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Gulf Islands and Port Renfrew

Wastewater and Marine Environment Program

2014 Annual Report

Parks & Environmental Services | Environmental Protection

Prepared by
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GULF ISLANDS AND PORT RENFREW
WASTEWATER AND MARINE ENVIRONMENT PROGRAM
2014 ANNUAL REPORT

EXECUTIVE SUMMARY

This report summarizes the 2014 results of the Wastewater and Marine Environment Program (WMEP) for the wastewater treatment plants (WWTP) operated by the Capital Regional District (CRD) in the Gulf Islands and Port Renfrew. Two of these WWTP (Ganges Harbour and Schooner Way) discharge ultraviolet disinfected, secondary treated effluent; two WWTP (Cannon Crescent and Port Renfrew) discharge undisinfected, secondary treated effluent; and one (Maliview Estates) discharges undisinfected, secondary treated effluent mixed with fine-screened effluent during high flows. The program includes regular monitoring as stipulated by the British Columbia Ministry of Environment (MOE), either through permits or registrations under the Municipal Wastewater Regulation (MWR) (formerly the Municipal Sewage Regulation). In addition, there are monitoring requirements under the Federal Wastewater Systems Effluent Regulations (Fisheries Act) for the Ganges Harbour and Schooner Way treatment plants as their average daily flow volumes exceed minimum thresholds.

All WWTP discharges (effluents) were monitored on a monthly basis as required by provincial and federal regulations for monitoring treatment plant performance. Results were also compared to water quality guidelines set to protect aquatic life and human health. Sludge (mixed liquor) was also monitored for the Ganges Harbour facility to inform the Regional Source Control Program.

After discussion with MOE, changes were made to the receiving water monitoring program for fecal coliform and enterococci to allow for a more direct comparison of bacterial indicators to relevant human health protection criteria. The revised monitoring program consisted of five sets of daily samples collected over a 30-day period (5-in-30), once per year. After two years of sampling at each WWTP over the 2011 to 2013 time period, results were reviewed with MOE to assess the need for further monitoring, and it was determined that receiving water monitoring can be suspended until 2016 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.

GANGES HARBOUR

Wastewater

Wastewater influent and effluent were analyzed for a list of conventional and priority substances, as well as for acute and chronic toxicity. None of the daily effluent flows from the Ganges Harbour WWTP exceeded the allowable maximum in 2014. Effluent quality met provincial and federal regulatory requirements for all parameters, including total suspended solids (TSS), carbonaceous biochemical oxygen demand (CBOD), un-ionized ammonia, and fecal coliform bacteria. Ammonia concentrations remained below regulatory limits for all of 2014, after elevated levels were observed for parts of 2007, 2009 and 2010.

Most priority substances in the effluent were below the BC Water Quality Guidelines (BCWQG) (2010) before the predicted minimum initial dilution of 419:1. Three substances exceeded BCWQG in undiluted effluent: copper, iron, and zinc. These substances, and all others, were well below the BCWQG after the minimum initial dilution calculation was applied. Minimum initial dilution represents the predicted concentration of effluent in the marine water column at a distance of 100 m away from the outfall.

Of the 146 priority substances analyzed, fewer were detected at standard detection limits in effluent during 2014 than in 2013. Those detected included total phenols, phenol, naphthalene and bis(2)ethylhexyl phthalate; these parameters have also been detected in previous years.

Toxicity Testing

The effluent sample from July 2014 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 2011–2013.

Sludge (Mixed Liquor)

Ganges Harbour WWTP sludge (mixed liquor) met the criteria for BC Organic Matter Recycling Regulations (OMRR) Class A Biosolids in 2014. 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 receiving water monitoring conducted at the Ganges WWTP in 2014. Monitoring is scheduled to be repeated in 2016 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.

Recommendations

- Maintain effectiveness and reliability of the treatment process.
- Continue monitoring total residual chlorine levels following membrane washes.
- Continue to share priority pollutant and sludge (mixed liquor) results with Regional Source Control Program.

MALIVIEW ESTATES

Wastewater

The Maliview Estates WWTP produces secondary treated effluent when flows are below 60 m^3/d. For flows over 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 57% of the days in 2014. Total combined daily flows exceeded the allowable maximum of 250 m^3/d on a single day in January 2014, representing 0.27% of the total daily flow measurements. Flow to the secondary treatment plant exceeded 60 m^3/d on 26% of days in 2014, resulting in a portion of the effluent bypassing the secondary treatment process of the plant to be treated solely by fine screening. Flows to the fine-screened portion of the facility exceeded the allowable maximum of 190 m^3/day on 0.33% of the days.

Secondary effluent quality exceeded the allowable maximum for flows <60 m^3/d for TSS and CBOD in 25% and 18% of samples, respectively. All other monthly TSS and CBOD values met provincial regulatory limits.

Receiving Water

There was no routine receiving water monitoring conducted at the Maliview Estates WWTP in 2014. Monitoring is scheduled to be repeated in 2016 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. There was one shoreline sampling event conducted in April 2014 after a break in the outfall pipe caused treated effluent to spill onto the beach. All results were below human health guidelines.

Recommendations

- Utilize results of upcoming strategic asset management plan to identify and prioritize potential system modifications to resolve flow and effluent quality issues.
- Review the regulatory thresholds for high flow bypass events with MOE.

SCHOONER WAY

Wastewater

Daily flows in 2014 exceeded the allowable maximum 0.3% of the time. All other regulatory parameters met provincial and federal regulatory requirements including TSS, CBOD, un-ionized ammonia and fecal coliform bacteria.

Toxicity Testing

The effluent sample from July 2014 passed the 96-hour trout acute toxicity test with 100% survival. These results are consistent with 2011–2013.

Receiving Water

There was no routine receiving water monitoring conducted at the Schooner Way WWTP in 2014. Monitoring is scheduled to be repeated in 2016 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. However, there were two non-routine receiving water monitoring events conducted in 2014 as a result of a planned bypass, and one monitoring event conducted as a result of a heavy rain overflow. All results were below human health guidelines.

Recommendations

- Utilize results of strategic asset management plan to identify and prioritize potential system modifications to resolve flow and effluent quality issues.

CANNON CRESCENT

Wastewater

Mean annual flow from the Cannon Crescent WWTP in 2014 was consistent with previous years. Daily flows exceeded the allowable maximum 7% of the time. Effluent quality was also consistent with 2013, with no exceedences of any provincial wastewater quality compliance parameters in 2014.

Receiving Water

There was no routine receiving water monitoring conducted at the Cannon Crescent WWTP in 2014. Monitoring is scheduled to be repeated in 2016 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.

Recommendations

- Utilize results of strategic asset management plan to identify and prioritize potential system modifications to resolve flow and effluent quality issues.

PORT RENFREW

Wastewater

Mean daily flows in 2014 were in the upper range of flows measured since 2007, but there were no exceedences of the allowable maximum. There was one provincial permit exceedence for TSS levels, representing 8% of the monthly samples.

Receiving Water

There was no routine receiving water monitoring conducted at the Port Renfrew WWTP in 2014. Monitoring is scheduled to be repeated in 2016 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.

Recommendations

- None.

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1.0 INTRODUCTION

This report summarizes the 2014 results of the Wastewater and Marine Environment Program (WMEP) for the wastewater treatment plants (WWTP) operated by the Capital Regional District (CRD) in the Gulf Islands and Port Renfrew. Two of these WWTP (Ganges Harbour and Schooner Way) discharge ultraviolet disinfected, secondary treated effluent; two (Cannon Crescent and Port Renfrew) discharge undisinfected, secondary treated effluent; and one (Maliview Estates) 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 WMEP includes regular monitoring as stipulated by the British Columbia Ministry of Environment (MOE) either through a permit or registrations under the Municipal Wastewater Regulation (MWR) (formerly the Municipal Sewage Regulation). In addition, effective January 1 2013, new monitoring requirements came into effect under the Federal Wastewater Systems Effluent Regulations (WSER) (*Fisheries Act*) for the Ganges Harbour and Schooner Way facilities. The three remaining facilities (Schooner Way, Cannon Crescent and Port Renfrew) do not require monitoring under the WSER due to their low volumes of discharge. Monitoring is also conducted to assess treatment plant performance.

1.1 Wastewater Monitoring

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

High resolution analysis was conducted on Ganges effluent collected in July 2014. Influent and effluent were analyzed for pesticides, nonylphenols, polycyclic aromatic hydrocarbons (PAH), polybrominated diphenyl ethers (PBDE), polychlorinated biphenyls (PCB), and pharmaceuticals and personal care products (PPCP).

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 fecal coliform. Some discharges were monitored for additional parameters, such as ammonia (NH3), pH and total residual chlorine.

1.1.2 Toxicity Testing

Effluent samples from the Ganges Harbour and Schooner Way WWTP were analyzed for potential toxicity to freshwater trout (both sites) and *Daphnia magna* (Ganges only). Toxicity testing was a requirement under the MWR registrations for both these facilities.

1.1.3 Priority Substances

Wastewater influent and effluent from the Ganges Harbour WWTP were analyzed for a list of priority substances as stipulated in the MWR registration for this facility. Influent and effluent priority substances were compared to water quality guidelines (BC MoE, 2006) and summarized in Appendix A1. These data were used to assess the quality of the final effluent and the effectiveness of both the Regional Source Control Program (RSCP) and the treatment process.

1.1.4 Treatment Plant Sludge (Mixed Liquor)

The Ganges Harbour WWTP 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 *BC Ministry of Environment Organic Matter Recycling Regulations* (OMRR) (BC MoE, 2002). Sludge (mixed liquor) is a by-product of sewage treatment, and at the Ganges Harbour plant, it is de-watered prior to monitoring.

The intent of this mixed liquor monitoring was originally to assess suitability for land application. However, Ganges Harbour mixed liquor is currently transferred to a septage treatment facility on Vancouver Island and no land application takes place. However, mixed liquor sampling (at a reduced frequency) is still of benefit to the RSCP to help assess the effectiveness of their various source control campaigns such as the Dental Code of Practice.

Figure 1.1 - Ganges, Maliview Estates, Schooner Way, Cannon Crescent 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 2014 Wastewater and Surface Water Components of the Gulf Islands and Port Renfrew WMEP

Component	Parameter	Frequency and Stations
Wastewater	Flow	Daily: Ganges Harbour, Maliview Estates, Schooner Way, Cannon Crescent, 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 Harbour, Schooner Way
	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 Estates
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month: Cannon Crescent, Port Renfrew
	Federal compliance monitoring: • Final Effluent: TSS, CBOD, un-ionized ammonia, total residual chlorine, pH @ 15ºC	Once per month (reported quarterly): Ganges Harbour, Schooner Way
	Influent and effluent priority substances	Once per year: Ganges Harbour
	Effluent toxicity	Once per year: Ganges Harbour, Schooner Way
	Sludge (mixed liquor)	Once per month: Ganges Harbour
Receiving Water	Surface water indicator bacteria (fecal coliform and enterococci)	Ganges Harbour 5 days of sampling in a 30-day period next in 2016* Maliview Estates 5 days of sampling in a 30-day period next in 2016* Schooner Way 5 days of sampling in a 30-day period next in 2016* Cannon Crescent 5 days of sampling in a 30-day period next in 2016* Port Renfrew 5 days of sampling in a 30-day period next in 2016*

Notes:

*Routine receiving water sampling is next required in 2016 unless 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

There was no routine receiving water monitoring conducted at any of the Gulf Island facilities or at Port Renfrew in 2014. Receiving water was last monitored as part of the WMEP in 2013, and consisted of collecting five sets of samples within a 30-day period (5-in-30) around the WWTP outfalls and analyzing them for fecal coliform and enterococci (Table 1.1). This is a significant modification from previous years, when trigger processes were used to assess the need for shoreline or surface water monitoring each year, and only fecal coliforms were monitored. These changes were made in consultation with MOE in order to make direct comparisons to MOE Approved Water Quality Guidelines (BCWQG) for primary recreational contact as a means to assess potential for human health risks (Warrington, 2001). These guidelines apply to primary contact recreational waters, such as beaches, where the majority of recreational activities occur. Guidelines include the requirement that the geometric mean of five samples taken within a 30-day period must not exceed 200 colony forming units (CFU) in 100 mL (CFU/100 mL) for fecal coliform or 20 CFU/100 mL for enterococci. Enterococci have been added to monitoring programs because they are more persistent in the marine environment and have a more direct correlation to human health impacts. In addition, results are now compared to Health Canada guidelines for enterococci (Health Canada, 2012) which include the requirements that the geometric mean of five samples taken approximately weekly do not exceed 35 CFU/100 mL and no single sample should exceed 70 CFU/100 mL.

Past monitoring programs sampled surface water only (0.5 to 1 m below the surface). The 5-in-30 program includes sampling of initial dilution zone (IDZ) stations at a depth midway between the surface and seafloor, in addition to surface samples. The IDZ is defined as the area 100 m around the outfall and is where provincial WQG must be met.

The 5-in-30 sampling programs were implemented at Schooner Way and Maliview Estates in 2011 and at Port Renfrew, Cannon Crescent and Ganges Harbour in 2012. Based on commitments to MOE, monitoring using the 5-in-30 monitoring programs was to be conducted annually for two years at each facility, after which results were to be reviewed in collaboration with MOE and the future sampling frequency determined. Results for all sites were reviewed with MOE and it was determined that receiving water monitoring can be suspended until 2016 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. Any receiving water sampling that was conducted in 2014, as a result of these non-routine conditions, is detailed in the appropriate facility section of this report.

2.0 METHODOLOGY

2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

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

Laboratory analyses were conducted at the Saanich Peninsula Wastewater Treatment Plant (SPWWTP) Laboratory or Maxxam Analytics Ltd. (Victoria, BC). TSS was determined gravimetrically using glass fibre filters dried at 105°C (APHA, 1998). BOD was determined by 5-day oxygen depletion at 20°C using an oxygen meter (APHA, 1998). CBOD was determined by 5-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). Ammonia was determined by distillation and Nesslerization colourimetry. Nitrite was determined by diazotization colourimetry. Nitrate was determined by cadmium reduction followed by diazotization colourimetry. The concentration of un-ionized 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 ½ the detection limit were used for non-detect results.

TOXICITY TESTING

Effluent toxicity samples were collected by grab sampling. Testing was conducted using standardized and approved protocols by Maxxam Analytics (Burnaby, BC). Effluent toxicity was determined through two tests:

1. A 96-hour acute toxicity test using juvenile Rainbow trout (*Oncorhynchus mykiss*). Ten test organisms per replicate were exposed to effluent and the number of organisms surviving at 96 hours was recorded. Fifty percent or greater survival is considered a pass, while less than 50% survival is a fail.

2. A 48-hour acute toxicity test using *Daphnia magna*. Ten test organisms per replicate were exposed to effluent and the number of organisms surviving at 48 hours was recorded. Fifty percent or greater survival is considered a pass, while less than 50% survival is a fail.

PRIORITY SUBSTANCES

At Ganges Harbour, influent and effluent samples were collected as composite samples for priority substance analysis. The composite samples were collected by an ISCO automated sampler, with 400 mL of wastewater collected every 20 minutes over a 24-hr period. The composite sample was then split into smaller sample bottles for individual analyses and preserved before shipping to Maxxam Analytics (Burnaby, BC). 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 WQG.

SLUDGE (MIXED LIQUOR)

Dewatered sludge (mixed liquor) at Ganges Harbour was sampled on a monthly basis and analyzed for 29 metals and moisture content. Results were compared to the BC OMRR (BCMOE, 2002) 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

SHORELINE SURFACE WATER FECAL COLIFORMS

There was no routine receiving water monitoring conducted in 2014. Routine sampling will be undertaken again in 2016, as agreed upon with MOE, 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.

Four receiving water sampling events were conducted in 2014 as a result of planned bypass or overflow events (three at Schooner and one at Maliview).

Maliview sampling (April 17) was conducted as a result of a crack in the outfall pipe in the bank below the road resulting in effluent leakage onto the beach. Sampling was conducted at seven stations along the shoreline (Figure 2.1):

- One station located where the outfall pipe crosses the shoreline.
- Three stations northwest of the outfall pipe, at 100 m, 200 m and 400 m from the pipe.
- Three stations southeast of the outfall pipe, at 100 m, 200 m and 400 m from the pipe.

For the sampling conducted at Schooner (May 29, May 30 and Dec. 16), water samples were collected at six offshore stations (Figure 2.2):

- Four stations located at the edge of the IDZ (i.e., 100 m from the end of the outfall) to the SW, NW, NE and SE) sampled at two depths: 1.0 m below the surface and mid-way between the surface and the seafloor.
- Two stations located 200 m from the end of the outfall and sampled at 1.0 m below the surface only.

The May 29/30 samples were collected following a planned bypass to allow for clean-out of excess grit and debris in the Schooner aeration tank. The Dec. 16 event took place following a heavy rain overflow.

Surface samples were collected in sterile, wide-mouth bottles by rapidly submerging open, upright bottles attached to a pole. Subsurface samples were collected using a vertically oriented Niskin bottle and then decanted into sterile, wide-mouth bottles.

Bacteriology was analyzed at Maxxam Analytics. 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. Geometric mean values were calculated for each bacteriological indicator at each station/depth. Values of ½ the detection limit were used for each non-detect result.

