regulation I, Section 9.01 of the Olympic Air Pollution Control Authority' and requested any information that EPA should consider prior to issuance of a notice of violation to the 'Shelton City Dump'. A response letter dated October 15, 1973 from Ecology indicated that an implementation schedule was in place, and approved by the Olympic Air Pollution Control Authority, to work towards cessation of open burning at the Shelton dump. The letter further indicated that open burning at the Shelton dump would stop on January 31, 1974 and that a new central sanitary landfill site would begin operation in August of 1974. An EPA Land Disposal Site Modification report dated May 1975 indicates that the Shelton Dump site has been 'eliminated' with 'rats eradicated, burning stopped, water pollution corrected, and site covered'.

Between March 1976 and June 1984, baghouse residue (consisting of one-third unburned or charred wood residue and two-thirds salt) was combined with water and sent as a slurry to the municipal sewage treatment plant. Sludge from the sewage treatment plant was disposed at the Shelton C Street Landfill from March 1976 until November 1981. In May 1986, EPA and Simpson Timber

Company announced that dioxin compounds were detected in baghouse ash from a wood-fueled boiler at the Simpson mill power plant during a national EPA study to evaluate dioxin contamination in the environment.

EPA issued an Administrative Order on Consent (AOC) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to the Simpson Timber Company, effective September 26, 1986, to ‘determine the nature and extent of any threat to the public health or welfare or the environment that may be caused by the release or threatened release of hazardous substances, specifically dioxins and furans…’. A 1986 Dioxin Sampling Plan (CH2M Hill, 1986) prepared to meet the requirements of the AOC, indicates that baghouse residue mixed with municipal sludge was discharged into a 100- by 150-foot area of the Shelton C Street Landfill. The draft 1987 Final Dioxin Study Report (CH2M Hill, 1987) documents sampling results including those collected to “determine the chlorinated dioxin and furan content of the residual sludge at the City of Shelton landfill (the only landfill with uncovered deposits of potentially contaminated sludge).” Ten sludge samples, collected from the sludge-disposal area at the landfill, were collected between the surface and 4-inches below ground surface (bgs) and composited for laboratory analysis of dioxins and furans. The results detected the principal congener of concern, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) at 0.17 parts per billion (ppb) with a total 2,3,7,8-TCDD toxicity equivalency factor (TEQ) of 3.1 ppb. The EPA Report of Dioxin Study Findings and Announcement of Public Meeting, dated April 13, 1987 presented these results.

A July 2, 1986 inspection of the Shelton Dump, C-Street by Ecology indicated that the landfill was still being used for disposal and identified recent dumping of vegetative debris, small quantities of trash and household debris, and disposal of sewage treatment plant sludge. However, the letter documenting the inspection is the only indication of post-1981 dumping/disposal and the letter was not substantiated with other evidence.

The Correction and Closure Plan: Shelton Landfill Disposal Facility, prepared by Brown and Caldwell and dated January 4, 1988, provided recommendations to correct deficiencies in compliance and support landfill closure. Specifically, the plan called for placement of an additional 2-feet of soil cover over sludge soils, recommended application for a variance to allow for site closure without a groundwater monitoring system, and recommended new and larger signs as the only additional access control measures. There is no information that indicates whether these recommendations resulted in any regulatory action.

In a letter dated June 8, 2004, Ecology notified the City of a pending Site Hazard Assessment (SHA). On June 5, 2014, Ecology published the SHA indicating an overall rank of 3, which appears to be based primarily on potential risk to human health through migration of contaminants via groundwater from the landfill to drinking water sources even through releases to groundwater have not been documented.

2 Preliminary COPCs

Except for some old and limited data for dioxins/furans, as discussed above, there has been no investigation into the presence of potential COPCs at the Shelton C Street Landfill site. Because of this, a broad list of COPCs has been developed for evaluation during the RI. The list of COPCs comprises three categories:

- Chemicals commonly associated with municipal landfills and/or included in landfill compliance monitoring and closure requirements;
- Chemicals documented to be present; and
- Chemicals potentially present based on the reported and/or suspected disposal of waste from demolition and operation of local pulp, paper and timber mills.

A description of each of these categories, and the specific chemicals associated with them, is provided in the following sections.

2.1 Landfill Chemicals of Potential Concern

The majority of waste, by volume, in the Shelton C Street Landfill is assumed to be municipal solid waste, defined by WAC 173-350 as waste consisting of unsegregated garbage, refuse and similar solid waste materials discarded from residential, commercial, institutional and industrial sources and community activities. The primary COPCs are those that are either typically associated with municipal waste landfills and/or required to demonstrate compliance with state laws and regulations regarding groundwater quality near the landfill. The preliminary COPC groups include the following:

- Metals, including priority pollutant metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, and silver) and geochemical indicator trace metals (calcium, iron, magnesium, manganese, sodium, and zinc).
- Total petroleum hydrocarbons (TPH).
- Volatile organic compounds (VOCs).
- Semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs).
- Pesticides and herbicides.
- Other geochemical indicator parameters, including alkalinity, ammonia, chloride, cyanide, nitrate, nitrite and sulfate.

The specific chemicals under each COPC group are presented on Tables 1 through 3.

2.2 Chemicals Documented to be Present

Based on the site background information compiled and reviewed in preparation of this memorandum, as summarized above, there is little existing chemical data for the Shelton C Street Landfill. The results of limited investigation activities performed in the 1980s identified the presence of dioxins and furans in sludge/surface soil at the Shelton C Street Landfill. Based on this, dioxins and furans are preliminary COPCs.

