

APPENDIX 8.1-2

Screening of Environmental Chemistry Data

1.0 INTRODUCTION

This appendix describes the chemical screening process used in the Human Health assessment as part of the overall Environmental Assessment for the WesPac Tilbury Marine Jetty Project (the Project). The purpose of the chemical screening process is to identify the constituents of potential concern (COPCs) for the human health multimedia risk assessment. The detailed results of the multimedia COPC screening process, including a description of the screening values, comparison to screening values and final selection of COPCs for the human health multimedia risk assessment are presented in this appendix.

2.0 SCREENING VALUES USED IN THE HUMAN HEALTH MULTIMEDIA RISK ASSESSMENT

British Columbia (BC) and Canadian environmental quality guidelines were used preferentially to screen baseline and predicted environmental quality data to identify COPCs. In the absence of BC or Canadian environmental quality criteria for a constituent, environmental quality criteria from international regulatory jurisdictions (e.g., the United States Environmental Protection Agency [US EPA]) were used. Regional background concentrations were also used for screening purposes, where available (Health Canada 2010a). Environmental quality regulations or guidelines used in this assessment are summarized below by media type with the exception of the air quality criteria, which are presented separately in Appendix 8.1-4.

2.1 Soil

Measured baseline and predicted soil quality concentrations at selected human health receptor locations were screened against the human health based residential land use soil quality criteria listed below. The Project boundary and area immediately surround the Project Site are considered industrial land use; however, residential standards and guidelines were used for screening because baseline sampling targeted areas outside the Project boundary and areas where people are living or carrying out recreational activities and they are more conservative than industrial standards and guidelines.

- Canadian Council of Ministers of the Environment (CCME 2018) – Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health. Where available, human health guidelines/check values for soil ingestion or direct contact were used. The Canadian soil quality guidelines are typically based on an allocation of 20% of the provisional tolerable daily intake of soil (i.e., assuming 20% of a person's tolerable daily intake of a chemical comes from soil, and the remaining 80% comes from other sources such as food and water).
- British Columbia Ministry of Environment and Climate Change Strategy (BC ENV 2018) – BC Contaminated Sites Regulation (CSR) Matrix Numerical Soil Standards (Schedule 3.1 – Part 1) and Generic Numerical Soil Standards to Protect Human Health (Schedule 3.1 – Part 2). Where available, the site-specific factor for intake of contaminated soil was used.

The soil quality screening values are presented in Attachment 1: Table 1-1 (metals) and Table 1-2 (polycyclic aromatic hydrocarbons [PAHs]). The lower of the CCME guideline and BC CSR standard was conservatively chosen as the screening value. If a CCME guideline and BC CSR standard was not available, US EPA regional screening levels (RSLs) for residential soils for chemical contaminants at superfund sites US EPA (2018a) were used. The US EPA RSLs are risk-based screening criteria that were derived based on an acceptable hazard quotient (HQ) of 1 for non-carcinogens, and an acceptable incremental lifetime cancer risk (ILCR) of 10^{-6} (1 in 1,000,000) for carcinogens. Health Canada considers an HQ of 0.2 and ILCR of 10^{-5} (1 in 100,000) to be acceptable thresholds for risk. For non-carcinogens, US EPA RSLs were adjusted to a HQ of 0.2 (to reflect an allocation of 20% of a person's tolerable daily intake from soil) by multiplying the RSL value by 0.2. For carcinogens, RSLs were adjusted to reflect a cancer risk level of 1 in 100,000 by multiplying the RSL value by 10 for comparison with Canadian environmental quality guidelines.

The BC ENV (2017a) provides background soil concentration estimates for inorganic constituents for seven regions across BC¹. The background soil concentrations are 95th percentiles calculated for a specific region. Regional background soil concentrations for the Lower Mainland are shown in Attachment 1: Table 1-1 and were used for screening soil data. If soil concentrations do not exceed regional background concentrations, it is not considered a COPC (Health Canada 2010a, BC ENV 2017a).

2.2 Sediment

In the absence of sediment quality criteria from BC and Canadian jurisdictions that are protective of human health, baseline sediment quality data were screened against the residential soil quality standards and guidelines described above in Section 2.1. This approach is consistent with Health Canada's sediment guidance (Health Canada 2017a).

The sediment quality screening is presented in Attachment 1: Table 1-3. The lower of the CCME guideline and BC CSR standard was conservatively chosen as the selected screening value. In the absence of a CCME guideline or BC CSR standard, the US EPA RSLs for residential soils for chemical contaminants at superfund sites US EPA (2018a) were used. A discussion on the US EPA RSL is provided in Section 2.1.

2.3 Surface Water

A detailed description of the constituents considered in the water quality assessment, and the process for predicting changes to water quality are presented in the Water Quality section (Section 4.6). Based on that assessment, water quality is not anticipated to change as a result of the Project. Although dredging may increase suspended sediments in the Local Assessment Area, the magnitude of the effect is expected to be low and any changes in surface water quality are not expected to be distinguishable from existing conditions, accounting for inherent variability due to tidal cycles and river discharge. Therefore, water quality data were not used to identify COPCs for the human health multimedia assessment. The baseline water quality data were screened for informational purposes using the following sources:

- Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada 2017b) – Drinking water guidelines are based on health effects, aesthetic effects and operational considerations. Health-based

¹ Vancouver Island, Lower Mainland, Metro Vancouver, Thompson/Nicola/Okanagan, Kootenay, Cariboo, Skeena and Omineca/Peace.

guidelines were established on the basis of a comprehensive review of current, published scientific research (Health Canada 2017b). The guidelines (or maximum acceptable concentrations) were generally derived using an average daily intake of 1.5 litres (L) of drinking water by a 70 kilogram (kg) adult. However, for some constituents, regulatory agencies have developed guidelines based on intake of the most sensitive sub-population (e.g., children). For non-carcinogenic constituents, a 20% allocation of the total daily intake to drinking water was generally applied (i.e., assuming 20% of a person's tolerable daily intake from a chemical comes from water, and the remaining 80% comes from other sources such as food), unless data on the proportion of total intake normally ingested in drinking water was available (Health Canada 1995).

- BC Water Quality Guideline – Recreational Water Quality Guidelines (BC ENV 2017b) and Source Drinking Water Quality Guidelines (BC ENV 2017c). The Recreational Water Quality Guidelines were derived to “help manage recreational water quality and assess the risks to human health” (BC ENV 2017b). The Source Drinking Water Quality Guidelines are applicable to ambient waters prior to treatment or distribution for domestic use in multi-use watersheds where human health exposure may be of concern (BC ENV 2017c).
- BC ENV (2018) – BC CSR Generic Numerical Water Standards (Schedule 3.2) for Drinking Water. Although these standards apply to groundwater used for drinking water, people may use surface water at the Site as a drinking water source. The drinking water standards are generally based on Health Canada's Guidelines for Canadian Drinking Water Quality (see above). For some chemicals, Health Canada has provided an aesthetic objective, while the BC CSR has derived a health-based standard (e.g., aluminum, iron, manganese). In addition, several BC CSR drinking water standards are based on the US EPA's RSLs for residential tap water (US EPA 2018a; see below) (e.g., beryllium, cobalt, vanadium).
- US EPA (2018a) – RSLs for residential tap water. The US EPA RSLs are risk-based screening criteria that were derived based on an acceptable HQ of 1 for non-carcinogens, and an acceptable ILCR of 10^{-6} (1 in 1,000,000) for carcinogens. Health Canada considers an HQ of 0.2 and ILCR of 10^{-5} (1 in 100,000) to be acceptable thresholds for risk. For non-carcinogens, US EPA RSLs were adjusted to a HQ of 0.2 (to reflect an allocation of 20% of a person's tolerable daily intake from water) by multiplying the RSL value by 0.2. For carcinogens, RSLs were adjusted to reflect a cancer risk level of 1 in 100,000 by multiplying the RSL value by 10 for comparison with Canadian environmental quality guidelines.

The Fraser River is not used as a drinking water source and therefore screening against drinking water guidelines is not applicable for this assessment. Recreational guidelines, however, were only available for a subset of constituents. Therefore, when a recreational guideline was not available, a conservative screening value was derived by multiplying the drinking water guideline by a factor of 10 as recommended by the World Health Organization's (WHO) Guidelines for Recreational Water Environments (WHO 2003). The WHO (2003) adjustment of 10% of potable water intake is based on a swimming scenario and is therefore conservative for recreational secondary contact where the recreational user would not be fully submerged in water. Drinking water guidelines based on aesthetic (non-health) considerations (e.g., colour, taste, odour) were not adjusted.

The surface water screening values are presented in Attachment 1: Table 1-4 (physical parameters, nutrients, ions and metals under high and low flow conditions) and Table 1-5 (PAHs from three surface water samples). The selected recreational screening value was chosen using the following hierarchy:

- 1) BC ENV Recreational Water Quality Guidelines (BC ENV 2017b).
- 2) The lower of health-based values from Health Canada (2017a), BC ENV Source Drinking Water Quality Guidelines (BC ENV 2017c) and BC CSR drinking water standards (BC ENV 2018).
- 3) US EPA RSL (US EPA 2018a).
- 4) The lower of aesthetic values from Health Canada (2017a), BC ENV Source Drinking Water Quality Guidelines (BC ENV 2017c) and BC CSR drinking water standards (BC ENV 2018).

2.4 Fish Tissue

With the exception of mercury and selenium, fish tissue screening criteria protective of human consumption are not available from BC or Canadian regulatory agencies. Health Canada recommends deriving site-specific fish tissue screening values using acceptable risk levels and fish ingestion rates appropriate for local subsistence populations. Fish tissue screening values were calculated based on the Health Canada (2012) equation for ingestion of country foods. The equations for calculating the non-cancer and cancer screening levels for fish tissue are presented below.

$$\text{Non – cancer Screening Level (mg/kg ww)} = \frac{THQ \times RfD \times BW \times 365}{IR_{fish} \times RAF_o \times EF}$$

Where:

THQ= target hazard quotient (unitless)

RfD= reference dose (mg/kg/day)

BW= body weight (kg)

IR_{fish}= fish ingestion rate (kg/day)

RAF_o= oral relative absorption factor (unitless)

EF= exposure frequency, days per year consuming fish (assumed 365)

$$\text{Cancer Screening Value (mg/kg ww)} = \frac{TILCR \times BW \times LE \times 365}{IR_{fish} \times SF \times RAF_o \times EF \times ED}$$

Where:

TILCR= target incremental lifetime cancer risk (unitless)

BW= body weight (kg)

LE = life expectancy (years)

IR_{fish}= fish ingestion rate (kg/day)

SF= slope factor (mg/kg/day)⁻¹

RAF_o= oral relative absorption factor (unitless)

EF= exposure frequency, days per year consuming fish (assumed 365)

ED= exposure duration (years)

Non-cancer screening values were calculated for both a toddler and an adult. Cancer screening values were calculated for an adult only, as this is the life stage with the longest exposure duration (60 years) that would result in a more conservative screening value. The lowest calculated screening value (of the non-carcinogenic and carcinogenic values) was used to screen fish tissue data. The inputs used to derive the fish tissue screening values are presented in Table 1.

Table 1: Inputs for Calculating Fish Tissue Screening Values

Input	Units	Toddler	Adult	Source
Body weight (BW)	kg	16.5	70.7	Health Canada (2012)
Fish ingestion rate (IR _{fish})	kg/day	0.054	0.128	Chan et al. (2011)
Relative absorption factor for oral exposure (RAF _o)	-	1	1	Health Canada (2012)
Target hazard quotient (THQ)	-	0.2	0.2	(Health Canada 2012)
Target incremental lifetime cancer risk (TILCR)	-	-	0.00001	(Health Canada 2012)
Life expectancy (LE)	years	-	80	(Health Canada 2012)
Life stage duration (ED)	years	-	60	(Health Canada 2012)
Exposure frequency (EF)	days/year	365	365	(Health Canada 2012)
Reference dose (RfD)	mg/kg/day	Chemical-specific (see Attachment 1: Table 1-6)		
Slope factor (SF)	(mg/kg/day) ⁻¹			

Additional information about the inputs used to derive the fish tissue screening values are provided below:

- Default body weights, life expectancy, exposure duration and exposure frequency were obtained from (Health Canada 2012).
- The relative absorption factor for oral exposure was assumed to be 100% (Health Canada 2012).
- The fish tissue screening values are based on a target hazard quotient of 0.2 and a target incremental lifetime cancer risk of 1 in 100,000 (1×10^{-5}), consistent with Health Canada guidance.
- Fish consumption data from the First Nations Food, Nutrition and Environment Study (Chan et al. 2011) were used to calculate fish ingestion rates representative of local subsistence populations. Salmon, eulachon sturgeon and char were identified as species of concern based on commercial, recreational or Aboriginal fisheries importance and their species at risk classification (EnviroWest Consultants Inc., as cited in Golder 2018). Therefore, it was assumed people may consume salmon (any type), trout (any type), eulachon and sturgeon from the Fraser River (Chan et al. 2011). Char was not listed as a species consumed in Chan et al. (2011). The 95th percentile consumption rates for the above species were obtained from Chan et al. (2011) and represents the fish consumption rate for an adult high consumer. The sum of the 95th percentile consumption rates for the above species was 0.128 kg/day. To adjust this adult consumption rate to a toddler consumption rate, the relative ingestion rates for fish consumption by toddlers and adults was used to derive a toddler ingestion rate of 0.054 kg/day (Richardson 1997).
- In order to select appropriate toxicity reference values (i.e., reference doses and slope factors), the constituents were classified as carcinogens or non-carcinogens. Several organizations have developed classification systems based on the carcinogenic properties of chemicals. BC ENV (2017d) classifies carcinogens based on evaluations by US EPA, International Agency for Research on Cancer (IARC) and

CCME. Because the Project is under joint federal and provincial review, carcinogen classifications from Health Canada (2010b) were also considered. The classification systems for Health Canada (2010b), IARC (2018) and US EPA (Integrated Risk Information System database; US EPA 2018a) are presented in Table 2. Chemicals classified as Group I/II (Health Canada), Group A/B1/B2 (US EPA) or Group 1/2A (IARC), and for which carcinogenic toxicity reference values were available, were assessed as carcinogens.

- The most conservative toxicity reference values (reference doses and slope factors) were selected preferentially from the Health Canada (2010b) and US EPA (2018b), as the Project is under joint federal and provincial review (the US EPA is the preferred source of toxicity reference values under the provincial legislation [BC ENV (2017e)]). In the absence of Health Canada and US EPA TRVs, reference doses and slope factors were selected from the other sources listed in BC ENV (2017e). The TRVs used to calculate the fish tissue screening values are presented in Attachment 1: Table 1-6.

Table 2: Carcinogen Classification System

Health Canada (2010b)	US EPA (2018b)	IARC (2018)	Description
Group I	Group A	Group 1	Human carcinogen
Group II	Group B	Group 2A	Probable human carcinogen
-	Group B1	-	Limited human evidence available
-	Group B2	-	Inadequate human evidence, sufficient animal evidence
Group III	Group C	Group 2B	Possible human carcinogen
Group IV	-	-	Unlikely to be a carcinogen (Health Canada only)
Group V	Group E	Group 4	Probably not carcinogenic to humans
Group VI	Group D	Group 3	Unclassifiable as to human carcinogenicity

2.4.1 Mercury

The fish tissue screening value for mercury was obtained from the (BC ENV 2001). When diet is based primarily on fish, the human consumption guideline is based on regular weekly consumption. To be conservative, the lowest screening value (0.1 milligrams per kilogram [mg/kg] wet weight [ww]) for a weekly consumption of 1,050 grams (g) ww was selected for identifying mercury as a COPC in fish tissue. The mercury fish tissue guideline protective of human consumption accounts for exposure from other sources such as water, air and other foods and is considered appropriate for screening purposes.

2.4.2 Selenium

The fish tissue screening value for selenium was obtained from the BC ENV (2014). BC ENV (2014) derived human consumption screening values for high, moderate and low consumers of fish using Health Canada's recommended equation for ingestion of selenium-contaminated fish:

$$C \text{ (mg/kg)} = \frac{\text{Dose} \times BW}{IR_{fish} \times RAF_o}$$

Where:

C= highest concentration of selenium in fish that will not exceed target hazard quotient of one

Dose = tolerable daily intake (5.7 mg/kg/day)

BW = body weight (70.7 kg)

IR_{fish}= fish ingestion rate Canadian First Nations (high; 220 g/day)

Canadian general population (moderate; 111 g/day)

Based on two recommended servings/week (low; 21.5 g/day)

RAF_o= oral relative absorption factor (unitless)

BC ENV (2014) assumed that fish are consumed on a daily basis throughout the year.

The most conservative screening value of 1.8 mg/kg, which is calculated based on the highest fish consumption rate, was selected for identifying selenium as a COPC in fish tissue. BC ENV (2014) calculated this screening value based on a target HQ of one. Therefore, the selected screening value (0.36 mg/kg) was derived by dividing the BC ENV high fish consumption screening value of 1.8 mg/kg by 5 to represent a screening value equivalent to a HQ of 0.2.

The calculated fish tissue screening values and fish tissue screening values for mercury and selenium protective of human consumption are presented in Attachment 1: Table 1-7.

2.5 Berries

There are no BC, Canadian or international environmental quality guidelines for berries. A COPC identified in soil will be carried forward as a COPC in berries as soil quality directly influences vegetation quality. Measured chemistry data for berries are presented in Appendix 8.1-1.

3.0 CONSTITUENTS OF POTENTIAL CONCERN IDENTIFIED FOR THE HUMAN HEALTH MULTIMEDIA RISK ASSESSMENT

3.1 Elimination of Non-toxic Constituents

Some metals and essential minerals are commonly analyzed in environmental samples (as part of the standard suite of metals treated by the analytical method) but generally have low toxicity at concentrations that occur in the environment (even at industrial sites). Many of these constituents are naturally occurring in parent soil materials and are present in a toxicologically inert form. In addition, some of these constituents are essential micro- and macro-nutrients. Although the following metals and essential minerals may be present in media in the local or regional assessment areas, they were excluded from further consideration in the COPC screening process based on their expected low toxicological hazard:

- Essential minerals (calcium, magnesium, phosphorus, potassium and sulphur); and
- Trace elements (bismuth, platinum, titanium and zirconium).

The rationale for excluding these COPCs from further consideration is described below.

Calcium, magnesium, phosphorus, potassium and sulphur are essential minerals that serve a variety of biochemical, intracellular, and ion balance purposes in human tissues. These constituents are naturally occurring constituents that are included in routine analytical chemical analyses. Government agencies often do not develop regulatory criteria for these and other innocuous constituents. As these constituents are not known or expected to be associated with Project activities, they have been excluded from the human health multimedia risk assessment.

Bismuth, platinum, titanium and zirconium are trace mineralogical constituents that are not commonly assessed in risk assessment. Human and animal toxicity data are lacking for these compounds.

3.2 Soil

The COPCs in soil were identified based on the predicted concentrations of constituents in soil in the Application Case. A constituent was identified as a COPC in soil if the predicted concentration exceeded the selected screening value and the regional background concentration. Detailed methods for the prediction of concentrations in soil are provided in Appendix 8.1-3. Methods for the prediction of aerial deposition rates are provided in the Air Quality section (Section 4.4).

The baseline soil quality screening is presented in Attachment 1: Table 1-1 (metals) and Table 1-2 PAHs. The predicted Baseline, Application and Project Case soil concentration screening for metals and PAHs is presented in Appendix 8.1-3. Deposition rates were provided for a subset of metals anticipated to be emitted by the Project. Based on the screening results, predicted soil concentrations were below the selected screening values at each receptor location. Therefore, no soil COPCs were identified for the human health multimedia risk assessment.

3.3 Sediment

Based on the results of the Water Quality section (Section 4.6), sediment quality is not anticipated to change as a result of the Project. Therefore, sediment concentrations as a result of the Project were not predicted and no sediment COPCs were identified for the human health multimedia risk assessment. Baseline sediment data were compared to screening values in Attachment 1: Table 1-3 for information purposes.

3.4 Surface Water

Based on the results of the Water Quality section (Section 4.6), water quality is not anticipated to change as a result of the Project. The Water Quality section identified a potential for mobilization of PAHs from disturbed sediment to the water column. To evaluate this, the 95th percentile of baseline sediment PAH concentrations from the proposed area of the dredge pocket were used to predict total surface water concentrations that may be expected during dredging for 50, 100, and 200 milligram per litre total suspended solids scenarios. Predicted PAH concentrations were below the selected surface water quality screening values (Water Quality section [Section 4.6]). Therefore, no surface water COPCs were identified for the human health multimedia risk assessment. Baseline surface water data were compared to selected screening values in Attachment 1: Table 1-4 (physical parameters, nutrients, ions and metals) and Table 1-5 (PAHs) for informational purposes.

3.5 Fish Tissue

Water and sediment quality are not anticipated to change as a result of the Project; therefore, fish tissue chemistry would not be expected to change. Baseline fish tissue data were compared to screening values in Attachment 1: Table 1-7 for informational purposes.

3.6 Summary of Constituents of Potential Concern

Based on the screening process outlined above, no COPCs were identified for the human health multimedia risk assessment.

- **Soil:** The soil concentrations predicted for the Baseline, Application and Project Cases were below the selected screening values at each receptor location. Therefore, no soil COPCs were identified for the human health multimedia risk assessment.
- **Sediment:** Sediment concentrations are not expected to change as a result of the Project and therefore, sediment data were not screened for selection of COPCs.
- **Surface Water:** Surface water concentrations are not expected to change as a result of the Project and therefore, water quality data were not screened for selection of COPCs.
- **Fish Tissue:** Sediment and surface water concentrations are not expected to change as a result of the Project and therefore, fish tissue concentrations are not anticipated to change. The fish tissue data were therefore not screened for selection of COPCs.
- **Vegetation (berries):** There are no screening guidelines that can be applied directly to vegetation. Vegetation COPCs were identified based on the soil data. If a COPC was retained in soil, it was retained as a COPC in vegetation. No COPCs were identified in soil; therefore, no COPCs were retained for vegetation.

