

2021 Annual Report

French Creek Pollution Control Centre

February 2022

Submitted to the Ministry of Environment and Climate Change Strategy
envauthorizationsreporting@gov.bc.ca

ISO 14001 Certified by PwC

Certification by PricewaterhouseCoopers LLP (Canada):
details of Certificate # **PwC-ISO14001:415** at <http://www.rdn.bc.ca/>

Executive Summary

The Regional District of Nanaimo (RDN) owns and operates the French Creek Pollution Control Centre (FCPCC) located at 957 Lee Road in Parksville. FCPCC provides secondary treatment. Treated effluent is discharged to the Strait of Georgia.

Operation of FCPCC is regulated by Environmental Management Permit No. PE-4200 issued by the Ministry of Environment and Climate Change Strategy. The authorized treatment works include a septage receiving facility; mechanical screens; grit tanks; primary clarifiers; biological reactors; secondary clarifiers; trickling filter; thermophilic aerobic digesters; biosolids thickening and dewatering facilities; odour control facilities; an outfall extending approximately 2 km from shore to a depth of 61 m below mean low water; an effluent pumping station and pipeline to convey effluent to the storage ponds at the Morningstar Golf Course; standby power; and related appurtenances.

This report was written by RDN staff as a permit requirement. This report summarizes and interprets the FCPCC monitoring data for 2021.

The summary of 2021 monitoring data at FCPCC is as follows:

Summary of Compliance	Permit	2021	Non-compliances
Maximum Daily Flow (Outfall)	16,000 m ³ /day	25,903 m ³ /day	3
Average Daily Flow	-	10,365 m ³ /day	
Average Daily cBOD ₅ (Outfall)	45 mg/L	22.8 mg/L	1
Average Daily TSS (Outfall)	60 mg/L	18.9 mg/L	0

The summary of 2021 monitoring data for the effluent discharged to Morningstar Golf Course is as follows:

Summary of Compliance	Permit	2021	Permit Exceedances
Maximum Daily Flow	1,370 m ³ /day	920.2 m ³ /day	0
Average Daily cBOD ₅	20 mg/L	13.1 mg/L	0
Average Daily TSS	30 mg/L	10.0 mg/L	0

- **Flow** – The combined volume of effluent discharged to the outfall and Morningstar Golf Course from French Creek Pollution Control Centre in 2021 was 3,836,715.7 m³/day, at an average daily flow of 10,511.5 m³/day.

The average daily flow discharged from the outfall in 2021 was 10,365 m³/day. The maximum daily flow was 25,903 m³/day. In 2021, there was three maximum daily flow exceedances for the outfall.

In 2021, flows were discharged to Morningstar Golf Course between June and September for a total of 79 days. The maximum permitted flow of that can be discharged to the lagoons is 1,370 m³/day. The total volume of effluent discharged to the Morningstar Golf Course in 2021 was 53,549.8 m³. There were no flow non-compliances.

- **5-day Carbonaceous Biochemical Oxygen Demand** – The influent and effluent average 5-day Carbonaceous Biochemical Oxygen Demand (cBOD₅) concentration for 2021 was 201 mg/L and 22.8 mg/L, respectively. The average removal efficiency in 2021 was 88.1%. The average cBOD₅ of the effluent discharged to Morningstar Golf Course was 13.1 mg/L.

There was one cBOD₅ non-compliance in 2021 where the maximum permitted cBOD₅ concentration was exceeded for the outfall discharge.

- **Total Suspended Solids** – The influent and effluent average Total Suspended Solids (TSS) concentration in 2021 was 344 mg/L and 18.9 mg/L, respectively. The average TSS removal efficiency in 2021 was approximately 94.0%. The average TSS of the effluent discharged to Morningstar Golf Course was 10.0 mg/L.

There were no TSS permit non-compliances in 2021.

- **General parameters, metals, volatile and semi-volatile compounds** – 2021 results were all consistent with historical data. Only one sample is taken per year so limited conclusions can be made on trending of the parameters.
- **Biosolids** – Biosolids generated by the FCPCC in 2021 met the standards for Class A biosolids in Schedules 3 and 4 of the Organic Matter Recycling Regulation (OMRR) based on the sampling program conducted by SYLVIS Environmental. Sampling completed by SYLVIS is used for OMRR regulatory reporting.

RDN sampling also showed that FCPCC Biosolids met Class A standards for fecal coliforms and for metals.

RDN Biosolids are currently being land applied in a Forest Fertilization Program and used for soil and biosolids growth medium fabrication at Harmac.

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1) Introduction

The Regional District of Nanaimo (RDN) owns and operates the French Creek Pollution Control Centre (FCPCC) located at 957 Lee Rd, Parksville, British Columbia. Treated effluent from FCPCC is discharged to the Strait of Georgia. A small portion of FCPCC treated effluent is pumped in some years to storage lagoons at the Morningstar Golf Course, which is located adjacent to the treatment facility. The treated effluent is used by the golf course to supplement irrigation water.

Operation of the treatment plant is regulated by the Ministry of Environment and Climate Change Strategy under Environmental Management Permit No. PE-4200 (the Permit), issued on January 16, 1976 and amended most recently on July 10, 1990 (see Appendix A).

The authorized works include a septage receiving facility; mechanical screens; grit tanks; primary clarifiers; biological reactors; secondary clarifiers; thermophilic aerobic digesters; biosolids thickening and dewatering facilities; odour control facilities; an outfall extending approximately 2 km from shore to a depth of 61 m below mean low water; an effluent pumping station and pipeline to convey effluent to the storage ponds at the Morningstar Golf Course; standby power; and related appurtenances.

The FCPCC was constructed in 1977 as an activated sludge treatment plant cable of serving a population of 12,000 people. In December 1996, a trickling filter was added to the process and an expansion undertaken to accommodate the increasing population of the area. The expansion, completed in 1997, doubled the plant's capacity and significantly improved the quality of its effluent and biosolids. The plant now uses trickling filter and solid contact tank technology. Further work was done to address odour problems associated with the plant's initial design.

Future upgrades and expansion are planned in the FCPCC Expansion and Odour Upgrade project which the RDN plans to issue to tender in late 2022/early 2023.

This report was written by RDN staff as a permit requirement to summarize and interpret the 2021 FCPCC monitoring data.

1.1 Environmental Management System

The RDN's Wastewater Services department's Environmental Management System (EMS) is certified to the ISO 14001:2015 standard. ISO 14001 is an international EMS standard based on a model of continual improvement. The overall aim of ISO 14001 is to support environmental protection and prevent pollution in balance with socio-economic needs. Visit www.rdn.bc.ca/environmental-management-system for more information.

2) Site Description and Neighborhood

The FCPCC is located at 957 Lee Road between Parksville and Qualicum Beach. The septage receiving area is accessed via a second driveway, located further away from Hwy 19A on Lee Road. The site is approximately 9 acres in size and is surrounded by relatively dense coniferous and deciduous trees.

A single-family residential subdivision is located directly to the south of the plant, condominiums to the southwest, and another single-family subdivision to the west. A campground, marina, pub, and restaurant are located across Hwy 19A to the north.

There were no significant changes to the layout of the neighbourhood in 2021. Phase I of French Creek Estates, to the north of the FCPCC, was constructed several years ago. Further phases are proposed in the next fifteen years.

The undeveloped areas around the plant are zoned for high-density residential use, except for the land directly across the highway, which is zoned CMQ6. This zoning allows for the following uses: residential, hotel, resort condominium, neighborhood pub, office, personal service use, public assembly use, recreation facility, restaurant, or retail store.

3) Permit Requirements

3.1 Authorized Discharges

Section 1.1 of the Permit states the maximum daily effluent discharge to the outfall is:

- 16,000 m³/day maximum daily flow.

Section 1.2 of the Permit stipulates that the characteristics of the discharge shall not exceed:

- 5-Day Carbonaceous Biochemical Oxygen Demand (cBOD₅): 45 mg/L
- Total Suspended Solids (TSS): 60 mg/L.

Appendix 02 of the Permit states the maximum daily effluent discharge to Morningstar Golf Course is:

- 1,370 m³/day.

And that the discharge shall not exceed:

- 5-Day Carbonaceous Biochemical Oxygen Demand (cBOD₅): 20 mg/L
- Total Suspended Solids (TSS): 30 mg/L.

From 2014 to 2018, no treated effluent flows were discharged to Morningstar Golf Course. Discharge to Morningstar Golf Course resumed in 2019.

3.2 Monitoring Requirements

The Permit monitoring requirements are summarized in Table 1. Monthly reports were submitted to the Ministry of Environment and Climate Change Strategy in 2021, reporting all required test results.

Table 1. Monitoring Requirements by Permit Subsection Number

Appendix C-1 A. Sampling and Analyses

A suitable sampling facility shall be installed, and a grab sample of the effluent shall be obtained once a day. The sample shall be analyzed on a daily basis for TSS and a weekly basis for cBOD₅.

Once per year a composite sample, over an eight-hour period shall be collected and analyzed for metals, volatile organics, phenolics, organochlorine pesticides, acid extractable herbicides, anions, and inorganics.

Appendix C-1 B. Flow Measurement

A flow measuring device must be provided and maintained to record, once per day, the effluent volume discharged over a 24-hour period.

Appendix B-1 E. Outfall Inspection

An inspection of the outfall line is conducted once every five years, using an underwater camera.

Appendix C-1 C. Sampling and Analytical Procedures

Sampling and flow measurement shall be carried out in accordance with the *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Sediment and Biological Samples (2013 Edition)*.

Analyses are to be carried out in accordance with the *British Columbia Environmental Laboratory Manual: For the Analysis of Water, Wastewater, Sediment, Biological Materials and Discrete Ambient Air Samples (2020)*, or by suitable alternative procedures as authorized by the Regional Waste Manager.

Appendix C-2 E. Reporting

The Permittee shall maintain records of analyses and flow measurements for inspection and once per month submit the data, suitably tabulated, to the Regional Waste Manager for the previous month's monitoring.

The 2021 monitoring program adhered to all sampling, analytical, flow measurements, and reporting requirements specified in the Permit.

3.3 Operational Certificate and MWR Registration

The RDN's approved Liquid Waste Management Plan (LWMP) includes a draft Operational Certificate for FCPCC. The Draft Operational Certificate may be superseded by a Registration under the Municipal Wastewater Regulation (MWR) to accommodate the planned expansion project.

3.4 Outfall Inspection

FCPCC's outfall was inspected by Remote Operated Vehicle (ROV) in 2017 by Seavey's Environmental and Marine Services. The inspection noted that the outfall pipe was in fair condition. The diffuser section of the outfall was replaced in 2013. No major leaks were identified in the ROV inspection.

However, a small leak was identified from the clamp between the old outfall pipe and the replacement diffuser section.

The 2017 inspection also identified heavy marine growth on the diffuser section of the outfall. However, a follow up inspection in 2019 showed this marine life did not impede diffuser function.

The RDN retained GreatPacific to review the ROV video and provide recommendations in terms of next steps. GreatPacific concluded the small leak from the clamp located approximately 60 m deep and 2 km offshore did not impact the performance of the diffusers. GreatPacific did not recommend a repair due to the expense of addressing the leak and concluded there was no significant risk of the leak to human health or the environment. The RDN increased the frequency of inspection based on GreatPacific's recommendations.

The outfall is scheduled for inspection again in 2022.

4) Flow Monitoring

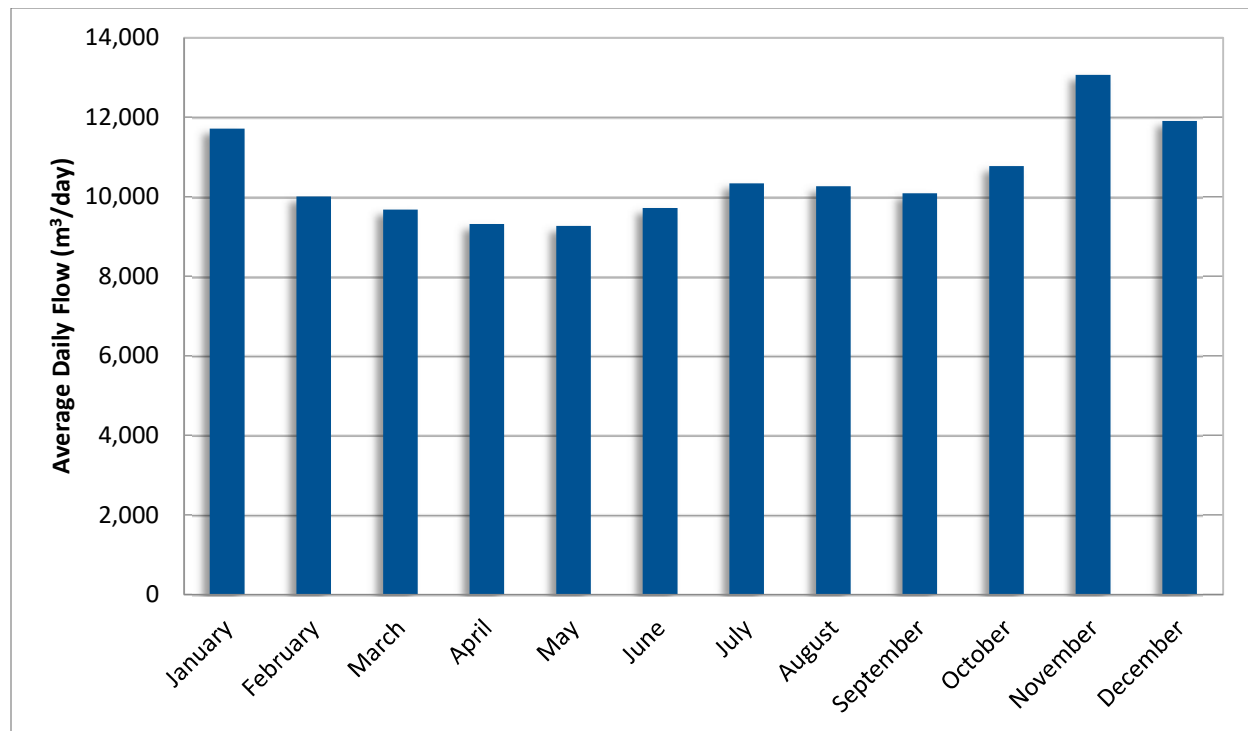
4.1 Treatment Plant Flow

Daily flow monitoring data for FCPCC in 2021 are presented in Appendix B. Results are summarised in Table 2 and graphed in Figure 1. The combined flow of effluent discharged from the outfall and to Morningstar Golf Course in 2021 was 3,836,715.7 m³, at an average daily flow of 10,551.5 m³/day.

