Lower Duwamish Waterway
Preliminary Cleanup Level Workbook
Supplemental Information

This supplemental information paper provides background information and instructions for using the Preliminary Cleanup Level (PCUL) workbook for the Lower Duwamish Waterway (LDW). PCULs apply to upland MTCA sites that have environmental transport pathways to the LDW and may impact surface water, sediments, or organisms in the river. The PCULs cover transport pathways to the river as well as additional pathways to support full MTCA cleanup actions.

The PCUL document is not intended to be used to establish discharge limits for permitted or unpermitted discharges at any site, water quality criteria for the LDW or other surface waters, or sediment CULs outside of the LDW.

The PCUL document implements the technical approach in an Ecology (2016a) policy memo regarding ground water CULs for the LDW by expanding it to more chemicals and additional transport pathways and by updating applicable or relevant and appropriate requirements (ARARs). The policy memo provides detailed discussions of the following issues that are not repeated here:

- Beneficial uses of the LDW
- Applicability of state and federal WQC for conventional parameters
- Rationale for using Method B CULs
- Descriptions of literature references used to estimate water concentrations protective of aquatic life.

The PCULs are calculated consistent with the Model Toxics Control Act (MTCA, 173-340 WAC), the Sediment Management Standards (SMS, 173-204 WAC), guidance associated with both of these regulations, and the CULs and remedial action levels (RALs) in EPA's (2014) record of decision (ROD) for the LDW.

The PCUL workbook has undergone quality assurance checks. Nevertheless, users are advised to perform their own quality assurance checks. Please notify Priscilla Tomlinson at priscilla.tomlinson@ecy.wa.gov or 425-649-7135 if potential errors are identified.

Purpose of PCULs

The PCULs in the workbook are intended to be used for two purposes during the cleanup process:

- Remedial investigation: Initial screening of environmental chemical concentrations to identify chemicals and transport and exposure pathways of concern
- Feasibility study and cleanup action plan (CAP): Starting point for developing final, site-specific CULs and remediation levels (RELs, WAC 173-340-355).

The comparison of site contaminant concentrations to PCULs may be used to identify contaminants of potential concern (COPCs). In addition, if environmental concentrations of a

chemical in a receiving medium do not exceed its PCUL for that medium, these data may be used to support an empirical demonstration that the applicable transport pathway is not occurring. Additional information concerning length of time the contamination has been present and anticipated future site conditions must also be considered in the empirical demonstration per WAC 173-340-747(9) and Implementation Memo 15 (Ecology 2016b).

For example, ground water concentrations in compliance with the ground water PCUL for a specific chemical could support a proposal to eliminate the leaching pathway from the soil PCUL for that chemical. Similarly, sediment concentrations in compliance with the target sediment concentration identified in the PCUL workbook could support a proposal to eliminate protection of sediment from the ground water PCUL. The Ecology cleanup project manager (site manager) will determine whether an empirical demonstration has been met.

The PCUL document should be the starting point for development of final CULs for LDW sites. Final CULs may be different from PCULs for reasons including, but not necessarily limited to, the following:

- Commercial or industrial land use (soil or air only)
- Exclusion from the terrestrial ecological evaluation (TEE) or qualification to use the simplified TEE
- Elimination of a transport pathway due to an empirical demonstration
- Consideration of natural attenuation during environmental transport
- Availability of biological data that over-ride the results of chemical testing (e.g., whole effluent toxicity test, benthic toxicity bioassay)
- Use of site-specific modeling (e.g., Reible sediment model, site-specific modeling of ground water transport)
- Adjustments based on practical quantitation limits (PQLs)
- Adjustments to consider additive noncancer hazards and cancer risks due to multiple chemicals and multiple exposure pathways.

Some of the issues listed above are discussed later in this document.

Contents of Workbook

PCULs were calculated for a variety of environmental transport and exposure pathways. Soil PCULs are labeled SL-1 through SL-10; ground water PCULs are labeled GW-1 through GW-5; air PCULs are labeled AR-1; and soil gas PCULs are labeled SG-1 and SG-2. A full list is provided below.

The environmental transport pathways to the LDW that are addressed in the PCUL document include the following (Figure 1):

- Transport of contaminated ground water to surface water (GW-2)
- Partitioning of ground water contamination to sediment (GW-3)
- Leaching of soil contaminants to potable ground water from the vadose zone (SL-2) or the saturated zone (SL-5)
- Leaching of soil contaminants from the vadose zone (SL-3) or the saturated zone (SL-6) to ground water followed by transport to surface water

- Leaching of soil contaminants from the vadose zone (SL-4) or the saturated zone (SL-7) to ground water followed by partitioning to sediment
- Erosion of contaminated soil directly to sediment (SL-8)
- Transport of soil into a storm water pipe that outfalls to the river (SL-8)
- Infiltration of soil (SL-8) or ground water (GW-2) into a storm water pipe that outfalls to the river.

The water portion of the surface runoff pathway, either directly into the river or into a storm drain that outfalls to the river, is not addressed by the PCUL document. However, if soil is protective of the leaching pathway (SL-2 through SL-7) and bank erosion (SL-8), it is expected that the water in surface runoff will also be protective. Other pathways for contaminants to be transported to the LDW, such as atmospheric deposition and spills directly to the waterway, should be discussed with the Ecology site manager.

The PCUL document includes the following media and pathways that do not involve the river:

- Upland soil contamination (SL-1 and SL-9)
- Ground water contamination in a potable aquifer (GW-1)
- Intrusion of soil vapors (SG-1 and SG-2) or vapors from ground water (GW-4) into a building.

The environmental exposure pathways and potential receptors addressed in the PCUL document include the following (Figure 2):

Medium	Exposure Pathway	Human Receptors	Ecological Receptors
Soil	Direct contact	SL-1	SL-9 (terrestrial)
Ground water	Potable use	GW-1	--
Air	Inhalation	AR-1	--
Surface water	Direct contact	--	GW-2 (aquatic)
	Seafood consumption	GW-2	--
Sediment	Direct contact	GW-3	GW-3 (benthic)
	Seafood consumption	GW-3	GW-3 (higher trophic level)

The most stringent PCULs are identified for residential land use. PCULs for industrial land use are also available and may be substituted if the site manager agrees that a site qualifies for industrial land use. The CULs for many chemicals are dominated by the leaching pathway; these CULs are not expected to be affected by land use.

The following individual PCULs are provided in the workbook.

PCUL Number	PCUL Name
SL-1	Direct contact under unrestricted land use
SL-2	Vadose zone protection of drinking water
SL-3	Vadose zone protection of surface water via ground water
SL-4	Vadose zone protection of sediment via ground water
SL-5	Saturated zone protection of drinking water

PCUL Number	PCUL Name
SL-6	Saturated zone protection of surface water via ground water
SL-7	Saturated zone protection of sediment via ground water
SL-8	Protection of sediment via soil erosion
SL-9	Site-specific TEE for unrestricted land use
SL-10	Natural background concentration
GW-1	Drinking water
GW-2	Protection of surface water
GW-3	Protection of sediment
GW-4	Protection of indoor air
GW-5	Natural background concentration
AR-1	Air cleanup level
SG-1	Sub-slab soil gas screening level for protection of indoor air
SG-2	Deep soil gas screening level for protection of indoor air

The workbook contains the following groups of sheets that contain sets of related information.

Category	Sheet	Contents
--	Mod	History of modifications
Media Summaries	SL	Most conservative soil PCULs
	GW	Most conservative ground water PCULs
	AR	PCULs for air and soil gas
Background Information	Chem	Chemical names, CAS numbers, and synonyms
	Param	Chemical and toxicological parameters
	Eqtn	Equations for calculating PCULs and non-chemical-specific parameter values for input to equations
Soil Calculation Support	SL-Det	Equation values for soil contact, table values for the TEE, and the TSCA[1] ARAR value for PCBs
	SL-Eq	Calculations for MTCA Equations 740-1, 740-2, 745-1, and 745-2 (soil contact)
	Leach	Calculations for MTCA Equation 747-1 (soil leaching to ground water)
Ground Water Calculation Support	PW	ARARs and MTCA equation values for potable water and ground water screening levels for vapor intrusion
	SW	ARARs for surface water and MTCA equation values for ingestion of fish
	GW-Eq	Calculations for MTCA Equations 720-1 and 720-2 (drinking water) and 730-1 and 730-2 (surface water)
	Partit	Calculations for modified MTCA Equation 747-1, which is used to model partitioning between ground water and sediment

1 CUL is for self-implementing cleanups, consistent with Method A.

Category	Sheet	Contents
	VI	Calculations for ground water screening levels for protection of indoor air
Sediment Calculation Support	Sed	SMS criteria for marine benthic organisms, sediment contact target concentrations, CULs and RALs from the ROD
	Sed-Eq	Calculations for SMS Equations 9-1 and 9-2 for three sediment contact scenarios from the ROD
Air Calculation Support	AR-Det	Equation values for air cleanup levels and soil gas screening levels
	AR-Eq	Calculations for MTCA Equations 750-1 and 750-2 (air inhalation)

Detailed notes on individual chemicals and on the contents of each sheet are provided in Tables 1 and 2, respectively. Table 3 provides definitions of acronyms. Within the spreadsheet, when the value for an individual chemical is obtained from a different source or represents a different endpoint from the other chemicals in the same column, this is explained in a comment inserted into the cell.

The PCULs in the workbook are calculated using ARARs; the equations in MTCA, SMS, and associated guidance; selected input parameters, including some site-specific values; and, for some chemicals, literature values for aquatic toxicity. PCUL values were not copied directly from Ecology's Cleanup Levels and Risk Calculation (CLARC) website. Some PCULs differ from the values presented in CLARC due to either site-specific assumptions or slight differences in rounding.

The chemicals included in the workbook are those that are commonly analyzed at MTCA sites. The chemical list does not imply that these are the only chemicals that should be analyzed at sites along the LDW. All chemicals suspected of being present, based on site history, should be analyzed. If a detected analyte is not listed in the workbook, request Ecology to develop PCULs for the analyte. The Ecology site manager must approve PCULs for chemicals not listed in the workbook.

On the soil and ground water summary sheets, the most stringent PCUL is identified from among multiple pathway-specific PCULs. If the most stringent PCUL falls below the natural background concentration, it is adjusted up to the natural background concentration. To address the possibility that one or more pathways are not applicable at a site, a column is provided for the user to define a PCUL that excludes one or more endpoints listed on the summary sheet. PCULs in the workbook are not adjusted for PQLs, as discussed later in this document.

On the far right side of some sheets is a matrix showing the basis for the most stringent PCUL for informational purposes. For example, the most stringent PCUL might be based on an ARAR, an adjusted ARAR, a value calculated using a Method B equation, a value calculated using the three-phase model, or natural background.

PCULs do not contain information related to point of compliance. For information on this topic, refer to the applicable sections of MTCA and SMS. Points of compliance must be approved by the Ecology site manager.

The PCULs are considered a living document. Updates to parameters or criteria may be incorporated into future revisions.

Site-Specific Assumptions

Some of the PCULs are based on information that is specific to the LDW. These aspects of the PCULs should be considered carefully before applying them to sites outside the LDW drainage basin. This process should not be used to establish soil or ground water PCULs to protect sediment outside of the LDW.

The LDW-specific information includes the following:

- The receiving surface water and sediments are marine and the surface water is nonpotable.
- The fish consumption rate is 97.5 grams/day[2], based on the LDW human health risk assessment (LDWG 2010).
- The scenarios for human contact with sediment are from the LDW human health risk assessment (LDWG 2010).
- Sediment natural background levels for total PCB congeners, total PCB toxicity equivalents (TEQ), total dioxin/furan TEQ, arsenic, and total cPAH TEQ are from the ROD.
- The natural background concentration of arsenic in ground water is based on Ecology (2013) for the Puget Sound Basin and EPI et al. (2006).
- Soil natural background levels for metals are from Ecology (1994) for the Puget Sound region.
- Ground water PCULs for protection of sediment are calculated using a modified version of the MTCA three-phase model (Equations 747-1 and 747-2), using LDW-specific parameter values for fraction organic carbon, porosity, and particle density (Ecology 2016a). Site-specific modeling approaches may be proposed to the Ecology site manager for LDW sites.

When water quality criteria for protection of aquatic life are not available, the following literature sources may be used to estimate concentrations protective of aquatic life [WAC 173-340-730(3)(b)(ii)]:

- Risk Assessment Information System (University of Tennessee 2013)
- NOAA (2008) screening quick reference tables (SQuiRT)
- Verbruggen et al. (2008)
- De Rooij et al. (2004)
- EPA's EcoTox database.

[2] Note that the state water quality criteria for human health are based on a fish consumption rate of 175 g/day. The evaluation of the protectiveness of these ARARs is discussed later in this document.

Values from these literature sources have been included for some of the commonly encountered chemicals (Ecology 2016a), but not for all chemicals in the PCUL workbook. The Ecology site manager will determine whether these or other literature sources should be consulted for additional chemicals detected at LDW sites.

Cautions on Modifications to the Workbook

The user of this workbook is advised to exercise caution when making changes because of the possibility of introducing errors. Always check the source of cell contents before editing a cell. The following workbook features should be considered before making any changes.

Many cells contain formulas linking to other cells or other sheets within the workbook. For example, values on the three media summary sheets (SL, GW, and AR) are linked to the media detail sheets (e.g., SL-Det, PW, SW, and AR-Det). Many of the values on the detail sheets are linked to the various equation calculation sheets (e.g., SL-Eq, GW-Eq, Sed-Eq, VI, Leach, and Partit), which in turn link to the chemical-specific parameters sheet (Param) and the equations sheet (Eqtn).

Chemicals are listed in the same order on each sheet. Do not move chemicals from one row to another on any of the sheets. Changes to the lists of chemicals on one sheet could result in confusion and potentially incorrect linkage among sheets. New chemicals may be added, but care must be exercised to insert each chemical in the same order on all sheets.

If changes are made to input parameters used in equations, these changes should be made to cells without formulas in the 'Param' sheet or the 'Eqtn' sheet. If the modification is made to the correct cell, the modification will be propagated correctly throughout the workbook.

The Ecology site manager will determine whether modifications to the workbook are warranted. All changes made to the workbook must be accompanied by a complete explanation of what was changed and why the change was appropriate.

Adjustments to ARARs

WQC and maximum contaminant levels (MCLs) constitute ARARs under MTCA. ARARs were evaluated to determine if any adjustments were required according to WAC 173-340-720(7)(b) and -730(5)(b). The adjustments discussed in this section pertain to individual ARARs. PCULs are not adjusted to account for multiple chemicals or multiple exposure pathways; this adjustment should be performed when developing final CULs for the feasibility study or CAP. The Ecology site manager will determine whether ground water at a site is considered potable and thus subject to MCLs.

The derivation of the ground water PCUL for protection of potable water (GW-1) involves identifying MCLs and calculating ground water CULs per MTCA Equations 720-1 and 720-2 using the toxicity values in the CLARC database (Figure 3). If the ratio of the minimum MCL to the Equation 720-1 value does not exceed 1, then the hazard quotient associated with the MCL does not exceed 1 and the MCL requires no adjustment. If the ratio exceeds 1, the MCL is adjusted to the Equation 720-1 value to achieve a hazard quotient of 1.

