# Northwest Langley Wastewater Treatment Plant Upgrade – Stage 2 Environmental Impact Study

# Terms of Reference

May 2025

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## About Metro Vancouver

Metro Vancouver is a diverse organization that plans for and delivers regional utility services, including water, sewers and wastewater treatment, and solid waste management. It also regulates air quality, plans for urban growth, manages a regional parks system, provides affordable housing, and serves as a regional federation. The organization is a federation of 21 municipalities, one electoral area, and one treaty First Nation located in the region of the same name. The organization is governed by a Board of Directors of elected officials from each member jurisdiction.


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## Prepared by Jacobs, November 6, 2024

The following Terms of Reference (ToR) for the Northwest Langley Wastewater Treatment Plant (NLWWTP) Upgrade (the Project) comprehensive Stage 2 Environmental Impact Study (EIS) has been developed based on the intent and requirements of the Municipal Wastewater Regulations (MWR, 2016) and the former Municipal Sewage Regulation companion Environmental Impact Study Guidelines (BC ENV, 2000).

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# Contents

# 1. Background

The Northwest Langley Wastewater Treatment Plant (NLWWTP), which currently serves approximately 30,000 people in Langley, will be upgraded on the same site to serve 280,000 people, including residents and businesses in Maple Ridge and Pitt Meadows across the Fraser River and a small catchment located in the northeast corner of Surrey at 104th Avenue. Like the existing plant, the upgraded plant will provide secondary treatment but will use a biological nutrient reduction treatment process followed by clarification. Several other projects will support the treatment plant improvements as part of the NLWWTP Program of works (NLWWTP Program).

Untreated wastewater from Maple Ridge and Pitt Meadows currently flows to the Annacis Island Wastewater Treatment Plant. To divert the flows to NLWWTP, a new pump station is required north of the Fraser River, along with two pipes installed under the Fraser River connecting the pump station in Maple Ridge to the NLWWTP. A new storage tank, sited with the pump station, will help to reduce overflows in the area.

The projects include:

- **Golden Ears Pump Station and Storage Tank:** A pump station in Maple Ridge will convey wastewater from Maple Ridge and Pitt Meadows to the NLWWTP in Langley. Construction of the pump station commenced in March 2020, and the pump station is now operational. A storage tank, connected to the pump station, will store wastewater. Construction of the storage tank commenced in March 2020 and is now operational.
- **Fraser River Crossing:** Two sewer forcemains will extend from the pump station, under the Fraser River, to the NLWWTP, and will convey wastewater from Maple Ridge and Pitt Meadows to NLWWTP once it is complete. Construction of the Fraser River Crossing commenced in November 2021 and is 99% complete, with few remaining minor deficiencies outstanding.
- **Expanded NLWWTP:** The expanded plant will accommodate an expanded service area and increased population and capacity. Ground improvements for the NLWWTP expansion commenced in 2018 and remain ongoing. Design of the NLWWTP expansion commenced in 2019 and remains ongoing.
- **Outfall Pipe:** An outfall pipe will move treated effluent from the NLWWTP to the Fraser River at a new location to be determined.

The existing NLWWTP treats an average annual flow of 16,300 cubic metres per day [$m^3$/d] [2023]) and includes secondary treatment. Following the completion of the expanded plant, the plant will be able to treat an annual average flow of 83,000 $m^3$/d and will include secondary treatment with biological nutrient removal (BNR). The upgraded plant is designed to produce an effluent quality that meets or surpasses regulatory requirement for a municipal wastewater treatment plant discharge.

The Environmental Impact Study (EIS) will assess the potential impacts associated with the estimated two times average dry weather flow (2x ADWF) and the peak wet weather flow (PWWF) discharged from the upgraded facility until the year 2041. Given that the maximum effluent discharge from the upgraded plant is greater than 10 ML/d (estimated PWWF discharge is 309 ML/d), the former SWR companion Environmental Impact Study Guidelines (BC MOE, 2000) document suggests a two-staged approach to the EIS. As a Stage 1 EIS was previously submitted for the Project (CH2M, 2018), for an outfall location in Parsons Channel, it is proposed that a comprehensive Stage 2 EIS is now completed rather than updating the Stage 1 EIS for the proposed new outfall location.


Figure 1: NLWWTP Projects Overview Map

As the general receiving area for the upgraded treatment plant has not changed, the receiving environment characterization presented in the Stage 1 study remains applicable and will be updated, where new data are available, as part of the Stage 2 study. The Stage 2 study will focus on the new outfall location and the dilution achieved within the Initial Dilution Zone (IDZ).

This Terms of Reference presents the Stage 1 and 2 components of the EIS, combined into the comprehensive Stage 2 study (the Study) that meets the intent of the MWR requirements for an EIS (MWR Division 3 – Subsection 19).

# 2. Proposed Outfall

The proposed location for the outfall has been changed from Parsons Channel to the Main Channel (Figure 2). This proposed relocation serves to address First Nations concerns around fish and fish habitat in Parsons Channel and occurred after the Port Authority indicated in late 2020 that they could not guarantee long-term maintenance dredging for Parsons Channel, which ultimately made it an unsuitable discharge location. The precise location of the proposed outfall has yet to be determined and will require engagement with First Nations and affected and relevant regulators and stakeholders.