4.0 CLOSURE

This appendix has been prepared in support of Section 8.1 (Human Health) of the EAC Application being prepared for the WesPac Tilbury Project under the joint review of the British Columbia Environmental Assessment Office and the Canadian Environmental Assessment Agency. This appendix should be read in conjunction with Section 8.1 (Human Health). Any use which a third party makes of this Appendix, or any reliance on or decisions made based on it, are the responsibility of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this appendix.

5.0 REFERENCES

- BC ENV. 2001. Ambient Water Quality Guidelines for Mercury: Overview Report — First Update. Water Protection and Sustainability Branch, Environmental Sustainability and Strategic Policy Division, BC ENV. <<https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/mercury-or.pdf>>.
- BC ENV. 2014. Ambient Water Quality Guidelines for Selenium: Technical Report Update. Water Protection and Sustainability Branch, Environmental Sustainability and Strategic Policy Division, BC ENV. <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/bc_moe_se_wqg.pdf>.
- BC ENV. 2017a. Protocol 4 for Contaminated Sites: Establishing Background Concentrations in Soil. Site Remediation Protocols, Environmental Protection & Sustainability, Air, Land & Water, Site Remediation, BC ENV. Victoria, BC, Canada.
- BC ENV. 2017b. BC Recreational Water Quality Guidelines: Guideline Summary. Water Quality Guideline Series, Water Quality & Aquatic Science, Water Protection & Sustainability Branch, BC ENV. Victoria, BC, Canada.
- BC ENV. 2017c. BC Source Drinking Water Quality Guidelines: Guideline Summary. Water Quality Guideline Series, Water Quality & Aquatic Science, Water Protection & Sustainability Branch, BC ENV. Victoria, BC, Canada.
- BC ENV. 2017d. Protocol 30 for Contaminated Sites: Classifying Substances as Carcinogenic. Site Remediation Protocols, Environmental Protection & Sustainability, Air, Land & Water, Site Remediation, BC ENV. Victoria, BC, Canada.
- BC ENV. 2017e. Technical Guidance on Contaminated Sites 7: Supplemental Guidance for Risk Assessments. Technical Guidance for Site Remediation, Environmental Protection & Sustainability, Air, Land & Water, Site Remediation, BC ENV. Victoria, BC, Canada.
- BC ENV. 2018. Contaminated Sites Regulation [BC CSR; includes amendments up to B.C. Reg. 116/2018, June 14, 2018]. <http://www.bclaws.ca/Recon/document/ID/freeside/375_96_00>.
- CCME. 2018. Soil Quality Guidelines for the Protection of Environmental and Human Health. CCME. <<http://st-ts.ccme.ca/en/index.html>>.
- Chan, L., O. Receveur, D. Sharp, H. Schwartz, A. Ing, and Tikhonov, C. 2011. First Nations Food, Nutrition & Environment Study: Results from British Columbia (2008/2009). University of British Columbia, Prince George, BC, Canada.
- Golder. 2018. Appendix D: Description of Ecological Attributes in Support of the Stage 2 Environmental Impact Study. In: Annacis Island Wastewater Treatment Plant Transient Mitigation and Outfall Project: Stage 2 Environment Impact Study. Prepared for Metro Vancouver. <<https://www.portvancouver.com/wp-content/uploads/2018/01/Appendix-K.2-Part-A-Stage-2-Environmental-Impact-Study-Report-Annacis-Outfall.pdf>>.
- Health Canada. 1995. Part I: Approach to the Derivation of Drinking Water Guidelines. Health Protection Branch, Health Canada, Ottawa, ON, Canada.

- Health Canada. 2010a. Federal Contaminated Site Risk Assessment in Canada, Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals (DQRA_{Chem}). Contaminated Sites Division, Safe Environments Directorate. Ottawa, ON, Canada.
- Health Canada. 2010b. Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-specific Factors, Version 2.0. Contaminated Sites Division, Safe Environments Directorate. Ottawa, ON, Canada.
- Health Canada. 2012. Federal Contaminated Site Risk Assessment in Canada Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0. Contaminated Sites Division, Safe Environments Directorate. Ottawa, ON, Canada.
- Health Canada. 2017a. Supplemental Guidance on Human Health Risk Assessment of Contaminated Sediments: Direct Contact Pathway. Contaminated Sites Division, Safe Environments Directorate. Ottawa, ON, Canada.
- Health Canada. 2017b. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada. Ottawa, ON, Canada.
- IARC. 2018. Agents Classified by the IARC Monographs, Volumes 1-122.
<<http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf>>.
- Richardson, M. G. 1997. Compendium of Canadian Human Exposure Factors for Risk Assessment. O'Connor Associates Environmental Inc. Ottawa, ON, Canada.
- US EPA. 2018a. Regional Screening Levels (RSLs) - Generic Tables. National Center for Environmental Assessment, US EPA. <<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>>.
- US EPA. 2018b. Integrated Risk Information System (IRIS) Assessments. National Center for Environmental Assessment, US EPA. <<https://www.epa.gov/iris>>.
- WHO. 2003. Guidelines for Safe Recreational Water Environments: Volume 1 Coastal and Fresh Water. WHO Regional Office for Europe, WHO. Geneva, Switzerland.

Appendix 8.1-2
Attachment 1
Table 1-1: Soil Screening Results - Metals
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample Location		CCME RL/PL SQG ¹					Notes	CSR RL _{LD} ²	Notes	Regional Background ³	Selected Screening Value ⁴	Farm Land	Farm Land	Farm Land	Dyke East of Project Site	Dyke West of Project Site	Dyke West of Project Site	Deas Park	Deas Park	Boat Launch	Dyke North of Project Site	Dyke North of Project Site	Park near Fraser River, Richmond	South-Dyke Park	Finn Slough	Gary Point
Sample ID	Units											15-Tilbury-S-1	15-Tilbury-S-2	15-Tilbury-S-3	15-Tilbury-S-4	15-Tilbury-S-5	15-Tilbury-S-6	15-Tilbury-S-7	15-Tilbury-S-8	15-Tilbury-S-9	15-Tilbury-S-10	15-Tilbury-S-11	15-Tilbury-S-12	15-Tilbury-S-13	15-Tilbury-S-14	15-Tilbury-S-15
Date Sampled												31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015
QA/QC												FDA	-	-	-	-	-	-	FDA	-	-	-	-	-	-	-
Physical Parameters																										
Moisture	%	-						-		-	-	13.5	10.4	15.4	4.03	4.27	5.62	6.33	7.53	3.24	8.30	8.91	27.0	11.0	6.32	13.5
pH	pH units	6 - 8						-		-	-	6.02	6.16	5.80	6.40	6.76	6.27	6.54	6.43	6.61	7.57	7.89	6.71	6.73	6.37	4.87
Organic Carbon																										
Total Organic Carbon	%	-						-		-	-	3.03	2.28	2.37	0.97	0.54	1.23	4.79	2.03	0.38	2.95	1.51	3.5	4.28	1.46	1.87
Metals																										
Aluminum (Al)	mg/kg	-						40,000	G _{HH}	35,000	40,000	21400	11300	16000	16300	15700	8540	10400	10400	9250	12400	8720	14700	13400	15300	17300
Antimony (Sb)	mg/kg	20	G	250				250	G _{HH}	4	20	0.72	0.39	0.98	0.54	<0.10	0.29	0.28	0.22	0.21	1.27	1.34	0.70	0.59	0.47	0.50
Arsenic (As)	mg/kg	12	SI	20				20	I	8.5	12	8.84	4.19	6.55	5.65	1.88	3.73	2.62	5.38	3.49	6.48	16.4	8.23	6.03	4.06	7.76
Barium (Ba)	mg/kg	6800	DC	8500				8500	I	150	6800	146	70.1	83.8	59.1	86.3	54.9	50.8	45.9	45.8	69.7	47.8	110	79.8	58.7	67.7
Beryllium (Be)	mg/kg	75	DC	85				85	I	0.7	75	0.47	0.23	0.29	0.23	0.31	0.19	0.18	0.17	0.2	0.26	0.16	0.35	0.31	0.22	0.29
Bismuth (Bi)	mg/kg	-						-		-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.68	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)	mg/kg	-						8500	G _{HH}	1	8500	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	10.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium (Cd)	mg/kg	14	SI	20				20	I	0.4	14	0.49	0.179	0.35	0.274	0.029	0.094	0.277	0.162	0.091	0.236	0.469	0.414	0.271	0.305	0.136
Chromium (Cr)	mg/kg	220	SI, Tot	100				100	I, Cr	55	100	50.9	29.1	35.1	23.8	4.78	29.8	25.4	39.3	32.3	28.7	17.8	42.8	35.7	26.2	49.1
Cobalt (Co)	mg/kg	50	G	25				25	I	15	25	13.4	8.32	11.3	10.9	5.35	8.01	9.2	7.95	8.28	8.59	5.24	13.9	12.1	10.4	8.18
Copper (Cu)	mg/kg	1100	SI	3500				3500	I	75	1100	42.8	26.4	44.0	41.7	3.9	15.8	44.9	22.1	14.1	29.9	21.8	35.2	32.7	42.0	35.3
Iron (Fe)	mg/kg	-						35,000	G _{HH}	30,000	35,000	29600	20100	27700	29300	17500	17600	18600	19400	20300	22100	15300	29100	25000	27100	32100
Lead (Pb)	mg/kg	140	SI	120				120	I	200	120	25.4	20.8	65.8	9.99	1.33	5.85	4.93	3.54	4.47	26.2	33.7	93.7	14.2	36.7	19.9
Lithium (Li)	mg/kg	-						30	G _{HH}	-	30	19.7	9.4	14.3	14.7	<2.0	7.6	6.4	7.6	7.3	11.0	5.5	14.8	14.0	14.5	17.1
Manganese (Mn)	mg/kg	-						6000	I	900	6000	337	310	432	504	370	327	378	364	341	294	314	533	347	499	224
Mercury (Hg)	mg/kg	6.6	SI	10				10	I	0.3	6.6	0.0725	0.0256	0.0322	0.0114	<0.0050	0.0267	0.035	0.0257	0.048	0.0611	0.0519	0.0823	0.0633	0.0296	0.0674
Molybdenum (Mo)	mg/kg	10	G	200				200	I	4	10	1.75	0.87	1.26	0.77	0.87	0.46	0.46	0.45	0.37	1.05	0.95	1.04	1.04	0.66	1.35
Nickel (Ni)	mg/kg	200	DC	450				450	I	75	200	43.1	21.5	27.5	18.5	4.06	30.1	26.8	23.7	32.8	24.2	15.5	43.4	38	18.2	28.5
Selenium (Se)	mg/kg	80	DC	200				200	I	4	80	0.48	<0.20	0.28	0.38	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.48	0.28	0.34	0.39
Silver (Ag)	mg/kg	20	G	200				200	G _{HH}	1	20	<0.10	<0.10	0.11	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.10	<0.10	0.10	0.11
Strontium (Sr)	mg/kg	-						9500	G _{HH}	60	9500	44.1	33.2	33.6	34.7	74.6	31.8	43.7	32.1	25.2	47.9	149	57.3	46.0	34.4	40.3
Thallium (Tl)	mg/kg	1	P, SI	-				-		-	1	0.138	0.064	0.076	0.060	<0.050	0.057	0.055	<0.050	<0.050	0.067	<0.050	0.103	0.084	<0.050	0.105
Tin (Sn)	mg/kg	50	G	25,000				25,000	G _{HH}	4	50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	mg/kg	23	SI	100				100	I	-	23	2.29	0.573	0.662	0.34	0.66	0.307	0.299	0.273	0.297	0.717	1.06	1.23	0.878	0.372	1.08
Vanadium (V)	mg/kg	-						200	I	80	200	69.3	47.5	66.2	72.5	24.4	40.5	43.2	48.7	49.8	49.0	30.0	55.0	50.6	73.0	65.6
Zinc (Zn)	mg/kg	10,000	DC	10,000				10,000	I	100	10,000	129	131	116	90.1	31.6	37.4	69.0	46.6	42.6	85.6	96.6	129	87.1	89.4	67.7

Notes:

< = not measured above the laboratory detection limit; % = percent; "-" = not available; Cr = all chromium species; DC = direct contact; FD = field duplicate; FDA = field duplicate available; G = generic; G_{HH} = generic human health standard; I = intake of contaminated soil; mg/kg = milligram per kilogram; QA/QC = quality assurance/quality control; P = provisional guideline; SI = soil ingestion; Tot = total.

1. Canadian Council of Ministers of the Environment (CCME). 1999, including updates to 2018. Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health. Residential/parkland (RL/PL) land use. Available at: <http://st-ts.ccme.ca/en/index.html>. Accessed January 2018.

The soil ingestion (SI) or direct contact (DC) guidelines were used preferentially; otherwise the generic (G), interim (int) or provisional (P) guidelines are shown.

2. British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2018. Contaminated Sites Regulation (CSR), includes amendments up to BC Reg. 116/2018. 14 June 2018. Residential Low Density (RL_{LD}) land use. Accessed August 2018. Available online at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/375_96_00.

Schedule 3.1 - Part 1 Matrix Numerical Soil Standards, intake of contaminated soil (I) standard is shown. If no site-specific factor was available, then the generic (G) standard from Schedule 3.1 - Part 2 Generic Numerical Soil Standards to Protect Human Health is shown.

3. BC ENV. 2017. Protocol 4 for Contaminated Sites: Establishing Background Concentrations in Soil. 1 November 2017. Regional estimates for background concentrations in soil for Region 2 - Lower Mainland.

4. The screening values were selected based on the lower of CCME or CSR.

value	= exceeds selected screening value
value	= exceeds Regional Background concentration

Appendix 8.1-2
Attachment 1
Table 1-2: Soil Screening Results - Polycyclic Aromatic Hydrocarbons
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample Location		CCME RL/PL SQG ¹				Notes	CSR RL _{Ld} ²	Notes	Selected Screening Value ³	Farm Land	Farm Land	Farm Land	Dyke East of Project Site	Dyke West of Project Site	Dyke West of Project Site	Deas Park	Deas Park	Boat Launch	Dyke North of Project Site	Dyke North of Project Site	Park near Fraser River, Richmond	South-Dyke Park	Finn Slough	Gary Point
Sample ID	Units									15-Tilbury-S-1	15-Tilbury-S-2	15-Tilbury-S-3	15-Tilbury-S-4	15-Tilbury-S-5	15-Tilbury-S-6	15-Tilbury-S-7	15-Tilbury-S-8	15-Tilbury-S-9	15-Tilbury-S-10	15-Tilbury-S-11	15-Tilbury-S-12	15-Tilbury-S-13	15-Tilbury-S-14	15-Tilbury-S-15
Date Sampled										31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015	31-Jul-2015
QA/QC										FDA	-	-	-	-	-	-	FDA	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons																								
Acenaphthene	mg/kg	-		950	G _{HH}	950			0.017	0.039	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.024	0.0123	<0.0050	<0.010	<0.0050	<0.0050
Acenaphthylene	mg/kg	-		-		-			0.019	<0.010	0.0107	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.029	0.0097	0.0076	0.027	<0.0050	0.0096
Anthracene	mg/kg	-		10,000	I	10000			0.0603	0.0632	0.0065	<0.0040	<0.0070	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.078	0.0364	0.0088	0.0218	0.0058	0.0067
Benz(a)anthracene	mg/kg	see B(a)P TPE	PEF=0.1	50	G _{HH}	50			0.173	0.121	0.017	<0.010	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	0.212	0.099	0.034	0.058	<0.010	0.024
Benzo(a)pyrene	mg/kg	see B(a)P TPE	PEF=1.0	5	I	5			0.311	0.217	0.024	<0.010	0.024	<0.010	<0.010	<0.010	<0.010	<0.010	0.40	0.084	0.037	0.104	<0.010	0.027
Benzo(b)fluoranthene	mg/kg	-		50	G _{HH}	50			0.572	0.413	0.041	0.011	0.070	<0.010	<0.010	<0.010	<0.010	<0.010	0.554	0.122	0.051	0.17	0.030	0.046
Benzo(b+j+k)fluoranthene	mg/kg	see B(a)P TPE	PEF=0.1	50	G _{HH}	50			0.809	0.585	0.055	<0.015	0.096	<0.015	<0.015	<0.015	<0.015	<0.015	0.809	<0.015	0.072	0.243	0.030	0.065
Benzo(g,h,i)perylene	mg/kg	see B(a)P TPE	PEF=0.01	-		-			0.221	0.175	0.020	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	0.251	0.054	0.021	0.068	0.013	0.016
Benzo(k)fluoranthene	mg/kg	-		50	G _{HH}	50			0.237	0.172	0.014	<0.010	0.026	<0.010	<0.010	<0.010	<0.010	<0.010	0.255	0.051	0.021	0.074	<0.010	0.019
Chrysene	mg/kg	see B(a)P TPE	PEF=0.01	200	G _{HH}	200			0.269	<0.30	0.032	<0.010	0.064	<0.010	<0.010	<0.010	<0.010	<0.010	0.274	0.135	0.054	0.091	<0.030	0.041
Dibenz(a,h)anthracene	mg/kg	see B(a)P TPE	PEF=1.0	5	G _{HH}	5			<0.040	<0.040	0.0055	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.040	0.0127	0.0056	<0.020	<0.0050	<0.0050
Fluoranthene	mg/kg	-		1500	I	1500			0.586	0.398	0.031	0.016	0.056	<0.010	<0.010	<0.010	<0.010	<0.010	0.476	0.197	0.073	0.116	0.020	0.065
Fluorene	mg/kg	-		600	G _{HH}	600			0.028	0.035	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020	<0.010	<0.010	0.028	0.015	<0.010	<0.020	<0.010	<0.010
Indeno(1,2,3-c,d)pyrene	mg/kg	see B(a)P TPE	PEF=0.1	50	G _{HH}	50			0.221	0.139	0.019	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010	0.219	0.059	0.024	0.059	<0.010	0.02
2-Methylnaphthalene	mg/kg	-		60	G _{HH}	60			<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.025	0.012	<0.010	<0.020	<0.010	<0.010
Naphthalene	mg/kg	-		850	I	850			<0.020	0.023	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.025	0.011	0.011	<0.020	<0.010	<0.010
Phenanthrene	mg/kg	-		1500	G _{HH}	1500			0.40	0.397	0.028	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.332	0.180	0.038	0.056	0.010	0.040
Pyrene	mg/kg	-		1000	G _{HH}	1000			0.481	0.352	0.033	0.013	0.058	<0.010	<0.010	<0.010	<0.010	<0.010	0.613	0.207	0.077	0.129	0.019	0.060
B(a)P Total Potency Equivalent ⁴	mg/kg	5.3	DC	-		5.3			0.456	0.325	0.039	<0.020	0.039	<0.020	<0.020	<0.020	<0.020	<0.020	0.55	0.132	0.056	0.152	<0.020	0.041

Notes:

< = not measured above the laboratory detection limit; "-" = not available; B(a)P TPE = benzo(a)pyrene total potency equivalent; FD = field duplicate; FDA = field duplicate available; G = generic; G_{HH} = generic human health standard; I = intake of contaminated soil; mg/kg = milligram per kilogram; PEF = potency equivalene factor; QA/QC = quality assurance/quality control.

1. Canadian Council of Ministers of the Environment (CCME). 2010. Polycyclic Aromatic Hydrocarbons. In: Canadian Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health.

2. British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2018. Contaminated Sites Regulation (CSR), includes amendments up to BC Reg. 116/2018. 14 June 2018. Residential Low Density (RL_{Ld}) land use. Accessed August 2018. Available online at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/375_96_00.

Standard for benzo[b]fluoranthene and benzo[b,j,k]fluoranthene is for benzo(b+j)fluoranthene.

The sum of the concentrations of: benz(a)anthracene, benzo(b+j)fluoranthenes, benzo(k)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene in soil, multiplied by each substance's respective 1998 World Health Organization benzo(a)pyrene toxic equivalency factor must not exceed the intake of contaminated soil, matrix soil standard for benzo(a)pyrene.

3. The screening values were selected based on the lower of CCME or CSR.

4. Benzo(a)pyrene Total Potency Equivalent was calculated by multiplying the concentration of the PAH in the sample by its BaP Potency Equivalence Factor, given below, and summing the products. Values were calculated assuming the full detection limit.