2.3 Chemicals Associated with Mill Waste Disposal and Others

Early in its operation (1931-1934), the landfill reportedly received by-products from the Rayonier (formerly Rainier Pulp and Paper) pulp mill. Additionally, as described in detail in the sections above, dioxins and furans are documented to be present in wastewater treatment plant sludge, that contained baghouse ash from the Simpson Timber Company timber mill and was disposed of in the landfill. The Correction and Closure Plan: Shelton Landfill Disposal Facility (Brown and Caldwell, 1988) indicated periodic disposal of waste under special permit including dredge spoils from Oakland Bay, old dock timbers from rework of one of the mill facilities, demolition debris from decommissioning of the Rayonier pulp mill, and residues from cleanup of a hardware store fire. In addition to those chemicals already presented above, the COPCs associated with these miscellaneous waste disposal activities include:

- Polychlorinated biphenyls; and
- Total sulfide.

3 Potential Exposure Pathways

The development of Site SLs relies on the identification of current and potential future exposure pathways and receptors. Potential future exposure pathways and receptors consider reasonably anticipated future site use(s). In contrast to the Public Institutional zoning of the Shelton C Street Landfill property, the surrounding properties are primarily zoned Industrial, where current and future surrounding land use is primarily aggregate mining. Public access to the landfill property, and the surrounding aggregate mining properties, is restricted for safety reasons. However, illegal public access of the landfill property for recreational use is evident by the presence of off-road vehicle trails. With this setting and current and potential future site uses, the following exposure pathways and receptors are applicable:

- Soil/landfill waste leaching to groundwater – Contaminants in soil and landfill waste can leach to groundwater by infiltration of precipitation through contaminated soil and landfill waste or where groundwater is in contact with contaminated soil or landfill waste.
- Ingestion of groundwater – Human receptors have the potential to contact contaminants in groundwater via ingestion. The presence, nature and extent of COPCs in groundwater will be evaluated during the RI to determine whether ingestion of groundwater is a complete pathway.
- Direct contact with soil and landfill waste– Human and terrestrial receptors have the potential to contact contaminants in surface and shallow subsurface soil under current exposure scenarios.
- Soil vapor/landfill gas discharge to ambient air – Soil vapor/landfill gas has the potential to migrate and expose ambient air receptors to volatile contaminants.

Groundwater discharge to surface water in Goldsborough Creek is a potential migration pathway; however, the nearest expression of surface water in Goldsborough Creek to the southeast, which is the presumed downgradient location from the landfill, is approximately 0.4-mile. The nature and extent of an impacted groundwater plume emanating from the landfill will be fully characterized during the RI, including potential risks to human health and the environment associated with groundwater discharge to surface water if it is determined to be a complete migration pathway.

4 Proposed Site Screening Levels

This section presents the proposed Site SLs, values that will be used to evaluate data collected during the RI to assess the nature and extent of contamination at the Shelton C Street Landfill site. The proposed Site SLs have been developed based on the current and potential future exposure pathways and receptors, as presented in the previous section, and applicable regulatory criteria. The proposed Site SLs are not cleanup levels, they are intentionally conservative, representing the most stringent of the relevant and appropriate criteria for all potential exposure pathways. Site-specific cleanup levels will be developed during the FS following completion of the RI.

4.1 Soil

Landfill refuse is heterogeneous and, for purposes of cleanup, assumed to be impacted with regulated hazardous substances. Under MTCA, it is not necessary to investigate the presence, nature or extent of COPCs in the landfill refuse. Ecology recognizes the need to use engineering controls, such as containment, for sites that contain large volumes of materials containing relatively low levels of hazardous substances (WAC 173-340-370(3)) where treatment or removal is impracticable. MTCA allows for containment to be the preferred remedy for historical landfill sites and uses the Minimum Functional Standards (MFS) established in WAC 173-304 as a relevant and appropriate requirement (WAC 173-340-710(7)(c)). Therefore, the soil criteria, including the proposed Site SLs and final cleanup levels, apply to soil within the MTCA Site but outside of the refuse footprint of the landfill.

The proposed Site SLs for soil include consideration of the following:

- MTCA Method B cleanup levels from the Ecology CLARC database.
- Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals.
- Natural Background Soil Metals Concentrations in Washington State (Ecology, 1994).
- Natural Background for Dioxins/Furans in Washington soils (Ecology, 2010).

The proposed Site SLs are the lowest published values of the MTCA Method B cleanup level and the Ecological Indicator Soil Concentration, adjusted upward if appropriate when compared to background concentrations and laboratory practical quantitation limits (PQLs), in accordance with MTCA (WAC 173-340-709 and -705(6)). There are no MTCA Method B cleanup levels for TPH so the MTCA Method A cleanup levels are used. The proposed Site SLs for soil are summarized on Table 1.

4.2 Groundwater

The proposed Site SLs for groundwater are based on the protection of drinking water and include the following:

- MTCA Method B groundwater cleanup levels from the Ecology CLARC database.
- Federal and State Maximum Contaminant Levels (MCLs).

The proposed Site SLs are the lowest published values of these criteria, adjusted upward, if appropriate, so that Site SLs are not lower than the laboratory PQLs. There are not MTCA Method B cleanup levels or MCLs for TPH in groundwater so the MTCA Method A values are used. The proposed Site SLs for groundwater are summarized on Table 2.