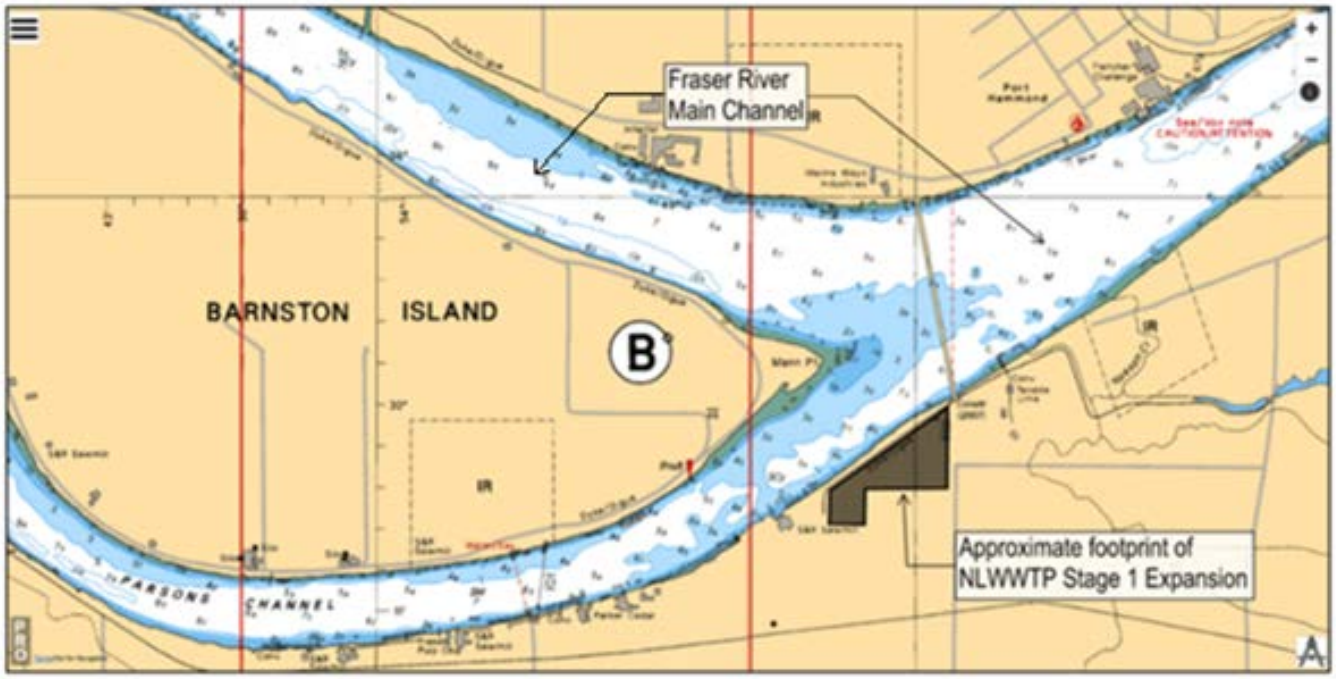


Figure 2: Nautical Chart of Fraser River near NLWWTP

The selection of the new outfall location in the main channel will consider land use and property impacts, First Nation cultural significance, archaeological sites, fish habitat, First Nation fishing, river water depth and dilution potential, geomorphology, navigation, seismic slope stability, conveyance options, along with other relevant considerations to be evaluated, as necessary.

The proposed outfall pipe will be designed to have sufficient hydraulic capacity for the estimated 2101 PWWFs; however, for the purposes of the EIS, only the 2041 design effluent flows, and an outfall diffuser designed for these 2041 flows, are considered.

# 3. Municipal Wastewater Regulations

Division 3 – Subsection 18 (1) (b) of the MWR states that an EIS is to be completed "if registered under Division 2, before expanding or making material change to the person's wastewater facility". The NLWWTP is not registered under Division 2; however, as the NLWWTP upgrade includes both an upgrade of the facility and the construction of a new outfall, an EIS will be conducted.

The requirements for an EIS are detailed in Section 19 of the MWR and should cover the following:

- Details of the provisions for controlling environmental impacts during the construction and operation of the wastewater facility or site.
- Consideration of the potential cumulative effects of the discharge on the receiving environment.
- Specified additional municipal effluent quality requirements if necessary to protect public health and the receiving environment.
- Recommendations (for the purposes of Section 20 [receiving environment monitoring program]) for receiving environment monitoring locations, and sampling parameters and frequencies for both pre- and post-discharge conditions.
- Demonstration, regarding the nature of the discharge and the receiving environment, that the proposed disposal system, treatment and reuse, and the discharges from these, will not adversely affect public health or the receiving environment.
- Addresses any impact on the receiving environment when:
    - municipal effluent quality is met, and
    - municipal effluent is degraded.

# 4. EIS Objectives

The objectives of the EIS, as presented in the EIS Guidelines (BC MOE, 2000) companion document to the Municipal Sewage Regulation (1999) now replaced by the MWR, were used to help define the scope of work for the Study and include the following:

- Establish pre-discharge conditions in the receiving environment using existing data and/or by conducting adequate sampling of water, sediment and biota.
- Establish, before and after discharge commences, receiving environment monitoring locations and sampling parameters and frequencies.
- Assess existing and potential uses of the receiving surface water, by humans, plants and animals.
- Assess whether receiving water quality guidelines will be met, and under what conditions.
- Assess the effluent dilution, and whether water quality guidelines will be met, at areas of concern such as water intakes, beaches, spawning, and rearing habitat.
- Carry out analysis, as appropriate on the nature of the discharge and the receiving environment, to determine if the proposed treatment will adversely affect human health or the environment.
- Provide recommendations to ensure that the proposed treatment will protect human health and the receiving environment, or to recommend against discharge, including the development of Effluent Discharge Objectives (EDO)s.
- Identify mitigation measures to be implemented during construction to control potential environmental impacts.

# 5. Comprehensive Stage 2 EIS Scope

The scope of the study includes updating elements completed as part of the Stage 1 EIS (CH2M, 2018) and new items required for a Stage 2 EIS. Both will be summarized in the Study report that will include the following sections:

## 5.1 Regulatory Setting

Regulatory requirements applicable to the construction and operation of the river outfall and discharge of effluent will be presented in this section. Federal, provincial, regional and local regulatory authorities are expected to be involved in issuing permits and approvals for the Project, including the new outfall.

## 5.2 Receiving Environment Characterization and Use

### Stage 2 EIS Study Area

The preliminary study area for the EIS has been defined as an area that is approximately 16 kilometres (km) long, encompassing the Fraser River 8 km downstream of the NLWWTP to the upstream end of Douglas Island, and 8 km upstream to the downstream end of McMillan Island (Figure 3). The study area was selected based on preliminary dispersion computer model results, which indicates a minimum dilution ratio in excess of 200 to 1 within the NLWWTP effluent plume when it passes Douglas Island. The study area will be refined, if required, as the EIS is advanced, and the dilution modelling is updated.

### Aquatic and Riparian Environment

Aquatic species within the study area will be detailed, this will include identifying species with conservation status (federally and provincially listed species), marine mammals and habitat, fish and fish habitat, bird life and habitats.

### River Flows, Depths and Currents

To estimate dilution at, and downstream, of the proposed outfall, river water depth and velocity (current) data is required. As the Fraser River is tidal, reverse river currents, where the river flow direction can be temporarily upstream due to the downstream tidal effects, can occur during 8 months of the year. It is noted that a distinct salt wedge can intrude upstream on the Fraser River, up to 30 km)depending on the seasonal runoff conditions, however monitoring results from Sapperton Bar and Barnston Island during the Fraser River Ambient Monitoring Program, show low salinities (<1 part per thousand) and therefore, the scope of the EIS is focused on a freshwater, but tidal, receiving environment (SLR, 2023).

It is proposed that a 3-D hydrodynamic model of the river will be used to generate a long-term dataset of river depths and currents at the proposed outfall location, rather than the long-term installation of equipment to collect this data. The inputs to this model will include Fraser River discharge, tide data and detailed bathymetric data. Bathymetric data has been collected over a number of years in Parsons Channel and the Main Channel,

along with river depths and current data that was collected on three occasions in 2017 and 2018.

