Gulf Islands and Port Renfrew Wastewater Facilities Environmental Monitoring Program 2019 Report

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GULF ISLANDS AND PORT RENFREW WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2019 REPORT

EXECUTIVE SUMMARY

The Capital Regional District (CRD) operates five wastewater treatment plants in the Gulf Islands and Port Renfrew. The Ganges and Schooner plants discharge ultraviolet disinfected, secondary treated effluent; Cannon and Port Renfrew discharge undisinfected, secondary treated effluent; and the Maliview plant discharges undisinfected, secondary treated effluent mixed with fine-screened effluent during high flows.

The CRD is required to monitor these facilities for compliance with the Municipal Wastewater Regulation under the provincial *Environmental Management Act* and the Wastewater Systems Effluent Regulation under the federal *Fisheries Act*.

Beyond regulatory compliance to ensure protection of human health and the environment, the CRD undertakes monitoring to support plant operation, including outfall performance as well as to inform the Regional Source Control Program about its effectiveness to reduce contaminants with the sanitary services to protect human health and the environment, as well as infrastructure. The next program review is due in 2020.

In 2019, Environment Canada also conducted additional toxicity testing at all of the Gulf Islands and Port Renfrew facilities as part of their oversight program.

GANGES PLANT

Wastewater

The CRD analyzed wastewater influent and effluent for a list of conventional and priority substances. Acute toxicity was tested for Ganges effluent. In 2019, two of the daily effluent flows from the Ganges Plant (representing 1% of the total annual flows) exceeded the allowable maximum. Effluent quality met provincial and federal regulatory requirements for all carbonaceous biochemical oxygen demand (CBOD), total suspended solids (TSS), unionized ammonia, total residual chlorine (TRC) and fecal coliform bacteria results. Similar to previous years, concentrations of TRC (used in washing the membranes) exceeded the permitted level in a number of samples, but this was most likely an artefact of taking the measurements using a relatively insensitive field-based test kit. Staff are investigating alternative chlorine test methods for use in the future.

Of the 190 priority substances analyzed, 78 parameters were detected at standard detection limits (conventionals, metals, total phenols, phenanthrene, diethyl phthalate, low and high molecular weight PAHs, trichloromethane, 2-methylnaphthalene, fluorene, and naphthalene). Effluent concentrations were within similar ranges relative to previous years. Most priority substances in the effluent were below the BC Water Quality Guidelines before the predicted minimum receiving water dilution of 419:1. Substances that exceeded the guidelines in undiluted effluent were: weak acid dissociable cyanide, sulfide, ammonia, naphthalene and some metals. Of these substances, cadmium, copper, manganese, and zinc were above their respective guidelines after the minimum dilution calculation was applied. All other substances were well below guidelines after dilution. Minimum dilution represents the predicted concentration of effluent in the marine water column at a distance of 100 metres (m) away from the outfall.

Toxicity Testing

The effluent sample from July 2019 completed the 96-hour trout acute toxicity test with 71% survival of test organisms. This is a deviation from the 100% survival of previous years, and is likely due to challenges with aeration and ammonia levels in the upgraded plant, which have now been rectified. The Daphnia acute toxicity test was completed with 100% survival, consistent with previous testing conducted 2011-2018.

Ganges effluent testing by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

Sludge (Mixed Liquor)

Ganges plant sludge (mixed liquor) met the criteria for BC Organic Matter Recycling Regulations (OMRR) Class A Biosolids in 2019. None of the metals measured, including mercury, which has exceeded limits in the past, exceeded applicable OMRR Class A Biosolids limits.

Receiving Water

There was no routine receiving water monitoring at the Ganges plant in 2019. Monitoring is scheduled to be repeated in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

As a result of a delay to an emergency construction project involving rerouting the bypass pipe around a manhole, treated effluent was discharged to Ganges Creek. Shoreline sampling was conducted at nine locations to monitor for potential bacterial exceedances. Most of the samples collected from within the creek were above the Health Canada single sample enterococci limit, while all marine samples were below this limit. Because the accidental discharge was disinfected, the source of bacteria in the creek is unknown. Investigation are ongoing.

Next Steps

Continue to share priority pollutant and sludge (mixed liquor) results with the CRD's Regional Source Control Program.

MALIVIEW PLANT

Wastewater

The Maliview plant produces secondary treated effluent when instantaneous flows are equivalent to less than 60 m^3/d. For instantaneous flows equivalent to greater than 60 m^3/d, the plant produces a final effluent that is a blend of secondary treated and fine-screened effluents. As such, there are different regulatory limits for this facility depending on whether the flows are above or below 60 m^3/day. The flow-splitting process responds to instantaneous peak flows, rather than daily flows, and bypass events can occur despite measured daily flows of less than 60 m^3/d. Bypass events occurred, despite flow being less than 60 m^3/d on 12% of the days in 2019. Flow also bypassed the secondary treatment process and received screening on days where the total flow was greater than 60 m^3/d, but the flow to the secondary treatment process was less than 60 m^3/d on 23% of the days. Exceedance of the allowable maximum of 250 m^3/d for total combined daily flows occurred on 1% of the days in 2019. Flow to the secondary treatment plant exceeded 60 m^3/d on 32% of days in 2019, resulting in a portion of the effluent bypassing the secondary treatment process of the plant to be treated solely by fine screening. Flow exceedances of the allowable maximum of 190 m^3/day to the fine-screened portion of the facility occurred on 1% of days in 2019.

The combined final effluent exceeded low flow (<60 m^3/d) registration limits for TSS and CBOD on three sampling days, representing 38% of the low flow sampling events. The combined final effluent did not exceed high flow (>60 m^3/d) registration limits for TSS and CBOD on any sampling days. The remaining wastewater parameters were in compliance.

Toxicity Testing

Maliview effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* failed these additional toxicity tests.

Receiving Water

There was no routine receiving water monitoring at the Maliview plant in 2019. Monitoring is scheduled to be repeated in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

Next Steps

Investigate ways to eliminate regulatory compliance violations. Staff and consultants have prepared a Strategic Asset Management Plan for the Maliview plant, and a subsequent conceptual design for a new treatment plant that will resolve flow and effluent quality issues.

SCHOONER PLANT

Wastewater

The Schooner plant exceeded regulatory limits for flow two times in 2019, representing <1% of the year. All other provincial and federal regulatory requirements, including flow, TSS, CBOD and unionized ammonia were met.

Toxicity Testing

The effluent sample from July 2019 passed the 96-hour trout acute toxicity test with 100% survival. The sample also passed the 48-hour *Daphnia* acute toxicity test with 100% survival. These results are consistent with previous testing conducted from 2011-2018.

Schooner effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

Receiving Water

There was no routine receiving water monitoring at the Schooner plant in 2019. Monitoring is scheduled to be repeated in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

Next Steps

Substantial upgrades to the Schooner plant and collection system are required to eliminate regulatory compliance violations for this facility. The CRD held a referendum in 2015 to borrow $6.1 million to complete the upgrades, but a majority of the electorate voted no. Therefore, staff have planned upgrades in a phased manner over a five- to seven-year period. Phase 1 upgrades are about 50% complete, while Phase 2 and Phase 3 upgrades will require the borrowing of additional funds.

CANNON PLANT

Wastewater

Mean annual flow from the Cannon plant in 2019 was consistent with previous years. Daily flows exceeded the allowable maximum 4% of the time, down from 13% in 2018. TSS exceeded compliance parameters on 4% of the sampling days. All other effluent compliance parameters were below regulatory criteria in 2019.

Toxicity Testing

Cannon effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

Receiving Water

There was no routine receiving water monitoring at the Cannon plant in 2019. Monitoring is scheduled to be repeated in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

Next Steps

As with the Schooner plant, the Condition Assessment conducted in 2011 noted several assets are nearing the end of their life and require upgrades. The CRD held a referendum in 2015 to borrow $6.1 million to complete the upgrades, but a majority of the electorate voted no. Therefore, staff have planned upgrades in a phased manner over a five- to seven-year period. Upgrades to Cannon plant are proposed to take place as part of the Phase 2/3 work plan and will require the borrowing of funds.

PORT RENFREW PLANT

Wastewater

Mean daily flows in 2019 were similar to previous years, with one exceedance of the allowable maximum, representing 0.3% of the year's flows. There was one wastewater compliance permit exceedance for TSS. All other parameters were below regulatory limits.

Toxicity Testing

Port Renfrew effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

Receiving Water

There was no routine receiving water monitoring at the Port Renfrew plant in 2019. Monitoring is scheduled to be repeated in 2020 unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

Next Steps

Staff and consultants completed a feasibility study in 2015 to improve/increase the treatment plant capacity and ensure ongoing effective operation of the treatment plant and conveyance system into the future. Grant funding will be required in order to complete any upgrades to this system. A condition assessment is also being undertaken.

GULF ISLANDS AND PORT RENFREW WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2019 REPORT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

GULF ISLANDS AND PORT RENFREW WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2019 REPORT

1.0 INTRODUCTION

This report summarizes the 2019 results of the Wastewater and Marine Environmental Monitoring Program for the wastewater treatment plants operated by the CRD in the Gulf Islands and Port Renfrew. The Ganges and Schooner plants discharge ultraviolet disinfected, secondary treated effluent; the Cannon and Port Renfrew plants discharge undisinfected, secondary treated effluent; and the Maliview plant discharges undisinfected, secondary treated effluent combined with fine-screened effluent during high flows. The locations of these five facilities are presented in Figure 1-1. The monitoring program includes regular monitoring, as stipulated by the BC Ministry of Environment and Climate Change Strategy (the ministry) either through a permit or registrations under the Municipal Wastewater Regulation (MWR)[1]. In addition, effective January 1, 2013, new monitoring requirements came into effect under the federal Wastewater Systems Effluent Regulations (*Fisheries Act*) for the Ganges and Schooner facilities. The three remaining facilities (Maliview, Cannon and Port Renfrew) do not require monitoring under the federal Wastewater Systems Effluent Regulations, due to their low volumes of discharge. Monitoring is also conducted to assess treatment plant performance and potential for impacts to the marine environment, aquatic life and human health.

1.1 Wastewater Monitoring

Wastewater monitoring components are summarized in Table 1.1. Plant-specific regulatory compliance levels for applicable parameters, and associated sampling and analytical methodologies, are discussed in the individual plant sections of this report.

1.1.1 Compliance and Treatment Plant Performance Monitoring

All wastewater discharges (effluents) were monitored for flow, total suspended solids (TSS), biochemical oxygen demand (BOD), carbonaceous biochemical oxygen demand (CBOD) and fecal coliform (FC) bacteria. All treatment plant influents were monitored for TSS, BOD and FC bacteria. Two plants (Schooner and Ganges) were monitored for additional parameters, such as ammonia (NH_3), pH and total residual chlorine, as described.

1.1.2 Toxicity Testing

Effluent samples from the Ganges and Schooner plants were analyzed for toxicity to Rainbow trout (96-h LC50 test) and *Daphnia magna* (48-h LC50 test). Toxicity testing was a requirement under the MWR registrations for both these facilities. In 2019 Environment Canada conducted additional toxicity testing at each of the Gulf Islands treatment plants as well as at the Port Renfrew treatment plant, as part of inspections under the *Fisheries Act*.

1.1.3 Priority Substances

Wastewater influent and effluent from the Ganges plant were analyzed for a list of priority substances, as stipulated in the MWR registration for this facility. Influent and effluent priority substance results were compared to water quality guidelines set to protect aquatic life (BCMoE&CCS, 2017; 2019). These data were also used to assess the quality of the final effluent and the effectiveness of the CRD's Regional Source Control Program.

[1] formerly the Municipal Sewage Regulation of the *Environmental Management Act*

1.1.4 Treatment Plant Sludge (Mixed Liquor)

The Ganges plant produces sludge (mixed liquor) with the objective of meeting Class A Biosolids guidelines, in accordance with the pathogen reduction and vector attraction reduction processes in the provincial Organic Matter Recycling Regulations (OMRR) (BCMoE&CCS, 2017b). Ganges plant sludge (mixed liquor) is a by-product of sewage treatment, which is de-watered prior to monitoring.

The intent of this mixed liquor monitoring was originally to assess suitability for land application. However, Ganges plant mixed liquor is currently transferred to a septage treatment facility on Vancouver Island and no land application takes place. Mixed liquor sampling (at a reduced frequency) is still of benefit to the Regional Source Control Program to help assess the effectiveness of their various campaigns by providing partitioning behaviour between the solid and liquid fractions of the treatment process.

Figure 1-1 Ganges, Maliview, Schooner, Cannon and Port Renfrew Outfall Locations

Outfall Pipe

N

CAPITAL REGIONAL DISTRICT
Environmental Services

Projection: Universal Transverse Mercator Zone 10 North
North American Datum 1983

December 22, 2005
Technologist: SR
Gan_Mal_Bck_Mag_PR_Outfalls.mxd

Ganges and Maliview

Galiano Island
Porlier Pass Dr
Maliview Estates Outfall
Walkers Hook Rd
North End Rd
Stark Rd
Robinson Rd
Lower Ganges Rd
Bullocks Lake
Upper Ganges Rd
Mansell Rd
Long Harbour Rd
Rainbow Rd
GANGES
Nose Point Rd
Scott Point Dr
Fulford-Ganges Rd
Cranberry Rd
Ganges Outfall
Salt Spring Island
Cusheon Lake Rd
Cusheon Lake
Stewart Rd
0 0.5 1 2 3 4 5 Kilometers

Schooner Way and Cannon Crescent

North Pender Island
Galleon Way
Shoal Rd
Schooner Way
Buck Lake
Bedwell Harbour Rd
Scarff Rd
Bosun Way
Ketch Rd
Privateers Rd
Schooner Way Outfall
Magic Lake
Pirates Rd
Cannon Crescent Outfall
0 250 500 1,000 1,500 2,000 Meters

Port Renfrew

Deering Rd
Port Renfrew Outfall
Pacheena First Nation Reserve
PORT RENFREW
Parkinson Rd
Juan de Fuca Electoral Area
0 50 100 200 300 400 500 Meters

Table 1.1 Summary of 2019 Wastewater and Surface Water Components of the Gulf Islands and Port Renfrew Monitoring Program

Component	Parameter	Frequency and Stations
Wastewater	Flow	Daily: **Ganges**, **Maliview**, **Schooner**, **Cannon**, **Port Renfrew**
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, fecal coliform • Disinfected Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month: **Ganges**, **Schooner**
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH • Combined Final Effluent (Secondary + Fine-screened): TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month: **Maliview**
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month: **Cannon**, **Port Renfrew**
	Federal compliance monitoring: • Final Effluent: TSS, CBOD, unionized ammonia, total residual chlorine, pH @ 15ºC	Once per month (reported quarterly): **Ganges, Schooner**
	Influent and effluent priority substances	Once per year: **Ganges**
	Effluent toxicity	Once per year: **Ganges Harbour**, **Schooner**
	Sludge (mixed liquor)	Once per month: **Ganges**
Receiving Water	Surface water indicator bacteria (fecal coliform and enterococci)	**Ganges Plant** five days of sampling in a 30-day period* **Maliview Plant** five days of sampling in a 30-day period* **Schooner Plant** five days of sampling in a 30-day period* **Cannon Plant** five days of sampling in a 30-day period* **Port Renfrew Plant** five days of sampling in a 30-day period*

Notes:
*Receiving water sampling is next required in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

1.2 Receiving Water Monitoring

Receiving environment monitoring was not historically undertaken routinely for all five of the small CRD wastewater facilities. In 2010, discussions with the provincial ministry led to the requirement that such monitoring be undertaken for all CRD wastewater facilities, but that the inter-year frequency of monitoring would depend on the size of the facility. In addition, intra-year sampling frequency was changed from monthly to five sets of daily samples collected over a 30-day period (5-in-30) to allow for a more direct comparison of bacterial indicators to relevant human health protection criteria. In addition, enterococci are now analyzed, in addition to fecal coliforms, as enterococci persist longer in the marine environment and have a more direct link to human health impacts.