If the ratio of the minimum MCL to the Equation 720-2 value does not exceed 10, then the cancer risk associated with the MCL does not exceed $1x10^{-5}$ and the MCL requires no adjustment. If the ratio exceeds 10, the MCL is adjusted to 10 times the Equation 720-2 value to achieve a cancer risk of $1x10^{-5}$.

If an MCL is available but no oral toxicity values are available to evaluate it (e.g., lead), the MCL is used without adjustment. If no MCL is available but an oral toxicity value is available, the minimum of the values from Equations 720-1 and 720-2 is used. If a chemical has no toxicity values and no MCL, there is no PCUL for potable water.

Similarly, the derivation of the ground water PCUL for protection of surface water (GW-2) involves identifying WQC and calculating ground water CULs per MTCA Equations 730-1 and 730-2 using the toxicity values in the CLARC database (Figure 4)[3]. Similar ratios are calculated and adjustments made, if needed, as described above for MCLs. The fish consumption rate in these equations is adjusted to 97.5 g/day and the fish diet fraction[4] is adjusted to 1 (Ecology 2016a), consistent with the ROD.

For ease of calculation, the literature values for protection of aquatic life are included in the determination of minimum WQC, though they are not actually ARARs because they are not promulgated regulations. This placement of the literature values is unlikely to affect the final PCULs.

Notes on Specific Parameters

Chemical Properties

Values for chemical properties (e.g., Kow, Hcc, BCF) were obtained from Ecology's CLARC database and from EPA's (1996) *Soil Screening Guidance*. PCULs that are dependent on chemical properties (e.g., leaching) are not calculated for chemicals without values in these two sources.

Practical Quantitation Limits

If a final CUL needs to be adjusted to a PQL, the PQL must be approved by the Ecology site manager. Because PQLs can vary depending on the analytical method and instrumentation, the workbook does not provide PQLs for soil, ground water, or air. It was necessary to have sediment PQLs, however, to allow calculation of soil and ground water PCULs to protect sediment for bioaccumulative chemicals. The process for developing target sediment concentrations is provided later in this document.

Sediment PQLs are from the Sediment Cleanup User's Manual (SCUM) Tables 11-1 and D-1 and represent mid-range values (medians in Table 11-1 and averages in Table D-1) (Ecology

[3] A small number of State or Federal WQC require adjustment because of differences in toxicity values used between TCP and WQP. TCP uses the toxicity values from IRIS and EPA's regional screening levels workbook, developed for Superfund cleanup work. WQP generally uses the toxicity values from EPA's Clean Water Act Section 304(a) criteria documents for the National Recommended WQC.

[4] Proportion of the total fish diet obtained from the LDW.

2019). The values in Table 11-1 were derived by eliminating the minimum and maximum values reported in a survey of accredited laboratories and taking the median of the remaining values. Sediment PQL data are reported for additional chemicals in Table D-1, but the amount of data available was considered insufficient to derive median values using the procedure for Table 11-1. For some chemicals in Table D-1, PQL values were available from only one or two laboratories. The average PQLs in Table D-1 are associated with a much higher level of uncertainty than the median values in Table 11-1.

Natural Background Concentrations

Natural background concentrations are provided for soil, ground water, and sediment where available. Potentially liable parties (PLPs) may propose natural background concentrations for additional chemicals per WAC 173-340-709.

Natural soil background concentrations are based on the 90th percentile, the 80th percentile, or four times the median of the data set of natural background concentrations. The choice of the statistical parameter depends on the shape of the distribution. In Ecology's (1994) background soil evaluation, non-detected values in the data sets were replaced with half the detection limits.

Natural sediment background concentrations for most chemicals are based on the upper 90 percent tolerance limit on the 90th percentile (90/90 UTL) of the background data set, as reported in Table 10-1 of SCUM (Ecology 2019). Non-detected values in the background data sets were handled using the Kaplan-Meier approach.

The natural background values for total PCB congeners, total dioxin/furan TEQ, and arsenic in sediment were taken from the ROD to be consistent with EPA's sediment cleanup. The values in the ROD are based on the upper 95 percent confidence limit (95UCL) on the mean of the background data set.

Washington State Water Quality Standards for Human Health

The ground water PCUL for protection of surface water (GW-2) considers State and Federal WQC for protection of aquatic life and humans consuming aquatic life. The State WQC for protection of human health were adopted on August 1, 2016, and became effective on September 1, 2016 (Ecology 2016c). EPA published partial approval and partial disapproval of the Washington State WQC for human health on November 15, 2016 (EPA 2016). EPA's revisions to the Washington State WQC became effective on December 15, 2016. EPA then retracted its partial disapproval on May 10, 2019, and plans to initiate a notice and comment process to withdraw the related federally promulgated criteria. The State of Washington has filed a legal challenge to EPA's withdrawal.

Both the State and the Federal WQC are provided on the 'SW' sheet; the State WQC are in the column titled 'WA State WQC, Human Health, Consumption of Organisms' while the Federal WQC are included in the column titled 'WA Toxics Rule, Protection of Human Health, Consumption of Organisms'. The WA Toxics Rule criteria will remain in the spreadsheet until state's legal challenge has been resolved. The minimum ARAR for surface water considers the values in both of these columns, as well as values from the National Recommended Water

Quality Criteria (NRWQC) for protection of human health and values from the State and NRWQC for protection of aquatic life.

Target Sediment Concentrations

It is necessary to have target sediment concentrations for the purpose of calculating ground water and soil PCULs protective of sediment. The minimum sediment CULs in the ROD are the preferred values for the target sediment concentrations. For chemicals not listed in the ROD, the target sediment concentrations are developed consistent with the SMS (Ecology 2019) sediment cleanup objective (SCO) (also referred to as lower tier) (Figure 5). SMS cleanup screening levels (CSLs, also referred to as upper tier) and the RALs in the ROD are also provided. The CSLs and RALs are not used for developing PCULs but are provided for potential use when developing site-specific CULs or RELs.

The ROD lists six different CULs and 13 different RALs covering four different remedial action objectives and multiple depth horizons. All of the CULs and RALs are provided in the PCUL workbook; the minimum CULs are used for developing PCULs. For some sites the Ecology site manager may determine that the minimum CULs are not applicable. In these cases, the applicable CULs or RALs can be identified in a user-defined target sediment concentration column.

Some of the criteria for protection of benthic life are expressed in terms of organic carbon (OC) normalized concentrations. Because TOC normalized values are not comparable to other sediment CULs, which are expressed in dry weight, the lowest apparent effects thresholds (LAET) values are listed for comparison with other sediment CULs to select the appropriate target sediment concentration. LAET values are expressed as dry weight. When developing CULs for the feasibility study or CAP, it may be appropriate to express benthic criteria as OC normalized.

Chapter 9 of SCUM (Ecology 2019) provides two methods for establishing sediment CULs for bioaccumulative chemicals. If data for sediment and aquatic tissue concentrations are available, a site-specific biota-to-sediment accumulation factor (BSAF) can be determined. This method requires a large level of effort. In many cases, the sediment CUL calculated using a site-specific BSAF is below the natural background concentration or the PQL. Thus, a simpler approach is to set the sediment CUL to the maximum of natural background and the PQL. Site-specific BSAFs are not available for the LDW, so the simplified background/PQL approach was used to establish target SMS concentrations for bioaccumulative chemicals in the PCUL workbook.

A chemical was considered bioaccumulative if it occurs on a list of bioaccumulative chemicals ***and*** there is evidence that the chemical is present in LDW seafood at concentrations of potential concern. Bioaccumulative chemicals were identified from the following two lists:

- Persistent bioaccumulative toxins (WAC 173-333-310) (43 analytes)
- Primary (List 1) and candidate (List 2) bioaccumulative contaminants of concern (DMMP 2018) (24 analytes).

Due to overlap between the two lists, a total of 59 analytes were identified as bioaccumulative in sediments.

Chemicals present in LDW seafood at levels of potential concern were identified from the following two lists:

- COCs for human consumption of seafood from the LDW (LDWG 2010, Table B.7-1) (18 analytes)
- COCs for higher trophic level receptors in the LDW (LDWG 2010, Table A.8-1) (5 analytes).

Due to overlap between the two lists, a total of 21 analytes were identified as present in LDW seafood at levels of potential concern.

The following 18 analytes were identified as bioaccumulative for the purpose of developing target sediment concentrations under SMS because they fit both criteria (persistent bioaccumulative toxins ***and*** present in LDW tissues at levels of potential concern):

- Total PCB congeners and total PCB TEQ
- 2,3,7,8-TCDD and total dioxin/furan TEQ
- Arsenic and mercury
- Tributyltin
- Carcinogenic PAH TEQ
- Hexachlorobenzene and pentachlorophenol
- Aldrin, chlordane, total DDTs, dieldrin, heptachlor, and heptachlor epoxide.

For the sake of consistency, 4,4'-DDT was also considered bioaccumulative.

The SCO (lower tier) concentration for a bioaccumulative chemical is set to the higher of natural background and the PQL. If neither a natural background concentration nor a numerical PQL value is available, the target sediment concentration is indicated as the text entry "PQL".

When the target SMS sediment concentration for a chemical is listed as the text entry "PQL" rather than a numerical value, it is not possible for the workbook to calculate numerical ground water or soil PCULs for protection of sediment. In these cases, the ground water and soil PCULs are listed as "TBD" (to be determined). Until a numerical sediment PQL is entered, the workbook will ignore non-numerical entries when identifying the most stringent soil and ground water PCULs. If a numerical sediment PQL for this chemical is entered on the 'Sed' sheet, all of the associated calculations will self-populate throughout the workbook.

Inclusion of Chemicals that LDWG Eliminated as Indicator Chemicals

LDWG (2010) eliminated some of the chemicals identified as COCs in their human health and ecological risk assessments from the final list of indicator chemicals based on considerations of frequency of detection, frequency of exceedance, analytical interference, and contribution to overall risk. For the reasons discussed below, Ecology assumed that all of the chemicals on LDWG's lists of COCs are potentially present in LDW seafood.

Although bis(2-ethylhexyl)phthalate (BEHP) and pentachlorophenol were listed as COCs for human consumption of seafood in RI Table B.7-1, LDWG eliminated them from the list of indicator chemicals (i.e., risk drivers) for human health because of small contribution to overall

risk and low frequency of detection. LDWG eliminated tributyltin and vanadium as indicator chemicals because the associated hazard quotients were only slightly above 1 for only one seafood consumption scenario. LDWG eliminated eleven organochlorine pesticides for three reasons: low contribution to overall risk; analytical interference due to high PCB concentrations in the samples that likely biased the pesticide results high; and, in some cases, low frequency of detection. Each of these issues could manifest differently on the small scale of individual upland cleanup sites, so Ecology did not eliminate any of these chemicals from consideration as being potentially present in LDW seafood. However, BEHP, vanadium, and three of the pesticides were not present on the lists of bioaccumulative chemicals and so were not treated as bioaccumulative for that reason.

The higher trophic level species evaluated in LDWG's ecological risk assessment included crabs, great blue herons, ospreys, river otters, and harbor seals. Chemical exposures for these receptors are dominated by their seafood diets. Total PCB exposures to crabs and otters exceeded their lowest observed adverse effect levels (LOAELs) and LDWG retained total PCBs as an indicator chemical for ecological receptors. PCB TEQ, arsenic, mercury, and zinc exposures exceeded the no observed adverse effect levels for crabs, otters, or osprey. LDWG eliminated these chemicals as risk drivers because exposures did not exceed the LOAELs. However, chemical concentrations associated with individual upland cleanup sites may be different from the river-wide exposure concentrations considered in LDWG's ecological risk assessment. Ecology considered all of the listed chemicals to be potentially present in LDW seafood. All of these chemicals are also considered bioaccumulative and so were treated as bioaccumulative for the purpose of deriving target sediment concentrations.

Soil PCULs to Protect Ground Water

MTCA Equation 747-1, shown below, is used to calculate soil PCULs protective of ground water via the leaching pathway (SL-2 through SL-7, Figure 6).

$$C_{soil} = C_{gw}\ x\ UCF\ x\ DF\ \left[K_d + \frac{\theta_w + \theta_a\ x\ H_{cc}}{\rho_b}\right]$$

Where:

C_{soil} = Soil PCUL for protection of ground water (mg/kg) (chemical-specific)
C_{gw} = Ground water PCUL (µg/L) (chemical-specific)
UCF = Unit conversion factor (1 mg/1,000 µg)
DF = Dilution factor (unitless) (default values: 20 for vadose zone or 1 for saturated zone)
K_d = Soil-water distribution coefficient (L/kg) (chemical-specific) (K_d for organic chemicals is calculated per MTCA Equation 747-2 below)
θ_w = Water-filled porosity (default values 0.3 ml/ml for vadose zone or 0.43 ml/ml for saturated zone)
θ_a = Air-filled porosity (default values of 0.13 ml/ml for vadose zone or 0 ml/ml for saturated zone)
H_{cc} = Henry's law constant (unitless) (chemical-specific)
ρ_b = Dry soil bulk density (default 1.5 kg/L).

MTCA Equation 747-2, shown below, is used to calculate Kd for organic chemicals:

$$K_d = K_{oc} \times f_{oc}$$

Where:

K_{oc} = Soil organic carbon-water partitioning coefficient (ml/g) (chemical-specific)
f_{oc} = Soil fraction of organic carbon (default 0.001 g/g)
Kd is as defined above.

Site-specific values may be used for f_{oc}, θ_w, θ_a, and ρ_b if approved by the Ecology site manager.

Soil PCULs for protection of ground water are calculated separately for the vadose and the saturated zones because of different default assumptions for DF, θ_w, and θ_a. Because ground water is shallow near the LDW, and because site development activities may move soils from the vadose zone to areas where they could become saturated, the use of soil PCULs for the vadose zone must be approved by the Ecology site manager.

For nonvolatile chemicals without numerical values for Henry's law constant (H_{cc}), the portion of the equation that uses Hcc is eliminated from the calculation. Otherwise, it would not be possible to perform the calculation. Exclusion of the vapor phase when modeling leaching for nonvolatile chemicals is not expected to result in significant error. For volatile chemicals without numerical values for Hcc, no leaching calculation is performed because failure to consider the vapor phase could result in significant error.

Ground Water PCULs to Protect Sediment

The following modified version of the MTCA three-phase model is used to calculate ground water PCULs protective of sediment on the 'Mod.Eq747-1' sheet of the workbook. The equation below is based on an Ecology (2016a) memorandum, but the target sediment concentrations have been updated to LAET values, as discussed previously. The ground water PCULs for protection of sediment supersede the CULs published in the 2016 memorandum.

$$C_{gw} = \frac{C_{sed}}{UCF\ x\ DF\ \left[K_d + \frac{\theta_w}{\rho_b}\right]}$$

Where:

C_{gw} = Ground water PCUL for protection of sediment (µg/L) (chemical-specific)
C_{sed} = Target sediment concentration (mg/kg) (chemical-specific)
UCF = Unit conversion factor (1 mg/1,000 µg)
DF = Dilution factor (unitless) (default value of 1 for saturated sediment)
K_d = Soil-water distribution coefficient (L/kg) (chemical-specific) (K_d for organic chemicals is calculated per MTCA Equation 747-2 above)
θ_w = Water-filled porosity (0.615 ml/ml) (LDWG 2010)
ρ_b = Dry sediment bulk density (1.02 kg/L) (Ecology 2016a).