If required, additional river depth and current data may be collected at the proposed location of the outfall to calibrate/verify the hydrodynamic model result. These acoustic doppler current profiler (ADCP) surveys would likely be conducted to cover the following river flow periods:

- At low Fraser River water levels (typically February)
- As the Fraser River flows increase (April/May)
- At or near the peak of freshet (June/July)

These ADCP surveys will include collecting velocity measurements to map flow separation in the lee of the Golden Ears Bridge piers during both ebb and flood tide conditions. Bathymetric data will also be collected and combined with the previously collected data.

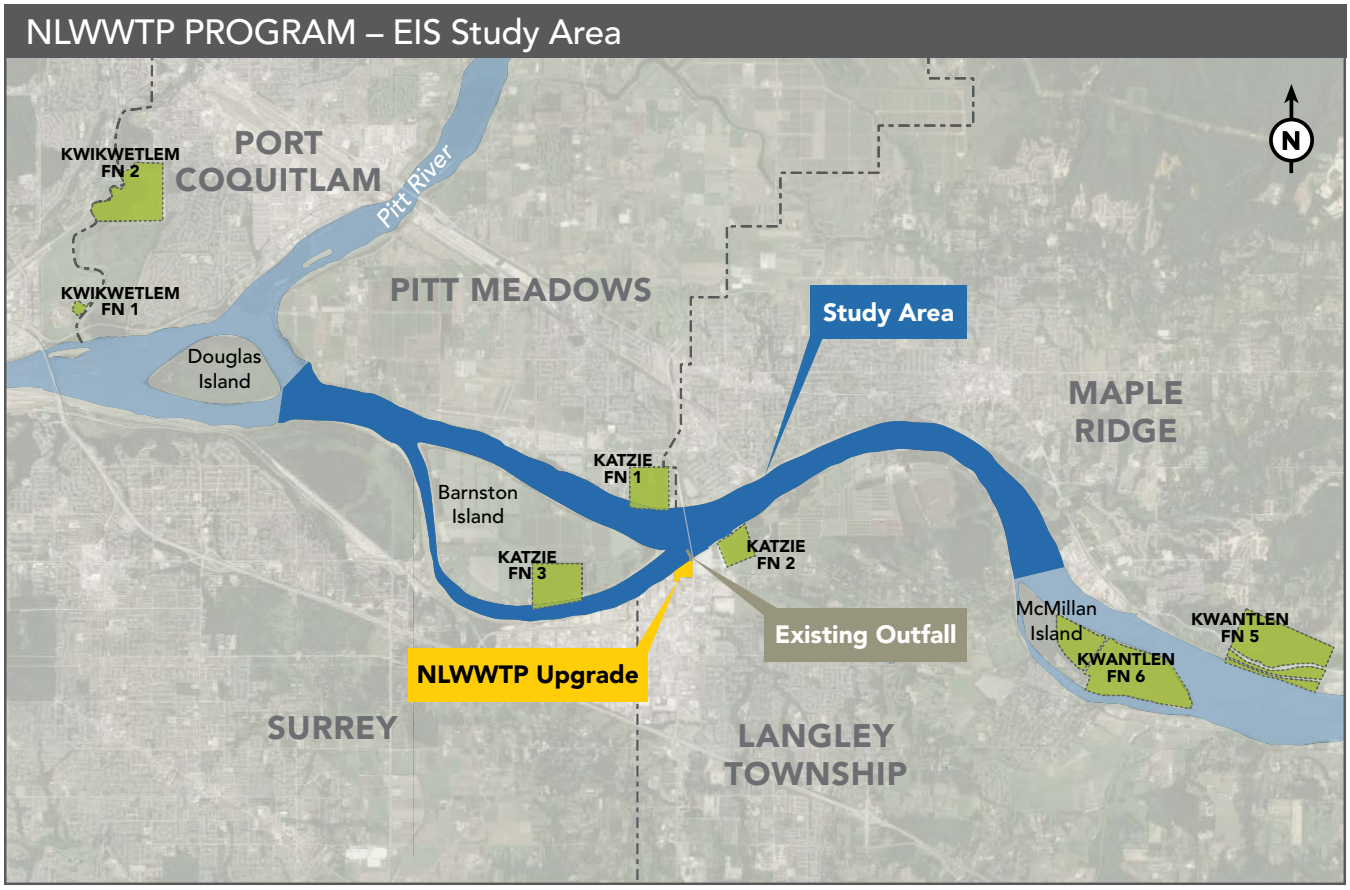


Figure 3: NLWWTP Program EIS Study Area

## Fraser River Temperature and pH

For the analysis of potential temperature effects in the outfall IDZ, and for the analysis of ammonia effects in the receiving environment; river temperature and pH data in the vicinity of the potential outfall location is required. It is proposed that a water quality sonde be installed in the Main Channel to collect site-specific data to complete the analysis (up to 1-year) in addition to temperature and pH, it is proposed that water level, turbidity and conductivity will also be monitored.

## Ambient Water Quality

The ambient water quality in the study area has been monitored extensively over the past two decades and has included programs conducted by BC Ministry of Environment and Climate Change Strategy (BC ENV), Environment Canada and Metro Vancouver.

Ambient water quality data for the EIS will primarily be obtained from Metro Vancouver's Fraser River Ambient environmental monitoring programs conducted between 2013 and 2024. The locations of data collected as part of these programs are presented on Figure 4.