Results were compared to the values specified in the BCWQG for recreational primary contact (Warrington, 2001) and Health Canada's Guidelines for Canadian Recreational Water Quality (Health Canada, 2012), as a means to assess potential human health risks (Section 1.2).

Figure 2.1
Maliview Surface Monitoring Locations

Outfall Pipe

01 = Sampling Station

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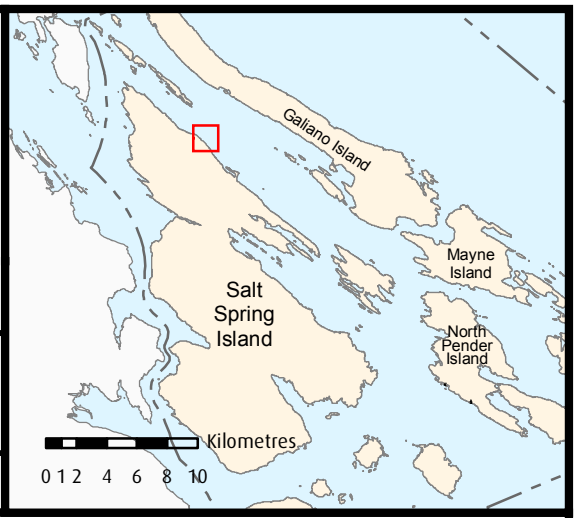
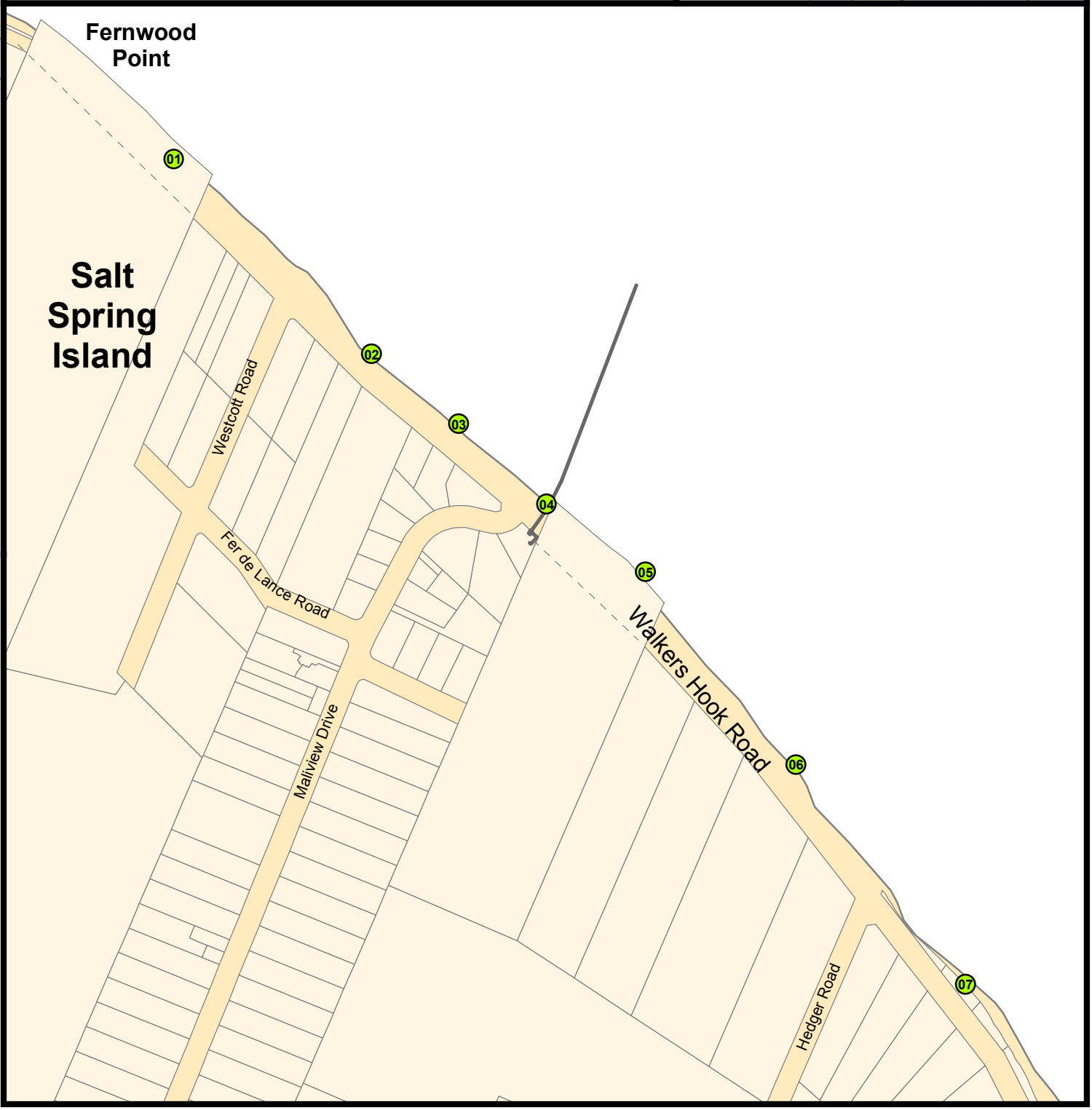
Metres

0 50 100 200 300

Projection: UTM ZONE 10N NAD 83





CRD - Parks & Environmental Services - Environmental Engineering - Jun 25, 2015 - Technologist: SR - Map Document: SurfaceSamplesMaliview.mxd

Figure 2.2
Schooner Way Surface Water Monitoring Locations

Outfall Pipe

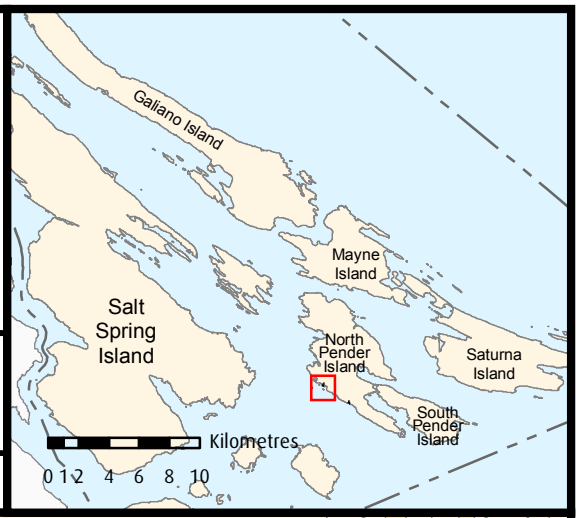
01 = Sampling Station

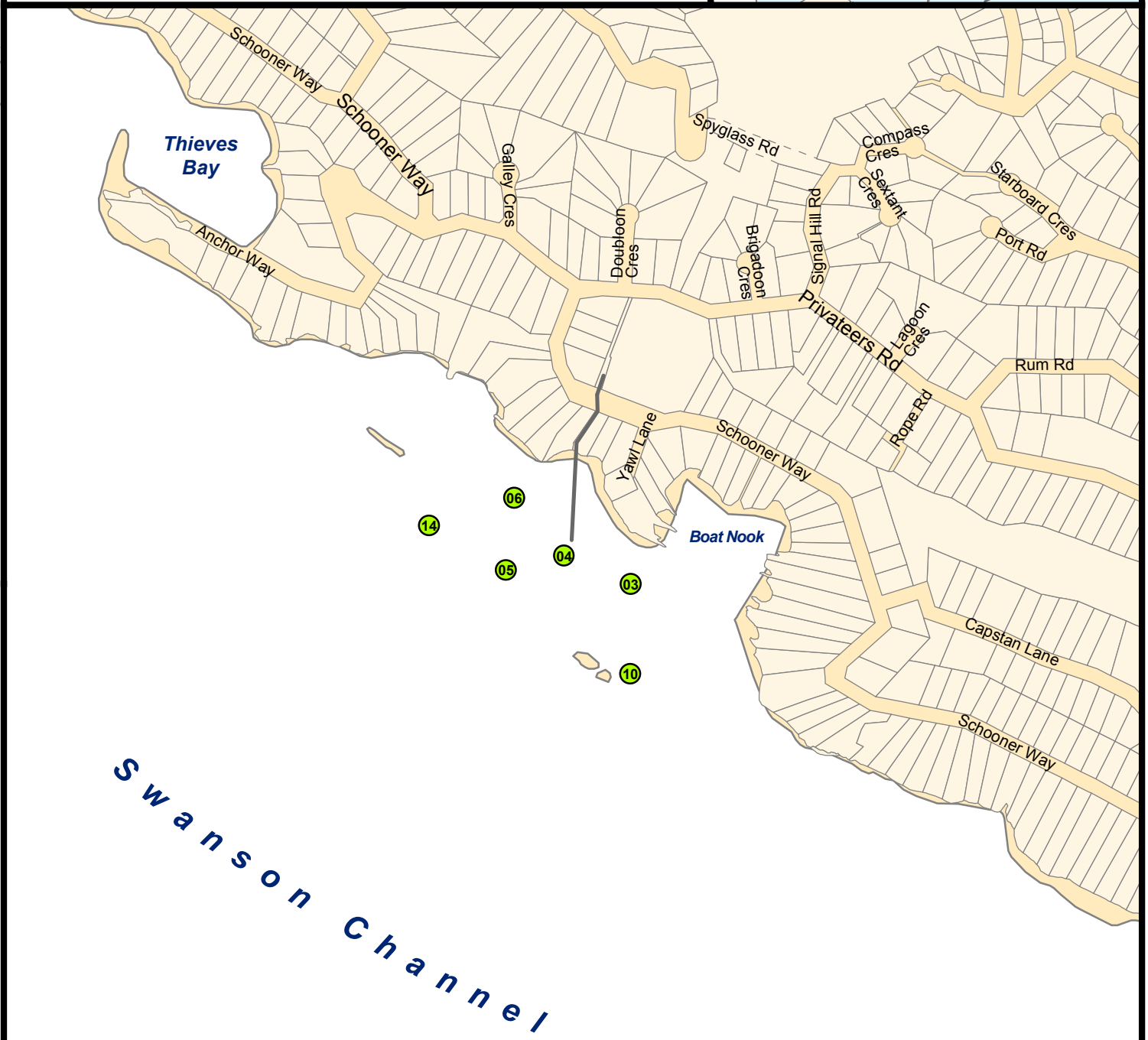
Making a difference...together

Metres

0 50 100 200 300 400 500

Projection: UTM ZONE 10N NAD 83





3.0 GANGES HARBOUR

3.1 Introduction

The Ganges Harbour WWTP 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-long 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 as chlorine is used when washing the membranes.

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

Table 3.1 Ganges Harbour Regulatory Requirements

Parameter	Regulatory Requirement	
	Provincial	Federal
Maximum daily flow	1,090 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	---
Un-ionized ammonia	---	max 1.25 mg/L
Total residual chlorine	---	average 0.02 mg/L
Toxicity test	96-hr LC_{50} Rainbow Trout	---

This registration also has a requirement for receiving water monitoring. Two years of monitoring was conducted in 2012 and 2013, as described in Section 1.2. Further monitoring is not required for this facility until 2016 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.

The following section reports the results from the Ganges Harbour treatment plant WMEP (Table 3.2).

Table 3.2 Ganges Harbour Treatment Plant WMEP

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, NH_3, pH	Once per month
	Effluent toxicity	Once per year
	Federal compliance monitoring: Final Effluent: TSS, CBOD, un-ionized ammonia, total residual chlorine	Once per month (reported quarterly)
	Influent and effluent priority substances[1]	Once per year
	Sludge (mixed liquor)	Once per month
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	Once per year[2]

Notes:
[1] All priority substances are listed in Appendix A1
[2] 5 samples in 30 days were conducted in 2012 and 2013. Next receiving water sampling will be conducted in 2016.

3.2 Results

3.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2014, none of the daily flows from the Ganges Harbour WWTP exceeded the allowable maximum (Table 3.3, Table 3.4, Appendix A3).

Compliance and treatment plant monitoring data (Table 3.4, Appendix A4) show that effluent quality was consistent with the previous three years for all parameters (CRD, 2011, 2012, 2013). None of the samples exceeded provincial or federal limits for flow, TSS, CBOD, fecal coliform or un-ionized ammonia. Overall, the treatment plant removed approximately 99% of the TSS and fecal coliform bacteria from the influent.

Total residual chlorine (TRC) was measured 11 times in 2014 as part of federal regulations, to monitor levels resulting from chlorine used to clean the membranes. Concentration of TRC exceeded the permitted level 55% of the time in disinfected secondary effluent.

Effluent ammonia concentrations at the Ganges Harbour treatment plant in 2005 and 2006 were consistent with ammonia concentrations reported at other CRD secondary treatment plants. However, an increase in ammonia concentrations was observed beginning in July 2007 through to February 2008 before returning to historic concentrations. A similar pattern was observed for 2009 and 2010, with increased concentrations of ammonia typically beginning in April and continuing through to September or October of those years. Ammonia concentrations in the last three months of 2010 returned to historic levels. Ammonia has remained at low levels since then including all of 2014. The high ammonia concentration in the past may have been related to operational deficiencies during the anoxic treatment process. These problems appear to have been resolved since 2011 after some infrastructure improvements and operational modifications.

Table 3.3 Ganges Harbour WWTP 2014 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	416	310	744	12,909	31	0
February	440	337	628	12,307	28	0
March	468	398	680	14,505	31	0
April	420	341	480	12,611	30	0
May	441	401	494	13,660	31	0
June	427	378	528	12,807	30	0
July	446	397	491	13,814	31	0
August	475	422	553	14,739	31	0
September	443	371	782	13,279	30	0
October	457	374	599	14,176	31	0
November	455	369	563	13,658	30	0
December	454	318	797	14,060	31	0
Annual	**445**	**310**	**797**	**162,525**	**365**	**0**

Table 3.4 Ganges Harbour WWTP 2014 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)	Un-ionized Ammonia (mg N/L)	Total Residual Chlorine (mg/L)	pH (pH)
Influent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	445	400	---	9,041,383	346	---	0.041	---	---
Minimum	310	160	---	3,300,000	197	---	0.041	---	---
Maximum	797	910	---	16,000,000	560	---	0.041	---	---
Regulatory violations	0%	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	---	1	---	---
Secondary Effluent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	445	1	---	121	---	---	---	---	---
Minimum	310	1	---	3	---	---	---	---	---
Maximum	797	3	---	603	---	---	---	---	---
Percent reduction (from Influent)	---	>99%	---	>99%	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---	---	---	---
Number of samples	---	12	---	12	---	---	---	---	---
Disinfected Secondary Effluent									
Regulatory Limit	1,090	25	25	1,000	---	---	1.25	0.02	---
Mean	445	2	3	27	2.5	2.49	0.02	0.04	7.1
Minimum	310	<2	<5	<1	<4	0.02	<0.0005	<0.02	6.7
Maximum	797	<5	<5	310	8	27	0.20	0.08	7.4
Percent reduction (from Influent)	---	>99%	---	>99%	99%	---	50%	---	---
Regulatory violations	---	---	---	---	---	---	---	55%	---
Number of samples	365	12	12	12	12	12	13	11	12

TOXICITY TESTING

As in 2011, 2012 and 2013, the 2014 disinfected effluent sample from July 17 passed the 96-hour Rainbow trout acute toxicity test with 100% survival of test organisms. This is in contrast to results in 2009 and 2010, where survival rates of 0% and 50% were likely caused by high ammonia levels. Since 2011, ammonia levels have decreased to pre-2009 levels, resulting in a corresponding drop in effluent toxicity.

As in 2012 and 2013, the disinfected effluent sample from July 17, 2014, also passed the 48-hour *Daphnia magna* acute toxicity test with 100% survival of test organisms. The *Daphnia* test is not required, but is conducted to maintain consistency with other CRD discharge monitoring programs and it is relatively inexpensive.

PRIORITY SUBSTANCES

Most priority substances in Ganges Harbour effluent were below BCWQG before the predicted minimum initial dilution of 419:1 (Appendix A1). This 419:1 dilution factor has previously been determined by computer modelling (Seaconsult Marine Research Ltd, 1994) and is the predicted minimum dilution factor to occur at the edge of the IDZ. Maximum concentration guidelines have not been established for all parameters, and guidelines that are in progress or developed for 30-day means are used when available.

Three substances exceeded the established BCWQG in undiluted effluent: copper, iron and zinc. All predicted receiving environment concentrations were well below BCWQG after the minimum initial dilution factor was applied.