Table 2. 2021 Treatment Plant Flow (Outfall and Morningstar Golf Course)

2021	Combined Average Daily Flow (m ³ /day)	Combined Total Flow (m ³)	Combined Maximum Flow (m ³ /day)	Combined Minimum Flow (m ³ /day)
January	11,708.6	362,966.8	16,000.9	9,604.1
February	10,002.1	280,057.9	10,839.3	8,820.5
March	9,673.8	299,888.2	10,453.2	8,328.2
April	9,315.2	279,455.8	9,961.4	8,954.3
May	9,263.2	287,159.4	9,847.8	8,927.2
June	9,716.8	291,504.3	10,430.4	8,418.1
July	10,336.4	320,428.9	10,629.4	9,821.4
August	10,258.9	318,026.2	10,924.5	9,680.3
September	10,084.3	302,529.8	11,991.8	9,619.1
October	10,771.0	333,900.0	13,447.4	9,953.6
November	13,060.6	391,818.1	25,903.3	10,781.8
December	11,902.6	368,980.3	14,281.9	10,924.7
Average	10,511.5			
Total		3,836,715.7		
Maximum			25,903.3	
Minimum				8,328.2

Figure 1. Combined Average Daily Treatment Plant Flow (Outfall and Morningstar Golf Course)



4.2 Outfall Flow

Daily flow monitoring data for FCPCC in 2021 are presented in Appendix B. The average flow discharged from FCPCC in 2021 was 10,364.8 m³/day, and the total annual flow was 3,783,165.9 m³. Table 3 and Figure 2 summarize flow data.

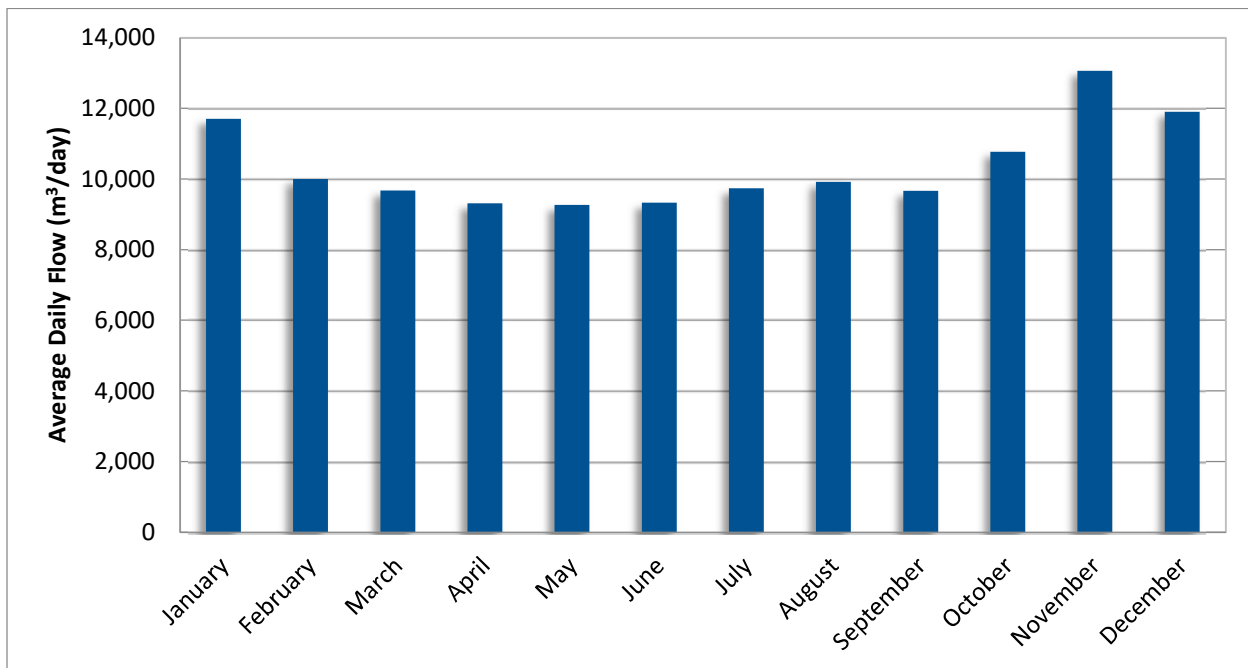
In 2021, there was three maximum daily flow non-compliances during high precipitation events which may be a result of inflow and infiltration (I&I). Appendix C contains more information on these non-compliances.

As part of the LWMP process, the RDN is working collaboratively on I&I reduction with our partners in the City of Parkville and the Town of Qualicum Beach. The RDN has also had Closed Circuit TV (CCTV) condition assessments completed of the interceptor pipes. The RDN also monitors influent quality and conducts a flow monitoring program to investigate sources of infiltration. The RDN also conducts a program to repair sources of infiltration on the Qualicum Beach and Parkville interceptor lines.

Table 3. 2021 Average Daily Flow per Month from the FCPCC Outfall

2021	Outfall Average Daily Flow (m ³ /day)	Outfall Total Flow (m ³)	Outfall Maximum Flow (m ³ /day)	Outfall Minimum Flow (m ³ /day)	Maximum Flow Non- compliances
January	11,708.6	362,966.8	16,000.9	9,604.1	1
February	10,002.1	280,057.9	10,839.3	8,820.5	0
March	9,673.8	299,888.2	10,453.2	8,328.2	0
April	9,315.2	279,455.8	9,961.4	8,954.3	0
May	9,263.2	287,159.4	9,847.8	8,927.2	0
June	9,326.5	279,794.9	10,102.1	8,418.1	0
July	9,734.3	301,764.4	10,596.4	9,206.0	0
August	9,917.8	307,450.7	10,924.5	9,125.0	0
September	9,664.3	289,929.4	11,299.0	8,797.3	0
October	10,771.0	333,900.0	13,447.4	9,953.6	0
November	13,060.6	391,818.1	25,903.3	10,781.8	2
December	11,902.6	368,980.3	14,281.9	10,924.7	0
Average	10,364.8				
Total		3,783,165.9			3
Maximum			25,903.3		
Minimum				8,328.2	

Figure 2. 2021 Outfall Average Daily Flow by Month



4.3 Flows to Morningstar Golf Course

The Morningstar Golf Course effluent reuse program resumed in 2019. During the summer months effluent can be discharged to lagoons on Morningstar Golf Course for irrigation. The maximum permitted flow of that can be discharged to the lagoons is 1,370 m³/day.

In 2021, flows were discharged from June to September for a total 79 days. Flow monitoring data for the effluent sent to Morningstar Golf Course are summarized in Table 4. The total volume of effluent discharged to the Morningstar Golf Course in 2021 was 53,549.8 m³. There were no maximum flow non-compliances in 2021.

Table 4. 2021 Average Daily Flow per Month from the FCPCC Outfall

2021	Morningstar Total Flows (m ³)	Number of Discharge days	Morningstar Maximum Flow (m ³ /day)	Morningstar Non-compliances (max daily flow)
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	11,709	15	920	0
July	18,665	25	855	0
August	10,575	17	859	0
September	12,600	22	864	0
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
Total	53,549.8	79		0
Maximum			920.2	

4.4 Historical Trends

Historical combined, outfall, and Morningstar flow data reported for previous years are summarised in Tables 5 to 7 and graphed in Figure 3. The discharge to Morningstar Golf Course over the past 10 years has been variable based on demand from the golf course.

In 2015, the RDN repaired a large source of infiltration of sea water on the Qualicum Beach interceptor line. Repairs to manholes to prevent infiltration on the Qualicum Beach interceptor line have also been conducted in 2018 and 2019.

Table 5. Historical Trends: Combined Discharge

Year	Combined Average Daily Flow (m ³ /day)	Combined Total Flow (m ³)	Combined Max Daily Flow (m ³ /day)
2012	10,246.5	3,752,129.8	14,461.0
2013	10,267.8	3,760,942.2	12,909.0
2014	11,063.9	4,038,338.7	18,983.0
2015	10,713.7	3,910,516.8	15,962.5
2016	10,457.4	3,827,402.4	17,935.2
2017	10,588.5	3,864,816.0	16,275.6
2018	10,356.0	3,779,923.6	19,908.0
2019	9,859.0	3,598,527.4	16,420.3
2020	9,920.3	3,630,815.1	18,439.9
2021	10,511.5	3,836,715.7	25,903.3

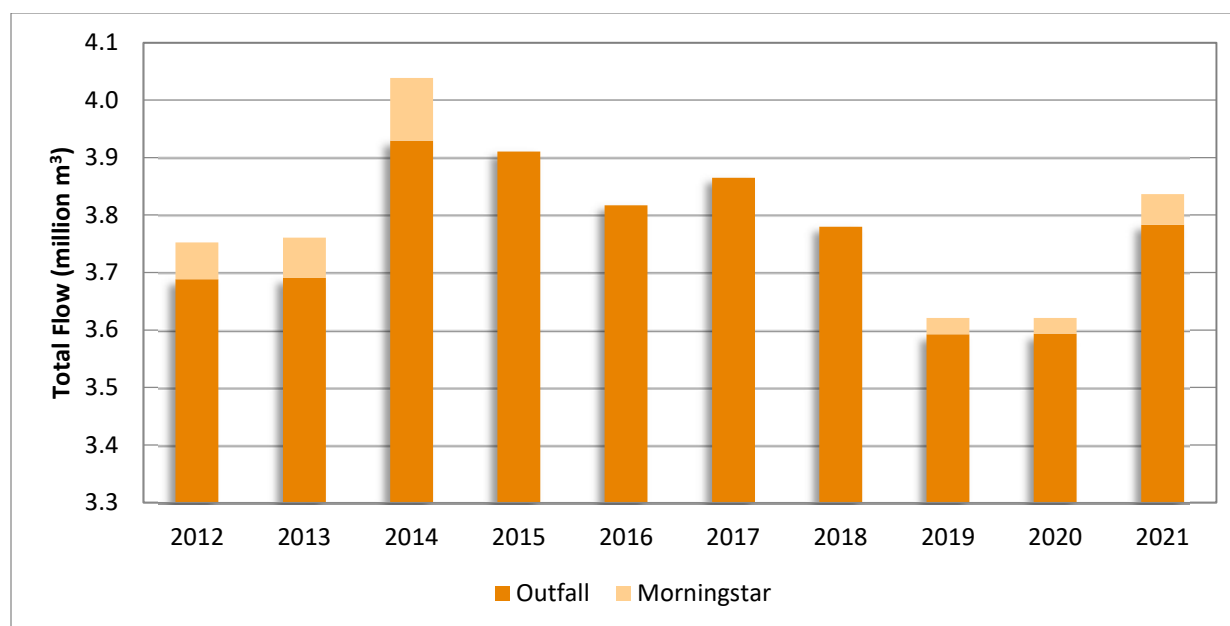
Table 6. Historical Trends: Outfall Discharge

Year	Outfall Average Daily Flow (m ³ /day)	Outfall Total Flow (m ³)	Non-conformances (Outfall max daily flow)
2012	10,071.9	3,688,403	0
2013	10,105.8	3,690,769	0
2014	10,765.4	3,929,361	4
2015	10,713.7	3,910,517	0
2016	10,457.1	3,816,837	2
2017	10,588.5	3,864,816	2
2018	10,356.0	3,779,924	3
2019	9,842.4	3,592,469	1
2020	9,846.1	3,593,821	1
2021	10,364.8	3,783,166	3

Table 7. Historical Trends: Morningstar Discharge

Year	Morningstar Total Flow (m ³)	Non-conformances (Morningstar max daily flow)
2012	63,726.9	0
2013	70,172.9	0
2014	108,977.6	0
2015	0.0	0
2016	0.0	0
2017	0.0	0
2018	0.0	0
2019	28,623.6	0
2020	27,271.2	0
2021	53,549.8	0

Figure 3. Historical Trends: Combined Total Yearly Flow



Note: The flow calculation used from 2012 -2013 was determined to be incorrect resulting in higher than actual total effluent flow for days effluent was discharged to Morningstar Golf Course. The calculation was corrected in the tables after 2014. The BC Ministry of Environment and Climate Change Strategy should contact the RDN if it would like the 2012 – 2013 flow summaries updated.

5) Effluent Monitoring

5.1 5-Day Carbonaceous Biochemical Oxygen Demand (cBOD₅)

Five-day carbonaceous biochemical oxygen demand (cBOD₅) is a measure of the quantity of oxygen consumed by microorganisms to break down organic matter in water in which the contribution from nitrogenous bacteria has been suppressed. A high cBOD₅ means less oxygen is available to support aquatic life. Thus, high cBOD₅ levels result in the contamination of the receiving environment.