For the five small facilities that are the subject of this report, the monitoring programs were added and/or revised to comprise the 5-in-30 sampling once every four years. Emergency sampling is also required after planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer. If the results from a single day of emergency sampling indicate no impact to the receiving environment (i.e., results less than human health guidelines), then no repeat emergency sampling is required for similar events of the same duration or less during that same wet weather season. If impacts are observed during the emergency sampling (i.e., results higher than human health guidelines), then sampling must repeat every few days until all results are below human health guidelines.

Pre-2010 monitoring programs sampled surface water only (0.5 to 1 m below the surface). The receiving water sampling programs now include sampling of near-surface stations at a depth mid-way between the surface and seafloor, in addition to surface samples, at stations at the edge of the initial dilution zone. The initial dilution zone is defined as the area 100 m around the outfall and is where BC Water Quality Guidelines must be met. In addition to the initial dilution zone sampling stations, surface samples are collected at two stations approximately 200 m up-current and down-current from the outfalls.

The 2019 sampling year represents year three of the current round of this four-year routine monitoring cycle. Routine receiving water sampling was conducted in 2016 and, therefore, was not collected in 2018. The next routine 5-in-30 sampling, as per the four-year cycle, will be required in 2020.

Emergency or non-routine sampling was only required at the Ganges plant in 2019, when shoreline samples were collected following a discharge to the Ganges Creek on June 4, 2019. The samples were analyzed for enterococci and results were compared to Health Canada guidelines for enterococci (Health Canada, 2012), which include the requirements that no single sample should exceed 70 CFU/100 mL.

2.0 METHODOLOGY

2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Influent and effluent samples from all five facilities were collected as grab samples at the frequency noted in Table 1.1.

Laboratory analyses were conducted at the Saanich Peninsula Plant laboratory or Bureau Veritas Laboratories (BV Labs, Burnaby, BC) (formerly Maxxam Analytics Ltd.). TSS was determined gravimetrically using glass fibre filters dried at 105°C (APHA, 1998). BOD was determined by five-day oxygen depletion at 20°C using an oxygen meter (APHA, 1998). CBOD was determined by five-day oxygen depletion at 20°C with TCMP (2-chloro-6-(trichloro methyl) pyridine) as a nitrification inhibitor and using an oxygen meter (APHA, 1998). Fecal coliforms were enumerated using 0.45 µm membrane filters incubated on mFC medium at 44.5°C for 24 hours (APHA, 1998). Enterococci spp. was determined by membrane-filtration technique, followed by incubation on mEI agar (an enzyme substrate medium) for 24 hours at 41°C. Nitrite was determined by diazotization colourimetry. Nitrate was determined by cadmium reduction, followed by diazotization colourimetry. The concentration of unionized ammonia was calculated using the measured concentration of total ammonia and the pH corrected to 15ºC.

Means reported for fecal coliform and enterococci are geometric (logarithmic) means. Means for all other parameters are arithmetic. Mean daily loadings were calculated from mean concentrations and mean daily flows. Annual loadings were calculated from mean concentrations and total annual flows. Values of half the detection limit were used for non-detect results.

TOXICITY TESTING

Effluent toxicity samples for Schooner and Ganges plants were collected by grab sampling. Testing was conducted using standardized and approved protocols by Nautilus Environmental (Burnaby, BC). Effluent toxicity was determined through two tests:

1. A 96-hour acute toxicity test using juvenile Rainbow trout (*Oncorhynchus mykiss*). Five effluent concentrations plus one control were tested, with 10 test organisms per concentration. The number of organisms surviving at 96 hours was recorded, with 50% or greater survival considered a pass, while less than 50% survival is a fail.

2. A 48-hour acute toxicity test using *Daphnia magna*. Five effluent concentrations plus one control were tested, with 10 test organisms per concentration. The number of organisms surviving at 48 hours was recorded, with 50% or greater survival considered a pass, while less than 50% survival is a fail.

Effluent toxicity samples collected at each treatment plant by Environment Canada inspectors were collected by grab sampling. These samples were used to conduct Rainbow trout LT50 and Rainbow trout LC50 acute lethality analyses.

PRIORITY SUBSTANCES

At Ganges plant, influent and effluent samples were collected as composite samples for priority substance analysis at routine detection limits. The composite samples were collected by an ISCO automated sampler, with 400 mL of wastewater collected every 30 minutes over a 24-hour period. The composite sample was then split into smaller sample bottles for individual analyses and preserved before shipping to BV Labs. An additional sample was collected as a grab for those parameters not suited for composite collection. Analytical detection limits were chosen to allow for comparison to BC Water Quality Guidelines.

SLUDGE (MIXED LIQUOR)

Dewatered sludge (mixed liquor) at Ganges plant was sampled on a monthly basis and analyzed for 29 metals and moisture content by CARO Analytical Services (Richmond, BC). Results were compared to the BC OMRR (BCMoE&CCS, 2017b) biosolids limits. These regulations stipulate the land uses that are acceptable for the tested biosolids according to the concentrations of a select group of substances. The regulations are set to protect human and environmental health.

2.2 Receiving Water Monitoring

RECEIVING WATER SURFACE WATER MONITORING

Routine sampling was not required at any of the facilities in 2019, as agreed upon with the ministry. Non-routine emergency sampling is only required after planned bypasses, plant failures/overflows or wet weather overflows that exceeded three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving water sampling was conducted only for the shoreline of the Ganges plant, as noted in Section 1.2.

Shoreline samples were collected in sterile, wide-mouth bottles by rapidly submerging open, upright bottles attached to a pole, as far off shore as the sampler was able to reach.

Bacteriology was analyzed at BV Labs using the same methods as those used for wastewater, and results were compared to the values specified in Health Canada's Guidelines for Canadian Recreational Water Quality (Health Canada, 2012), as a means to assess potential human health risks (Section 1.2).

3.0 GANGES PLANT

3.1 Introduction

The Ganges plant is located on the east side of Salt Spring Island (Figure 1-1). It discharges ultraviolet disinfected secondary treated effluent into Ganges Harbour through a 4,800-m outfall at a depth of 16 m below sea level. Because the average daily flow of this facility exceeds 100 m^3/day, both provincial and federal regulatory requirements must be met by this facility. Total residual chlorine must also be measured, but only when chlorine is used when washing the membranes.

The facility is regulated under BC MWR Registration RE-05521, dated April 28, 2005. Provincial and federal regulatory requirements are described in Table 3.1.

Ganges plant went through significant planned upgrades in 2019 to replace end of life equipment. In addition, the CRD requested a maximum daily flow limit increase of 10% in December 2019 as a result of increasing peak flow volumes. This was approved in early January 2020, effective from December 2019.

Table 3.1 Ganges Plant Regulatory Requirements

Parameter	Regulatory Requirement	
	Provincial	Federal
Maximum daily flow	1,198 m^3/d	---
CBOD	max 25 mg/L	average 25 mg/L
TSS	max 25 mg/L	average 25 mg/L
Fecal coliform	max 1,000 CFU/100 mL	---
Unionized ammonia	---	max 1.25 mg/L
Total residual chlorine	---	average 0.02 mg/L
Toxicity test	96-hr Rainbow Trout	---

This registration also has a requirement for receiving water monitoring. Routine monitoring was not required for this facility in 2019, and will not be until 2020. In 2019, as a result of a delay to an emergency construction project involving rerouting the bypass pipe around a manhole, approximately 400 m^3 of fully treated and disinfected effluent was discharged to the Ganges Creek on June 4. The outfall work was completed on June 5, 2019 and shoreline samples collected on June 6 (see Table 3.5 and Figure 3-2 for more details).

The following section reports the results from the Ganges treatment plant monitoring program (Table 3.2).

Table 3.2 Ganges Treatment Plant Environmental Monitoring Program

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary effluent: TSS, fecal coliform • Disinfected secondary effluent: TSS, BOD, CBOD, fecal coliform, ammonia, pH	Once per month
	Effluent toxicity • Rainbow trout 96-hour • *Daphnia magna* 48-hour	Once per year
	Federal compliance monitoring: Final effluent: TSS, CBOD, unionized ammonia, total residual chlorine	Once per month
	Influent and effluent priority substances[1]	Once per year
	Sludge (mixed liquor)	Once per month
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

Notes: [1] All priority substances are listed in Appendix A3

3.2 Results

3.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2019, two daily flows from January 2019 (representing 1% of the annual flows) exceeded the allowable maximum for the Ganges plant (Table 3.3, Table 3.4 and Appendix A1).

Compliance and treatment plant monitoring data (Table 3.4, Appendix A2) show that effluent quality was consistent with previous years for all parameters (CRD, 2011 to 2018). There were no exceedances of TSS, following replacement of the old membranes of the treatment plant in 2018. All other compliance parameters met regulatory limits. Overall, the treatment plant removed approximately 99% of the TSS and <99% of the fecal coliform bacteria from the influent.

Total residual chlorine was measured nine times in 2019, as part of federal regulations, to monitor levels resulting from chlorine used to clean the treatment plant membranes. Concentrations of total residual chlorine exceeded the permitted level 56% of the time in disinfected secondary effluent. However, this was most likely an artefact, due to measurements taken using a relatively insensitive field-based test kit that has a detection limit exactly the same as the federal guideline of 0.02 mg/L. The reliability of test kit results near the detection limit is low. Staff are investigating alternative chlorine test methods for use in the future.

Compliance data was reported to the ministry on a monthly basis, with individual environmental impact reports issued if there was an incident at the plant. There were three reports issued at Ganges plant in 2019, as a result of:

- heavy rain causing flow exceedance (January 4 and January 5);
- unanticipated bypass event occurring on June 4, 2019.

Table 3.3 Ganges Plant 2019 Influent Flow Summary

Month	Mean Flow (m^3/d)	Minimum Flow (m^3/d)	Maximum Flow (m^3/d)*	Total Flow (m^3)	Number of Samples	Permit Violations (%)
January	594	471	1,143	18,417	31	6
February	528	335	781	14,785	28	0
March	463	371	540	14,352	31	0
April	562	354	1,008	16,865	30	0
May	407	348	481	12,605	31	0
June	374	327	581	11,210	30	0
July	455	369	696	14,111	31	0
August	499	368	816	15,478	31	0
September	407	358	565	12,217	30	0
October	387	328	549	11,997	31	0
November	387	320	563	11,597	30	0
December	506	307	818	15,695	31	0
Annual	**464**	**307**	**1,143**	**169,329**	**365**	**1**

Notes:
*Provincially regulated maximum daily flow = 1,090 m^3/d prior to Dec 5, 2019, and 1,198 m^3/d after Dec 5, 2019.

Table 3.4 Ganges Plant 2019 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring				
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	Fecal Coliform (CFU/100 mL)	BOD (mg/L)	Ammonia (mg N/L)	Unionized Ammonia (mg N/L)	Total Residual Chlorine (mg/L)	pH
Influent									
Regulatory limit	---	---	---	---	---	---	---	---	---
Mean	464	365	---	13,035,918	386	---	---	---	---
Minimum	307	134	---	600,000	200	---	---	---	---
Maximum	1143	580	---	75,000,000	630	---	---	---	---
Regulatory violations (%)	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	---	---	---	---
Secondary effluent									
Regulatory limit	---	---	---	---	---	---	1.25	0.02	---
Mean	464	2	---	83	---	---	---	---	---
Minimum	307	1	---	2	---	---	---	---	---
Maximum	1,143	4	---	420	---	---	---	---	---
Percent reduction (from influent)	---	99%	---	100%	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	---	---	---	---	---
Disinfected secondary effluent									
Regulatory limit	1,090*	Max: 45 Mean: 25	Max: 45 Mean: 25	1,000	---	---	1.25	0.02	---
Mean	464	3	4	5	4	10.38	0.0562	0.05	7.5
Minimum	307	<1	<2	<1	<2	0.08	<0.0005	<0.02	7.1
Maximum	1,143	<4	<7	22	9	29	0.25	0.12	8.1
Percent reduction (from Influent)	---	99%	---	>99%	99%	---	---	---	---
Regulatory violations (%)	1%	0%	0%	0%	---	---	0%	56%	---
Number of samples	365	11	11	12	12	11	11	9	12

*Flow regulatory limit was increased to 1,198 m^3/day on December 5, 2019

TOXICITY TESTING

In 2019, the disinfected effluent sample from July 17, 2019 completed the 96-hour Rainbow trout acute toxicity test with 71% survival of test organisms. This is a deviation from previous years (2011-2018), where the test consistently resulted in a 100% survival of test organisms. Throughout the first half of 2019 operations staff were adjusting the performance of the aeration system and were experiencing challenges with ammonia levels. These issues have now been fully resolved.

As in previous years (2012-2018), the disinfected effluent sample from July 17 passed the 48-hour *Daphnia magna* acute toxicity test with 100% survival of test organisms, corresponding to an LC50 of >100%. The *Daphnia* test is not required, but it was conducted to maintain consistency with other CRD discharge monitoring programs where toxicity testing is conducted.

Ganges effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

PRIORITY SUBSTANCES

Of the 190 priority substances analyzed in Ganges plant effluent (Appendix A3), 78 parameters were detected at standard detection limits, (conventionals, metals, total phenols, 2-methylnaphthalene, fluorene, naphthalene, phenanthrene, low and high molecular weight PAHs, diethyl phthalate, and trichloromethane). Similar parameters and effluent concentrations were detected in previous years.

In 2019, most priority substance concentrations in the Ganges plant effluent were below BC Water Quality Guidelines (BCMoE&CCS, 2017a and 2019) in undiluted effluent before discharge to the environment (Appendix A3). Substances that exceeded the established guideline in undiluted effluent are: weak acid dissociable cyanide, sulfide, ammonia, naphthalene, and metals (arsenic, barium, cadmium, copper, lead, manganese, mercury, nickel, silver and zinc). Of these substances, only cadmium, copper, manganese and zinc were above the guideline after the near surface dilution factor of 419:1 was applied. This 419:1 dilution factor was determined by oceanographic modelling and is the predicted dilution factor to occur near the surface at the edge of the outfall Initial Dilution Zone (Seaconsult Marine Research Ltd, 1994).