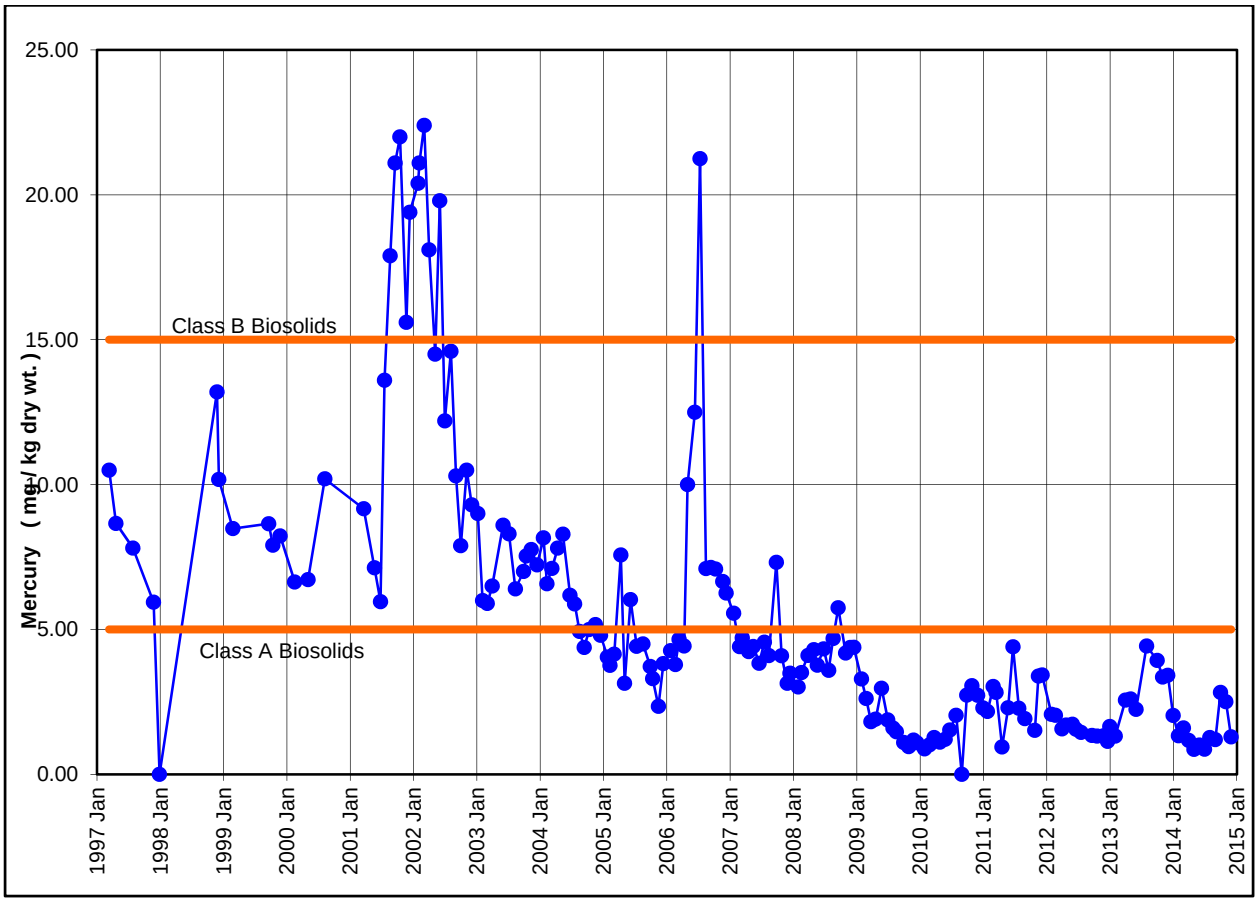
Most of the metal effluent concentrations were within similar ranges relative to previous years, including arsenic, mercury and silver, which have historically been elevated for this facility. There were fewer organic parameters detected in effluent in 2014 than in 2013. Detected organics included total phenols, phenol, naphthalene and bis(2)ethylhexyl phthalate.

SLUDGE (MIXED LIQUOR)

Results of sludge (mixed liquor) analysis were compared to BC OMRR Class A Biosolids criteria to assess the quality of the sludge produced at the treatment plant (Appendix A2). This class rating identifies biosolids as the highest quality that can be produced according to MOE 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. Class B criteria were used for chromium and copper, as no Class A criteria exist for these parameters. Ganges Harbour 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 RSCP to help assess the success of source control Codes of Practice (e.g., those in place for dental offices).

The 2014 Ganges Harbour treatment plant sludge (mixed liquor) results had metal concentrations well below the criteria for Class A Biosolids. Historically, mercury levels have been an issue in Ganges sludge. Mercury results were all below the Class A limit of 5.0 mg/kg in 2014, 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 RSCP Dental Code of Practice in July 2001, possibly as a result of flushing plumbing lines within dental offices 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.

Figure 3.1 Ganges Harbour WWTP Mixed Liquor Mercury Levels (1997 to 2014)



3.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

There was no receiving water monitoring conducted at the Ganges WWTP in 2014. Monitoring is scheduled to be repeated in 2016, and will only occur sooner in the case of planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer. For the most recent receiving water monitoring results see the *Gulf Islands and Port Renfrew Marine Environment Program 2013 Annual Report* (CRD, 2014).

3.3 Recommendations

MAINTAIN EFFECTIVENESS AND RELIABILITY OF THE TREATMENT PROCESS

The revised operating procedures that were implemented in 2009 to improve ammonia concentrations in effluent appear successful, as current ammonia levels are no longer elevated. Ensuring consistent operation and proper maintenance is important to ensure ammonia concentrations remain low.

MONITOR TOTAL RESIDUAL CHLORINE LEVELS FOLLOWING MEMBRANE WASHES

Chlorine is used when cleaning the membranes at this facility, but has not historically been monitored regularly. Chloride (as a surrogate for TRC) was tested once in 2013, as part of priority substance testing and the result exceeded BCWQG. In 2014, TRC was monitored 11 times in disinfected secondary effluent with 55% of the results exceeding BCWQG. Testing for TRC should continue in 2015.

CONTINUE TO SHARE RESULTS WITH THE REGIONAL SOURCE CONTROL PROGRAM

Effluent priority pollutant and sludge (mixed liquor) results are valuable to the RSCP. 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 RSCP to assess the effectiveness of their efforts.

4.0 MALIVIEW ESTATES

4.1 Introduction

The Maliview Estates WWTP is located on the east side of Salt Spring Island (Figure 1.1). It discharges treated effluent into Trincomali Channel through a 213-m-long 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 (formerly the Municipal Sewage Regulation) Registration RE-00242, as amended in June 2007.

Flows up to 60 m^3/d receive secondary treatment using a rotating biological contactor (RBC) 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 RBC 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 Estates 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. Two years of monitoring was conducted in 2011 and 2012, as described in Section 1.2. Further monitoring is not required for this facility until 2016 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. In April 2014, there was one round of receiving water monitoring conducted at Maliview after the outfall pipe cracked resulting in effluent leaking onto the beach. Sampling was conducted along the shoreline.

The following section reports the results from the Maliview Estates treatment plant WMEP (Table 4.2).

Table 4.2 Maliview Estates Treatment Plant WMEP

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	Monthly (but only required four times per year)
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	Once per year[2]

Notes:
[1] All substances are listed in Appendix B4
[2] 5 samples in 30 days were conducted in 2011 and 2012. Next receiving water sampling will be conducted in 2016.

4.2 Results

4.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data, including exceedences, are summarized for effluent discharged from the fine screens (bypassing the secondary treatment unit) in Table 4.3 and the complete data set is presented in Appendix B1. Overall in 2014, 0.33% of flows exceeded permitted levels for fine-screened effluent. Flow data for effluent discharged from the secondary treatment unit are summarized in Table 4.4 and the complete data set is presented in Appendix B2. Flow exceeded the allowable maximum for secondary effluent of 60 m^3/d on 26% of days in 2014.

Flow data for the entire facility are summarized in Table 4.5 and the complete data set is presented in Appendix B3. Total effluent flows discharged from the Maliview Estates treatment plant exceeded the registration allowable maximum of 250 m^3/d on a single day in January 2014 representing 0.27% of the total daily flow measurements. Short-term trends indicate that flow has remained relatively stable since 2006, varying between 23,000 and 31,000 m^3 (CRD, 2007, 2008, 2009, 2010, 2011, 2013 and 2014).

The Maliview WWTP was not designed to treat the volume of effluent that it presently receives. In addition, the process that splits flow between the RBC 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 RBC unit is not operating at full capacity as measured by the total daily flow. In 2014, flow bypassed the secondary treatment process and only received screening on days where flow was less than 60 m^3/d approximately 57% of the time. The operating staff at this facility is continually attempting to upgrade the splitting process while working within the budgetary and physical constraints imposed at this facility. Longer term solutions are being sought.

Table 4.3 Maliview Estates WWTP 2014 Fine-screened Effluent 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	24	0	205	744	31	3%
February	45	1	117	1,271	28	0%
March	47	12	153	1,471	31	0%
April	16	1	32	469	30	0%
May	9	0	26	282	31	0%
June	2	0	10	56	30	0%
July	1	0	7	44	31	0%
August	2	0	12	47	31	0%
September	1	0	3	23	30	0%
October	14	0	63	421	31	0%
November	41	2	95	1,230	30	0%
December	63	15	184	1,938	31	0%
Annual	**22**	**0**	**205**	**7,993**	**365**	**0.33%**

Table 4.4 Maliview Estates WWTP 2014 Secondary Effluent 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	60	29	84	1,853	31	39%
February	60	25	81	1,675	28	54%
March	61	50	73	1,892	31	58%
April	61	48	67	1,817	30	57%
May	56	20	68	1,736	31	39%
June	41	14	47	1,224	30	0%
July	43	30	49	1,319	31	0%
August	42	26	50	1,302	31	0%
September	40	30	45	1,196	30	0%
October	44	9	61	1,349	31	6%
November	57	47	76	1,717	30	20%
December	50	0	71	1,535	31	39%
Annual	**51**	**0**	**84**	**18,613**	**365**	**26%**

Table 4.5 Maliview Estates WWTP 2014 Total Effluent Flow Summary

Month	Secondary Effluent		Fine-Screened Effluent			Total Plant Flow	
	Total Flow (m^3)	Exceeded Regulatory Maximum (%)	Total Flow (m^3)	Bypass without max reached (%)	Exceeded Regulatory Maximum (%)	Total Flow (m^3)	Exceeded Regulatory Maximum (%)
January	1,853	39%	744	52%	3%	2,596	3%
February	1,675	54%	1,271	43%	0%	2,873	0%
March	1,892	58%	1,471	39%	0%	3,363	0%
April	1,817	57%	469	37%	0%	2,286	0%
May	1,736	39%	282	58%	0%	2,018	0%
June	1,224	0%	56	77%	0%	1,279	0%
July	1,319	0%	44	74%	0%	1,363	0%
August	1,302	0%	47	61%	0%	1,349	0%
September	1,196	0%	23	63%	0%	1,219	0%
October	1,349	6%	421	45%	0%	1,770	0%
November	1,717	20%	1,230	74%	0%	2,947	0%
December	1,535	39%	1,938	58%	0%	3,472	0%
Annual	**18,613**	**26%**	**7,993**	**57%**	**0.33%**	**26,533**	**0.27%**

Compliance and treatment plant monitoring data is summarized in Table 4.6 and the complete data set is presented in Appendix B4. The secondary treatment unit removed approximately 89% of the TSS, 93% of fecal coliform and 82% of total BOD. The combined final effluent exceeded registration limits for TSS and CBOD in 25% and 18% of the samples, respectively. Total plant flow volumes on these days were below 60 m^3/day and, therefore, the plant was out of compliance with the TSS limit of 45 mg/L on Sept. 23, Aug. 19 and July 22, and the CBOD limit of 45 mg/L on Sept. 23 and Aug. 19, representing 25% and 18% of the monthly sampling events, respectively (Table 4.6).

4.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Sampling was conducted on April 17 along the shoreline after the outfall pipe cracked. Results are detailed in Table 4.7. Sample number 4 is the station located immediately adjacent to the outfall. Fecal concentrations were highest at this station, and decreased with distance. All of the results were below the provincial and federal monitoring guidelines for fecal coliforms (Section 1.2).

4.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Maliview Estates WWTP likely would be required to eliminate all regulatory compliance violations for this facility. A strategic asset management plan is currently under development for this facility. The plan will be used to identify and prioritize ways to improve overall system performance with the eventual goal of reducing the number of flow and effluent quality limit violations.

HIGH FLOW BYPASS EVENTS

The splitting equipment used to bypass the secondary treatment unit during high flows responds to instantaneous peak flows. However, the regulatory threshold for when a bypass event can occur is based on total daily flow. A revised regulatory threshold based on instantaneous peak flows, such as using the instantaneous capacity of the RBC unit, should be investigated. In addition, the regulatory limits for final combined effluent should be clarified and reviewed with MOE.

Table 4.6 Maliview Estates WWTP 2014 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	73	356	---	4,064,187	235	---	---
Minimum	20	16	---	320,000	26	---	---
Maximum	260	1,474	---	15,000,000	570	---	---
Regulatory Violations	0%	---	---	---	---	---	---
Number of Samples	365	12					
Secondary Effluent							
Regulatory Limit	60	45	45	---	---	---	---
Mean	51	39	25	229,309	39	31.17	7.5
Minimum	0	17	7	43,000	16	9.50	7.3
Maximum	84	144	84	1,200,000	148	53.90	7.6
Percent Reduction	---	89%	---	94%	83%	---	---
Regulatory Violations	26%	17%	17%	---	---	---	---
Number of Samples	365	12	12	12	12	12	12
Fine-Screened Effluent[1]							
Regulatory Limit	190	---	---	---	---	---	---
Mean	22	---	---	---	---	---	---
Minimum	0	---	---	---	---	---	---
Maximum	205	---	---	---	---	---	---
Percent Reduction	---	---	---	---	---	---	---
Regulatory Violations	0.33%	---	---	---	---	---	---
Number of Samples	365	0	0	0	0	0	0
Combined Final Effluent[2]							
Regulatory Limit[3]	250	45/130	45/130	---	---	---	---
Mean	73	38	24	299,827	41	32	7
Minimum	20	17	6	45,000	12	11	7
Maximum	260	100	83	1,200,000	149	57	8
Percent Reduction	---	89%	---	93%	82%	---	---
Regulatory Violations	0.2%	25%	18%	---	---	---	---
Number of Samples	365	12	11	12	12	12	12

Notes:

1 No fine-screened effluent samples were collected in 2014. 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 m^3/day. Limits are 45 mg/L if flows are below 60 m^3/day and 130 mg/L if above 60 m^3/day.

Table 4.7 Maliview Estates WWTP 2014 Receiving Water Bacteria Summary

Station	Location	17-April-14
		Fecal Coliform CFU/100 mL
MAL-01	400 m NW	6
MAL-02	200 m NW	14
MAL-03	100 m NW	25
MAL-04	outfall crosses the shore	42
MAL-05	100 m SE	41
MAL-06	200 m SE	14
MAL-07	400 m SE	4

5.0 SCHOONER WAY

5.1 Introduction

The Schooner Way WWTP 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-long 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 Way 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	max 200 CFU/100 mL	---
Un-ionized ammonia	---	max 1.25 mg/L
Total residual chlorine	---	average 0.02 mg/L
Toxicity test	96-hr Pass/Fail Rainbow Trout	---

This registration also has a requirement for receiving water monitoring. Two years of monitoring were conducted in 2011 and 2012, as described in Section 1.2. Further monitoring is not required for this facility until 2016 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. In 2014, three non-routine sampling events took place: two (May 29/30) as a result of a planned bypass to allow for clean-out of excess grit and debris from the aeration tank, and one (Dec. 16) as a result of a heavy rain overflow event.

The following section reports the results from the Schooner Way treatment plant WMEP (Table 5.2).

Table 5.2 Schooner Way Treatment Plant WMEP

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, fecal coliform, un-ionized NH_3, TRC • Disinfected Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH, un-ionized NH_3	Once per month[1]
	Federal compliance monitoring: Final Effluent: TSS, CBOD, un-ionized ammonia, total residual chlorine	Once per month (reported quarterly)
	Effluent toxicity	Once per year
Surface Water	Indicator bacteria (fecal coliform and enterococci)	Once per year[2]

Notes:
[1] All substances are listed in Appendix C2
[2] 5 samples in 30 days were conducted in 2011 and 2012. Next receiving water sampling will be conducted in 2016.

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 2014, daily flows to the Schooner Way WWTP exceeded the allowable maximum on 3% of the days in January, representing 0.3% of total flow monitoring days in 2014. Annual mean daily flow was slightly higher than in 2013.

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 2014, Schooner disinfected secondary effluent had no exceedences to any of the provincial or federal regulatory limits, with the exception of the above mentioned flow limits. The treatment plant removed approximately 97% of the TSS, >99% of the fecal coliform and 96% of the total BOD it received.

TOXICITY TESTING

As in 2012 and 2013, the 2014 disinfected effluent sample from July 22 passed the 96-hour Rainbow trout acute toxicity test with 100% survival of test organisms.