The Permit requires testing the effluent for cBOD₅ weekly, with a maximum permitted concentration of 45 mg/L for discharge to the outfall, and 20 mg/L for discharge to Morningstar Golf Course. The average influent and effluent cBOD₅ concentration for 2021 was 201 mg/L and 22.8 mg/L, respectively. The average cBOD₅ removal efficiency was 88.1%. The average BOD₅ for effluent discharged to Morningstar Golf Course was 13.1 mg/L. Results are summarized Table 8 and graphed in Figure 4. Appendix B contains the daily cBOD₅ results.

In 2021, there was one cBOD₅ non-compliance result of 46.0 mg/L on December 28, 2021. This non-compliance was related to sudden freezing temperatures which affected on the biological organisms in the Trickling Filter. The cold air passing through the media reduced the biological activity resulting in higher cBOD₅ in the effluent.

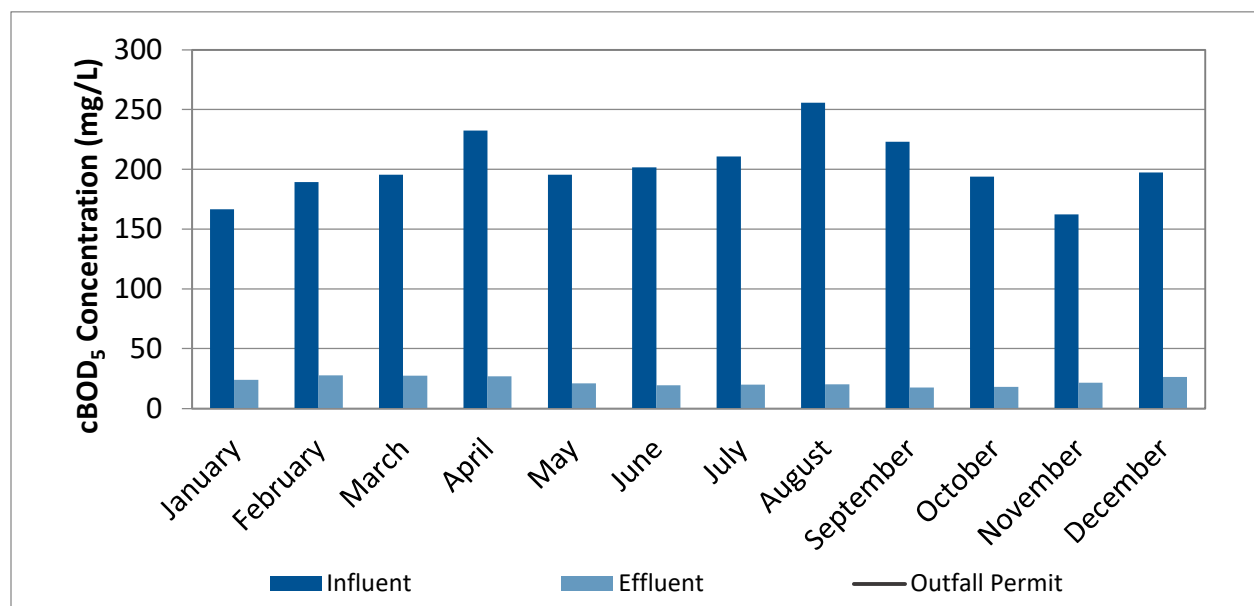
In 2021, effluent was also tested each week for cBOD₅ in a separate sampling program at the ISO17025:2017 certified lab at Greater Nanaimo Pollution Control Centre (GNPCC) to meet the Wastewater Systems Effluent Regulations (WSER) requirements for quarterly average cBOD₅ results.

Table 8. 2021 Influent & Effluent cBOD₅ Concentrations

2021	Influent Average cBOD ₅ (mg/L)	Outfall Effluent Average cBOD ₅ (mg/L)	Average % Reduction in cBOD ₅ (%)	Non- Compliances cBOD ₅ >45 mg/L (Outfall)	Morningstar Effluent Average cBOD ₅ (mg/L)	Non- Compliances cBOD ₅ >20 mg/L (Morningstar)
January	167	23.8	84.8	0		
February	189	27.5	85.4	0		
March	195	27.3	85.5	0		
April	233	26.9	87.6	0		
May	196	20.8	88.9	0		
June	202	19.4	90.0	0	14.4	0
July	211	19.8	89.6	0	15.0	0
August	256	20.1	92.1	0	12.9	0
September	223	17.5	92.1	0	9.7	0
October	194	17.9	90.9	0		
November	162	21.5	87.0	0		
December	197	26.2	87.0	1		
Average	201	22.8	88.1		13.1	
Total				1		0

* % Reduction only determined when the influent and effluent cBOD₅ testing was done on the same day

Figure 4. 2021 Influent & Effluent Monthly Average cBOD₅ Concentration



5.1.1 Historical Trends

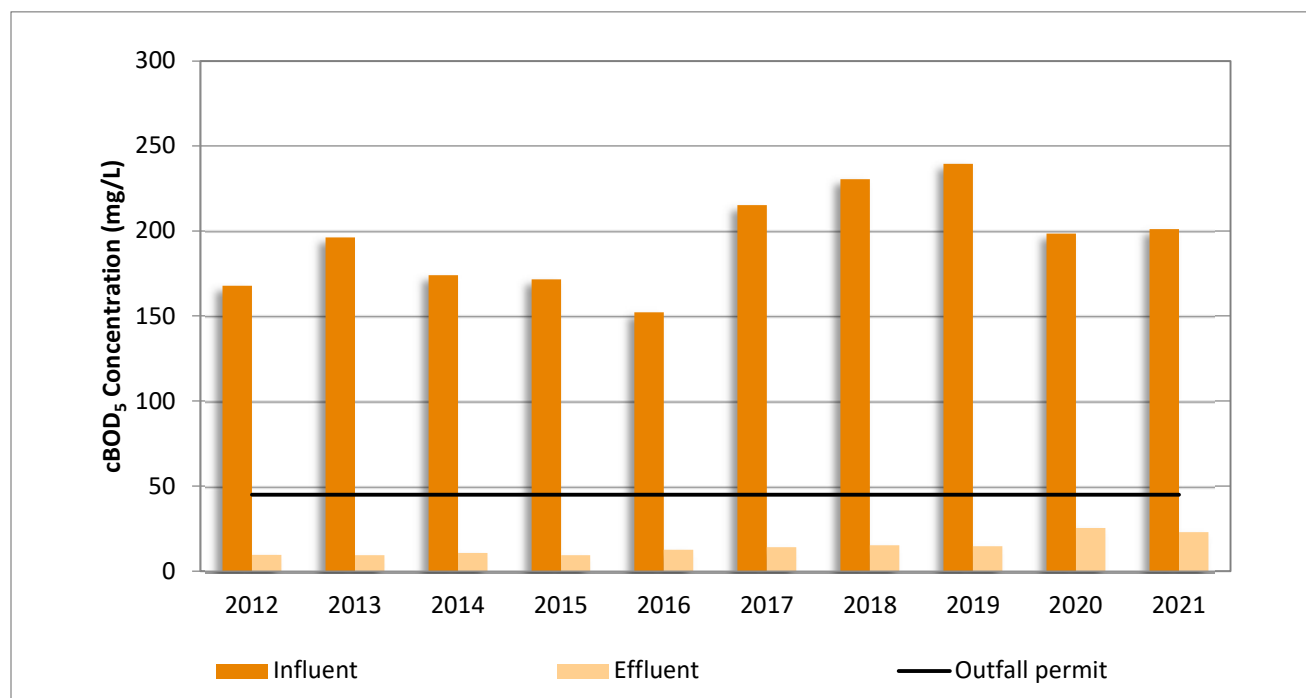
Historical influent and effluent average cBOD₅ concentrations, reduction efficiencies and the number of outfall and Morningstar Golf Course cBOD₅ non-compliances reported over the past 10 years are summarised in the Table 9 and graphed in Figure 5. 2021 data are consistent with previous years.

Table 9. Historical Trends: Influent & Effluent cBOD₅ Concentrations

Year	Influent Average cBOD ₅ (mg/L)	Outfall Effluent Average cBOD ₅ (mg/L)	Average % Reduction in cBOD ₅	Non-Compliances (Outfall)	Non-Compliances (Morningstar)
2012	168	9.5	94.2	0	0
2013	196	9.3	95.2	0	0
2014	174	11	93.3	0	0
2015	172	9.3	94.0	0	0
2016	152	12.5	91.4	0	0
2017	215	14.0	93.6	0	0
2018	230	15.1	93.0	2	0
2019	240	14.7	93.7	0	0
2020	198	25.3	88.8	19	7
2021	201	22.8	88.5	1	0

* Percent reduction from 2014 to 2017 was determined from the influent and effluent cBOD₅ results from testing done on the same day. Before 2014, percent reduction was determined from the monthly average influent and effluent cBOD₅ levels.

Figure 5. Historical Trends: Influent & Effluent Yearly Average cBOD₅ Concentration



5.2 Total Suspended Solids

Total suspended solids (TSS) are solids within wastewater that can be captured on a fine filter paper. They are visible in water and decrease water clarity. High concentrations of TSS can cause many problems for aquatic life.

The Permit requires testing of the effluent daily, with a maximum permitted concentration of 60 mg/L for discharge to the outfall, and 30 mg/L for discharge to Morningstar Golf Course (see Appendix B for test data). The pump sending effluent to Morningstar Golf Course is controlled by a TSS probe. The pump turns off the probe hits the 30 mg/L Morningstar TSS permit limit.

The average TSS concentration for influent and outfall effluent was 344 mg/L and 18.9 mg/L, respectively. The average TSS removal efficiency in 2021 was approximately 94.0%. Table 10 and Figure 6 present the average monthly TSS levels for the influent and effluent in 2021.

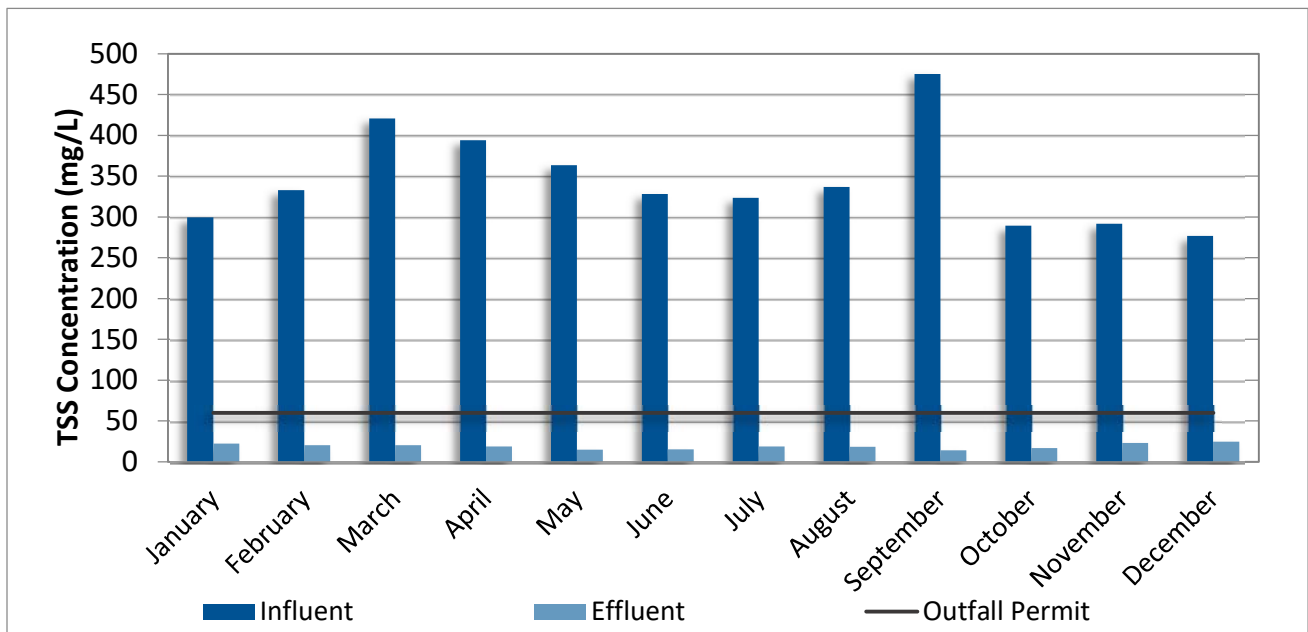
The RDN is undertaking an expansion of FCPCC which will allow the wastewater treatment process to treat higher maximum daily flows more efficiently.

In 2021, there were no TSS non-compliances for the outfall effluent or for discharge to Morningstar Golf Course.