4.3 Soil Vapor/Landfill Gas

Landfill gas is produced during decomposition of solid waste and typically contains methane and other organic and inorganic gases. MTCA does not provide cleanup levels for methane or landfill gas, but does establish Standard Method B air cleanup levels that do not exceed ten percent (10%) of the lower explosive limit (LEL) of any hazardous substance or mix of hazardous substances (WAC 173-340-750(3)(b)(iii)). The Minimum Function Standards (WAC 173-304) provide air quality and toxic air emissions requirements that may apply to landfill gas at the property, as follows:

- The concentrations of explosive gases cannot exceed 25% of the LEL in site structures.
- The concentration of explosive gases cannot exceed the LEL in the subsurface at or beyond the property boundary.
- The concentration of explosive gases cannot exceed 100 parts per million by volume of hydrocarbons (expressed as methane) in offsite structures.

The LEL for methane is 5% by volume.

The presence of hazardous substances in landfill waste may provide a source of contaminants to soil vapor. Individual contaminant concentrations in soil vapor will be compared to MTCA Method B soil gas screening levels. The proposed Site SLs for volatile COPCs in soil vapor are summarized on Table 3.

5 References

Brown and Caldwell. 1988. Correction and Closure Plan, Shelton Landfill Disposal Facility.

CH2M Hill. 1987. Final Dioxin Study Report – Simpson Timber Company. March.

CH2M Hill. 1986. Dioxin Sampling Plan, Simpson Timber Company, Shelton, Washington. Prepared for the US Environmental Protection Agency Simpson Timber Company. June.

GeoEngineers, 2013. Water Resources Element Report, Shelton Hills Development Project, Shelton, Washington. Appendix C of the Draft Environmental Impact Statement, Shelton Hills Mixed-Use Development Project, prepared by the City of Shelton, August 2013. February 25.

6 Limitations

Work for this project was performed for the City of Shelton (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

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Attachments

Table 1 - Proposed Site Screening Levels for Soil
Table 2 - Proposed Site Screening Levels for Groundwater
Table 3 - Proposed Site Screening Levels for Soil Vapor
Figure 1 - Site Vicinity Map

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TABLES

Table 1 - Proposed Site Screening Levels for Soils

150074 Shelton C Street Landfill Remediation, Shelton WA

	Applicable Soil Criteria						
	Direct Contact	Protective of Ecological Receptors[2]					
Analyte (by group)	MTCA Method B[1]	Plants	Soil biota	Wildlife	Natural Background Concentration	Practical Quantitation Limit (PQL)[3]	Proposed Site Screening Level
Total Petroleum Hydrocarbons (mg/kg)							
tph, diesel range organics	2000[7]		200	6000		25	200
tph, heavy oils	2000[7]					50	2000
tph, mineral oil	2000[7]					50	2000
tph: gasoline range organics, benzene present	100[7]		100	5000		10	100
tph: gasoline range organics, no detectable benzene	800[7]		100	5000		10	100
Dioxins/Furans (ng/kg)[4,5]							
tetrachlorodibenzo-p-dioxin (tcdd); 2,3,7,8-	12.8			2.0		0.605	2.0
chlorinated dibenzo-p-dioxins (PCDDs), total				2.0	2.2		2.2
chlorinated dibenzofurans (PCDFs), total				2.0	2.2		2.2
Geochemical Indicator Parameters (mg/kg)							
alkalinity							--
ammonia							--
calcium						50	--
chloride							--
cyanide	48					0.25	--
iron	56000					20	--
magnesium						20	--
manganese	11200	1100		1500		0.5	--
nitrate	128000						--
nitrite	8000						--
sodium						100	--
sulfate							--
sulfide, total							--
Metals (mg/kg)[6]							
arsenic	0.67	10	60	132	7	0.5	7
barium	16000	500		102		0.5	102
cadmium	80	4	20	14	0.77	0.1	4
chromium (total)		42	42	67	48	0.5	48
chromium(VI)	240					1.0	240
copper	3200	100	50	217	36	0.5	50
lead		50	500	118	24	0.1	50
mercury		0.30	0.10	5.50	0.07	0.025	0.10
nickel	1600	30	200	980		0.5	30
selenium	400	1	70	0.30	0.78	0.5	0.78
silver	400	2			0.61	0.2	2
zinc	24000	86	200	360	85	4	86
Polycyclic Aromatic Hydrocarbons (mg/kg)							
acenaphthene	4800	20				0.005	20.00
acenaphthylene						0.005	--
anthracene	24000					0.005	24000
benzo(g,h,i)perylene						0.005	--
benzo[a]anthracene	1.37					0.005	1.37
benzo[a]pyrene	0.14			12		0.005	0.14
benzo[b]fluoranthene	1.37					0.005	1.37
benzo[k]fluoranthene	13.7					0.005	13.7
chrysene	137					0.005	137