Table 5.3 Schooner Way WWTP 2014 Effluent Flow Annual 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	216	151	664	6,707	31	3%
February	280	150	471	7,845	28	0%
March	331	207	616	10,251	31	0%
April	219	167	294	6,584	30	0%
May	182	19	277	5,644	31	0%
June	162	126	238	4,860	30	0%
July	169	143	190	5,250	31	0%
August	181	155	227	5,625	31	0%
September	152	118	194	4,557	30	0%
October	185	112	349	5,729	31	0%
November	240	147	363	7,195	30	0%
December	278	189	496	8,621	31	0%
Annual	**216**	**19**	**664**	**78,868**	**365**	**0.3%**

Table 5.4 Schooner Way WWTP 2014 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)	Un-ionized Ammonia (mg N/L)	Total Residual Chlorine (mg/L)	pH
Influent									
Regulatory Limit	640	---	---	---	---	---	---	---	---
Mean	216	199	---	5,227,022	214	---	---	---	---
Minimum	19	51	---	840,000	44	---	---	---	---
Maximum	664	344	---	16,000,000	396	---	---	---	---
Regulatory violations	0.3%	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	---	---	---	---
Secondary Effluent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	216	7	---	11,464	---	---	---	---	---
Minimum	19	2	---	2,700	---	---	---	---	---
Maximum	664	14	---	44,000	---	---	---	---	---
Percent Reduction	---	97%	---	>99%	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	---	---	---	---	---
Disinfected Secondary Effluent									
Regulatory Limit	640	45	45	200	---	---	1.25	0.02	---
Mean	216	5	3	17	9	0.44	0.002	---	6.8
Minimum	19	<4	<5	1	<4	0.07	<0.0005	---	6.5
Maximum	664	15	5	68	57	3.10	0.007	---	7.0
Percent Reduction	---	97%	---	100%	96%	---	---	---	---
Regulatory violations	0.3%	0.0%	0.0%	0.0%	---	---	---	---	---
Number of samples	365	12	12	12	12	12	12	---	12

5.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

There was no routine receiving water monitoring conducted at the Schooner WWTP in 2014. Monitoring is scheduled to be repeated in 2016, and will only occur sooner in the case of planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer. For the most recent routine scheduled receiving water monitoring results see the *Gulf Islands and Port Renfrew Wastewater Marine Environment Program 2013 Annual Report* (CRD, 2014).

Sampling was conducted three times at Schooner in 2014. Two of the sampling events (May 29 and May 30) were part of a planned bypass to clean out grit and debris from the aeration tank. The third sampling event (Dec. 16) was conducted as a result of a plant overflow after a heavy rain event. Results are detailed in Table 5.5. All of the fecal coliform and enterococci results were below the provincial and federal monitoring regulations (Section 1.2).

Table 5.5 Schooner Way WWTP 2014 Receiving Water Bacteria Summary

Station	Location	Depth	29-May-2014		30-May-2014		16-Dec-2014	
			FC CFU/100 mL	Enterococci CFU/100 mL	FC CFU/100 mL	Enterococci CFU/100 mL	FC CFU/100 mL	Enterococci CFU/100 mL
Sch-03	100 m SE	1	<1	<1	6	2	4	3
		5	<1	<1	23	4	1	<1
Sch-04	100 m S	1	<1	<1	<1	<1	2	4
		5	<1	<1	37	5	3	2
Sch-05	100 m WSW	1	<1	<1	<1	<1	3	3
		9	<1	<1	9	6	1	4
Sch-06	100 m NW	1	4	<1	7	1	4	2
		5	2	<1	<1	5	<1	6
Sch-10	200 m SSE	1	2	2	1	<1	3	2
Sch-14	200 m W	1	26	<1	2	1	1	<1

5.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Schooner Way WWTP and collection system would likely be required to eliminate all regulatory compliance violations for this facility. A strategic asset management plan for this facility, the Cannon Crescent WWTP and the drinking water treatment plant has been completed. The plan and its recommendations are under review.

6.0 CANNON CRESCENT

6.1 Introduction

The Cannon Crescent WWTP is located on the southwest side of North Pender Island (Figure 1.1). It discharges undisinfected secondary effluent into Swanson Channel through a 204-m-long outfall at a depth of 29 m below sea level.

The facility is regulated by the Environmental Management Act's Waste Discharge Regulation, under permit PE-00220 dated April 28, 1981, with the following requirements:

Table 6.1 Cannon Crescent 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. Two years of monitoring was conducted in 2012 and 2013, as described in Section 1.2. Further monitoring is not required for this facility until 2016 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.

The following section reports the results from the Cannon Crescent treatment plant WMEP (Table 6.2).

Table 6.2 Cannon Crescent Treatment Plant WMEP

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)	Once per year[2]

Notes:
[1] All substances are listed in Appendix D2
[2] 5 samples in 30 days were conducted in 2012 and 2013. Next receiving water sampling will be conducted in 2016.

6.2 Results

6.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2014, 24 total daily flows, representing 7% of the year, from the Cannon Crescent WWTP exceeded the allowable maximum (Table 6.3, Appendix D1). Flow exceedences occurred in January, February, March and December, similar to previous years. The mean flow of 44 m^3/day is typical of the last 10 years. Average daily flow ranged from 32 to 63 m^3/day. Effluent quality was similar to 2012 and 2013, with no exceedences of the wastewater quality compliance parameters (Table 6.4, Appendix D2).

Overall, the treatment plant removed approximately 85% of the TSS, 97% of the fecal coliform, and 91% of the BOD from the influent.

Table 6.3 Cannon Crescent WWTP 2014 Annual 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	49	34	121	1,524	31	10%
February	59	33	84	1,639	28	29%
March	63	41	104	1,943	31	32%
April	43	31	60	1,283	30	0%
May	36	13	47	1,130	31	0%
June	34	17	47	1,018	30	0%
July	38	21	51	1,182	31	0%
August	40	23	52	1,236	31	0%
September	32	23	42	962	30	0%
October	36	16	63	1,108	31	0%
November	46	31	64	1,388	30	0%
December	51	51	84	1,541	30	7%
Annual	**44**	**13**	**121**	**16,003**	**365**	**7%**

Table 6.4 Cannon Crescent WWTP 2014 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring		
	Flow (m^3/d)	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	CBOD (mg/L)	NH_3 (mg/L N)	pH (pH)
Influent							
Regulatory Limit	---	---	---	---	---	---	---
Mean	44	115	---	819,075	165	---	---
Minimum	13	<5	---	18,000	<20	---	---
Maximum	121	495	---	4,900,000	550	---	---
Permit Violations	7%	---	---	---	---	---	---
Number of Samples	365	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	68	60	45	---	---	---	---
Mean	44	17	3	23,716	15	5.56	6.3
Minimum	13	5	<4	2,000	5	0.02	4.5
Maximum	121	42	26	970,000	26	37.50	7.2
Percent Reduction	---	85%	---	97%	91%	---	---
Permit Violations	7%	0%	0%	---	---	---	---
Number of Samples	365	12	12	12	12	12	12

6.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

There was no receiving water monitoring conducted at the Cannon Crescent WWTP in 2014. Monitoring is scheduled to be repeated in 2016, and will only occur sooner in the case of planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer. For the most recent receiving water monitoring results see the *Gulf Islands and Port Renfrew Wastewater Marine Environment Program 2013 Annual Report* (CRD, 2014

6.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Cannon Crescent WWTP and collection system would likely be required to eliminate all regulatory compliance violations for this facility. A strategic asset management plan for this facility, the Schooner Way WWTP and the drinking water treatment plant has been completed. The plan and its recommendations are under review.

7.0 PORT RENFREW

7.1 Introduction

The Port Renfrew WWTP 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-long outfall at a depth of 3 m.

The facility is regulated by Environmental Management Act's Waste Discharge Regulation, under permit PE-00312 dated April 15, 1992, with the following requirements:

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. Two years of monitoring was conducted in 2012 and 2013, as described in Section 1.2. Further monitoring is not required for this facility until 2016 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.

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

Table 7.2 Port Renfrew Treatment Plant WMEP

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)	Once per year[2]

Notes:
[1] All substances are listed in Appendix E2
[2] 5 samples in 30 days were conducted in 2012 and 2013. Next receiving water sampling will be conducted in 2016.

7.2 Results

7.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2014, there were no exceedences for daily flows at the Port Renfrew WWTP (Table 7.3, Appendix E1). Mean daily flows in 2014 were 57 m^3/day, the high end of flows measured since 2007, which ranged from 38 to 55 m^3/day. Flows from 1997 to 2006 ranged from 30 to 50 m^3/d; the range shifted upwards after the installation of a new flow meter in 2007. The newer flow meter is considered to be more accurate, and trend comparisons to pre-2007 data are, therefore, not possible.

In 2014, there was one permit violation for TSS levels, representing 8% of the monthly samples. The treatment plant removed approximately 90% of the TSS, 96% of the BOD, and >99% of the fecal coliforms.

Table 7.3 Port Renfrew WWTP 2014 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	64	37	122	1,975	31	0
February	64	42	110	1,794	28	0
March	68	38	140	2,123	31	0
April	54	33	90	1,629	30	0
May	46	31	61	1,424	31	0
June	37	26	67	1,110	30	0
July	43	36	50	1,342	31	0
August	48	36	67	1,481	31	0
September	42	28	72	1,262	30	0
October	75	31	124	2,320	31	0
November	70	33	156	2,110	30	0
December	68	41	165	2,122	31	0
Annual	**57**	**26**	**165**	**20,691**	**365**	**0**

Table 7.4 Port Renfrew WWTP 2014 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 (pH)
Influent							
Regulatory Limit	---	---	---	---	---	---	---
Mean	57	281	---	1,874,189	245	---	---
Minimum	26	44	---	410,000	74	---	---
Maximum	165	1,074	---	6,300,000	547	---	---
Permit Violations	0%	---	---	---	---	---	---
Number of Samples	365	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	220	60	45	---	---	---	---
Mean	57	27	6	6,613	11	0.74	5.5
Minimum	26	13	4	1,000	6	0.07	4.2
Maximum	165	67	11	170,000	26	2.40	6.6
Percent Reduction	---	90%	---	>99%	96%	---	---
Permit Violations	0%	8%	0%	---	---	---	---
Number of Samples	365	12	11	12	12	12	12

7.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

There was no receiving water monitoring conducted at the Port Renfrew WWTP in 2014. Monitoring is scheduled to be repeated in 2016, and will only occur sooner in the case of planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer. For the most recent receiving water monitoring results see the *Gulf Islands and Port Renfrew Wastewater Marine Environment Program 2013 Annual Report* (CRD, 2014).

7.3 Recommendations

None.

8.0 REFERENCES

APHA, 1998. Standard Methods for the Examination of Water and Wastewater, 20th Edition. American Public Health Association, Washington, DC.

BC MoE (British Columbia Ministry of Environment). 2002. Environmental Management Act and Health Act, Organic Matter Recycling Regulation. Queens Printer, Victoria, BC Canada.

BC MoE (British Columbia Ministry of Environment) (2010). British Columbia Approved British Columbia Water Quality Guidelines (Criteria). http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved.

CRD, 2007. Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2006 Annual Report. Capital Regional District Environmental Services, Victoria, BC Canada.

CRD, 2008a. Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2007 Annual Report. Capital Regional District Environmental Services, Victoria, BC Canada.

CRD, 2008b. Regional Source Control Program Annual Report 2008. Capital Regional District Environmental Services, Victoria, BC Canada.

CRD, 2009. Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2008 Annual Report. Capital Regional District Environmental Protection, Victoria, BC Canada.

CRD, 2010. Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2009 Annual Report. Capital Regional District Environmental Protection, Victoria, BC Canada.

CRD, 2011. Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2010 Annual Report. Capital Regional District Environmental Protection, Victoria, BC Canada.

CRD, 2013. Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2012 Annual Report. Capital Regional District Environmental Protection, Victoria, BC Canada.

CRD, 2014. Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2013 Annual Report. Capital Regional District Environmental Protection, Victoria, BC Canada.

Health Canada, 2012. Guidelines for Canadian Recreational Water Quality. Third Edition. Published by authority of the Minister of Health. Ottawa, Ontario. 161 pp.

BC MoE. 2006. A compendium of Working Water Quality Guidelines for British Columbia. Ministry of Environment, Environmental Protection Division, BC Canada.

Seaconsult Marine Research Ltd., 1994. Wastewater Dilution and Dispersion for the Ganges Treatment Plant Outfall. Prepared for the Capital Regional District, Victoria, BC Canada.

Warrington, 2001. Water Quality Criteria for Microbiological Indicators. BC Ministry of Environment, Victoria, BC, Canada.

APPENDIX A

GANGES HARBOUR

Appendix A1 Wastewater Priority Substances Detected in Ganges Harbour Influent and Effluent 2014