A default f_{oc} value of 0.019 g/g is used in Equation 747-2, based on the remedial investigation (RI) report (LDWG 2010). Site-specific values may be used for f_{oc}, θ_w, and ρ_b if approved by the Ecology site manager.

When developing CULs for the FS or CAP, if some of the sediment CULs are expressed as OC normalized (see Target Sediment Concentrations above), the Kd value in the equation above should be replaced by Koc and the term θ_w/ρ_b should be eliminated. The elimination of this term will have negligible impact on the result.

It should be noted that the three-phase model is a simple mass-balance equation calculated independently for each contaminant in soil. It was developed for soil subsurface conditions and uses mass-balance between soil grains, air pore-space, and associated aqueous phases. The mass balance among the three phases is based on two chemical factors: Kd and Henry's Law constant. Sediment and water physicochemical conditions (e.g. salinity, pH, hardness, dissolved oxygen, alkalinity, and multiple solutes) and dynamic physical conditions (e.g. currents; waves; daily, monthly, and annual temporal temperature changes; and light intensity) are significantly different from and more complex than soil. Hence, the model results for the transition zone between ground water and surface water do not fully account for the complexity of this environment.

These differing physicochemical sediment/water conditions have diverse impacts upon various chemical classes and their ionic forms and partial charges, which in turn, impact bioavailability and toxicity. For example, metals are often significantly affected by the physicochemical properties (e.g., pH, alkalinity, salinity) of the water. Marine or estuarine water can significantly impact pH due to its high buffering capacity. High sulfide conditions within the marine environment can also significantly affect formations of metal–sulfide complexes. Changes in pH in the near shoreline transition zone between fresh ground water and saline marine water can regulate dissolution of the metal solids in upland soil leachate.

Nonpolar organics, on the other hand, are less affected by these conditions because their nonpolar properties restrict the chemical response to the water conditions. However, light-intensity has a greater impact on non-polar organics due to their photoactivation properties and this significantly affects reactivity and toxicity.

With approval from the Ecology site manager, other models developed specifically for sediment and water may be used on a site-specific basis with site-specific modifications, such as the Reible Two-Layer Sediment Cap and Steady State Analytical[5]. The Two-Layer model was developed to predict sediment cap effectiveness and is a two layer steady state model that predicts concentrations and fluxes in a chemical isolation layer or in the near surface biologically active zone (bioturbation layer).

The Steady State model uses input parameters that incorporate a significant number of variables that may be important in improving overall model accuracy in predicting effectiveness. Some of these variables include depositional velocity, conventional and active cap decay rates, and carbon fractions within conventional and active cap layers. The model determines concentrations and fluxes in a two layer sediment cap at steady-state, using various sediment, water and contaminant

[5] Available at: https://www.depts.ttu.edu/ceweb/groups/reiblesgroup/downloads.html.

factors assuming advection, diffusion, dispersion, deposition/erosion, sorption onto colloidal organic matter, and boundary layer mass transfer. This is normally used to estimate migration through an active layer (lower layer) and a conventional cap layer (upper layer). Unlike the Two-Layer model, however, the Steady State model does not consider a bioturbation layer.

The Two-Layer Sediment Cap and the Steady State Analytical models cannot be used for the PCULs because they require site-specific data. The modified version of the MTCA three-phase model was used instead because it can be run on a general, default scenario. However, the modified three-phase model is likely to be conservative when applied to ground water-sediment partitioning. It will overestimate contaminant adsorption to sediments and thus provide a ground water PCUL that is lower (more protective) than necessary.

Soil PCULs to protect sediment (SL-4 and SL-7) are derived by using two modeling steps in tandem. First the ground water PCUL to protect sediment (GW-3) is calculated using the modified version of Equation 747-1. Then soil PCULs are calculated using the standard version of Equation 747-1. The use of two models in tandem introduces a higher level of uncertainty than the use of either model alone.

The soil and ground water PCULs for protection of sediment are useful for screening purposes, but professional judgement should be used when setting final CULs to protect sediment. For example, if bulk sediment concentrations do not exceed their target sediment concentrations, the Ecology site manager may consider the ground water to be protective of sediment regardless of the predictions of the partitioning model (i.e., empirical demonstration). Sediment bioassays and alternative partitioning models, such as those discussed above, can provide additional lines of evidence. The use of bioassays or alternative models must be approved by the site manager. The complete weight of evidence, including the empirical relationships between soil, ground water, and sediment concentrations, should be considered when developing final soil and ground water CULs for protection of sediment.

Vapor Intrusion Screening Levels

Ground water and soil gas screening levels for vapor intrusion are calculated per Ecology's (2010b, 2018b, 2018c) guidance. Evaluation of the vapor intrusion pathway should be conducted consistent with these guidance documents as well as Implementation Memo 14 (Ecology 2016d). Results for soil vapor samples collected sub-slab or up to about 15 feet below ground surface (bgs) should be compared with the sub-slab soil gas screening levels (Ecology 2009). Results for soil vapor samples collected deeper than about 15 feet bgs should be compared with the deep soil gas screening levels.

PCULs for Industrial/Commercial Land Use

Method C PCULs for soil and air at industrial sites are provided on detail pages in the workbook. These include soil PCULs for worker contact, site-specific and simplified TEE soil concentrations for industrial/commercial sites, air PCULs for industrial sites, and soil gas and ground water screening levels for protection of indoor air at industrial sites. These PCULs are not intended to be used for initial screening of soil and ground water data. They are provided for potential use when developing site-specific soil CULs or RELs at sites that qualify for industrial

land use per WAC 173-340-706(1), -745(1), and -745(2) as determined by the Ecology site manager. Note that soil CULs for many chemicals are likely to be based on the leaching pathway, which is not affected by the designation of a site as industrial.

Method C PCULs for drinking water and protection of surface water are not included in the workbook because industrial land use does not qualify a site for Method C in these media (Ecology 2016a). Method C is not normally used for ground water or surface water CULs.

Screening Levels for Terrestrial Ecological Evaluation

The TEE screening level provided for initial screening of soil data is the minimum of the values for protection of plants, soil biota, and wildlife in the site-specific TEE under unrestricted land use. Screening levels for site-specific TEEs under industrial/commercial land use and screening levels for simplified TEEs under both unrestricted and industrial/commercial land use are provided on the soil detail page for developing site-specific soil CULs or RELs. The Ecology site manager will determine if a site qualifies for the simplified TEE.

Note that if a site undergoes a site-specific TEE, PCULs for the TEE are needed for all detected chemicals, not just the chemicals listed in MTCA Table 749-3. On the other hand, if a site undergoes a simplified TEE, only the chemicals listed in MTCA Table 749-2 need to be evaluated in the TEE.

If the Ecology site manager determines that a site qualifies for exclusion from the TEE, SL-9 may be eliminated from consideration.

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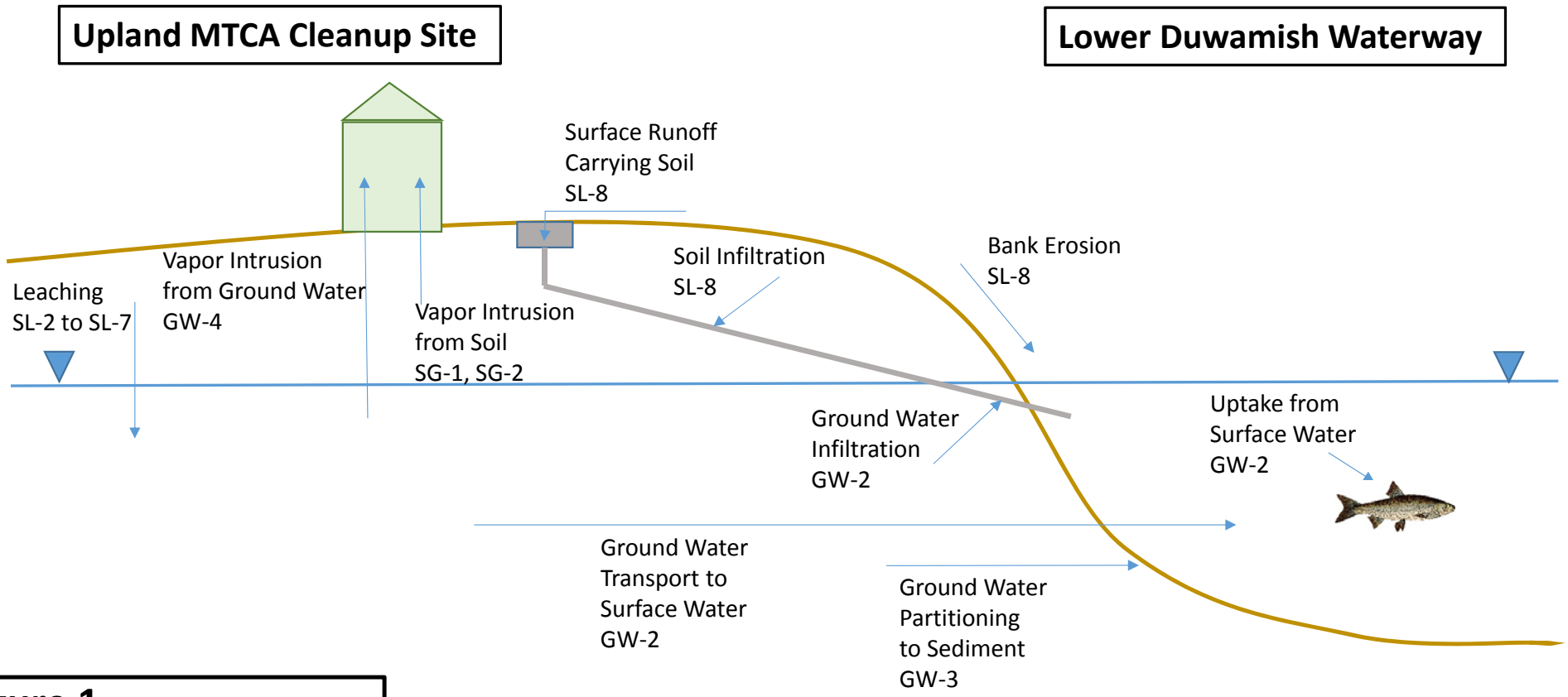