Table 1 - Proposed Site Screening Levels for Soils

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Soil Criteria: Direct Contact: MTCA Method B[1]	Protective of Ecological Receptors[2]: Plants	Soil biota	Wildlife	Natural Background Concentration	Practical Quantitation Limit (PQL)[3]	Proposed Site Screening Level
dibenzo[a,h]anthracene	0.14					0.005	0.14
fluoranthene	3200					0.005	3200
fluorene	3200		30			0.005	30
indeno[1,2,3-cd]pyrene	1.37					0.005	1.37
methyl naphthalene;1-	34					0.005	34
methyl naphthalene;2-	320					0.005	320
naphthalene	1600					0.005	1600
phenanthrene						0.005	--
pyrene	2400					0.005	2400
total cPAHs TEQ	0.14					--	0.14
Polychlorinated Biphenyls (mg/kg)							
aroclor 1016	5.6					0.33	5.6
aroclor 1254	0.50					0.33	0.50
aroclor 1260	0.50					0.33	0.50
Total PCBs	0.50	40		0.65		0.33	0.50
Semivolatile Organic Compounds (mg/kg)							
aniline	175					0.067	175
benzidine	0.00435					0.33	0.33
benzoic acid	320000					0.67	320000
benzyl alcohol	8000					0.33	8000
biphenyl;1,1-	125	60				0.05	60
bis(2-chloroethyoxy)methane	--					0.067	--
bis(2-chloroethyl)ether	0.91					0.067	0.91
bis(2-ethylhexyl) adipate (DEHA)	833					0.067	833
bis(2-ethylhexyl) phthalate	71.4					0.067	71.4
butyl benzyl phthalate	526					0.067	526
chlorophenol;2-	400					0.067	400
cresol;m-	4000					0.067	4000
cresol;o-	4000					0.067	4000
cresol;p-	8000					0.067	8000
dibenzofuran	80					0.067	80
di-butyl phthalate	8000					0.067	8000
dichlorobenzene;1,2-	7200					0.067	7200
dichlorobenzene;1,3-	--					0.067	--
dichlorobenzene;1,4-	185		20			0.067	20
dichlorobenzidine;3,3'-	2.22					0.067	2.22
dichlorophenol;2,4-	240					0.33	240
diethyl phthalate	64000	100				0.067	100
dimethylphenol;2,4-	1600					0.067	1600
dinitrophenol;2,4-	160	20				0.67	20
dinitrotoluene;2,4-	3.23					0.33	3.23
dinitrotoluene;2,6-	0.667					0.33	0.667
di-n-octyl phthalate	800					0.067	800
dioxane;1,4-	10					0.067	10
hexachlorobenzene	0.625					0.067	0.625
hexachlorocyclopentadiene	480	10				0.33	10
hexachloroethane	25					0.067	25
isophorone	1053					0.067	1053

Table 1 - Proposed Site Screening Levels for Soils

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Soil Criteria				Natural Background Concentration	Practical Quantitation Limit (PQL)[3]	Proposed Site Screening Level
	Direct Contact	Protective of Ecological Receptors[2]					
	MTCA Method B[1]	Plants	Soil biota	Wildlife			
nitroaniline, 2-	800					0.33	800
nitrobenzene	160		40			0.067	40
nitrosodimethylamine;N-	0.02					0.33	0.33
nitroso-di-n-propylamine;N-	0.14					0.067	0.14
nitrosodiphenylamine;N-	204		20			0.067	20
pentachlorophenol	2.5	3	6	4.5		0.33	2.5
phenol	24000	70	30			0.067	30
trichlorobenzene;1,2,4-	34		20			0.067	20
trichlorophenol;2,4,5-	8000	4	9			0.33	4
trichlorophenol;2,4,6-	80		10			0.33	10
dimethyl phthalate	--		200			0.067	200
Volatile Organic Compounds (mg/kg)							
acetone	72000					0.005	72000
acrolein	40					0.05	40
benzene	18.2					0.001	18.2
bromodichloromethane	16.1					0.001	16.1
bromoform	127					0.001	127
bromomethane	112					0.001	112
carbon disulfide	8000					0.001	8000
carbon tetrachloride	14					0.001	14
chlorobenzene	1600		40			0.001	40
chloroform	32					0.001	32
chloromethane	--					0.001	--
cumene (isopropylbenzene)	8000					0.001	8000
dibromo-3-chloropropane;1,2-	1.3					0.005	1.3
dibromochloromethane	11.9					0.001	11.9
dichloro-2-butene;1,4-	--					0.001	--
dichlorodifluoromethane	16000					0.001	16000
dichloroethane;1,1-	175					0.001	175
dichloroethane;1,2-	11					0.001	11
dichloroethylene;1,1-	4000					0.001	4000
dichloroethylene;1,2-,cis	160					0.001	160
dichloroethylene;1,2-,trans	1600					0.001	1600
dichloropropane;1,2-	28		700			0.001	28
dichloropropene,1,3-	--					0.001	--
ethylbenzene	8000					0.001	8000
ethylene dibromide (EDB)	0.50					0.001	0.50
hexachlorobutadiene	13					0.005	13
methyl ethyl ketone	48000					0.001	48000
methyl isobutyl ketone	6400					0.005	6400
methyl tert-butyl ether	556					0.001	556
n-butylbenzene	4000					0.001	4000
propylbenzene;n-	8000					0.001	8000
sec-butylbenzene	8000					0.001	8000
styrene	16000	300				0.001	300
tert-butylbenzene	8000					0.001	8000
tetrachloroethane;1,1,1,2-	38					0.001	38
tetrachloroethane;1,1,2,2-	5					0.001	5