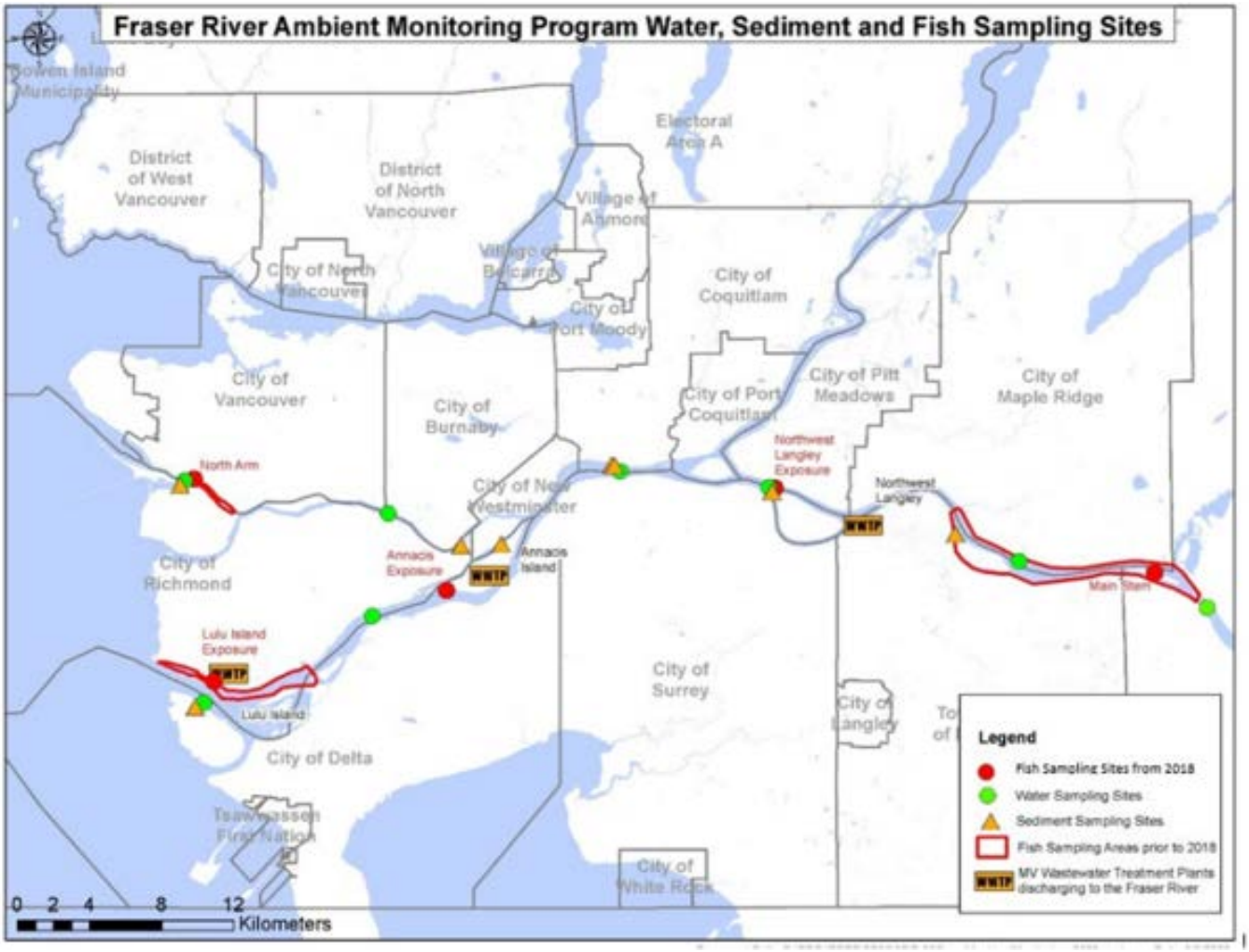


Figure 4: Fraser River Ambient Water, Sediment and Fish Sampling Site - Metro Vancouver, 2023

Data will also be obtained from Metro Vancouver ambient monitoring programs where available, including the AIWWTP outfall receiving environment monitoring program - the NLWWTP does not currently have a targeted receiving environmental monitoring program for the edge of the IDZ, however a pilot program was completed in 2017/2018.

A comprehensive review of Metro Vancouver's Fraser River Environmental Monitoring Programs (2014-2019) was completed by Hatfield in 2020 (Hatfield 2020a). This included an analysis of ambient water column monitoring, receiving environment monitoring programs and the 2017/2018 NLWWTP pilot receiving environment monitoring program. The findings of this review will be presented in the EIS along with analysis of data collected during Fraser River environmental monitoring programs conducted between 2020 to 2024.

Conventional wastewater parameters, nutrients, total and dissolved metals, organics and biological constituents will be included in the water quality assessment and impact study where data are available. The data will be reviewed, and summary statistics generated for each parameter measured. Where sufficient data are available, seasonal characterization of the data will be completed such that the seasonality of ambient concentrations can be included in the prediction of receiving environment water quality.

## Sediment Quality

Sediment quality has been monitored as part of the Fraser River Estuary Management Program since the 1980s and BC Ministry of Environment's System Environmental Assessment and Management (SEAM) database contains sediment data collected prior to 1989. Metro Vancouver has conducted more recent sediment sampling in the study area as part of the Fraser River ambient monitoring programs, with sediment samples collected during the low flow period in 2006 (Enkon, 2007), 2011 (Keystone Environmental, 2011) and 2016 (Enkon, 2016) and 2021 (Enkon, 2023). Sediment samples were also collected as part of the 2017/2018 pilot receiving environment monitoring program at NLWWTP (Hatfield, 2020a). Applicable sediment data will be reviewed, with data and summary statistics presented as pre-discharge conditions in the receiving environment and compared to applicable sediment quality guidelines.

## Fish Health and Benthic Invertebrates

Fish tissue and studies of fish health in the Fraser River have been monitored since the 1970s by Environment Canada in 1994, 1995 and 1996 (Raymond, et al. 2001), as well as by Metro Vancouver in 2004, 2007, 2012 (Enkon, 2009; Enkon, 2014b) and 2018 (Hatfield, 2020b) – results from the earlier studies have been summarized by Tri-Star Environmental Consulting (2015) and these results will be compared to fish studies conducted prior to the drafting of the Water Quality Assessment and Objectives for the Fraser River (Swain, et al 1998), and with the fish studies completed as part of the Fraser River ambient monitoring programs in 2018 and 2023. Fish species of interest will be identified during the study but are expected to include eulachon, white sturgeon and all species of Pacific salmon.

Benthic invertebrate communities are often studied for their value as indicators to disturbance and pollution, and considering their ecological importance in nutrient cycling and as a food source for other aquatic life. Benthic invertebrates were sampled along the Fraser River by Metro Vancouver as part of the Fraser River ambient monitoring program in 2021 (ENKON, 2021). Analysis of the benthic invertebrate community showed salinity to be the primary factor in determining the community composition, as expected in an estuary. The analysis also found that sediment particle size, dioxins/furans and/or copper may play a role in determining community composition, but the relative importance of these factors is difficult to determine, and spatial variability is unlikely to be a

useful indicator of ecosystem health. However, temporal changes in community structure could be useful for monitoring ecosystem health within individual monitoring sites. The existing composition of benthic invertebrate communities within the study area will be summarized in the EIS.

## Receiving Water Uses

The lower Fraser River is used for a variety of commercial and recreational activities, including international and domestic shipping; recreational boating and moorage; material handling, log storage, sorting and booming; and commercial, recreational, Indigenous fishing activities and diversion for irrigation and livestock. The receiving environment river uses section of the study report will include additional First Nation, stakeholders and uses identified as part of the wider NLWWTP Upgrade Stakeholder and First Nations engagements activities as per the Metro Vancouver publication Northwest Langley Wastewater Treatment Projects – Engagement Results, 2018.