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
Conventionals								
specific conductivity - 25°C	µS/cm	1	639	480	---	---		
alkalinity - total - pH 4.5	mg/L	0.5	161	74	---	---		
biochemical oxygen demand	mg/L	5	331	5	---	n/a		
carbonaceous biochemical oxygen demand	mg/L	5	274	5	---	n/a		
chemical oxygen demand	mg/L	1	730	20	---	n/a		
SAD cyanide	mg/L	0.0005	---	---	---	---		
WAD cyanide	mg/L	0.0005	---	---	---	---	0.001b	
hardness (as CaCO3)	mg/L	0.5	61.4	54	0.129	n/a		
oil & grease, total	mg/L	1	21	1	0.002	423		
oil & grease, mineral	mg/L	2	<2	<2	---	---		
pH	pH	1	7	7.5	---	---		
pH @ 15°C	pH	1	---	7.02	---	---		
sulphate	mg/L	0.5	ND	ND	---	---		
sulfide	mg/L	0.005	ND	<0.05	<0.05			
temperature	°C	0.1	ND	ND	---	---		
total organic carbon	mg/L	0.5	101	16	0.04	6937		
total suspended solids	mg/L	1	314	<4	<4			
Bacteriology								
Enterococci	CFU/100 mL	10	3,300,000	10	0.02	4230	20j	35/70n
Fecal Coliforms	CFU/100 mL	1	14,000,000	<1	<1	---	200j	
Nutrients								
N - TKN (as N)	mg/L	0.003	37.1	0.26	0.0006	109		
N - NH3 (as N)	mg/L	0.003	33	0.26	0.0006	110	19.7e	
N - NH3 (as N)- unionized	mg/L	0.0005	---	0.0007	0.000002	0.313		
N - NO2 (as N)	mg/L	0.002	<0.01	0.13	0.0003	55		
N - NO3 (as N)	mg/L	0.003	<0.01	1.78	0.004	753		
N - Total (as N)	mg/L	0.02	ND	ND	---	---		
P - PO4 - total (as P dissolved)	mg/L	0.002	ND	ND	---	---		
P - PO4 - total (as P)	mg/L	0.002	6.76	0.144	0.0003	61		
P - PO4 - ortho (as P)	mg/L	0.1	4.12	<0.1	<0.1	---		
Metals - Total								
aluminum	mg/L	0.0002	0.272	0.0251	0.0001	11		
antimony	mg/L	0.00002	0.000123	0.000259	0.000001	0.110		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
arsenic	mg/L	0.00002	0.000651	0.00027	0.000001	0.114	0.0125cg	0.0125
barium	mg/L	0.00002	0.0144	0.00783	0.00002	3.3	0.5ac	
beryllium	mg/L	0.00001	<0.00001	<0.00001	<0.00001	---		
cadmium	mg/L	0.000005	0.000143	0.0001	0.0000002	0.044	0.00012c	0.00012
calcium	mg/L	0.05	14.5	13.8	0.033	5837		
chloride	mg/L	1	---	---	---	---		
chromium	mg/L	0.0001	0.00103	0.00038	0.000001	0.161		
chromium VI	mg/L	0.001	<0.001	<0.001	<0.001	---		
cobalt	mg/L	0.000005	0.000395	0.0002	0.0000004	0.067		
copper	mg/L	0.00005	0.103	0.00603	0.00001	2.6	0.003bh	
iron	mg/L	0.001	0.93	0.0662	0.00016	28	0.05ac	
lead	mg/L	0.000005	0.00187	0.00031	0.000001	0.131	0.14bh	
magnesium	mg/L	0.05	6.14	4.75	0.011	2009		
manganese	mg/L	0.00005	0.0699	0.0404	0.00010	17	0.1c	
mercury	mg/L	0.000002	0.0000128	<0.000002	<0.000002	---	0.002b	
molybdenum	mg/L	0.00005	0.000679	0.0002	0.0000004	0.075		
nickel	mg/L	0.00002	0.00345	0.000915	0.000002	0.387	0.075ci	
potassium	mg/L	0.05	20.6	16.6	0.040	7022		
selenium	mg/L	0.00004	0.000222	0.0001	0.0000002	0.039		
silver	mg/L	0.000005	0.000261	0.00002	0.0000001	0.009	0.003bh	
thallium	mg/L	0.000002	0.000005	<0.000002	<0.000002	---		
tin	mg/L	0.0002	0.00091	0.0003	0.000001	0.131		
zinc	mg/L	0.0001	0.0994	0.0483	0.0001	20	0.01b	
Metals - Dissolved								
aluminum	mg/L	0.0002	0.0451	0.0193	0.000046	8.2		
antimony	mg/L	0.00002	0.00008	0.0003	0.000001	0.110		
arsenic	mg/L	0.00002	0.00058	0.0003	0.000001	0.111		
barium	mg/L	0.00002	0.00815	0.008	0.00002	3.2		
beryllium	mg/L	0.00001	<0.00001	<0.00001	<0.00001	---		
cadmium	mg/L	0.000005	0.000025	0.0001	0.000000	0.036		
calcium	mg/L	0.05	10.9	13.8	0.033	5837		
chloride	mg/L	0.5	79.3	92.2	0.220	39001		
chromium	mg/L	0.0001	0.000235	0.0003	0.000001	0.127		
cobalt	mg/L	0.000005	0.0467	0.0002	0.0000004	0.065		
copper	mg/L	0.00005	0.752	0.01	0.00001	2.5		
iron	mg/L	0.001	0.00062	0.06	0.00015	27		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
lead	mg/L	0.000005	5.75	0.0003	0.000001	0.118		
magnesium	mg/L	0.05	0.043	4.53	0.011	1916		
manganese	mg/L	0.00005	<0.000002	0.04	0.00009	17		
mercury	mg/L	0.000002	0.000129	<0.000002	<0.000002	---		
molybdenum	mg/L	0.00005	ND	<0.00005	<0.00005	---		
nickel	mg/L	0.00002	18.9	---	---	---		
potassium	mg/L	0.05	ND	16.5	0.039	6980		
selenium	mg/L	0.00004	0.000087	---	---	---		
silver	mg/L	0.000005	0.000002	0.00001	0.00000003	0.006		
thallium	mg/L	0.000002	0.00068	<0.000002	<0.000002	---		
tin	mg/L	0.0002	ND	0.0004	0.000001	0.152		
zinc	mg/L	0.0001	ND	---	---	---		
Metals - Other								
Methyl Mercury	mg/L	0.00000008	0.00000128	<0.00000016	<0.00000016	---		
Monobutyltin	mg/L	0.000001	0.000001	0.000002	0.000000	0.0008		
Monobutyltin Trichloride	mg/L	0.000001	---	---	---	---		
Dibutyltin	mg/L	0.000001	<0.000001	<0.000001	<0.000001	---		
Tributyltin	mg/L	0.000001	<0.000001	<0.000001	<0.000001	---		
Tributyltin Chloride	mg/L	0.000001	<0.000001	<0.000001	<0.000001	---		
Dibutyltin Dichloride	mg/L	0.000001	ND	---	---	---		
Aldehydes								
acrolein	mg/L	0.003	<0.0048	<0.003	<0.003	---		
Phenolic Compounds								
total phenols	mg/L	0.001	0.097	0.01	0.00001	2.4		
Chlorinated Phenols								
2,4 + 2,5 Dichlorophenol	mg/L	0.0001	<0.0005	<0.0005	<0.0005	---		
2,4,6-trichlorophenol	mg/L	0.0001	<0.0005	<0.0005	<0.0005	---		
2-chlorophenol	mg/L	0.0001	<0.0005	<0.0005	<0.0005	---		
4-chloro-3-methylphenol	mg/L	0.0002	<0.001	<0.001	<0.001	---		
pentachlorophenol	mg/L	0.0001	<0.0005	<0.0005	<0.0005	---		
Non-chlorinated Phenolics								
2-nitrophenol	mg/L	0.0005	<0.0025	<0.0025	<0.0025	---		
4-nitrophenol	mg/L	0.0005	<0.0025	<0.0025	<0.0025	---		
2,4-dimethylphenol	mg/L	0.0005	<0.0025	<0.0025	<0.0025	---		
2-methyl-4,6-dinitrophenol	mg/L	0.0005	ND	---	---	---		
2,4-dinitrophenol	mg/L	0.0013	ND	---	---	---		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
phenol	mg/L	0.0005	<0.0025	0.02	0.00004	7.0		
Polycyclic Aromatic Hydrocarbons								
2-chloronaphthalene	mg/L	0.00005	<0.00025	<0.00025	<0.00025	---		
2-methylnaphthalene	mg/L	0.00001	<0.00001	<0.00002	<0.00002	---	0.001b	
acenaphthene	mg/L	0.00001	<0.00001	<0.00002	<0.00002	---	0.006b	
acenaphthylene	mg/L	0.00001	---	---	---	---		
anthracene	mg/L	0.00001	<0.00001	<0.00002	<0.00002	---		
benzo(a)pyrene	mg/L	0.00001	<0.00001	<0.00008	<0.00008	---		
benzo(a)anthracene	mg/L	0.00001	<0.00001	<0.00002	<0.00002	---		
benzo(b)fluoranthene + benzo(j)fluoranthene	mg/L	0.00001	<0.00001	<0.00002	<0.00002	---		
dibenzo(a,h)anthracene	mg/L	0.00002	<0.00002	<0.00002	<0.00002	---		
benzo(g,h,i)perylene	mg/L	0.00002	<0.00002	<0.00002	<0.00002	---		
benzo(k)fluoranthene	mg/L	0.00001	<0.00001	<0.00001	<0.00001	---		
chrysene	mg/L	0.00001	<0.00001	<0.00002	<0.00002	---		
fluoranthene	mg/L	0.00001	<0.00001	<0.00005	<0.00005	---		
fluorene	mg/L	0.00001	<0.00001	<0.00007	<0.00007	---	0.012bh	
indeno(1,2,3-c,d)pyrene	mg/L	0.00002	<0.00002	<0.00002	<0.00002	---		
naphthalene	mg/L	0.00001	<0.00001	0.00003	0.0000001	0.01		
octachlorostyrene	mg/L	0.000005	---	---	---	---		
phenanthrene	mg/L	0.00001	0.000015	<0.0001	<0.0001	---		
pyrene	mg/L	0.00001	<0.00001	<0.00004	<0.00004	---		
Total HMW-PAH	mg/L	0.00002	<0.00002	<0.00008	<0.00008	---		
Total LMW-PAH	mg/L	0.00001	0.000015	<0.0001	<0.0001	---		
total PAH	mg/L	0.00002	<0.00002	<0.0001	<0.0001	---		
Semivolatile Organics								
bis(2-ethylhexyl)phthalate	mg/L	0.001	<0.005	0.01	0.00003	6.0		
butylbenzyl phthalate	mg/L	0.0005	<0.0025	<0.0025	<0.0025	---		
diethyl phthalate	mg/L	0.00005	ND	---	---	---		
dimethyl phthalate	mg/L	0.00005	ND	---	---	---		
di-n-butyl phthalate	mg/L	0.0005	ND	---	---	---		
di-n-octyl phthalate	mg/L	0.00005	<0.00025	<0.00063	<0.00063	---		
Misc Semivolatile Organics								
1,2-diphenylhydrazine	mg/L	0.00001	<0.00005	<0.0004	<0.0004	---		
2,6-dinitrotoluene	mg/L	0.00005	<0.00025	<0.00025	<0.00025	---		
2,4-dinitrotoluene	mg/L	0.00005	<0.00025	<0.00025	<0.00025	---		
4-chlorophenyl phenyl ether	mg/L	0.00005	<0.00025	<0.00025	<0.00025	---		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
4-bromophenyl phenyl ether	mg/L	0.00001	<0.00005	<0.00005	<0.00005	---		
3,3-dichlorobenzidine	mg/L	0.0001	<0.0005	<0.0005	<0.0005	---		
bis(2-chloroisopropyl)ether	mg/L	0.00005	<0.00025	<0.00054	<0.00054	---		
bis(2-chloroethyl)ether	mg/L	0.00005	<0.00025	<0.00025	<0.00025	---		
bis(2-chloroethoxy)methane	mg/L	0.00005	<0.00025	<0.00032	<0.00032	---		
benzidine	mg/L	0.01	---	---	---	---		
hexachlorocyclopentadiene	mg/L	0.000005	<0.00025	<0.00025	<0.00025	---		
hexachloroethane	mg/L	0.00001	<0.00025	<0.00025	<0.00025	---		
hexachlorobutadiene	mg/L	0.000009	<0.00025	<0.00025	<0.00025	---		
isophorone	mg/L	0.00005	<0.00025	<0.00059	<0.00059	---		
N-nitrosodiphenylamine	mg/L	0.0002	<0.001	<0.001	<0.001	---		
N-nitrosodi-n-propylamine	mg/L	0.0002	<0.001	<0.001	<0.001	---		
N-nitrosodimethylamine	mg/L	0.0002	<0.001	<0.001	<0.001	---		
nitrobenzene	mg/L	0.00005	<0.00025	<0.00025	<0.00025	---		
Volatile Organic Compounds								
Monocyclic Aromatic Hydrocarbons								
1,2,4-trichlorobenzene	mg/L	0.00004	<0.0002	<0.0002	<0.0002	---		
1,2-dichlorobenzene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,3-dichlorobenzene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,4-dichlorobenzene	mg/L	0.0005	<0.00059	<0.0005	<0.0005	---		
benzene	mg/L	0.0004	<0.0004	<0.0004	<0.0004	---		
chlorobenzene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
ethylbenzene	mg/L	0.0004	<0.0004	<0.0004	<0.0004	---		
m & p xylenes	mg/L	0.0004	<0.0004	<0.0004	<0.0004	---		
o-xylene	mg/L	0.0004	<0.0004	<0.0004	<0.0004	---		
styrene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
toluene	mg/L	0.0004	0.01	<0.0004	<0.0004	---		
xylenes	mg/L	0.0004	<0.0004	<0.0004	<0.0004	---		
Aliphatic								
acrylonitrile	mg/L	0.004	<0.004	<0.004	<0.004	---		
methyl tertiary butyl ether	mg/L	0.004	<0.004	<0.004	<0.004	---		
Chlorinated Aliphatic								
1,1,1,2-tetrachloroethane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,1,1-trichloroethane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,1,2,2-tetrachloroethane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,1,2-trichloroethane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
1,1-dichloroethane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,1-dichloroethene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,2-dichloropropane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
1,2-dichloroethane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
bromomethane	mg/L	0.001	<0.001	<0.001	<0.001	---		
chloromethane	mg/L	0.001	<0.001	<0.001	<0.001	---		
chloroethene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
chloroethane	mg/L	0.001	<0.001	<0.001	<0.001	---		
cis-1,3-dichloropropene	mg/L	0.001	<0.001	<0.001	<0.001	---		
cis-1,2-dichloroethene	mg/L	0.001	<0.001	<0.001	<0.001	---		
dichloromethane	mg/L	0.002	<0.002	<0.002	<0.002	---		
dibromomethane	mg/L	0.0009	<0.0009	<0.0009	<0.0009	---		
tetrachloromethane	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
tetrachloroethene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
tetrabromomethane	mg/L	0.05	<0.05	<0.05	<0.05	---		
trans-1,3-dichloropropene	mg/L	0.001	<0.001	<0.001	<0.001	---		
trans-1,2-dichloroethene	mg/L	0.001	<0.001	<0.001	<0.001	---		
trichloromethane	mg/L	0.001	0.011	0.001	0.000003	0.508	0.0018c	
trichlorofluoromethane	mg/L	0.004	<0.004	<0.004	<0.004	---		
trichloroethene	mg/L	0.0005	<0.0005	<0.0005	<0.0005	---		
tribromomethane	mg/L	0.001	<0.001	<0.001	<0.001	---		
Trihalomethanes								
chlorodibromomethane	mg/L	0.001	<0.001	<0.001	<0.001	---		
bromodichloromethane	mg/L	0.001	0.0011	<0.001	<0.001	---		
Ketones								
methyl isobutyl ketone	mg/L	0.01	<0.01	<0.01	<0.01	---		
dimethyl ketone	mg/L	0.015	0.064	<0.015	<0.015	---		
methyl ethyl ketone	mg/L	0.01	0.01	<0.01	<0.01	---		
Terpenes								
alpha-terpineol	mg/L	0.001	<0.005	0.02	0.00004	6.5		
Toxicity								
96-hour LC50 - RT	% survival	1	---	>100	---	---		
48-hour LC50 - DM	% survival	1	---	>100	---	---		
High Resolution Analyses								
Nonylphenols								
4-Nonylphenols	mg/L	9.43	0.002	0.0002	0.000001	0.1	0.0007c	