Table 1 - Proposed Site Screening Levels for Soils

150074 Shelton C Street Landfill Remediation, Shelton WA

	Applicable Soil Criteria						
	Direct Contact	Protective of Ecological Receptors[2]					
Analyte (by group)	**MTCA Method B[1]**	**Plants**	**Soil biota**	**Wildlife**	**Natural Background Concentration**	**Practical Quantitation Limit (PQL)[3]**	**Proposed Site Screening Level**
tetrachloroethylene (PCE)	476					0.001	476
toluene	6400	200				0.001	200
trichloroethane;1,1,1-	160000					0.001	160000
trichloroethane;1,1,2-	18					0.001	18
trichloroethylene (TCE)	12					0.001	12
trichlorofluoromethane	24000					0.001	24000
trichloropropane;1,2,3-	0.03					0.002	0.03
trimethylbenzene;1,2,4-	--					0.001	--
trimethylbenzene;1,3,5-	800					0.001	800
vinyl acetate	80000					0.005	80000
vinyl chloride	0.67					0.001	0.67
xylene;m-	16000					0.001	16000
xylene;o-	16000					0.001	16000
xylene;p-	16000					0.001	16000
xylenes	16000					0.002	16000
Organochlorine Pesticides (mg/kg)							
hexachlorobenzene (BHC)	0.625			17		0.05	0.625
alpha-BHC	--			6		0.05	6
beta-BHC	--			6		0.05	6
gamma-BHC (Lindane)	0.909			6		0.05	0.909
delta-BHC	--			6		0.05	6
heptachlor	0.222					0.05	0.222
aldrin	0.0588			0.1		0.05	0.0588
hHeptachlor epoxide	0.11			0.4		0.05	0.11
trans-chlordane	2.86		1	2.7		0.1	1
cis-chlordane	2.86		1	2.7		0.1	1
endosulfan I	480					0.05	480
dieldrin	0.0625			0.07		0.1	0.1
endrin	24			0.2		0.1	0.2
endosulfan II	480					0.1	480
4,4'-DDE	2.94					0.1	2.94
4,4'-DDD	4.17					0.1	4.17
4,4'-DDT	2.94					0.1	2.94
Total DDT/DDD/DDE	--			0.75		0.1	0.75
endrin aldehyde	--					0.1	--
endosulfan sulfate	--					0.1	--
endrin ketone	--					0.1	--
methoxychlor	400					0.1	400
toxaphene	0.9					0.5	0.9
Chlorinated Herbicides (mg/kg)							
2,4-D	--					0.094	--
2,4-DB	640					0.095	640
2,4,5-T	--					0.095	--
2,4,5-TP (silvex)	640					0.095	640
2,4,6-trichlorophenol	90.9		10			0.047	10
dalapon	2400					2.300	2400
dicamba	2400					0.094	2400
dichloroprop	--					0.710	--

Table 1 - Proposed Site Screening Levels for Soils
150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Soil Criteria: Direct Contact: MTCA Method B[1]	Applicable Soil Criteria: Protective of Ecological Receptors[2]: Plants	Soil biota	Wildlife	Natural Background Concentration	Practical Quantitation Limit (PQL)[3]	Proposed Site Screening Level
dinoseb	80					0.095	80
MCPA	--					9.40	--
MCPP	--					9.40	--

Notes:

"--" Indicates no applicable criteria.

Ecology = Washington State Department of Ecology

[1]Model Toxics Control Act Cleanup Regulation (MTCA), Chapter 173-340 of the Washington Administrative Code, Method B standard formula values.

[2]Ecological Indicator Soil Concentrations for Protection of Terrestiral Plants and Animals, MTCA 173-340-7493, Table 749-3.

[3]Laboratory PQLs provided by Analytical Resources, Inc (ARI) of Tukwila, Washington, except for 2,3,7,8-TCDD (see note 5).

[4]Natural Background for Dioxins/Furans in WA Soils, Ecology Technical Memorandum #8, August 9, 2010.

[5]Dioxins, Furans, and Dioxin-Like PCB Congeners, Addressing Non-Detects and Establishing PQLs for Ecological Risk Assesments in pland Soil, Ecology Implmenetation Memorandum #11, July 22, 2015.

[6]Background metals concentrations from Ecology Natural Background Soil Metals Concentrations in Washignton State, October 1994. Puget Sound region values used where established, statewide values used otherwise.

[7]MTCA Method A soil cleanup levels for unrestricted land uses, Table 740-1.

Table 2 - Proposed Site Screening Levels for Groundwater

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Groundwater Criteria (ug/L) Protection of Human Health MTCA Method B[1]	Federal MCL[2]	WA State MCL[3]	Practical Quantitation Limit[4]	Proposed Site Screening Level
Total Petroleum Hydrocarbons					
tph, diesel range organics	500[5]			250	500
tph, heavy oils	500[5]			500	500
tph, mineral oil	500[5]			500	500
tph: gasoline range organics, benzene present	800[5]			100	800
tph: gasoline range organics, no detectable benzene	1000[5]			100	1000
Dioxins/Furans					
tetrachlorodibenzo-p-dioxin (tcdd); 2,3,7,8-	6.73E-07	3.00E-05	3.00E-05	3.00E-05	3.00E-05
Geochemical Indicator Parameters					
alkalinity				1000	--
ammonia (as nitrogen)				40	--
calcium				50	--
chloride			250000	50	250000
cyanide	9.6	200	200	5	9.6
iron	11200		300	0.4	300
magnesium				20	--
manganese	2240		50	0.1	50
nitrate	25600	10000	10000	10	10000
nitrite	1600	1000	1000	10	1000
sodium				100	--
sulfate			250000	100	250000
sulfide, total				50	--
Metals					
arsenic	0.058	10	10	0.2	0.2
barium	3200	2000	2000	0.5	2000
cadmium	8	5	5	0.1	5
chromium (total)		100	100	0.5	100
chromium(VI)	48			0.01	48
copper	640	1300	1300	0.5	640
lead		15	15	0.1	15
mercury		2	2	0.1	2
nickel	320		100	0.5	100
selenium	80	50	50	0.5	50
silver	80		100	0.2	80
zinc	4800		5000	4	4800
Polycyclic Aromatic Hydrocarbons					
acenaphthene	960			0.010	960