## Existing Water Withdrawals and Discharges

A summary of licensed Fraser River water withdrawals located within the study area will be presented, including the location, withdrawal rates and purpose of each withdrawal.

Existing point source discharges within the study area will be presented in the study report, including a summary of the monitoring results of each permitted discharge. Details of the various non-point sources of anthropogenic pollution to the Lower Fraser River, including forestry, urban stormwater runoff, ship building, port activities and domestic waste from floating vessels (Swain, et al., 1998), will also be presented. The water quality constituents of interests for each source will be summarized.

## Site-Specific Environmental Quality Objectives

In addition to compliance with regulatory criteria for wastewater discharges, comparison of the predicted treated wastewater effluent quality with site specific EQOs, established from ambient water quality objectives (WQO) and guidelines (WQGs), is required to assess potential effects. EQOs are set to protect water body ecosystems and users including aquatic health, agriculture (irrigation and livestock watering), wildlife, human drinking water, and recreational activities. EQOs are set at site-specific (a catchment or reach of water), provincial, and federal levels, and represent threshold limits which, if exceeded, potentially result in risks to human health or the environment. At a screening level this does not necessarily imply that the exceedance of an EQO will result in an adverse impact, but it indicates that further assessment is required.

Water quality objectives and guidelines applicable to the Project will be selected from the following: the Fraser River Water Quality Objectives, the BC Water Quality Guidelines (approved and working) for aquatic life, wildlife and agriculture, Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the protection of aquatic life, Environment and Climate Change Canada (ECCC) Federal Environmental Quality Guidelines, the BC Recreational Water Quality Guidelines, BC Source Drinking Water Quality Guidelines, Guidelines for Canadian Recreational Water Quality, Health Canada Guidelines for Canadian Drinking Water Quality and the US Environmental Protection Agency (EPA) Regional Screening Levels for contaminants in tap water.

## 5.3 Maximum Daily and Average Annual Effluent Flow

The Project has treatment and hydraulic capacity for design flows and loads for a service population of 280,000 people by the year 2041. The catchment includes Northwest Langley, Maple Ridge, Pitt Meadows and northeast Surrey at 104th Avenue (Figure 5). The design maximum daily flow (MDF) is 172 ML/d, which is slightly lower than the 2x average dry weather flow (2xADWF -184 ML/d), which is the effluent flow rate used for the assessment of potential adverse impacts to the receiving environment. The 2041 design average annual flow (AAF) and the PWWF are 104 ML/d and 309 ML/d, respectively.

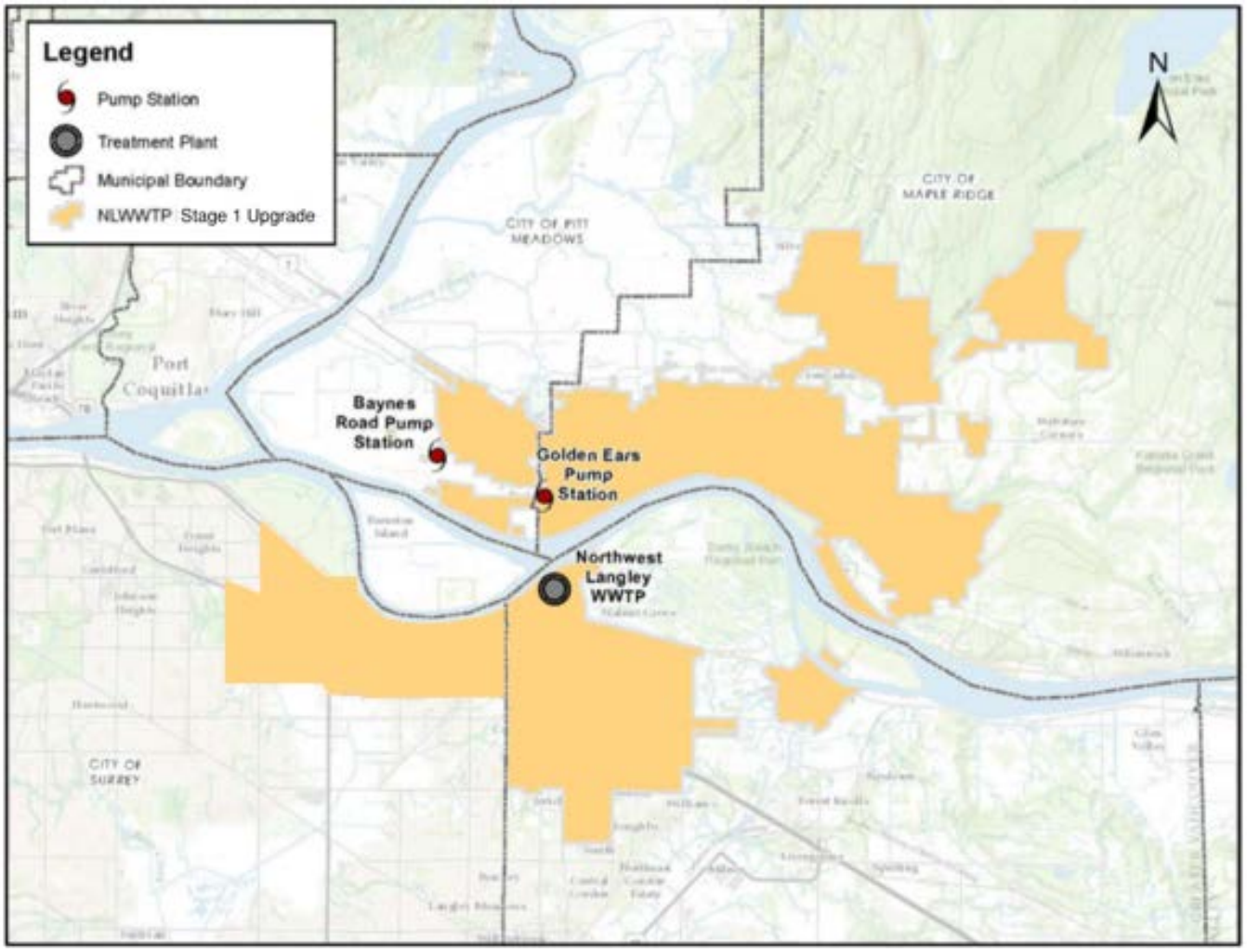


Figure 5: NLWWTP Upgrade Catchment Area

## 5.4 Influent and Effluent Water Quality

The influent and effluent water quality analysis will include routine municipal wastewater constituents (CBOD5, TSS, pH, temperature, nutrients, ammonia [NH3], fecal coliforms/E. coli) along with other non-conventional constituent that are typically found in sanitary wastewater (see Appendix A for additional details).