Figure 1.
Transport Pathways

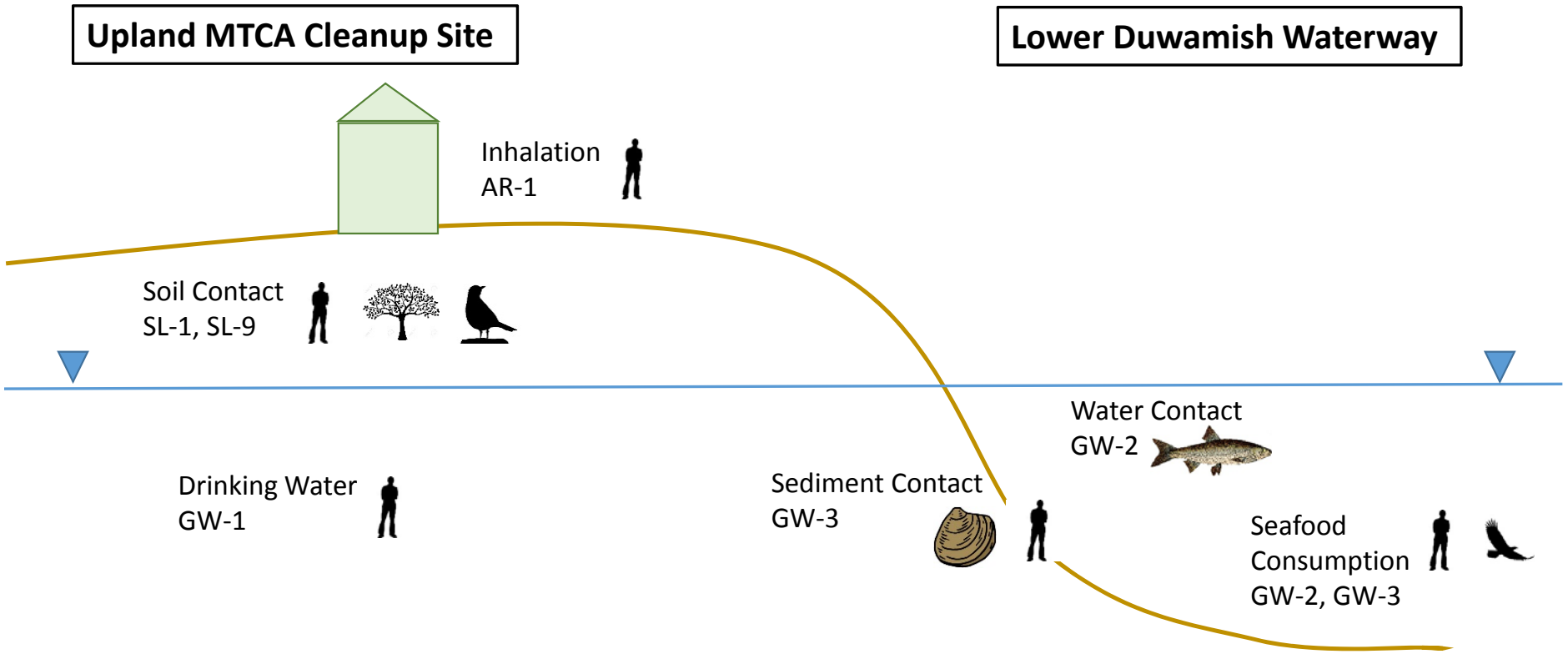

Figure 2.
Exposure Pathways

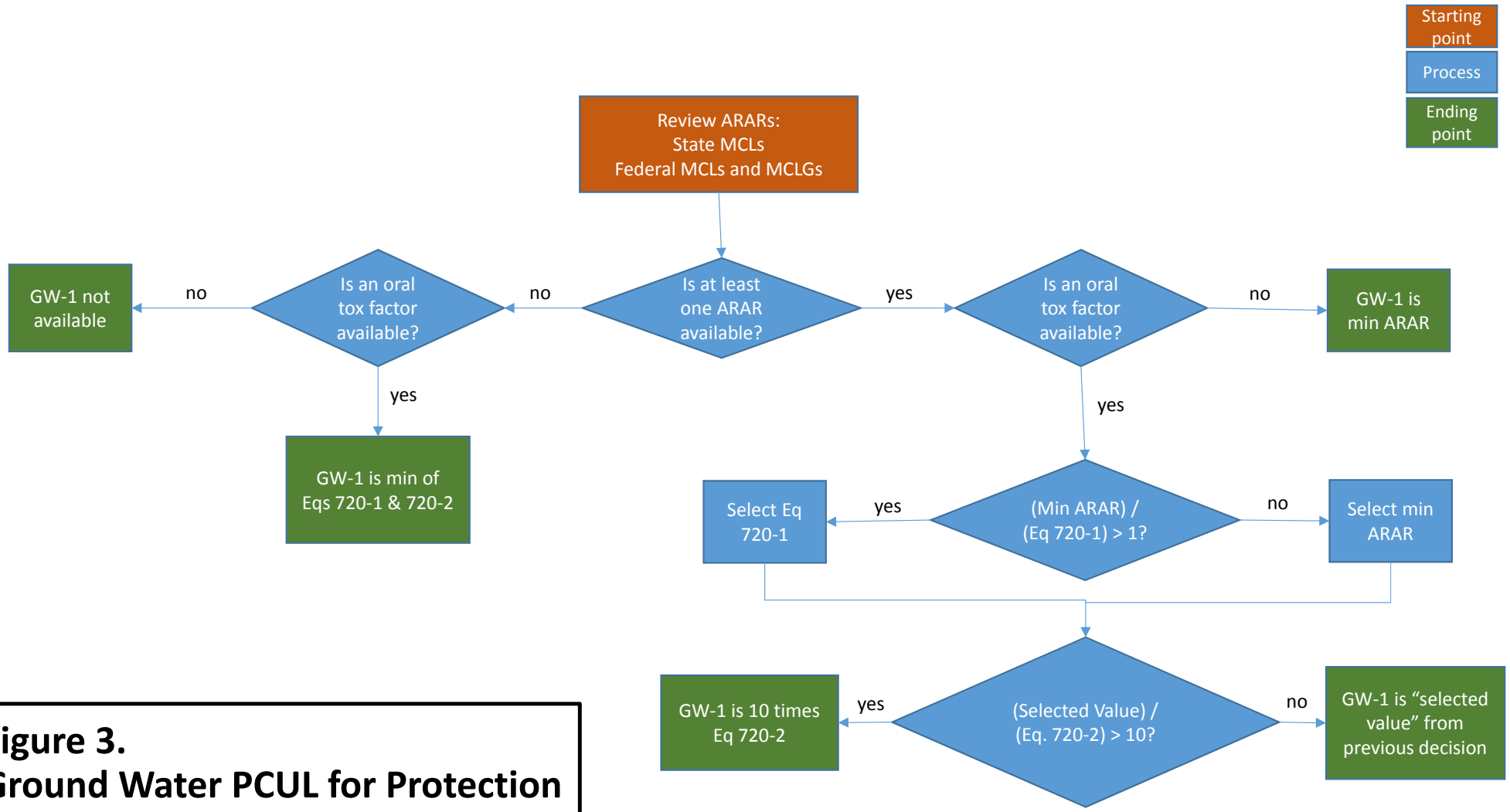

Figure 3.
Ground Water PCUL for Protection of Drinking Water

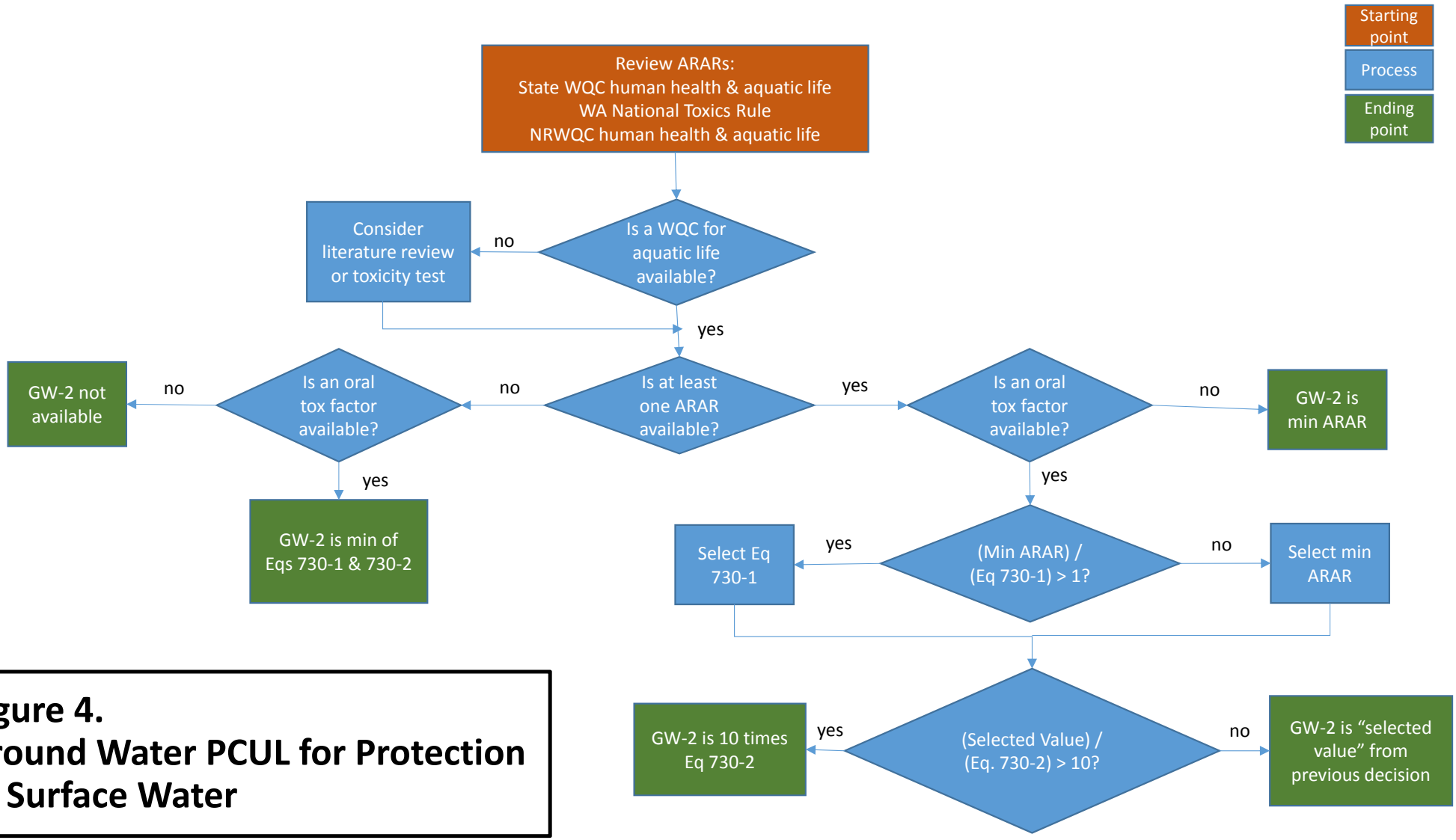

Figure 4.
Ground Water PCUL for Protection of Surface Water

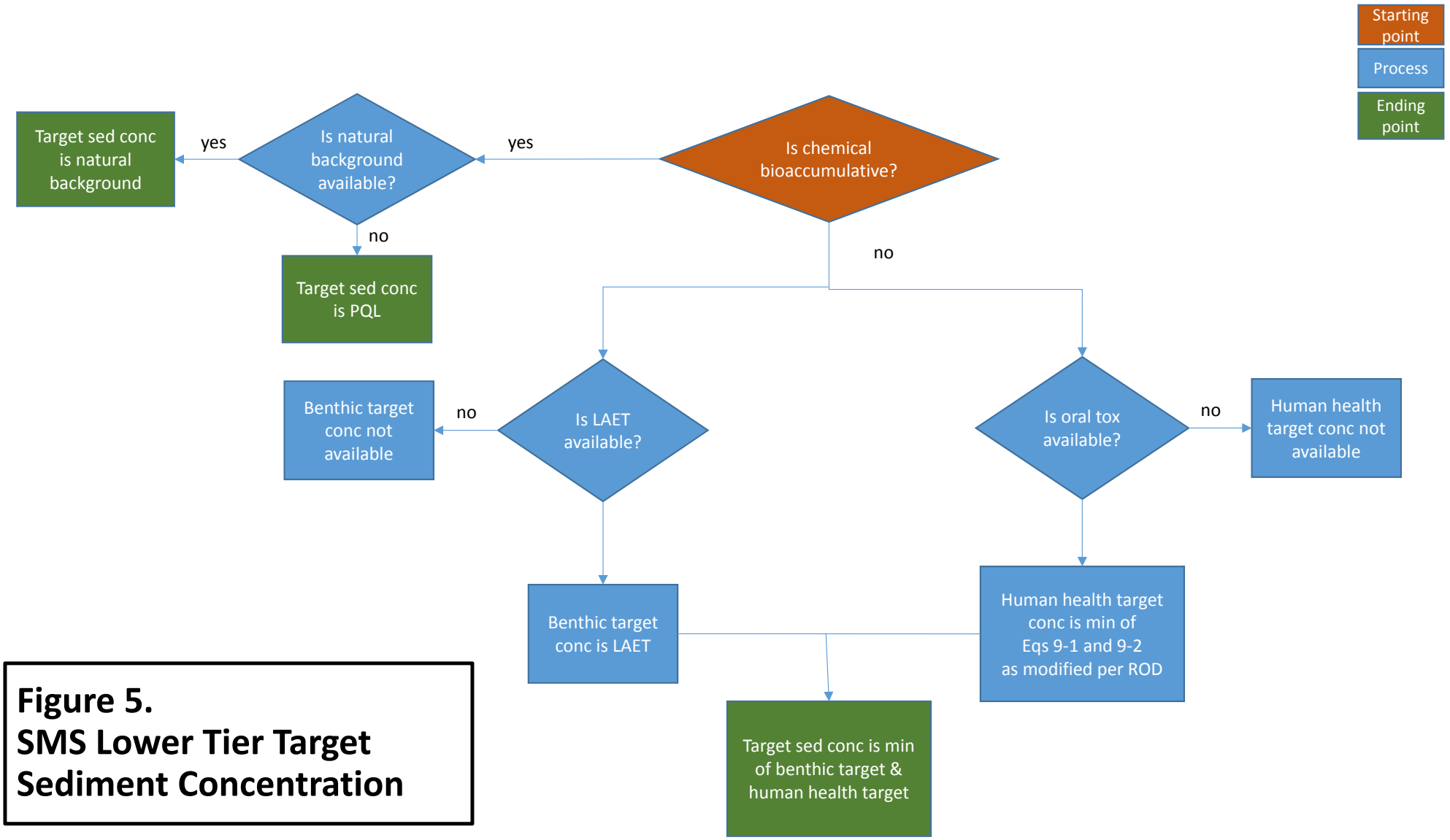

Figure 5.
SMS Lower Tier Target Sediment Concentration

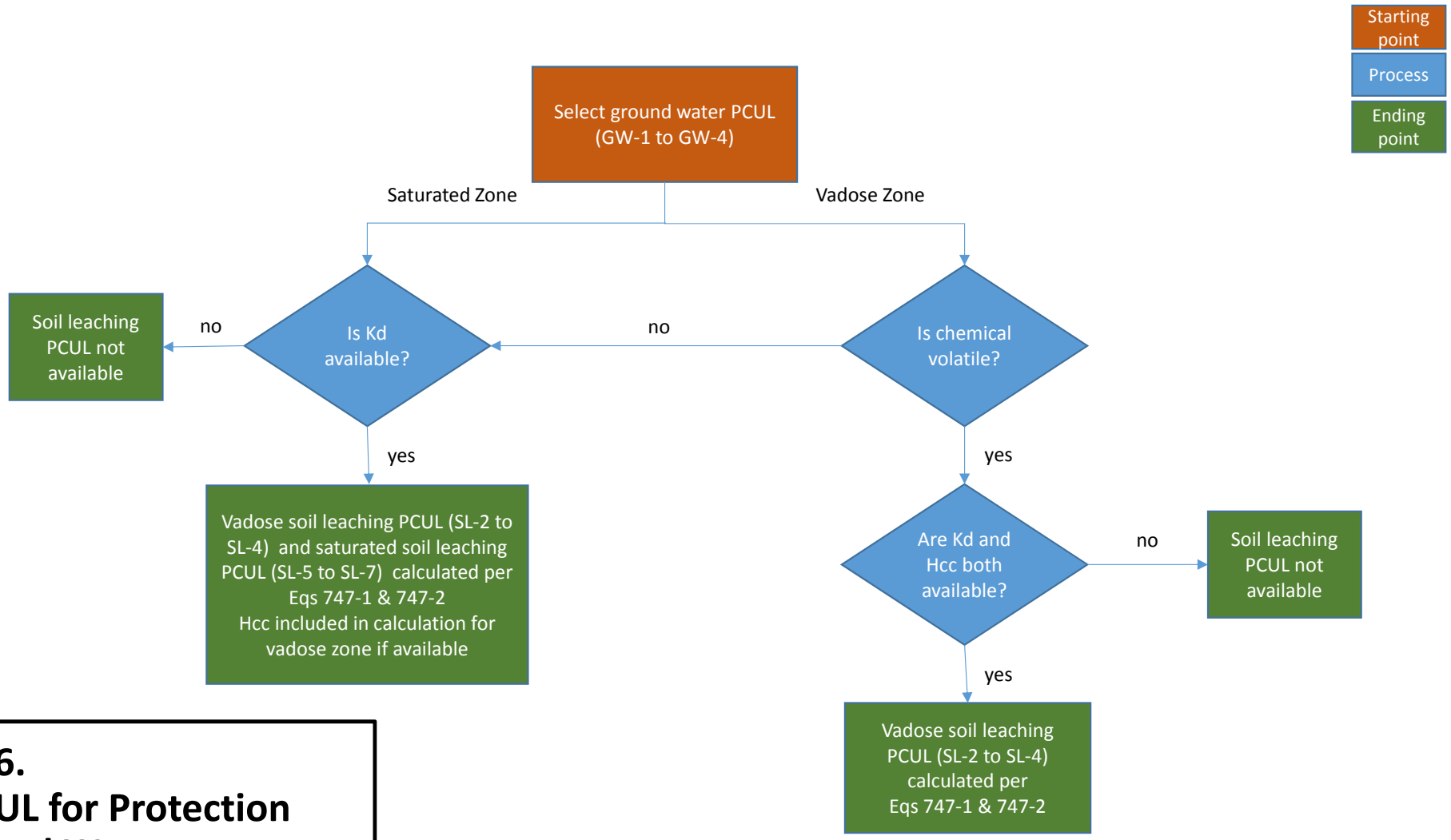

Figure 6.
Soil PCUL for Protection of Ground Water

Table 1. Notes on Individual Analytes

Analyte	Notes
PCBs	The Ecology CPM will determine whether site samples should be analyzed for PCB Aroclors, congeners, or both in accordance with Implementation Memos 12 and 13 (Ecology 2015a, 2016e).
Total PCB Aroclors	Represents the sum of detected PCB Aroclors.
Total PCB congeners	Represents the sum of detected congeners not modified using TEFs.
Total PCB TEQ	Represents the sum of the 12 dioxin-like PCB congeners, each adjusted using its TEF in MTCA Table 708-4. PCULs are derived using the toxicity values and ARARs for 2,3,7,8-TCDD. When calculating TEQ, treat nondetected values as instructed in Ecology's Implementation Memo 11. Ecology (2015b)
Dioxins and furans	To determine compliance for surface water human health, two standards must be met: • Under the NRWQC, the standard for 2,3,7,8-TCDD must be met. • Under MTCA, the total dioxin/furan TEQ must meet the standard for 2,3,7,8-TCDD. The calculation of total dioxin/furan TEQ is explained below. WAC 173-340-708(8)(d)
Total dioxin/furan TEQ	Represents the sum of the 17 carcinogenic congeners, each adjusted using its TEF in MTCA Table 708-1. PCULs are derived using the toxicity values and ARARs for 2,3,7,8-TCDD. When calculating TEQ, treat nondetected values as instructed in Ecology's Implementation Memo 11. Ecology (2015c)
Arsenic	The toxicity values are for inorganic arsenic. The TEE screening levels are the minimum for arsenic III and arsenic V. If site-specific data are available to determine the form of arsenic, the TEE screening levels specific to that form should be used. Because the ground water PCULs for protection of drinking water and surface water are below natural background (8 µg/L), they will be adjusted up to natural background. When calculating soil leaching PCULs for these scenarios, it would make sense to use 8 µg/L as the target ground water PCUL, however the spreadsheet is automatically set up to use the risk-based concentration. It becomes a moot point at the end of the process because the soil leaching PCULs for both of these scenarios need to be adjusted up to natural background (7.3 mg/kg).
Cadmium	Has two separate RfDs for water and soil/food matrices due to differences in absorption. The RfD listed on the 'Param' sheet is for cadmium in soil; this RfD is used for MTCA Equations 730-1, 740-1, and 745-1 (Equation 730-1 is based on ingestion of fish.) The