Table 2 - Proposed Site Screening Levels for Groundwater

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Groundwater Criteria (ug/L) Protection of Human Health MTCA Method B[1]	Federal MCL[2]	WA State MCL[3]	Practical Quantitation Limit[4]	Proposed Site Screening Level
acenaphthylene	--			0.010	--
anthracene	4800			0.010	4800
benzo(g,h,i)perylene	--			0.010	--
benzo[a]anthracene	0.12			0.010	0.12
benzo[a]pyrene	0.012	0.20	0.20	0.010	0.012
benzo[b]fluoranthene	0.12			0.010	0.12
benzo[k]fluoranthene	1.2			0.010	1.2
chrysene	12			0.010	12
dibenzo[a,h]anthracene	0.012			0.010	0.012
fluoranthene	640			0.010	640
fluorene	640			0.010	640
indeno[1,2,3-cd]pyrene	0.12			0.010	0.12
methyl naphthalene;1-	1.51			0.010	1.51
methyl naphthalene;2-	32			0.010	32
naphthalene	160			0.010	160
phenanthrene	--			0.010	--
pyrene	480			0.010	480
total cPAHs TEQ					0.012
Polychlorinated Biphenyls					
aroclor 1016	1.1			1.0	1.1
aroclor 1254	0.044			1.0	0.044
aroclor 1260	0.044			1.0	0.044
Total PCBs	0.044	0.5	0.5		0.044
Semivolatile Organic Compounds					
aniline	7.68			1.0	7.68
benzidine	0.00038			10	10.0
benzoic acid	64000			20	64000
benzyl alcohol	800			2	800
biphenyl;1,1-	5.5			1.0	5.5
bis(2-chloroethyoxy)methane	--			1.0	--
bis(2-chloroethyl)ether	0.0398			1.0	1.00
bis(2-ethylhexyl) adipate (DEHA)	72.9			1.0	72.9
bis(2-ethylhexyl) phthalate	6.3	6	6	1.00	6
butyl benzyl phthalate	46			1.0	46
chlorophenol;2-	40			1.0	40
cresol;m-	400			1.0	400
cresol;o-	400			1.0	400
cresol;p-	800			1.0	800

Table 2 - Proposed Site Screening Levels for Groundwater

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Groundwater Criteria (ug/L) Protection of Human Health			Practical Quantitation Limit[4]	Proposed Site Screening Level
	MTCA Method B[1]	Federal MCL[2]	WA State MCL[3]		
dibenzofuran	16			1.0	16
di-butyl phthalate	1600			1.0	1600
dichlorobenzene;1,2-	720	600	600	1.0	600
dichlorobenzene;1,3-	--			1.0	
dichlorobenzene;1,4-	8.1	75	75	1.0	8.1
dichlorobenzidine;3,3'-	0.19			1.0	1.00
dichlorophenol;2,4-	24			1.0	24
diethyl phthalate	12800			1.0	12800
dimethylphenol;2,4-	160			1.0	160
dinitrophenol;2,4-	32			3.0	32
dinitrotoluene;2,4-	0.28			1.0	1.00
dinitrotoluene;2,6-	0.06			1.0	1.00
di-n-octyl phthalate	160			1.0	160
dioxane;1,4-	0.438			2.0	2.0
hexachlorobenzene	0.05	1	1	1.0	1.00
hexachlorocyclopentadiene	48	50	50	1.0	48
hexachloroethane	1.1			1.0	1.1
isophorone	46			1.0	46
nitroaniline, 2-	160			1.0	160
nitrobenzene	16			1.0	16
nitrosodimethylamine;N-	0.00086			1.0	1.0
nitroso-di-n-propylamine;N-	0.0125			1.0	1.0
nitrosodiphenylamine;N-	17.9			1.0	17.9
pentachlorophenol	0.22	1	1	10	10.0
phenol	2400			1.0	2400
trichlorobenzene;1,2,4-	1.5	70	70	1.0	1.5
trichlorophenol;2,4,5-	800			1.0	800
trichlorophenol;2,4,6-	4.0			1.0	4.0
dimethyl phthalate	--			1.0	--
Volatile Organic Compounds					
acetone	7200			5.0	7200
acrolein	4			5.0	5.0
benzene	0.8	5	5	0.20	0.8
bromodichloromethane	0.71	80	80	0.20	0.71
bromoform	5.5	80	80	0.20	5.5
bromomethane	11.2			1.0	11.2
carbon disulfide	800			0.20	800
carbon tetrachloride	0.63	5	5	0.20	0.63

Table 2 - Proposed Site Screening Levels for Groundwater

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Groundwater Criteria (ug/L) Protection of Human Health			Practical Quantitation Limit[4]	Proposed Site Screening Level
	MTCA Method B[1]	Federal MCL[2]	WA State MCL[3]		
chlorobenzene	160	100	100	0.20	100
chloroform	1.4	80	80	0.20	1.4
chloromethane	--			0.50	--
cumene	800			0.20	800
dibromo-3-chloropropane;1,2-	0.05	0.2	0.2	0.50	0.50
dibromochloromethane	0.52	80	80	0.20	0.52
dichloro-2-butene;1,4-	--			1.00	--
dichlorodifluoromethane	1600			0.20	1600
dichloroethane;1,1-	7.68			0.20	7.68
dichloroethane;1,2-	0.48	5	5	0.20	0.48
dichloroethylene;1,1-	400	7	7	0.20	7
dichloroethylene;1,2-,cis	16	70	70	0.20	16.00
dichloroethylene;1,2-,trans	160	100	100	0.20	100
dichloropropane;1,2-	1.2	5	5	0.20	1.2
dichloropropene,1,3-	0.438			0.20	0.438
ethylbenzene	800	700	700	0.20	700
ethylene dibromide (EDB)	0.02	0.05	0.05	0.20	0.20
hexachlorobutadiene	0.56			0.50	0.56
methyl ethyl ketone	4800				4800
methyl isobutyl ketone	640			5.0	640
methyl tert-butyl ether	24.3			0.50	24.3
n-butylbenzene	400			0.20	400
propylbenzene;n-	800			0.20	800
sec-butylbenzene	800			0.20	800
styrene	1600	100	100	0.20	100
tert-butylbenzene	800			0.20	800
tetrachloroethane;1,1,1,2-	1.7			0.20	1.7
tetrachloroethane;1,1,2,2-	0.22			0.20	0.22
tetrachloroethylene (PCE)	20.8	5	5	0.20	5
toluene	640	1000	1000	0.20	640
trichloroethane;1,1,1-	16000	200	200	0.20	200
trichloroethane;1,1,2-	0.77	5	5	0.20	0.77
trichloroethylene (TCE)	0.54	5	5	0.20	0.54
trichlorofluoromethane	2400			0.20	2400
trichloropropane;1,2,3-	0.0015			0.50	0.50
trimethylbenzene;1,2,4-	--			0.20	--
trimethylbenzene;1,3,5-	80			0.20	80
vinyl acetate	8000			0.20	8000
vinyl chloride	0.029	2	2	0.20	0.20