SLUDGE (MIXED LIQUOR)

Results of sludge (mixed liquor) analysis were compared to BC OMRR Biosolids Class A criteria to assess the quality of the sludge produced at the treatment plant (Appendix A4). This class rating identifies biosolids as the highest quality that can be produced according to provincial ministry requirements. Class A Biosolids can be used in land applications (limits are set to protect human and environmental health) with an approved land application plan. Ganges plant mixed liquor is not applied to land, but is transferred to a Vancouver Island septage treatment facility for disposal. However, the mixed liquor monitoring results are still valuable information for the Regional Source Control Program to help assess the success of their codes of practice (e.g., those in place for dental offices).

The 2019 Ganges treatment plant sludge (mixed liquor) results had metal concentrations well below the criteria for Class A Biosolids. Historically, mercury levels have been elevated at times in Ganges sludge. Mercury results were all below the Class A limit of 5.0 mg/kg in 2019, and have declined steadily over the past 10 years, except for peaks in 2002 and 2006 (Figure 3-1). The peaks in mercury concentrations in 2002 reached three times the historic mean. This was thought to be a result of implementation of the Regional Source Control Program dental code of practice in July 2001, when plumbing lines within dental offices were flushed prior to installing the required amalgam separators. This purging of accumulated amalgam (likely containing high concentrations of mercury) may have then accumulated in the Ganges sludge that was removed in 2001 and 2002 (CRD, 2009). Mercury concentrations began to decline steadily after July 2002 and had met the Class A criterion by the last quarter of 2005. The causes of the few spikes in mercury concentrations since 2005 are unknown, but no spikes have been observed since late 2008. Monthly analyses will continue, in order to determine if there is a pattern to future spikes. If a pattern is identified, a source investigation will be initiated.

3.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

As a result of a delay of an emergency construction project involving rerouting the bypass pipe around a manhole, fully treated and disinfected effluent was discharged to Ganges Creek. The outfall work was completed at 13:00 hours on June 5, 2019, with approximately 400 m^3 of treated effluent discharged to the storm drain bypassing the outfall. Shoreline sampling was conducted on June 6, 2019 at nine locations to monitor for potential bacterial exceedances (Figure 3-2). Five of the sample locations were in the creek, while the remaining four were collected from the shoreline in the marine receiving environment.

Most of the results from samples in the creek were above the Health Canada single sample Enterococci limit of 70 CFU/100 mL (Health Canada, 2012), whereas all marine receiving environment samples were below this limit (Table 3.5). Because the accidental discharge was fully disinfected, staff have not yet been able to confirm bacterial sources within the creek. Investigations are ongoing.

Table 3.5 Ganges Plant 2019 Overflow Shoreline Sampling

Station	June 6, 2019 Shoreline Sampling
	Enterococci CFU/100 mL
1	66
2	1,100
3	not sampled (stagnant)
4	940
5	340
6 (marine)	3
7 (marine)	48
8 (marine)	7
9 (marine)	non-detect

Notes:
Shading of result indicates exceedance of Health Canada 70 CFU/100 mL limit

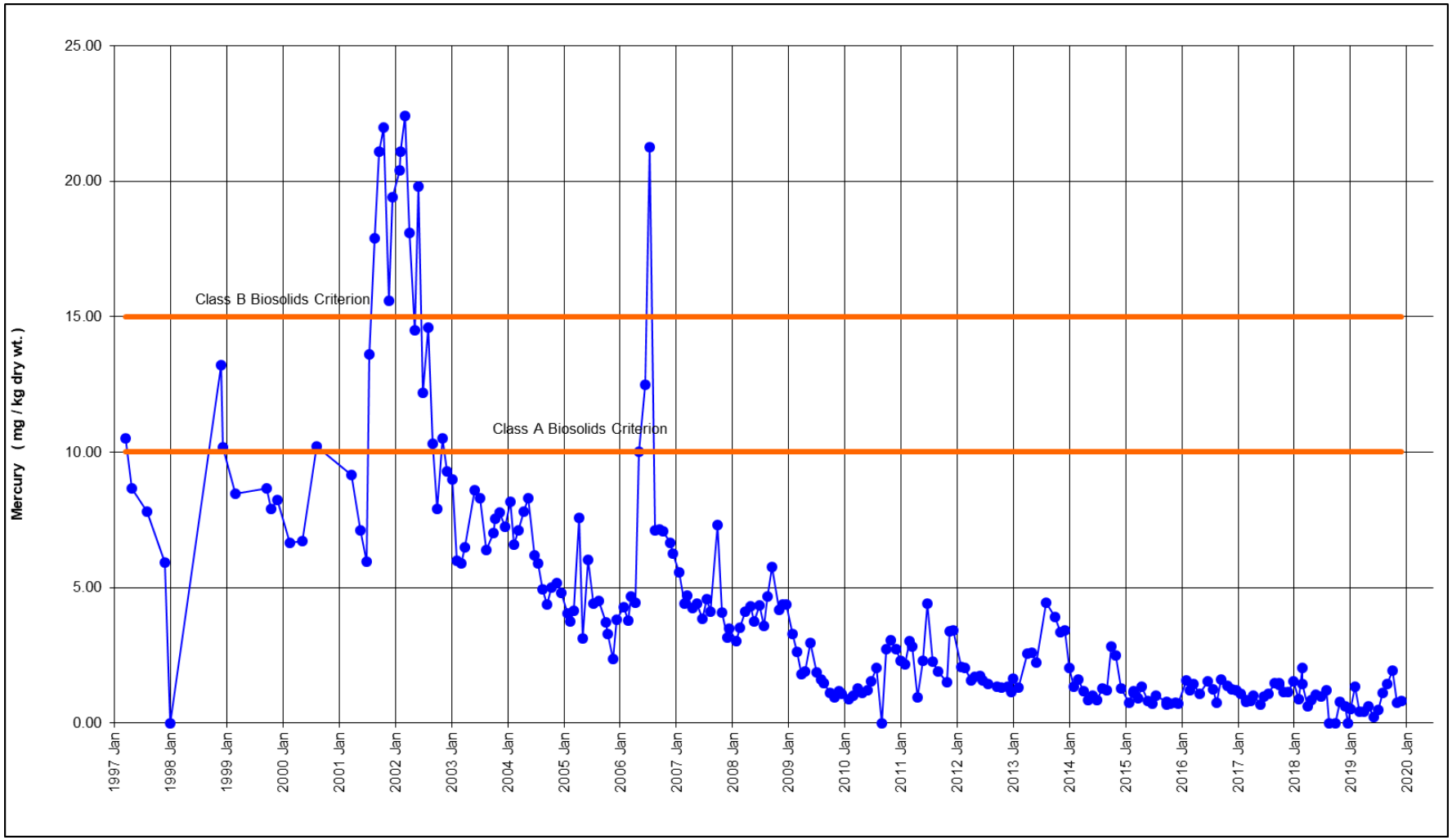
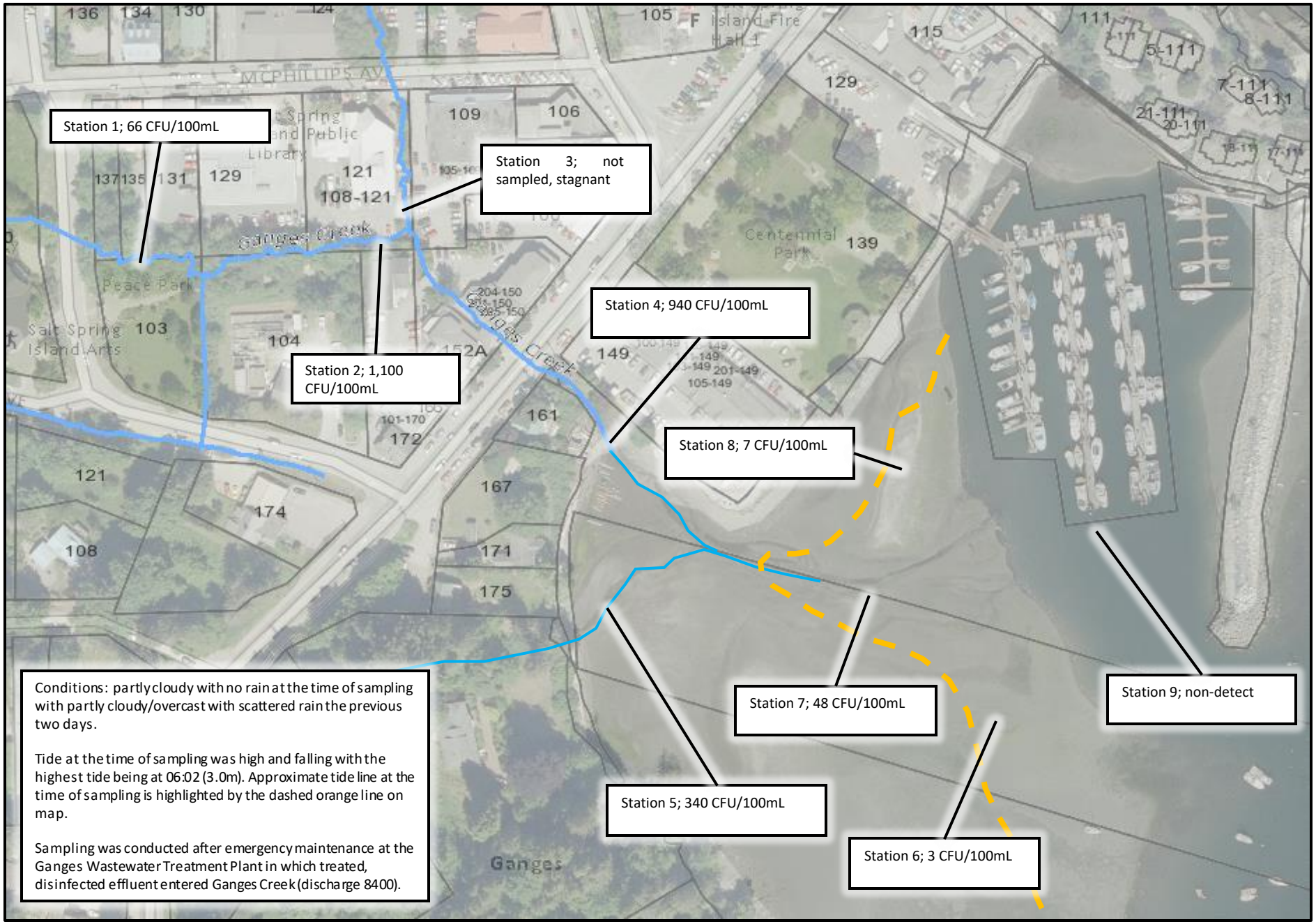


Figure 3-1 Ganges Plant Mixed Liquor Mercury Levels (1997 to 2019)

Figure 3-2 Ganges Shoreline Sampling Map



3.3 Recommendations

CONTINUE TO SHARE RESULTS WITH THE REGIONAL SOURCE CONTROL PROGRAM

Effluent priority pollutant and sludge (mixed liquor) results are valuable to the Regional Source Control Program. Effluent priority pollutant monitoring is a requirement of the provincial registration for this facility and must continue, but sludge (mixed liquor) monitoring is not. It is recommended that sludge (mixed liquor) sampling continue to allow the program to assess the effectiveness of their initiatives.

4.0 MALIVIEW PLANT

4.1 Introduction

The Maliview plant is located on the east side of Salt Spring Island (Figure 1-1). It discharges treated effluent into Trincomali Channel through a 213-m outfall at a depth of 14 m below sea level. The original primary treatment plant was upgraded to a secondary treatment facility in July 2006.

The facility is registered under BC MWR Registration RE-00242, as amended in June 2007.

Flows up to 60 m^3/d receive secondary treatment using the rotating biological contactor, and flows greater than 60 m^3/d (greater than twice the mean daily dry weather flow) receive preliminary treatment using fine screens. Both effluent streams are combined before discharge. Blending effluent streams is an option available under the MWR to deal with high effluent flows. Historically (prior to 2013), monitoring was done separately on the contactor and fine-screened portions of the effluent, and final effluent quality was predicted using a combination of the two effluent quality results and the relative flow volumes. In December 2012, a sampling point was installed that allowed for direct sampling of the combined final effluent quality. As such, the fine-screened effluent sampling point was abandoned in 2013 and replaced with the new combined final effluent sampling point. Compliance requirements are as follows:

Table 4.1 Maliview Plant Regulatory Requirements

Parameter	Regulatory Requirements	
Maximum daily secondary flow	60 m^3/d	
Maximum daily fine-screened flow	190 m^3/d	
Maximum daily total flow	250 m^3/d	
	Flows up to 60 m^3/d	**Flows over 60 m^3/d**
Maximum CBOD	45 mg/L	130 mg/L
Maximum TSS	45 mg/L	130 mg/L

This registration also has a requirement for receiving water monitoring. Routine monitoring was not required for this facility in 2019, and is next required in 2020. In 2019, there was no non-routine emergency receiving environment sampling.

The following section reports the results from the Maliview treatment plant monitoring program (Table 4.2).

Table 4.2 Maliview Treatment Plant Environmental Monitoring Program

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring[1]: • Influent: TSS, BOD, fecal coliform • Secondary fine-screened effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH • Combined final effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Quarterly
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

Notes:
[1] All substances are listed in Appendix B4

4.2 Results

4.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

The complete flow data set is presented in Appendix B1. In 2019, there were seven days when there was no power to the flow meter at the Maliview plant. On these dates, flow was recorded as 0 m^3/day. These erroneous values were deleted (indicated in Appendix B1 by *) and not used in further calculations.

Flow data, including exceedances, are summarized for effluent discharged from the fine screens (bypassing the secondary treatment unit) in Table 4.3. Overall, in 2019, there were two (1% of the year) flow exceedances for fine-screened effluent. Flow data for effluent discharged from the secondary treatment unit are summarized in Table 4.4 (see Appendix B1 for the complete data set). Flow exceeded the allowable maximum for secondary effluent of 60 m^3/d on 32% of days in 2019.

Flow data for the entire facility are summarized in Table 4.5 (see Appendix B1 for the complete data set). Total effluent flows discharged from the Maliview treatment plant exceeded the registration allowable maximum of 250 m^3/d on two days (1% of the time) in 2019.

The rotating biological contactor component of the Maliview plant was not designed to treat the volume of effluent that it presently receives, particularly when it is rainy and significant inflow and infiltration enters the conveyance system. In addition, the process that splits flow between the contactor and the fine screens responds to instantaneous peak flows, rather than total daily flows. This results in frequent fine-screening events on days that the contactor unit is not operating at full capacity, as measured by the total daily flow. In 2019, flow bypassed the secondary treatment process and only received screening on days where the total flow was less than 60 m^3/d on approximately 43 days (12% of the time). Flow bypassed the secondary treatment process and received screening on days where the total flow was greater than 60 m^3/d, but the flow to the secondary treatment process was less than 60 m^3/d on approximately 84 days (23% of the time).

CRD staff have met on site with a contracting engineer who has reviewed the design and operation of the facility to identify solutions to increase capacity and treatment. The chosen solution has been fed into short-, medium- and longer- term upgrade plans. It should also be noted that repairs were made in summer 2019 to the upstream conveyance system to reduce inflow and infiltration. Since these repairs, the frequency and volume of flow limit exceedances have been substantially reduced; wet weather peak flows have been reduced to almost half of previous years, but extreme wet weather will still lead to overflows.