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
4-Nonylphenol monoethoxylates	mg/L	16.9	0.005	ND	---	---		
4-Nonylphenol diethoxylates	mg/L	22.7	0.002	0.00003	0.0000001	0.01		
Octylphenol	mg/L	3.59	ND	ND	---	---		
PAH								
Naphthalene	mg/L	0.304	0.00004	0.000004	0.00000001	0.002		
Acenaphthylene	mg/L	0.215	0.000002	ND	---	---		
Acenaphthene	mg/L	0.209	0.00001	0.000001	0.000000004	0.001	0.006b	
Fluorene	mg/L	0.0794	0.00001	0.000003	0.00000001	0.001	0.012bh	
Phenanthrene	mg/L	0.0909	0.00007	0.000006	0.00000001	0.002		
Anthracene	mg/L	0.0886	0.00001	0.0000003	0.000000001	0.0001		
Fluoranthene	mg/L	0.135	0.00003	0.000001	0.000000002	0.0004		
Pyrene	mg/L	0.132	0.00004	0.000002	0.00000001	0.001		
Benz[a]anthracene	mg/L	0.0908	0.00001	ND	---	---		
Chrysene	mg/L	0.082	0.00002	0.0000004	0.000000001	0.0002		
Benzo[b]fluoranthene	mg/L	0.0933	0.000008	ND	---	---		
Benzo[j,k]fluoranthenes	mg/L	0.0903	0.000008	ND	---	---		
Benzo[e]pyrene	mg/L	0.124	0.00001	ND	---	---		
Benzo[a]pyrene	mg/L	0.12	0.000007	ND	---	---		
Perylene	mg/L	0.129	0.000004	ND	---	---		
Dibenz[a,h]anthracene	mg/L	0.15	ND	ND	---	---		
Indeno[1,2,3-cd]pyrene	mg/L	0.168	0.000007	ND	---	---		
Benzo[ghi]perylene	mg/L	0.172	0.00001	ND	---	---		
2-Methylnaphthalene	mg/L	0.187	0.00002	0.000002	0.000000004	0.0008	0.001b	
2,6-Dimethylnaphthalene	mg/L	0.499	0.000008	ND	---	---		
2,3,5-Trimethylnaphthalene	mg/L	0.0855	0.00001	0.0000006	0.000000001	0.0002		
1-Methylphenanthrene	mg/L	0.295	0.00001	ND	---	---		
Dibenzothiophene	mg/L	0.215	0.00001	0.0000008	0.000000002	0.0003		
PBDE								
7	mg/L	1.43	0.000000004	0.000000002	0.000000000005	0.000001		
8	mg/L	1.4	0.000000007	0.000000002	0.00000000001	0.000001		
10	mg/L	1.56	ND	ND	---	---		
11	mg/L	---	ND	ND	---	---		
12	mg/L	1.4	0.000000005	ND	---	---		
13	mg/L	---	ND	ND	---	---		
15	mg/L	1.4	0.00000004	0.000000005	0.00000000001	0.000002		
17	mg/L	2.57	0.0000004	0.00000003	0.0000000001	0.00001		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
25	mg/L	---	ND	ND	---	---		
28	mg/L	2.27	0.000001	0.00000004	0.0000000001	0.00002		
30	mg/L	2.77	ND	ND	---	---		
32	mg/L	2.12	0.000000003	ND	---	---		
33	mg/L	---	ND	ND	---	---		
35	mg/L	1.8	0.000000008	ND	---	---		
37	mg/L	1.83	0.00000002	0.00000002	0.00000000005	0.00001		
47	mg/L	1.51	0.00005	0.0000004	0.000000001	0.0002		
49	mg/L	2.22	0.000001	0.00000003	0.00000000007	0.00001		
51	mg/L	1.45	0.0000002	0.000000007	0.00000000002	0.000003		
66	mg/L	3.01	0.000001	0.00000002	0.00000000005	0.00001		
71	mg/L	2.14	0.0000001	0.000000003	0.00000000001	0.000001		
75	mg/L	1.87	0.00000008	0.000000004	0.00000000001	0.000002		
77	mg/L	1.84	ND	ND	---	---		
79	mg/L	1.84	ND	ND	---	---		
85	mg/L	3.17	0.000001	0.000000008	0.00000000002	0.000004		
99	mg/L	1.81	0.00004	0.0000002	0.0000000004	0.0001		
100	mg/L	1.4	0.000008	0.00000004	0.0000000001	0.00002		
105	mg/L	4.32	ND	ND	---	---		
116	mg/L	5.65	ND	0.00000001	0.00000000003	0.000005		
119	mg/L	2.85	0.00000008	0.000000004	0.00000000001	0.000002		
120	mg/L	---	ND	ND	---	---		
126	mg/L	2.16	0.00000002	ND	---	---		
128	mg/L	9.71	ND	ND	---	---		
138	mg/L	9.09	0.0000004	ND	---	---		
140	mg/L	5.11	0.0000001	ND	---	---		
153	mg/L	5.57	0.000008	0.00000001	0.00000000003	0.000004		
154	mg/L	2.83	0.000002	0.00000001	0.00000000003	0.000005		
155	mg/L	2.97	0.0000002	ND	---	---		
166	mg/L	---	ND	ND	---	---		
181	mg/L	13.2	ND	ND	---	---		
183	mg/L	6.37	0.0000005	0.00000001	0.00000000002	0.000004		
190	mg/L	24.3	0.0000001	ND	---	---		
203	mg/L	21.3	0.0000004	0.00000003	0.0000000001	0.00001		
206	mg/L	50.3	0.000003	0.0000003	0.000000001	0.0001		
207	mg/L	62.9	0.000003	0.0000002	0.000000001	0.0001		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
208	mg/L	65.8	0.000002	0.0000003	0.000000001	0.0001		
209	mg/L	1470	0.00005	0.000005	0.00000001	0.002		
PCB								
Total Monochloro Biphenyls	mg/L	---	0.00000006	0.00000002	0.00000000004	0.000008		
Total Dichloro Biphenyls	mg/L	---	0.000002	0.0000001	0.0000000003	0.00005		
Total Trichloro Biphenyls	mg/L	---	0.000001	0.00000006	0.0000000001	0.00002		
Total Tetrachloro Biphenyls	mg/L	---	0.000001	0.00000005	0.0000000001	0.00002		
Total Pentachloro Biphenyls	mg/L	---	0.000001	0.00000004	0.00000000009	0.00002		
Total Hexachloro Biphenyls	mg/L	---	0.000001	0.00000001	0.00000000002	0.000004		
Total Heptachloro Biphenyls	mg/L	---	0.0000004	0.000000004	0.000000000009	0.000002		
Total Octachloro Biphenyls	mg/L	---	0.0000001	ND	---	---		
Total Nonachloro Biphenyls	mg/L	---	0.00000001	ND	---	---		
Decachloro Biphenyl	mg/L	---	0.00000001	ND	---	---		
TOTAL PCBs	mg/L	---	0.000007	0.0000003	0.0000000007	0.0001	0.0000001b	
TEQ (ND = 0)	mg/L	---	ND	0.000000000001	0.000000000000003	---		
TEQ (ND = 1/2 DL)	mg/L	---	ND	0.00000000004	0.0000000000001	---		
1	mg/L	0.699	0.00000001	0.000000005	0.00000000001	0.000002		
2	mg/L	0.699	0.00000001	0.000000004	0.000000000009	0.000002		
3	mg/L	0.699	0.00000005	0.000000009	0.00000000002	0.000004		
4	mg/L	3.14	0.00000002	ND	---	---		
5	mg/L	2.86	ND	ND	---	---		
6	mg/L	2.41	0.00000002	ND	---	---		
7	mg/L	2.46	ND	0.000000003	0.000000000007	0.000001		
8	mg/L	2.14	0.00000005	0.000000005	0.00000000001	0.000002		
9	mg/L	2.52	ND	ND	---	---		
10	mg/L	2.45	ND	ND	---	---		
11	mg/L	2.64	0.000002	0.0000001	0.0000000003	0.00005		
12	mg/L	2.67	ND	ND	---	---		
13	mg/L	---	ND	ND	---	---		
14	mg/L	2.58	ND	ND	---	---		
15	mg/L	3.09	0.00000004	0.000000006	0.00000000001	0.000003		
16	mg/L	0.699	0.00000004	0.000000004	0.00000000001	0.000002		
17	mg/L	0.699	0.00000004	0.000000003	0.000000000007	0.000001		
18	mg/L	0.699	0.00000009	0.000000009	0.00000000002	0.000004		
19	mg/L	0.699	0.00000001	0.000000002	0.000000000004	0.0000007		
20	mg/L	0.699	0.0000002	0.000000009	0.00000000002	0.000004		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
21	mg/L	0.699	0.0000001	0.000000004	0.000000000009	0.000002		
22	mg/L	0.699	0.00000006	0.000000004	0.000000000009	0.000002		
23	mg/L	0.699	ND	ND	---	---		
24	mg/L	0.699	ND	ND	---	---		
25	mg/L	0.699	0.00000001	ND	---	---		
26	mg/L	0.699	0.00000002	0.000000002	0.000000000005	0.0000008		
27	mg/L	0.699	0.00000001	ND	---	---		
28	mg/L	---	ND	ND	---	---		
29	mg/L	---	ND	ND	---	---		
30	mg/L	---	ND	ND	---	---		
31	mg/L	0.699	0.0000002	0.000000008	0.00000000002	0.000003		
32	mg/L	0.699	0.00000003	0.000000002	0.000000000006	0.000001		
33	mg/L	---	ND	ND	---	---		
34	mg/L	0.699	ND	ND	---	---		
35	mg/L	0.725	0.0000003	0.000000006	0.00000000001	0.000003		
36	mg/L	0.699	0.00000005	0.000000002	0.000000000004	0.0000007		
37	mg/L	0.699	0.00000004	0.000000002	0.000000000005	0.0000009		
38	mg/L	0.699	ND	ND	---	---		
39	mg/L	0.699	ND	ND	---	---		
40	mg/L	0.699	0.00000009	0.000000004	0.000000000008	0.000002		
41	mg/L	---	ND	ND	---	---		
42	mg/L	0.699	0.00000003	0.000000001	0.000000000004	0.0000006		
43	mg/L	0.699	0.00000001	ND	---	---		
44	mg/L	0.699	0.0000002	0.000000009	0.00000000002	0.000004		
45	mg/L	0.699	0.00000004	0.000000002	0.000000000005	0.0000009		
46	mg/L	0.699	0.00000001	ND	---	---		
47	mg/L	---	ND	ND	---	---		
48	mg/L	0.699	0.00000004	0.000000001	0.000000000003	0.0000005		
49	mg/L	0.699	0.00000009	0.000000004	0.000000000008	0.000002		
50	mg/L	0.699	0.00000002	0.000000001	0.000000000004	0.0000006		
51	mg/L	---	ND	ND	---	---		
52	mg/L	0.699	0.0000002	0.00000001	0.00000000003	0.000005		
53	mg/L	---	ND	ND	---	---		
54	mg/L	0.699	ND	ND	---	---		
55	mg/L	0.699	ND	ND	---	---		
56	mg/L	0.699	0.00000006	0.000000002	0.000000000005	0.0000009		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
57	mg/L	0.699	ND	ND	---	---		
58	mg/L	0.699	ND	ND	---	---		
59	mg/L	0.699	0.00000001	0.000000001	0.000000000002	0.0000003		
60	mg/L	0.699	0.00000004	0.000000001	0.000000000003	0.0000005		
61	mg/L	0.699	0.0000003	0.00000001	0.00000000003	0.000005		
62	mg/L	---	ND	ND	---	---		
63	mg/L	0.699	0.000000005	ND	---	---		
64	mg/L	0.699	0.00000007	0.000000003	0.000000000006	0.000001		
65	mg/L	---	ND	ND	---	---		
66	mg/L	0.699	0.0000001	0.000000004	0.000000000009	0.000002		
67	mg/L	0.699	0.000000003	ND	---	---		
68	mg/L	0.699	0.00000001	ND	---	---		
69	mg/L	---	ND	ND	---	---		
70	mg/L	---	ND	ND	---	---		
71	mg/L	---	ND	ND	---	---		
72	mg/L	0.699	ND	ND	---	---		
73	mg/L	0.699	ND	ND	---	---		
74	mg/L	---	ND	ND	---	---		
75	mg/L	---	ND	ND	---	---		
76	mg/L	---	ND	ND	---	---		
77	mg/L	0.699	0.00000003	0.0000000008	0.000000000002	0.0000003	0.000000040l	
78	mg/L	0.699	0.000000004	ND	---	---		
79	mg/L	0.699	0.00000001	ND	---	---		
80	mg/L	0.699	ND	ND	---	---		
81	mg/L	0.699	ND	ND	---	---		
82	mg/L	0.699	0.00000002	ND	---	---		
83	mg/L	0.699	0.0000001	0.000000002	0.00000000001	0.000001		
84	mg/L	0.699	0.00000006	0.000000002	0.000000000005	0.0000009		
85	mg/L	0.699	0.00000003	0.000000001	0.000000000002	0.0000004		
86	mg/L	0.699	0.0000001	0.000000007	0.00000000002	0.000003		
87	mg/L	---	ND	ND	---	---		
88	mg/L	0.699	0.00000003	0.000000001	0.000000000002	0.0000004		
89	mg/L	0.699	0.000000003	ND	---	---		
90	mg/L	0.699	0.0000002	0.000000007	0.00000000002	0.000003		
91	mg/L	---	ND	ND	---	---		
92	mg/L	0.699	0.00000004	0.000000002	0.000000000004	0.0000007		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
93	mg/L	0.699	0.0000002	0.000000008	0.00000000002	0.000004		
94	mg/L	0.699	ND	ND	---	---		
95	mg/L	---	ND	ND	---	---		
96	mg/L	0.699	0.000000002	ND	---	---		
97	mg/L	---	ND	ND	---	---		
98	mg/L	---	ND	ND	---	---		
99	mg/L	---	ND	ND	---	---		
100	mg/L	---	ND	ND	---	---		
101	mg/L	---	ND	ND	---	---		
102	mg/L	---	ND	ND	---	---		
103	mg/L	0.699	0.000000002	ND	---	---		
104	mg/L	0.699	0.000000001	ND	---	---		
105	mg/L	0.699	0.00000006	0.000000002	0.00000000001	0.0000009	0.000000090l	
106	mg/L	0.699	ND	ND	---	---		
107	mg/L	0.699	0.00000001	ND	---	---		
108	mg/L	---	ND	ND	---	---		
109	mg/L	0.699	0.00000001	ND	---	---		
110	mg/L	0.699	0.0000002	0.000000007	0.00000000002	0.000003		
111	mg/L	0.699	ND	ND	---	---		
112	mg/L	0.699	ND	ND	---	---		
113	mg/L	---	ND	ND	---	---		
114	mg/L	0.699	0.000000005	ND	---	---		
115	mg/L	---	ND	ND	---	---		
116	mg/L	---	ND	ND	---	---		
117	mg/L	---	ND	ND	---	---		
118	mg/L	0.699	0.0000002	0.000000006	0.00000000001	0.000003		
119	mg/L	---	ND	ND	---	---		
120	mg/L	0.699	ND	ND	---	---		
121	mg/L	0.699	ND	ND	---	---		
122	mg/L	0.699	ND	ND	---	---		
123	mg/L	0.699	0.000000004	ND	---	---		
124	mg/L	---	ND	ND	---	---		
125	mg/L	---	ND	ND	---	---		
126	mg/L	0.699	ND	ND	---	---	0.00000000025b	
127	mg/L	0.699	ND	ND	---	---		
128	mg/L	0.699	0.00000003	0.000000001	0.000000000003	0.000001		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
129	mg/L	0.699	0.0000002	0.000000005	0.00000000001	0.000002		
130	mg/L	0.699	0.00000002	ND	---	---		
131	mg/L	0.699	0.000000003	ND	---	---		
132	mg/L	0.699	0.00000006	0.000000001	0.000000000003	0.000001		
133	mg/L	0.699	0.000000003	ND	---	---		
134	mg/L	0.699	0.00000001	ND	---	---		
135	mg/L	0.699	0.00000006	0.000000001	0.000000000004	0.000001		
136	mg/L	0.699	0.00000002	0.000000001	0.000000000002	0.0000004		
137	mg/L	0.699	0.00000001	ND	---	---		
138	mg/L	---	ND	ND	---	---		
139	mg/L	0.699	0.000000005	ND	---	---		
140	mg/L	---	ND	ND	---	---		
141	mg/L	0.699	0.00000004	0.000000001	0.000000000004	0.000001		
142	mg/L	0.699	ND	ND	---	---		
143	mg/L	---	ND	ND	---	---		
144	mg/L	0.699	0.00000001	ND	---	---		
145	mg/L	0.699	ND	ND	---	---		
146	mg/L	0.699	0.00000003	0.000000001	0.000000000002	0.0000004		
147	mg/L	0.699	0.0000001	0.000000004	0.00000000001	0.000002		
148	mg/L	0.699	0.000000001	ND	---	---		
149	mg/L	---	ND	ND	---	---		
150	mg/L	0.699	0.000000001	ND	---	---		
151	mg/L	---	ND	ND	---	---		
152	mg/L	0.699	ND	ND	---	---		
153	mg/L	0.699	0.0000002	0.000000004	0.00000000001	0.000002		
154	mg/L	---	ND	ND	---	---		
155	mg/L	0.699	0.00000001	ND	---	---		
156	mg/L	0.699	0.00000003	0.000000001	0.000000000002	0.0000003		
157	mg/L	---	ND	ND	---	---		
158	mg/L	0.699	0.00000002	0.000000001	0.000000000002	0.0000003		
159	mg/L	0.699	ND	ND	---	---		
160	mg/L	---	ND	ND	---	---		
161	mg/L	0.699	ND	ND	---	---		
162	mg/L	0.699	ND	ND	---	---		
163	mg/L	---	ND	ND	---	---		
164	mg/L	0.699	0.00000001	ND	---	---		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
165	mg/L	0.699	ND	ND	---	---		
166	mg/L	---	ND	ND	---	---		
167	mg/L	0.699	0.00000001	ND	---	---		
168	mg/L	---	ND	ND	---	---		
169	mg/L	0.699	ND	ND	---	---	0.00000006b	
170	mg/L	0.699	0.00000005	0.000000001	0.000000000002	0.0000004		
171	mg/L	0.699	0.00000002	ND	---	---		
172	mg/L	0.699	0.00000001	ND	---	---		
173	mg/L	---	ND	ND	---	---		
174	mg/L	0.699	0.00000003	ND	---	---		
175	mg/L	0.699	0.000000002	ND	---	---		
176	mg/L	0.699	0.00000001	ND	---	---		
177	mg/L	0.699	0.00000002	ND	---	---		
178	mg/L	0.699	0.00000001	ND	---	---		
179	mg/L	0.699	0.00000002	ND	---	---		
180	mg/L	0.699	0.0000001	0.000000002	0.00000000001	0.000001		
181	mg/L	0.699	ND	ND	---	---		
182	mg/L	0.699	ND	ND	---	---		
183	mg/L	0.699	0.00000003	0.000000001	0.000000000002	0.0000003		
184	mg/L	0.699	0.00000002	ND	---	---		
185	mg/L	---	ND	ND	---	---		
186	mg/L	0.699	ND	ND	---	---		
187	mg/L	0.699	0.00000007	0.000000002	0.000000000004	0.000001		
188	mg/L	0.699	ND	ND	---	---		
189	mg/L	0.699	0.000000003	ND	---	---		
190	mg/L	0.699	0.00000001	ND	---	---		
191	mg/L	0.699	0.000000002	ND	---	---		
192	mg/L	0.699	ND	ND	---	---		
193	mg/L	---	ND	ND	---	---		
194	mg/L	0.699	0.00000003	ND	---	---		
195	mg/L	0.699	0.00000001	ND	---	---		
196	mg/L	0.699	0.00000001	ND	---	---		
197	mg/L	0.699	0.000000004	ND	---	---		
198	mg/L	0.699	0.00000004	0.000000001	0.000000000003	0.0000005		
199	mg/L	---	ND	ND	---	---		
200	mg/L	---	ND	ND	---	---		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
201	mg/L	0.699	0.00000001	ND	---	---		
202	mg/L	0.699	0.00000001	ND	---	---		
203	mg/L	0.699	0.00000002	ND	---	---		
204	mg/L	0.699	ND	ND	---	---		
205	mg/L	0.699	ND	ND	---	---		
206	mg/L	0.699	0.00000001	ND	---	---		
207	mg/L	0.699	ND	ND	---	---		
208	mg/L	0.699	0.000000004	ND	---	---		
209	mg/L	0.699	0.00000001	0.966	0.002	409		
Pesticides								
1,3-Dichlorobenzene	mg/L	0.219	0.00005	0.000004	0.000000009	0.002		
1,4-Dichlorobenzene	mg/L	0.219	0.0007	0.00006	0.0000001	0.03		
1,2-Dichlorobenzene	mg/L	0.219	0.000004	0.000001	0.000000002	0.0004		
1,3,5-Trichlorobenzene	mg/L	0.219	0.0000002	ND	---	---		
1,2,4-Trichlorobenzene	mg/L	0.219	ND	0.000001	0.000000001	0.0002		
1,2,3-Trichlorobenzene	mg/L	0.219	ND	ND	---	---		
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	mg/L	0.219	ND	ND	---	---		
1,2,3,4-Tetrachlorobenzene	mg/L	0.219	ND	ND	---	---		
Pentachlorobenzene	mg/L	0.0219	0.0000001	0.0000001	0.0000000002	0.00003		
Hexachlorobutadiene	mg/L	0.0792	ND	ND	---	---		
Hexachlorobenzene	mg/L	0.0219	ND	0.0000001	0.0000000002	0.00003		
HCH, alpha	mg/L	0.0439	0.00000007	0.0000001	0.0000000001	0.00002		
HCH, beta	mg/L	0.0439	0.0000002	0.0000002	0.0000000004	0.0001		
HCH, gamma	mg/L	0.0439	0.0000002	0.0000002	0.0000000004	0.0001		
Heptachlor	mg/L	0.0512	ND	ND	---	---		
Aldrin	mg/L	0.0439	ND	ND	---	---		
Octachlorostyrene	mg/L	0.0504	ND	ND	---	---		
Chlordane, oxy-	mg/L	0.11	ND	ND	---	---		
Chlordane, gamma (trans)	mg/L	0.0439	0.0000004	ND	---	---		
Chlordane, alpha (cis)	mg/L	0.0439	ND	ND	---	---		
Nonachlor, trans-	mg/L	0.0439	ND	ND	---	---		
Nonachlor, cis-	mg/L	0.0631	ND	ND	---	---		
2,4'-DDD	mg/L	0.0439	ND	ND	---	---		
4,4'-DDD	mg/L	0.0439	0.0000001	ND	---	---		
2,4'-DDE	mg/L	0.0439	ND	ND	---	---		
4,4'-DDE	mg/L	0.0439	0.000001	ND	---	---		