Table 2 - Proposed Site Screening Levels for Groundwater

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Groundwater Criteria (ug/L) Protection of Human Health MTCA Method B[1]	Federal MCL[2]	WA State MCL[3]	Practical Quantitation Limit[4]	Proposed Site Screening Level
xylene;m-	1600			0.20	1600
xylene;o-	1600			0.20	1600
xylene;p-	1600			0.20	1600
xylenes	1600	10000	10000	0.20	1600
Organochlorine Pesticides					
hexachlorobenzene (BHC)	0.0547	1.00	1.00	0.0050	0.0547
alpha-BHC	--			0.0050	--
beta-BHC	--			0.0050	--
gamma-BHC (Lindane)	0.0795	0.2	0.2	0.0050	0.0795
delta-BHC	--			0.0050	--
heptachlor	0.0194	0.4	0.4	0.0050	0.0194
aldrin	0.00257			0.0050	0.0050
hHeptachlor epoxide	0.00481	0.2	0.2	0.0050	0.0050
trans-chlordane	0.25	2	2	0.0050	0.25
cis-chlordane	--			0.0050	--
endosulfan I	96			0.0050	96
dieldrin	0.00547			0.0050	0.0055
endrin	4.8	2	2	0.0050	2
endosulfan II	96			0.0050	96
4,4'-DDE	0.257			0.0050	0.257
4,4'-DDD	0.365			0.0050	0.365
4,4'-DDT	0.257			0.0050	0.257
Total DDT/DDD/DDE	--			0.0050	--
endrin aldehyde	--			0.0050	--
endosulfan sulfate	--			0.0050	--
endrin ketone	--			0.020	--
methoxychlor	80	40	40	0.010	40
toxaphene	0.0795	3	3	0.050	0.0795
Chlorinated Herbicides					
2,4-D				0.047	--
2,4-DB	128			0.071	128
2,4,5-T				0.047	--
2,4,5-TP (silvex)	128	50	50	0.048	50
2,4,6-trichlorophenol	3.98			0.019	3.98
dalapon	240	200	200	0.46	200
dicamba	480			0.047	480
dichloroprop				0.047	--
dinoseb	16	7	7	0.047	7

Table 2 - Proposed Site Screening Levels for Groundwater

150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Groundwater Criteria (ug/L)			Practical Quantitation Limit[4]	Proposed Site Screening Level
	Protection of Human Health				
	MTCA Method B[1]	Federal MCL[2]	WA State MCL[3]		
MCPA				7	--
MCPP				4.7	--

Notes:
"--" Indicates no applicable criteria.
[1]Model Toxics Control Act Cleanup Regulation (MTCA), Chapter 173-340 of the Washington Administrative Code, Method B standard formula values.
[2]US Environmental Protection Agency Maximum Contaminant Levels (MCLs), 40CFR 141.
[3]Washington State maximum contaminant levels (MCLs), WAC 246-290-310
[4]Laboratory PQLs provided by Analytical Resources, Inc (ARI) of Tukwila, Washington.
[5]MTCA Method A cleanup levels for groundwter, Table 720-1.