Compliance data was reported to the ministry on a monthly basis, with environmental impact reports issued if there was an incident at the plant. There were 10 reports issued at Maliview plant in 2019, as a result of:

- heavy rain causing flow exceedance (January 3);
- power outage resulting in sewage spill from influent wet well (February 12);
- downed tree resulting in power outage and wet well bypass (April 27);
- CBOD/TSS exceedances (May 21, June 5 [follow up from May 21)];
- influent wet well pump plugged resulting in overflow via bypass (August 30, September 11);
- TSS exceedance in rotating biological contactor and combined effluent (October 15, November 12); and
- influent wet well pump plugged resulting in wet well overflow (December 7).

Compliance and treatment plant monitoring data is summarized in Table 4.6 and the complete data set is presented in Appendix B2. The secondary treatment unit removed approximately 77% of the TSS, 84% of fecal coliform and 82% of total BOD. The combined final effluent exceeded low flow (<60 m^3/d) limits for TSS and CBOD on three of the sampling days where flow was below 60 m^3/day, representing 38% of the low flow sampling events. The combined final effluent did not exceed high flow (>60 m^3/d) limits for TSS and CBOD on any of the sampling days.

Table 4.3 Maliview Plant 2019 Fine-screened Effluent Flow Summary

Month	Mean Daily Flow (m^3/d)	Min. Daily Flow (m^3/d)	Max. Daily Flow (m^3/d)*	Total Flow (m^3)	# of Samples	Permit Violations (%)
January	73	22	230	2,267	31	6
February	41	5	102	1,153	28	0
March	8	0	32	259	31	0
April	1	0	7	34	30	0
May	0	0	2	2	31	0
June	0	0	0	0	30	0
July	0	0	0	0	31	0
August	0	0	1	1	31	0
September	0	0	2	4	30	0
October	2	0	33	77	31	0
November	12	0	75	356	30	0
December	37	4	104	1,136	31	0
Annual	**14**	**0**	**230**	**5,288**	**365**	**1**

Notes:
*Permitted maximum daily flow = 190 m^3/d
Flow data was not available on some days due to power outage. See Appendix B1 for details.

Table 4.4 Maliview Plant 2019 Secondary Effluent Flow Summary

Month	Mean Daily Flow (m^3/d)	Min. Daily Flow (m^3/d)	Max. Daily Flow (m^3/d)*	Total Flow (m^3)	# of Samples	Permit Violations (%)
January	69	62	79	2,145	30	100
February	67	57	78	1,887	28	96
March	55	26	75	1,708	29	13
April	67	46	90	1,998	30	70
May	45	33	69	1,392	28	6
June	36	23	45	1,066	30	0
July	34	8	47	1,043	30	0
August	30	21	35	920	31	0
September	36	30	47	1,090	30	0
October	47	21	90	1,459	31	23
November	52	32	73	1,560	30	23
December	58	41	65	1,793	31	48
Annual	**49**	**8**	**90**	**18,059**	**358**	**32**

Notes:
*Provincially regulated maximum daily flow = 60 m^3/d
Flow data was not available on some days due to power outage. See Appendix B1 for details.

TOXICITY TESTING

Maliview effluent was used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act*. The Maliview effluent LT50 Rainbow trout acute lethality test showed 100% mortality at 100% effluent concentration after 2 hours. The LC50 Rainbow trout pH controlled acute lethality test showed 100% mortality at 100% effluent concentration after 2.67 hours.

Table 4.5 Maliview Plant 2019 Total Effluent Flow Summary

Month	Total Daily Flow				Days TF <60 (2° flow only expected)	Days TF <60 and FS discharged	Days TF >60 (blended flow expected)	Days TF >60 and FS discharged, but 2° <60	Exceeded Regulatory Maximum (%)
	Mean	Min.	Max.	Total					
January	142	93	296	4,412	0	0	31	27	6
February	108	70	173	3,031	0	1	28	22	0
March	63	29	107	1,967	13	11	17	16	0
April	68	46	97	2,032	9	2	21	11	0
May	45	33	69	1,394	29	12	2	0	0
June	36	23	45	1,066	30	4	0	0	0
July	34	8	47	1,043	31	1	0	0	0
August	30	21	35	920	31	0	0	0	0
September	36	30	47	1,094	30	4	0	0	0
October	50	21	112	1,536	22	4	9	0	0
November	64	32	123	1,916	13	4	17	5	0
December	89	54	166	2,314	9	0	17	3	0
Annual Total	**64**	**8**	**296**	**22,723**	**217**	**43**	**142**	**84**	**1**

Notes:
Permitted maximum daily total flow = 250 m^3/d
Permitted maximum daily fine-screened flow = 190 m^3/d
Flow splitting threshold (max. flow that can be handled by the rotating biological contactor secondary treatment process) = 60 m^3/d
FS = fine-screened
2° = secondary treated flow
TF = total daily flow (combined FS and 2°)
The flow splitting mechanisms responds to instantaneous peak flow, so can get FS flow even when TF <60 m^3/day

Table 4.6 Maliview Plant 2019 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring					Treatment Plant Performance Monitoring		
	Flow (m^3/d)	TSS (mg/L)		CBOD (mg/L)		FC (CFU/100 mL)	BOD (mg/L)	NH_3 (mg/L N)	pH
Influent									
Regulatory Limit	250	---		---		---	---	---	---
Mean	63	314		---		4,578,413	335	---	---
Minimum	8	65		---		240,000	64	---	---
Maximum	296	1,070		---		74,000,000	770	---	---
Regulatory Violations (%)	1	---		---		---	---	---	---
Number of Samples	358	12		---		12	12	---	---
Secondary Effluent									
Regulatory Limit	60	45		45		---	---	---	---
Mean	49	52		28		455,401	52	36	7.5
Minimum	8	8		6		9,600	11	4.84	7.0
Maximum	90	226		180		11,000,000	230	59	7.9
Percent Reduction	---	84		---		90	85	---	---
Regulatory Violations (%)	32	---		---		---	---	---	---
Number of Samples	360	12		12		12	12	12	12
Fine-Screened Effluent[1]									
Regulatory Limit	190	---		---		---	---	---	---
Mean	14	---		---		---	---	---	---
Minimum	0	---		---		---	---	---	---
Maximum	230	---		---		---	---	---	---
Percent Reduction	---	---		---		---	---	---	---
Regulatory Violations (%)	1	---		---		---	---	---	---
Number of Samples	365	---		---		---	---	---	---
Combined Final Effluent[2]									
Regulatory Limit[3]	250	45	130	45	130	---	---	---	---
Mean	63	71	35	66	15	740,596	60	38	7.6
Minimum	8	24	11	9	9	11,000	13	6	7.0
Maximum	296	230	68	180	18	9,600,000	170	63	8.0
Percent Reduction	---	77	89	---	---	84	82	---	---
Regulatory Violations (%)	1	38	25	38	50	---	---	---	---
Number of Samples	360	8	4	8	4	12	12	11	12
Discharged Effluent									
Mean	63	57		51		740,596	60	37.1	7.5
Percent Reduction	---	82		---		84	82	---	---

Notes on next page

Table 4.6, cont'd

Notes:

[1] No fine-screened effluent samples were collected in 2019. See footnote 2.

[2] Historically, the values for final effluent were calculated using individual secondary and fine-screened effluent quality values along with their relative flow volume proportions. In 2013, the fine-screened effluent sampling point was abandoned and replaced by direct sampling of final combined (secondary + screened) effluent quality via a new combined sampling point that was installed in December 2012.

[3] Regulatory limits for TSS and CBOD are dependent upon whether average daily flow is above or below 60 m3/day. Limits are 45 mg/L if flows are below 60 m^3/day and 130 mg/L if above 60 m^3/day

[4] Power outages resulting in no flow data for some days. See Appendix B1 for details.

4.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Routine monitoring was not required for this facility in 2019. This sampling was last conducted in 2016 and is next due in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

4.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Maliview plant are required to eliminate all regulatory compliance violations for this facility. The design and operation of the facility is under review to identify solutions to increase capacity and treatment, and reduce or eliminate high-flow bypass events. A potential solution is being fed into short-, medium- and longer-term upgrade plans. It should also be noted that repairs were made in summer 2019 to the upstream conveyance system to reduce inflow and infiltration. Since these repairs, the frequency and volume of flow limit exceedances have been substantially reduced; wet weather peak flows have been reduced to almost half of previous years, but extreme wet weather will still lead to overflows. Grant funding will be required in order to complete any upgrades to this system.

5.0 SCHOONER PLANT

5.1 Introduction

The Schooner plant is located on the southwest side of North Pender Island (Figure 1-1). It discharges ultraviolet disinfected secondary treated effluent into Swanson Channel through a 198-m outfall at a depth of 8 m below sea level. Because the average daily flow of this facility exceeds 100 m^3/day, both provincial and federal regulatory requirements must be met.

The facility is regulated under BC MWR Registration RE-01693 dated November 15, 2000. Provincial and federal regulatory requirements are described in Table 5.1.

Table 5.1 Schooner Plant Regulatory Requirements

Parameter	Regulatory Requirement	
	Provincial	Federal
Maximum daily flow	640 m^3/d	---
CBOD	max. 45 mg/L	average 25 mg/L
TSS	max. 45 mg/L	average 25 mg/L
Fecal coliform	200 CFU/100 mL	---
Unionized ammonia	---	max. 1.25 mg/L
Total residual chlorine	---	average 0.02 mg/L
Toxicity test	96-hr Rainbow Trout	---

This registration also has a requirement for receiving water monitoring. Routine monitoring was not required for this facility in 2019, and is next required in 2020. In 2019, there was no non-routine emergency receiving environment sampling conducted.

The following section reports the results from the Schooner treatment plant monitoring program (Table 5.2).

Table 5.2 Schooner Treatment Plant Environmental Monitoring Program

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, fecal coliform, unionized NH_3, total residual chlorine • Disinfected secondary effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH, unionized NH_3	Once per month[1]
	Federal compliance monitoring: Final Effluent: TSS, CBOD, unionized ammonia, total residual chlorine, pH	Once per month (reported quarterly)
	Effluent toxicity	Once per year
Surface Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

Notes:
[1] All substances are listed in Appendix C2

5.2 Results

5.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data are summarized in Table 5.3 and the complete data set is presented in Appendix C1. In 2019, two total daily flows, representing 1% of the year, from the Schooner plant exceeded the allowable maximum, consistent with recent years.

Monthly compliance and treatment plant performance monitoring data are summarized in Table 5.4 and the complete data set is presented in Appendix C2. In 2019, all compliance parameters at Schooner plant were within compliance limits in collected samples. However, while samples were not collected during power outages (noted below), it is assumed that the provincial fecal coliform limit was exceeded during these events. The treatment plant removed approximately 98% of the TSS, >99% of the fecal coliform and 98% of the total BOD it received. Chlorine is not used at this facility, so is not monitored with respect to federal Wastewater Systems Effluent Regulations requirements.

Compliance data was reported to the ministry on a monthly basis, with environmental impact reports issued if there was an incident at the plant. There were seven reports issued at Schooner plant in 2019, as a result of:

- heavy rainfall event resulting in TSS and likely fecal coliform exceedances (January 3);
- extremely heavy rainfall event resulting in flow exceedance (January 4); and
- power failure resulting in loss of UV treatment (February 4, February 9, February 12, February 13, February 15).

TOXICITY TESTING

As in previous years (2012-2018), the 2019 disinfected effluent sample from July 23, 2019 passed the 96-hour Rainbow trout acute toxicity test with 100% survival of test organisms.

The disinfected effluent sample from July 23, 2019 also passed the 48-hour *Daphnia magna* acute toxicity test with 100% survival of test organisms. The *Daphnia* test is not required, but it was conducted to maintain consistency with other CRD discharge monitoring programs where toxicity testing is required.

Schooner effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

Table 5.3 Schooner Plant 2019 Effluent Flow Annual Summary

Month	Mean Flow (m^3/d)	Min. Flow (m^3/d)	Max. Flow (m^3/d)*	Total Flow (m^3)	# of Samples	Permit Violations (%)
January	390	278	919	12,101	31	6
February	349	267	506	9,759	28	0
March	261	207	302	8,102	31	0
April	242	186	328	7,271	30	0
May	173	139	208	5,371	31	0
June	146	125	175	4,365	30	0
July	144	122	176	4,478	31	0
August	149	75	244	4,625	31	0
September	149	109	181	4,461	30	0
October	188	114	376	5,826	31	0
November	186	129	340	5,579	30	0
December	234	135	537	7,256	31	0
Annual	**217**	**75**	**919**	**79,194**	**365**	**1**

Notes:
*Provincially regulated maximum daily flow = 640 m^3/d

Table 5.4 Schooner Plant 2019 Compliance Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring				
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	BOD (mg/L)	Ammonia (mg/L N)	Unionized Ammonia (mg N/L)	Total Residual Chlorine (mg/L)	pH
Influent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	217	257	---	9,500,318	228	---	---	---	---
Minimum	75	46	---	1,300,000	34	---	---	---	---
Maximum	919	548	---	67,000,000	450	---	---	---	---
Regulatory violations (%)	1	---	---	---	---	---	---	---	---
Number of samples	365	12	---	11	12	---	---	---	---
Secondary Effluent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	217	5	---	5,106	---	---	---	---	---
Minimum	75	2	---	1	---	---	---	---	---
Maximum	919	11	---	46,000	---	---	---	---	---
Percent Reduction	---	98	---	100	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	---	---	---	---	---
Disinfected Secondary Effluent									
Regulatory Limit	640	Max.: 45 Avg.: 25	Max.: 45 Avg.: 25	200	---	---	1.25	0.02	---
Mean	217	5	4	24	4	0.22	<0.0005	---	7.1
Minimum	75	3	2	1	2	0.04	<0.0005	---	6.6
Maximum	919	10	5	120	6	0.62	<0.0005	---	7.7
Percent Reduction	---	98	---	>99	98	---	---	---	---
Regulatory violations (%)	1	0	0	0	---	---	0	---	---
Number of samples	365	11	11	12	12	11	4	---	12

5.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Routine monitoring was not required for this facility in 2019. This sampling was last conducted in 2016 and is next due in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

5.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Investigate ways to eliminate regulatory compliance violations; substantial upgrades to the Schooner plant and collection system would be required for this facility. Staff and consultants completed a Condition Assessment of the sewer service assets in 2011. Several assets were noted to be nearing the end of their life and upgrades were approved. Staff are undertaking the proposed upgrades in a phased manner over a five- to seven-year period. Phase 1 upgrades are about 50% complete, including installation of a new Chart Drive pump station and forcemain, replacement of about 44 m of sewer pipe, implementing an inflow and infiltration reduction program, and assessing the remaining life of the aeration tank at Schooner plant. Phase 2 and Phase 3 upgrades will require the borrowing of funds to complete major upgrades to five pump stations and to Cannon and Schooner plants.