Appendix A1, continued

Parameter	Units	MDL	Influent	Effluent	Effluent at 419:1 dilution	Loading (kg/yr)	BC WQG	CCME/ HC WQG
2,4'-DDT	mg/L	0.0667	0.0000001	ND	---	---		
4,4'-DDT	mg/L	0.069	0.0000003	ND	---	---		
Mirex	mg/L	0.0439	ND	ND	---	---		
HCH, delta	mg/L	0.11	ND	ND	---	---		
Heptachlor Epoxide	mg/L	0.11	ND	ND	---	---		
alpha-Endosulphan	mg/L	0.11	0.0000004	0.0000003	0.000000001	0.0001		
Dieldrin	mg/L	0.11	0.0000006	0.0000001	0.0000000003	0.0001		
Endrin	mg/L	0.11	ND	ND	---	---		
beta-Endosulphan	mg/L	0.178	ND	0.0000005	0.000000001	0.0002		
Endosulphan Sulphate	mg/L	0.147	0.0000002	ND	---	---		
Endrin Aldehyde	mg/L	0.11	ND	ND	---	---		
Endrin Ketone	mg/L	0.11	ND	ND	---	---		
Methoxychlor	mg/L	0.219	0.0000003	ND	---	---		
PPCP								
Bisphenol A	mg/L	971	ND	ND	---	---		
Furosemide	mg/L	77.7	0.003	0.0002	0.000001	0.1		
Gemfibrozil	mg/L	2.91	ND	ND	---	---		
Glipizide	mg/L	11.7	ND	ND	---	---		
Glyburide	mg/L	5.83	ND	ND	---	---		
Hydrochlorothiazide	mg/L	28.7	ND	0.0006	0.000002	0.3		
2-Hydroxy-ibuprofen	mg/L	155	0.04	0.0003	0.000001	0.1		
Ibuprofen	mg/L	29.1	0.02	0.0001	0.0000003	0.1		
Naproxen	mg/L	5.83	ND	0.0001	0.0000004	0.1		
Triclocarban	mg/L	5.83	0.0001	ND	---	---		
Triclosan	mg/L	117	0.001	ND	---	---		
Warfarin	mg/L	2.91	0.00002	0.000006	0.00000002	0.003		

Notes: Shading indicates BCWQG exceedence

*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

a. these are "minimum risk" guidelines. There are also "hazard" guidelines for these substances (which are higher concentrations), b. approved, c. working, d. inorganic, e. maximum concentration at 7.0 pH and 15^{o}C, f. as H_2S, g. interim, h. maximum, i. chronic, --- not detected $\geq$50%, n/a not analyzed or not applicable, j. assumes a geometric mean of five samples in 30 days, k. guideline expressed as a TEQ basis using NP TEFs, l. The criteria recommended above are more restrictive than the CCREM (1987) and CCME (1991) guidelines of 10,000 pg PCBs/L for the protection of aquatic life. The CCREM and CCME guidelines were designed to protect aquatic biota from toxic effects of PCBs, rather than to protect consumers of PCB contaminated foods; hence CCME guidelines are less restrictive than the BC WQGs, m. recalled guideline, n. Health Canada 2012, geomean of five samples not to exceed 35 CFU/100mL and single results not to exceed 70 CFU/100 mL.

Appendix A2 Ganges Harbour WWTP Sludge (Mixed Liquor) Concentrations 2014

Regulated Parameters (mg/kg dry wt.)	Class A Biosolid Limits (mg/kg)*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct+	Nov+	Dec	Mean
Number of replicates		1	1	1	1	1	1	1	1	1	2	2	1	14
Metals														
Arsenic	75	2.17	1.78	2.17	2.32	2.16	2.26	2.44	2.49	2.46	2.125	2.03	1.29	2.13
Cadmium	20	1.49	1.03	1.4	1.47	1.5	1.59	1.7	1.29	1.39	1.125	1.145	0.778	1.30
Cobalt	150	1.72	1.2	1.41	1.22	1.25	1.24	1.8	1.61	1.68	2.295	2.225	1.2	1.67
Lead	500	14.5	11.6	13.1	12.6	12.7	12.3	13.6	15.5	14.9	14.55	13.45	7.59	13.17
Mercury	5	2.03	1.33	1.6	1.17	0.861	1.01	0.865	1.27	1.2	2.83	2.51	1.29	1.66
Molybdenum	20	4.74	3.63	4.02	3.95	3.76	3.62	3.56	4.28	4.39	4.11	3.94	2.28	3.88
Nickel	180	17	13	13.1	11.6	11.5	11.6	13.8	14.4	14.5	15	14.2	8.46	13.38
Selenium	14	4.18	3.32	3.34	3.07	3.26	3.26	4	3.64	3.48	2.67	2.74	2.01	3.17
Zinc	1,850	357	310	325	390	375	354	364	380	375	351	339	187	343
Unregulated Parameters (mg/kg dry wt.)	**Class A Biosolid Limits (mg/kg)***	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct+**	**Nov+**	**Dec**	**Mean**
Conventionals														
pH	n/a	6.44	6.66	6.58	6.11	6.06	5.91	5.71	6.71	6.33	6.41	6.705	6.65	6.39
Measurement														
Moisture	n/a	96	98	97	98	95	96	95	91	93	94	96.5	96	95
Metals														
Aluminum	n/a	2,590	2,030	2,180	1,660	2,030	1,910	2,240	2,050	2,100	2,570	2,615	1,500	2,190
Antimony	n/a	1.05	1.08	1	1.18	1.05	1.06	0.96	1.02	0.96	0.975	0.89	0.53	0.97
Barium	n/a	71.4	57.6	63.4	48	90.7	68.9	64.5	61.4	60.7	65.6	60	32.4	62
Beryllium	n/a	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.04
Bismuth	n/a	15.2	13.7	12.9	18.1	17.3	16.7	16	19.7	19.9	13.65	18.4	8.81	15.89
Calcium	n/a	9,390	9,420	9,760	6,430	7,700	7,440	7,840	8,520	8,920	9,395	10,025	5,860	8,580
Chromium	n/a	11.6	9.3	10.5	9.8	10.1	9.8	12.6	9.5	10	12.1	10.65	7.2	10.42
Copper	n/a	613	506	502	534	473	461	504	554	548	533.5	464.5	278	498
Iron	n/a	4,400	3,580	4,060	3,040	3,610	3,550	4,400	4,130	4,110	4,590	4,790	2,820	4,033
Lithium	n/a	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Magnesium	n/a	4,300	4,410	4,480	3,500	4,550	4,500	3,830	3,850	3,790	3,625	3,635	2,360	3,864

Appendix A2, continued

Unregulated Parameters (mg/kg dry wt.)	Class A Biosolid Limits (mg/kg dry)*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct+	Nov	Dec	Mean
Manganese	n/a	261	121	184	89.9	93.8	93.9	242	193	195	390	397	182	231
Phosphorus	n/a	23,200	20,500	19,400	16,700	20,900	20,900	16,600	16,900	16,400	17,450	17,150	11,300	18,000
Potassium	n/a	10,900	9,750	10,400	5,900	9,310	9,250	6,920	6,640	6,260	8,005	8,700	5,950	8,192
Silver	n/a	5.31	3.92	4.02	4.03	3.4	3.58	2.85	4.19	3.6	4.935	4.735	2.66	4.06
Sodium	n/a	2,060	3,180	2,430	955	2,200	1,870	1,180	1,820	1,410	1,405	2,375	905	1,826
Strontium	n/a	47.3	40	43	33.9	36.9	36.6	47.9	49.2	48.1	46.1	48.65	26	43
Thallium	n/a	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tin	n/a	22.6	16.7	19.1	17.5	17.1	16.2	19	20.2	20.2	19.4	20.9	12.8	18.71
Titanium	n/a	35.8	30	31.9	22.7	18.4	17.4	26.2	15	16.8	33.65	42.5	24.2	28
Vanadium	n/a	0.162	0.113	0.13	0.117	0.12	0.108	0.169	0.146	0.14	0.174	0.178	0.1	0.14
Uranium	n/a	4.5	2.2	3.8	3.8	3.4	3.6	4.7	3.2	3.4	4.7	5	2.7	3.91
Zirconium	n/a	9.51	6.47	7.86	5.87	2.81	2.42	2.89	2.68	3.27	7.81	7.86	4.39	5.68

Notes:

+ When the number of samples is greater than 1, the reported value represents the mean of field replicate samples.

* Class B limits were used for these substances as no limits included in Class A list.

Appendix A3 Ganges Harbour WWTP 2014 Flow Data (m^3/d)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
01	363	359	450	438	426	401	456	440	469	459	470	376
02	310	353	430	431	419	379	409	454	563	409	414	400
03	401	355	448	431	401	447	401	484	782	422	419	404
04	348	354	510	461	436	409	450	422	475	423	500	378
05	333	380	525	423	432	410	451	440	426	425	504	426
06	385	354	634	457	423	456	471	463	425	388	490	471
07	744	363	680	341	447	449	416	432	450	447	538	451
08	519	358	494	438	411	452	453	458	397	437	470	396
09	408	337	555	420	485	409	460	439	417	406	430	467
10	429	361	490	418	449	464	414	460	429	452	432	680
11	434	366	467	429	437	448	480	423	381	467	441	797
12	701	443	444	405	419	384	463	436	416	436	420	684
13	467	437	422	438	433	449	474	501	477	398	458	551
14	477	453	447	359	483	444	429	522	471	404	455	462
15	500	502	442	440	481	528	432	514	396	468	436	411
16	399	547	500	406	470	378	436	553	403	440	377	444
17	430	628	466	405	425	422	406	545	406	467	369	427
18	404	612	425	480	494	458	448	505	390	482	421	434
19	355	579	422	387	462	402	485	512	435	387	426	469
20	335	487	398	430	435	410	491	500	433	374	391	412
21	380	484	448	389	455	414	434	454	450	437	441	501
22	436	457	448	385	420	447	428	494	400	447	485	441
23	368	422	423	428	434	379	442	472	422	520	435	427
24	386	439	431	382	457	429	444	528	457	544	450	458
25	371	366	429	456	455	378	460	424	451	478	459	414
26	327	511	442	435	410	408	451	433	437	599	563	318
27	333	493	441	438	452	459	487	482	439	466	546	357
28	371	507	478	406	453	434	397	471	420	500	510	430
29	379	---	461	423	429	456	446	475	371	579	468	400
30	431	---	452	432	414	404	451	469	391	490	440	372
31	385	---	403	---	413	---	449	534	---	525	---	402

Appendix A4 Ganges Harbour WWTP 2014 Compliance and Treatment Plant Performance Monitoring Data

Date	Influent				Secondary Effluent (Undisinfected)		Secondary Effluent (Disinfected)							
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	Un-ionized NH_3 (mg N/L)	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)	Un-ionized NH_3 (mg N/L)	Total residual chlorine (mg/L)	pH
2014 Dec 03	294	304	12,000,000	---	3	174	<5	<4	<5	<1	0.03	<0.0005	0.05	7.2
2014 Nov 18	396	302	8,200,000	---	1	35	<3	<4	<5	<1	0.03	<0.0005	<0.02	7.2
2014 Oct 15	332	329	8,100,000	---	1	144	<4	<4	<5	<1	0.03	<0.0005	<0.02	7.2
2014 Sep 23	466	467	14,000,000	---	2	603	<5	<4	<5	<1	0.46	0.0011	<0.02	7.0
2014 Aug 19	470	358	9,900,000	---	1	115	<2	<4	<5	310	27	0.2	0.04	7.4
2014 Jul 22	459	560	15,000,000	---	1	152	<2	8	<5	6	1.90	0.007	0.02	7.2
2014 Jun 17	360	346	8,700,000	---	1	124	<2	<4	<5	2	0.12	<0.0005	0.05	7.1
2014 May 20	396	290	16,000,000	---	1	14	<4	<4	<5	<1	0.05	0.0056	0.08	6.9
2014 Apr 22	910	509	12,000,000	---	1	26	<5	<4	<5	<1	0.05	<0.0005	0.02	7.1
2014 Mar 18	160	226	3,300,000	---	1	16	<5	<4	<5	<1	0.12	0.0034	0.02	6.9
2014 Feb 18	330	267	9,900,000	---	1	40	<4	<4	<5	<1	0.02	<0.0005	0.07	6.7
2014 Jan 21	232	197	3,300,000	---	1	3	<2	<4	<5	<1	0.03	<0.0005	0.04	6.8
Mean	400	346	9,041,383	---	1	121	2	2.5	3	27	2.5	0.02	0.04	7.1
Min	160	197	3,300,000	---	1	3	<2	<4	<5	<1	0.02	<0.0005	<0.02	6.7
Max	910	560	16,000,000	---	3	603	<5	8	<5	310	27.0	0.20	0.08	7.4
n	12	12	12	---	12	12	12	12	12	12	12	13	11	12
Mean Daily Loading	kg/day	kg/day			kg/day		kg/day	kg/day	kg/day		kg/day			
	178.3	154.2	---	---	0.5	---	0.8	1.1	1.1	---	1.1	---	---	---

APPENDIX B

MALIVIEW ESTATES

Appendix B1 Maliview Estates WWTP Fine Screened Effluent Flow (m^3/d) From Bypass Events 2014

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
01	13	1	77	28	9	1	2	3	1	0	70	41
02	12	1	60	23	1	1	3	3	3	3	66	48
03	23	4	77	32	6	0	0	2	2	1	64	73
04	17	4	79	23	6	0	1	4	0	0	64	20
05	19	12	76	25	26	1	1	4	0	0	90	15
06	22	19	115	20	19	1	1	1	0	0	66	32
07	13	19	153	24	18	1	2	0	3	11	95	61
08	19	15	67	15	17	6	0	0	1	17	54	63
09	31	16	61	13	18	4	2	1	0	0	42	49
10	39	11	66	11	20	10	4	1	0	0	34	151
11	49	16	44	11	19	0	1	2	0	0	11	184
12	205	16	34	6	17	2	1	0	0	1	17	128
13	63	50	31	6	11	1	2	0	1	3	4	90
14	38	33	27	6	7	1	2	12	1	0	9	68
15	32	47	30	4	8	1	0	3	2	0	9	62
16	20	69	55	6	5	4	0	0	1	0	7	48
17	22	108	63	10	4	0	1	1	1	0	10	45
18	23	117	36	9	5	3	0	1	0	0	9	37
19	25	84	26	20	4	1	0	0	2	0	2	46
20	25	63	30	15	5	1	0	0	0	1	4	48
21	23	57	25	18	1	4	5	0	2	5	5	79
22	6	38	21	18	1	2	1	1	0	0	24	85
23	0	46	20	8	2	3	0	0	0	18	38	66
24	0	86	33	12	1	1	1	2	0	24	52	64
25	0	105	12	29	2	2	1	2	0	19	39	63
26	4	96	15	20	9	0	2	5	1	47	86	45
27	1	71	16	21	2	0	2	0	1	63	92	40
28	0	73	25	25	1	0	7	0	1	36	66	58
29	0		30	18	0	5	4	2	2	60	58	54
30	5		36	1	23	6	1	2	1	59	50	46
31	2		36		24		4	0		57		37

Appendix B2 Maliview Estates WWTP Secondary Effluent Flow Data (m^3/d) 2014

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
01	63	81	60	62	63	45	45	48	44	37	58	66
02	60	77	56	61	63	47	43	46	45	41	55	56
03	59	77	58	60	58	34	42	47	44	38	56	18
04	59	73	57	59	63	45	45	50	41	36	55	69
05	57	63	58	60	64	43	47	48	43	38	56	71
06	55	57	59	63	67	42	46	47	40	40	56	69
07	55	56	56	62	65	41	44	44	39	9	59	65
08	56	61	61	60	65	45	40	48	42	12	76	65
09	60	64	73	59	67	43	42	44	30	34	75	53
10	57	63	69	60	68	14	43	40	39	35	57	60
11	57	64	71	64	66	29	42	43	39	40	64	60
12	56	64	64	65	65	40	39	26	38	39	71	61
13	75	67	62	61	54	40	41	38	38	42	70	65
14	72	69	59	59	62	40	43	41	37	40	58	65
15	67	70	58	48	59	39	30	48	40	44	54	64
16	67	67	60	57	58	39	41	41	41	38	50	63
17	63	57	59	59	57	43	37	38	42	40	47	64
18	29	54	51	63	55	44	40	41	37	40	47	60
19	53	60	62	62	53	42	38	38	40	49	49	57
20	50	58	62	62	55	42	41	41	37	44	48	57
21	49	57	62	61	53	42	46	38	41	54	49	60
22	57	56	62	59	52	45	45	41	42	46	49	56
23	66	57	64	59	51	43	41	43	39	50	57	56
24	63	27	50	61	54	45	45	40	39	56	56	55
25	61	33	63	67	54	44	46	41	45	57	56	57
26	64	25	63	65	51	43	49	41	37	61	57	48
27	60	60	64	64	52	41	42	41	45	61	58	0
28	58	63	64	59	50	42	45	42	40	60	56	0
29	60		64	61	51	45	47	42	39	59	60	0
30	68		64	62	28	44	46	40	39	58	65	0
31	71		64		20		46	46		58		1