Analyte	Notes
	RfD for cadmium in water is hand-entered into the MTCA Equation 720-1 calculation.
Chromium	Separate lines are provided for total, trivalent, and hexavalent chromium. The PCULs for trivalent and hexavalent chromium should be used only when site samples are speciated.
Lead	The values listed for MTCA Equations 720-1, 740-1, and 745-1 are from the Method A tables.
Manganese	EPA's oral RfD of 0.14 mg/kg-day is divided by 3 (modified RfD of 0.0467 mg/kg-day) for non-food exposures.
Mercury	The RfD is for mercuric chloride. If a different from of mercury is present, the Ecology CPM may approve a different toxicity value.
Nickel	The RfD is for nickel soluble salts. If a different from of nickel is present, the Ecology CPM may approve a different toxicity value.
Thallium	The RfD is for thallium soluble salts. If a different from of thallium is present, the Ecology CPM may approve a different toxicity value.
Tributyltin	The RfD is for tributyltin oxide. If a different from of tributyltin is present, the Ecology CPM may approve a different toxicity value.
Benzo(a)pyrene and Total cPAH TEQ	The Method B carcinogen equation values for soil, ground water, sediment and air were hand-entered from CLARC to account for exposures to mutagens during early life stages when children are more susceptible to cancer. The Method B carcinogen equation value was adjusted to account for the LDW site-specific fish consumption rate of 97.5 g/day with a fish diet fraction of 1, as opposed to the default MTCA rate of 54 g/day with a fish diet fraction of 0.5.
cPAHs	To determine compliance for drinking water, two standards must be met: • Under the SDWA and State MCLs, the MCL for benzo(a)pyrene must be met • Under MTCA, the total cPAH TEQ must meet the PCUL for benzo(a)pyrene. The calculation of total cPAH TEQ is explained below. To determine compliance for surface water human health, two standards must be met: • Under the NRWQC, the NTR, and the State water quality rule, the human health standard for each individual cPAH must be met. • Under MTCA, the total cPAH TEQ must meet the PCUL for benzo(a)pyrene. To determine compliance for soil or air, the total cPAH TEQ must meet the PCUL for benzo(a)pyrene. WAC 173-340-708(8)(e)

Analyte	Notes
Total cPAH TEQ	Represents the sum of the 7 carcinogenic PAH compounds, each adjusted using its TEF in MTCA Table 708-2. PCULs are derived using the toxicity values and ARARs for benzo(a)pyrene. When calculating TEQ, treat nondetected values as instructed in Ecology's Implementation Memo 10. Ecology (2016d)
VOCs	Were not detected in sediments above screening levels in the LDW RI, so sediment PCULs are not developed for VOCs.
Bromoform, chloroform, dibromochloromethane, dichlorobromomethane	The MCLs listed on 'GW-Detail-PW" are 80 μg/L for each of these chemicals, but 80 μg/L is the MCL for the total of these chemicals.
cis- and trans-1,3-Dichloropropene	The WQC values shown on the 'GW-Detail-SW' sheet are for 1,3-dichloropropene.
Ethylene oxide	This chemical is considered mutagenic via inhalation. The Method B cancer equation values for air is hand-entered from CLARC, which uses age-dependent adjustment factors to account for higher risk of cancer from early life exposures.
Methylene chloride	This chemical is considered mutagenic via ingestion and inhalation. Method B cancer equation values are hand-entered from CLARC, which uses age-dependent adjustment factors to account for higher risk of cancer from early life exposures. The Method B carcinogen equation value was adjusted to account for the LDW site-specific fish consumption rate of 97.5 g/day with a fish diet fraction of 1, as opposed to the default MTCA rate of 54 g/day with a fish diet fraction of 0.5.
Xylenes	Refers to the sum of all isomers (ortho, meta, and para).
TCE	Multiple target organs for cancer and differences in mutagenicity among target organs complicate the calculation of PCULs for TCE. The Method B and Method C equation values for all media were hand-entered from CLARC. The Method B carcinogen equation value was adjusted to account for the LDW site-specific fish consumption rate of 97.5 g/day with a fish diet fraction of 1, as opposed to the default MTCA rate of 54 g/day with a fish diet fraction of 0.5.
1,2,3-Trichloropropane	This chemical is considered mutagenic via ingestion. Method B cancer equation values for soil and groundwater are hand-entered from CLARC, which uses age-dependent adjustment factors to account for higher risk of cancer from early life exposures.
Vinyl chloride	Cancer equation values for soil contact and air inhalation at industrial sites are calculated using conservative CPFs that consider early life exposure to mutagens because pregnant women could be present. If it is not possible for pregnant women to be present, PCULs for industrial exposures could be calculated using less conservative CPFs.

Analyte	Notes
Petroleum hydrocarbons	The value listed for Method B soil contact for gasoline range hydrocarbons is from Ecology's (2017) *Model Remedies for Sites with Petroleum Contaminated Soils*. The value listed for Method C soil contact is the Method B value adjusted for an industrial exposure scenario per advice from Policy. The values listed for MTCA Equation 747-1 are from the Method A soil table. The values listed for MTCA Equation 720-1 are from the Method A ground water table. The values listed for MTCA Equation 750-1 are from Ecology's (2018) *Implementation Memo 18*. Refer to the implementation memo for the proper use of this value. The TEE values for protection of plants and soil biota for gasoline and diesel range hydrocarbons are from Ecology's (2017) *Implementation Memo 19*. The literature values for protection of aquatic life are from Ecology's (2020) *Implementation Memo 23*.
Diesel and oil range hydrocarbons	Separate rows are provided for various combinations of heavy hydrocarbons. If only a DRO analysis was run, use the row for diesel range hydrocarbons. If only an ORO analysis was run, use the row for oil range hydrocarbons. If both DRO and ORO were run, sum the results and compare the sum to the row for total diesel & oil range hydrocarbons. For additional detail, refer to Implementation Memo 4.
Jet fuel	When evaluating this analyte, use the PCULs for diesel range organics.
alpha-BHC, beta-BHC, delta-BHC, and gamma-BHC	The TEE screening levels are from benzene hexachloride.
cis- and trans-Chlordane	The chemical characteristics, toxicity data, and TEE screening levels are from chlordane.
Total DDD	Includes 2,4'- and 4,4'-DDD. The TEE screening levels shown for individual forms of DDD, DDE, and DDT should be applied to the total of DDD, DDE, and DDT.
Total DDE	Includes 2,4'- and 4,4'-DDE. The TEE screening levels shown for individual forms of DDD, DDE, and DDT should be applied to the total of DDD, DDE, and DDT.
Total DDT	Includes 2,4'- and 4,4'-DDT. The TEE screening levels shown for individual forms of DDD, DDE, and DDT should be applied to the total of DDD, DDE, and DDT.
Endosulfan I Endosultan II	The RfDs are for endosulfan.
Heptachlor and heptachlor epoxide	The TEE screening levels shown for the individual analytes should be applied to the total of the two analytes.

Additional notes on individual analytes related to specific parameters are noted in the column by column notes in Table 2 and in comments inserted into individual cells within the workbook. Chemical names in Table 2 are highlighted in blue for easy identification.

Table 2. Column by Column Notes

Column	Title	Notes
		'Mod' Sheet
A	Date	Date of modification.
B	Sheet	Sheet(s) modified.
C	Chemical/Parameter Modified	Chemicals or parameters affected by modification.
D	Modification	Description of modification.
E	Consequences	Changes that occurred as a result of the modifications, particularly changes to PCUL values.
		'SL' Sheet
C	Most Stringent Soil PCUL, Vadose Zone, Potable GW	Most stringent soil PCUL for the vadose (unsaturated) zone above potable ground water, which includes the following endpoints: • SL-1: Direct human contact with soil • SL-2: Leaching from vadose zone to protect drinking water • SL-3: Leaching from vadose zone to protect surface water via ground water • SL-4: Leaching from vadose zone to protect sediment via ground water • SL-8: Protection of sediment via bank erosion • SL-9: Site-specific TEE for unrestricted land use. If the minimum PCUL is below the natural background concentration (SL-10), it is adjusted up to the natural background concentration.
D	Most Stringent Soil PCUL, Saturated Zone, Potable GW	Most stringent soil PCUL for the saturated zone in potable ground water, which includes the following endpoints: • SL-1: Direct human contact with soil • SL-2: Leaching from saturated zone to protect drinking water • SL-3: Leaching from saturated zone to protect surface water via ground water • SL-4: Leaching from saturated zone to protect sediment via ground water • SL-8: Protection of sediment via bank erosion • SL-9: Site-specific TEE for unrestricted land use. If the minimum PCUL is below the natural background concentration (SL-10), it is adjusted up to the natural background concentration.

Column	Title	Notes
E	Most Stringent Soil PCUL, Vadose Zone, Nonpotable GW	Most stringent soil PCUL for the vadose (unsaturated) zone above nonpotable ground water, which includes the following endpoints: • SL-1: Direct human contact with soil • SL-3: Leaching from vadose zone to protect surface water via ground water • SL-4: Leaching from vadose zone to protect sediment via ground water • SL-8: Protection of sediment via bank erosion • SL-9: Site-specific TEE for unrestricted land use. If the minimum PCUL is below the natural background concentration (SL-10), it is adjusted up to the natural background concentration.
F	Most Stringent Soil PCUL, Saturated Zone, Nonpotable GW	Most stringent soil PCUL for the saturated zone in nonpotable ground water, which includes the following endpoints: • SL-1: Direct human contact with soil • SL-3: Leaching from saturated zone to protect surface water via ground water • SL-4: Leaching from saturated zone to protect sediment via ground water • SL-8: Protection of sediment via bank erosion • SL-9: Site-specific TEE for unrestricted land use. If the minimum PCUL is below the natural background concentration (SL-10), it is adjusted up to the natural background concentration.
G	User-Defined PCUL	The user may define a site-specific PCUL by specifying the desired SL numbers. List the SL numbers included in the column heading.
H	SL-1, Direct Contact	PCUL for direct human contact with soil. From 'SL-Detail' sheet. WAC 173-340-740(3)(b)(iii)(B)
I	SL-2, Protect Drinking Water, Vadose Zone	Leaching PCUL for vadose zone soil to protect drinking water. From '747-1' sheet. WAC 173-340-740(3)(b)(iii)(A), -747(4)
J	SL-3, Protect Surface Water via Ground Water, Vadose Zone	Leaching PCUL for vadose zone soil to protect surface water via ground water. From '747-1' sheet. WAC 173-340-740(3)(b)(iii)(A), -747(4)
K	SL-4, Protect Sediment via Ground Water, Vadose Zone	Leaching PCUL for vadose zone soil to protect the target sediment concentration via ground water. From '747-1' sheet. WAC 173-340-740(3)(b)(iii)(A), -747(4)

Column	Title	Notes
L	SL-5, Protect Drinking Water, Saturated Zone	Leaching PCUL for saturated zone soil to protect drinking water. From '747-1' sheet. WAC 173-340-740(3)(b)(iii)(A), -747(4)
M	SL-6, Protect Surface Water via Ground Water, Saturated Zone	Leaching PCUL for saturated zone soil to protect surface water via ground water. From '747-1' sheet. WAC 173-340-740(3)(b)(iii)(A), -747(4)
N	SL-7, Protect Sediment via Ground Water, Saturated Zone	Leaching PCUL for saturated zone soil to protect drinking water. From '747-1' sheet. WAC 173-340-740(3)(b)(iii)(A), -747(4)
O	SL-8, Protect Sediment via Bank Erosion	PCUL to protect sediment via direct bank erosion, based on LAET values. From 'Sed' sheet. WAC 173-340-740(1)(d)
P	SL-9, Site-Specific TEE, Unrestricted Land Use	Terrestrial ecological evaluation screening level for unrestricted land use from MTCA Table 749-3. WAC 173-340-7740(2)(b)(ii), -7492
Q	SL-10, Natural Background	The background value for **dioxins/furans** (statewide) is from Ecology's (2010) Implementation Memo 8. Background values for **metals** in the Puget Sound region are from Ecology's (1994) *Natural Background Soil Metals Concentrations in Washington State*. WAC 173-340-700(6)(d), -740(5)(c)
S-Y	Basis for PCUL – Vadose, Potable GW	These columns record the endpoint driving the most stringent PCUL for the vadose zone above potable ground water (column D).
Z-AF	Basis for PCUL – Saturated, Potable GW	These columns record the endpoint driving the most stringent PCUL for the saturated zone in potable ground water (column E).
AG-AL	Basis for PCUL – Vadose, Nonpotable GW	These columns record the endpoint driving the most stringent PCUL for the vadose zone above nonpotable ground water (column F).
AM-AR	Basis for PCUL – Saturated, Nonpotable GW	These columns record the endpoint driving the most stringent PCUL for the saturated zone in nonpotable ground water (column G).
AT	Select	By placing an "X" in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'GW' Sheet		
C	Most Stringent PCUL, Potable Water	Most stringent ground water PCUL for potable ground water, which includes the following endpoints:

Column	Title	Notes
		• GW-1: Drinking water • GW-2: Protection of surface water • GW-3: Protection of sediment • GW-4: Protection of indoor air via vapor intrusion. If the minimum PCUL is below the natural background concentration (GW-5), it is adjusted up to natural background.
D	Most Stringent PCUL, Nonpotable Water	Most stringent ground water PCUL for nonpotable ground water, which includes the following endpoints: • GW-2: Protection of surface water • GW-3: Protection of sediment • GW-4: Protection of indoor air via vapor intrusion. If the minimum PCUL is below the natural background concentration (GW-5), it is adjusted up to natural background.
E	User-Defined PCUL	The user may define a site-specific PCUL by specifying the desired GW numbers. List the GW numbers included in the column heading.
F	GW-1, Protect Drinking Water	PCUL for drinking water. From 'GW-Detail-PW' sheet. WAC 173-340-720(4)(b)(i), '720(4)(b)(iii), and -720(7)(b)
G	GW-2, Protect Surface Water	PCUL to protect surface water. From 'GW-Detail-SW' sheet. WAC 173-340-720(1)(c)
H	GW-3, Protect Sediment	PCUL to protect the target sediment concentration. From 'Mod.747-1' sheet. WAC 173-340-720(1)(c)
I	GW-4, Protect Indoor Air	PCL to protect indoor air via vapor intrusion. From 'GW-Detail-PW' sheet. WAC 173-340-720(1)(d)(iv)
J	GW-5, Natural Background	Natural background concentration. The value for **arsenic** is based on the Puget Sound Basin is from Ecology's (2018) draft *Ambient Ground Water Arsenic Concentrations in Washington State* and Environmental Partners, Inc, et al. (2006) *Boeing Plant 2, Seattle/Tukwila, Washington, Technical Memorandum: Development and Use of Background Values*. No other natural background ground water concentrations have been established. WAC 173-340-700(6)(d), -720(7)(c)
L-P	Basis – Potable GW	These columns record the endpoint driving the most stringent PCUL for potable

Column	Title	Notes
		ground water (column D).
Q-T	Basis – Nonpotable GW	These columns record the endpoint driving the most stringent PCUL for nonpotable ground water (column E).
V	Select	By placing an "X" in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'AR' Sheet		
C	AR-1, Indoor Air PCUL	Method B PCUL for indoor air. From 'AR-Detail' sheet. WAC 173-340-750(3)(b)(ii)
D	SG-1, Sub-Slab Soil Gas PCUL, Protect Indoor Air	Method B PCUL for sub-slab soil gas to protect indoor air. From 'AR-Detail' sheet. Ecology's (2009) *Vapor Intrusion Guidance*, Equation 2 with 2015 update to vapor attenuation factor
E	SG-2, Deep Soil Gas PCUL, Protect Indoor Air	Method B PCUL for deep soil gas to protect indoor air. From 'AR-Detail' sheet. Ecology's (2009) *Vapor Intrusion Guidance*, Equation 2 with 2015 update to vapor attenuation factor
G	Select	By placing an "X" in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'Chem' Sheet		
B	Chemical	Not all chemicals listed in CLARC have been included; the selected list of chemicals is based on those most frequently analyzed at LDW cleanup sites. The Ecology CPM must approve PCULs for chemicals not listed in the workbook.
C	CAS No.	For chemical groups without a Chemical Abstracts Service number, a letter designation is used.
D	Chemical Name in CLARC	If the chemical name shown in CLARC is different from the name shown in the workbook, the CLARC name is provided here.
E	Alternate CAS No.	If a different CAS number was encountered while searching for chemical-specific information, it is recorded here.
F	Abbreviation	The elemental abbreviations are provided for metals.
G	Synonyms	If a synonym was encountered while searching for chemical-specific information, it is recorded here. There was no attempt to provide a complete list of synonyms.
I	Select	By placing an "X" in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.