For the assessment of potential effects in the receiving environment only constituents with applicable water quality guidelines (municipal, provincial or federal) will be considered. The initial selection of the potential contaminants of concern (PCOCs) is based on constituents that have been analyzed in the effluent of the existing plant and have applicable water quality guidelines. Effluent constituents that do not have a water quality guideline but are detected at concentrations exceeding ambient WQGs, will be identified for future potential monitoring, however these constituents will not be carried forward as PCOCs in the effects assessment as there is currently insufficient data to determine potential adverse effects.

Typical non-conventional sanitary wastewater constituents

- Total and dissolved metals,
- Volatile organic compounds (VOCs),
- Polychlorinated biphenyls (PCBs)
- Polybrominated diphenyls (PBDEs),
- Polycyclic aromatic hydrocarbons (PAHs),
- Nonylphenols, nonylphenols polyethoxlates
- Pharmaceuticals and personal care products (PPCPs)

### Influent Water Quality

The influent water quality dataset used for the EIS is based on water quality analysis of samples collected during routine sampling of the existing NLWWTP influent (2013 to 2024), sampling programs completed in 2017 and 2018 at key manholes in the future catchment areas located north of the river, sampling completed as part of the 2019/2020 source control targeted sampling program (SLR, 2024) and additional key manhole sampling that may be completed for the 104th Avenue catchment area. A statistical comparison of the existing plant influent water quality and the water quality of samples collected from the catchments that will be directed to the upgraded plant in the future, will be used to identify constituents that may be present at higher concentration in the influent following the plant upgrade.

Influent water quality – as sampled at NLWWTP and from the future catchment areas – are considered to be representative of the water quality improvements that are achieved through Metro Vancouver's Source Control Program, which includes discharge restriction as detailed in Metro Vancouver's Liquid Waste Management Plan including the Sewer Use Bylaw #299.

### Effluent Water Quality

The upgraded plant has been designed to meet CCME National Performance Standards (NPS) for TSS, CBOD5 and ammonia, and MWR Part 6, Division 1 (Sections 94, 95 and 96) requirements for TSS, CBOD5, pH, ammonia and fecal coliforms.

**Routine Wastewater Constituent**

For routine wastewater effluent constituents, the removal achieved through the upgraded plant (including secondary treatment [biological nutrient removal]) has been simulated using the computer model Sumo (dynamita process modelling). The EIS will also estimate the fecal coliform, enterococci and E. coli concentrations at the edge of the IDZ with, and without, UV disinfection.

**Non-Conventional Wastewater Constituents**

For other wastewater constituents the effluent water quality of the existing plant will be used as the basis of the EIS, however, the effluent dataset for the existing plant (2013 - 2024) will be adjusted, if needed, to account for potential changes in influent quality. This modified effluent dataset will be used to complete a preliminary screening of PCOCs against site specific EQOs.

Following preliminary screening, PCOCs identified as potentially exceeding EQOs will be reviewed individually to evaluate if the upgraded plant may remove a higher percentage of the constituent than the existing NLWWTP plant, based on the expected performance as demonstrated at other plants utilizing similar technology.

## 5.5 Outfall Design and Location

The new outfall will include pipes, risers and ports that discharge the treated effluent into the receiving water in a manner that optimizes the dilution. The location of the outfall in the river is critical to how effectively the treated effluent can be mixed into and diluted by the diffuser system within the receiving environment, close to the outfall (nearfield) and further downstream (farfield). The location of the outfall diffuser system will be established during the development of the EIS and will require engagement with First Nations and affected and relevant regulators and stakeholders.

The selected outfall diffuser location will meet the requirement of the Municipal Wastewater Regulations Part 6, Division 1 (Section 94) and applicable land and water usage requirements. An IDZ will be developed for the selected outfall location in accordance with provincial guidance on the development and use of an IDZ (BC ENV, 2019).

## 5.6 Dilution Modelling

To estimate the effluent parameter concentrations used in the analysis of potential effects in the receiving environment, the performance of the proposed outfall diffuser over a range of river flow conditions, ocean tides and effluent flow rates is required. Dilution modelling will be used to estimate initial dilution in the nearfield within the IDZ, and in the farfield at key locations downstream.

### Nearfield Dilution

A dilution model (Visual Plumes [US EPA 2018], CORMIX2 or VISJET) will be used for mixing zone analysis of the effluent plume with ambient water. The model will simulate the initial dilution and subsequent dilution, diffusion and dispersion that will occur at and downstream of the outfall diffuser, using worst-case values for river temperature, pH, river currents and effluent temperature.

Simulating the nearfield dilution achieved within the IDZ requires the following:

- Outfall diffuser indicative design.
- Effluent flow rate (2x ADWF).
- River velocity and water depth at the diffuser over a range of river conditions.
- Monthly variations in treated effluent and river temperature at the diffuser.

The key elements of the outfall design will be defined prior to completing the dilution modelling this will include the location, depth, number of diffusers, alignment and orientation of the diffusers, and the effluent velocity at the design flows.

The river depth and velocities data required for the dilution modelling will likely be extracted from an existing 1-D hydraulic model (Mike 11) and 3-D hydrodynamic model (TELEMAC) of the river at the proposed outfall. Details of the modelling will be provided in the study report. Figure 6 presents the domain of the existing TELEMAC model that may be used for the simulation of river depths and velocities at the proposed outfall location.