BaP Potency Equivalence Factors: Benz[a]anthracene 0.1; Benzo[g,h,i]perylene 0.01; Indeno[1,2,3-c,d]pyrene 0.1; Benzo[a]pyrene 1; Chrysene 0.01; Benzo[b+j+k]fluoranthene 0.1; Dibenz[a,h]anthracene 1.

value = exceeds selected screening value

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

							2015 Sonic Hole Core Segment Samples													
Sample ID ALS Sample Number Sample Date Sample Depth (m bml) QA/QC							SH15-01-SA1 L1671794-1 10-Sep-2015 0.05 - 0.5 FDA	SH15-01-DUP L1671794-12 10-Sep-2015 0.05 - 0.5 FD	SH15-01-SA5 L1671794-2 10-Sep-2015 2.5 - 3.0	SH15-01-SA10 L1671794-3 10-Sep-2015 5 - 5.5	SH15-02-SA1 L1671794-4 10-Sep-2015 0 - 0.5	SH15-02-SA4 L1671794-5 10-Sep-2015 1.5 - 2.0	SH15-02-SA6 L1671794-6 10-Sep-2015 2.5 - 3.0 FDA	SH15-02-SA7 L1671794-7 10-Sep-2015 2.5 - 3.0 FD	SH15-03-SA1 L1671794-8 10-Sep-2015 0 - 0.5	SH15-03-SA4 L1671794-9 10-Sep-2015 1.5 - 1.8	SH15-03-SA7 L1671794-10 10-Sep-2015 3.5 - 3.9	SH15-03-SA9 L1671794-23 10-Sep-2015 4.5 - 5.0	SH15-03-SA10 L1671794-42 10-Sep-2015 5.0 - 5.5	
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴													
Grain Size																				
Gravel (>2 mm)	%	-		-		-	-	5.4	-	2.07	1.02	5.52	1.58	0.68	0.4	<0.10	<0.10	<0.10	<0.10	<0.10
Sand (2.0 mm - 0.063 mm)	%	-		-		-	-	88.5	-	97.1	97.4	91	96.6	98.4	98.8	53.7	49.1	19.2	90.9	94.3
% Silt (0.063 mm - 4 µm)	%	-		-		-	-	5.36	-	0.73	1.47	3.42	1.81	0.96	0.76	42.7	45.2	70	8.68	4.68
% Clay (<4 µm)	%	-		-		-	-	0.73	-	0.1	0.1	<0.10	<0.10	<0.10	<0.10	3.65	5.68	10.8	0.44	1
% Fines (<0.075 mm)	%	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Variables																				
Moisture	%	-		-		-	-	22.2	21.2	19.6	18.8	23.3	15.7	19.5	19.7	24.5	28.4	33.1	23.6	23.5
pH (1:2 soil:water)	pH units	6 to 8	G	-		-	6 to 8	8.39	-	8.02	8.21	7.92	8.10	7.92	7.90	7.35	8.04	7.46	8.25	9.09
Organic / Inorganic Carbon																				
Total Organic Carbon	% dw	-		-		-	-	0.19	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.79	1.06	1.4	0.3	0.23
Metals																				
Aluminum	mg/kg dw	-		40,000	G	-	40,000	9200	-	8350	7700	7640	8580	8710	8610	10700	12000	14200	8650	-
Antimony	mg/kg dw	20	G	250	G	-	20	0.24	-	0.17	0.21	0.23	0.21	0.17	0.2	0.38	0.38	0.61	0.31	-
Arsenic	mg/kg dw	12	SI	20	I	-	12	3.33	-	2.9	2.97	3.48	3.48	2.96	3.1	4.42	5.26	7.13	4.16	-
Barium	mg/kg dw	6800	DC	8500	I	-	6800	61.4	-	36.9	39.3	39.3	35.4	44.6	47.1	69	69.4	126	60.3	-
Beryllium	mg/kg dw	75	DC	85	G	-	75	0.2	-	0.16	0.17	0.16	0.18	0.17	0.19	0.26	0.28	0.39	0.2	-
Bismuth	mg/kg dw	-		-		-	-	<0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-
Boron	mg/kg dw	-		8500	G	-	8500	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-
Cadmium	mg/kg dw	14	SI	20	I	-	14	0.137	-	0.083	0.096	0.077	0.115	0.08	0.083	0.181	0.196	0.347	0.132	-
Calcium	mg/kg dw	-		-		-	-	4750	-	4370	4060	4210	4510	4470	4710	7060	8150	9500	5630	-
Chromium	mg/kg dw	220	SI, total	100	I, Cr+6	-	100	28.5	-	20.1	18.7	28.6	20.1	20.5	23.2	35.7	37.9	43.1	30.3	-
Cobalt	mg/kg dw	50	G	25	I	-	25	8.6	-	7.15	7.06	8.04	7.19	7.54	7.68	10.6	11.6	14.5	9.15	-
Copper	mg/kg dw	1100	SI	3500	I	-	1100	15.9	-	12.5	12	14.3	13.4	12.9	22.9	26.9	35.8	18.5	-	-
Iron	mg/kg dw	-		35,000	G	-	35,000	20000	-	16800	15900	19900	17100	17700	18000	24600	26600	30600	21500	-
Lead	mg/kg dw	140	SI	120	I	-	120	2.76	-	1.81	1.86	2.26	1.91	1.84	2	4.07	5.11	7.27	3.03	-
Lithium	mg/kg dw	-		30	G	-	30	9	-	7.7	7.8	7.4	7.8	7.8	8.2	11.5	13.7	15	9	-
Magnesium	mg/kg dw	-		-		-	-	7390	-	6170	6040	7290	6400	6530	6760	8890	10000	10400	8200	-
Manganese	mg/kg dw	-		6000	I	-	6000	349	-	325	302	308	353	333	340	357	420	689	323	-
Mercury	mg/kg dw	6.6	SI	10	I	-	6.6	0.0266	-	0.0146	0.0182	0.0208	0.0164	0.0182	0.0969	0.0303	0.0349	0.0531	0.053	-
Molybdenum	mg/kg dw	10	G	200	I	-	10	0.35	-	0.26	0.3	0.54	0.3	0.26	0.29	0.68	0.77	0.88	0.43	-
Nickel	mg/kg dw	200	DC	450	I	-	200	33.1	-	28.8	28.1	34.2	30	30.7	32.4	39	43.1	48.8	37.4	-
Phosphorus	mg/kg dw	-		-		-	-	477	-	413	379	457	418	454	398	588	712	768	500	-
Potassium	mg/kg dw	-		-		-	-	650	-	470	480	490	500	550	560	830	1010	1090	580	-
Selenium	mg/kg dw	80	DC	200	I	-	80	<0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.25	0.26	0.49	<0.20	-
Silver	mg/kg dw	20	G	200	G	-	20	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	-
Sodium	mg/kg dw	-		1,000,000	I, ion	-	1,000,000	752	-	1290	989	441	1410	1750	1450	494	812	552	339	-
Strontium	mg/kg dw	-		9500	G	-	9500	25	-	19.5	20.1	21.4	21.1	21.3	19.7	38.2	40.4	50.4	29.7	-
Sulfur	mg/kg dw	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg dw	1	SI, P	-		-	1	0.051	-	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	0.06	0.066	0.099	<0.050	-
Tin	mg/kg dw	50	G	25,000	G	-	50	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-
Titanium	mg/kg dw	-		-		-	-	816	-	707	656	676	726	812	805	903	886	917	735	-
Tungsten	mg/kg dw	-		15	G	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/kg dw	23	DC	100	I	-	23	0.297	-	0.196	0.268	0.291	0.237	0.208	0.202	0.576	0.639	0.818	0.351	-
Vanadium	mg/kg dw	-		200	I	-	200	43	-	38.3	36.7	42.6	38.7	40.7	41.5	51.2	51	55.5	46.2	-
Zinc	mg/kg dw	10,000	DC	10,000	I	-	10,000	40.9	-	33.5	31.9	36.9	33.3	34.6	35.6	51.5	58	70.3	44.6	-
Zirconium	mg/kg dw	-		-		1.3	1.3	4.9	-	4.5	4.5	4.7	4.9	4.8	4.9	7	6.8	8.4	5.3	-

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID ALS Sample Number Sample Date Sample Depth (m bml) QA/QC								SH15-01-SA1	SH15-01-DUP	SH15-01-SA5	SH15-01-SA10	SH15-02-SA1	SH15-02-SA4	SH15-02-SA6	SH15-02-SA7	SH15-03-SA1	SH15-03-SA4	SH15-03-SA7	SH15-03-SA9	SH15-03-SA10
								L1671794-1	L1671794-12	L1671794-2	L1671794-3	L1671794-4	L1671794-5	L1671794-6	L1671794-7	L1671794-8	L1671794-9	L1671794-10	L1671794-23	L1671794-42
								10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015
								0.05 - 0.5	0.05 - 0.5	2.5 - 3.0	5 - 5.5	0 - 0.5	1.5 - 2.0	2.5 - 3.0	2.5 - 3.0	0 - 0.5	1.5 - 1.8	3.5 - 3.9	4.5 - 5.0	5.0 - 5.5
								FDA	FD					FDA	FD					
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴													
Polycyclic Aromatic Hydrocarbons																				
Acenaphthene	mg/kg dw	-		950	G	-	950	<0.0050	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0053	0.0171	<0.0050	<0.0050	<0.0050
Acenaphthylene	mg/kg dw	-		-	-	-	-	<0.0050	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0073	0.0167	<0.0050	<0.0050	<0.0050
Anthracene	mg/kg dw	-		10,000	I	-	10,000	<0.0040	-	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0229	0.0156	<0.0040	<0.0040	<0.0040
Benzo[a]anthracene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.028	0.032	<0.010	<0.010	<0.010
Benzo[a]pyrene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	I	-	5	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.023	0.021	<0.010	<0.010	<0.010
Benzo[b]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.031	0.078	<0.010	<0.010	<0.010
Benzo[b&j]fluoranthene	mg/kg dw	-		50	G	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b,j,k]fluoranthene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.015	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.046	0.107	<0.015	<0.015	<0.015
Benzo[g,h,i]perylene	mg/kg dw	see B(a)P TPE	PEF=0.01	-	-	-	-	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010
Benzo[k]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	0.029	<0.010	<0.010	<0.010
Chrysene	mg/kg dw	see B(a)P TPE	PEF=0.01	200	G	-	200	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.026	0.118	<0.010	<0.010	<0.010
Dibenzo[a,h]anthracene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	G	-	5	<0.0050	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	mg/kg dw	-		1500	I	-	1500	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.072	0.648	0.015	0.01	0.012
Fluorene	mg/kg dw	-		600	G	-	600	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	0.022	<0.010	<0.010	<0.010
Indeno[1,2,3-cd]pyrene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010
2-Methylnaphthalene	mg/kg dw	-		60	G	-	60	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	<0.010	0.013	<0.010
Naphthalene	mg/kg dw	-		850	I	-	850	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010
Phenanthrene	mg/kg dw	-		1500	G	-	1500	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.064	0.199	0.019	0.011	0.037
Pyrene	mg/kg dw	-		1000	G	-	1000	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.053	0.409	0.012	<0.010	<0.010
B(a)P Total Potency Equivalent ⁽⁴⁾	mg/kg dw	5.3	DC	-	-	-	5.3	<0.0187	-	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	0.03676	0.0422	<0.0187	<0.0187	<0.0187
Volatile Organic Compounds																				
Benzene	mg/kg dw	110	SS, SI	150	I	-	110	<0.0050	<0.0050	-	-	-	<0.0050	-	-	-	-	-	-	-
Ethylbenzene	mg/kg dw	10,000	SS, SI	4000	I	-	4000	<0.015	<0.015	-	-	-	<0.015	-	-	-	-	-	-	-
Methyl t-butyl ether	mg/kg dw	-		4000	G	-	4000	<0.20	<0.20	-	-	-	<0.20	-	-	-	-	-	-	-
Styrene	mg/kg dw	5	G	8500	G	-	5	<0.050	<0.050	-	-	-	<0.050	-	-	-	-	-	-	-
Toluene	mg/kg dw	22,000	SS, SI	3500	I	-	3500	<0.050	<0.050	-	-	-	<0.050	-	-	-	-	-	-	-
ortho-Xylene	mg/kg dw	-		-		130	130	<0.050	<0.050	-	-	-	<0.050	-	-	-	-	-	-	-
meta- & para-Xylene	mg/kg dw	-		-		110	110	<0.050	<0.050	-	-	-	<0.050	-	-	-	-	-	-	-
Xylenes	mg/kg dw	150,000	SS, SI	8500	I	-	8500	<0.075	<0.075	-	-	-	<0.075	-	-	-	-	-	-	-
Hydrocarbons																				
Volatile Hydrocarbons (VH6-10)	mg/kg dw	12,000	SS, DC	-	-	-	12,000	<100	<100	-	-	-	<100	-	-	-	-	-	-	-
Volatile Petroleum Hydrocarbon (C6-C10)	mg/kg dw	12,000	SS, DC	200	G	-	200	<100	<100	-	-	-	<100	-	-	-	-	-	-	-

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID							SH15-01-SA1	SH15-01-DUP	SH15-01-SA5	SH15-01-SA10	SH15-02-SA1	SH15-02-SA4	SH15-02-SA6	SH15-02-SA7	SH15-03-SA1	SH15-03-SA4	SH15-03-SA7	SH15-03-SA9	SH15-03-SA10
ALS Sample Number							L1671794-1	L1671794-12	L1671794-2	L1671794-3	L1671794-4	L1671794-5	L1671794-6	L1671794-7	L1671794-8	L1671794-9	L1671794-10	L1671794-23	L1671794-42
Sample Date							10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015
Sample Depth (m bml)							0.05 - 0.5	0.05 - 0.5	2.5 - 3.0	5 - 5.5	0 - 0.5	1.5 - 2.0	2.5 - 3.0	2.5 - 3.0	0 - 0.5	1.5 - 1.8	3.5 - 3.9	4.5 - 5.0	5.0 - 5.5
QA/QC							FDA	FD					FDA	FD					
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴												
Phenolics																			
4-Chloro-3-methylphenol	mg/kg dw	-		1500	G	-	1500	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2-Chlorophenol	mg/kg dw	0.5	G	200	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
3-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
4-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,3-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,4 & 2,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,6-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
3,4-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
3,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,4-Dimethylphenol	mg/kg dw	1	G	850	G	-	1	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
o-Cresol (2-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
m-Cresol (3-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
p-Cresol (4-methyl phenol)	mg/kg dw	1	G	200	G	-	1	<0.020	-	-	-	-	<0.050	-	-	-	-	-	-
Pentachlorophenol	mg/kg dw	93	SI	90	I	-	90	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
Phenol	mg/kg dw	1900	SI	10,000	I	-	1900	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,3,4,5-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	mg/kg dw	0.5	G	1000	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,3,5,6-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,3,4-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,3,5-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,3,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg dw	0.5	G	4000	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
Polychlorinated Biphenyls																			
PCB Arochlor 1016	mg/kg dw	-		-		0.82	0.82	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1221	mg/kg dw	-		-		2	2	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1232	mg/kg dw	-		-		1.7	1.7	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1242	mg/kg dw	-		-		2.3	2.3	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1248	mg/kg dw	-		-		2.3	2.3	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1254	mg/kg dw	-		-		0.24	0.24	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1260	mg/kg dw	-		-		2.4	2.4	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1262	mg/kg dw	-		-		-	-	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
PCB Arochlor 1268	mg/kg dw	-		-		-	-	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-
Total PCBs	mg/kg dw	-		5	I	-	5	<0.020	-	-	-	-	<0.020	-	-	-	-	-	-

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

		Sample ID				SH15-01-SA1	SH15-01-DUP	SH15-01-SA5	SH15-01-SA10	SH15-02-SA1	SH15-02-SA4	SH15-02-SA6	SH15-02-SA7	SH15-03-SA1	SH15-03-SA4	SH15-03-SA7	SH15-03-SA9	SH15-03-SA10
		ALS Sample Number				L1671794-1	L1671794-12	L1671794-2	L1671794-3	L1671794-4	L1671794-5	L1671794-6	L1671794-7	L1671794-8	L1671794-9	L1671794-10	L1671794-23	L1671794-42
		Sample Date				10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015	10-Sep-2015
		Sample Depth (m bml)				0.05 - 0.5	0.05 - 0.5	2.5 - 3.0	5 - 5.5	0 - 0.5	1.5 - 2.0	2.5 - 3.0	2.5 - 3.0	0 - 0.5	1.5 - 1.8	3.5 - 3.9	4.5 - 5.0	5.0 - 5.5
		QA/QC				FDA	FD					FDA	FD					
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _L ²	Notes	US EPA ³	Selected Screening Value ⁴											
Dioxins and Furans																		
2,3,7,8-TCDD	pg/g dw	-		-		-	-	<0.078	-	-	-	-	<0.11	-	-	-	-	-
1,2,3,7,8-PeCDD	pg/g dw	-		-		-	-	<0.052	-	-	-	-	<0.060	-	-	-	-	-
1,2,3,4,7,8-HxCDD	pg/g dw	-		-		-	-	<0.043	-	-	-	-	<0.059	-	-	-	-	-
1,2,3,6,7,8-HxCDD	pg/g dw	-		-		-	-	<0.035	-	-	-	-	<0.053	-	-	-	-	-
1,2,3,7,8,9-HxCDD	pg/g dw	-		-		-	-	0.083	-	-	-	-	<0.055	-	-	-	-	-
1,2,3,4,6,7,8-HpCDD	pg/g dw	-		-		-	-	0.983	-	-	-	-	<0.067	-	-	-	-	-
OCDD	pg/g dw	-		-		-	-	12.1	-	-	-	-	0.324	-	-	-	-	-
2,3,7,8-TCDF	pg/g dw	-		-		-	-	<0.070	-	-	-	-	<0.073	-	-	-	-	-
1,2,3,7,8-PeCDF	pg/g dw	-		-		-	-	<0.049	-	-	-	-	<0.050	-	-	-	-	-
2,3,4,7,8-PeCDF	pg/g dw	-		-		-	-	<0.042	-	-	-	-	<0.044	-	-	-	-	-
1,2,3,4,7,8-HxCDF	pg/g dw	-		-		-	-	<0.036	-	-	-	-	<0.043	-	-	-	-	-
1,2,3,6,7,8-HxCDF	pg/g dw	-		-		-	-	<0.028	-	-	-	-	<0.031	-	-	-	-	-
1,2,3,7,8,9-HxCDF	pg/g dw	-		-		-	-	<0.049	-	-	-	-	<0.057	-	-	-	-	-
2,3,4,6,7,8-HxCDF	pg/g dw	-		-		-	-	<0.034	-	-	-	-	<0.039	-	-	-	-	-
1,2,3,4,6,7,8-HpCDF	pg/g dw	-		-		-	-	0.054	-	-	-	-	<0.050	-	-	-	-	-
1,2,3,4,7,8,9-HpCDF	pg/g dw	-		-		-	-	<0.051	-	-	-	-	<0.068	-	-	-	-	-
OCDF	pg/g dw	-		-		-	-	0.14	-	-	-	-	<0.084	-	-	-	-	-
Total Dioxin TEF	pg/g dw	4	SI, P	95	I	-	4	0.196	-	-	-	-	0.228	-	-	-	-	-

Notes:

< = below laboratory detection limit; "-" = screening value not available or parameter not analyzed; µm = micrometers; % = percent; B(a)P TPE = benzo(a)pyrene total potency equivalent; dw = dry weight; m bml = meters below mud line; mg/kg = milligram per kilogram; mm = millimeters; FD = Field duplicate; FDA = Field duplicate available; PCB = polychlorinated biphenyl; PEF = potency equivalene factor; pg/g = picogram per gram; QA/QC = quality assurance/quality control; TEF = Toxic Equivalency Factors.

1. Canadian Council of Ministers of the Environment (CCME). 1999, including updates to 2018. Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health. Residential/parkland (RL/PL) land use. Available at: <http://st-ts.ccme.ca/en/index.html>. Accessed January 2018.

The most conservative guideline of the following pathways are shown: soil ingestion (SI) or direct contact (DC); otherwise the generic (G), interim (int) or provisional (P) guidelines are shown. Surficial soil guidelines were selected if available.

Guideline for chromium is for the total of all valences (total).

Guideline for volatile hydrocarbon and volatile petroleum hydrocarbon is for petroleum hydrocarbon fraction 1 (C6-C10).

2. British Columbia Ministry of Environment and Climate Change Strategy. 2018. Contaminated Sites Regulation (CSR), includes amendments up to BC Reg. 116/2018. 14 June 2018. Accessed August 2018. Available online at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/375_96_00.

Schedule 3.1 - Part 1 Matrix Numerical Soil Standards for low density residential land use, intake of contaminated soil (I) standard is shown. If no site-specific factor was available, then the generic (G) standard from Schedule 3.1 - Part 2 Generic Numerical Soil Standards to Protect Human Health is shown.

The standard for sodium is for the ionic form (ion). The standard for chromium is only for the 6+ valence (Cr6+).

Standard for benzo[b]fluoranthene and benzo[b,j,k]fluoranthene is for benzo(b+j)fluoranthene.

The sum of the concentrations of: benz(a)anthracene, benzo(b+j)fluoranthenes, benzo(k)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene in soil, multiplied by each substance's respective 1998 World Health Organization benzo(a)pyrene toxic equivalency factor must not exceed the intake of contaminated soil, matrix soil standard for benzo(a)pyrene.

3. United States Environmental Protection Agency (US EPA). 2018. Regional Screening Levels (RSL) for residential soil. Accessed 21 June 2018. Available online at: <http://www2.epa.gov/risk/risk-based-screening-table-generic-tables>.

Values are based on a hazard quotient of 0.2 (dividing the RSL by 5 for non-carcinogens) and an incremental lifetime cancer risk of 10⁻⁵ (multiplying the RSL by 10 for carcinogens).

Values are only shown where CCME guidelines and CSR standards are not available.

4. Benzo(a)pyrene Total Potency Equivalent was calculated by multiplying the concentration of the PAH in the sample by its BaP Potency Equivalence Factor, given below, and summing the products. Values were calculated assuming the full detection limit.

BaP Potency Equivalence Factors: Benz[a]anthracene 0.1; Benzo[g,h,i]perylene 0.01; Indeno[1,2,3-c,d]pyrene 0.1; Benzo[a]pyrene 1; Chrysene 0.01; Benzo[b+]+k]fluoranthene 0.1; Dibenz[a,h]anthracene 1.