Table 10: 2021 Influent & Effluent TSS Concentrations

2021	Influent Average TSS (mg/L)	Outfall Effluent Average TSS (mg/L)	Average % Reduction in TSS	Outfall Permit (mg/L)	Non-Compliances (Outfall) TSS > 60 mg/L	Morningstar Effluent Average TSS (mg/L)	Non-Compliance TSS>30 mg/L (Morningstar)
January	299	22.0	91.8	60	0		
February	333	20.3	93.7	60	0		
March	421	20.1	94.8	60	0		
April	394	18.7	95.1	60	0		
May	363	14.8	95.8	60	0		
June	328	15.3	95.2	60	0	9.1	0
July	323	18.8	94.1	60	0	10.8	0
August	337	18.2	94.5	60	0	10.4	0
September	475	14.0	96.4	60	0	9.2	0
October	289	16.7	94.1	60	0		
November	292	23.2	91.1	60	0		
December	277	24.6	91.0	60	0		
Average	344	18.9	94.0			10.0	
Total					0		0

Figure 6. 2021 Influent & Effluent Monthly Average TSS Concentration



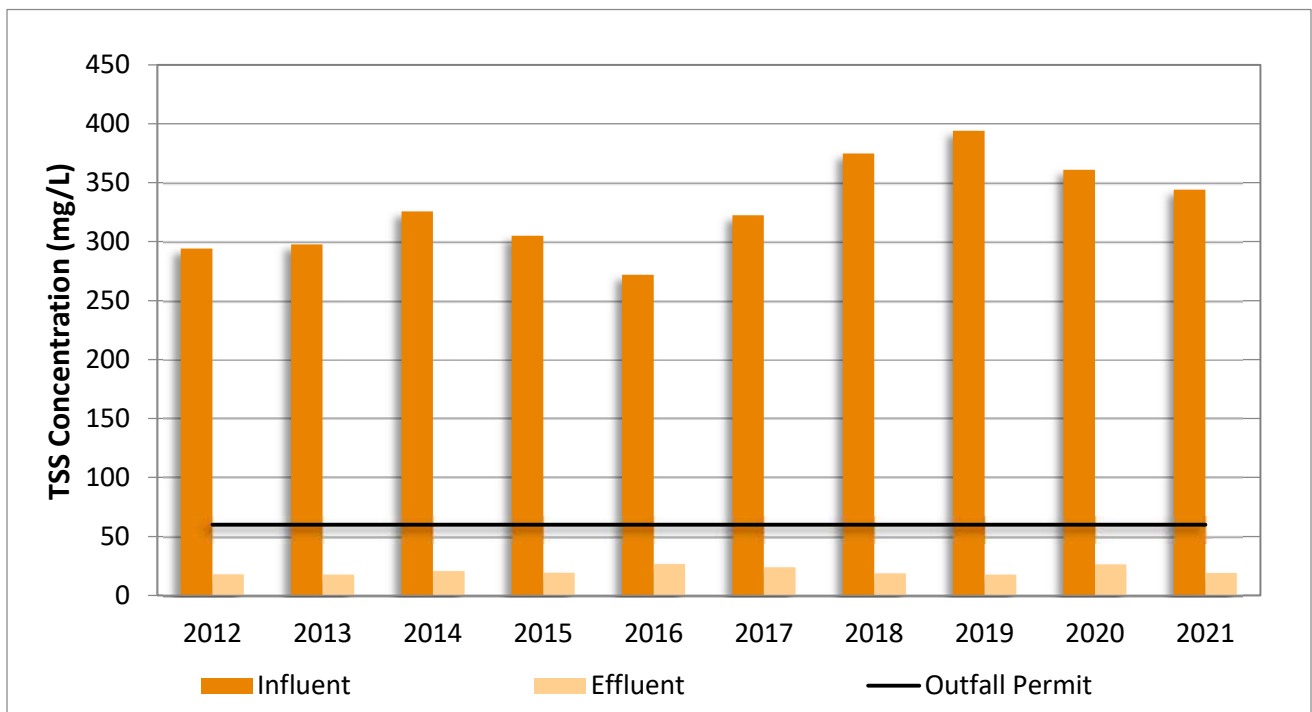
5.2.1 Historical Trends

Historical average TSS concentration in the influent and effluent, reduction efficiencies and the number of outfall and Morningstar Golf Course TSS non-compliances reported over the past 10 years are summarised in Table 11 and graphed in Figure 7. 2021 data are consistent with previous years.

Table 11: Historical Trends: Influent & Effluent TSS Concentration

Year	Influent Average TSS (mg/L)	Effluent Average TSS (mg/L)	Average % Reduction in TSS	Outfall Permit
2012	294	17.9	93.9%	60
2013	298	17.7	94.0%	60
2014	326	20.7	93.2%	60
2015	305	19.3	93.1%	60
2016	272	26.6	90.1%	60
2017	322	23.8	92.4%	60
2018	375	18.8	94.5%	60
2019	394	17.6	95.2%	60
2020	361	26.2	92.3%	60
2021	344	18.9	94.0%	60

Figure 7. Historical Trends: Influent & Effluent Yearly Average TSS Concentration



5.3 Other General Parameters

The Permit requires annual testing of the effluent for the following parameters:

Alkalinity	Dissolved Sulphate	pH	Total Phosphorus
Chloride	Dissolved Sulphide	Total Cyanide	Total Organic Carbon
Dissolved Fluoride	Oil and Grease	Total Kjeldahl Nitrogen	

A sample of the effluent is tested in September of each year by an external laboratory. In 2021, operators sampled on September 14 (see Appendix D for test results). Results of these general parameters reported over previous years are summarized in Table 12.

Results reported for 2021 for general parameters were consistent with previous years. Only one sample is taken per year so limited conclusions can be made on trending of the parameters. Dissolved chloride and sulphate in the effluent has progressively increased until 2014 but showed a decrease after 2015. Other parameters remain consistent with historical data.

Table 12: Historical Trends: Effluent General Parameters

Parameter	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
pH	mg/L	7.7	7.64	7.07	7.45	7.81	8.17	7.81	7.77	7.71	7.94
Total Alkalinity	mg/L	150	169	149	188	160	202	217	238	250	220
Dissolved Chloride	mg/L	2,600	3,200	3,460	1,830	1,500	1,600	1,400	1,920	1,400	1,700
Total Kjeldahl Nitrogen	mg/L	27.8	17.6	10	21	22.5	31.4	35.9	36.2	37.2	41.2*
Total Oil and Grease	mg/L	< 1.0	<1.0	<1.0	1	<1.0	<1.0	<1.0	<2.0	<1.0	12
Dissolved Sulphate	mg/L	312	416	463	266	220	248	172	270	200	250
Dissolved Sulphide	mg/L	0.0408	0.0441	<0.01	0.02	0.0551	0.0568	0.068	0.039	0.040	0.038
Total Cyanide	mg/L	0.0158	0.00222	0.003	0.002	0.00238	0.00218	<0.0050	0.00440	0.00250	<0.0050
Dissolved Fluoride	mg/L	0.18	0.21	0.17	0.04	0.110	0.130	0.130	<1.00	0.13	0.14
Total Organic Carbon	mg/L	12.1	10.1	12.6	16.2	15.8	18.1	21	19	34	22
Total Phosphorus	µg/L	3,250	3,450	2,050	2,650	2,780	2,130	3,740	2,410	4,000	2,100

5.4 Metals

The Permit requires annual testing of the effluent for the following metals:

Aluminum (total)	Chromium (total)	Manganese (dissolved)	Selenium (total)
Arsenic (total)	Cobalt (dissolved)	Mercury (total)	Silver (total)
Barium (dissolved)	Copper (dissolved)	Molybdenum (total)	Tin (total)
Boron (dissolved)	Iron (Dissolved)	Nickel (dissolved)	Zinc (total)
Cadmium (dissolved)	Lead (total)		

A composite sample of the effluent is collected over a 24-hour period in September (a low flow month) each year and is tested by an external laboratory. In 2021, metals were sampled on September 14 (see Appendix D). Historic metals results are summarized in Tables 13 and 14. All parameters were consistent with previous years.

Table 13: Historical Trends: Effluent Total Metal Concentrations

Total Metals	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Aluminum	µg/L	243	57	35	40	97.6	92	30	42.3	80	41
Arsenic	µg/L	0.57	0.77	1	0.6	1.2	0.7	0.67	0.72	0.64	0.72
Chromium	µg/L	2.1	<2.0	<0.5	<0.5	9.7	<5.0	<5.0	1.26	<5.0	<5.0
Lead	µg/L	0.67	0.27	0.18	0.2	0.36	<1.0	<1.0	0.32	<1.0	<1.0
Mercury	µg/L	< 0.20	<0.20	<0.01	<0.0025	<0.010	<0.010	0.0040	<0.010	0.0030	0.068
Molybdenum	µg/L	1.7	2	2.5	1.4	1.4	<5.0	<5.0	1.98	<5.0	<5.0
Selenium	µg/L	< 0.80	<0.80	21.2	<0.5	0.28	<0.50	<0.50	<0.50	<0.50	<0.50
Silver	µg/L	< 0.10	<0.1	<0.02	0.03	0.027	<0.10	<0.10	<0.050	<0.10	<0.10
Tin	µg/L	< 5.0	<5.0	NT*	0.38	<5.0	<25	<25	0.56	<25	<25
Zinc	µg/L	54	49	42	29	37.2	<25	<25	24.9	34	<25

Table 14: Historical Trends: Effluent Dissolved Metal Concentrations

Dissolved Metals	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Barium	µg/L	2.7	4.5	4.8	3.8	22.7	7.3	<5.0	<5.0	3.3	78.7
Boron	µg/L	659	773	647	510	469	570	490	635	470	550
Cadmium	µg/L	< 0.10	<0.10	<0.01	0.02	0.024	<0.05 0	<0.05 0	0.033	<0.02 0	<0.50
Cobalt	µg/L	< 0.50	<0.50	0.43	0.44	<0.50	<1.0	<1.0	1.67	0.47	<1.0
Copper	µg/L	6.6	3.2	2.3	11.6	17.6	14.1	10.8	11.7	17.1	23.0
Iron	µg/L	237	171	357	523	354	146	286	442	807	169
Manganese	µg/L	113	97.9	96	100	92.2	96	83.2	123	96	110
Nickel	µg/L	5.1	2.1	2.5	2.9	2.3	<5.0	<5.0	7.0	3.4	<0.50

5.5 Volatile and Semi-Volatile Compounds

The Permit requires annual testing of effluent for the following volatile and semi-volatile compounds:

Benzene	Dichloromethane	1,1-1 Trichloroethane
Chloroform	Di-n-butyl phthalate	1,1-2 Trichloroethane
Chloromethane	Ethylbenzene	Trichloroethylene
Di(2-ethylhexyl)phthalate	PCBs	Toluene
Dichlorobromomethane	Tetrachloroethylene	Total Phenols

A composite sample of the effluent is collected over a 24-hour period in September (a low flow month) each year and is tested by an external laboratory. In 2021, volatiles were sampled on September 14 (refer to Appendix D for test results). The historical average concentration of the volatile and semi-volatile compounds is summarised in Table 15. 2021 data are consistent with previous years.

Table 15: Historical Trends: Effluent Semi Volatile and Volatile Compounds

Volatile and Semi-Volatile Compounds	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Benzene	µg/L	< 0.40	<0.40	<0.5	<0.5	<0.40	<0.40	1.0	<0.5	<0.40	<0.40
Chloroform	µg/L	1.8	<1.0	<1.0	<1	<1.0	1.5	1.2	<1.0	1.4	1.2
Chloromethane	µg/L	3.7	<1.0	2	<1	<1.0	<1.0	<1.0	NT	<1.0	<1.0
Dichlorobromomethane	µg/L	< 1.0	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloromethane	µg/L	< 2.0	<1.0	<1	<1	<2.0	<2.0	<2.0	<3.0	<2.0	<1.0
Ethylbenzene	µg/L	< 0.40	<0.40	<0.5	<0.5	<1.0	<0.40	<0.40	<1.0	<0.40	<0.40
Tetrachloroethylene	µg/L	< 0.50	<0.50	<1	<1	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50
Toluene	µg/L	0.46	<0.40	<0.5	<0.5	<0.40	<0.40	1.7	<1.0	<0.40	<0.40
Total Phenols	mg/L	0.035	0.044 ₍₁₎	0.005	0.010	0.005	0.016	0.025	0.0087	0.0082	<0.40
1,1,1-Trichloroethane	µg/L	<0.50	<0.50	<1	<1	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50
1,1,2-Trichloroethane	µg/L	<0.50	<0.50	<1	<1	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50
Trichloroethylene	µg/L	< 0.50	<0.50	<1	<1	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50
Di(2-ethylhexyl)phthalate	µg/L	2.1	2.1	0.23	<0.20	<2.0	<2.0	<2.0	<1.0	<8.0	<2.0
Di-N-Butyl Phthalate	µg/L	< 40	<1.0	<0.2	<0.2	<2.0	<2.0	<0.80	<1.0	<8.0	<2.0
PCB's	µg/L	< 0.20	<0.10	<0.01	<0.009	<0.050	<0.050	<0.050	<0.050	<0.050	<0.056

6) Biosolids

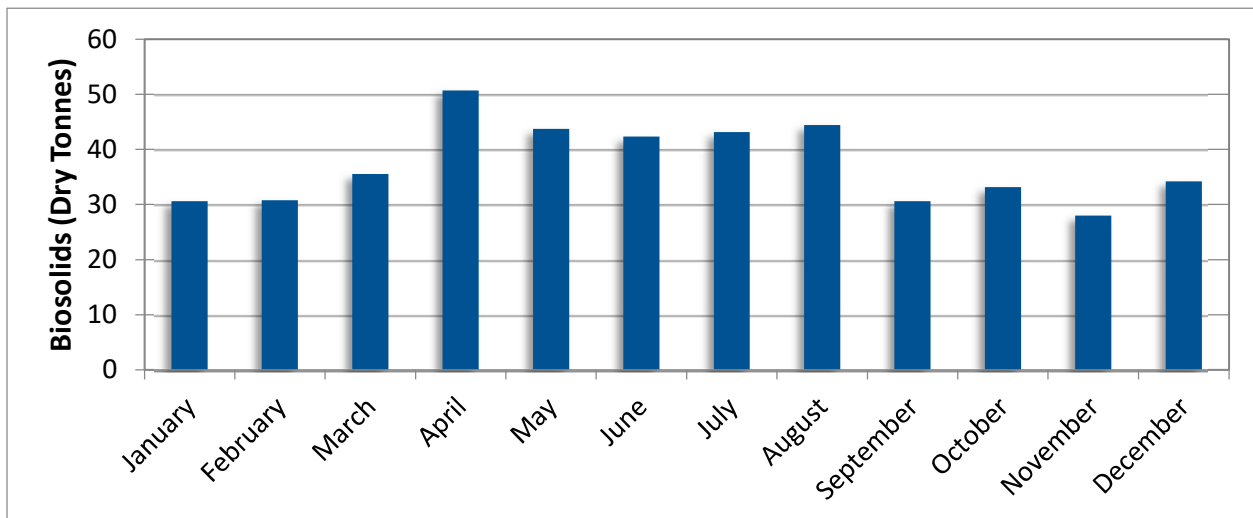
6.1 Biosolids Production

FCCP produces Class A biosolids. The average monthly production of biosolids in 2021 is summarized in Table 16 and graphed in Figure 8.