Table 3 - Proposed Site Screening Levels for Soil Vapor

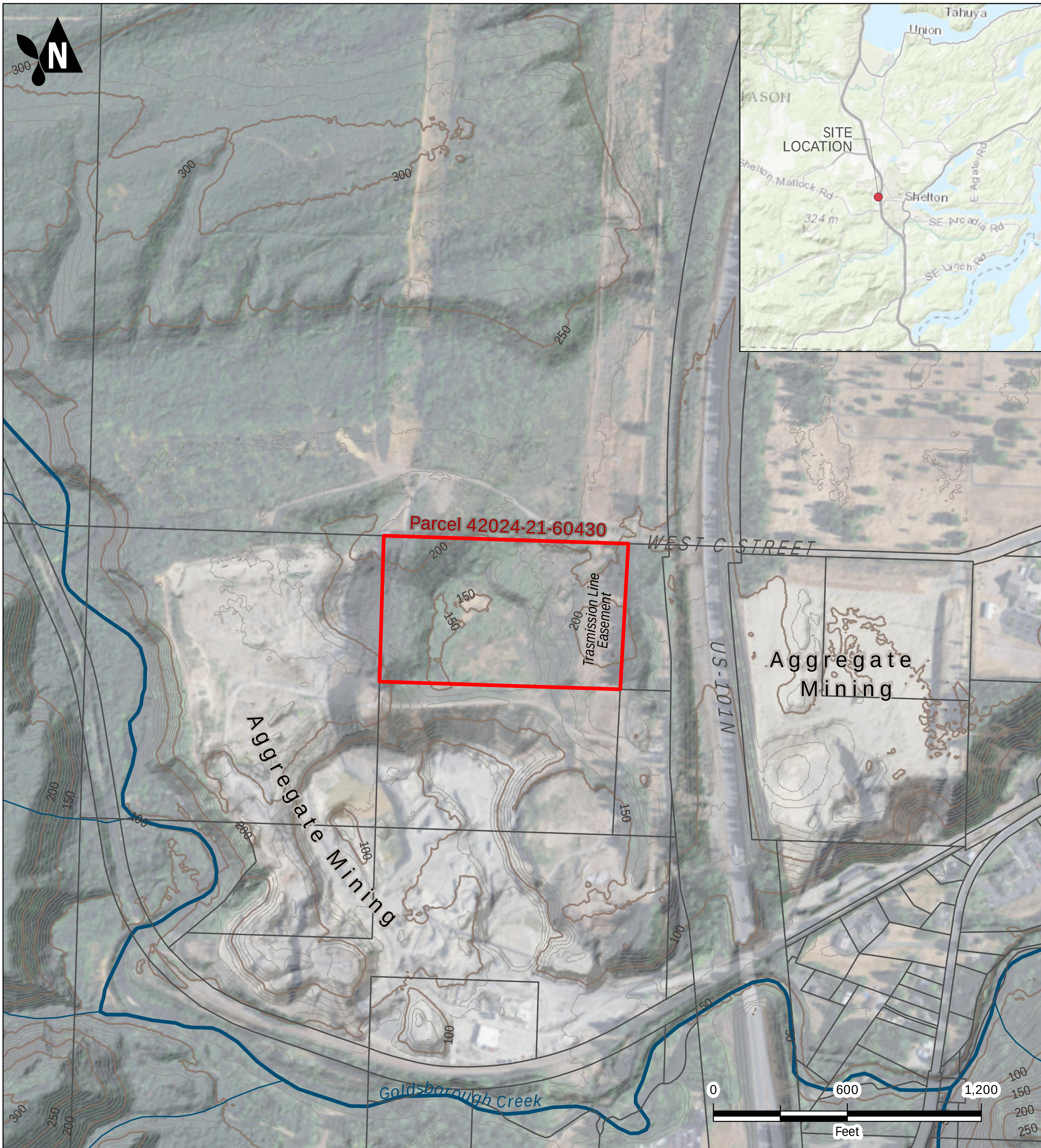
150074 Shelton C Street Landfill Remediation, Shelton WA

Analyte (by group)	Applicable Soil Vapor/Soil Gas Critiera (µg/m³)[1] Sub-Slab Method B	Deep Soil Gas Method B
Total Petroleum Hydrocarbons		
APH [EC5-8 aliphatics] fraction	90000	270000
APH [EC9-12 aliphatics] fraction	4700	14000
APH [EC9-10 aromatics] fraction	6000	18000
Metals		
mercury	4.6	13.7
Polycyclic Aromatic Hydrocarbons		
naphthalene	2.5	7.4
Semivolatile Organic Compounds		
bis(2-chloroethyl)ether	0.3	0.8
dichlorobenzene;1,2-	3048	9143
dichlorobenzene;1,4-	7.6	23
nitrobenzene	2.1	6.3
trichlorobenzene;1,2,4-	30	91
Volatile Organic Compounds		
acrolein	0.3	0.9
benzene	10.7	32.1
bromodichloromethane	2.3	6.8
bromoform	75.8	227
bromomethane	76.2	229
carbon disulfide	10667	32000
carbon tetrachloride	13.9	41.7
chlorobenzene	762	2286
chloroform	3.6	10.9
chloromethane	1371	4114
cumene	6095	18286
dibromochloromethane	3.1	9.3
dichlorodifluoromethane	1524	4571
dichloroethane;1,1-	52.1	156
dichloroethane;1,2-	3.2	9.6
dichloroethylene;1,1-	3048	9143
dichloropropane;1,2-	8.3	25.0
dichloropropene,1,3-	20.83	62.50
ethylbenzene	15238	45714
ethylene dibromide (EDB)	0.14	0.42
hexachlorobutadiene	3.8	11.4
methyl ethyl ketone	76190	228571
methyl isobutyl ketone	45714	137143
methyl tert-butyl ether	321	962
methylene chloride	8333	25000
styrene	15238	45714
tetrachloroethane;1,1,1,2-	11.3	33.8
tetrachloroethane;1,1,2,2-	1.4	4.3
tetrachloroethylene (PCE)	321	962
toluene	76190	228571
trichloroethane;1,1,1-	76190	228571
trichloroethane;1,1,2-	5.2	15.6
trichloroethylene (TCE)	12.3	37.0
trichlorofluoromethane	10667	32000
trimethylbenzene;1,2,4-	107	320
vinyl acetate	3048	9143
vinyl chloride	9.3	28
xylene;m-	1524	4571
xylene;o-	1524	4571

µg/m³ = microgram per cubic meter

[1]Washington State Deparment of Ecology Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, Table B-1, April 2015 (Ecology, 2016).

FIGURE



Shelton C Street Landfill Property

Mason County Parcel

Topographic contours derived from PSLC LiDAR, 2005

Site Vicnity Map

COPC and Site SLs Memorandum
Shelton C Street Landfill
Mason County, Washington

Aspect CONSULTING

JAN-2017	BY: CEB / RAP	FIGURE NO.
PROJECT NO. 150074	REVISED BY: - - -	1

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GIS Path: T:\projects_8\Shelton C Street Landfill\Delivered\COPC and Site SLs Memo\1 Site Vicinity Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 1/9/2017 || User: rpepin || Print Date: 1/9/2017