Value	Concentration exceeds selected screening value
Value	Detection limit exceeds screening value

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

								2015 Sonic Hole Core Segment Samples											
Sample ID								SH15-03-SA11	SH15-03-SA11 B	SH15-04-SA1	SH15-04-SA5	SH15-04-SA7	SH15-04-SA8	SH15-05-SA1	SH15-05-SA4	SH15-05-SA6	SH15-05-SA7	SH15-05-SA9	SH15-05-SA12
ALS Sample Number								L1671794-11	L1671794-55	L1671794-13	L1671794-14	L1671794-15	L1671794-16	L1671794-17	L1671794-18	L1671794-19	L1671794-20	L1671794-21	L1671794-22
Sample Date								10-Sep-2015	10-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015
Sample Depth (m bml)								5.5 - 6.0	5.5 - 6.0	0 - 0.5	1.5 - 2.0	3.6 - 4.0	3.6 - 4.0	0 - 0.6	1.7 - 2.2	2.8 - 3.3	2.8 - 3.3	4.1 - 4.7	5.8 - 6.4
QA/QC												FDA	FD			FDA	FD		
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{Ld} ²	Notes	US EPA ³	Selected Screening Value ⁴												
Grain Size																			
Gravel (>2 mm)	%	-		-		-	-	0.3	<0.10	<0.10	1.43	0.4	0.45	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sand (2.0 mm - 0.063 mm)	%	-		-		-	-	87.6	85.5	96.2	97.5	98.4	98.6	82	51.1	44.8	47	79.1	96.9
% Silt (0.063 mm - 4 µm)	%	-		-		-	-	11.4	12.5	3.62	1.08	1.18	0.93	16.9	42.7	48.4	46.1	19	3.07
% Clay (<4 µm)	%	-		-		-	-	0.77	1.9	0.16	<0.10	<0.10	<0.10	1.09	6.2	6.82	6.9	1.92	<0.10
% Fines (<0.075 mm)	%	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Variables																			
Moisture	%	-		-		-	-	17.3	24.6	22.1	20.9	21	19.4	24.9	26.3	27.9	28.4	25.6	20.9
pH (1:2 soil:water)	pH units	6 to 8	G	-		-	6 to 8	7.82	7.82	8.31	8.34	8.17	8.42	8.03	7.65	7.70	8.00	8.00	8.43
Organic / Inorganic Carbon																			
Total Organic Carbon	% dw	-		-		-	-	1.24	1.06	<0.10	<0.10	<0.10	<0.10	0.13	0.72	0.92	0.83	0.5	0.15
Metals																			
Aluminum	mg/kg dw	-		40,000	G	-	40,000	7900	-	8850	8170	9100	8200	9200	12200	12300	12200	10100	8360
Antimony	mg/kg dw	20	G	250	G	-	20	0.25	-	0.26	0.18	0.2	0.2	0.36	0.46	0.47	0.47	0.41	0.22
Arsenic	mg/kg dw	12	SI	20	I	-	12	3.56	-	3.62	3.03	3.07	4	4.39	5.79	5.92	6.2	4.93	3.61
Barium	mg/kg dw	6800	DC	8500	I	-	6800	50.8	-	56.4	30.5	42.8	37.4	61.7	83.5	100	99.7	77.6	47.5
Beryllium	mg/kg dw	75	DC	85	G	-	75	0.18	-	0.2	0.17	0.17	0.18	0.24	0.32	0.31	0.3	0.24	0.18
Bismuth	mg/kg dw	-		-		-	-	<0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	mg/kg dw	-		8500	G	-	8500	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	mg/kg dw	14	SI	20	I	-	14	0.125	-	0.105	0.116	0.159	0.121	0.121	0.217	0.252	0.244	0.164	0.111
Calcium	mg/kg dw	-		-		-	-	4640	-	5480	4080	4930	4460	7130	9260	9170	8740	7190	4820
Chromium	mg/kg dw	220	SI, total	100	I, Cr+6	-	100	28.6	-	31	26.2	24.2	23.8	37.4	38.4	38.6	36.9	35.2	28.6
Cobalt	mg/kg dw	50	G	25	I	-	25	8.03	-	8.17	7.92	7.72	7.06	10.1	11.9	12.2	11.6	10.2	8.11
Copper	mg/kg dw	1100	SI	3500	I	-	1100	14.8	-	15.9	13.7	12.9	12.6	20	28.4	28.8	27.3	23.5	13.8
Iron	mg/kg dw	-		35,000	G	-	35,000	18200	-	19600	18400	16800	16300	25400	27100	27000	25300	23200	18800
Lead	mg/kg dw	140	SI	120	I	-	120	2.46	-	2.52	1.98	2.03	1.9	3.9	5.71	5.52	5.22	3.9	2.4
Lithium	mg/kg dw	-		30	G	-	30	7.8	-	8.2	8	6.9	8.2	9.5	14.5	13.2	12.9	10.7	7.7
Magnesium	mg/kg dw	-		-		-	-	7320	-	7620	7140	7070	6360	8630	9850	9520	9230	8760	7290
Manganese	mg/kg dw	-		6000	I	-	6000	329	-	311	343	360	345	377	455	522	491	420	324
Mercury	mg/kg dw	6.6	SI	10	I	-	6.6	0.0275	-	0.0287	0.016	0.0175	0.0208	0.0256	0.0389	0.0435	0.0466	0.0285	0.0252
Molybdenum	mg/kg dw	10	G	200	I	-	10	0.51	-	0.43	0.4	0.31	0.32	0.55	0.7	0.74	0.8	0.62	0.34
Nickel	mg/kg dw	200	DC	450	I	-	200	35.6	-	34.1	32.8	33.4	28.6	38.6	42.9	43.1	41.6	38.5	34.8
Phosphorus	mg/kg dw	-		-		-	-	427	-	516	417	412	406	598	702	663	641	556	455
Potassium	mg/kg dw	-		-		-	-	550	-	590	490	490	530	640	1000	960	950	730	530
Selenium	mg/kg dw	80	DC	200	I	-	80	<0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	0.31	0.34	0.35	<0.20	<0.20
Silver	mg/kg dw	20	G	200	G	-	20	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10
Sodium	mg/kg dw	-		1,000,000	I, ion	-	1,000,000	352	-	991	1110	1570	1410	455	668	660	644	498	295
Strontium	mg/kg dw	-		9500	G	-	9500	24.8	-	29.2	20.4	21.4	20.3	35	48.3	48.7	45.7	36.2	24.4
Sulfur	mg/kg dw	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg dw	1	SI, P	-		-	1	<0.050	-	<0.050	<0.050	<0.050	<0.050	0.054	0.084	0.08	0.077	0.058	<0.050
Tin	mg/kg dw	50	G	25,000	G	-	50	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	mg/kg dw	-		-		-	-	676	-	815	679	768	704	892	905	894	837	833	763
Tungsten	mg/kg dw	-		15	G	-	15	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/kg dw	23	DC	100	I	-	23	0.329	-	0.311	0.253	0.224	0.22	0.467	0.754	0.683	0.646	0.507	0.22
Vanadium	mg/kg dw	-		200	I	-	200	39.2	-	44.8	41.2	40.8	37.7	57.7	52.7	52.5	49.1	49.3	44
Zinc	mg/kg dw	10,000	DC	10,000	I	-	10,000	36.5	-	39.2	34.5	36.4	33.7	46.2	59.8	59.8	58.3	49.5	36.4
Zirconium	mg/kg dw	-		-		1.3	1.3	5.5	-	5.8	4.7	5.1	4.9	5.8	7.4	7.2	7.3	5.1	4.9

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID								SH15-03-SA11	SH15-03-SA11 B	SH15-04-SA1	SH15-04-SA5	SH15-04-SA7	SH15-04-SA8	SH15-05-SA1	SH15-05-SA4	SH15-05-SA6	SH15-05-SA7	SH15-05-SA9	SH15-05-SA12
ALS Sample Number								L1671794-11	L1671794-55	L1671794-13	L1671794-14	L1671794-15	L1671794-16	L1671794-17	L1671794-18	L1671794-19	L1671794-20	L1671794-21	L1671794-22
Sample Date								10-Sep-2015	10-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015
Sample Depth (m bml)								5.5 - 6.0	5.5 - 6.0	0 - 0.5	1.5 - 2.0	3.6 - 4.0	3.6 - 4.0	0 - 0.6	1.7 - 2.2	2.8 - 3.3	2.8 - 3.3	4.1 - 4.7	5.8 - 6.4
QA/QC												FDA	FD			FDA	FD		
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴												
Polycyclic Aromatic Hydrocarbons																			
Acenaphthene	mg/kg dw	-		950	G	-	950	0.103	0.102	<0.0050	<0.0050	<0.0050	<0.0050	0.0069	0.0752	0.0056	0.0053	<0.0050	<0.0050
Acenaphthylene	mg/kg dw	-		-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Anthracene	mg/kg dw	-		10,000	I	-	10,000	0.0063	0.0086	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0353	<0.0040	<0.0040	<0.0040	<0.0040
Benzo[a]anthracene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.023	<0.010	<0.010	<0.010	<0.010
Benzo[a]pyrene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	I	-	5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[b]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.021	<0.010	<0.010	<0.010	<0.010
Benzo[b&j]fluoranthene	mg/kg dw	-		50	G	-	50	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b,j,k]fluoranthene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.021	<0.015	<0.015	<0.015	<0.015
Benzo[g,h,i]perylene	mg/kg dw	see B(a)P TPE	PEF=0.01	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[k]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chrysene	mg/kg dw	see B(a)P TPE	PEF=0.01	200	G	-	200	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.03	<0.010	<0.010	<0.010	<0.010
Dibenzo[a,h]anthracene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	G	-	5	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	mg/kg dw	-		1500	I	-	1500	0.03	0.043	<0.010	<0.010	<0.010	<0.010	0.012	0.13	0.017	0.018	<0.010	<0.010
Fluorene	mg/kg dw	-		600	G	-	600	0.111	0.117	<0.010	<0.010	<0.010	<0.010	<0.010	0.089	<0.010	<0.010	<0.010	<0.010
Indeno[1,2,3-cd]pyrene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2-Methylnaphthalene	mg/kg dw	-		60	G	-	60	0.014	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.028	<0.010	<0.010	<0.010	<0.010
Naphthalene	mg/kg dw	-		850	I	-	850	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010
Phenanthrene	mg/kg dw	-		1500	G	-	1500	0.114	0.206	<0.010	<0.010	<0.010	<0.010	0.026	0.256	0.024	0.023	<0.010	<0.010
Pyrene	mg/kg dw	-		1000	G	-	1000	0.023	0.026	<0.010	<0.010	<0.010	<0.010	<0.010	0.088	0.013	0.014	<0.010	<0.010
B(a)P Total Potency Equivalent ⁽⁴⁾	mg/kg dw	5.3	DC	-	-	-	5.3	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	0.0208	<0.0187	<0.0187	<0.0187	<0.0187
Volatile Organic Compounds																			
Benzene	mg/kg dw	110	SS, SI	150	I	-	110	<0.0050	-	<0.0050	-	-	-	-	-	<0.0050	-	-	<0.0050
Ethylbenzene	mg/kg dw	10,000	SS, SI	4000	I	-	4000	<0.015	-	<0.015	-	-	-	-	-	<0.015	-	-	<0.015
Methyl t-butyl ether	mg/kg dw	-		4000	G	-	4000	<0.20	-	<0.20	-	-	-	-	-	<0.20	-	-	<0.20
Styrene	mg/kg dw	5	G	8500	G	-	5	<0.050	-	<0.050	-	-	-	-	-	<0.050	-	-	<0.050
Toluene	mg/kg dw	22,000	SS, SI	3500	I	-	3500	<0.050	-	<0.050	-	-	-	-	-	<0.050	-	-	<0.050
ortho-Xylene	mg/kg dw	-		-		130	130	<0.050	-	<0.050	-	-	-	-	-	<0.050	-	-	<0.050
meta- & para-Xylene	mg/kg dw	-		-		110	110	<0.050	-	<0.050	-	-	-	-	-	<0.050	-	-	<0.050
Xylenes	mg/kg dw	150,000	SS, SI	8500	I	-	8500	<0.075	-	<0.075	-	-	-	-	-	<0.075	-	-	<0.075
Hydrocarbons																			
Volatile Hydrocarbons (VH6-10)	mg/kg dw	12,000	SS, DC	-	-	-	12,000	<100	-	<100	-	-	-	-	-	<100	-	-	<100
Volatile Petroleum Hydrocarbon (C6-C10)	mg/kg dw	12,000	SS, DC	200	G	-	200	<100	-	<100	-	-	-	-	-	<100	-	-	<100

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID							SH15-03-SA11	SH15-03-SA11 B	SH15-04-SA1	SH15-04-SA5	SH15-04-SA7	SH15-04-SA8	SH15-05-SA1	SH15-05-SA4	SH15-05-SA6	SH15-05-SA7	SH15-05-SA9	SH15-05-SA12	
							ALS Sample Number	L1671794-11	L1671794-55	L1671794-13	L1671794-14	L1671794-15	L1671794-16	L1671794-17	L1671794-18	L1671794-19	L1671794-20	L1671794-21	L1671794-22
							Sample Date	10-Sep-2015	10-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015
							Sample Depth (m bml)	5.5 - 6.0	5.5 - 6.0	0 - 0.5	1.5 - 2.0	3.6 - 4.0	3.6 - 4.0	0 - 0.6	1.7 - 2.2	2.8 - 3.3	2.8 - 3.3	4.1 - 4.7	5.8 - 6.4
QA/QC							FDA	FD	FDA	FD	FDA	FD	FDA	FD	FDA	FD	FDA	FD	
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴												
Phenolics																			
4-Chloro-3-methylphenol	mg/kg dw	-		1500	G	-	1500	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2-Chlorophenol	mg/kg dw	0.5	G	200	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
3-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
4-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,3-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,4 & 2,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,6-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
3,4-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
3,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,4-Dimethylphenol	mg/kg dw	1	G	850	G	-	1	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
o-Cresol (2-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
m-Cresol (3-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
p-Cresol (4-methyl phenol)	mg/kg dw	1	G	200	G	-	1	<0.020	-	<0.030	-	-	-	-	<0.040	-	-	<0.020	
Pentachlorophenol	mg/kg dw	93	SI	90	I	-	90	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
Phenol	mg/kg dw	1900	SI	10,000	I	-	1900	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,3,4,5-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,3,4,6-Tetrachlorophenol	mg/kg dw	0.5	G	1000	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,3,5,6-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,3,4-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,3,5-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,3,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,4,5-Trichlorophenol	mg/kg dw	0.5	G	4000	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
2,4,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
Polychlorinated Biphenyls																			
PCB Arochlor 1016	mg/kg dw	-		-		0.82	0.82	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1221	mg/kg dw	-		-		2	2	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1232	mg/kg dw	-		-		1.7	1.7	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1242	mg/kg dw	-		-		2.3	2.3	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1248	mg/kg dw	-		-		2.3	2.3	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1254	mg/kg dw	-		-		0.24	0.24	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1260	mg/kg dw	-		-		2.4	2.4	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1262	mg/kg dw	-		-		-	-	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
PCB Arochlor 1268	mg/kg dw	-		-		-	-	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	
Total PCBs	mg/kg dw	-		5	I	-	5	<0.020	-	<0.020	-	-	-	-	<0.020	-	-	<0.020	

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID							SH15-03-SA11	SH15-03-SA11 B	SH15-04-SA1	SH15-04-SA5	SH15-04-SA7	SH15-04-SA8	SH15-05-SA1	SH15-05-SA4	SH15-05-SA6	SH15-05-SA7	SH15-05-SA9	SH15-05-SA12
ALS Sample Number							L1671794-11	L1671794-55	L1671794-13	L1671794-14	L1671794-15	L1671794-16	L1671794-17	L1671794-18	L1671794-19	L1671794-20	L1671794-21	L1671794-22
Sample Date							10-Sep-2015	10-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015	11-Sep-2015
Sample Depth (m bml)							5.5 - 6.0	5.5 - 6.0	0 - 0.5	1.5 - 2.0	3.6 - 4.0	3.6 - 4.0	0 - 0.6	1.7 - 2.2	2.8 - 3.3	2.8 - 3.3	4.1 - 4.7	5.8 - 6.4
QA/QC											FDA	FD			FDA	FD		
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴											
Dioxins and Furans																		
2,3,7,8-TCDD	pg/g dw	-		-		-	<0.070	-	<0.069	-	-	-	-	-	<0.10	-	-	<0.16
1,2,3,7,8-PeCDD	pg/g dw	-		-		-	<0.043	-	<0.058	-	-	-	-	-	0.117	-	-	<0.087
1,2,3,4,7,8-HxCDD	pg/g dw	-		-		-	<0.038	-	<0.024	-	-	-	-	-	<0.067	-	-	<0.13
1,2,3,6,7,8-HxCDD	pg/g dw	-		-		-	0.142	-	<0.022	-	-	-	-	-	0.385	-	-	<0.12
1,2,3,7,8,9-HxCDD	pg/g dw	-		-		-	0.06	-	0.045	-	-	-	-	-	0.342	-	-	<0.12
1,2,3,4,6,7,8-HpCDD	pg/g dw	-		-		-	1.17	-	0.4	-	-	-	-	-	3.68	-	-	0.91
OCDD	pg/g dw	-		-		-	10.6	-	2.83	-	-	-	-	-	35.7	-	-	5.91
2,3,7,8-TCDF	pg/g dw	-		-		-	0.098	-	<0.058	-	-	-	-	-	1.65	-	-	<0.12
1,2,3,7,8-PeCDF	pg/g dw	-		-		-	<0.054	-	<0.026	-	-	-	-	-	<0.053	-	-	<0.076
2,3,4,7,8-PeCDF	pg/g dw	-		-		-	<0.047	-	<0.022	-	-	-	-	-	<0.045	-	-	<0.066
1,2,3,4,7,8-HxCDF	pg/g dw	-		-		-	<0.033	-	<0.026	-	-	-	-	-	<0.043	-	-	<0.070
1,2,3,6,7,8-HxCDF	pg/g dw	-		-		-	<0.026	-	<0.020	-	-	-	-	-	<0.032	-	-	<0.055
1,2,3,7,8,9-HxCDF	pg/g dw	-		-		-	<0.042	-	<0.033	-	-	-	-	-	0.055	-	-	<0.094
2,3,4,6,7,8-HxCDF	pg/g dw	-		-		-	<0.033	-	<0.025	-	-	-	-	-	0.069	-	-	<0.069
1,2,3,4,6,7,8-HpCDF	pg/g dw	-		-		-	0.3	-	0.035	-	-	-	-	-	0.982	-	-	0.178
1,2,3,4,7,8,9-HpCDF	pg/g dw	-		-		-	<0.037	-	<0.034	-	-	-	-	-	<0.065	-	-	<0.080
OCDF	pg/g dw	-		-		-	0.47	-	0.059	-	-	-	-	-	1.98	-	-	<0.13
Total Dioxin TEF	pg/g dw	4	SI, P	95	I	-	0.194	-	0.165	-	-	-	-	-	0.555	-	-	0.36

Notes:

< = below laboratory detection limit; "-" = screening value not available or parameter not analyzed; µm = micrometers; % = percent; B(a)P TPE = benzo(a)pyrene total potency equivalent; dw = dry weight; m bml = meters below mud line; mg/kg = milligram per kilogram; mm = millimeters; FD = Field duplicate; FDA = Field duplicate available; PCB = polychlorinated biphenyl; PEF = potency equivalence factor; pg/g = picogram per gram; QA/QC = quality assurance/quality control; TEF = Toxic Equivalency Factors.

1. Canadian Council of Ministers of the Environment (CCME). 1999, including updates to 2018. Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health. Residential/parkland (RL/PL) land use. Available at: <http://st-ts.ccme.ca/en/index.html>. Accessed January 2018.

The most conservative guideline of the following pathways are shown: soil ingestion (SI) or direct contact (DC); otherwise the generic (G), interim (int) or provisional (P) guidelines are shown. Surficial soil guidelines were selected if available.

Guideline for chromium is for the total of all valences (total).

Guideline for volatile hydrocarbon and volatile petroleum hydrocarbon is for petroleum hydrocarbon fraction 1 (C6-C10).

2. British Columbia Ministry of Environment and Climate Change Strategy. 2018. Contaminated Sites Regulation (CSR), includes amendments up to BC Reg. 116/2018. 14 June 2018. Accessed August 2018. Available online at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/375_96_00.

Schedule 3.1 - Part 1 Matrix Numerical Soil Standards for low density residential land use, intake of contaminated soil (I) standard is shown. If no site-specific factor was available, then the generic (G) standard from Schedule 3.1 - Part 2 Generic Numerical Soil Standards to Protect Human Health is shown.

The standard for sodium is for the ionic form (ion). The standard for chromium is only for the 6+ valence (Cr6+).

Standard for benzo[b]fluoranthene and benzo[b,j,k]fluoranthene is for benzo(b+j)fluoranthene.

The sum of the concentrations of: benz(a)anthracene, benzo(b+j)fluoranthenes, benzo(k)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene in soil, multiplied by each substance's respective 1998 World Health Organization benzo(a)pyrene toxic equivalency factor must not exceed the intake of contaminated soil, matrix soil standard for benzo(a)pyrene.

3. United States Environmental Protection Agency (US EPA). 2018. Regional Screening Levels (RSL) for residential soil. Accessed 21 June 2018. Available online at: <http://www2.epa.gov/risk/risk-based-screening-table-generic-tables>.

Values are based on a hazard quotient of 0.2 (dividing the RSL by 5 for non-carcinogens) and an incremental lifetime cancer risk of 10⁻⁵ (multiplying the RSL by 10 for carcinogens).

Values are only shown where CCME guidelines and CSR standards are not available.

4. Benzo(a)pyrene Total Potency Equivalent was calculated by multiplying the concentration of the PAH in the sample by its BaP Potency Equivalence Factor, given below, and summing the products. Values were calculated assuming the full detection limit.

BaP Potency Equivalence Factors: Benz[a]anthracene 0.1; Benzo[g,h,i]perylene 0.01; Indeno[1,2,3-c,d]pyrene 0.1; Benzo[a]pyrene 1; Chrysene 0.01; Benzo[b+j+k]fluoranthene 0.1; Dibenz[a,h]anthracene 1.