Table 16: 2021 Biosolids Production

2021	Trucked Biosolids (Dry Tonnes)	Trucked Biosolids (Wet Tonnes)	% Solids (Dewatered)
January	30.59	89.7	34.1
February	30.8	88.5	34.8
March	35.5	104.1	34.1
April	50.7	143.9	35.3
May	43.7	123.5	35.4
June	42.4	124.7	34.0
July	43.1	126.9	34.0
August	44.4	120.7	36.8
September	30.6	95.3	33.9
October	33.1	99.0	33.5
November	28.0	81.4	34.4
December	34.2	101.6	33.7
Average	37.3	108.3	34.5
Total	448	1,299	

Figure 8. 2021 Monthly Biosolids Production (Trucked Dry Tonnes)



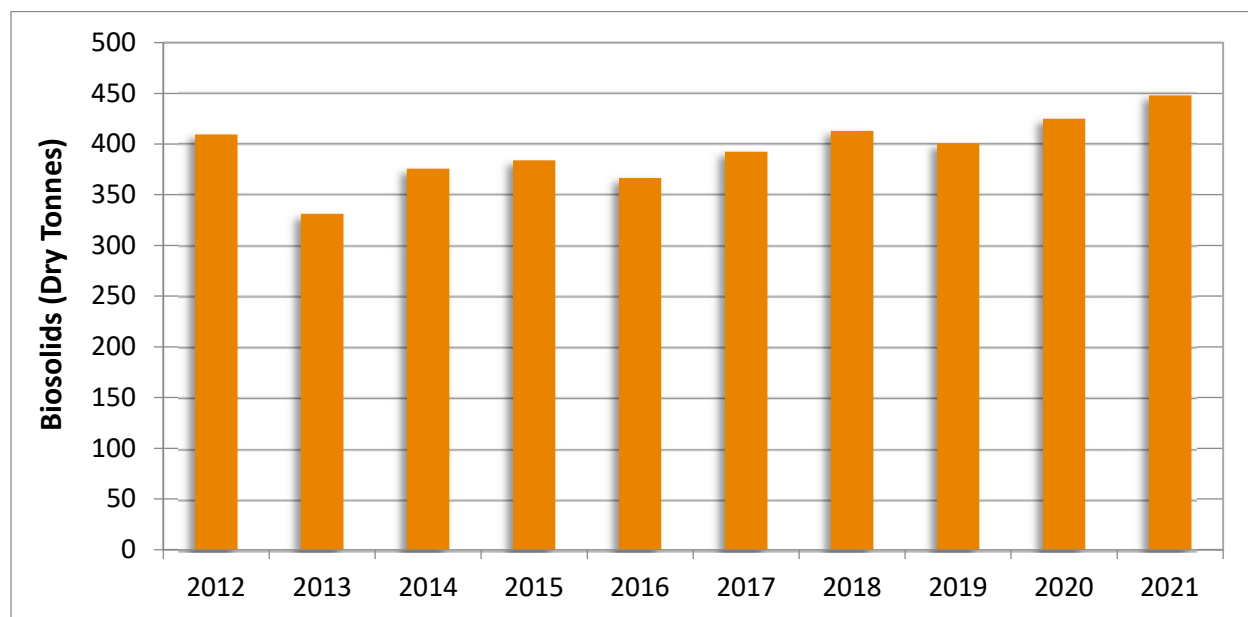
6.1.1 Historical Trends

Historical average polymer usage, total trucked solids (wet tonnes and dry tonnes) and yearly average percent solids reported for biosolids are summarized in Table 17 and graphed in Figure 9. Biosolids production has been trending at a consistent level with a gradual increase over time.

Table 17: Historical Trends: Biosolids Production

Year	Polymer Usage (Kg/year)	Trucked Biosolids (Dry Tonnes/year)	Trucked Biosolids (Wet Tonnes/year)	% Solids (Average Pressed Solids)
2012	4,024	409	1,323.59	30.8
2013	6,000	331	1,067.15	31.0
2014	5,402	376	1,236.15	30.3
2015	6,566	384	1,298.93	29.5
2016	5,867	367	1,188.66	30.8
2017	4,860	392	1,260.32	31.1
2018	5,610	413	1,286.52	32.1
2019	5,481	401	1,255.85	31.9
2020	6,383	425	1,280.71	33.2
2021	4,815	448	1,299.19	34.5

Figure 9. Historical Trends: Biosolids Production per Year (Trucked Dry Tonnes)



6.2 Biosolids Analysis

The Organic Matter Recycling Regulation (OMRR) requires that sampling for quality criteria must be taken once per year or from every 1,000 tonnes dry weight, whichever occurs first. Sampling to meet requirements of the Land Application Plan is conducted by SYLVIS.

The RDN also conducts a program to test FCPCC biosolids for quality criteria. Testing for the following parameters is conducted twice a year by an external laboratory.

Total Solids	Chromium*	Molybdenum*
Volatile Suspended Solids	Cobalt*	Nickel*
Moisture	Copper*	Phosphorus
Total Kjeldahl Nitrogen	Iron	Potassium
Arsenic*	Lead*	Selenium*
Cadmium*	Mercury*	Zinc*

*Monitoring required by the Organic Matter Recycling Regulation (OMRR).

Biosolids were tested in January and July 2021 (see Appendix D for test reports). The average concentration of these parameters, reported over previous years, is summarised in Table 18. 2021 metal concentrations were consistent with previous years' data.

All FCPCC biosolids samples in 2021 met the OMRR Class A regulatory limits for metals.

Table 18: Historical Trends: Biosolids General Parameters

Parameter	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	OMRR Limits	
												Class A	Class B
Total Solids	%	33	29.5	29.0	25.5	26.6	29.8	30.8	31.5	32.4	33.7	-	-
Volatile Solids	%	69.7	48	74.4	76.9	75.75	70.2	72.9	71.5	74.35	72.5	-	-
Moisture	%	67	69	70.9	74.5	69.65	69	69.5	68.5	67.8	66.0	-	-
Total Kjeldahl Nitrogen	% dry weight	4.95	4.65	2.85	4.875	4.97	5.7	5.7	6.6	3.86	5.50	-	-
Arsenic	µg/g	2.5	32.02	2.8	2.1	2.8	2.8	2.7	3.3	2.1	2.3	75	75
Cadmium	µg/g	2.9	2.2	2.1	1.9	1.9	2.1	1.4	2.1	1.8	1.6	20	20
Chromium	µg/g	35.4	25.65	25.85	19.5	24.5	27.3	27.9	37.9	35.1	37.1	-	1,060
Cobalt	µg/g	1.7	1.9	2.0	1.6	3.0	4.9	2.9	2.5	2.0	2.5	150	150
Copper	µg/g	773	854	832	733	702.5	807	637	798	620	603	-	2,200
Iron	µg/g	57,350	31,950	30,950	ND	ND	ND	41,400	48,800	37,900	43,800	-	-
Lead	µg/g	17.9	22.85	21.7	15.4	19.2	18.75	21.8	19.3	14.3	13.1	500	500
Mercury	µg/g	1.49	2.13	1.86	1.50	1.60	0.99	0.66	0.80	1.07	0.82	5	15
Molybdenum	µg/g	4.2	5.9	5.7	5.4	5.4	4.7	3.6	4.6	4.9	6.3	20	20
Nickel	µg/g	12.3	12.55	12.15	10.25	12.5	11.7	10.47	14.15	12.95	13.4	180	180
Phosphorus	µg/g	27,250	20,000	21,800	16,900	17,900	25,750	22,800	28,600	21,300	23,850	-	-
Potassium	µg/g	701.5	791	993	ND	ND	ND	727.5	964.5	759.5	987	-	-
Selenium	µg/g	4.1	5.2	5.1	4.0	3.9	4.4	3.1	4.2	3.2	3.0	14	14
Zinc	µg/g	852	1120	1035	880	954.5	1175	890	1,250	1,080	1,110	1,850	1,850

ND – Not determined

6.3 Fecal Coliforms

OMRR requires 7 representative samples for fecal coliforms to be taken every 1,000 tonnes dry weight or once per year, whichever occurs first. The level of fecal coliforms in each Class A sample must be <1000 MPN per gram of total solids (dry weight basis).

Regulatory sampling for the Land Application Plan under OMRR is based on a separate fecal coliform sampling program done by SYLVIS (see Appendix G). All seven samples completed by SYLVIS met Class A limits of <1000 MPN per gram of total solids. The maximum value was 22 MPN per gram of total solids (see Appendix G Table 3 page 10).

The RDN also conducts its own fecal coliform sampling program. In 2021, the RDN sent seven representative samples of biosolids to an external laboratory for fecal coliform analysis (see test reports in Appendix D).

The average fecal coliform concentration of the biosolids based on the RDN sampling in 2021 was <20 MPN/g (dry weight) and is summarized in Table 19.

Table 19: 2021 Biosolids Fecal Coliforms Concentrations

FCPCC Biosolids	
Parameter	Fecal Coliforms
Unit	MPN / g dry
12-Jan-21	<20
2-Mar-21	<20
18-May-21	<20
14-Jul-21	<20
10-Aug-21	<20
7-Oct-21	<20
9-Dec-21	<20
Average	<20

6.4 Stabilization and Dewatering

Biosolids at FCPCC are stabilized using autothermal thermophilic aerobic digesters (ATADs). The ATADs consist of 4 digesters and 3 cooling storage cells which treat sludge collected from the bottom of the sedimentation tanks. Sludge is held in the tanks for 10 to 12 days at 45 to 65°C, during which time it is decomposed and stabilized by biological processes. Once digested, the stabilized sludge is dewatered through a centrifuge, resulting in biosolids with a moist, soil-like consistency. Significant pathogen reduction is achieved in the ATAD tanks, which create Class A biosolids (defined according to OMRR parameters). Stabilization and dewatering process data are presented in Tables 20 and 21.

Volatile Solids Reduction was determined using sampling points from the sludge entering and existing the ATADs. In previous years, Volatile Solids Reduction was determined from samples in ATAD 3 and ATAD 6. Average Volatile Solids Reduction for 2021 is presented below.

Table 20: Stabilization Process Data

Stabilization Process		
Total Mass of Sludge Delivered for Stabilization	110,028	Tonnes (dry)
% Volatile Solids in Sludge Feed	85.4	%
Mass of Biosolids Remaining after Stabilization	658.8	Tonnes (dry)

Table 21: Dewatering Process Data

Dewatering Process		
Volume of Biosolids delivered for dewatering	17,541	m ³
Volatile Solids Reduction	49.1	%
% solids in biosolids dewatering feed	3.76	%
% solids in dewatered biosolids	34.5	%
Polymer dosage to aid dewatering	0.274	kg/m ³

6.5 Biosolids Management

In 2021, RDN biosolids were beneficially managed in two programs:

- Forest Fertilization
- Soil and Biosolids Growth Medium (BGM) Fabrication.

6.5.1 Forest Fertilization

Forest fertilization occurs on private forested land located northwest of Nanaimo. The land is owned by TimberWest and managed by Mosaic Forest Management (Mosaic). The area is also used by the public for recreational activities. The Forest Fertilization Program operates under agreement and in partnership with Mosaic and the Nanaimo Mountain Bike Club.

The biosolids were land applied in a forest fertilization project managed by SYLVIS Environmental. The SYLVIS Environmental 2021 Biosolids Management Summary, attached in Appendix G, provides a summary and interpretation of the effects of biosolids discharges on the receiving environment.

6.5.2 Soil and Biosolids Growth Medium (BGM) Fabrication

Soil fabrication operates in partnership with Harmac Pacific (Harmac). At the Harmac kraft mill site in Nanaimo, RDN biosolids, Harmac wood waste, and mineral soil are blended to fabricate soil for cover material for the Harmac landfill during its landfill closure activities.

In 2021, FCPCC Class A biosolids were used in Biosolids Growth Medium (BGM) fabrication.

More details of the soil fabrication program are provided in the 2021 Biosolids Management Summary and TimberWest Properties Compliance Report, completed by SYLVIS Environmental attached in Appendix G.

6.5.3 Excellence in Biosolids Award

In 2019, the Regional District of Nanaimo won the Northwest Biosolids 'Excellence in Biosolids' Award for the second time. This award presented by Northwest Biosolids recognizes significant contributions to the development and implementation of cost-effective and environmentally beneficial biosolids management practices. The RDN won this award previously in 2013.