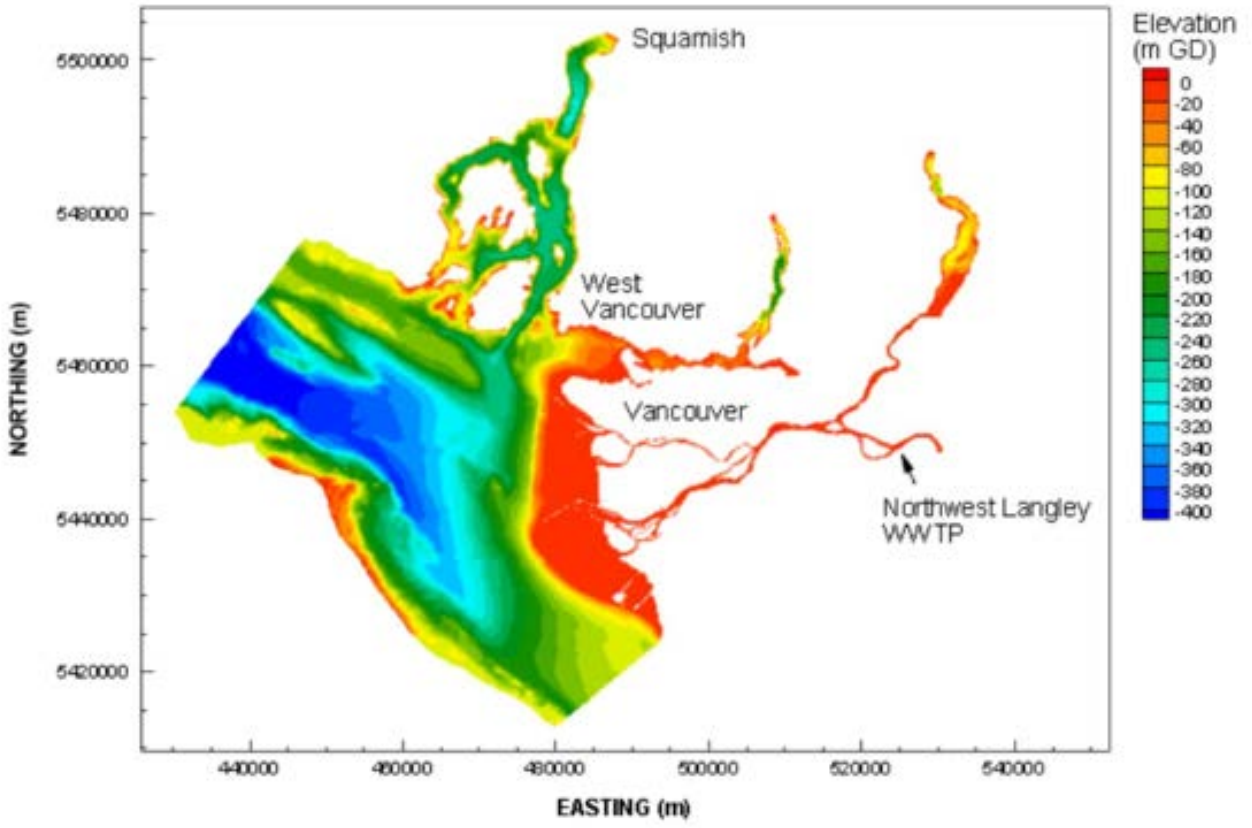


Figure 6: TELEMAC Numerical Model Domain and Elevations (NHC, >?@A)

The effluent temperature will be based on the monthly measured effluent temperature at the current NLWWTP (as reported in the 2023 Greater Vancouver Sewerage and Drainage District Environmental Management Report [Metro Vancouver, 2023]) as this is expected to be representative of the future effluent temperature following the plant upgrade, and the river temperatures near the proposed outfall diffuser will be measured as a component of the proposed EIS field programs.

### Farfield Dilution

The 3-D hydrodynamic model will also be used to simulate the behavior of the effluent plume beyond the IDZ including the complex influence of tidally varying currents on plume dilution. The model will be used to simulate the periods of critical dilution in the farfield; dilution factors at areas of concern downstream of the proposed outfall will be extracted from the model.

Currently, six areas of concern, centered around known recreational areas, sensitive areas, and permitted water diversions used for irrigation, have been identified near the NLWWTP proposed outfall (downstream and upstream).

1. Mann Point, Barnston Island
2. Eulachon Spawning Zone, northern bank of the main channel opposite Barnston Island
3. House Boat Docks at 208 Street, Derby Reach, Langley
4. Water Diversion (Irrigation) located in the northeast of Barnston Island
5. Robert Point, Barnston Island
6. Water Diversion (Irrigation) located on the northern bank of the river opposite Surrey Bend Park

## 5.7 Water Quality Assessment

As part of the EIS, EDOs will be established through a site-specific environmental risk assessment that includes initial characterization of the effluent and considers the characteristics of the receiving environment and mixing that will occur within the IDZ.

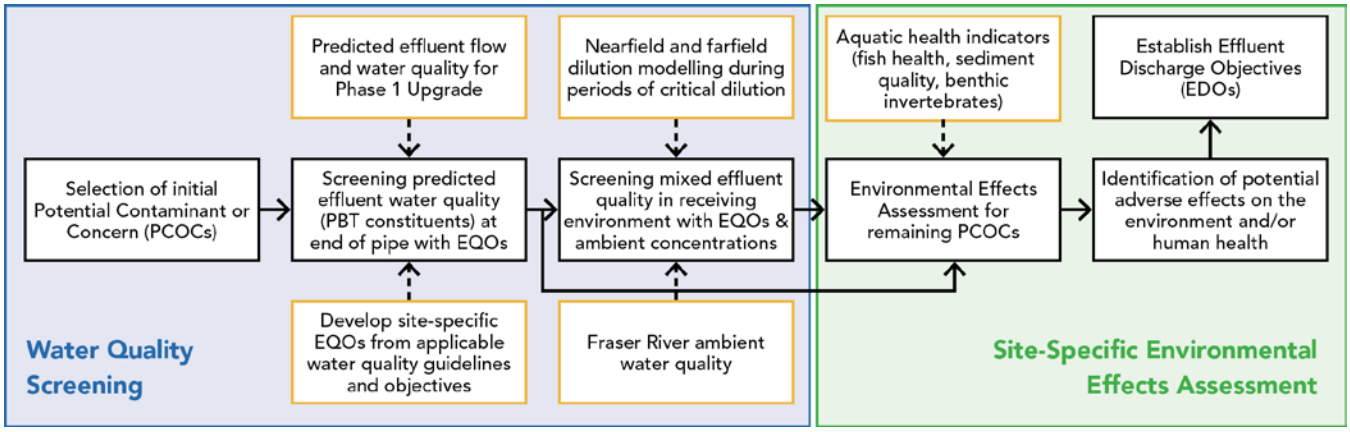


Figure 7: Simplified Schematic of Environmental Discharge Objective Development.

### Water Quality Screening

The objective of the water quality screening is to compare the predicted effluent water quality from the upgraded treatment plant (for the selected PCOCs) against EQOs. Screening of the predicted effluent water quality at the downstream end of the treatment plant, referred to as the "end of pipe", will be for constituents that are categorized as persistent, bio-accumulative, and toxic (PBT). The screening will a be straight comparison against EQOs, as no dilution is allowed for PBT parameters, with constituents that exceed the EQOs being carried forward to the site-specific environmental effects assessment. Metro Vancouver have identified 13 PBT substances with published water quality guidelines that may be present in the discharge from municipal wastewater treatment plants (Quinn, 2023).

Downstream of the end of pipe the concentrations of diluted degradable PCOCs following nearfield mixing with ambient water within the IDZ and far field mixing with ambient water beyond the IDZ (both upstream and downstream) will be used for water quality screening against the EQO. Degradable PCOCs constituents that are predicted to potentially exceed both water quality guidelines and ambient concentrations in the receiving environment will be carried forward to the site-specific environmental effects assessment.