The service area residents recently approved the borrowing of $6 million for capital improvement infrastructure upgrades, including back-up power. Installation of the new standby generator will be complete in 2022. Next steps are being determined, but it is likely that additional funding will be required to complete Phase 2 and 3 of the work.

6.0 CANNON PLANT

6.1 Introduction

The Cannon plant is located on the southwest side of North Pender Island (Figure 1-1). It discharges undisinfected secondary effluent into Swanson Channel through a 60-m outfall (note that the length has previously been erroneously reported as 204 m long) at a depth of 31 m below sea level.

The facility is regulated under BC MWR Permit PE-00220 dated April 28, 1981. Regulatory requirements are described in Table 6.1.

Table 6.1 Cannon Plant Regulatory Requirements

Parameter	Regulatory Requirement
Maximum daily flow	68 m^3/d
Maximum CBOD	45 mg/L
Maximum TSS	60 mg/L

This registration also has a requirement for receiving water monitoring. Routine monitoring was not required for this facility in 2019, and is next required in 2020. In 2019, non-routine emergency receiving environment sampling was not conducted.

The following section reports the results from the Cannon treatment plant monitoring program (Table 6.2).

Table 6.2 Cannon Treatment Plant Environmental Monitoring Program

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring[1] • Influent: TSS, CBOD, fecal coliform • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

Notes:
[1] All substances are listed in Appendix D2

6.2 Results

6.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2019, 15 total daily flows, representing 4% of the year, from the Cannon plant exceeded the allowable maximum (Table 6.3, Appendix D1), down from 2018 when 49 total daily flows exceeded the allowable maximum. Flow exceedances occurred in January, February and December. In 2019 there was one day when there was no power to the flow meter at the Cannon plant, and flow was recorded as an abnormally low value. This erroneous value was deleted (indicated in Appendix D1 by *) and not used in further calculations. The mean flow of 40 m^3/day is typical of the last 10 years and average monthly flow ranged from 27 to 60 m^3/day. Effluent quality was similar to previous years. Only TSS had exceedances of the wastewater quality permit compliance parameters, representing 4% of the sampling days (Table 6.4, Appendix D2).

Overall, the treatment plant removed approximately 84% of the TSS, >99% of the fecal coliform, and 93% of the TBOD from the influent.

Compliance data was reported to the ministry on a monthly basis, with environmental impact reports issued if there was an incident at the plant. There were 13 reports issued at Cannon plant in 2019. 12 of these were a result of overflows due to heavy rain/snow (multiple dates in January, February and December). The remaining report was issued on October 15, 2019 for a TSS exceedance, which was later concluded to be an outlier, likely as a result of debris in the sample, as a second sample collected three hours later was <5 mg/L.

Cannon effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

Table 6.3 Cannon Plant 2019 Annual Flow Summary

Month	Mean Flow (m^3/d)	Min. Flow (m^3/d)	Max. Flow (m^3/d)*	Total Flow (m^3)	# of Samples	Permit Violations (%)
January	60	33	127	1,849	31	19
February	53	32	94	1,490	28	18
March	39	25	47	1,196	31	0
April	43	26	66	1,282	30	0
May	31	13	42	972	31	0
June	27	14	39	819	30	0
July	31	16	43	967	31	0
August	32	16	55	979	31	0
September	30	15	42	900	30	0
October	35	14	66	1,099	31	0
November	43	20	68	1,293	31	0
December	54	54	95	1,681	31	13
Annual	**40**	**13**	**127**	**14,527**	**365**	**4**

Notes:
*Provincially regulated maximum daily flow = 68 m^3/d

Table 6.4 Cannon Plant 2019 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring		
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	TBOD (mg/L)	NH_3 (mg/L N)	pH
Influent							
Regulatory Limit	---	---	---	---	---	---	---
Mean	40	159	---	4,838,468	229	---	---
Minimum	4	10	---	100,000	27	---	---
Maximum	127	540	---	29,000,000	440	---	---
Permit Violations (%)	4	---	---	---	---	---	---
Number of Samples	365	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	68	60	45	---	---	---	---
Mean	40	25	16	15,485	16	4.07	7.1
Minimum	4	2	<2	2,300	3	0.08	6.3
Maximum	127	221	12	250,000	78	16.0	8.0
Percent Reduction	---	84	---	>99	93	---	---
Permit Violations (%)	4	8	0	---	---	---	---
Number of Samples	365	12	12	12	12	12	12

6.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Routine monitoring was not required for this facility in 2019. This sampling was last conducted in 2016 and is next due in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

6.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Investigate ways to eliminate regulatory compliance violations; substantial upgrades to the Cannon plant and collection system would be required for this facility. Staff and consultants completed a Condition Assessment of the sewer service assets in 2011. Several assets were noted to be nearing the end of their life and upgrades were approved. Staff are undertaking the proposed upgrades in a phased manner over a five- to seven-year period. Phase 1 upgrades are about 50% complete, including installation of a new Chart Drive pump station and forcemain, replacement of about 44 m of sewer pipe, implementing an inflow and infiltration reduction program, and assessing the remaining life of the aeration tank at Cannon plant. Phase 2 and Phase 3 upgrades will require the borrowing of funds to complete major upgrades to five pump stations and to Cannon and Schooner plants.

The service area residents recently approved the borrowing of $6 million for capital improvement infrastructure upgrades, including back-up power. Installation of the new standby generator will be complete in 2022. Next steps are being determined, but it is likely that additional funding will be required to complete Phase 2 and 3 of the work. As noted in the Schooner plant section, staff and consultants completed a Condition Assessment of the sewer service assets in 2011. Several assets were noted to be nearing the end of their life and upgrades were recommended. The CRD held a referendum in 2015 to borrow $6.1 million to complete the upgrades, but a majority of the electorate voted no to borrowing funds. Therefore, staff are planning the proposed upgrades in a phased manner over a five- to seven-year period.

The recommendations for Cannon plant is to install a new pump station and pump the flow from this catchment to the upgraded Schooner plant to have it treated there. The Cannon plant could then be decommissioned.

7.0 PORT RENFREW

7.1 Introduction

The Port Renfrew plant is located on the southeast corner of Port San Juan on Vancouver Island (Figure 1-1). It discharges undisinfected secondary treated effluent into Port San Juan through an 81-m outfall at a depth of 3 m.

The facility is regulated under BC MWR Permit PE-00312 dated April 15, 1992. Regulatory requirements are described in Table 7.1.

Table 7.1 Port Renfrew Regulatory Requirements

Parameter	Regulatory Requirement
Maximum daily flow	220 m^3/d
Maximum CBOD	45 mg/L
Maximum TSS	60 mg/L

This registration also has a requirement for receiving water monitoring. Routine monitoring was not required for this facility in 2019, and is next required in 2020.

Non-routine emergency receiving environment sampling was not conducted at the Port Renfrew plant in 2019.

The following section reports the results from the Port Renfrew treatment plant monitoring program (Table 7.2).

Table 7.2 Port Renfrew Treatment Plant Environmental Monitoring Program

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring[1]: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

Notes:
[1] All substances are listed in Appendix E2

7.2 Results

7.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data are summarized in Table 7.3 and the complete data set is presented in Appendix E1. In 2019, there was one exceedance for daily flows at the Port Renfrew plant, representing 0.3% of the year's flow. Average monthly flow was similar to recent years.

Monthly compliance and treatment plant performance monitoring data are summarized in Table 7.4 and the complete data set is presented in Appendix E2. In 2019, there was one permit violation for TSS levels. All other compliance parameters were below regulatory limits. The treatment plant removed approximately 95% of the TSS, 93% of the BOD and >99% of the fecal coliforms.

Compliance data was reported to the ministry on a monthly basis, with environmental impact reports issued if there was an incident at the plant. There were two reports issued at Port Renfrew plant in 2019, as a result of:

- overflow due to heavy rain (January 3); and
- TSS exceedance section (February 19).

Port Renfrew effluent used for testing conducted by Environment Canada as part of an inspection under the *Fisheries Act* passed all additional toxicity tests.

7.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Routine monitoring was not required for this facility in 2019. This sampling was last conducted in 2016 and is next due in 2020, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

Non-routine emergency receiving environment sampling was not conducted in 2019.

Table 7.3 Port Renfrew Plant 2019 Flow Summary

Month	Mean Flow (m^3/d)	Min. Flow (m^3/d)	Max. Flow (m^3/d)*	Total Flow (m^3)	# of Samples	Permit Violations (%)
January	68	31	246	2,112	31	3
February	52	32	81	1,460	28	0
March	42	31	58	1,303	31	0
April	59	31	100	1,768	30	0
May	35	28	47	1,099	31	0
June	34	30	40	1,020	30	0
July	44	34	75	1,370	31	0
August	42	32	62	1,312	31	0
September	54	29	108	1,617	30	0
October	62	35	148	1,912	31	0
November	49	25	179	1,463	30	0
December	60	35	139	1,849	31	0
Annual	**50**	**25**	**246**	**18,285**	**365**	**0.3**

Notes:
*Provincially regulated maximum daily flow = 220 m^3/d

Table 7.4 Port Renfrew Plant 2019 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring		
	Flow (m/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	BOD (mg/L)	NH_3 (mg/L N)	pH
Influent							
Regulatory Limit	---	---	---	---	---	---	---
Mean	50	724	---	8,503,971	303	---	---
Minimum	25	90	---	2,000,000	82	---	---
Maximum	246	5,960	---	44,000,000	1,300	---	---
Permit Violations (%)	1	---	---	---	---	---	---
Number of Samples	365	11	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	220	60	45	---	---	---	---
Mean	50	36	8	34,918	22	2.60	6.0
Minimum	25	7	<4	3,100	5	0.06	4.4
Maximum	246	188	32	1,800,000	71	12.0	7.7
Percent Reduction	---	95	---	>99	93	---	---
Permit Violations (%)	0	1	0	---	---	---	---
Number of Samples	365	12	12	12	12	12	12

7.3 Recommendations

MAINTAIN EFFECTIVENESS AND RELIABILITY OF THE TREATMENT PROCESS

Staff and consultants completed a feasibility study in 2015 to improve/increase the treatment plant capacity and ensure ongoing effective operation of the treatment plant and conveyance system into the future. A condition assessment is also underway. Grant funding will be required in order to complete any upgrades to this system.

8.0 REFERENCES

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APPENDIX A

GANGES PLANT

Appendix A1 Ganges Plant Effluent Flow Data 2019 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	585	520	540	397	402	377	379	816	416	385	363	525
2	496	511	432	512	397	403	369	437	372	370	323	440
3	571	491	430	868	407	359	375	658	375	329	320	307
4	1,114	469	413	896	402	371	414	501	387	377	329	460
5	1,143	613	440	908	382	355	385	426	370	398	342	474
6	662	538	453	786	364	581	405	396	386	381	370	474
7	608	558	426	961	400	370	452	475	562	365	322	448
8	578	335	456	965	403	334	406	398	565	388	358	387
9	573	448	521	856	394	359	533	458	378	399	350	315
10	587	346	523	1,008	418	329	488	705	424	342	361	435
11	628	570	371	744	352	355	433	666	393	352	338	483
12	576	431	505	459	409	353	387	402	406	375	325	487
13	547	357	476	398	348	327	525	558	434	374	429	818
14	498	409	450	442	481	380	696	481	412	358	349	760
15	491	493	521	407	442	376	643	584	404	329	365	598
16	507	579	487	438	381	380	426	419	374	387	385	477
17	476	487	448	431	423	333	393	500	392	391	351	653
18	564	781	450	434	433	367	407	479	433	441	382	595
19	591	659	484	445	466	370	390	433	362	423	401	633
20	620	678	502	451	412	370	419	440	442	500	535	587
21	509	694	478	456	404	358	439	485	384	442	426	654
22	542	614	509	390	416	371	452	562	405	429	400	600
23	677	595	457	398	360	381	383	427	422	549	382	482
24	634	574	448	472	405	339	425	610	393	398	372	455
25	605	476	390	425	448	440	405	583	416	376	334	538
26	547	533	452	421	434	370	489	512	401	368	377	349
27	487	519	492	377	356	368	585	377	393	360	426	401
28	471	507	472	380	404	411	372	470	384	328	563	413
29	518	---	451	354	416	344	460	368	374	354	552	486
30	502	---	414	386	444	379	402	418	358	355	467	474
31	510	---	461	---	402	---	640	434	---	374	---	487
Min	471	335	371	354	348	327	369	368	358	328	320	307
Max	1,143	781	540	1,008	481	581	696	816	565	549	563	818
Average	594	528	463	562	407	374	451	499	407	387	387	506
Total Flow	18,417	14,785	14,352	16,865	12,605	11,210	13,977	15,478	12,217	11,997	11,597	15,695

Note: shading indicates exceedance of regulatory limit (1,090 m^3)

Annual Min	**307**
Annual Max	**1,143**
Annual Average	**464**

Appendix A2 Ganges Plant Compliance and Treatment Plant Performance Monitoring Data 2019

Date	Influent			Secondary Effluent (Undisinfected)		Secondary Effluent (Disinfected)							
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	Unionized NH_3 (mg/L N)	TRC (mg/L)	pH
Regulatory Limit						25		25	1000		1.25	0.02	
January	278	279	5,800,000	1	2	<2	<4	<5	<1	0.27	<0.0005	0.02	7.1
February	134	200	600,000	<1	40	<2	6	<5	<1	13.00	0.0210	<0.02	7.4
March	266	305	8,000,000	1	16	---	6	---	<1	---	---	---	7.4
April	390	436	7,500,000	1	62	<4	5	<5	<1	24.00	0.1000	---	7.6
May	348	310	7,400,000	2	45	<3	<5	<5	<10	26.00	0.0800	0.12	7.7
June	424	630	29,000,000	<2	71	3	7	7	<10	20.00	0.1600	0.04	8.0
July	392	470	11,000,000	2	420	<2	9	<5	<1	29.00	0.2500	---	8.1
August	580	480	29,000,000	1	60	<1	<2	<2	5	1.50	0.0048	0.04	7.2
September	518	470	27,000,000	4	79	<4	<2	<2	1	0.09	<0.0005	0.02	7.8
October	402	410	32,000,000	1	22	<4	<2	<2	<1	0.08	<0.0005	0.02	7.3
November	374	390	26,000,000	<4	148	<4	<2	<2	10	0.08	<0.0005	0.11	7.3
December	272	250	75,000,000	<4	32	<2	<2	<2	22	0.15	<0.0005	0.05	7.3
Mean	365	386	13,035,918	2	83	3	4	4	5	10.38	0.056	0.05	7.5
Min	134	200	600,000	<1	2	<1	<2	<2	<1	0.08	<0.005	<0.02	7.1
Max	580	630	75,000,000	4	420	<4	<9	<7	22	29.0	0.25	0.12	8.1
N	12	12	12	12	12	11	12	11	12	11	11	9	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	169	179	6,047,559	1	39	1	2	2	<1	4.8	0.026	0.02	---

TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, TRC = total residual chlorine, NH_3 = ammonia
Shading indicates exceedance of regulatory limit

Appendix A3 Priority Substances Detected in Ganges Plant Influent and Effluent 2019