7) Process Control Monitoring

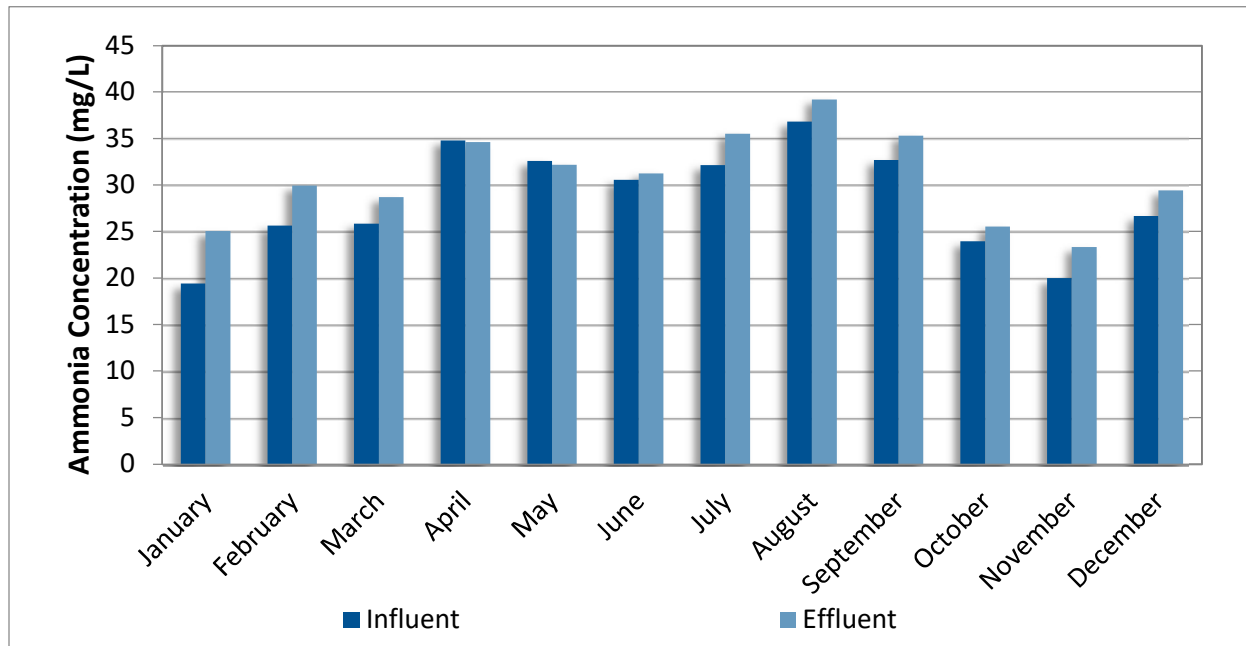
7.1 Ammonia

Ammonia is one of the typical constituents of domestic wastewater. Ammonia can be toxic to fish (freshwater and marine) and so is monitored to determine potential impacts to the receiving environment. Wastewater Services' staff test ammonia in the influent and effluent weekly. The average ammonia concentration in 2021 in the influent and effluent was 28.4 mg/L and 31.0 mg/L, respectively. Appendix B contains the weekly Ammonia test data for FCPCC for 2021. Results are summarized in Table 22 and Figure 10.

Table 22. 2021 Influent & Effluent Ammonia Concentration

2021	Average Ammonia (mg/L)		% Reduction
	Influent	Effluent	
January	19.4	25.1	-29.12
February	25.7	29.9	-16.65
March	25.8	28.7	-11.0
April	34.8	34.6	0.4
May	32.6	32.2	1.28
June	30.6	31.3	-2.32
July	32.2	35.5	-10.47
August	36.8	39.2	-6.41
September	32.7	35.3	-8.0
October	23.9	25.5	-6.7
November	20.0	23.3	-16.72
December	26.7	29.4	-10.3
Average	28.4	31.0	-9.7

Figure 10. 2021 Influent & Effluent Monthly Average Ammonia Concentration



7.2 Nitrate, Nitrite, Alkalinity

Wastewater Services' staff conduct weekly testing of the effluent for nitrate, nitrite, and alkalinity. The average monthly concentration is summarized in Table 23 and graphed in Figures 11 and 12.

Table 23. Effluent Nitrate, Nitrite, and Alkalinity

2021	Effluent Average Nitrate (NO ₃) (mg/L)	Effluent Average Nitrite (NO ₂) (mg/L)	Effluent Average Alkalinity (mg/L)
January	1.039	0.650	218
February	0.979	0.840	218
March	0.961	0.556	212
April	0.901	0.660	241
May	1.894	0.898	229
June	1.112	0.567	254
July	0.984	1.575	267
August	0.882	0.922	236
September	1.310	0.991	238
October	1.537	1.187	208
November	1.990	0.828	168
December	1.545	0.720	145
Average*	1.252	0.843	218

Figure 11: 2021 Effluent Nitrate and Nitrite Monthly Average Concentration

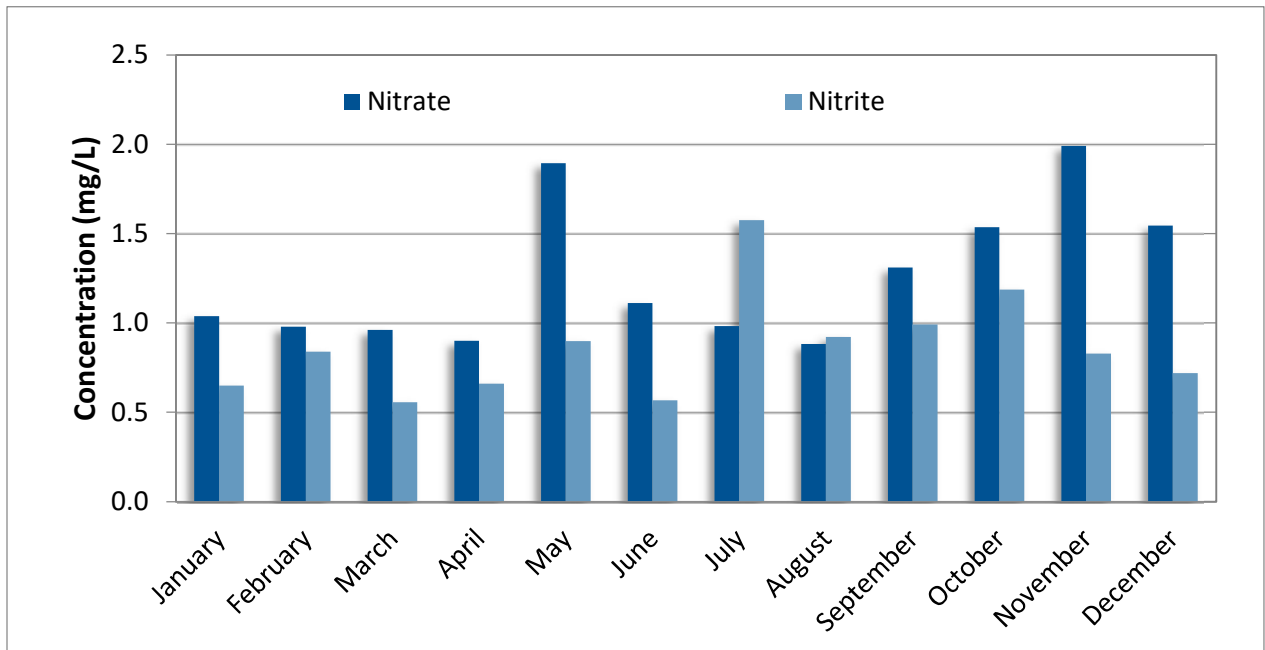
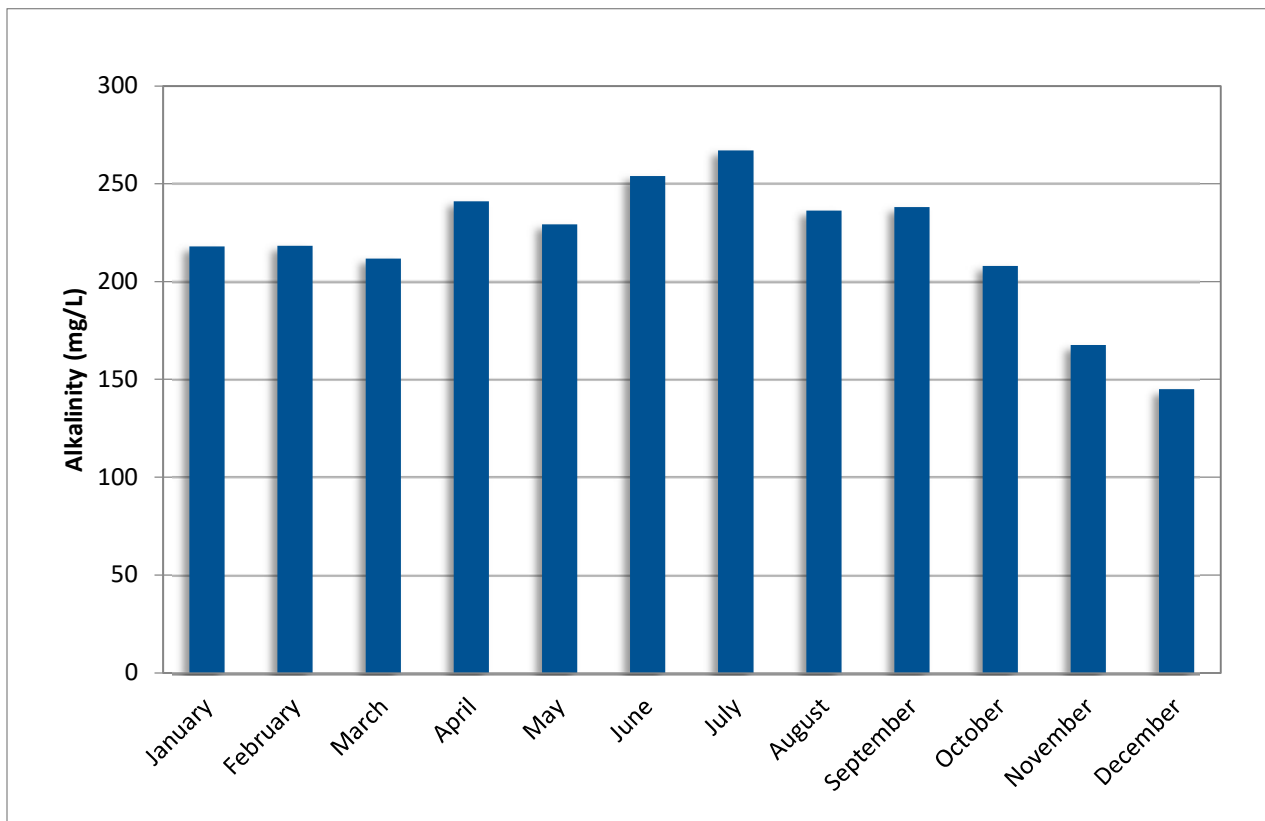


Figure 12: 2021 Effluent Alkalinity Monthly Average



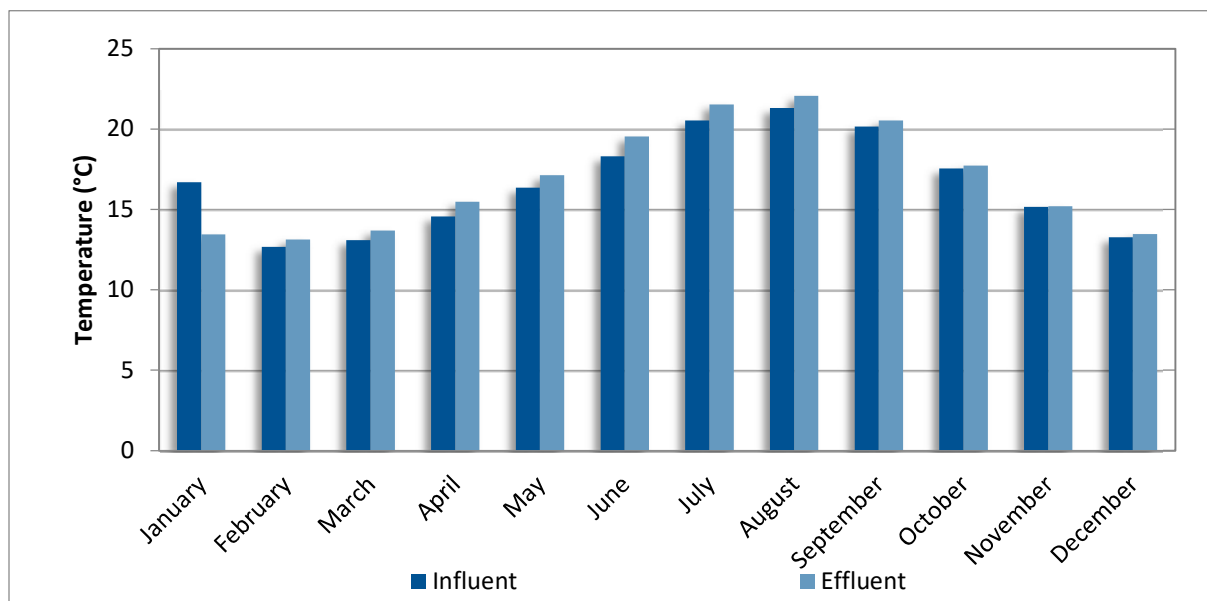
7.3 Temperature

Wastewater Services' staff monitor the temperature of the influent and effluent daily. Temperature data for 2021 is presented in Appendix B. The average temperature for each month is summarized in Table 24 and graphed in Figure 13.