Appendix B3 Maliview Estates Total Combined Effluent Flow Data (m^3/d) 2014

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
01	75	81	137	89	72	46	47	50	45	37	127	107
02	72	77	115	84	64	47	45	49	48	44	121	104
03	82	77	135	92	63	34	42	49	46	39	120	91
04	76	77	136	82	69	45	46	54	41	36	118	89
05	75	67	134	85	90	44	48	52	43	38	146	86
06	76	69	174	83	86	43	47	48	40	40	121	101
07	68	74	208	86	83	42	46	44	42	20	154	126
08	75	80	128	75	82	50	40	48	43	29	129	127
09	90	79	134	71	84	46	43	44	30	34	117	102
10	96	79	135	70	87	24	47	41	39	35	91	211
11	105	75	115	75	85	29	43	44	39	40	74	244
12	260	80	98	70	82	42	40	26	38	40	88	189
13	138	83	93	67	65	41	42	38	39	45	74	155
14	110	119	86	65	69	41	44	52	38	40	67	133
15	99	103	88	52	66	39	30	51	41	44	63	126
16	87	114	115	63	62	43	41	41	42	38	57	111
17	84	126	122	69	61	43	37	39	42	40	57	108
18	51	161	87	72	60	46	40	42	37	40	56	96
19	78	176	88	82	57	42	38	38	42	49	51	102
20	75	142	92	77	60	43	41	41	37	45	52	105
21	72	120	87	79	54	46	50	38	43	59	54	138
22	63	113	82	77	53	47	46	42	42	46	73	141
23	66	95	83	66	53	45	41	43	39	67	94	122
24	63	73	83	73	55	46	45	42	39	79	108	119
25	61	119	75	95	55	46	47	43	45	76	95	120
26	67	130	78	85	60	43	51	46	38	107	143	92
27	61	156	80	84	53	41	44	41	45	124	150	40
28	58	134	89	84	51	42	51	42	41	96	122	58
29	60		93	78	51	49	50	43	41	119	118	54
30	73		99	63	51	50	47	41	40	117	114	46
31	86		100		43		50	46		115		38

Appendix B4 Maliview Estates WWTP Compliance and Treatment Plant Performance Monitoring Data 2014

Date	Influent			Secondary Effluent (Undisinfected)						Final Combined (Secondary + Fine-Screened) 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	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH
2014 Dec 03	230	184	4,100,000	26	24	16	60,000	12.4	7.3	27	26	17	780,000	11.9	7.3
2014 Nov 18	1474	570	12,000,000	21	19	8	410,000	29.7	7.5	29	18	8	840,000	29.3	7.5
2014 Oct 15	228	304	9,400,000	30	28	16	250,000	46.0	7.6	32	30	16	350,000	45.6	7.6
2014 Sep 23	506	>220	14,000,000	144	148	84	>1,200,000	53.9	7.4	100	149	83	>1,200,000	55.0	7.5
2014 Aug 19	950	>500	7,000,000	44	49	37	590,000	53.8	7.6	46	54	48	660,000	56.5	7.6
2014 Jul 22	106	240	1,100,000	46	67	50	620,000	39.1	7.5	58	71	---	660,000	41.0	7.5
2014 Jun 17	178	154	15,000,000	28	26	16	230,000	38.7	7.5	28	21	17	160,000	38.0	7.5
2014 May 20	202	91	5,900,000	28	27	17	98,000	29.1	7.3	26	24	14	100,000	30.9	7.3
2014 Apr 22	108	226	2,900,000	43	42	28	340,000	29.1	7.4	45	37	26	320,000	31.2	7.4
2014 Mar 18	216	226	6,200,000	28	28	15	270,000	13.0	7.5	27	36	16	210,000	13.4	7.4
2014 Feb 18	63	75	320,000	17	16	9	43,000	9.5	7.5	17	12	6	45,000	10.7	7.5
2014 Jan 21	16	26	800,000	17	20	7	88,000	19.7	7.3	20	16	11	91,000	20.3	7.3
Mean	356	235	4,064,187	39	39	25	229,309	31	7.5	38	41	24	299,827	32	7.5
Min	16	26	320,000	17	16	7	43,000	10	7.3	17	12	6	45,000	11	7.3
Max	1474	570	15,000,000	144	148	84	1,200,000	54	7.6	100	149	83	1,200,000	57	7.6
n	12	12	12	12	12	12	12	12	12	12	12	11	12	12	12
Mean daily	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	---	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d
loading	25.9	17.2	---	2.9	2.8	1.8	---	2.3	---	2.8	3.0	1.7	---	2.3	---

APPENDIX C

SCHOONER WAY

Appendix C1 Schooner Way WWTP Effluent Flow Data 2014

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
01	181	187	407	236	167	160	188	176	194	136	319	239
02	168	174	344	244	217	175	146	191	194	140	289	234
03	182	169	374	219	166	174	143	205	175	128	267	204
04	186	168	457	219	163	145	160	186	163	138	278	206
05	175	150	384	209	197	202	162	206	147	151	315	189
06	179	164	563	228	188	143	167	164	155	134	285	222
07	156	180	616	231	189	126	180	164	176	163	329	234
08	154	176	468	195	186	177	172	161	162	116	304	219
09	217	161	444	220	186	202	150	176	163	131	257	226
10	245	167	459	200	226	238	160	185	138	146	257	394
11	236	187	392	215	199	126	166	176	135	155	244	496
12	664	238	388	169	189	159	154	160	120	174	234	463
13	464	329	321	184	189	164	150	155	163	167	180	384
14	328	254	292	209	152	151	175	174	137	158	165	325
15	276	266	288	167	214	149	184	177	160	156	165	306
16	245	283	322	175	156	175	149	164	142	148	173	303
17	217	270	346	192	178	147	175	191	151	137	169	240
18	217	460	302	242	219	146	161	184	138	149	159	218
19	197	393	271	279	201	144	178	189	172	112	147	229
20	195	339	287	253	231	142	178	174	118	140	157	234
21	180	353	281	259	151	141	187	161	131	147	147	284
22	165	306	242	223	168	148	188	185	160	139	195	337
23	165	288	234	200	169	182	178	195	130	196	191	288
24	159	412	229	205	177	146	162	194	134	267	217	314
25	164	435	220	294	167	135	171	213	150	241	218	287
26	158	443	207	237	175	158	190	196	125	316	288	261
27	160	471	211	237	277	158	173	179	168	333	363	247
28	154	422	210	238	204	176	187	162	168	255	313	268
29	151	---	231	214	180	175	169	174	149	305	307	255
30	185	---	244	191	19	196	164	181	139	349	263	269
31	184	---	217	---	144	---	183	227	---	302	---	246

Appendix C2 Schooner Way WWTP Compliance and Treatment Plant Performance Monitoring Data 2014

Date	Influent			Secondary Effluent (Undisinfected)		Disinfected Secondary Effluent							
	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)	Un-ionized NH_3 (mg N/L)	Total residual chlorine (mg/L)	pH
2014 Dec 02	124	138	6,800,000	6	8,200	<5	4	<5	<2	0.22	<0.0005	---	6.6
2014 Nov 18	222	226	16,000,000	6	35,000	5	<7	<5	1	0.17	<0.0005	---	6.9
2014 Oct 14	344	>210	12,000,000	7	14,000	<3	<4	<5	2	0.30	0.0021	---	6.5
2014 Sep 23	332	334	4,700,000	5	9,700	5	4	<5	1	0.10	<0.0005	---	6.8
2014 Aug 19	288	361	6,000,000	14	7,300	<15	<7	<5	6	0.26	0.0014	---	7.0
2014 Jul 22	238	249	13,000,000	2	4,800	3	<5	<5	2	0.12	0.00089	---	7.0
2014 Jun 17	152	136	11,000,000	5	44,000	4	5	5	14	0.22	<0.0005	---	6.8
2014 May 20	204	396	4,100,000	5	15,000	<5	6	<5	39	0.47	0.0017	---	6.9
2014 Apr 22	241	238	3,700,000	10	17,000	10	7	5	65	0.08	<0.0005	---	6.8
2014 Mar 18	51	44	1,000,000	3	8,900	<5	<4	<5	2	0.13	0.003	---	6.9
2014 Feb 18	85	97	840,000	9	14,000	8	57	<5	68	0.07	<0.005	---	6.9
2014 Jan 21	112	134	6,200,000	8	2,700	7	7	<5	6	3.10	0.007	---	6.7
Mean	199	214	5,227,022	7	11,464	5	9	3	17	0.4	0.0017	---	6.8
Min	51	44	840,000	2	2,700	<4	<4	<5	1	0.07	<0.0005	---	6.5
Max	344	396	16,000,000	14	44,000	15	57	5	68	3.1	0.007	---	7.0
n	12	12	12	12	12	12	12	12	12	12	12	---	12
Mean Daily Loading	kg/day	kg/day	kg/d	kg/day	kg/d	kg/day	kg/day	kg/day	kg/d	kg/day			kg/d
	43.1	46.2	---	1.5	---	1.1	1.9	0.6	---	0.1	0.0	---	---

APPENDIX D

CANNON CRESCENT

Appendix D1 Cannon Crescent WWTP Flow Data 2014

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
01	44	38	70	44	36	35	51	23	42	29	60	48
02	47	38	66	38	33	39	46	41	38	25	60	46
03	47	42	71	38	26	34	35	47	26	22	54	44
04	45	36	71	37	42	32	40	48	34	30	55	43
05	43	33	70	40	43	32	38	52	34	28	59	38
06	39	34	98	38	42	32	39	40	23	30	54	38
07	42	33	104	40	37	17	42	40	38	28	59	44
08	38	34	87	38	36	38	35	34	34	28	52	45
09	58	35	92	40	39	37	39	40	32	29	52	45
10	61	48	87	39	45	27	36	39	29	27	54	72
11	51	60	77	43	44	29	21	37	31	28	47	84
12	121	62	71	31	47	35	37	35	37	35	41	60
13	89	68	67	42	40	31	40	25	25	33	36	57
14	71	67	53	38	36	31	39	45	37	38	37	58
15	61	66	62	35	36	39	37	40	40	32	35	56
16	41	68	68	37	33	39	37	42	32	25	34	51
17	49	82	66	42	39	35	39	48	33	33	34	45
18	48	84	54	49	42	35	36	47	30	26	34	41
19	48	79	48	55	43	35	41	43	28	31	33	40
20	46	70	50	54	42	33	40	41	27	30	31	42
21	41	67	47	54	35	35	42	41	32	31	32	57
22	46	61	50	48	30	38	37	39	29	16	37	63
23	39	67	48	43	31	39	32	37	27	45	40	56
24	36	84	47	39	37	39	36	39	28	49	44	57
25	39	62	41	60	36	32	36	46	31	41	41	57
26	37	72	45	50	38	29	27	40	28	63	45	48
27	41	80	46	44	37	33	47	36	36	59	64	47
28	39	69	45	46	30	22	42	37	35	55	59	55
29	34	---	48	40	26	39	37	38	33	56	56	53
30	42	---	45	41	13	47	39	36	33	55	49	51
31	41	---	49	---	36	---	39	40	---	51	---	49

Appendix D2 Cannon Crescent WWTP Compliance and Treatment Plant Performance Monitoring Data 2014

Date	Influent			Secondary Effluent (Undisinfected)					
	TSS (mg/L)	BOD (mg/L)	FC (CFU /100 mL)	TSS (mg/L)	BOD	CBOD (mg/L)	FC (CFU /100 mL)	NH_3 (mg/L N)	pH
2014 Dec 02	66	90	400,000	11	7	<4	8,700	0.16	6.3
2014 Nov 18	116	192	180,000	17	8	4	58,000	0.10	6.2
2014 Oct 14	48	96	2,200,000	14	25	4	66,000	8.10	6.4
2014 Sep 23	110	150	3,800,000	26	11	5	41,000	4.90	4.5
2014 Aug 19	298	390	900,000	23	20	<6	15,000	5.00	6.7
2014 Jul 22	60	132	1,800,000	14	23	5	15,000	7.80	6.8
2014 Jun 17	72	116	4,900,000	25	17	<7	29,000	2.90	4.7
2014 May 20	495	550	3,900,000	42	>26	>26	970,000	37.50	7.2
2014 Apr 22	60	128	170,000	8	11	5	2,000	0.15	6.6
2014 Mar 18	<5	<20	18,000	5	5	<4	5,700	0.03	6.7
2014 Feb 18	34	78	390,000	10	12	8	51,000	0.02	6.8
2014 Jan 21	20	31	4,100,000	8	9	<4	6,300	0.03	6.3
Mean	115	165	819,075	17	15	3	23,716	5.6	6.3
Min	<5	<20	18,000	5	5	<4	2,000	0.02	4.5
Max	495	550	4,900,000	42	26	26	970,000	37.5	7.2
n	12	12	12	12	12	12	12	12	12
Mean Daily Loading	kg/day	kg/day	kg/d	kg/day	kg/day	kg/day	kg/d	kg/day	kg/d
	5.1	7.2	---	0.74	0.6	0.1	---	0.24	---

APPENDIX E

PORT RENFREW

Appendix E1 Port Renfrew WWTP Flow Data 2014

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
01	67	53	42	59	38	67	50	45	36	69	86	63
02	62	47	40	48	33	67	47	45	42	50	62	52
03	92	47	54	47	34	39	49	51	40	37	64	51
04	75	44	92	47	50	28	44	46	37	33	156	56
05	65	44	71	57	57	34	42	47	47	38	126	55
06	58	42	88	68	52	34	42	45	41	42	93	52
07	55	44	130	55	42	30	45	42	53	39	76	80
08	62	48	90	53	38	33	36	44	53	42	110	58
09	77	61	140	56	44	34	39	42	34	35	61	81
10	92	64	110	46	52	27	50	38	35	31	74	101
11	112	69	70	35	55	26	39	37	45	40	57	165
12	122	72	53	38	43	26	41	46	43	65	38	132
13	91	92	46	33	38	29	38	45	32	60	42	94
14	83	67	44	34	35	30	41	44	38	91	34	74
15	70	67	76	33	34	32	46	47	45	85	36	53
16	64	73	97	45	31	33	45	45	33	78	34	46
17	57	86	99	74	37	27	44	67	32	66	36	43
18	51	73	70	90	57	27	44	63	28	95	34	53
19	50	110	55	65	60	32	49	57	33	86	33	66
20	55	74	65	77	56	36	48	65	41	83	33	69
21	47	83	52	75	47	29	44	55	42	102	36	116
22	42	61	45	67	48	34	48	49	34	112	83	78
23	37	62	46	54	45	35	47	46	30	118	67	62
24	43	75	42	62	49	38	44	49	45	103	81	69
25	43	75	38	63	47	44	36	53	41	103	90	60
26	43	63	53	52	47	44	39	51	38	124	118	47
27	54	53	65	48	52	44	41	49	72	96	101	41
28	42	49	50	56	61	48	43	42	58	77	102	59
29	49		58	50	47	51	43	36	55	112	79	56
30	62		66	45	46	52	40	45	60	100	68	48
31	54		78		51		38	47		107		45

Appendix E2 Port Renfrew WWTP Compliance and Treatment Plant Performance Monitoring Data 2014

Date	Influent			Secondary Effluent (Undisinfected)					
	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	Ammonia (mg/L N)	pH
2014 Dec 02	266	225	1,100,000	19	7	4	8,500	0.10	6.2
2014 Nov 18	1,074	547	5,700,000	24	11	6	170,000	0.42	5.9
2014 Oct 15	66	90	500,000	51	13	10	3,900	0.36	6.6
2014 Sep 23	262	198	1,500,000	35	15	9	5,300	2.40	4.5
2014 Aug 19	304	283	6,300,000	23	7	4	2,700	1.01	6.1
2014 Jul 22	388	289	4,700,000	13	9	---	4,400	1.91	5.0
2014 Jun 17	206	262	5,100,000	28	10	6	1,000	0.97	4.2
2014 May 20	68	128	1,200,000	17	6	4	1,000	0.46	4.5
2014 Apr 22	44	134	2,800,000	<14	6	4	2,500	0.28	5.1
2014 Mar 18	48	74	410,000	19	10	5	20,000	0.08	5.8
2014 Feb 18	340	294	1,200,000	67	26	11	58,000	0.78	6.5
2014 Jan 29	308	412	1,600,000	24	12	7	6,800	0.07	5.6
Mean	281	245	1,874,189	27	11	6	6,613	0.7	5.5
Min	44	74	410,000	13	6	4	1,000	0.07	4.2
Max	1,074	547	6,300,000	67	26	11	170,000	2.4	6.6
n	12	12	12	12	12	11	12	12	12
Mean Daily	kg/day	kg/day	kg/d	kg/day	kg/day	kg/day	kg/d	kg/day	kg/d
Loading	15.9	13.9	---	0.68	0.7	0.6	---	0.04	---