Column	Title	Notes
	'Param' Sheet	
C	Koc	Soil organic carbon-water partitioning coefficient from CLARC for organic chemicals.
D	Kd – Inorganics, pH 6.8	Distribution factor from CLARC for inorganic chemicals and ionizing organic chemicals at the typical ground water pH of 6.8.
E	Kd – Organics, Foc 0.1%	Soil-water partitioning coefficient calculated for organic chemicals per MTCA Equation 747-2 assuming the default value of 0.001 for fraction organic carbon.
F	Selected Soil Kd (pH 6.8, Foc 0.1%)	The values in columns E and F are collected here.
G	Kd – Inorganics, pH 8.0	Soil-water partitioning coefficient from Table 46 of EPA's (1996) *Soil Screening Guidance Technical Background Document* for inorganic chemicals and ionizing organic chemicals at the typical marine pH of 8.
H	Kd – Organics, Foc 1.9%	Soil-water partitioning coefficients are calculated for organic chemicals per MTCA Equation 747-2 assuming a value of 0.019 for fraction organic carbon, which is the average value for LDW sediment. For ionizing organic, Kd values are calculated using Koc values adjusted to pH 8.0, from Table 42 of EPA (1996).
I	Selected Sediment Kd (pH 8.0, Foc 1.9%)	The values in columns E and F are collected here.
J	Hcc at 13°C	Henry's law constant from CLARC for a soil temperature of 13°C.
K	Hcc at 25°C	Henry's law constant from CLARC for a soil temperature of 25°C.
L	Selected Hcc	Hcc values are collected here. Hcc at 13°C is preferred. Hcc at 25°C is used for chemicals without a value at 13°C.
M	BCF	Fish bioconcentration factor from CLARC.
N	RfDo	Oral RfD from CLARC or EPA's Regional Screening Level (RSL) table.
O	RfDo Source	Source of oral RfD, including the following: • EPA's Integrated Risk Information System (denoted by "IRIS" in the source column) • EPA's Provisional Peer-Reviewed Toxicity Values ("PPRTV") • ATSDR's minimal risk levels ("ATSDR") • CalEPA's chronic reference exposure levels ("CalEPA") • PPRTV appendix values ("PPRTV-APP")

Column	Title	Notes
		• Health Effects Assessment Summary Tables ("HEAST") • Other EPA sources ("Other EPA"). The notations "E" and "S" are also used in CLARC but are not defined.
P	Oral Noncancer Target Organ	Noncancer target organ for evaluating additive noncancer hazards to target organs via ingestion/dermal exposure. The preferred source was CLARC. If no target organ was available in CLARC, IRIS and EPA's MCL database were consulted.
Q	GI	Gastrointestinal absorption conversion factor from MTCA Equation 740-5.
R	RfDd	Dermal RfD calculated per SCUM II Equation 9-4.
S	RfDi	Inhalation RfD from CLARC or converted from the reference concentration in EPA's RSL assuming a body weight of 70 kg and inhalation rate of 20 m^3/day. Sources are as listed for column P.
T	RfDi Source	Source of inhalation RfD. Sources are as listed for column P.
U	Inhalation Noncancer Target Organ	Noncancer target organ for evaluating additive noncancer hazards to target organs via inhalation exposure. The preferred source was CLARC. If no target organ was available in CLARC, IRIS was consulted.
V	CPFo	Oral CPF (slope factor) from CLARC or EPA's RSL.
W	CPFo Source	Source of oral CPF. Sources are as listed for column P.
X	CPFd	Dermal CPF calculated per SCUM II Equation 9-3.
Y	CPFi	Inhalation CPF from CLARC or converted from the inhalation unit concentration in EPA's RSL assuming a body weight of 70 kg and inhalation rate of 20 m^3/day.
Z	CPFi Source	Source of inhalation CPF. Sources are as listed for column P.
AA	INH	Groundwater vapor inhalation correction factor from CLARC. Accounts for extra exposure to volatile chemicals in groundwater due to vaporization during household use. For chemicals not listed in CLARC, a value of 2 is assigned for chemicals that qualify as volatile organic compounds per WAC 173-340-210.
AB	ABS	Dermal absorption fraction from MTCA Equation 740-5.
AC	AB1/GI	Gastrointestinal absorption fraction from MTCA Equation 740-5.
AD	Listed on CLARC VI page?	Indicates whether chemical is considered volatile for purposes of evaluating vapor intrusion.
AE	PBT List	Listed as a persistent bioaccumulative toxin in WAC 173-333-310.
AF	DMMP List 1 or 2	Included on List 1 or List 2 in the DMMP's (20018) *Dredged Material Evaluation*

Column	Title	Notes
		and Disposal Procedures User Manual.
AG	LDW COC for Human Consumption of Seafood	Listed as a chemical of concern for human health in Table B.7-1 of the LDW RI report (LDWG 2010).
AH	Exceeded NOAEL for LDW Higher Trophic Level	Listed as a chemical of concern for ecological receptors in Table A.8-1 of the LDW RI report (LDWG 2010).
AI	Considered Bioaccumulative for Calculating Sediment PCULs	"YES" is recorded if ***both*** of the following criteria are met: 1. The chemical is listed on the PBT list (column AC), on DMMP Lists 1 or 2 (column AD), or both. 2. The chemical is listed in RI Table B.7-1 (column AE), RI Table A.8-1 (column AF), or both. In addition, "YES" is recorded for all **dioxin/furan** analytes. Although the decision logic would return "YES" for **total PCB Aroclors**, an entry of "no" was hand-entered to over-ride the decision logic. This allows the LAET to be reported as the target sediment concentration. A result of "YES" would have caused the target sediment concentration to be a text entry "PQL".
AK	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'Eqtn' Sheet		
Calculation sheets (Sl-Eq, GW-Eq, Sed-Eq, and AR-Eq) link to the equations shown on this sheet. Any changes to assumptions/parameters on this sheet will be reflected on the equation sheets and subsequently the three media summary sheets (SL, GW, and AR). This sheet is protected to prevent inadvertent changes with the password "LDW".		
'SL-Det' Sheet		
C	MTCA-B Soil Direct Contact, Noncancer	Method B PCUL for direct human contact with soil for noncancer health effects under a residential scenario calculated per MTCA Equation 740-1. From 'SL-Eq' sheet.
D	MTCA-B Soil Direct Contact, Cancer	Method B PCUL for direct human contact with soil for cancer under a residential scenario calculated per MTCA Equation 740-2. From 'SL-Eq' sheet.
E	SL-1, MTCA-B Soil Direct Contact	Minimum of Method B noncancer and cancer PCULs (columns D and E).
F	MTCA Ecological Indicator Soil Conc., Plants	Site-specific terrestrial ecological evaluation screening level for plants from MTCA Table 749-3. Values for **gasoline** and **diesel** range hydrocarbons are from Ecology's (2017) Implementation Memo 19.

Column	Title	Notes
G	MTCA Ecological Indicator Soil Conc., Soil Biota	Site-specific terrestrial ecological evaluation screening level for soil biota from MTCA Table 749-3. Values for **gasoline** and **diesel** range hydrocarbons are from Ecology's (2017) Implementation Memo 19.
H	MTCA Ecological Indicator Soil Conc., Wildlife	Site-specific terrestrial ecological evaluation screening level for wildlife from MTCA Table 749-3.
I	SL-9, MTCA Ecological Indicator Soil Conc., Unrestricted Land Use	Site-specific terrestrial ecological evaluation screening level for unrestricted land use. Minimum of values for plants, soil biota, and wildlife (columns G, H, and I).
J	MTCA Ecological Indicator Soil Conc., Industrial or Commercial Land Use	Site-specific terrestrial ecological evaluation screening level for industrial or commercial land use. Value for wildlife only (column I). Not used for PCULs but provided for potential use in site-specific CULs or RELs.
K	MTCA Simplified TEE, Unrestricted Land Use	Simplified terrestrial ecological evaluation screening level for unrestricted land use from MTCA Table 749-2. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
L	MTCA Simplified TEE, Industrial or Commercial Land Use	Terrestrial ecological evaluation screening level for commercial or industrial land use from MTCA Table 749-2. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
M	MTCA-C Soil Direct Contact, Noncancer	Method C PCUL for direct human contact with soil for noncancer health effects under an industrial scenario calculated per MTCA Equation 745-1. From 'SL-Eq' sheet. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
N	MTCA-C Soil Direct Contact, Cancer	Method C PCUL for direct human contact with soil for cancer under an industrial scenario calculated per MTCA Equation 745-2. From 'SL-Eq' sheet. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
O	MTCA-C Soil Direct Contact	Minimum of Method C noncancer and cancer PCULs (columns H and I). Not used for PCULs but provided for potential use in site-specific CULs or RELs.
P	Federal TSCA	The only ARAR for soil is the TSCA cleanup action level for **PCBs**. The TSCA action level is sufficiently protective, per WAC 173-340-740(5)(b), so it replaces the MTCA Equation 740-2 value. Depending on the material and the occupancy usage, TSCA cleanup action levels are 1 or 10 ppm for high occupancy areas, and 25 or 50 or 100 ppm for low occupancy areas. A value of 1 mg/kg is used on this sheet.
R	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter

Column	Title	Notes
		the spreadsheet to show only the chemicals of interest.
		'SL-Eq' Sheet
C	RfDo	Oral reference dose from 'Param' sheet.
D	CPFo	Oral carcinogenic potency factor from 'Param' sheet.
E	AB1	Gastrointestinal absorption fraction from 'Param' sheet.
F	MTCA-B Soil Direct Contact, Noncancer	Method B PCUL for noncancer effects from soil contact under a residential scenario calculated per MTCA Equation 740-1.
G	MTCA-B Soil Direct Contact, Cancer	Method B PCUL for cancer effects from soil contact under a residential scenario calculated per MTCA Equation 740-2.
H	MTCA-C Soil Direct Contact, Noncancer	Method C PCUL for noncancer effects from soil contact under an industrial scenario calculated per MTCA Equation 745-1. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
I	MTCA-C Soil Direct Contact, Cancer	Method C PCUL for cancer effects from soil contact under an industrial scenario calculated per MTCA Equation 745-2. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
K	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
		'Leach' Sheet
For nonvolatile chemicals without numerical values for Hcc, the portion of the equation that uses Hcc is eliminated to allow the calculation to be performed. For volatile chemicals without numerical values for Hcc, no leaching calculation is performed (entry shows as "na"). This is discussed in more detail in the text.		
C	Soil Kd	Soil Kd at pH 6.8 and foc 0.1%. From 'Param' sheet.
D	Hcc at 13^{o}C	Selected value for the unitless version of Henry's law constant. From 'Param' sheet.
E	GW-1, GW PCUL, Protect Drinking Water	Ground water PCUL for protection of drinking water. From 'GW-Detail-PW' sheet.
F	SL-2, Soil Protect Drinking Water Vadose Zone	Soil PCUL for leaching to drinking water from the vadose zone calculated per MTCA Equation 747-1.
G	SL-5, Soil Protect Drinking Water, Saturated Zone	Soil PCUL for leaching to drinking water from the saturated zone calculated per MTCA Equation 747-1.
H	GW-2, GW PCUL Protect Surface Water	Ground water PCUL for protection of surface water. From 'GW-Detail-SW' sheet.

Column	Title	Notes
I	SL-3, Soil Protect Surface Water, Vadose Zone	Soil PCUL for leaching to surface water from the vadose zone calculated per MTCA Equation 747-1.
J	SL-6, Soil Protect Surface Water, Saturated Zone.	Soil PCUL for leaching to surface water from the saturated zone calculated per MTCA Equation 747-1.
K	GW-3, GW PCUL, Protect Sediment	Ground water PCUL for protection of sediment (minimum ROD CUL plus SMS lower tier concentration for chemicals not listed in ROD). From 'Mod.747-1' sheet.
L	SL-4, Protect Sediment, Vadose Zone	Soil PCUL for leaching from the vadose zone to protect sediment, calculated per MTCA Equation 747-1.
M	SL-7, Protect Sediment, Saturated Zone	Soil PCUL for leaching from the saturated zone to protect sediment, calculated per MTCA Equation 747-1.
N	GW PCUL, Protect Sed., Min. ROD RAL	Ground water PCUL for protection of sediment at the minimum ROD RAL. From 'Mod.747-1' sheet.
O	Soil Protect Sed., Min. ROD RAL, Vadose Zone	Soil PCUL for leaching from the vadose zone to protect sediment at the minimum ROD RAL, calculated per MTCA Equation 747-1. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
P	Soil Protect Sed., Min. ROD RAL, Saturated Zone	Soil PCUL for leaching from the saturated zone to protect sediment at the minimum ROD RAL, calculated per MTCA Equation 747-1. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
Q	User-Defined Ground Water PCUL	This could be the value defined in column F of the 'GW' sheet.
R	Soil Protect GW at User-Defined GW PCUL, Vadose Zone	Soil PCUL for leaching from the vadose zone to achieve the user-defined ground water PCUL, calculated per MTCA Equation 747-1.
S	Soil Protect GW at User-Defined GW PCUL, Saturated Zone	Soil PCUL for leaching from the saturated zone to achieve the user-defined ground water PCUL, calculated per MTCA Equation 747-1.
U	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'PW' Sheet		
C	Federal MCLs	Federal maximum contaminant level for drinking water (40 CFR 141).
D	Federal MCLGs	Federal MCL goal for noncarcinogens only (non-zero values).