Table 24: 2021 Influent & Effluent Temperatures

2021	Average Temperature (°C)	
	Influent	Effluent
January	16.7	13.4
February	12.7	13.1
March	13.1	13.7
April	14.6	15.5
May	16.4	17.1
June	18.3	19.5
July	20.5	21.5
August	21.3	22.1
September	20.1	20.5
October	17.5	17.7
November	15.2	15.2
December	13.3	13.5
Average	16.7	16.9

Figure 13. 2021 Influent & Effluent Monthly Average Temperature



7.3.1 Historical Trends

Historical influent and effluent average temperatures reported over previous years are summarized in Table 25. 2021 data are consistent with historical data.

Table 25: Historical Trends: Influent & Effluent Average Temperature

Year	Average Temperature (°C)	
	Influent	Effluent
2012	16.4	16.0
2013	16.9	17.2
2014	16.6	17.2
2015	16.9	17.4
2016	16.7	17.2
2017	16.1	16.6
2018	16.3	16.9
2019	16.1	16.6
2020	16.0	16.5
2021	16.7	16.9

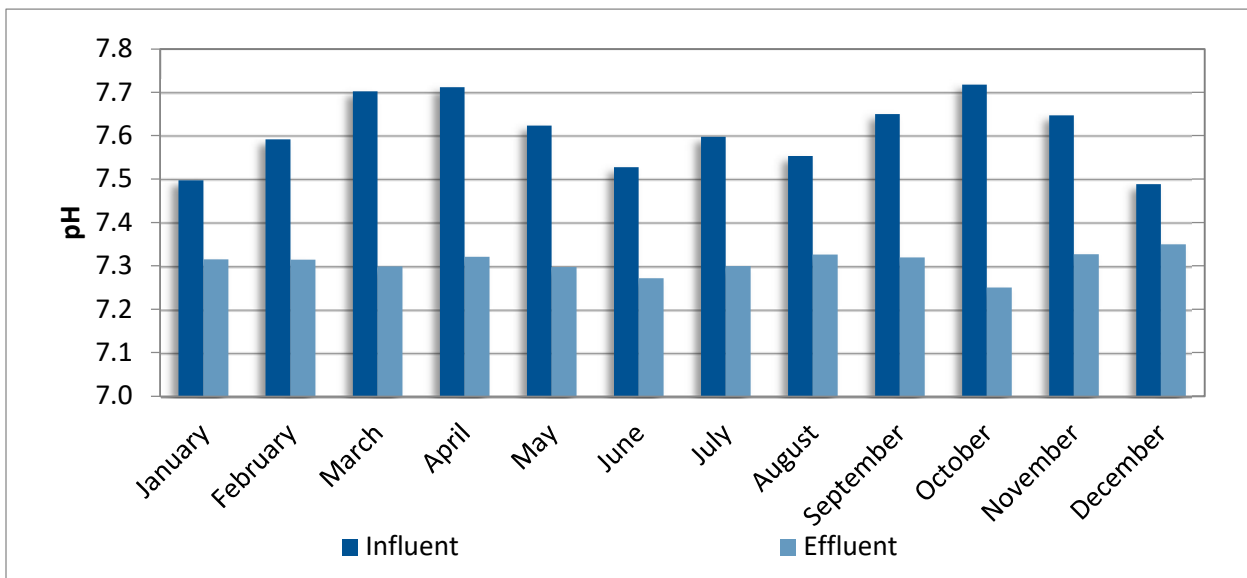
7.4 pH

Wastewater Services' staff monitor the pH of grab samples of the influent and effluent daily. The pH data for FCPCC for 2021 is presented in Appendix B, the average monthly pH data are summarized in Table 26 and Figure 14.

Table 26: 2021 Influent & Effluent Average pH

2021	Average pH	
	Influent	Effluent
January	7.50	7.31
February	7.59	7.31
March	7.70	7.30
April	7.71	7.32
May	7.62	7.30
June	7.53	7.27
July	7.60	7.30
August	7.55	7.33
September	7.65	7.32
October	7.72	7.25
November	7.65	7.33
December	7.49	7.35
Average	7.61	7.31

Figure 14. 2021 Influent & Effluent Monthly Average pH



7.4.1 Historical Trends

Historical average influent and effluent pH values reported previous years are summarized in Table 27. 2021 data are consistent with historical data.

Table 27: Historical Trends: Influent & Effluent pH

Year	Average pH	
	Influent	Effluent
2012	7.4	6.9
2013	7.6	7.0
2014	7.52	6.90
2015	7.79	7.07
2016	7.84	7.22
2017	7.68	7.35
2018	7.67	7.35
2019	7.72	7.34
2020	7.59	7.30
2021	7.61	7.31

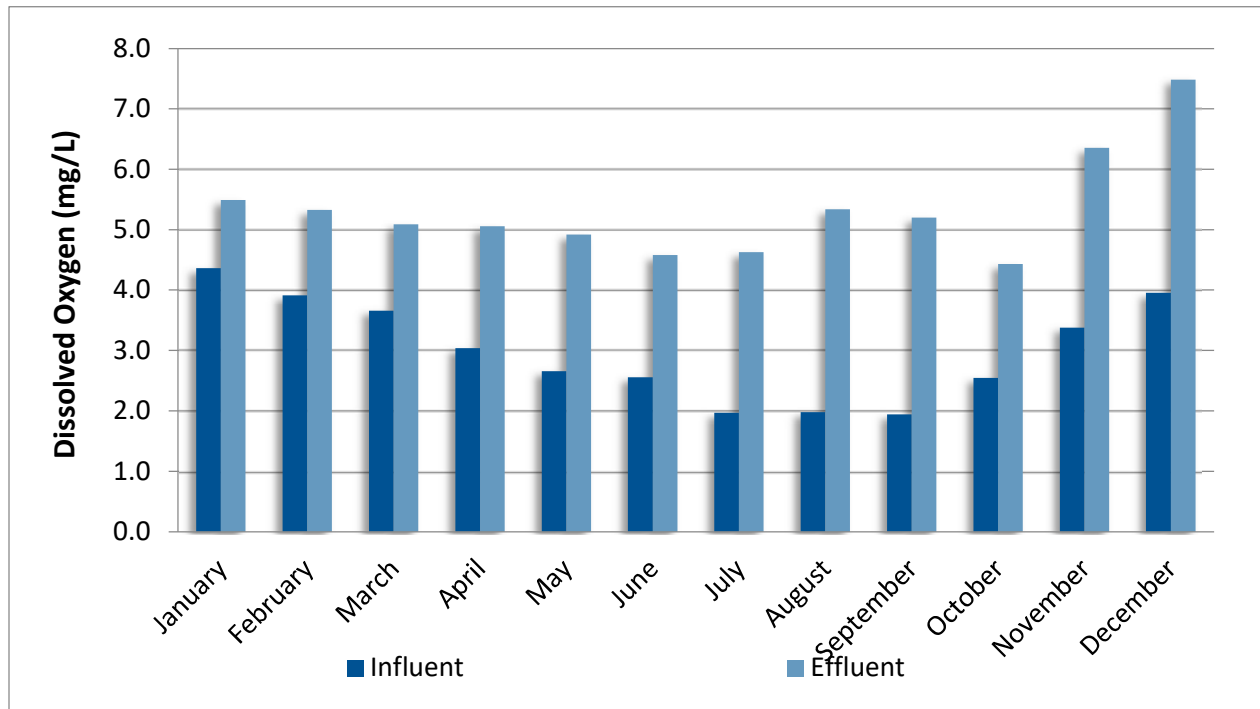
7.5 Dissolved Oxygen

Wastewater Services' staff measure dissolved oxygen (DO) of the influent and effluent daily. The average monthly DO concentrations are summarized in Table 28 and graphed in Figure 15.

Table 28. 2021 Influent & Effluent Dissolved Oxygen Concentration

2021	Average Dissolved Oxygen (mg/L)	
	Influent	Effluent
January	4.36	5.49
February	3.91	5.33
March	3.66	5.09
April	3.04	5.06
May	2.65	4.92
June	2.55	4.58
July	1.97	4.63
August	1.98	5.34
September	1.94	5.20
October	2.54	4.43
November	3.38	6.36
December	3.95	7.48
Average	2.99	5.32

Figure 15. 2021 Influent & Effluent Average Dissolved Oxygen Concentration



7.5.1 Historical Trends

Historical influent and effluent average DO concentration are summarized in Table 29. 2021 data are consistent with historical data.

Table 29. Historical Trends: Influent & Effluent Dissolved Oxygen Concentration

Year	Average Dissolved Oxygen (mg/L)	
	Influent	Effluent
2012	2.90	4.30
2013	2.80	4.80
2014	3.04	4.71
2015	3.26	5.11
2016	2.62	4.25
2017	3.44	4.91
2018	3.45	5.01
2019	3.08	5.20
2020	3.36	5.51
2021	2.99	5.32

8) Resource Consumption

8.1 Chemical Consumption

Table 30 summarizes the cost of chemicals used in the treatment process (treatment plant only) in 2021.

Table 30: 2021 Chemical Consumption

Chemical	FCPCC Usage (%)	Consumption	Units	Cost (\$)*	Use
Dry Polymer (W-Hydrofloc 1622)	100%	4,815	Kg	\$32,982	Dewatering
Liquid Polymer (ClearFloc CE405)	100%	4,396	Kg	\$25,279	Thickening
Caustic Soda	100%	1,304	Kg	\$7,469	Odour Control
Ferrous Chloride	100%	84,710	L	\$23,765	Odour Control
Sodium Hypochloride	100%	56,763	L	\$32,923	Odour Control
Defoamer (KemFoam)	100%			\$3,991	
Total				\$126,409	

8.1.1 Historical Trends

Annual costs of chemicals consumed in over the last ten years are summarised in Table 31.

Table 31: Historical Trends: Chemical Consumption

Year	Dewatering Polymer	Thickening Polymer	Secondary Treatment Polymer	Caustic Soda	Ferrous Chloride	Sodium Hypochlorite	De-Odorizer	De-Foamer	Hydrogen Peroxide	Total
2012	\$53,160	\$31,101	ND	\$25,520	\$3,392	\$9,697	\$2,170	\$15,840	-	\$140,880
2013	\$46,380	\$28,153	\$2,080	\$7,379	\$5,850	\$16,605	\$8,724	\$14,160	-	\$129,330
2014	\$41,760	\$17,785	\$6,034	\$9,630	\$8,606	\$11,190	\$1,935	\$2,410	-	\$99,350
2015	\$42,680	\$14,978	\$3,375	\$7,241	\$9,021	\$12,348	\$1,820	\$5,146	-	\$96,608
2016	\$38,137	\$13,627	\$9,563	\$7,260	\$13,015	\$10,149	\$0	\$0	-	\$91,752
2017	\$31,592	\$16,288	\$15,754	\$393	\$15,976	\$11,673	\$2,018	\$2,759	-	\$96,453
2018	\$36,467	\$21,980	\$133	\$1,726	\$20,798	\$15,899	\$1,995	\$1,576	-	\$100,574
2019	\$35,628	\$28,071	-	\$2,060	\$19,974	\$34,576	-	-	\$1,862	\$122,172
2020	\$41,488	\$27,510	-	\$879	\$20,696	\$24,608	-	-	\$3,724	\$118,905
2021	\$32,982	\$25,279	-	\$7,469	\$23,765	\$32,923	-	\$3,991	-	\$126,409

Note: Cost provided for the chemicals does not include taxes. ND – Not determined.

- 1.Data missing prior to 2013 due to secondary polymer being used only infrequently during maintenance procedures, 2013 data based on estimate.
- 2.In 2014, operators discontinued adding ferrous chloride to Hall Road pump station. It is only added to the process at FCPCC and at Bay Avenue pump station. Due to a corrosion of the ferrous chloride tank at Bay Avenue pump station, ferrous was only used at FCPCC after 2017.
- 3.Ferric chloride was used as a replacement product for ferrous chloride when ferrous chloride was in short supply in 2010. \$1,799 was spent on ferric chloride in 2010.

8.2 Electrical Consumption

Historical annual electrical consumption and costs are summarised in Table 32 and graphed in Figure 16.

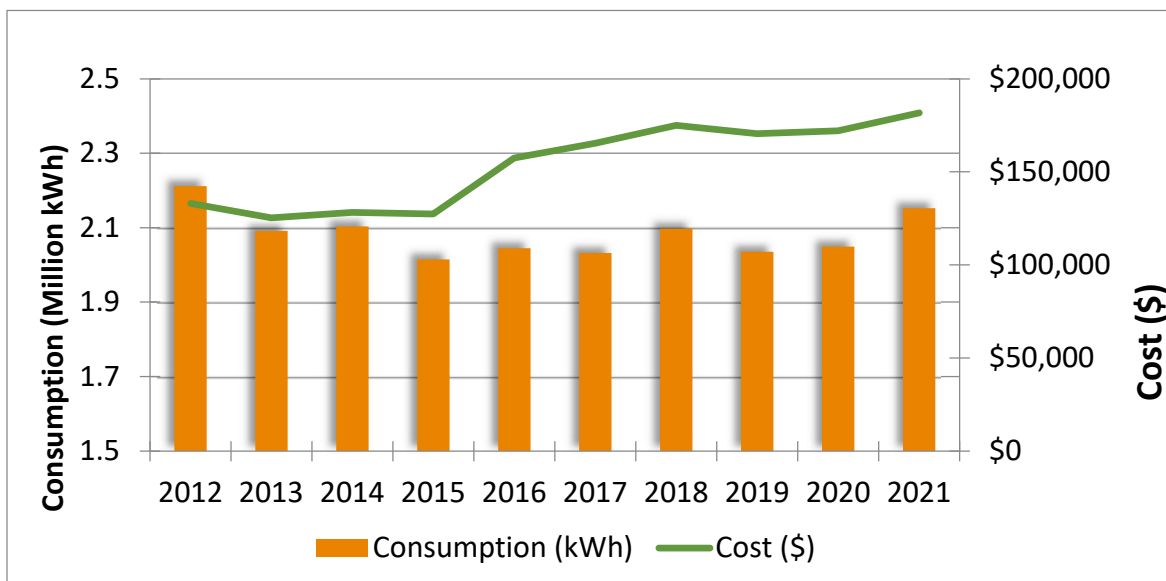
Note: this section reports electrical consumption at the treatment plant only (pump stations are excluded). The cost of electricity excludes federal and provincial taxes. Electrical costs have increased due to rate recalculations from BC Hydro.