Value	Concentration exceeds selected screening value
Value	Detection limit exceeds screening value

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Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

							2015 Surface Sediment Samples														
							Sample ID	DAS15-SS1	DAS15-SS2	DAS15-DUP2	DAS15-SS3	DAS15-SS4	DAS15-SS5	DAS15-SS6	DAS15-SS7	DAS15-SS8	DAS15-SS9	DAS15-DUP1	DAS15-SS10	DAS15-SS11	DAS15-SS12
							ALS Sample Number	L1676950-1	L1676187-1	L1676187-2	L1676950-2	L1676187-3	L1676187-4	L1676187-5	L1676950-3	L1676187-6	L1676950-4	L1676950-5	L1676187-7	L1676187-8	L1676187-9
							Sample Date	22-Sep-15	21-Sep-15	21-Sep-15	22-Sep-15	21-Sep-15	21-Sep-15	21-Sep-15	21-Sep-15	21-Sep-15	22-Sep-15	22-Sep-15	21-Sep-15	21-Sep-15	21-Sep-15
							Sample Depth (m bml)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
							QA/QC		FDA	FD							FDA	FD			
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴														
Grain Size																					
Gravel (>2 mm)	%	-		-		-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sand (2.0 mm - 0.063 mm)	%	-		-		-	-	98.5	84.8	84.9	97.3	83.6	69.8	75.1	67.6	51.9	49.5	51	45.1	57.8	61.7
% Silt (0.063 mm - 4 µm)	%	-		-		-	-	0.95	11.9	11.8	1.87	12.4	22.8	18.9	25.9	37.7	41.7	40.9	45.4	33.7	33.1
% Clay (<4 µm)	%	-		-		-	-	0.46	3.25	3.29	0.8	3.95	7.3	6	6.54	10.5	8.81	8.15	9.49	8.59	5.19
% Fines (<0.075 mm)	%	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Variables																					
Moisture	%	-		-		-	-	21.8	25.9	25.8	24.6	26.3	37.2	27.7	35.7	40	37.1	36.9	34.7	30.8	32.1
pH (1:2 soil:water)	pH units	6 to 8	G	-		-	6 to 8	7.71	7.88	7.94	7.82	8.18	7.91	7.87	7.99	7.99	7.78	7.79	7.85	8.07	8.11
Organic / Inorganic Carbon																					
Total Organic Carbon	% dw	-		-		-	-	<0.10	0.34	0.28	<0.10	0.22	0.39	0.36	0.45	0.62	0.6	0.58	0.55	0.43	0.49
Metals																					
Aluminum	mg/kg dw	-		40,000	G	-	40,000	9480	10100	10100	9670	10300	11800	10200	12600	13800	14900	14700	13900	12900	11500
Antimony	mg/kg dw	20	G	250	G	-	20	0.23	0.27	0.28	0.22	0.29	0.34	0.27	0.36	0.45	0.49	0.45	0.92	0.4	0.42
Arsenic	mg/kg dw	12	SI	20	I	-	12	3.32	3.86	3.9	3.36	3.82	4.87	4.29	5.07	5.73	6.21	6.15	5.74	5.57	4.99
Barium	mg/kg dw	6800	DC	8500	I	-	6800	37.8	47.5	50.1	42.2	50.1	57.5	55	70.5	73.9	89.1	87.4	91.4	75.6	83.4
Beryllium	mg/kg dw	75	DC	85	G	-	75	0.2	0.22	0.24	0.2	0.24	0.29	0.22	0.31	0.33	0.35	0.36	0.35	0.31	0.28
Bismuth	mg/kg dw	-		-		-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	mg/kg dw	-		8500	G	-	8500	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.3	5.4	<5.0	<5.0	<5.0
Cadmium	mg/kg dw	14	SI	20	I	-	14	0.085	0.11	0.109	0.091	0.102	0.148	0.105	0.137	0.178	0.195	0.174	0.186	0.154	0.177
Calcium	mg/kg dw	-		-		-	-	5620	5550	5510	5820	5410	5930	5390	7160	7310	8330	8340	8480	7350	7500
Chromium	mg/kg dw	220	SI, total	100	I, Cr+6	-	100	30.5	32.3	27.7	30	31	35.3	33.3	34.5	38.4	42.6	41.8	37.9	36.3	35.6
Cobalt	mg/kg dw	50	G	25	I	-	25	8	8.83	8.89	8.42	9.32	11	9.39	11.1	12.7	13	12.9	12.8	12	11.3
Copper	mg/kg dw	1100	SI	3500	I	-	1100	14	17	17.1	16.3	17.7	24	17.9	23.5	28.6	30	29.4	29.6	25.9	23.7
Iron	mg/kg dw	-		35,000	G	-	35,000	18900	20100	20500	19400	21500	24900	22000	25100	28600	29900	29800	28300	27400	25400
Lead	mg/kg dw	140	SI	120	I	-	120	2.27	3.15	3.22	2.44	3.37	4.98	3.47	4.87	6.11	6.21	6.25	6.23	5.59	4.89
Lithium	mg/kg dw	-		30	G	-	30	8.2	10.2	10.7	9.1	11.1	14.3	10.6	14.2	16.7	16.5	16.3	16.4	15.3	12.5
Magnesium	mg/kg dw	-		-		-	-	7780	8090	7990	7980	8310	9300	8330	9360	10400	10700	10500	10300	9750	9050
Manganese	mg/kg dw	-		6000	I	-	6000	387	420	421	389	413	470	406	459	522	512	508	542	511	437
Mercury	mg/kg dw	6.6	SI	10	I	-	6.6	0.0226	0.0272	0.0304	0.0255	0.0264	0.0382	0.0276	0.042	0.0408	0.0427	0.0427	0.0349	0.0335	0.0326
Molybdenum	mg/kg dw	10	G	200	I	-	10	0.35	0.45	0.41	0.37	0.41	0.55	0.45	0.62	0.69	0.79	0.74	0.97	0.63	0.61
Nickel	mg/kg dw	200	DC	450	I	-	200	35	36	35.4	35.5	37	39.8	36.7	40.3	43.8	45.4	44.7	43.9	41	40
Phosphorus	mg/kg dw	-		-		-	-	429	505	470	480	493	579	555	591	675	732	692	668	653	668
Potassium	mg/kg dw	-		-		-	-	570	740	750	590	740	1040	750	1100	1270	1410	1380	1170	1040	840
Selenium	mg/kg dw	80	DC	200	I	-	80	<0.20	<0.20	<0.20	<0.20	<0.20	0.21	<0.20	0.21	0.3	0.32	0.3	0.3	0.27	0.23
Silver	mg/kg dw	20	G	200	G	-	20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	0.13	<0.10	<0.10
Sodium	mg/kg dw	-		1,000,000	I, ion	-	1,000,000	975	1620	1620	1500	1190	2350	1630	1600	2200	1830	1790	1010	764	689
Strontium	mg/kg dw	-		9500	G	-	9500	25.2	28.9	28.3	24.9	27.6	34.4	29.4	40.3	42.7	49.5	49.3	46.9	41.5	41.1
Sulfur	mg/kg dw	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg dw	1	SI, P	-		-	1	<0.050	<0.050	<0.050	<0.050	<0.050	0.057	<0.050	0.06	0.07	0.081	0.076	0.075	0.062	0.059
Tin	mg/kg dw	50	G	25,000	G	-	50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	mg/kg dw	-		-		-	-	817	706	746	787	743	692	766	870	846	1040	1020	875	802	793
Tungsten	mg/kg dw	-		15	G	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/kg dw	23	DC	100	I	-	23	0.537	0.357	0.354	0.293	0.349	0.494	0.377	0.576	0.618	0.742	0.981	0.658	0.563	0.577
Vanadium	mg/kg dw	-		200	I	-	200	47.9	42.6	43.2	48.6	46.3	47.5	48.2	50.3	54.5	62.2	61.1	53.2	51.9	50.4
Zinc	mg/kg dw	10,000	DC	10,000	I	-	10,000	38.5	43.9	44.5	40.1	45.1	55	45.9	56.6	64.3	68.2	67	64.8	60.6	55.7
Zirconium	mg/kg dw	-		-		1.3	1.3	5.5	5.3	5.7	5.6	5.5	5.2	5.5	6.4	6.3	7.3	7.2	7.2	6.5	6.6

Appendix 8.1-2
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Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID ALS Sample Number Sample Date Sample Depth (m bml) QA/QC							DAS15-SS1 L1676950-1 22-Sep-15 Surface	DAS15-SS2 L1676187-1 21-Sep-15 Surface FDA	DAS15-DUP2 L1676187-2 21-Sep-15 Surface FD	DAS15-SS3 L1676950-2 22-Sep-15 Surface	DAS15-SS4 L1676187-3 21-Sep-15 Surface	DAS15-SS5 L1676187-4 21-Sep-15 Surface	DAS15-SS6 L1676187-5 21-Sep-15 Surface	DAS15-SS7 L1676950-3 22-Sep-15 Surface	DAS15-SS8 L1676187-6 21-Sep-15 Surface	DAS15-SS9 L1676950-4 22-Sep-15 Surface FDA	DAS15-DUP1 L1676950-5 22-Sep-15 Surface FD	DAS15-SS10 L1676187-7 21-Sep-15 Surface	DAS15-SS11 L1676187-8 21-Sep-15 Surface	DAS15-SS12 L1676187-9 21-Sep-15 Surface
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴													
Polycyclic Aromatic Hydrocarbons																				
Acenaphthene	mg/kg dw	-		950	G	-	950	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0066	<0.0050	<0.0050
Acenaphthylene	mg/kg dw	-		-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Anthracene	mg/kg dw	-		10,000	I	-	10,000	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0057	0.0049	<0.0040	<0.0040	<0.0040
Benzo[a]anthracene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[a]pyrene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	I	-	5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[b]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[b&j]fluoranthene	mg/kg dw	-		50	G	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b,j,k]fluoranthene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Benzo[g,h,i]perylene	mg/kg dw	see B(a)P TPE	PEF=0.01	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[k]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chrysene	mg/kg dw	see B(a)P TPE	PEF=0.01	200	G	-	200	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Dibenzo[a,h]anthracene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	G	-	5	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	mg/kg dw	-		1500	I	-	1500	<0.010	0.014	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	0.02	0.021	<0.010	<0.010
Fluorene	mg/kg dw	-		600	G	-	600	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Indeno[1,2,3-cd]pyrene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2-Methylnaphthalene	mg/kg dw	-		60	G	-	60	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Naphthalene	mg/kg dw	-		850	I	-	850	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.014	<0.010	<0.010	<0.010	<0.010
Phenanthrene	mg/kg dw	-		1500	G	-	1500	<0.010	0.014	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	0.012	0.018	0.019	0.026	0.011
Pyrene	mg/kg dw	-		1000	G	-	1000	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	0.018	0.016	<0.010	<0.010
B(a)P Total Potency Equivalent ⁽⁴⁾	mg/kg dw	5.3	DC	-	-	-	5.3	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187
Volatile Organic Compounds																				
Benzene	mg/kg dw	110	SS, SI	150	I	-	110	<0.0050	-	-	<0.0050	-	-	-	<0.0050	-	<0.0050	<0.0050	-	-
Ethylbenzene	mg/kg dw	10,000	SS, SI	4000	I	-	4000	<0.015	-	-	<0.015	-	-	-	<0.015	-	<0.015	<0.015	-	-
Methyl t-butyl ether	mg/kg dw	-		4000	G	-	4000	<0.20	-	-	<0.20	-	-	-	<0.20	-	<0.20	<0.20	-	-
Styrene	mg/kg dw	5	G	8500	G	-	5	<0.050	-	-	<0.050	-	-	-	<0.050	-	<0.050	<0.050	-	-
Toluene	mg/kg dw	22,000	SS, SI	3500	I	-	3500	<0.050	-	-	<0.050	-	-	-	<0.050	-	<0.050	<0.050	-	-
ortho-Xylene	mg/kg dw	-		-		130	130	<0.050	-	-	<0.050	-	-	-	<0.050	-	<0.050	<0.050	-	-
meta- & para-Xylene	mg/kg dw	-		-		110	110	<0.050	-	-	<0.050	-	-	-	<0.050	-	<0.050	<0.050	-	-
Xylenes	mg/kg dw	150,000	SS, SI	8500	I	-	8500	<0.075	-	-	<0.075	-	-	-	<0.075	-	<0.075	<0.075	-	-
Hydrocarbons																				
Volatile Hydrocarbons (VH6-10)	mg/kg dw	12,000	SS, DC	-	-	-	12,000	<100	-	-	<100	-	-	-	<100	-	<100	<100	-	-
Volatile Petroleum Hydrocarbon (C6-C10)	mg/kg dw	12,000	SS, DC	200	G	-	200	<100	-	-	<100	-	-	-	<100	-	<100	<100	-	-

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID							DAS15-SS1	DAS15-SS2	DAS15-DUP2	DAS15-SS3	DAS15-SS4	DAS15-SS5	DAS15-SS6	DAS15-SS7	DAS15-SS8	DAS15-SS9	DAS15-DUP1	DAS15-SS10	DAS15-SS11	DAS15-SS12
ALS Sample Number							L1676950-1	L1676187-1	L1676187-2	L1676950-2	L1676187-3	L1676187-4	L1676187-5	L1676187-6	L1676950-3	L1676187-7	L1676950-4	L1676950-5	L1676187-8	L1676187-9
Sample Date							22-Sep-15	21-Sep-15	21-Sep-15	22-Sep-15	21-Sep-15	21-Sep-15	21-Sep-15	21-Sep-15	22-Sep-15	21-Sep-15	22-Sep-15	22-Sep-15	21-Sep-15	21-Sep-15
Sample Depth (m bml)							Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
QA/QC								FDA	FD							FDA	FD			
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴													
Phenolics																				
4-Chloro-3-methylphenol	mg/kg dw	-		1500	G	-	1500	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2-Chlorophenol	mg/kg dw	0.5	G	200	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
3-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
4-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,3-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,4 & 2,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,6-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
3,4-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
3,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,4-Dimethylphenol	mg/kg dw	1	G	850	G	-	1	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
o-Cresol (2-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.030	-	-
m-Cresol (3-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
p-Cresol (4-methyl phenol)	mg/kg dw	1	G	200	G	-	1	0.037	-	-	<0.020	-	-	-	<0.020	-	<0.020	0.052	-	-
Pentachlorophenol	mg/kg dw	93	SI	90	I	-	90	0.039	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
Phenol	mg/kg dw	1900	SI	10,000	I	-	1900	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,3,4,5-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,3,4,6-Tetrachlorophenol	mg/kg dw	0.5	G	1000	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,3,5,6-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,3,4-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,3,5-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,3,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,4,5-Trichlorophenol	mg/kg dw	0.5	G	4000	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
2,4,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
Polychlorinated Biphenyls																				
PCB Arochlor 1016	mg/kg dw	-		-		0.82	0.82	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1221	mg/kg dw	-		-		2	2	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1232	mg/kg dw	-		-		1.7	1.7	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1242	mg/kg dw	-		-		2.3	2.3	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1248	mg/kg dw	-		-		2.3	2.3	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1254	mg/kg dw	-		-		0.24	0.24	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1260	mg/kg dw	-		-		2.4	2.4	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1262	mg/kg dw	-		-		-	-	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
PCB Arochlor 1268	mg/kg dw	-		-		-	-	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-
Total PCBs	mg/kg dw	-		5	I	-	5	<0.020	-	-	<0.020	-	-	-	<0.020	-	<0.020	<0.020	-	-

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

		Sample ID ALS Sample Number Sample Date Sample Depth (m bml) QA/QC					DAS15-SS1 L1676950-1 22-Sep-15 Surface	DAS15-SS2 L1676187-1 21-Sep-15 Surface FDA	DAS15-DUP2 L1676187-2 21-Sep-15 Surface FD	DAS15-SS3 L1676950-2 22-Sep-15 Surface	DAS15-SS4 L1676187-3 21-Sep-15 Surface	DAS15-SS5 L1676187-4 21-Sep-15 Surface	DAS15-SS6 L1676187-5 21-Sep-15 Surface	DAS15-SS7 L1676950-3 22-Sep-15 Surface	DAS15-SS8 L1676187-6 21-Sep-15 Surface	DAS15-SS9 L1676950-4 22-Sep-15 Surface FDA	DAS15-DUP1 L1676950-5 22-Sep-15 Surface FD	DAS15-SS10 L1676187-7 21-Sep-15 Surface	DAS15-SS11 L1676187-8 21-Sep-15 Surface	DAS15-SS12 L1676187-9 21-Sep-15 Surface
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴													
Dioxins and Furans																				
2,3,7,8-TCDD	pg/g dw	-		-		-	<0.12		<0.12											
1,2,3,7,8-PeCDD	pg/g dw	-		-		-	<0.060		<0.060											
1,2,3,4,7,8-HxCDD	pg/g dw	-		-		-	<0.041		<0.041											
1,2,3,6,7,8-HxCDD	pg/g dw	-		-		-	0.04		0.04											
1,2,3,7,8,9-HxCDD	pg/g dw	-		-		-	0.067		0.067											
1,2,3,4,6,7,8-HpCDD	pg/g dw	-		-		-	0.633		0.633											
OCDD	pg/g dw	-		-		-	3.89		3.89											
2,3,7,8-TCDF	pg/g dw	-		-		-	<0.13		<0.13											
1,2,3,7,8-PeCDF	pg/g dw	-		-		-	<0.041		<0.041											
2,3,4,7,8-PeCDF	pg/g dw	-		-		-	<0.037		<0.037											
1,2,3,4,7,8-HxCDF	pg/g dw	-		-		-	<0.037		<0.037											
1,2,3,6,7,8-HxCDF	pg/g dw	-		-		-	<0.031		<0.031											
1,2,3,7,8,9-HxCDF	pg/g dw	-		-		-	0.066		0.066											
2,3,4,6,7,8-HxCDF	pg/g dw	-		-		-	<0.034		<0.034											
1,2,3,4,6,7,8-HpCDF	pg/g dw	-		-		-	0.058		0.058											
1,2,3,4,7,8,9-HpCDF	pg/g dw	-		-		-	<0.035		<0.035											
OCDF	pg/g dw	-		-		-	<0.081		<0.081											
Total Dioxin TEF	pg/g dw	4	SI, P	95	I	-	0.245		0.245											

Notes:

< = below laboratory detection limit; "-" = screening value not available or parameter not analyzed; µm = micrometers; % = percent; B(a)P TPE = benzo(a)pyrene total potency equivalent; dw = dry weight; m bml = meters below mud line; mg/kg = milligram per kilogram; mm = millimeters; FD = Field duplicate; FDA = Field duplicate available; PCB = polychlorinated biphenyl; PEF = potency equivalene factor; pg/g = picogram per gram; QA/QC = quality assurance/quality control; TEF = Toxic Equivalency Factors.

1. Canadian Council of Ministers of the Environment (CCME). 1999, including updates to 2018. Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health. Residential/parkland (RL/PL) land use. Available at: <http://st-ts.ccme.ca/en/index.html>. Accessed January 2018.

The most conservative guideline of the following pathways are shown: soil ingestion (SI) or direct contact (DC); otherwise the generic (G), interim (int) or provisional (P) guidelines are shown. Surficial soil guidelines were selected if available.

Guideline for chromium is for the total of all valences (total).

Guideline for volatile hydrocarbon and volatile petroleum hydrocarbon is for petroleum hydrocarbon fraction 1 (C6-C10).

2. British Columbia Ministry of Environment and Climate Change Strategy. 2018. Contaminated Sites Regulation (CSR), includes amendments up to BC Reg. 116/2018. 14 June 2018. Accessed August 2018. Available online at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/375_96_00.

Schedule 3.1 - Part 1 Matrix Numerical Soil Standards for low density residential land use, intake of contaminated soil (I) standard is shown. If no site-specific factor was available, then the generic (G) standard from Schedule 3.1 - Part 2 Generic Numerical Soil Standards to Protect Human Health is shown.

The standard for sodium is for the ionic form (ion). The standard for chromium is only for the 6+ valence (Cr6+).

Standard for benzo[b]fluoranthene and benzo[b,j,k]fluoranthene is for benzo(b+j)fluoranthene.

The sum of the concentrations of: benz(a)anthracene, benzo(b+j)fluoranthenes, benzo(k)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene in soil, multiplied by each substance's respective 1998 World Health Organization benzo(a)pyrene toxic equivalency factor must not exceed the intake of contaminated soil, matrix soil standard for benzo(a)pyrene.

3. United States Environmental Protection Agency (US EPA). 2018. Regional Screening Levels (RSL) for residential soil. Accessed 21 June 2018. Available online at: <http://www2.epa.gov/risk/risk-based-screening-table-generic-tables>.

Values are based on a hazard quotient of 0.2 (dividing the RSL by 5 for non-carcinogens) and an incremental lifetime cancer risk of 10⁻⁵ (multiplying the RSL by 10 for carcinogens).

Values are only shown where CCME guidelines and CSR standards are not available.

4. Benzo(a)pyrene Total Potency Equivalent was calculated by multiplying the concentration of the PAH in the sample by its BaP Potency Equivalence Factor, given below, and summing the products. Values were calculated assuming the full detection limit.

BaP Potency Equivalence Factors: Benz[a]anthracene 0.1; Benzo[g,h,i]perylene 0.01; Indeno[1,2,3-c,d]pyrene 0.1; Benzo[a]pyrene 1; Chrysene 0.01; Benzo[b+j+k]fluoranthene 0.1; Dibenz[a,h]anthracene 1.