Column	Title	Notes
E	WA State MCLs	State MCL for drinking water (WAC 246-290).
F	Most Stringent ARAR	Minimum of drinking water ARARs (columns D through F).
G	MTCA-B Ground Water, Noncancer	Calculated per MTCA Equation 720-1. From 'GW-Eq' sheet.
H	ARAR Evaluation	Ratio of minimum ARAR (column G) to MTCA Equation 720-1 value (column H).
I	Does ARAR need adjustment for noncancer health effects?	If the ratio in column I exceeds 1, the entry is "YES", indicating that the associated hazard quotient exceeds 1 and the minimum ARAR needs to be adjusted. If the ratio does not exceed 1, the entry is "no", indicating that no adjustment is needed. If one or both of columns G and H are blank, the entry is "na", indicating that the ratio cannot be calculated.
J	Protection of Drinking Water, Noncancer	Noncancer PCUL for drinking water: If the entry in column J is "YES", the adjusted noncancer PCUL is the value from MTCA Equation 720-1 (column H). Otherwise, if there is a minimum ARAR (column G), the noncancer PCUL is the minimum ARAR. Otherwise, if there is a value from Equation 720-1, the noncancer PCUL is the equation value. Otherwise, the noncancer PCUL is noted as "na".
K	MTCA-B Ground Water, Cancer	Calculated per MTCA Equation 720-2. From 'GW-Eq' sheet.
L	ARAR Evaluation	Ratio of minimum ARAR (column G) to MTCA Equation 720-2 value (column L).
M	Does ARAR need adjustment for cancer health effects?	If the ratio in column M exceeds 10, the entry is "YES", indicating that the associated cancer risk exceeds 1E-5 and the minimum ARAR needs to be adjusted. If the ratio does not exceed 10, the entry is "no", indicating that no adjustment is needed. If one or both of columns G and L are blank, the entry is "na", indicating that the ratio cannot be calculated.
N	Protection of Drinking Water, Cancer	Cancer PCUL for drinking water: If the entry in column N is "YES", the adjusted cancer PCUL is 10 times the value from MTCA Equation 720-2 (column L). If the entry is "no", the cancer PCUL is the minimum ARAR (column G). If the entry is "na", the cancer PCUL is noted as "na".
O	GW-1, Ground Water PCUL, Protect Drinking Water	The ground water PCUL for protection of drinking water is the minimum of the noncancer and cancer PCULs (columns K and O).
P	GW-4, Ground Water PCUL, Protect Indoor Air	Method B ground water screening level to protect indoor air via vapor intrusion. From 'Eq.1(VI)'.

Column	Title	Notes
Q	MTCA-C GW Protect Indoor Air	Method C ground water screening level to protect indoor air via vapor intrusion. From 'Eq.1(VI)'. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
S	Most Stringent Drinking Water PCUL	The most stringent PCUL for drinking water is the minimum of the ground water PCUL for protection of drinking water (GW-1 in column P) and the Method B ground water screening level to protect indoor air via vapor intrusion (GW-7 in column Q).
T-Z	Basis	These columns record the endpoint driving the most stringent PCUL for drinking water (column U).
AB	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'SW' Sheet		
C	WA State WQC, Aquatic Life, Marine-Chronic	Washington State WQC for protection of marine aquatic life under chronic exposure (WAC 173-201A-240, Table 240).
D	NRWQC, Aquatic Life, Marine – Chronic	National recommended WQC for protection of marine aquatic life under chronic exposure (Clean Water Act Section 304).
E	WA State WQC, Human Health, Consumption of Organisms	Washington State WQC for protection of human health via consumption of aquatic organisms published in August 2016 (WAC 173-201A-240, Table 240).
F	WA Toxics Rule, Human Health, Consumption of Organisms	National Toxics Rule WQC for Washington State for protection of human health via consumption of aquatic organisms published in November 2016 (40 CFR 131.3).
G	NRWQC, Human Health, Consumption of Organisms	National recommended water quality criterion for protection of human health via consumption of aquatic organisms (Clean Water Act Section 3).
H	Aquatic Life: Literature Values	Concentration estimated to result in no adverse effects on the protection and propagation of wildlife, fish, and other aquatic life, based on a literature review of the following sources (Ecology 2016): • Oak Ridge National Laboratory's Risk Assessment Information System (RAIS) • National Oceanic and Atmospheric Administration's Screening Quick Reference Tables (SQuiRT) • EPA's EcoTox database

Column	Title	Notes
		• Verbruggen et al. (2008) • De Rooij et al. (2004). WAC 173-340-730(3)(b)(ii)
I	Most Stringent ARAR	Minimum of surface water ARARs (columns D through J).
J	MTCA-B Surface Water, Fish Consumption, Noncancer	Calculated per MTCA Equation 730-1. From 'GW-Eq' sheet.
K	ARAR Evaluation	Ratio of minimum ARAR (column K) to MTCA Equation 730-1 value (column L).
L	Does ARAR need adjustment for noncancer health effects?	If the ratio in column M exceeds 1, the entry is "YES", indicating that the associated hazard quotient exceeds 1 and the minimum ARAR needs to be adjusted. If the ratio does not exceed 1, the entry is "no", indicating that no adjustment is needed. If one or both of columns K and L are blank, the entry is "na", indicating that the ratio cannot be calculated.
M	Protection of Surface Water, Noncancer	Noncancer PCUL for protection of surface water: If the entry in column N is "YES", the adjusted noncancer PCUL is the value from MTCA Equation 730-1 (column L). Otherwise, if there is a minimum ARAR (column K), the noncancer PCUL is the minimum ARAR. Otherwise, if there is a value from Equation 730-1, the noncancer PCUL is the equation value. Otherwise, the noncancer PCUL is noted as "na".
N	MTCA-B Surface Water, Fish Consumption, Cancer	Calculated per MTCA Equation 730-2. From 'GW-Eq' sheet.
O	ARAR Evaluation	Ratio of minimum ARAR (column K) to MTCA Equation 720-2 value (column P).
P	Does ARAR need adjustment for cancer health effects?	If the ratio in column Q exceeds 10, the entry is "YES", indicating that the associated cancer risk exceeds 1E-5 and the minimum ARAR needs to be adjusted. If the ratio does not exceed 10, the entry is "no", indicating that no adjustment is needed. If one or both of columns K and P are blank, the entry is "na", indicating that the ratio cannot be calculated.
Q	Protection of Surface Water, Cancer	Cancer PCUL for protection of surface water: If the entry in column R is "YES", the adjusted cancer PCUL is 10 times the value from MTCA Equation 730-2 (column P). If the entry is "no", the cancer PCUL is the minimum ARAR (column K). If the entry is "na", the cancer PCUL is noted as "na".
R	GW-2, Ground Water PCUL, Protect Surface Water	The ground water PCUL for protection of surface water is the minimum of the noncancer and cancer PCULs (columns O and S).

Column	Title	Notes
T-AB	Basis for PCUL	These columns record the endpoint driving the most stringent PCUL for protection of surface water (GW-2 in column T).
AD	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'GW-Eq' Sheet		
C	RfDo	Oral reference dose from 'Param' sheet.
D	CPFo	Oral carcinogenic potency factor from 'Param' sheet.
E	INH	Inhalation correction factor from 'Param' sheet.
F	BCF	Fish bioconcentration factor from 'Param' sheet.
G	MTCA-B, Ground Water, Noncancer	Method B PCUL for noncancer effects from drinking water calculated per MTCA Equation 720-1.
H	MTCA-B, Ground Water, Cancer	Method B PCUL for cancer effects from drinking water calculated per MTCA Equation 720-2.
I	MTCA-B, Surface Water, Noncancer	Method B PCUL for noncancer effects from consuming fish contaminated from surface water, calculated per MTCA Equation 730-1 with fish consumption rate (97.5 g/day) and fish diet fraction (1) from the ROD.
J	MTCA-B, Surface Water, Cancer	Method B PCUL for cancer effects from consuming fish contaminated from surface water, calculated per MTCA Equation 730-2 with fish consumption rate (97.5 g/day) and fish diet fraction (1) from the ROD.
L	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'Partit' Sheet		
C	Sediment Kd	Sediment Kd at pH 8 and foc 1.9%. From 'Param' sheet.
D	Target Sediment Concentration	Target sediment concentration: Minimum ROD CUL plus SMS lower tier target sediment concentration for chemicals not listed in the ROD. From 'Sed' sheet.
E	GW-3, Ground Water PCUL, Protect Sediment	Ground water PCUL to protect sediment, calculated per the modified form of MTCA Equation 747-1.
F	SMS Upper Tier	SMS upper tier target sediment concentration. From 'Sed' sheet.
G	Ground Water PCUL, Protect Sediment, SMS Upper Tier	Ground water PCUL to protect sediment at the SMS upper tier target sediment concentration, calculated per the modified form of MTCA Equation 747-1. Not used for PCULs but provided for potential use in site-specific CULs or RELs.

Column	Title	Notes
H	Minimum ROD RAL	Minimum ROD RAL. From 'Sed' sheet.
I	Ground Water PCUL, Protect Sediment, Minimum ROD RAL	Ground water PCUL to protect sediment at minimum ROD RAL calculated per the modified form of MTCA Equation 747-1. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
J	User-Defined Target Sediment Conc.	User-defined target sediment concentration.
K	Ground Water PCUL to Protect User-Defined Target Sed. Conc.	Ground water PCUL to achieve the user-defined target sediment concentration, calculated per the modified form of MTCA Equation 747-1.
M	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'VI' Sheet		
C	Listed on CLARC VI page?	Indicates whether the chemical is listed as a VOC in Ecology's (2009) draft guidance on VI.
D	Hcc	Selected value for the unitless version of Henry's law constanct. From 'Param' sheet.
E	AR-1, MTCA-B Air	Method B air PCUL from 'Air-Detail' sheet.
F	GW-4, MTCA-B Ground Water, Protect Indoor Air via Vapor Intrusion	Ground water PCUL to protect indoor air via vapor intrusion under Method B. Calculated per Equation 1 in Ecology's (2009) vapor intrusion guidance.
G	MTCA-C Air	Method C air PCUL from 'Air-Detail' sheet. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
H	MTCA-C Ground Water, Protect Indoor Air via Vapor Intrusion	Ground water PCUL to protect indoor air via vapor intrusion under Method C. Calculated per Equation 1 in Ecology's (2009) vapor intrusion guidance. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
J	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'Sed' Sheet		
C	Bioaccumulative	Indicates which chemicals are considered bioaccumulative for the purpose of developing lower tier and upper tier target sediment concentrations under SMS.
D	Lower Tier, Natural Background	The preferred source for natural background sediment concentrations is EPA's ROD Table 3. Background concentrations for additional chemicals are from SCUM II

Column	Title	Notes
		Table 10-1.
E	Upper Tier, Regional Background	Regional background concentration, which would be used in determining the upper tier target sediment concentration but which has not been developed.
F	PQL	Representative mid-range sediment PQL from 'Param' sheet.
G	SMS Lower Tier, Marine Benthic SCO, Dry Weight	Dry weight benthic SCO. Not currently used in any calculations in the spreadsheet.
H	SMS Lower Tier, Marine Benthic SCO, OC Normalized	OC-normalized benthic SCO provided for use in setting site-specific CULs. Not currently used in any calculations in the spreadsheet.
I	SMS Lower Tier, Marine Benthic LAET, Dry Weight	Lowest apparent effects threshold (LAET) value for marine benthic organisms. For chemicals with dry weight benthic SCOs, the SCO and LAET are the same value. For chemicals with OC normalized SCOs, the SCO and the LAET are different. The dry weight LAET concentrations are used for calculating groundwater CULs to protect sediment.
J	SMS Upper Tier, Marine Benthic CSL, Dry Weight	Dry weight benthic CSL. Not currently used in any calculations in the spreadsheet.
K	SMS Upper Tier, Marine Benthic CSL, OC Normalized	OC-normalized benthic CSL provided for use in setting site-specific CULs. Not currently used in any calculations in the spreadsheet.
L	SMS Upper Tier, Marine Benthic 2nd LAET, Dry Weight	Second LAET value for marine benthic organisms. For chemicals with dry weight benthic CSLs, the CSL and 2nd LAET are the same value. For chemicals with OC normalized CSLs, the CL and the 2nd LAET are different. The dry weight 2nd LAET concentrations are used for calculating groundwater CULs to protect sediment.
M	SMS Lower Tier, Human Health Direct Contact	Minimum CUL for cancer risk of 1E-6 and HQ=1 for sediment contact under the scenarios included in the ROD.
N	SMS Upper Tier, Human Health, Direct Contact	Minimum CUL for cancer risk of 1E-5 and HQ=1 for sediment contact under the scenarios included in the ROD.
O	Lower Tier, Risk-Based Concentration for Bioaccumulatives	For chemicals considered bioaccumulative (column C), the risk-based target concentration is the maximum of the natural background concentration (column D) and the PQL (column F). If neither a natural background concentration nor a numerical PQL value is available, the target concentration is noted as "PQL". If the chemical is not considered bioaccumulative, the result in this column is noted as "na".
P	Upper Tier, Risk-Based	For chemicals considered bioaccumulative (column C), the risk-based target

Column	Title	Notes
	Concentration for Bioaccumulatives	concentration is the maximum of the regional background concentration (column E) and the PQL (column F). If no regional background concentration is available, the natural background concentration (column D) is substituted if available. If neither a natural background concentration, a regional background, nor a numerical PQL value is available, the target concentration is noted as "PQL". If the chemical is not considered bioaccumulative, the result in this column is noted as "na".
Q	Lower Tier, Risk-Based Concentration for Non-Bioaccumulatives	For nonbioaccumulative chemicals, the lower tier risk-based concentration is the minimum of the LAET (column I) and the lower tier target for human sediment contact (column M). If the chemical is considered bioaccumulative, the result in this column is noted as "na".
R	Upper Tier, Risk-Based Concentration for Non-Bioaccumulatives	For nonbioaccumulative chemicals, the upper tier risk-based concentration is the minimum of the 2ndLAET (column L) and the upper tier target for human sediment contact (column N). If the chemical is considered bioaccumulative, the result in this column is noted as "na".
S	SMS Lower Tier, Target Concentration	The lower tier target sediment concentration under SMS is either the value in column N for bioaccumulatives or the value in column O for nonbioaccumulatives.
T	SMS Upper Tier, Target Concentration	The upper tier target sediment concentration under SMS is either the value in column N for bioaccumulatives or the value in column P for nonbioaccumulatives. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
U	LDW ROD, RAO 1 CUL	The sediment CUL for remedial action objective 1 (human seafood consumption) in EPA's record of decision for LDW, Table 19.
V	LDW ROD, RAO 2 CUL, LDW-Wide	Sediment CUL for remedial action objective 2 (human sediment contact with sediment throughout the LDW) in EPA's record of decision for LDW, Table 19.
W	LDW ROD, RAO 2 CUL, Clamming	Sediment CUL for RAO 2 (human sediment contact with in clamming areas) in ROD Table 19.
X	LDW ROD, RAO 2 CUL, Beaches	Sediment CUL for RAO 2 (human sediment contact with sediment at beaches) in ROD Table 19.
Y	LDW ROD, RAO 3 CUL	Sediment CUL for RAO 3 (protection of benthic invertebrates) in ROD Table 20.
Z	LDW ROD, RAO 4 CUL	Sediment CUL for RAO 4 (protection of upper trophic level ecological receptors) in ROD Table 19.
AA	Lowest LDW ROD CUL for	Minimum ROD CUL for comparison with average sediment concentrations, which

Column	Title	Notes
	Comparison to Average Conc.	includes RAO 1 (column T), RAO 2 (columns U through W), and RAO 4 (column Y).
AB	LDW ROD CUL for Point-by-Point Comparisons	ROD CUL for point by point comparisons, which is for RAO 3 (column X).
AC	Minimum LDW ROD CUL	Overall minimum sediment CUL from ROD, which is the minimum of columns Z and AA.
AD	Target Sediment Concentration, Minimum ROD CUL + SMS Lower Tier	Target sediment concentration for calculating ground water PCUL protective of sediment. The overall minimum sediment CUL from the ROD (column AB) is the preferred value. If no ROD CUL is available, the SMS lower tier concentration (column R) is used.
AE	LDW ROD RAL, Intertidal Rec. Cat. 1, 0-10 cm	Sediment RAL for intertidal sediments in recovery category 1 (0-10 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AF	LDW ROD RAL, Intertidal Rec. Cat. 1, 0-45 cm	Sediment RAL for intertidal sediments in recovery category 1 (0-45 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AG	LDW ROD RAL, Intertidal Rec. Cat. 2, 0-10 cm	Sediment RAL for intertidal sediments in recovery category 2 (0-10 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AH	LDW ROD RAL, Intertidal Rec. Cat. 2, Upper Limit for ENR, 0-10 cm	Upper limit for the enhanced natural recovery remedy for intertidal sediments in recovery category 2 (0-10 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AI	LDW ROD RAL, Intertidal Rec. Cat. 2, 0-45 cm	Sediment RAL for intertidal sediments in recovery category 2 (0-45 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AJ	LDW ROD RAL, Intertidal Rec. Cat. 2, Upper Limit for ENR, 0-45 cm	Upper limit for the enhanced natural recovery remedy for intertidal sediments in recovery category 2 (0-45 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AK	LDW ROD RAL, Subtidal Rec. Cat. 1, 0-10 cm	Sediment RAL for subtidal sediments in recovery category 1 (0-10 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AL	LDW ROD RAL, Subtidal Rec. Cat. 1, 0-60 cm	Sediment RAL for subtidal sediments in recovery category 1 (0-60 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.