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
CONVENTIONALS								
alkalinity	mg/L asCaCO3	---	---	---	---	---		
biochemical oxygen demand (BOD)	mg/L as O2	5.0	470	9	0.021	n/a		
carbonaceous biochemical oxygen demand (CBOD)	mg/L	5.0	3,200	30	0.072	n/a		
chemical oxygen demand (COD)	mg/L as O2	---	---	---	---	---		
cyanide-SAD	mg/L	0.0005	0.0142	0.0014	0.000003	0.0002		
cyanide-WAD	mg/L	0.0005	0.0046	0.0025	0.000006	0.0004	0.001	
Hardness (As Caco3)-dis	mg/L	0.5	95	49	0.116	7.04		
Hardness (As Caco3)-tot	mg/L	0.5	281	46	0.110	6.66		
oil & grease, mineral	mg/L	2	53	<2	ND	ND		
oil & grease, total	mg/L	1	600	<1	ND	ND		
total organic carbon	mg/L	1	240	14	0.033	2.03		
pH	pH	---	5.48	8.21	0	0.00		
pH @ 15° C	pH	---	5.56	7.43	0.018	1.08		
Specific conductivity - 25°C	µS/cm	---	---	696	1.66	n/a		
sulfide	mg/L	0.0019	4	0.019	0.00005	0.003	0.002	
TSS	mg/L	4	4.0	14,900	<4	ND		
temperature	°C	---	---	---	---	---		
BACTERIOLOGY								
Enterococci	CFU/100 mL	10.0	3,100,000	10	0.024	1.45	10.0	35 geomean / 70 single sample
Fecal Coliforms	CFU/100 mL	1.0	11,000,000	<1	ND	ND		
NUTRIENTS								
N - NH3 (as N)	mg/L	0.75	50	30	0.072	4.35	19.7	
N - NH3 (as N)- unionized	mg/L	0.01	0.005	0.22	0.0005	0.032		
N - NO2 (as N)	mg/L	0.01	<0.005	0.102	0.0002	0.015		
N - NO3 (as N)	mg/L	0.02	<0.02	0.087	0.0002	0.013		
N - NO3 + NO2 (as N)	mg/L	0.02	<0.02	0.19	0.0005	0.028		
N - TKN (as N)	mg/L as N	0.000000	0	0	0	0.0000		
P - PO4 - ortho (as P)	mg/L	0.003	15	0.32	0.001	0.05		
P - PO4 - total (as P)	µg/L	5.0	25,000	422	1.01	0.06		
METALS DISSOLVED								
aluminum-dis	µg/L	0.50	1,410	47.8	0.114	0.007		
antimony-dis	µg/L	0.02	0.106	0.289	0.001	0.00004		
arsenic-dis	µg/L	0.02	0.432	0.34	0.001	0.00005		
barium-dis	µg/L	0.02	41.9	6.75	0.016	0.001		
beryllium-dis	µg/L	0.01	0.023	<0.01	ND	ND		

Appendix A3, continued

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
cadmium-dis	µg/L	0.01	0.142	0.096	0.0002	0.00001		
calcium-dis	mg/L	0.05	26.7	13	0.031	1.89		
chromium-dis	µg/L	0.10	1.77	0.39	0.0009	0.0001		
chromium VI	mg/L	0.00	0.0025	0.0015	0.000004	0.0002		
cobalt-dis	µg/L	0.01	0.571	0.19	0.0005	0.00003		
copper-dis	µg/L	0.05	1.93	3.84	0.0092	0.0006		
iron-dis	µg/L	1.00	1790	118	0.282	0.02		
lead-dis	µg/L	0.01	3	0.232	0.0006	0.00003		
magnesium-dis	mg/L	0.05	6.93	3.87	0.0092	0.56		
manganese-dis	µg/L	0.05	151	49.1	0.117	0.007		
mercury-dis	µg/L	0.02	<0.02	<0.02	ND	ND		
molybdenum-dis	µg/L	0.05	4.03	0.097	0.0002	0.00001		
nickel-dis	µg/L	0.02	5.42	1.26	0.003	0.0002		
potassium-dis	mg/L	0.05	19.2	17.9	0.043	2.60		
selenium-dis	µg/L	0.04	0.179	0.088	0.0002	0.00001		
silver-dis	µg/L	0.01	0.0078	0.014	0.00003	0.000002		
thallium-dis	µg/L	0.002	0.0102	<0.002	ND	ND		
tin-dis	µg/L	0.20	0.44	0.64	0.002	0.0001		
zinc-dis	µg/L	0.10	188	51.9	0.124	0.01		
METALS - TOTAL								
aluminum-tot	µg/L	3.00	14,600	45.6	0.109	0.007		
antimony-tot	µg/L	0.02	0.208	0.285	0.001	0.00004		
arsenic-tot	µg/L	0.02	2.13	0.323	0.001	0.00005	0.0125	0.0125
barium-tot	µg/L	0.05	240	6.4	0.015	0.001	0.5	
beryllium-tot	µg/L	0.01	0.252	<0.01	ND	ND		
cadmium-tot	µg/L	0.01	1.99	0.0923	0.0002	0.00001	0.00012	0.00012
calcium-tot	mg/L	0.25	89.7	12.2	0.0291	1.77		
chromium-tot	µg/L	0.10	18.7	0.37	0.0009	0.0001		
cobalt-tot	µg/L	0.01	3.7	0.179	0.0004	0.00003		
copper-tot	µg/L	0.10	418	3.87	0.0092	0.0006	0.003	
iron-tot	µg/L	5.00	4,350	116	0.277	0.02		
lead-tot	µg/L	0.02	50.9	0.238	0.0006	0.00003	0.14	
magnesium-tot	mg/L	0.25	13.7	3.71	0.0089	0.54		
manganese-tot	µg/L	0.10	487	46.7	0.1115	0.01	0.1	
mercury-tot	µg/L	0.00	0.059	0.003	0.00001	0.0000004	0.00002	
molybdenum-tot	µg/L	0.05	1.06	0.091	0.0002	0.00001		
nickel-tot	µg/L	0.10	29.4	1.15	0.0027	0.0002	0.083	
potassium-tot	mg/L	0.25	26.2	16.8	0.0401	2.44		
selenium-tot	µg/L	0.04	0.569	0.075	0.0002	0.00001		

Appendix A3, continued

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
silver-tot	µg/L	0.01	0.274	0.01	0.00002	0.000001	0.003	
thallium-tot	µg/L	0.002	0.163	<0.002	ND	ND		
tin-tot	µg/L	0.20	2.39	0.58	0.001	0.0001		
zinc-tot	µg/L	1.00	2,030	49.3	0.118	0.01	0.01	
METALS - OTHER								
dibutyltin	µg/L	0.001	<0.001	<0.001	ND	ND		
dibutyltin dichloride	µg/L	0.001	<0.001	<0.001	ND	ND		
methyl mercury	ng/L	0.02	1.03	0.047	0.00011	0.00000001		
monobutyltin	µg/L	0.001	0.005	0.018	0.00004	0.000003		
monobutyltin trichloride	µg/L	0.001	0.008	0.029	0.00007	0.000004		
tributyltin	µg/L	0.001	<0.001	<0.001	ND	ND		
tributyltin chloride	µg/L	0.001	<0.001	<0.001	ND	ND		
ALDEHYDES								
acrolein	µg/L	3.0	<3	<3	ND	ND		
CHLORINATED PHENOLICS								
2,4 + 2,5 dichlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
2-chlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
2,4,6-trichlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
4-chloro-3-methylphenol	µg/L	1.0	<1	<1	ND	ND		
pentachlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
PHENOLIC COMPOUNDS								
total phenols	mg/L	0.0	0.11	0.011	0.00003	0.002		
NON-CHLORINATED PHENOLICS								
2,4-dimethylphenol	µg/L	2.5	<2.5	<2.5	ND	ND		
2,4-dinitrophenol	µg/L	6.5	<6.5	<6.5	ND	ND		
4,6-dinitro-2-methylphenol	µg/L	2.5	<2.5	<2.5	ND	ND		
2-nitrophenol	µg/L	2.5	<2.5	<2.5	ND	ND		
4-nitrophenol	µg/L	2.5	<2.5	<2.5	ND	ND		
phenol	µg/L	2.5	17.1	<2.5	ND	ND		
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)								
2-chloronaphthalene	µg/L	0.25	<0.25	<0.25	ND	ND		
2-methylnaphthalene	µg/L	0.01	0.025	0.012	0.00003	0.000002	0.001	
acenaphthene	µg/L	0.01	0.018	<0.01	ND	ND	0.006	
acenaphthylene	µg/L	0.01	0.11	<0.01	ND	ND		
anthracene	µg/L	0.01	<0.01	<0.01	ND	ND		
benzo(a)anthracene	µg/L	0.01	0.016	<0.01	ND	ND		
benzo(a)pyrene	µg/L	0.01	<0.005	<0.005	ND	ND	0.00001	
benzo(b)fluoranthene	µg/L	0.01	0.014	<0.01	ND	ND		
benzo(b)fluoranthene + benzo(j)fluoranthene	µg/L	0.01	0.014	<0.01	ND	ND		

Appendix A3, continued

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
benzo(g,h,i)perylene	µg/L	0.02	<0.02	<0.02	ND	ND		
benzo(k)fluoranthene	µg/L	0.01	<0.01	<0.01	ND	ND		
chrysene	µg/L	0.01	0.15	<0.01	ND	ND	0.0001	
fluoranthene	µg/L	0.01	0.016	<0.01	ND	ND		
fluorene	µg/L	0.01	0.069	0.011	0.00003	0.000002	0.012	
indeno(1,2,3-c,d)pyrene	µg/L	0.02	<0.02	<0.02	ND	ND		
naphthalene	µg/L	0.01	0.017	0.024	0.00006	0.000003	0.001	
phenanthrene	µg/L	0.01	0.044	0.02	0.00005	0.000003		
pyrene	µg/L	0.01	0.017	<0.01	ND	ND		
PAH-high molecular weight	µg/L	0.02	0.21	<0.02	ND	ND		
PAH-low molecular weight	µg/L	0.01	0.32	0.11	0.00026	0.00002		
total PAHs	µg/L	0.02	0.54	0.11	0.00026	0.00002		
SEMIVOLATILE ORGANICS								
bis(2-ethylhexyl)phthalate	µg/L	5.0	7.9	<5	ND	ND		
butylbenzyl phthalate	µg/L	2.5	<2.5	<2.5	ND	ND		
diethyl phthalate	µg/L	0.3	1.35	11.6	0.0277	0.002		
dimethyl phthalate	µg/L	0.3	<0.25	<0.25	ND	ND		
di-n-butyl phthalate	µg/L	2.5	<2.5	<2.5	ND	ND		
di-n-octyl phthalate	µg/L	0.3	<0.25	<0.25	ND	ND		
MISC SEMIVOLATILE ORGANICS								
bis(2-chloroethoxy)methane	µg/L	0.3	<0.25	<0.25	ND	ND		
bis(2-chloroethyl)ether	µg/L	0.3	<0.25	<0.25	ND	ND		
bis(2-chloroisopropyl)ether	µg/L	0.3	<0.25	<0.25	ND	ND		
hexachlorobutadiene	µg/L	0.3	<0.25	<0.25	ND	ND		
hexachlorocyclopentadiene	µg/L	0.3	<0.25	<0.25	ND	ND		
hexachloroethane	µg/L	0.3	<0.25	<0.25	ND	ND		
isophorone	µg/L	0.3	<0.25	<0.25	ND	ND		
nitrobenzene	µg/L	0.3	<0.25	<0.25	ND	ND		
N-nitrosodimethylamine	µg/L	1.0	<1	<1	ND	ND		
N-nitrosodi-n-propylamine	µg/L	1.0	<1	<1	ND	ND		
N-nitrosodiphenylamine	µg/L	1.0	<1	<1	ND	ND		
VOLATILE ORGANIC COMPOUNDS								
MONOCYCLIC AROMATIC HYDROCARBONS								
1,2,4-trichlorobenzene	µg/L	0.2	<0.2	<0.2	ND	ND		
1,2-dichlorobenzene	µg/L	0.5	<0.5	<0.5	ND	ND		
1,2-diphenylhydrazine	µg/L	0.1	<0.05	<0.05	ND	ND		
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	ND	ND		
1,4-dichlorobenzene	µg/L	0.5	1.2	<0.5	ND	ND		
2,6-dinitrotoluene	µg/L	0.3	<0.25	<0.25	ND	ND		

Appendix A3, continued

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
3,3-dichlorobenzidine	µg/L	0.5	<0.5	<0.5	ND	ND		
4-bromophenyl phenyl ether	µg/L	0.1	<0.05	<0.05	ND	ND		
4-chlorophenyl phenyl ether	µg/L	0.3	<0.25	<0.25	ND	ND		
benzene	µg/L	0.4	<0.4	<0.4	ND	ND	0.11	
ethylbenzene	µg/L	0.4	<0.4	<0.4	ND	ND	0.25	
m & p xylenes	µg/L	0.4	<0.4	<0.4	ND	ND		
o-xylene	µg/L	0.4	<0.4	<0.4	ND	ND		
styrene	µg/L	0.5	<0.5	<0.5	ND	ND		
toluene	µg/L	0.4	270	<0.4	ND	ND		
xylenes	µg/L	0.4	<0.4	<0.4	ND	ND		
CHLORINATED ALIPHATIC								
1,1,1,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1,2,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1,1-trichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1,2-trichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,2-dichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1-dichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1-dichloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
1,4-dioxane	µg/L	0.5	<0.49	<0.49	ND	ND		
2,4-dinitrotoluene	µg/L	0.3	<0.25	<0.25	ND	ND		
alpha-terpineol	µg/L	5.0	9	<5	ND	ND		
bromomethane	µg/L	1.0	<1	<1	ND	ND		
chlorobenzene	µg/L	0.5	<0.5	<0.5	ND	ND		
chlorodibromomethane	µg/L	1.0	<1	<1	ND	ND		
chloroethane	µg/L	1.0	<1	<1	ND	ND		
chloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
chloromethane	µg/L	1.0	<1	<1	ND	ND		
ALIPHATIC								
acrylonitrile	µg/L	1.0	<1	<1	ND	ND		
methyl tertiary butyl ether	µg/L	4.0	<4	<4	ND	ND		
cis-1,3-dichloropropene	µg/L	1.0	<1	<1	ND	ND		
dibenzo(a,h)anthracene	µg/L	0.0	<0.02	<0.02	ND	ND		
1,2-dibromoethane	µg/L	0.2	<0.2	<0.2	ND	ND		
dibromomethane	µg/L	0.9	<0.9	<0.9	ND	ND		
dichloromethane	µg/L	2.0	5.3	<2	ND	ND		
tetrabromomethane	µg/L	50.0	<50	<50	ND	ND		
tetrachloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
tetrachloromethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	ND	ND		