Value	Concentration exceeds selected screening value
Value	Detection limit exceeds screening value

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

							2015 Foreshore Surface Sediment Samples for Benthic Baseline			2018 Supplemental Surface Sediment Samples										2018 Supplemental Surface Sediment Samples									
							BB15-SED1 L1677751-1 23-Sep-2015 Surface FDA	BB15-DUP L1677751-3 23-Sep-2015 Surface FD	BB15-SED2 L1677751-2 23-Sep-2015 Surface	SED18-01 L2073609-1 28-Mar-2018 Surface	SED18-02 L2073609-2 28-Mar-2018 Surface FDA	DUP 1 L2073609-14 28-Mar-2018 Surface FD	SED18-03 L2073609-3 28-Mar-2018 Surface	SED18-04 L2073609-4 28-Mar-2018 Surface	SED18-05 L2073609-5 28-Mar-2018 Surface	SED18-06 L2073609-6 28-Mar-2018 Surface	SED18-07 L2073609-7 28-Mar-2018 Surface	SED18-08 L2073609-8 28-Mar-2018 Surface	SED18-09 L2073609-9 28-Mar-2018 Surface	SED18-10 L2073609-10 28-Mar-2018 Surface	SED18-11 L2073609-11 28-Mar-2018 Surface	SED18-12 L2073609-12 28-Mar-2018 Surface	SED18-13 L2073609-13 28-Mar-2018 Surface FDA	DUP 2 L2073609-15 28-Mar-2018 Surface FD					
							Sample ID	ALS Sample Number	Sample Date	Sample Depth (m bml)	QA/QC																		
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{Lo} ²	Notes	US EPA ³	Selected Screening Value ⁴																						
Grain Size																													
Gravel (>2 mm)	%	-		-		-	-	<0.10	<0.10	<0.10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0					
Sand (2.0 mm - 0.063 mm)	%	-		-		-	-	21.9	20.7	15.2	75.9	94	95	95.5	96.9	96.2	95.9	96	67.1	49.9	41.6	67.3	29.1	40.6	41.6				
% Silt (0.063 mm - 4 µm)	%	-		-		-	-	69.8	69.3	76.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
% Clay (<4 µm)	%	-		-		-	-	8.35	9.98	8.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
% Fines (<0.075 mm)	%	-		-		-	-	-	-	-	24	6	5	3.6	2.4	2.5	1.9	3.2	32.7	50	58.2	32.6	70.7	59.2	58.3				
Conventional Variables																													
Moisture	%	-		-		-	-	32.1	32.2	40.6	29.2	23.6	26.3	21.2	23.5	23.6	23.5	22.5	32.2	32.9	41.5	31.8	51.1	35.2	34.8				
pH (1:2 soil:water)	pH units	6 to 8	G	-		-	6 to 8	7.69	7.71	7.58	7.84	7.65	7.64	7.63	7.38	7.49	7.51	7.55	7.91	7.94	7.59	7.80	7.66	7.69	7.69				
Organic / Inorganic Carbon																													
Total Organic Carbon	% dw	-		-		-	-	0.69	0.78	2.44	0.385	0.201	0.198	0.171	0.147	0.184	0.141	0.22	0.559	0.575	1.24	0.651	2.25	0.968	1				
Metals																													
Aluminum	mg/kg dw	-		40,000	G	-	40,000	15200	15400	14100	10700	10000	8660	9220	9150	9200	8420	9200	11400	12600	13000	10500	14600	12400	12500				
Antimony	mg/kg dw	20	G	250	G	-	20	0.47	0.51	0.44	0.35	0.3	0.24	0.25	0.23	0.25	0.25	0.25	0.41	0.46	0.51	0.38	0.56	0.43	0.45				
Arsenic	mg/kg dw	12	SI	20	I	-	12	5.37	5.21	5.78	4.58	3.5	3.16	3.27	3.32	3.11	3.15	3.22	5.16	5.16	6.64	4.98	7.37	6.2	5.81				
Barium	mg/kg dw	6800	DC	8500	I	-	6800	112	109	96.3	53.7	39.3	38.6	46.8	35	38.6	40.4	40	61.6	69.1	70.4	58.4	73.3	70.4	66.6				
Beryllium	mg/kg dw	75	DC	85	G	-	75	0.37	0.36	0.34	0.22	0.2	0.17	0.18	0.16	0.17	0.18	0.17	0.25	0.28	0.3	0.23	0.35	0.27	0.27				
Bismuth	mg/kg dw	-		-		-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.29	<0.20	<0.20				
Boron	mg/kg dw	-		8500	G	-	8500	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.2	<5.0	7.4	<5.0	<5.0				
Cadmium	mg/kg dw	14	SI	20	I	-	14	0.212	0.222	0.236	0.119	0.088	0.077	0.082	0.077	0.079	0.078	0.079	0.158	0.163	0.24	0.144	0.338	0.198	0.203				
Calcium	mg/kg dw	-		-		-	-	9120	9120	7960	6170	5590	4590	5010	4150	4360	4330	4470	6820	7650	7080	6150	7330	7370	7130				
Chromium	mg/kg dw	220	SI, total	100	I, Cr+6	-	100	40.1	40.5	38.3	30	28.9	27	27.7	22	24.9	26.2	28.3	34.2	34.6	37.4	32.3	39.4	37.1	36.3				
Cobalt	mg/kg dw	50	G	25	I	-	25	12.6	12.9	12.1	9.22	8.49	7.57	8.25	7.64	7.46	7.48	7.69	10.4	11	11.6	9.82	12.9	11.2	11.1				
Copper	mg/kg dw	1100	SI	3500	I	-	1100	27.6	28.8	29.7	19.1	15.2	13.4	14.2	13.5	15.1	13.4	14.9	23.2	24	30.6	22.2	38.3	27	26.6				
Iron	mg/kg dw	-		35,000	G	-	35,000	28500	28700	26200	21700	19600	18200	19800	17700	18000	17800	18600	24300	25000	27200	22900	30000	27300	26900				
Lead	mg/kg dw	140	SI	120	I	-	120	6.04	6.2	6.85	3.57	2.58	2.4	2.39	2.25	2.42	2.28	2.36	4.38	5.32	5.71	4.12	7.09	5.22	5.08				
Lithium	mg/kg dw	-		30	G	-	30	16.2	16.2	15.6	8.8	7.8	6.6	6.3	6.7	7	6.4	6.8	10.1	11.6	12.5	8.8	17.4	11.5	11.3				
Magnesium	mg/kg dw	-		-		-	-	9920	10300	9590	8680	7960	7080	7900	7030	6860	7080	7190	9010	9310	9950	8580	10700	9770	9630				
Manganese	mg/kg dw	-		6000	I	-	6000	464	476	393	350	368	332	373	366	361	359	351	387	383	407	345	465	379	400				
Mercury	mg/kg dw	6.6	SI	10	I	-	6.6	0.0475	0.0607	0.045	0.0273	0.0216	0.0195	0.0188	0.0178	0.0192	0.049	0.029	0.0333	0.0322	0.0569	0.0303	0.0497	0.0347	0.0424				
Molybdenum	mg/kg dw	10	G	200	I	-	10	0.67	0.67	0.78	0.51	0.43	0.38	0.38	0.38	0.4	0.41	0.36	0.56	0.59	0.72	0.51	0.85	0.63	0.76				
Nickel	mg/kg dw	200	DC	450	I	-	200	42.1	43.8	41.2	35.2	33.7	30.9	35.7	31	30.4	32.2	30.8	38.4	38.6	40.7	36.3	44.6	40.1	39				
Phosphorus	mg/kg dw	-		-		-	-	771	817	697	577	487	450	496	447	432	423	449	668	690	794	625	934	812	767				
Potassium	mg/kg dw	-		-		-	-	1200	1210	1140	860	660	570	570	600	620	570	640	970	1030	1170	840	1460	1070	1040				
Selenium	mg/kg dw	80	DC	200	I	-	80	0.29	0.33	0.31	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.26	0.25	0.34	<0.20	0.46	0.33	0.32				
Silver	mg/kg dw	20	G	200	G	-	20	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	0.15	<0.10				
Sodium	mg/kg dw	-		1,000,000	I, ion	-	1,000,000	612	659	669	1820	1380	1320	1170	1320	1710	1430	1380	1330	1180	1430	1490	3190	1130	1190				
Strontium	mg/kg dw	-		9500	G	-	9500	53.7	52.5	49.5	35.1	26.9	22.3	24.4	22.1	23.3	22.2	23.9	38.6	41.6	48.5	36.5	52.7	43.3	44.9				
Sulfur	mg/kg dw	-		-		-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000				
Thallium	mg/kg dw	1	SI, P	-		-	1	0.087	0.084	0.087	0.058	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.065	0.073	0.092	0.063	0.103	0.08	0.081				
Tin	mg/kg dw	50	G	25,000	G	-	50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0				
Titanium	mg/kg dw	-		-		-	-	1010	1020	958	819	873	707	835	744	719	744	800	901	865	905	749	860	928	907				
Tungsten	mg/kg dw	-		15	G	-	15	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
Uranium	mg/kg dw	23	DC	100	I	-	23	0.729	0.776	0.779	0.489	0.335	0.3	0.405	0.311	0.338	0.311	0.316	0.578	0.655	0.794	0.523	0.825	0.733	0.682				
Vanadium	mg/kg dw	-		200	I	-	200	56	58.3	52.6	43.2	45.5	39.3	47.3	40.3	39.8	41.6	42	48.5	47.2	50.2	43.6	52.4	50.7	49.5				
Zinc	mg/kg dw	10,000	DC	10,000	I	-	10,000	66	68.7	66.2	49.8	41.2	37.9	40.2	37.3	39.2	37.8	40.9	57.3	59.3	66.8	52.1	81.2	63.3	63.6				
Zirconium	mg/kg dw	-		-		1.3	1.3	8.3	8.2	8.3	5.2	5.4	4.9	5.1	5.1	5.2	5.3	5.4	4.9	5	4.6	4.8	3.5	4.6	4.9				

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID ALS Sample Number Sample Date Sample Depth (m bml) QA/QC								BB15-SED1 L1677751-1 23-Sep-2015 Surface FDA	BB15-DUP L1677751-3 23-Sep-2015 Surface FD	BB15-SED2 L1677751-2 23-Sep-2015 Surface	SED18-01 L2073609-1 28-Mar-2018 Surface	SED18-02 L2073609-2 28-Mar-2018 Surface FDA	DUP 1 L2073609-14 28-Mar-2018 Surface FD	SED18-03 L2073609-3 28-Mar-2018 Surface	SED18-04 L2073609-4 28-Mar-2018 Surface	SED18-05 L2073609-5 28-Mar-2018 Surface	SED18-06 L2073609-6 28-Mar-2018 Surface	SED18-07 L2073609-7 28-Mar-2018 Surface	SED18-08 L2073609-8 28-Mar-2018 Surface	SED18-09 L2073609-9 28-Mar-2018 Surface	SED18-10 L2073609-10 28-Mar-2018 Surface	SED18-11 L2073609-11 28-Mar-2018 Surface	SED18-12 L2073609-12 28-Mar-2018 Surface	SED18-13 L2073609-13 28-Mar-2018 Surface FDA	DUP 2 L2073609-15 28-Mar-2018 Surface FD	
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴																			
Polycyclic Aromatic Hydrocarbons																										
Acenaphthene	mg/kg dw	-		950	G	-	950	<0.0050	<0.0050	0.0123	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0053	<0.0050	0.0279	<0.0050	<0.0050	
Acenaphthylene	mg/kg dw	-		-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	
Anthracene	mg/kg dw	-		10,000	I	-	10,000	<0.0040	<0.0040	0.0166	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.005	<0.0040	<0.0040	<0.0040	<0.0040	<0.0060	<0.0040	<0.020	<0.0040	<0.0040	
Benzo[a]anthracene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	<0.010	0.018	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	0.028	<0.010	<0.010	
Benzo[a]pyrene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	I	-	5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.030	<0.010	<0.010	
Benzo[b]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	<0.010	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo[b&j]fluoranthene	mg/kg dw	-		50	G	-	50	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	0.025	<0.010	<0.010	
Benzo[b,j,k]fluoranthene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.015	<0.015	0.02	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.038	<0.015	<0.015	
Benzo[g,h,i]perylene	mg/kg dw	see B(a)P TPE	PEF=0.01	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	
Benzo[k]fluoranthene	mg/kg dw	-		50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	
Chrysene	mg/kg dw	see B(a)P TPE	PEF=0.01	200	G	-	200	<0.010	<0.010	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.030	<0.010	<0.010	
Dibenzo[a,h]anthracene	mg/kg dw	see B(a)P TPE	PEF=1.0	5	G	-	5	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	
Fluoranthene	mg/kg dw	-		1500	I	-	1500	0.021	0.017	0.089	<0.010	<0.010	<0.010	<0.010	<0.010	0.021	<0.010	<0.010	0.016	0.014	0.04	0.01	0.134	0.019	0.02	
Fluorene	mg/kg dw	-		600	G	-	600	<0.010	<0.010	0.019	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.025	<0.010	<0.010	
Indeno[1,2,3-cd]pyrene	mg/kg dw	see B(a)P TPE	PEF=0.1	50	G	-	50	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	
2-Methylnaphthalene	mg/kg dw	-		60	G	-	60	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	
Naphthalene	mg/kg dw	-		850	I	-	850	<0.010	<0.010	0.023	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	
Phenanthrene	mg/kg dw	-		1500	G	-	1500	0.014	0.014	0.058	<0.010	<0.010	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	0.014	0.016	0.032	0.012	0.124	0.016	0.016	
Pyrene	mg/kg dw	-		1000	G	-	1000	0.018	0.014	0.077	<0.010	<0.010	<0.010	<0.010	<0.010	0.02	<0.010	<0.010	0.012	0.01	0.03	<0.010	0.096	0.016	0.016	
B(a)P Total Potency Equivalent ⁽⁴⁾	mg/kg dw	5.3	DC	-	-	-	5.3	<0.0187	<0.0187	0.0201	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	<0.0187	0.0188	<0.0187	0.0437	<0.0187	<0.0187	
Volatile Organic Compounds																										
Benzene	mg/kg dw	110	SS, SI	150	I	-	110	-	-	-	<0.0050	-	-	-	-	-	-	<0.0050	<0.0090	-	-	-	-	<0.0050	<0.0050	
Ethylbenzene	mg/kg dw	10,000	SS, SI	4000	I	-	4000	-	-	-	<0.015	-	-	-	-	-	-	<0.015	<0.015	-	-	-	-	<0.015	<0.015	
Methyl t-butyl ether	mg/kg dw	-		4000	G	-	4000	-	-	-	<0.20	-	-	-	-	-	-	<0.20	<0.20	-	-	-	-	<0.20	<0.20	
Styrene	mg/kg dw	5	G	8500	G	-	5	-	-	-	<0.050	-	-	-	-	-	-	<0.050	<0.050	-	-	-	-	<0.050	<0.050	
Toluene	mg/kg dw	22,000	SS, SI	3500	I	-	3500	-	-	-	<0.050	-	-	-	-	-	-	<0.050	0.065	-	-	-	-	<0.050	<0.050	
ortho-Xylene	mg/kg dw	-		-	-	130	130	-	-	-	<0.050	-	-	-	-	-	-	<0.050	<0.050	-	-	-	-	<0.050	<0.050	
meta- & para-Xylene	mg/kg dw	-		-	-	110	110	-	-	-	<0.050	-	-	-	-	-	-	<0.050	<0.050	-	-	-	-	<0.050	<0.050	
Xylenes	mg/kg dw	150,000	SS, SI	8500	I	-	8500	-	-	-	<0.075	-	-	-	-	-	-	<0.075	<0.075	-	-	-	-	<0.075	<0.075	
Hydrocarbons																										
Volatile Hydrocarbons (VH6-10)	mg/kg dw	12,000	SS, DC	-	-	-	12,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Volatile Petroleum Hydrocarbon (C6-C10)	mg/kg dw	12,000	SS, DC	200	G	-	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

		Sample ID ALS Sample Number Sample Date Sample Depth (m bml) QA/QC					BB15-SED1 L1677751-1 23-Sep-2015 Surface FDA	BB15-DUP L1677751-3 23-Sep-2015 Surface FD	BB15-SED2 L1677751-2 23-Sep-2015 Surface	SED18-01 L2073609-1 28-Mar-2018 Surface	SED18-02 L2073609-2 28-Mar-2018 Surface FDA	DUP 1 L2073609-14 28-Mar-2018 Surface FD	SED18-03 L2073609-3 28-Mar-2018 Surface	SED18-04 L2073609-4 28-Mar-2018 Surface	SED18-05 L2073609-5 28-Mar-2018 Surface	SED18-06 L2073609-6 28-Mar-2018 Surface	SED18-07 L2073609-7 28-Mar-2018 Surface	SED18-08 L2073609-8 28-Mar-2018 Surface	SED18-09 L2073609-9 28-Mar-2018 Surface	SED18-10 L2073609-10 28-Mar-2018 Surface	SED18-11 L2073609-11 28-Mar-2018 Surface	SED18-12 L2073609-12 28-Mar-2018 Surface	SED18-13 L2073609-13 28-Mar-2018 Surface FDA	DUP 2 L2073609-15 28-Mar-2018 Surface FD
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴																	
Phenolics																								
4-Chloro-3-methylphenol	mg/kg dw	-		1500	G	-	1500	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2-Chlorophenol	mg/kg dw	0.5	G	200	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
3-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
4-Chlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,3-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,4 & 2,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,6-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
3,4-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
3,5-Dichlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,4-Dimethylphenol	mg/kg dw	1	G	850	G	-	1	-	-	-	-	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
o-Cresol (2-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m-Cresol (3-methyl phenol)	mg/kg dw	1	G	2000	G	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
p-Cresol (4-methyl phenol)	mg/kg dw	1	G	200	G	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	mg/kg dw	93	SI	90	I	-	90	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
Phenol	mg/kg dw	1900	SI	10,000	I	-	1900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,4,5-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,3,4,6-Tetrachlorophenol	mg/kg dw	0.5	G	1000	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,3,5,6-Tetrachlorophenol	mg/kg dw	0.5	G	100	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,3,4-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,3,5-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,3,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,4,5-Trichlorophenol	mg/kg dw	0.5	G	4000	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
2,4,6-Trichlorophenol	mg/kg dw	0.5	G	40	G	-	0.5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
Polychlorinated Biphenyls																								
PCB Arochlor 1016	mg/kg dw	-		-		0.82	0.82	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1221	mg/kg dw	-		-		2	2	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1232	mg/kg dw	-		-		1.7	1.7	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1242	mg/kg dw	-		-		2.3	2.3	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1248	mg/kg dw	-		-		2.3	2.3	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1254	mg/kg dw	-		-		0.24	0.24	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1260	mg/kg dw	-		-		2.4	2.4	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1262	mg/kg dw	-		-		-	-	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
PCB Arochlor 1268	mg/kg dw	-		-		-	-	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020
Total PCBs	mg/kg dw	-		5	I	-	5	-	-	-	<0.020	-	-	-	-	-	<0.020	<0.020	-	-	-	-	<0.020	<0.020

Appendix 8.1-2
Attachment 1
Table 1-3: Sediment Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

		Sample ID				BB15-SED1	BB15-DUP	BB15-SED2	SED18-01	SED18-02	DUP 1	SED18-03	SED18-04	SED18-05	SED18-06	SED18-07	SED18-08	SED18-09	SED18-10	SED18-11	SED18-12	SED18-13	DUP 2
		ALS Sample Number				L1677751-1	L1677751-3	L1677751-2	L2073609-1	L2073609-2	L2073609-14	L2073609-3	L2073609-4	L2073609-5	L2073609-6	L2073609-7	L2073609-8	L2073609-9	L2073609-10	L2073609-11	L2073609-12	L2073609-13	L2073609-15
		Sample Date				23-Sep-2015	23-Sep-2015	23-Sep-2015	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018	28-Mar-2018
		Sample Depth (m bml)				Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
		QA/QC				FDA	FD			FDA	FD											FDA	FD
Parameter	Sample ID	CCME RL/PL ¹	Notes	CSR RL _{LD} ²	Notes	US EPA ³	Selected Screening Value ⁴																
Dioxins and Furans																							
2,3,7,8-TCDD	pg/g dw	-		-		-	-	-	<0.035	-	-	-	-	-	-	<0.034	<0.047	-	-	-	-	<0.050	<0.067
1,2,3,7,8-PeCDD	pg/g dw	-		-		-	-	-	0.06	-	-	-	-	-	-	0.028	0.102	-	-	-	-	0.07	0.118
1,2,3,4,7,8-HxCDD	pg/g dw	-		-		-	-	-	0.092	-	-	-	-	-	-	0.05	0.118	-	-	-	-	0.078	0.116
1,2,3,6,7,8-HxCDD	pg/g dw	-		-		-	-	-	0.206	-	-	-	-	-	-	0.079	0.376	-	-	-	-	0.336	0.565
1,2,3,7,8,9-HxCDD	pg/g dw	-		-		-	-	-	0.216	-	-	-	-	-	-	0.078	0.41	-	-	-	-	0.274	0.41
1,2,3,4,6,7,8-HpCDD	pg/g dw	-		-		-	-	-	3.79	-	-	-	-	-	-	1	9.39	-	-	-	-	4.71	7.48
OCDD	pg/g dw	-		-		-	-	-	37.6	-	-	-	-	-	-	13.1	103	-	-	-	-	54.2	62.2
2,3,7,8-TCDF	pg/g dw	-		-		-	-	-	0.087	-	-	-	-	-	-	0.13	0.16	-	-	-	-	0.141	0.15
1,2,3,7,8-PeCDF	pg/g dw	-		-		-	-	-	<0.025	-	-	-	-	-	-	0.021	0.037	-	-	-	-	<0.033	<0.030
2,3,4,7,8-PeCDF	pg/g dw	-		-		-	-	-	<0.021	-	-	-	-	-	-	0.037	0.037	-	-	-	-	<0.030	0.085
1,2,3,4,7,8-HxCDF	pg/g dw	-		-		-	-	-	0.047	-	-	-	-	-	-	<0.014	0.077	-	-	-	-	0.053	0.102
1,2,3,6,7,8-HxCDF	pg/g dw	-		-		-	-	-	0.059	-	-	-	-	-	-	0.02	0.049	-	-	-	-	0.053	0.061
1,2,3,7,8,9-HxCDF	pg/g dw	-		-		-	-	-	0.04	-	-	-	-	-	-	0.028	0.063	-	-	-	-	<0.053	0.067
2,3,4,6,7,8-HxCDF	pg/g dw	-		-		-	-	-	0.069	-	-	-	-	-	-	0.016	0.13	-	-	-	-	0.12	0.16
1,2,3,4,6,7,8-HpCDF	pg/g dw	-		-		-	-	-	0.517	-	-	-	-	-	-	0.22	0.812	-	-	-	-	0.755	1.58
1,2,3,4,7,8,9-HpCDF	pg/g dw	-		-		-	-	-	0.062	-	-	-	-	-	-	<0.031	0.06	-	-	-	-	0.06	0.14
OCDF	pg/g dw	-		-		-	-	-	1.31	-	-	-	-	-	-	0.23	2.97	-	-	-	-	2.26	4.46
Total Dioxin TEF	pg/g dw	4	SI, P	95	I	-	4	-	0.239	-	-	-	-	-	-	0.132	0.434	-	-	-	-	0.313	0.486

Notes:
< = below laboratory detection limit; "-" = screening value not available or parameter not analyzed; µm = micrometers; % = percent; B(a)P TPE = benzo(a)pyrene total potency equivalent; dw = dry weight; m bml = meters below mud line; mg/kg = milligram per kilogram; mm = millimeters; FD = Field duplicate; FDA = Field duplicate available; PCB = polychlorinated biphenyl; PEF = potency equivalence factor; pg/g = picogram per gram; QA/QC = quality assurance/quality control; TEF = Toxic Equivalency Factors.