### Site-Specific Environment Effects Assessment

A receiving environment effects assessment will be completed for the PCOCs that are carried forward following the water quality screening – including PCOCs that are PBT and exceed EQOs at the end of pipe, and PCOCs that are degradable that exceed EQOs at the edge of the IDZ and in the farfield.

The effects assessment will use the predicted effluent concentrations in the receiving environment, along with aquatic health indicators (such as sediment quality, benthic invertebrates and fish health), and the spatial extent, duration and frequency of potential exceedances. Nutrient loading in the receiving environment and the potential for adverse effects will be assessed, along with an assessment of the potential temperature effects of the effluent at the end of pipe, and within the IDZ.

Effluent quality will be determined through the application of the risk assessment protocol will be applied including consideration of other approaches for liquid waste utilities as outlined in the CCME Canada-wide Strategy for the Management of Municipal Effluent (CCME,2009).

## 5.8 Climate Change

Potential climate change impacts (through to 2041) on the receiving environment water quality will be discussed, including potential changes to the Fraser River flows, currents and tidal range.

## 5.9 Outfall Construction

Mitigation measures will be evaluated, designed and then implemented during the construction of the outfall to reduce the risk of adverse impact to the receiving environment. This will include the preparation of a detailed construction environmental management plan that will provide the instream timing windows for white sturgeon, eulachon and Pacific salmon for instream works, and nesting windows for bird life for terrestrial construction activities. The EIS will provide an overview of the potential mitigation measures and work timing windows proposed for the project.

## 5.10 EIS Uncertainty Assessment

The uncertainties identified during the EIS will be summarized along with the applicable mitigations and a quantitative assessment of the uncertainties pre- and post-mitigation.

## 5.11 Recommend Environmental Monitoring Program

A post discharge monitoring plan will be developed in consultation with Metro Vancouver as part of the comprehensive Stage 2 EIS. The monitoring program may be required to confirm findings of the EIS and will include reference to site specific EDOs developed as part of the EIS for the NLWWTP.

# 6. Proposed Field Programs

As presented in Section 5, the Study may include the following field programs to supplement site-specific data collected to date:

- Water quality sampling of key manholes in the 104th Avenue catchment to inform the prediction of the future influent water quality to NLWWTP.
- River current and depth monitoring surveys using an ADCP in the vicinity of the proposed outfall location – discrete monitoring events (3 proposed) to be representative of different flow conditions in the river and used for the calibration/verification of the 3-D hydrodynamic model.
- Temperature and pH data collection in the vicinity of the proposed outfall (up to 12-month dataset) to inform the dilution modelling, the analysis of potential effluent temperature impacts and ammonia water quality screening.

# 7. Comprehensive Stage 2 EIS Report

The comprehensive Stage 2 EIS report will detail methodology, expected effluent quality, dilution modelling results, effluent water quality screening summary, the receiving environment effects assessment, study conclusions and the recommended post discharge environmental monitoring program.

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# Appendix A: Typical Municipal Wastewater Constituents

| Constituent | Description |
|---|---|
| TSS | Suspended solids are fine particles measured in water containing nutrients which affect water clarity and contribute to increased phytoplankton levels and periphyton growth in receiving waters (Canadian Water Network 2018). High removal rates of suspended solids are achieved during secondary wastewater treatment. |
| $cBOD_5$ | 5-day carbonaceous biochemical oxygen demand measures organic materials that consume oxygen as they degrade. Potentially reducing oxygen concentrations in receiving waters and reduce survival for fish and other aquatic organisms that rely on dissolved oxygen (Canadian Water Network 2018). |
| Nutrients | Phosphorus and nitrogen are the primary nutrients that facilitate eutrophication and harmful algae blooms in receiving waters. Can cause declining fish survival and pose a risk to humans during exposure to contaminated water or seafood (Canadian Water Network 2018). High nutrient removal rates can be targeted during secondary treatment in WWTPs. |
| Ammonia | Ammonia promotes the growth of algae, cyanobacteria, and heterotrophic bacteria and contributes to phytoplankton growth and eutrophication in receiving waters leading to negative effects in aquatic health (Canadian Water Network 2018). |
| Metals | Metals are naturally occurring in receiving waters and sediment; however, high concentrations can contribute to acute or chronic health impacts on animals and phytotoxic effects on vegetation. Metal toxicity can result in negative impacts to an organism's growth, metabolism, and reproduction (Canadian Water Network 2018). Reduction in metal concentrations of effluent is generally achieved during primary treatment and solids removal. |
| Pathogens | Domestic waste includes pathogens which pose a major risk to human health. Indicators for measuring risk to human health include Enterococci, Fecal coliforms and E. coli (Canadian Water Network 2018). Reduction in effluent pathogen concentrations is generally achieved during disinfection (chlorination or UV irradiation). |

| Constituent | Description |
|---|---|
| VOCs | Volatile organic compounds (VOCs) are pollutants that persist in receiving waters although many substances have now been banned in Canada. Chronic exposure in humans has been linked to an increased risk of cancer (Health Canada 2017b). |
| PCBs | Polychlorinated biphenyls (PCBs) are highly persistent substances that were used in electrical equipment, hydraulic systems and heat exchangers up until they were banned in the 1970s. PCBs can accumulate in animal tissue causing endocrine disruption and are detrimental to human and animal health (Canadian Water Network 2018). |
| PBDEs | Polybrominated diphenyl ethers (PBDEs) are materials or coatings that inhibit or resist the spread of fire. These substances persist in receiving waters and sediment and have the potential to bioaccumulate in animal tissue. The chronic exposure of PBDEs to animals and humans can impact endocrine function (Canadian Water Network 2018). |
| PAHs | Polycyclic aromatic hydrocarbons (PAHs) are substances found in soils, sediment and receiving waters which originate from oil spills, petroleum discharge, domestic wastewater and landfills (CCME 1999a). Several PAHs are known to have acute toxic effects on aquatic organisms when exposed to solar UV radiation (CCME 1999). |
| Nonylphenols, nonylphenols polyethoxylates | These chemical compounds form when detergents break down via treatment or environmental degradation. Due to the strong estrogenic properties, they can cause endocrine disruption in exposed mammals or aquatic organisms (Canadian Water Network 2018). |
| PPCPs | Pharmaceuticals and personal care products (PPCPs) are chemical substances used in the prevention or treatment of physiological conditions. PPCPs can negatively affect the behavior of aquatic organisms and can bioaccumulate in animal tissue (Canadian Water Network 2018). The removal of PPCPs in effluent is targeted during solids removal |


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