Appendix A3, continued

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
trans-1,2-dichloroethene	µg/L	1.0	<1	<1	ND	ND		
trans-1,3-dichloropropene	µg/L	1.0	<1	<1	ND	ND		
trichloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
trichlorofluoromethane	µg/L	4.0	<4	<4	ND	ND		
trichloromethane	µg/L	1.0	7.9	1.7	0.0041	0.0002		
TRIHALOMETHANES								
bromodichloromethane	µg/L	1.0	<1	<1	ND	ND		
dichlorodifluoromethane	µg/L	2.0	<2	<2	ND	ND		
tribromomethane	µg/L	1	<1	<1	ND	ND		
KETONES								
dimethyl ketone	µg/L	15	310	<15	ND	ND		
methyl ethyl ketone	µg/L	50	<50	<50	ND	ND		
methyl isobutyl ketone	µg/L	10	<10	<10	ND	ND		

Notes: Shading indicates WQG exceedance
*dilution calculated from maximum concentration
BC WQG = British Columbia Water Quality Guidelines, CCME WQG = Canadian Council of Ministers of the Environment Water Quality Guidelines, HC = Health Canada WQG
NM indicates not measured
ND indicates non detect
--- value not available

Appendix A4 Ganges Plant Sludge (Mixed Liquor) Concentrations 2019

Regulated Parameters (mg/kg dry wt)	Class A Biosolids Limit (mg/kg)*	Jan	Feb+		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Metals															
arsenic	20	1.42	1.26	0.02	1.3	1.05	2.7	0.51	1.2	1.11	1.67	<2	1.54	1.48	1.47
cadmium	20	1.04	1.32	0.04	1.48	1.21	1.08	0.399	0.856	1.03	1.38	1.39	1.37	1.36	1.17
chromium	100	6	7.8	0.05	7.6	5.3	9.9	1.8	5.6	5.7	8	8	8.9	7.6	7.30
cobalt	25	1.23	1.18	0.01	1.11	0.96	3.15	0.54	1.05	0.98	1.28	1.24	1.6	1.39	2.36
copper	3,500	524	544	6	456	331	349	112	327	421	572	569	567	641	798
lead	120	8.93	8.01	0.07	7.04	6.62	9.37	2.14	6.76	8.27	8.76	9.16	11.3	10.3	10.70
mercury	10	0.535	1.35	0.24	0.404	0.405	0.615	0.234	0.482	1.12	1.44	1.95	0.735	0.823	1.11
molybdenum	200	2.44	2.29	0.04	2.68	2.17	2.56	0.77	2.18	2.47	2.9	2.81	3.18	3.21	2.93
nickel	450	9.53	8.76	0.03	8.23	7.4	11.4	3.21	7.55	7.77	10.8	10.8	11	10.8	9.63
selenium	200	2.88	2.14	0.03	2.42	2.17	2.26	0.5	2.15	2.53	2.67	2.88	2.75	2.82	2.48
zinc	10,000	224	204	4.00	201	175	205	77.8	232	195	300	297	278	270	282

Unregulated Parameters (mg/kg dry wt)	Class A Biosolids Limit (mg/kg)*	Jan	Feb+		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Conventionals															
Metals															
aluminum	n/a	2,960	2,155	45	2,250	1,790	4,970	845	2,140	2,040	2,480	2,470	2,660	2,540	2,480
antimony	n/a	0.65	0.56	0.06	0.88	0.68	0.74	0.21	0.56	0.6	0.94	0.92	0.71	0.73	0.64
barium	n/a	46.2	36.9	0.65	37	41.7	65.7	9.6	33.8	32.1	45.1	45.1	60.9	60.9	72.90
beryllium	n/a	<0.14	<0.1	n/a	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.53	<0.67	<0.1	<0.14	<0.1
bismuth	n/a	10.5	9.1	0.27	12.4	11.6	13.4	3.62	12.3	13.2	18	17.8	14.6	15.5	16.10
boron	n/a	81.1	75.8	1.20	---	63.5	76.7	27.9	85.9	54.5	78.6	80.9	76.6	51	41.20
calcium	n/a	9,200	7,875	65	8,470	7,110	9,170	1,360	7,110	6,910	9,400	9,260	7,020	9,140	8,330
iron	n/a	3,990	3,220	50	3,530	2,480	6,350	937	2,810	2,660	4,010	3,980	3,870	3,520	4,140
lithium	n/a	2.39	1.83	0	2.01	1.57	3.85	1.12	1.45	1.2	1.82	1.88	1.79	1.7	1.71
magnesium	n/a	5,940	4,750	90	5,630	4,140	4,970	1,810	4,180	5,450	6,750	6,830	4,440	5,020	4,490
manganese	n/a	125	108	3.00	112	98.2	269	48.7	97.6	80.4	110	112	131	193	319
phosphorus	n/a	20,100	18,900	400	22,500	17,100	17,300	5,740	17,500	21,400	31,700	32,400	15,600	21,200	17,600
potassium	n/a	11,800	10,400	100	12,600	10,200	10,500	4,050	9,990	12,300	13,900	14,400	5,530	10,800	7,750
silver	n/a	2.52	1.40	0.04	1.82	1.94	2.56	1.29	3.22	5.53	7.46	7.69	9.6	7.2	7.54
sodium	n/a	5,030	4,010	40	5,350	4,150	4,360	2,270	4,110	6,380	7,040	7,280	1,930	5,740	4,680
strontium	n/a	51.2	44.0	0.55	50.7	40.7	56.8	5.69	35.1	33.1	47.5	48.1	38.4	49.7	48.90
sulphur	n/a	7,840	8,365	235	---	7,250	9,410	2,500	9,130	7,440	<5260	<6670	8,440	8,630	7,830
tellurium	n/a	<0.14	<0.1	0	---	<0.1	<0.1	<0.1	<0.1	<0.1	<0.53	<0.67	<0.1	<0.14	<0.1
thallium	n/a	<0.14	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.53	<0.67	<0.1	<0.14	<0.1
thorium	n/a	<0.7	<0.5	0	---	<0.5	<0.5	<0.5	<0.5	<0.5	<2.63	<3.33	<0.5	<0.72	<0.5
tin	n/a	9.68	8.15	0.04	9.87	9.38	9.85	2.09	8.24	9.07	13.5	13.2	12.9	13.2	14.20
titanium	n/a	42.8	24.9	2.05	44.1	37.5	112	6.6	25.5	29.7	34.1	44.2	52.6	33.3	55.50
tungsten	n/a	---	---	---	0.33	0.24	0.25	<0.2	0.27	0.42	<1.05	<1.33	0.33	0.33	0.25
uranium	n/a	0.166	0.135	0.00	0.117	0.123	0.194	<0.05	0.096	0.089	<0.263	<0.333	0.146	0.117	0.13
vanadium	n/a	4.5	4.2	0.05	4.1	2.7	12.5	2.1	3.5	2.3	<5.3	<6.7	4.2	2.5	3.50
zirconium	n/a	<2.8	1.95	0.95	2.6	2.8	2.2	<2	<2	<2	<10.5	<13.3	3.1	<2.9	2.60

Notes:

Shading indicates exceedance of regulatory limit

+ represents the mean of two field replicate samples.

--- indicates sludge not collected due to facility construction.

** From Organic Matter Recycling Regulation (B.C. Reg. 18/2002, Schedule 4 Section 3, February 28, 2019) which references Trade Memorandum T-4-93 'Safety Guidelines for Fertilizers and Supplements' (Sept 1997) and contains maximum acceptable metal concentrations based on annual application rates (mg metal/kg product) 4400 kg/ha –yr.*

APPENDIX B

MALIVIEW PLANT

Appendix B1 Maliview Plant Effluent Flow Data 2019 (m^3/day)

Day	Jan			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C
1	76	76	152	14	70	83	32	75	107	0	54	54	0	54	54	0	38	38	0	47	47	0	28	28	0	36	36	0	21	21	0	45	45	9	51	59
2	61	74	135	36	70	105	21	68	89	0	47	47	0	53	53	0	39	39	0	46	46	0	28	28	0	30	30	0	29	29	0	47	47	7	50	57
3	57	71	127	39	67	106	15	64	79	0	46	46	0	45	45	0	40	40	0	41	41	0	28	28	0	37	37	0	31	31	0	42	42	6	50	56
4	230	67	296	38	68	106	17	63	80	0	54	54	0	52	52	0	37	37	0	39	39	0	30	30	0	32	32	0	27	27	0	40	40	5	54	58
5	219	67	286	25	69	93	11	55	66	0	52	52	0	54	54	0	37	37	0	35	35	0	30	30	0	33	33	0	35	35	0	32	32	6	53	59
6	131	71	202	18	69	87	10	60	70	0	53	53	0	50	50	0	38	38	0	37	37	0	29	29	0	30	30	0	33	33	0	40	40	4	51	54
7	112	67	179	14	68	82	9	58	67	0	57	57	0	49	49	0	34	34	0	34	34	0	30	30	0	33	33	0	38	38	0	39	39	6	53	59
8	82	66	147	15	67	82	8	57	65	0	66	66	0	44	44	0	39	39	0	41	41	0	27	27	2	31	33	0	36	36	0	38	38	9	51	59
9	67	65	131	20	63	82	8	52	60	0	62	62	0	45	45	0	39	39	0	*	*	0	27	27	1	36	37	0	29	29	0	38	38	17	56	73
10	72	64	135	18	65	83	13	*	*	4	80	84	0	47	47	0	39	39	0	24	24	0	35	35	0	33	33	0	34	34	1	43	44	16	41	57
11	87	62	149	15	64	79	13	*	*	0	69	69	0	*	*	0	38	38	0	32	32	0	27	27	0	33	33	0	34	34	0	43	43	10	58	68
12	69	64	133	13	65	78	13	56	70	2	75	77	0	*	*	0	23	23	0	32	32	0	29	29	2	31	33	0	37	37	2	39	41	16	61	76
13	52	63	115	11	57	68	8	58	66	7	90	97	0	*	*	0	32	32	0	30	30	0	21	21	0	36	36	0	38	38	1	64	64	80	64	144
14	48	66	113	9	72	81	6	57	63	6	88	94	0	41	41	0	34	34	0	33	33	0	30	30	0	39	39	0	36	36	0	67	67	75	65	140
15	42	68	109	5	74	79	5	57	62	5	86	91	0	40	40	0	35	35	0	33	33	0	30	30	0	47	47	0	47	47	0	61	61	51	64	115
16	27	69	96	14	75	89	3	26	29	0	68	68	0	41	41	0	33	33	0	35	35	0	28	28	0	41	41	0	31	31	0	65	65	42	63	105
17	24	69	93	49	78	127	8	60	67	0	69	69	0	42	42	0	37	37	0	30	30	0	29	29	0	34	34	0	43	43	2	67	68	33	62	95
18	26	71	97	102	72	174	8	56	64	0	66	66	0	44	44	0	35	35	0	29	29	0	29	29	0	39	39	0	44	44	15	73	87	35	62	96
19	42	72	114	96	71	167	6	54	60	1	73	73	0	49	49	0	31	31	0	39	39	0	35	35	0	37	37	0	55	55	30	70	100	35	62	97
20	82	71	153	97	69	166	7	55	62	4	80	84	0	69	69	0	34	34	0	32	32	0	32	32	0	35	35	2	79	81	75	48	123	74	65	139
21	84	71	154	102	67	169	4	53	57	2	77	79	0	65	65	0	30	30	0	35	35	0	33	33	0	36	36	2	83	85	45	59	103	102	64	166
22	51	68	118	77	66	143	5	52	57	2	75	77	1	46	47	0	34	34	0	39	39	0	29	29	0	38	38	33	54	87	34	58	92	104	64	168
23	71	79	150	70	64	134	6	52	58	0	72	72	0	39	39	0	32	32	0	38	38	0	32	32	0	46	46	22	90	112	30	57	87	74	63	136
24	137	70	207	68	63	130	8	52	60	1	71	71	0	33	33	0	41	41	0	30	30	0	31	31	0	44	44	13	76	89	26	57	83	53	48	101
25	88	71	159	69	61	130	10	50	59	0	71	71	0	36	36	0	34	34	0	37	37	0	35	35	0	43	43	4	72	76	26	56	82	44	59	103
26	66	72	137	59	61	119	7	50	57	0	64	64	2	39	41	0	34	34	0	33	33	0	34	34	0	45	45	2	68	69	19	56	75	47	60	107
27	51	71	122	43	64	106	2	54	55	0	62	62	0	46	46	0	33	33	0	32	32	0	32	32	0	34	34	1	60	61	22	57	78	47	60	106
28	41	72	113	23	76	99	0	55	55	2	56	58	0	39	39	0	36	36	0	31	31	0	30	30	0	33	33	0	61	61	19	58	76	43	61	104
29	32	71	103	---	---	---	0	51	51	1	65	66	0	37	37	0	43	43	0	28	28	0	28	28	0	37	37	0	52	52	8	55	62	33	60	93
30	28	73	100	---	---	---	0	50	50	0	56	56	0	38	38	0	45	45	0	42	42	0	31	31	0	39	39	0	49	49	7	53	60	28	62	89
31	22	*	*	---	---	---	0	51	51	---	---	---	0	37	37	---	---	---	0	29	29	0	31	31	---	---	---	0	46	46	---	---	---	33	63	96
Min	22	62	93	5	57	68	0	26	29	0	46	46	0	33	33	0	23	23	0	24	24	0	21	21	0	30	30	0	21	21	0	32	32	4	41	54
Max	230	79	296	102	78	174	32	75	107	7	90	97	2	69	69	0	45	45	0	47	47	0	35	35	2	47	47	33	90	112	75	73	123	104	65	168
Average	73	69	144	41	67	109	8	55	63	1	67	68	0	45	45	0	36	36	0	34	34	0	30	30	0	36	36	2	47	50	12	52	64	37	58	94
Total Flows	2,267	2,074	4,319	1,153	1,887	3,040	259	1,595	1,828	34	1,998	2,032	2	1,268	1,270	0	1,066	1,066	0	1,035	1,035	0	920	920	4	1,090	1,094	77	1,459	1,536	356	1,560	1,916	1,136	1,793	2,928

Annual Min	**0**	**21**	**21**
Annual Max	**230**	**90**	**296**
Annual Average	**15**	**50**	**64**

Notes: F-S: Fine-screened; Sec: Secondary; T-C: Total combined.
*indicates power outage, resulting in no/faulty flow data recorded.
Shading indicates exceedance of regulatory limit (190 m^3/day)

Appendix B2 Maliview Plant Compliance and Treatment Plant Performance Monitoring Data 2019