1. Canadian Council of Ministers of the Environment (CCME). 1999, including updates to 2018. Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health. Residential/parkland (RL/PL) land use. Available at: <http://st-ts.ccme.ca/en/index.html>. Accessed January 2018.

The most conservative guideline of the following pathways are shown: soil ingestion (SI) or direct contact (DC); otherwise the generic (G), interim (int) or provisional (P) guidelines are shown. Surficial soil guidelines were selected if available.

Guideline for chromium is for the total of all valences (total).

Guideline for volatile hydrocarbon and volatile petroleum hydrocarbon is for petroleum hydrocarbon fraction 1 (C6-C10).

2. British Columbia Ministry of Environment and Climate Change Strategy. 2018. Contaminated Sites Regulation (CSR), includes amendments up to BC Reg. 116/2018. 14 June 2018. Accessed August 2018. Available online at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/375_96_00.

Schedule 3.1 - Part 1 Matrix Numerical Soil Standards for low density residential land use, intake of contaminated soil (I) standard is shown. If no site-specific factor was available, then the generic (G) standard from Schedule 3.1 - Part 2 Generic Numerical Soil Standards to Protect Human Health is shown.

The standard for sodium is for the ionic form (ion). The standard for chromium is only for the 6+ valence (Cr6+).

Standard for benzo[b]fluoranthene and benzo[b,j,k]fluoranthene is for benzo(b+j)fluoranthene.

The sum of the concentrations of: benz(a)anthracene, benzo(b+j)fluoranthenes, benzo(k)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene in soil, multiplied by each substance's respective 1998 World Health Organization benzo(a)pyrene toxic equivalency factor must not exceed the intake of contaminated soil, matrix soil standard for benzo(a)pyrene.

3. United States Environmental Protection Agency (US EPA). 2018. Regional Screening Levels (RSL) for residential soil. Accessed 21 June 2018. Available online at: <http://www2.epa.gov/risk/risk-based-screening-table-generic-tables>.

Values are based on a hazard quotient of 0.2 (dividing the RSL by 5 for non-carcinogens) and an incremental lifetime cancer risk of 10⁻⁵ (multiplying the RSL by 10 for carcinogens).

Values are only shown where CCME guidelines and CSR standards are not available.

4. Benzo(a)pyrene Total Potency Equivalent was calculated by multiplying the concentration of the PAH in the sample by its BaP Potency Equivalence Factor, given below, and summing the products. Values were calculated assuming the full detection limit.

BaP Potency Equivalence Factors: Benz[a]anthracene 0.1; Benzo[g,h,i]perylene 0.01; Indeno[1,2,3-c,d]pyrene 0.1; Benzo[a]pyrene 1; Chrysene 0.01; Benzo[b+j+k]fluoranthene 0.1; Dibenz[a,h]anthracene 1.

Value	Concentration exceeds selected screening value
Value	Detection limit exceeds screening value

Appendix 8.1-2
Attachement 1
Table 1-4: Surface Water Screening Results - Metals and Inorganics
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Parameter	Units	Selected Recreational Screening Value ¹	Notes	Fraser River at Tilbury Island (Low Flow Season)								Fraser River at Tilbury Island (High Flow Season)								
				Number of Samples	Number of Samples < MDL	Percent of Samples < MDL	Minimum ^a	Median ^{a,b}	Mean ^b	95th Percentile ^{c,d}	Maximum ^a	Number of Samples	Number of Samples < MDL	Percent of Samples < MDL	Minimum ^a	Median ^{a,b}	Mean ^b	95th Percentile ^{c,d}	Maximum ^a	
Conventional Parameters																				
pH		5.0 to 9.0	R	WQG	1045	0	0	7.1	NC	7.6	7.9	8.1	840	0	0	7.3	NC	7.7	7.9	8.0
Salinity	ppt	-			49	13	27	0.03	NC	0.4	1.0	2.3	40	16	40	0.04	NC	0.43	1.0	<1
Specific Conductivity	µS/cm	-			562	0	0	35	NC	672	2581	4855	433	0	0	7.7	NC	142	351	952
Temperature	°C	15	AO	HC, WQG	1105	0	0	0.18	NC	7.6	17	20	830	0	0	5.1	NC	14	20	21
Dissolved Oxygen	mg/L	-			559	0	0	1.6	NC	12	14	63	433	0	0	8.9	NC	11	12	14
Dissolved Organic Carbon	mg/L	-			27	0	0	1.4	NC	2.6	3.8	5.5	40	0	0	1.7	NC	3.3	5.5	8.2
Hardness, as CaCO ₃	mg/L	-			79	0	0	29	NC	53	85	427	54	0	0	32	NC	50	63	136
Total alkalinity, as CaCO ₃	mg/L	-			29	0	0	28	NC	39	47	50	40	0	0	36	NC	45	50	118
Total dissolved solids	mg/L	500	AO	HC	24	0	0	30	NC	209	522	2190	-	-	-	-	-	-	0	-
Total suspended Solids	mg/L	-			53	0	0	3.4	NC	19	40	218	37	0	0	7.9	NC	62	175	246
Turbidity	NTU	50	AO, R	WQG	572	0	0	0.6	NC	42	36	1000 ^f	433	0	0	6.6	NC	27	58	714
Nutrients																				
Total ammonia as N	mg-N/L	-			50	0	0	0.016	NC	0.083	0.22	0.28	38	0	0	0.017	NC	0.052	0.1	0.34
Ammonia (un-ionized) ^e	mg-N/L	-			46	0	0	0.000076	NC	0.00049	0.00092	0.0023	37	0	0	0.00018	NC	0.0007	0.0016	0.0026
Nitrogen - Nitrate as N	mg-N/L	10	R ²	WQG	52	0	0	0.0083	NC	0.13	0.23	0.25	38	0	0	0.0085	NC	0.058	0.14	0.69
Nitrogen - Nitrite as N	mg-N/L	1	R	WQG	53	7	13	<0.001	NC	0.0042	0.0072	0.021	40	11	28	<0.001	NC	0.0064	0.018	0.033
Nitrate + Nitrite	mg-N/L	10	R ²	WQG	53	0	0	0.041	NC	0.16	0.23	0.25	38	0	0	0.027	NC	0.16	0.16	3.1
Total Nitrogen (Calculated)	mg-N/L	-			47	0	0	0.14	NC	0.35	0.53	0.58	38	0	0	0.13	NC	0.38	0.61	3.8
Total phosphorus	mg-P/L	0.01	AO, R	WQG (lakes)	50	0	0	0.011	NC	0.032	0.053	0.063	41	0	0	0.019	NC	0.11	0.31	0.35
Dissolved phosphorus	mg-P/L	-			27	0	0	0.0061	NC	0.018	0.033	0.055	39	0	0	0.0048	NC	0.015	0.035	0.047
Major Ions																				
Chloride	mg/L	250	AO	HC, CSR, WQG	53	0	0	1.0	NC	45	164	1200	40	0	0	0.56	NC	5.3	21	76
Fluoride	mg/L	15	DW	HC, CSR, WQG	29	0	0	0.021	NC	0.031	0.039	0.042	40	0	0	0.031	NC	0.037	0.043	0.059
Sulphate	mg/L	500	AO	CSR	29	0	0	5.1	NC	9.7	18	27	40	0	0	3.4	NC	7.2	14	19
Calcium	mg/L	-			53	0	0	9.2	NC	14	19	39	40	0	0	11	NC	14	16	22
Magnesium	mg/L	-			53	0	0	1.8	NC	5.9	13.4	82	40	0	0	2.1	NC	3.5	8.4	19
Potassium	mg/L	-			53	13	25	0.62	NC	2.0	4.1	26	40	15	38	0.56	NC	1.3	2.4	3.2
Sodium	mg/L	2000	DW	CSR	53	0	0	2.1	NC	28	91	661	40	7	18	1.5	NC	5.2	13	66
Dissolved Metals ³																				
Aluminum	mg/L	-			53	0	0	0.0093	NC	0.028	0.052	0.062	45	0	0	0.0043	NC	0.11	0.22	0.28
Antimony	mg/L	-			53	1.0	2	0.000032	NC	0.000053	0.000074	<0.0005	45	0	0	0.00003	NC	0.000042	0.000057	0.00007
Arsenic	mg/L	-			54	0	0	0.00026	NC	0.00034	0.00043	0.00057	45	0	0	0.00025	NC	0.00036	0.00047	0.00058
Barium	mg/L	-			54	0	0	0.0091	NC	0.013	0.016	0.018	45	0	0	0.011	NC	0.014	0.016	0.036
Beryllium	mg/L	-			54	24	44	0.000001	NC	0.000024	0.00001	<0.001	45	0	0	0.000001	NC	0.0000052	0.000011	0.000015
Bismuth	mg/L	-			54	45	83	<0.000001	<0.000001	NC	0.000005	<0.001	45	23	51	<0.000001	<0.000001	NC	0.000003	0.000017
Boron	mg/L	-			54	21	39	0.0041	NC	0.024909259	0.051	0.26	45	0	0	0.0021	NC	0.0055	0.019	0.043
Cadmium	mg/L	-			54	1	2	0.000005	NC	0.0000106	0.000017	0.000035	45	0	0	0.000005	NC	0.000014	0.000031	0.00005
Chromium	mg/L	-			54	9	17	0.00007	NC	0.00013	0.0002	<0.0005	45	0	0	0.00008	NC	0.00022	0.00044	0.00066
Cobalt	mg/L	-			54	1.0	2	0.000026	NC	0.000049	0.000076	0.00014	45	0	0	0.000027	NC	0.000093	0.00021	0.00028
Copper	mg/L	-			48	0	0	0.00064	NC	0.00091	0.0014	0.0022	34	0	0	0.00019	NC	0.0012	0.0023	0.0038
Iron	mg/L	-			54	0	0	0.018	NC	0.054	0.084	0.19	45	0	0	0.024	NC	0.12	0.24	0.37
Lead	mg/L	-			54	2	4	<0.000005	NC	0.000031	0.000053	0.00009	45	0	0	0.000021	NC	0.000071	0.00016	0.00019
Lithium	mg/L	-			54	6	11	<0.0005	NC	0.00124	0.0022	<0.02	45	0	0	0.00063	NC	0.00084	0.0012	0.0027
Manganese	mg/L	-			54	0	0	0.00337	NC	0.0081	0.013	0.017	45	0	0	0.0024	NC	0.0087	0.013	0.074
Molybdenum	mg/L	-			54	0	0	0.00051	NC	0.00074	0.00096	0.0015	45	0	0	0.00054	NC	0.00073	0.00092	0.0013
Nickel	mg/L	-			54	0.0	0.0	0.00033	NC	0.00057	0.00089	0.001	45	1	2	<0.00002	NC	0.00097	0.0016	0.013
Platinum	mg/L	-			30	26	87	<0.000001	<0.000001	NC	0.000001	<0.000001	45	42	93	<0.000001	<0.000001	NC	0.000001	<0.000001
Selenium	mg/L	-			54	1.0	1.9	0.00005	NC	0.000095	0.00013	<0.0005	45	0	0	0.00002	NC	0.000082	0.00014	0.00033
Silver	mg/L	-			54	44	81	<0.000001	<0.0000015	NC	0.000005	<0.000005	45	18	40	<0.000001	NC	0.0000016	0.0000048	0.000005
Strontium	mg/L	-			54	0	0	0.04790	NC	0.089	0.14	0.56	45	0	0	0.06	NC	0.074	0.084	0.15
Sulphur	mg/L	-			24	14	58	<0.003	0.0035	NC	0.015	0.065	-	-	-	-	-	-	-	-
Thallium	mg/L	-			54	7	13	0.0000020	NC	0.0000061	0.000013	<0.0001	45	0	0	0.000002	NC	0.0000043	0.000006	0.00001
Tin	mg/L	-			54	43	80	<0.000005	0.0000105	NC	0.00048	0.0027	45	37	82	<0.000005	<0.000005	NC	0.0000076	0.000044
Titanium	mg/L	-			29	15	52	0.0003	<0.0005	NC	0.0012	0.0014	13	0	0	0.00037	NC	0.0033	0.0075	0.0076
Tungsten	mg/L	-			30	0	0	0.000006	NC	0.0000093	0.000014	0.000019	45	3	7	<0.000001	NC	0.0000075	0.000011	0.000013
Uranium	mg/L	-			54	0	0	0.000092	NC	0.00019	0.00029	0.00036	45	0	0	0.000044	NC	0.00018	0.00022	0.00025
Vanadium	mg/L	-			54	4	7	<0.0002	NC	0.00052	0.00051	<0.01	45	0	0	0.00032	NC	0.00058	0.001	0.0012
Zinc	mg/L	-			54	0	0	0.0002	NC	0.00068	0.0015	0.0018	45	2	4	0.0002	NC	0.00047	0.00098	0.0023

Appendix 8.1-2
Attachement 1
Table 1-4: Surface Water Screening Results - Metals and Inorganics
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Parameter	Units	Selected Recreational Screening Value ¹	Notes	Fraser River at Tilbury Island (Low Flow Season)								Fraser River at Tilbury Island (High Flow Season)								
				Number of Samples	Number of Samples < MDL	Percent of Samples < MDL	Minimum ^a	Median ^{a,b}	Mean ^b	95th Percentile ^{c,d}	Maximum ^a	Number of Samples	Number of Samples < MDL	Percent of Samples < MDL	Minimum ^a	Median ^{a,b}	Mean ^b	95th Percentile ^{c,d}	Maximum ^a	
Total Metals																				
Aluminum	mg/L	95	DW	CSR, WQG	53	0	0	0.05	NC	0.39	0.66	3.8	46	0	0	0.16	NC	1.5	4.3	5.7
Antimony	mg/L	0.06	DW	HC, CSR	54	2	4	0.000037	NC	0.000063	0.000097	<0.0005	46	0	0	0.000044	NC	0.000069	0.00011	0.00013
Arsenic	mg/L	0.1	DW	HC, CSR, WQG	54	0	0	0.00037	NC	0.00051	0.00071	0.0019	46	0	0	0.00038	NC	0.00079	0.0015	0.002
Barium	mg/L	10	DW	HC, CSR	54	0	0	0.0096	NC	0.017	0.023	0.056	46	0	0	0.015	NC	0.03	0.061	0.077
Beryllium	mg/L	0.08	DW	CSR	54	16	30	0.000004	NC	0.000032	0.000045	<0.001	46	0	0	0.000006	NC	0.000044	0.00012	0.00015
Bismuth	mg/L	-			54	17	31	0.000001	NC	0.0000258	0.000020	<0.001	46	0	0	0.000001	NC	0.000013	0.000031	0.000036
Boron	mg/L	50	DW	HC, CSR, WQG	54	21	39	0.004	NC	0.030	0.052	0.3	46	0	0	0.0015	NC	0.0056	0.018	0.043
Cadmium	mg/L	0.05	DW	HC, CSR, WQG	54	0	0	0.000009	NC	0.000022	0.000048	0.00014	46	0	0	0.000012	NC	0.000042	0.00011	0.00011
Chromium	mg/L	0.5	DW	HC, CSR	54	1	2	0.00013	NC	0.00083	0.0014	0.011	46	0	0	0.00037	NC	0.0028	0.0072	0.0095
Cobalt	mg/L	0.01	DW	CSR	54	0	0	0.000049	NC	0.00037	0.00082	0.0036	46	0	0	0.0002	NC	0.0014	0.004	0.0048
Copper	mg/L	15	DW	CSR	54	0	0	0.00081	NC	0.002	0.0033	0.012	46	0	0	0.0012	NC	0.0048	0.012	0.019
Iron	mg/L	65	DW	CSR	54	0	0	0.13	NC	0.64	1.2	6.8	46	0	0	0.29	NC	2.3	6.2	7.5
Lead	mg/L	0.05	R	WQG	54	0	0	0.000046	NC	0.00031	0.00077	0.0023	46	0	0	0.00015	NC	0.00096	0.0025	0.0028
Lithium	mg/L	0.08	DW	CSR	54	1	2	0.00057	NC	0.0015	0.0025	<0.02	46	0	0	0.001	NC	0.0019	0.0036	0.0043
Manganese	mg/L	15	DW	CSR	54	0	0	0.0088	NC	0.024	0.05	0.14	46	0	0	0.011	NC	0.074	0.19	0.23
Molybdenum	mg/L	2.5	DW	CSR, WQG	54	0	0	0.00049	NC	0.00071	0.00089	0.0016	46	0	0	0.0004	NC	0.00061	0.00079	0.0012
Nickel	mg/L	0.8	DW	CSR	54	0	0	0.00052	NC	0.0016	0.0033	0.013	46	0	0	0.00078	NC	0.0056	0.015	0.029
Platinum	mg/L	-			30	30	100	<0.000001	<0.000001	NC	NC	<0.000001	46	41	89	<0.000001	<0.000001	NC	0.000001	0.000002
Selenium	mg/L	0.1	DW	CSR, WQG	54	1	2	0.00006	NC	0.000104	0.00015	<0.0005	46	0	0	0.00006	NC	0.000095	0.00015	0.00041
Silver	mg/L	0.2	DW	CSR	54	17	31	0.000001	NC	0.0000060	0.000012	<0.00005	46	0	0	0.000002	NC	0.000013	0.000034	0.00004
Strontium	mg/L	25	DW	CSR	54	0	0	0.047	NC	0.089	0.14	0.55	46	0	0	0.065	NC	0.081	0.11	0.15
Sulphur	mg/L	-			24	15	63	<0.003	<0.01	NC	0.019	0.065	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0004	DW	EPA	54	2	4	0.000002	NC	0.0000088	0.000023	<0.0001	46	0	0	0.000004	NC	0.000017	0.00004	0.000046
Tin	mg/L	25	DW	CSR	54	27	50	<0.000005	NC	0.00011	0.0002	<0.001	46	5	11	<0.000005	NC	0.0000098	0.000017	0.000025
Titanium	mg/L	-			29	0	0	0.0019	NC	0.018	0.065	0.18	13	0	0	0.0096	NC	0.054	0.14	0.17
Tungsten	mg/L	0.03	DW	CSR	30	0	0	0.000008	NC	0.000015	0.000016	0.000149	46	3	7	<0.000001	NC	0.0000075	0.000012	0.000013
Uranium	mg/L	0.2	DW	HC, CSR	54	0	0	0.00012	NC	0.00021	0.00029	0.00046	46	0	0	0.00005	NC	0.00025	0.00039	0.00049
Vanadium	mg/L	0.2	DW	CSR	54	1	2	0.00044	NC	0.0015	0.0038	0.013	46	0	0	0.00068	NC	0.0038	0.0097	0.012
Zinc	mg/L	30	DW	CSR	54	0	0	0.00073	NC	0.0026	0.0058	0.015	46	0	0	0.0009	NC	0.0068	0.018	0.022

Notes:
< = not measured above the laboratory detection limit; µS/cm = microseimens per centimeter; "-" = not available; °C = degrees Celsius; CSR = Bristish Columbia Contaminated Sites Regulation; AO = aesthetic objective; DW = Drinking Water Guideline (x10); EPA = Environmental Protection Agency; HC = Guidelines for Canadian Drinking Water Quality (Health Canada); MDL = method detection limit; mg/L = milligrams per liter; mg N/L = milligrams nitrogen per liter; mg P/L = milligrams phosphorus per liter; NC = not calculated; NR = none required; NTU = Nephelometric Turbidity Unit; OG = operational guidance value; ppt = parts per trillion; R = recreational guideline; WQG = British Columbia Approved Water Quality Guidelines.