Column	Title	Notes
AM	LDW ROD RAL, Subtidal Rec. Cat. 2, 0-10 cm	Sediment RAL for subtidal sediments in recovery category 2 (0-10 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AN	LDW ROD RAL, Subtidal Rec. Cat. 2, Upper Limit for ENR, 0-10 cm	Upper limit for the enhanced natural recovery remedy for subtidal sediments in recovery category 2 (0-10 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AO	LDW ROD RAL, Subtidal Rec. Cat. 2, 0-60 cm	Sediment RAL for subtidal sediments in recovery category 2 (0-60 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AP	LDW ROD RAL, Subtidal Rec. Cat. 2, Upper Limit for ENR, 0-60 cm	Upper limit for the enhanced natural recovery remedy for subtidal sediments in recovery category 2 (0-60 cm) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AQ	LDW ROD RAL, Subtidal Shoaled Areas	Sediment RAL for subtidal shoaled areas (top of navigation depth plus 2 feet) in ROD Table 28. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AR	Minimum LDW ROD RAL, Intertidal, Rec. Cat. 1	Minimum ROD RAL for intertidal sediments in recovery category 1, which includes columns AD and AE. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AS	Minimum LDW ROD RAL, Intertidal, Rec. Cat. 2	Minimum ROD RAL for intertidal sediments in recovery category 2, which includes columns AF and AI. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AT	Minimum LDW ROD RAVAL, Subtidal, Rec. Cat. 1	Minimum ROD RAL for subtidal sediments in recovery category 1, which includes columns AJ and AK. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AU	Minimum LDW ROD RAL, Subtidal, Rec. Cat. 2	Minimum ROD RAL for subtidal sediments in recovery category 2, which includes columns AL through AO. Not used for PCULs but provided for potential use in site-specific CULs.
AV	Minimum LDW ROD RAL, Overall	Overall minimum ROD RAL, which includes columns AQ through AT. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
AW	User-Defined Target Sediment Concentration	The user may define a site-specific target sediment concentration by specifying the ROD CULs or RALs relevant to the site. Indicate the CULs or RALs that are included in the column heading.
AY-BP	Basis for SMS Lower Tier	These columns record the endpoints driving the SMS lower tier target concentration

Column	Title	Notes
	Basis for SMS Upper Tier Basis for Minimum ROD CUL Basis for Minimum ROD RAL	(column S), the SMS upper tier target concentration (column T), the minimum ROD CUL (column AC), and the minimum ROD RAL (column AV).
BR	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
	'Sed-Eq' Sheet	
C	CPFo	Oral carcinogenic potency factor from 'Param' sheet.
D	CPFd	Dermal carcinogenic potency factor from 'Param' sheet.
E	RfDo	Oral reference dose from 'Param' sheet.
F	RfDd	Dermal reference dose from 'Param' sheet.
G	AB	Gastrointestinal absorption fraction from 'Param' sheet.
H	ABS	Dermal absorption fraction from 'Param' sheet.
I	Beach Play, Risk=1E-6	Target sediment concentration to protect a child engaged in beach play, based on a cancer risk of 1E-6. Calculated per SMS Equation 9-1 using LDW exposure assumptions from the ROD.
J	Subsistence Clam Digging, Risk=1E-6	Target sediment concentration to protect an adult digging clams, based on a cancer risk of 1E-6. Calculated per SMS Equation 9-1 using LDW exposure assumptions from the ROD.
K	Subsistence Netfishing, Risk=1E-6	Target sediment concentration to protect an adult netfisher, based on a cancer risk of 1E-6. Calculated per SMS Equation 9-1 using LDW exposure assumptions from the ROD.
L	Beach Play, Risk=1E-5	Target sediment concentration to protect a child engaged in beach play, based on a cancer risk of 1E-5. Calculated per SMS Equation 9-1 using LDW exposure assumptions from the ROD.
M	Subsistence Clam Digging, Risk=1E-5	Target sediment concentration to protect an adult digging clams, based on a cancer risk of 1E-5. Calculated per SMS Equation 9-1 using LDW exposure assumptions from the ROD.
N	Subsistence Netfishing, Risk=1E-5	Target sediment concentration to protect an adult netfisher, based on a cancer risk of 1E-5. Calculated per SMS Equation 9-1 using LDW exposure assumptions from the ROD.
O	Beach Play, HQ=1	Target sediment concentration to protect a child engaged in beach play, based on a

Column	Title	Notes
		noncancer hazard quotient of 1. Calculated per SMS Equation 9-2 using LDW exposure assumptions from the ROD.
P	Subsistence Clam Digging, HQ=1	Target sediment concentration to protect an adult digging clams, based on a noncancer hazard quotient of 1. Calculated per SMS Equation 9-2 using LDW exposure assumptions from the ROD.
Q	Subsistence Netfishing, HQ=1	Target sediment concentration to protect an adult netfisher, based on a noncancer hazard quotient of 1. Calculated per SMS Equation 9-2 using LDW exposure assumptions from the ROD.
R	Lower Tier, Beach Play (1E-6 or HQ=1)	Minimum of PCULs for beach play (columns I and O).
S	Lower Tier, Clam Digging (1E-6 or HQ=1)	Minimum of PCULs for clam digging (columns J and P).
T	Lower Tier, Netfishing (1E-6 or HQ=1)	Minimum of PCULs for netfishing (columns K and Q).
U	Lower Tier Minimum Direct Contact Scenario	Minimum of the three scenarios (columns R-T).
V	Upper Tier, Beach Play (1E-5 or HQ=1)	Minimum of PCULs for beach play (columns L and O).
W	Upper Tier, Clam Digging (1E-5 or HQ=1)	Minimum of PCULs for clam digging (columns M and P).
X	Upper Tier, Netfishing (1E-5 or HQ=1)	Minimum of PCULs for netfishing (columns N and Q).
Y	Upper Tier Minimum Direct Contact Scenario	Minimum of the three scenarios (columns V-X).
AA	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'AR-Det' Sheet		
C	MTCA-B Air, Noncancer	Method B air PCUL for noncancer effects. From 'AR-Eq' sheet.
D	MTCA-B Air, Cancer	Method B air PCUL for cancer effects. From 'AR-Eq' sheet.
E	Listed on CLARC VI page?	YES indicates chemical is considered volatile for purposes of evaluating vapor intrusion.

Column	Title	Notes
F	AR-1, MTCA-B Air	Minimum of Method B PCULs for noncancer effects (column C) and cancer effects (column D).
G	SG-1, MTCA-B, Sub-Slab Soil Gas, Protect Indoor Air	Method B shallow/sub-slab soil gas PCUL calculated from AR-1 (column E) per Equation 2 in Ecology's (2009) vapor intrusion guidance using a vapor attenuation factor of 0.03.
H	SG-2, MTCA-B, Deep Soil Gas, Protect Indoor Air	Method B deep soil gas PCUL calculated from AR-1 (column E) per Equation 2 in Ecology's (2009) vapor intrusion guidance using a VAF of 0.01.
I	MTCA-C Air, Noncancer	Method C air PCUL for noncancer effects. From 'AR-Eq' sheet. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
J	MTCA-C Air, Cancer	Method C air PCUL for cancer effects. From 'AR-Eq' sheet. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
K	MTCA-C Air	Minimum of Method C PCULs for noncancer effects (column H) and cancer effects (column I). Not used for PCULs but provided for potential use in site-specific CULs or RELs.
L	MTCA-C, Sub-Slab Soil Gas, Protect Indoor Air	Method C shallow/sub-slab soil gas PCUL calculated from AR-1 (column E) per Equation 2 in Ecology's (2009) vapor intrusion guidance using a vapor attenuation factor of 0.03. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
M	MTCA-C, Deep Soil Gas, Protect Indoor Air	Method C deep soil gas PCUL calculated from AR-1 (column E) per Equation 2 in Ecology's (2009) vapor intrusion guidance using a VAF of 0.01. Not used for PCULs but provided for potential use in site-specific CULs or RELs.
O	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.
'AR-Eq' Sheet		
C	RfDi	Inhalation reference dose from 'Param' sheet.
D	CPFi	Inhalation carcinogenic potency factor from 'Param' sheet.
E	MTCA-B Air, Noncancer	Method B air PCUL for noncancer effects calculated per MTCA Equation 750-1. The values for GRO and DRO are from Ecology's (2018) Implementation Memo 18.
F	MTCA-B Air, Cancer	Method B air PCUL for cancer effects calculated per MTCA Equation 750-2.
G	MTCA-C Air, Noncancer	Method C air PCUL for noncancer effects calculated per MTCA Equation 750-1 adjusted per WAC 173-340-750(4). Not used for PCULs but provided for potential

Column	Title	Notes
		use in site-specific CULs or RELs.
H	MTCA-C Air, Cancer	Method C air PCUL for cancer effects calculated per MTCA Equation 750-2 adjusted per WAC 173-340-750(4). Not used for PCULs but provided for potential use in site-specific CULs or RELs.
J	Select	By placing an 'X' in this column on the rows for chemicals of interest, one can filter the spreadsheet to show only the chemicals of interest.

Table 3. Abbreviations

Acronym	Definition
AB	Gastrointestinal absorption fraction (abbreviation used in SMS)
AB1	Gastrointestinal absorption fraction (abbreviation used in MTCA)
ABS	Dermal absorption fraction
ADAF	Age-dependent adjustment factor
AF	Sediment-skin adherence factor
AR	Air
ARAR	Applicable or relevant and appropriate requirement
AT	Averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
BCF	Fish bioconcentration factor
BEHP	Bis(2-ethylhexyl) phthalate
BHC	Benzene hexachloride (hexachlorocyclohexane)
BW	Body weight
CalEPA	California Environmental Protection Agency
CAP	Cleanup action plan
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLARC	Cleanup Levels and Risk Calculation database
COC	Chemical of concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CPF	Carcinogenic potency factor (also known as slope factor)
CPFd	Dermal CPF
CPFi	Inhalation CPF
CPFo	Oral CPF
CR	Target cancer risk
CSL	Cleanup screening level
CUL	Cleanup level
DDD	Dichlorodiphenyl dichloroethane
DDE	Dichlorodiphenyl dichloroethene
DDT	Dichlorodiphenyl trichloroethane
DMMP	Dredged Materials Management Program
DRO	Diesel range organics or diesel range hydrocarbons
DW	Dry weight
Ecology	Washington State Department of Ecology
ED	Exposure duration
EF	Exposure frequency
ENR	Enhanced natural recovery
EPA	U.S. Environmental Protection Agency
Eq	Equation
GI	Gastrointestinal absorption conversion factor
GW	Ground water

Acronym	Definition
Hcc	Henry's law constant
HEAST	Health Effects Assessment Summary Tables
HH	Human health
HPAH	High molecular weight polycyclic aromatic hydrocarbons
HQ	Noncancer hazard quotient
INH	Inhalation correction factor
IR	Ingestion rate
IRIS	Integrated Risk Information System
IUR	Inhalation unit risk
Kd	Soil-water partitioning coefficient
Koc	Organic carbon-water partitioning coefficient
LAET	Lowest apparent effects threshold
LDW	Lower Duwamish Waterway
LOAEL	Lowest observed adverse effect level
LPAH	Low molecular weight polycyclic aromatic hydrocarbons
MCL	Maximum contaminant level
MCLG	MCL goal
MTCA	Model Toxics Control Act
MTCA-B	MTCA Method B
MTCA-C	MTCA Method C
na	Not available or not applicable
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No observed adverse effects level
NRWQC	National recommended water quality criteria
NTR	National toxics rule
OC	Organic carbon (normalized)
ORNL	Oak Ridge National Laboratory
ORO	Oil range organics or oil range hydrocarbons
PAH	Polycyclic aromatic hydrocarbon
PBT	Persistent bioaccumulative toxin
RAO	Remedial action objective
PCB	Polychlorinated biphenyl
PCUL	Preliminary cleanup level
PLP	Potentially liable party
PPRTV	Preliminary peer-reviewed toxicity value
PQL	Practical quantitation limit
PW	Potable Water
RAL	Remedial action level
Rec. Cat.	Recovery category
REL	Remediation level
RfC	Reference concentration
RfD	Reference dose

Acronym	Definition
RfDd	Dermal RfD
RfDi	Inhalation RfD
RfDo	Oral RfD
ROD	Record of decision
RSL	EPA's regional screening levels
SA	Surface area
SCO	Sediment cleanup objective
SCUM II	Sediment Cleanup Users Manual II
SL	Soil
SMS	Sediment Management Standards
SQuiRT	Screening quick reference tables
SVOC	Semi-volatile organic compound
SW	Surface water
2,3,7,8-TCDD	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin
TBD	To be determined
TCP	Toxics Cleanup Program
TEE	Terrestrial ecological evaluation
TEF	Toxicity equivalence factor
TEQ	Toxicity equivalent concentration
TOC	Total organic carbon
TPH	Total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
UCF	Unit conversion factor
95UCL	Upper 95 percent confidence limit on the mean
90/90 UTL	Upper 90 percent tolerance limit on the 90^{th} percentile
VOC	Volatile organic compound
WA	Washington State
WQC	Water quality criteria
WQP	Water Quality Program
WQS	Water quality standard