Date	Influent			Secondary Effluent (Undisinfected)						Secondary Effluent (Disinfected)							
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH	TSS (mg/L)	TSS Applicable Limit (mg/L)	BOD (mg/L)	CBOD (mg/L)	CBOD Applicable Limit (mg/L)	FC (CFU/100 mL)	Ammonia (mg/L N)	pH
January	104	170	2,400,000	8	11	6	9,600	4.8	7.0	11	130	13	9	130	11,000	5.6	7.0
February	66	147	240,000	14	19	15	21,000	21.2	7.4	71	130	94	87	130	420,000	12.1	7.5
March	750	488	4,400,000	26	26	20	110,000	28.5	7.4	25	130	27	17	130	76,000	---	7.4
April	124	161	1,100,000	20	29	20	110,000	24.8	7.5	24	45	22	16	45	130,000	23.1	7.5
May	1070	770	3,200,000	88	81	140	1,600,000	35.0	7.8	92	45	120	140	45	1,800,000	37.0	7.8
June	294	370	6,400,000	45	94	89	1,300,000	59.0	7.8	43	45	79	80	45	2,400,000	59.0	7.8
July	113	230	3,900,000	25	35	29	450,000	47.0	7.9	31	45	31	27	45	290,000	45.0	8.0
August	300	580	11,000,000	32	32	26	>660000	56.0	7.5	32	45	30	25	45	1,400,000	57.0	7.4
September	330	320	5,500,000	36	35	33	2,000,000	43.0	7.8	37	45	34	31	45	1,800,000	46.0	7.9
October	370	510	74,000,000	226	230	180	11,000,000	42.0	7.2	230	45	170	180	45	9,600,000	42.0	7.2
November	184	210	3,700,000	86	79	20	2,400,000	40.0	7.5	78	45	79	9	45	8,200,000	63.0	7.5
December	65	64	23,000,000	15	15	13	1,000,000	30.0	7.5	68	130	19	18	130	2,400,000	32.0	7.7
Mean	314	335	4,578,413	52	52	28	455,401	36	7.5	62		60	53		740,596	38	7.6
Min	65	64	240,000	8	11	6	9,600	5	7.0	11		13	9		11,000	6	7.0
Max	1,070	770	74,000,000	226	230	180	11,000,000	59	7.9	230		170	180		9,600,000	63	8.0
N	12	12	12	12	12	12	12	12	12	12		12	12		12	11	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	---	kg/day	---	kg/day	kg/day	---	kg/day	kg/day	---
	20	21	288,987	3	3	1	22,531	2	---	4	---	4	3	---	46,746	2	---

Notes:
TSS and CBOD shading indicates exceeding of the applicable regulatory limit; FC = Fecal Coliforms
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, TRC = total residual chlorine, NH_3 = ammonia

APPENDIX C

SCHOONER PLANT

Appendix C1 Schooner Plant Effluent Flow Data 2019 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	481	280	291	223	195	130	176	125	181	146	137	156
2	412	360	301	186	200	147	170	138	168	129	151	155
3	390	353	285	205	196	157	167	152	175	114	154	140
4	873	328	283	216	193	158	159	160	140	129	154	148
5	919	317	290	198	208	125	153	148	137	137	160	139
6	550	297	271	195	187	146	144	164	109	149	137	139
7	465	308	302	199	205	139	156	139	123	144	129	135
8	418	299	278	201	192	136	167	144	146	179	132	169
9	368	293	276	204	178	145	141	131	129	142	148	153
10	351	350	274	234	168	153	128	75	133	167	146	160
11	333	310	281	218	176	142	144	244	128	162	170	150
12	338	296	275	259	176	152	143	155	127	172	174	142
13	336	267	274	273	177	129	139	154	141	173	198	331
14	313	303	281	283	166	135	159	127	138	199	194	317
15	306	271	266	276	153	141	152	138	149	189	168	283
16	296	318	262	302	155	157	143	144	170	164	193	257
17	278	385	268	236	157	149	128	139	152	189	215	235
18	285	506	265	225	158	146	147	152	144	225	274	207
19	285	478	261	293	185	129	129	160	165	221	300	200
20	315	444	253	328	188	146	143	145	139	229	340	259
21	314	434	252	309	192	136	136	141	138	241	264	434
22	283	414	252	292	166	135	159	144	138	366	232	537
23	346	395	264	288	148	149	140	142	171	376	218	383
24	495	387	255	257	164	165	126	162	181	268	204	307
25	399	381	233	243	147	155	128	172	178	212	187	290
26	357	366	234	232	174	140	122	176	150	187	190	272
27	362	328	232	229	173	131	134	159	141	185	152	238
28	343	291	207	225	158	170	141	139	153	186	153	248
29	313	---	210	227	156	147	141	149	158	163	153	229
30	296	---	207	215	139	175	137	150	159	141	152	227
31	281	---	219	---	141	---	126	157	---	142	---	216
Min	278	267	207	186	139	125	122	75	109	114	129	135
Max	919	506	302	328	208	175	176	244	181	376	340	537
Average	390	349	261	242	173	146	144	149	149	188	186	234
Total Flows	12,101	9,759	8,102	7,271	5,371	4,365	4,478	4,625	4,461	5,826	5,579	7,256

Annual Min	**75**
Annual Max	**919**
Annual Average	**217**

Note: shading indicates exceedance of regulatory limit (640 m^3/day)

Appendix C2 Schooner Plant Compliance and Treatment Plant Performance Monitoring Data 2019

Date	Influent			Secondary Effluent (Undisinfected)		Secondary Effluent (Disinfected)							
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	Unionized NH_3 (mg/L N)	TRC (mg/L)	pH
Regulatory Limit						45 max / 25 average		45 max / 25 average	200		1.25	0.02	
January	128	96	9,100,000	11	8,200	10	5	<5	16	0.04	<0.0005	---	6.8
February	90	114	3,900,000	7	19,000	7	<4	<5	4	0.04	<0.0005	---	6.7
March	548	323	1,300,000	5	21,000	---	<4	---	2	---	<0.0005	---	6.7
April	219	245	3,600,000	3	4,800	4	<4	<5	1	0.04	<0.0005	---	6.9
May	420	310	33,000,000	6	3,400	6	<5	<5	10	0.62	0.00052	---	7.7
June	260	310	24,000,000	3	5,900	3	6	<5	10	0.11	<0.0005	---	7.3
July	322	450	8,900,000	6	8,800	4	<5	<5	9	0.13	0.00053	---	7.5
August	330	370	67,000,000	4	8,500	6	3	<2	120	0.24	<50	---	6.6
September	180	250	---	4	29,000	3	<2	<2	100	0.20	<0.0005	---	7.4
October	46	34	3,900,000	2	10,000	4	<2	<2	15	0.30	0.0007	---	6.9
November	264	140	6,000,000	7	46,000	6	4	<2	<1	0.62	0.00096	---	6.9
December	280	91	31,000,000	4	*	3	3	2	<1	0.11	<0.0005	---	7.1
Mean	257	228	9,500,318	5	11,097	5	4	4	24	0.22	0.0004	---	7.1
Min	46	34	1,300,000	2	3,400	3	<2	<2	1	0.04	<0.0005	---	6.6
Max	548	450	67,000,000	11	46,000	10	6	5	120	0.6	0.00096	---	7.7
N	12	12	11	12	11	11	12	11	12	11	12	12	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	56	**49**	**2,061,283**	**1**	**1,108**	**1**	**1**	**1**	**5**	0.05	0.0001		---

Notes:
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, TRC = total residual chlorine, NH_3 = ammonia
* faulty data, so value removed from calculations
--- data not collected
Shading indicates exceedance of regulatory limit

APPENDIX D

CANNON PLANT

Appendix D1 Cannon Plant Effluent Flow Data 2019 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	70	41	45	41	39	26	34	35	34	30	20	47
2	65	48	45	43	42	27	38	18	32	31	37	44
3	58	56	45	26	32	29	34	36	32	27	38	45
4	127	58	47	44	35	25	33	40	28	14	36	41
5	118	38	42	41	37	25	21	41	26	32	35	42
6	84	45	41	37	38	25	32	43	15	33	35	24
7	77	44	40	37	32	14	32	33	24	33	32	44
8	65	42	41	35	32	16	35	32	26	42	34	45
9	60	39	29	40	31	18	30	25	27	40	36	45
10	59	94	40	42	18	39	29	28	27	18	38	43
11	43	41	37	41	31	29	32	55	28	27	42	40
12	51	40	41	43	31	28	39	35	24	28	46	42
13	50	35	41	33	34	26	22	32	16	28	51	70
14	50	36	40	46	34	16	36	31	30	28	32	66
15	47	32	40	49	31	29	43	29	31	24	45	60
16	45	46	28	45	31	27	34	28	33	26	44	60
17	42	61	37	44	18	30	30	21	29	14	47	53
18	33	86	40	40	33	30	30	30	32	57	58	52
19	47	78	39	43	35	28	16	30	40	*	59	39
20	51	73	39	66	39	27	29	30	18	32	68	63
21	53	69	25	60	39	28	31	27	30	46	58	89
22	47	52	37	53	34	19	30	32	30	66	38	95
23	57	60	41	53	31	36	31	16	39	63	54	76
24	78	60	40	51	18	33	35	34	41	51	51	66
25	67	60	43	28	27	31	31	34	42	49	53	62
26	54	56	37	42	34	27	27	35	38	46	47	58
27	56	50	36	39	34	27	21	33	36	44	46	58
28	53	50	34	43	33	33	33	30	19	47	44	54
29	48	---	36	41	29	35	35	32	37	42	44	55
30	48	---	36	36	27	36	32	22	36	41	25	53
31	46	---	34	---	13	---	32	32	---	36	---	50
Min	33	32	25	26	13	14	16	16	15	14	20	24
Max	127	94	47	66	42	39	43	55	42	66	68	95
Average	60	53	39	43	31	27	31	32	30	37	43	54
Total Flows	1,849	1,490	1,196	1,282	972	819	967	979	900	1,095	1,293	1,681

Annual Min	**4**
Annual Max	**127**
Annual Average	**40**

Notes:

***** indicates power outage, resulting in no/faulty flow data recorded; shading indicates exceedance of regulatory limit (68 m^3/day)

Appendix D2 Cannon Plant Compliance and Treatment Plan Performance Monitoring Data 2019

Date	Influent			Secondary Effluent (Undisinfected)					
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH
Regulatory Limit				60		45			
January	362	284	>10000000	4	5	<4	2,500	0.35	6.3
February	80	92	2,200,000	4	8	<4	3,100	0.82	6.6
March	258	350	850,000	6	7	5	2,600	1.94	6.7
April	100	>300	7,800,000	9	10	5	250,000	0.08	6.7
May	66	160	18,000,000	6	11	<5	100,000	16.00	8.0
June	77	410	6,500,000	11	26	8	4,600	9.10	7.7
July	122	220	2,200,000	13	20	6	43,000	0.12	7.7
August	540	440	27,000,000	2	15	2	11,000	15.00	7.2
September	220	270	100,000	4	7	<2	2,300	1.10	7.5
October	10	27	5,600,000	221	78	12	10,000	0.38	6.6
November	35	150	10,000,000	8	3	<2	58,000	3.80	7.0
December	32	41	29,000,000	15	7	6	130,000	0.10	6.7
Mean	159	229	4,838,468	25	16	16	15,485	4.1	7.1
Min	10	27	100,000	2	3	<2	2,300	0.08	6.3
Max	540	440	29,000,000	221	78	12	250,000	16.0	8.0
N	12	12	12	12	12	12	12	12	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	6	9	192,571	1	1	1	616	0.2	---

Notes:
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, NH_3 = ammonia
Shading indicates exceedance of regulatory limit

APPENDIX E

PORT RENFREW PLANT

Appendix E1 Port Renfrew Plant Effluent Flow Data 2019 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	62	32	39	42	40	35	53	40	39	51	34	35
2	48	76	35	35	34	36	43	47	42	49	33	37
3	82	59	38	31	33	39	39	52	38	39	31	35
4	246	50	42	51	33	39	38	46	34	39	34	44
5	146	43	44	49	41	33	40	45	31	50	30	67
6	84	40	45	58	36	32	37	45	39	52	29	47
7	81	40	38	75	31	38	36	37	29	46	27	42
8	68	41	58	82	29	34	39	38	29	105	27	56
9	70	42	39	65	28	31	34	36	30	60	25	49
10	95	39	32	64	32	38	34	39	31	46	35	41
11	83	47	37	67	33	40	45	39	30	40	39	40
12	61	53	43	60	32	30	39	37	30	37	36	57
13	51	52	56	55	34	31	39	38	52	39	39	95
14	42	43	48	80	36	33	40	40	57	42	38	90
15	39	45	44	72	37	34	42	37	80	44	35	71
16	34	46	47	58	33	38	49	40	84	55	56	53
17	36	72	47	50	34	33	48	51	71	131	100	54
18	54	78	49	59	36	34	75	52	92	103	179	53
19	80	64	44	98	44	30	55	50	66	78	76	87
20	75	54	37	100	47	32	53	46	50	67	60	139
21	56	51	37	73	45	31	51	46	45	74	56	121
22	48	45	34	66	38	31	48	62	51	148	44	72
23	91	68	38	63	30	36	46	52	84	91	42	64
24	92	81	42	58	36	31	48	48	68	64	90	50
25	64	65	38	43	32	30	36	40	67	47	76	46
26	53	51	31	41	33	32	36	39	62	57	51	41
27	38	41	43	45	39	30	40	32	108	66	43	48
28	37	42	45	45	41	40	50	38	62	61	35	55
29	35	---	45	41	31	31	48	33	58	62	34	57
30	32	---	44	41	32	39	50	32	58	35	33	52
31	31	---	45	---	39	---	41	36	---	36	---	54
Min	31	32	31	31	28	30	34	32	29	35	25	35
Max	246	81	58	100	47	40	75	62	108	148	179	139
Average	68	52	42	59	35	34	44	42	54	62	49	60
Total Flows	2,112	1,460	1,303	1,768	1,099	1,020	1,370	1,312	1,617	1,912	1,463	1,849

Annual Min	**25**
Annual Max	**246**
Annual Average	**50**

Notes: shading indicates exceedance of regulatory limit (220 m^3/day)

Appendix E2 Port Renfrew Plant Compliance and Treatment Plant Performance Monitoring Data 2019

Date	Influent			Secondary Effluent (Undisinfected)					
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH
Regulatory Limit				60		45			
January	122	148	2,000,000	18	7	<4	62,000	0.17	5.8
February	98	118	6,400,000	188	71	32	100,000	0.29	6.3
March	---	149	>10000000	20	8	4	33,000	0.82	4.8
April	5,960	1,300	3,100,000	38	57	14	91,000	12.00	7.7
May	332	530	9,300,000	12	15	4	6,000	0.07	7.1
June	168	300	4,100,000	27	24	4	3,100	2.50	4.7
July	554	420	19,000,000	34	22	8	9,600	2.60	4.4
August	251	210	6,400,000	33	11	4	13,000	0.26	6.1
September	110	114	>10000000	14	5	<4	6,800	0.06	6.3
October	180	100	31,000,000	25	20	5	23,000	3.00	4.7
November	90	160	5,700,000	15	13	4	270,000	9.30	7.1
December	97	82	44,000,000	7	7	4	1,800,000	0.08	6.7
Mean	724	303	8,503,971	36	22	8	34,918	2.6	6.0
Min	90	82	2,000,000	7	5	<4	3,100	0.06	4.4
Max	5,960	1,300	44,000,000	188	71	32	1,800,000	12.0	7.7
N	11	12	12	12	12	12	12	12	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	36.3	15.2	426,016	0.60	0.6	0.6	0.6	0.13	---

Notes:
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, NH_3 = ammonia
--- data not collected
Shading indicates regulatory exceedance