1. Values were preferentially selected from the BC Approved Water Quality Guidelines (WQG) Summary Report for secondary recreational contact. If no recreational value was available, the drinking water guideline multiplied by 10 is shown. Health-based drinking water guidelines were obtained from the BC Approved WQGs and Guidelines for Canadian Drinking Water Quality (Health Canada 2017), with the most conservative value selected preferentially. The US EPA (2018) tapwater Regional Screening Levels (RSLs) are shown when a BC or Health Canada value was not available. The RSLs were adjusted to reflect a hazaard quotient (HQ) of 0.2 and an incremental lifetime cancer risk (ILCR) of 10⁻⁵ (target risk levels for Canada).
2. Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
3. The water screening criteria are applicable for total metals; therefore, dissolved metals results were not used to identify constituents of potential concern.
- a. Minimum, Maximum, and Median were calculated using absolute values; that is, when the summary statistic corresponded to a non-detect (ND) value in the dataset, the MDL was reported.
- b. Mean and Geometric Mean were not calculated for parameters with greater than 50% non-detect values. A median was reported where a mean was not calculated.
- c. 95th percentile was not calculated for parameters with less than 10 samples.
- d. 95th percentile was not calculated for parameters with greater than 95% non-detect values.
- e. Un-ionized ammonia values are calculated using the equation: un-ionized ammonia = total ammonia x 1/(1 + 10 (pKa-pH)) where pKa is: 0.09018+2729.92/temperature, mean temperatures and pHs are used for the mean un-ionized ammonia calculation.
- f. Turbidity collected by the YSI 6600 V2 Water Quality Sonde had a range of 0 to 1000 NTU. If a value was reported above this range, the range limit was reported.

***Flow Condition Definitions**

Low Flow season represents the months September to March. High Flow season represents the months April to August.

value	=exceeds the selected recreational screening value
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References

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2017a. Contaminated Sites Regulation. Schedule 3.2 Generic Numerical Water Standards. Accessed February 2018.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2017b. Summary of Water Quality Guidelines - Recreation. Available at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines>. Accessed February 2018

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2017c. Summary of Water Quality Guidelines - Drinking Water Sources. Available at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines>. Accessed February 2018

Health Canada. 2017. Guidelines for Canadian Drinking Water Quality. Available at: <http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php>. Accessed February 2018

United States Environmental Protection Agency (US EPA) Regional Screening Levels (RSLs). 2018. Residential Tapwater. Available at: <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>. Accessed June 2018.

Table 1-5: Surface Water Screening Results - PAHs
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample Name		Selected			SW14-01	DUP-A	SW14-02	SW14-03
Sample Control Number	Units	Recreational	Notes		L1560058-1	L1560058-4	L1560058-2	L1560058-3
Date Sampled		Screening			17-Dec-14	17-Dec-14	17-Dec-14	17-Dec-14
QA/QC		Value ¹			FDA	FD		
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	mg/L	2.5	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010
Acenaphthylene	mg/L	-			<0.000010	<0.000010	<0.000010	<0.000010
Acridine	mg/L	-			<0.000020	<0.000010	<0.000010	<0.000010
Anthracene	mg/L	10	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010
Benzo(a)anthracene	mg/L	0.0007	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010
Benzo(a)pyrene	mg/L	0.0001	DW	CSR, WQG	<0.000010	<0.000010	<0.000010	<0.000010
Benzo(b)fluoranthene	mg/L	0.025	DW	EPA	<0.000010	<0.000010	<0.000010	<0.000010
Benzo(g,h,i)perylene	mg/L	-			<0.000010	<0.000010	<0.000010	<0.000010
Benzo(k)fluoranthene	mg/L	0.25	DW	EPA	<0.000010	<0.000010	<0.000010	<0.000010
Chrysene	mg/L	0.07	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010
Dibenz(a,h)anthracene	mg/L	0.0001	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010
Fluoranthene	mg/L	1.5	DW	CSR	<0.000010	<0.000010	<0.000010	0.000011
Fluorene	mg/L	1.5	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010
Indeno(1,2,3-c,d)pyrene	mg/L	0.025	DW	EPA	<0.000010	<0.000010	<0.000010	<0.000010
Naphthalene	mg/L	0.8	DW	CSR	<0.000050	<0.000050	<0.000050	<0.000050
Phenanthrene	mg/L	-			<0.000020	<0.000020	<0.000020	<0.000020
Pyrene	mg/L	1	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010
Quinoline	mg/L	0.0005	DW	CSR	<0.000010	<0.000010	<0.000010	<0.000010

Notes:

< = not measured above the laboratory detection limit; CSR = British Columbia Contaminated Sites Regulation; DW = Drinking Water Guideline (x10); EPA = Environmental Protection Agency; FD = field duplicate; FDA = field duplicate available; mg/L = milligrams per liter; QA/QC = quality assurance/quality control; WQG = British Columbia Approved Water Quality Guidelines.

1. Values were preferentially selected from the BC Approved Water Quality Guidelines (BC WQG) Summary Report for secondary recreational contact. If no recreational value was available, the drinking water guideline multiplied by 10 is shown. Health-based drinking water guidelines were obtained from the BC CSR, BC WQGs and Guidelines for Canadian Drinking Water Quality (Health Canada 2017), with the most conservative value selected preferentially. The US EPA (2018) tapwater Regional Screening Levels (RSLs) are shown when a BC or Health Canada value was not available. The RSLs were adjusted to reflect a hazard quotient (HQ) of 0.2 and an incremental lifetime cancer risk (ILCR) of 10^{-5} (target risk levels for Canada).

value

=exceeds the selected recreational screening value

References

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2017a. Contaminated Sites Regulation. Schedule 3.2 Generic Numerical Water Standards. Accessed February 2018.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2017b. Summary of Water Quality Guidelines - Recreation. Available at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines>. Accessed February 2018

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2017c. Summary of Water Quality Guidelines - Drinking Water Sources. Available at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines>. Accessed February 2018

Health Canada. 2017. Guidelines for Canadian Drinking Water Quality. Available at: <http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php>. Accessed February 2018.

United States Environmental Protection Agency (US EPA) Regional Screening Levels (RSLs). 2018. Residential Tapwater. Available at: <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>. Accessed June 2018.

Appendix 8.1-2
Attachment 1
Table 1-6: Toxicity Reference Values for Calculating Fish Tissue Screening Values
Human Health Assessment

Parameter	Carcinogenic Classification for Oral Exposure			Carcinogenic Classification	Oral Reference Dose (mg/kg BW/day)					Oral Slope Factor (mg/kg BW/day) ⁻¹			
	US EPA (2018)	Health Canada (2010)	IARC (2018)		US EPA	Health Canada or Other Agency			US EPA	Health Canada or Other Agency			
						Toddler	Adult	Source					
Metals													
Aluminum (Al)	-	-	-	NC	-	-	1.0	1.0	ATSDR 2008	-	-	-	-
Antimony (Sb)	-	-	2B	NC	0.0004	US EPA 1987 (IRIS)	-	-	-	-	-	-	-
Arsenic (As)	A	1	1	C	0.0003	US EPA 1991a (IRIS)	-	-	-	1.5	US EPA 1995a (IRIS)	1.8	Health Canada 2010
Barium (Ba)	D	VA	-	NC	0.2	US EPA 2005a (IRIS)	0.2	0.2	Health Canada 2010	-	-	-	-
Beryllium (Be)	D	-	1	NC	0.002	US EPA 1998a (IRIS)	-	-	-	-	-	-	-
Bismuth (Bi)	-	-	-	NC	-	-	-	-	-	-	-	-	-
Boron (B)	D	IVC	-	NC	0.2	US EPA 2004 (IRIS)	0.0175	0.0175	Health Canada 2010	-	-	-	-
Cadmium (Cd)	-	-	1	NC	0.001	US EPA 1989a (IRIS)	0.001	0.001	Health Canada 2010	-	-	-	-
Chromium (Cr) III	D	-	3	NC	1.5	US EPA 1998b (IRIS)	0.001	0.001	Health Canada 2010 ^[e]	-	-	-	-
Chromium (Cr) VI	D	-	1	NC	0.003	US EPA 1998c (IRIS)	-	-	-	-	-	-	-
Cobalt (Co)	-	-	2B	NC	-	-	0.0014	0.0014	RIVM 2001	-	-	-	-
Copper (Cu)	D	-	-	NC	-	-	0.091	0.141	Health Canada 2010	-	-	-	-
Iron (Fe)	-	-	-	NC	0.7	US EPA 2006	-	-	-	-	-	-	-
Lead (Pb)	B2	-	2B	NC	-	-	0.0006	0.0013	SNC 2012, WHO 2011	-	-	-	-
Lithium (Li)	-	-	-	NC	0.002	US EPA 2008	-	-	-	-	-	-	-
Manganese (Mn)	D	-	-	NC	0.14	US EPA 1995b (IRIS)	0.136	0.156	Health Canada 2010	-	-	-	-
Molybdenum (Mo)	-	-	-	NC	0.005	US EPA 1992a (IRIS)	0.023	0.028	Health Canada 2010	-	-	-	-
Nickel (Ni)	-	VI	1	NC	0.02	US EPA 1991b (IRIS) ^[a]	0.011	0.011	Health Canada 2010	-	-	-	-
Silver (Ag)	D	-	-	NC	0.005	US EPA 1991d (IRIS)	-	-	-	-	-	-	-
Strontium (Sr)	-	-	-	NC	0.6	US EPA 1992b (IRIS)	-	-	-	-	-	-	-
Thallium (Tl)	D ^[a]	-	-	NC	-	-	0.00061	0.00014	WHO 1996 ^[b]	-	-	-	-
Tin (Sn)	-	-	-	NC	0.6	US EPA 1997	-	-	-	-	-	-	-
Uranium (U)	-	V	-	NC	0.003	US EPA 1989b (IRIS) ^[a]	0.0006	0.0006	Health Canada 2010	-	-	-	-
Vanadium (V)	-	-	2B ^[d]	NC	0.0050	US EPA 1988 (IRIS) ^[c]	-	-	-	-	-	-	-
Zinc (Zn)	D	-	-	NC	0.3	US EPA 2005b (IRIS)	0.48	0.57	Health Canada 2010	-	-	-	-
Polycyclic Aromatic Hydrocarbon													
Acenaphthene	-	-	3	NC	0.06	US EPA 1990a (IRIS)	-	-	-	-	-	-	-
Acenaphthylene ^[g]	D	-	-	NC	0.06	US EPA 1990a (IRIS)	-	-	-	-	-	-	-
Anthracene	D	-	3	NC	0.3	US EPA 1990b (IRIS)	-	-	-	-	-	-	-
Benz(a)anthracene	B2	-	2B	C ^[f]	-	-	-	-	-	0.1	US EPA 2017 (IRIS) ^[f]	0.23	Health Canada 2010 ^[f]
Benzo(a)pyrene	A	II	1	C	0.0003	US EPA 2017 (IRIS)	-	-	-	1	US EPA 2017 (IRIS)	2.3	Health Canada 2010
Benzo(b)fluoranthene	B2	-	2B	C ^[f]	-	-	-	-	-	0.1	US EPA 2017 (IRIS) ^[f]	0.23	Health Canada 2010 ^[f]
Benzo(g,h,i)perylene	D	-	3	C ^[f]	-	-	0.03	0.03	RIVM 2001	0.01	US EPA 2017 (IRIS) ^[f]	0.023	Health Canada 2010 ^[f]
Benzo(k)fluoranthene	B2	-	2B	C ^[f]	-	-	-	-	-	0.1	US EPA 2017 (IRIS) ^[f]	0.23	Health Canada 2010 ^[f]
Chrysene	B2	-	2B	C ^[f]	-	-	-	-	-	0.01	US EPA 2017 (IRIS) ^[f]	0.023	Health Canada 2010 ^[f]
Dibenz(a,h)anthracene	B2	-	2A	C ^[f]	-	-	-	-	-	1	US EPA 2017 (IRIS) ^[f]	2.3	Health Canada 2010 ^[f]
Dibenzofuran	D	-	-	NC	-	-	-	-	-	-	-	-	-
Fluoranthene	-	-	3	NC	0.04	US EPA 1990c (IRIS)	-	-	-	-	-	-	-
Fluorene	D	-	3	NC	0.04	US EPA 1990d (IRIS)	-	-	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	B2	-	2B	C ^[f]	-	-	-	-	-	0.1	US EPA 2017 (IRIS) ^[f]	0.23	Health Canada 2010 ^[f]
2-Methylnaphthalene	D	-	-	NC	0.004	US EPA 2003 (IRIS)	0.004	0.004	Health Canada	-	-	-	-
Naphthalene	C	-	2B	NC	0.02	US EPA 1998d (IRIS)	0.02	0.02	Health Canada	-	-	-	-
Phenanthrene	D	-	3	NC	-	-	0.04	0.04	RIVM 2001	-	-	-	-
Pyrene	D	-	3	NC	0.03	US EPA 1990e (IRIS)	0.03	0.03	Health Canada	-	-	-	-

Appendix 8.1-2
Attachment 1

Table 1-6: Toxicity Reference Values for Calculating Fish Tissue Screening Values
Human Health Assessment

Notes:

"-" = value or classification is not available; BW = body weight; C = carcinogen; mg/kg = milligram per kilogram; NC = non-carcinogen.

[a] Value for soluble salt.

[b] The oral reference dose for thallium is based on a urine concentration of 5 µg/L below which adverse human health effects are unlikely, which corresponds to a daily dose of less than 10 ug in the form of a soluble compound. The daily dose was adjusted by the age-specific body weight (16.5 kg for toddlers and 70.7 kg for adults) to derive the oral reference dose.

[c] Derived from the oral reference dose for vanadium pentoxide of 0.009 mg/kg-day based upon the proportion of the compound that is vanadium metal. Therefore, 0.009 mg/kg-day x 56% = 0.00504 mg/kg-day.

[d] Vanadium pentoxide.

[e] Value is for total chromium.

[f] Assessed as a carcinogen based on potency equivalency factors (PEF) for carincogenic toxicity relative to benzo(a)pyrene (Health Canada 2012).

[g] A reference dose was not available for acenaphthylene; therefore, the value for acenaphthene was used as a surrogate.

value	= selected to derive fish tissue screening value
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References:

ATSDR (Agency for Toxic Substances and Disease Registry). 2008. Toxicological Profile for Aluminum. US Department of Health and Human Services, Public Health Service. Atlanta, GA.

Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Part II: Toxicological Reference Values (TRVs) and Chemical-Specific Factors. Version 2.0. Contaminated Sites Division. Safe Environments Directorate. Ottawa, ON.

IARC (International Agency for Research on Cancer). 2018. List of Classifications, Volumes 1 - 122. Last Updated 30 July 2018. Available at: <https://monographs.iarc.fr/list-of-classifications-volumes/>. Accessed August 2018.

RIVM (Rijksinstituut Voor Volksgezondheid en Milieu; National Institute of Public Health and the Environment). 2001. Re-evaluation of Human Toxicological Maximum Permissible Risk Levels. RIVM Report No. 711701 025. Bilthoven, Netherlands.

SNC Lavalin. 2012. Proposed Toxicological Reference Values for Lead (Pb). Prepared by Ross Wilson. May 29, 2012.

WHO (World Health Organization). 1996. Environmental Health Criteria 182: Thallium. International Programme on Chemical Safety. Geneva.

WHO. 2011. WHO Food Additive Series: 64. Safety Evaluation of Certain Food Additives and Contaminants. Prepared by the seventy-third meeting of JECFA. Joint FAO/WHO Expert Committee on Food Additives. WHO Press, Geneva, Switzerland. ISBN 978 924 166064 8.

US EPA (United States Environmental Protection Agency). 1997. Health Effects Assessment Summary Tables, FY 1997 Update. July 1997. Office of Research and Development. Office of Emergency and Remedial Response. Washington, DC.

US EPA. 2006. Provincial Peer Reviewed Toxicity Values (PPRTV) for Iron and Compounds. Superfund Health Risk Technical Support Center. National Center for Environmental Assessment. Office of Research and Development. Cincinnati, OH.

US EPA. 2008. PPRTV for Lithium. Superfund Health Risk Technical Support Center. National Center for Environmental Assessment. Office of Research and Development. Cincinnati, OH.

US EPA. 2018. Integrated Risk Information System Online Database. Available at: www.epa.gov/iris/. Accessed January 2018. The assessment date is provided for each chemical.

Attachment 1

Table 1-7: Fish Tissue Screening Results
Human Health Assessment
WesPac Tilbury Project, Delta, BC

Sample ID	Units	Fish Tissue Screening Value ¹	Notes	MT-2-CC-01	S-5-CC-02	MT-5-CC-01	COMPOSITE ²
Date Sampled				17-Jun-2015	17-Jun-2015	17-Jun-2015	17-Jun-2015
Physical Parameters							
Moisture	%	-		73.4	78.0	76.3	75.6
Metals							
Aluminum (Al)	mg/kg ww	61		42.9	14.1	112	58.7
Antimony (Sb)	mg/kg ww	0.024		0.0038	0.0021	0.0041	0.0039
Arsenic (As)	mg/kg ww	0.0041		0.160	0.130	0.205	0.246
Barium (Ba)	mg/kg ww	12		1.72	1.64	1.54	2.00
Beryllium (Be)	mg/kg ww	0.12		<0.0020	<0.0020	0.0021	<0.0020
Bismuth (Bi)	mg/kg ww	-		0.0022	<0.0020	<0.0020	<0.0020
Boron (B)	mg/kg ww	1.1		<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg ww	0.061		0.0151	0.0191	0.029	0.0265
Chromium (Cr)	mg/kg ww	0.061	a	0.092	0.035	0.190	0.159
Cobalt (Co)	mg/kg ww	0.086		0.0571	0.0466	0.102	0.0963
Copper (Cu)	mg/kg ww	5.6		0.877	0.616	0.878	0.773
Iron (Fe)	mg/kg ww	43		73.6	30.9	221	118
Lead (Pb)	mg/kg ww	0.037		0.0671	0.050	0.55	0.0437
Lithium (Li)	mg/kg ww	0.12		<0.10	<0.10	<0.10	<0.10
Manganese (Mn)	mg/kg ww	8.3		6.38	2.52	5.53	8.13
Mercury (Hg)	mg/kg ww	0.1	b	0.0282	0.0489	0.0373	0.0231
Molybdenum (Mo)	mg/kg ww	0.31		0.0308	0.0125	0.0211	0.0282
Nickel (Ni)	mg/kg ww	0.67		0.135	0.057	0.305	0.198
Selenium (Se)	mg/kg ww	0.36	c	0.432	0.53	0.44	0.465
Silver (Ag)	mg/kg ww	0.31		0.0012	<0.0010	0.0018	0.0012
Strontium (Sr)	mg/kg ww	37		21.3	22.9	27.3	21.8
Thallium (Tl)	mg/kg ww	0.016		0.0109	0.00985	0.0107	0.00833
Tin (Sn)	mg/kg ww	37		0.024	0.032	0.042	0.053
Uranium (U)	mg/kg ww	0.037		0.00732	0.00384	0.0114	0.00788
Vanadium (V)	mg/kg ww	0.31		0.174	0.176	0.54	0.295
Zinc (Zn)	mg/kg ww	18		17.2	15.4	15.9	19.5
PAH							
Acenaphthene	µg/kg ww	3667		-	1.8	3.1	1.9
Acenaphthylene	µg/kg ww	3667		-	1.1	0.93	1.4
Anthracene	µg/kg ww	18,333		-	0.52	0.49	0.91
Benz(a)anthracene	µg/kg ww	32		-	1.5	1.2	1.9
Benzo(a)pyrene	µg/kg ww	3.2		-	1.1	<0.55	<0.96
Benzo(b)fluoranthene	µg/kg ww	32		-	1.5	<0.50	<0.86
Benzo(g,h,i)perylene	µg/kg ww	320		-	2.6	<0.66	<1.2
Benzo(k)fluoranthene	µg/kg ww	32		-	0.83	<0.33	<0.58
Chrysene	µg/kg ww	320		-	0.86	1.0	<0.60
Dibenz(a,h)anthracene	µg/kg ww	3.2		-	<0.81	<0.65	<1.2
Dibenzofuran	µg/kg ww	-		-	1.9	2.3	1.6
Fluoranthene	µg/kg ww	2444		-	2.3	2.1	2.8
Fluorene	µg/kg ww	2444		-	4.7	5.1	5.3
Indeno(1,2,3-cd)pyrene	µg/kg ww	32		-	1.3	<0.66	<1.2
2-Methylnaphthalene	µg/kg ww	244		-	1.4	1.9	1.6
Naphthalene	µg/kg ww	1222		-	2.2	2.7	2.9
Phenanthrene	µg/kg ww	2444		-	5.2	5.8	5.2
Pyrene	µg/kg ww	1833		-	1.4	1.2	1.3

Notes:

< = not measured above the laboratory detection limit; % = percent; µg/kg = microgram per kilogram; "-" = not available; mg/kg = milligram per kilogram; ww = wet weight.

1. Fish tissue screening values were derived using the Health Canada (2012) equation for ingestion of contaminated foods and fish ingestion rates from Chan et al. (2011) and Richardson (1997).

2. Composite of samples S-4-CC-01, S-5-CC-01, S-4-CC-02, MT-5-CC-02.

a. Screening value for total chromium.

b. Aquatic life guideline for fish when human diet is based primarily on fish (BC ENV 2001).

c. Human health consumption screening value for high fish intake (BC ENV 2014).

value = exceeds fish tissue screening value

References:

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2001. Ambient Water Quality Guidelines for Mercury, Overview Report, First Update. Available at: <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/mercury-or.pdf>. Accessed February 2018.

BC ENV. 2014. Ambient Water Quality Guidelines for Selenium, Technical Report, Update. April. 2014. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/bc_moe_se_wqg.pdf. Accessed February 2018.

Chan L, Receveur O, Sharp D, Schwartz H, Ing A, Tikhonov C. 2011. First Nations Food, Nutrition and Environment Study (FNFNES): Results from British Columbia (2008/2009). Prince George: University of Northern British Columbia.

Health Canada. 2012. Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0. September 2010, revised 2012. Contaminated Sites Division. Safe Environments Directorate. Ottawa, ON.

Richardson G. 1997. Compendium of Canadian human exposure factors for risk assessment. Ottawa: Published by O'Connor Associates Environmental Inc.