Table 32: Historical Trends: FCPCC Electrical Consumption

Year	Consumption (kWh)	Cost (\$)
2012	2,211,180	\$133,044
2013	2,090,880	\$125,379
2014	2,103,120	\$128,146
2015	2,014,928	\$127,321
2016	2,044,800	\$157,473
2017	2,031,840	\$165,277
2018	2,097,360	\$174,964
2019	2,035,440	\$170,450
2020	2,048,974	\$172,096
2021	2,152,216	\$181,784

Note: Electrical consumption at the treatment plant only (pump stations are excluded). Electricity costs do not include tax.

Figure 16. Historical Trends: FCPCC Electrical Consumption and Costs (Treatment Plant Only)



8.3 Water Consumption

Water consumption at FCPCC for 2021 was estimated at 4,815 m³ using water invoices. Table 33 contains the water consumption records over the last eight years. There have been considerable decreases in water consumption since 2012 due to proactive water monitoring and increased use of

reclaimed water in treatment processes. Water use has declined to a new technology to pressurize the seals on pumps using air pressure and water as opposed to constant water flow. Note: this is water consumption at the treatment plant only (pump stations are excluded).

Table 33: Historical Trends: FCPCC Water Consumption

Year	Consumption (m ³)
2012	10,128
2013	9,496
2014	8,539
2015	5,109
2016	4,575
2017	2,013
2018	4,894
2019	6,160
2020	4,815
2021	4,356

*2014 Water Consumption obtained from WaterTrax records.

All other years were from invoices

9) Odour

Odours at the FCPCC were a significant concern prior to 2000, and considerable progress has been made in reducing odours at the FCPCC facility. The odour control system at FCPCC now includes two bioscrubbers, one chemical scrubber, and one biofilter.

RDN staff will continue to monitor the effectiveness of odour control initiatives to ensure the impacts to neighborhoods adjacent to the plant are minimized. The RDN acknowledges the assistance and input from residents in addressing air quality issues around the FCPCC.

9.1 Operational Procedures

Wastewater that enters FCPCC comes mainly from domestic sources. Tourism in the summer months substantially increases the flows to the treatment plant, as well as results in more solids. Winter flows are higher, but the solids concentration is lower during this time. TSS and cBOD₅ are measured in the influent and effluent to determine the strength of the wastewater. A higher strength of wastewater in the summer appears to correlate to a higher level of odours throughout the treatment plant.

Influent and effluent temperatures increase during the summer months, thereby also increasing odours. Increased temperature releases additional gas and vapour into the atmosphere causing odours. As a result, there is an increase in odour complaints in the summer.

The FCPCC staff have a schedule of routine duties that have an impact on odours. In 2013, the air flow through the trickling filters was reversed to avoid stripping odorous compounds and improve odour conditions at the plant. In 2016, FCPCC installed a new ultraviolet system on the stack which vents trickling filter air to reduce odours. In 2020, the media for the bio-filters was replaced.

9.2 Odour Records

The most common sources of odours at wastewater treatment plants are ammonia and hydrogen sulphide gases. At FCPCC, more odour reports are typically received in the summer months due to septage dumping (septic trucks) and higher temperatures resulting in increased biological activity. The concentration of hydrogen sulphide gas in the influent also increases in the summer months.

Odour reports received at FCPCC are routinely recorded on a form and entered into the department's Environmental Management System. The location of the complainant, time of day, weather conditions, and current activities at the plant are noted along with the report. Through this system, the Operations Superintendent is notified of all complaints within 24 hours.

In previous years, many of the odour complaints were mistaken as odours from FCPCC but were due to odours from herring roe. Herring spawn along the beaches near FCPCC in the spring and the rotting of these eggs later in the season produces strong odours near the treatment plant. There were no issues with roe in 2021.

The number of odour concerns decreased in 2021 in comparison to previous years. This is likely related replacement of the media in the biofilters at FCPCC in 2020.

Appendix E contains further information on the 6 odour records which were received in 2021

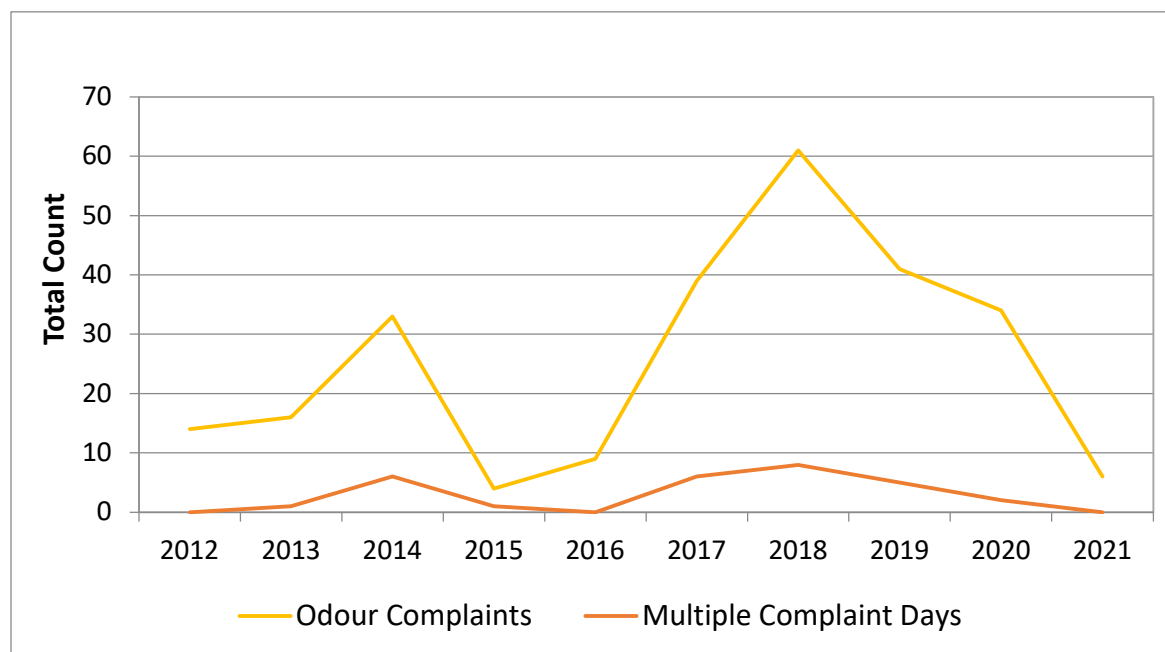
9.2.1 Historical Trends

The odour concern records over the last 10 years are summarized in Table 34 and graphed in Figure 17.

Table 34: Historical Trends: FCPCC - Number of Odour Complaints

Year	Odour Complaints	Multiple Complaint Days
2012	14	0
2013	16	1
2014	33	6
2015	4	1
2016	9	0
2017	39	6
2018	61	8
2019	41	5
2020	34	2
2021	6	0

Figure 17. Historical Trends: FCPCC Odour Complaints



9.3 Odour Episodes

An odour episode is any disruption in the regular operation of the treatment plant that may cause odour. There were no odour episodes identified in 2021.

9.4 Future Plans

RDN staff will continue to monitor the effectiveness of odour control initiatives to ensure that the impacts on adjacent neighborhoods are minimized.

The RDN has been working in partnership with Vancouver Island University (VIU) to identify, locate, and monitor sources of odours near FCPCC. The final report from VIU was submitted January 2021 and identified several odour control systems at FCPCC which could be made more efficient. The design of the expansion project will incorporate these results.

The RDN is also finalizing Detailed Design of the FCPCC Expansion and Odour Control Upgrade. The project will include significant odour control upgrades at the existing plant and the expansion site.

10) Septage Receiving

The total combined volume of Septage and Pump & Haul discharged in 2021 was 2,668,307 Imperial gallons (12,130 m³).

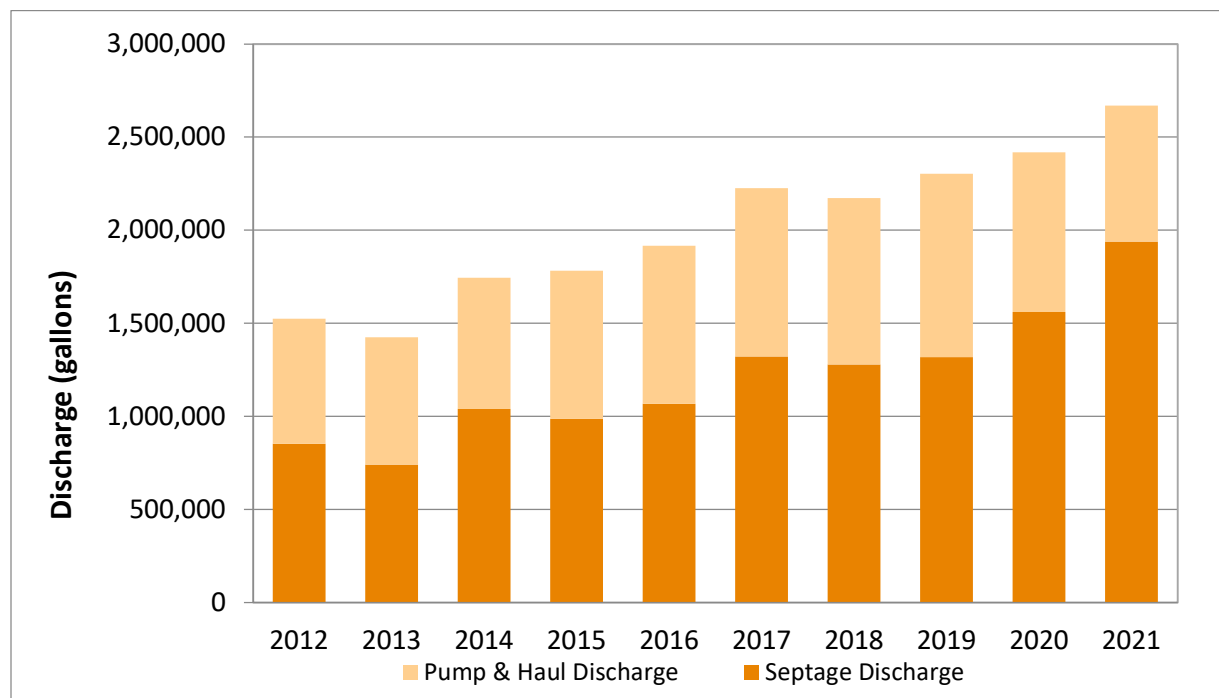
10.1 Historical Trends

The volumes of Septage and Pump & Haul waste discharged over the past ten years are summarised in Table 35 and graphed in Figure 17. The volume received has shown an increasing trend since 2013. This is likely related to better tracking of volumes discharged due to the installation of a septage meter.

Table 35: Historical Trends: Septage and Pump & Haul Discharged at FCPCC

Year	Total Gallons of Septage Discharged at FCPCC	Total Gallons of Pump & Haul Discharged at FCPCC	Combined Total (Imperial Gallons)	Combined Total (m ³ /year)
2012	851,955	671,825	1,523,780	6,927
2013	741,016	682,894	1,423,910	6,473
2014	1,039,564	703,950	1,743,514	7,926
2015	986,594	795,197	1,781,791	8,100
2016	1,067,458	847,500	1,914,958	8,706
2017	1,320,987	903,700	2,224,687	10,114
2018	1,277,508	893,594	2,171,102	9,870
2019	1,318,518	984,713	2,303,231	10,471
2020	1,559,241	859,025	2,418,266	10,994
2021	1,938,308	729,999	2,668,307	12,130

Figure 18. Historical Trends: Annual Septage and Pump & Haul Waste Discharged at FCPCC



10.2 Septage Testing

Septage used to be tested quarterly for a series of parameters. In December 2013, the monitoring program discontinued because:

- 1) Sampling of septage is not required for any regulatory authorities as it enters the main waste stream where the final effluent is tested before being discharged to the receiving environment.
- 2) Sufficient historical data created a reference and determined that septage had a negligible impact on overall effluent quality.
- 3) A random sampling program that targets haulers directly may better detect the discharge of unauthorized waste.

In 2019, the RDN implemented a new sampling protocol for testing of septage discharged by haulers at FCPCC. One hauler per quarter was randomly selected, their discharge was tested for a variety of parameters, and results were compared to the Trucked Liquid Waste Rates and Regulations Bylaw No. 1732.

The random septage sampling program has not occurred since 2020, however. Sampling safety issues and bylaw limit review will need to be resolved before this program is resumed.

11) Contributory Population and Remaining Plant Capacity

The current FCPCC plant operating capacity is designed for an average daily flow of 12,000 m³/day, with a maximum daily flow capacity of 18,360 m³/day. Wastewater Services continues to install new equipment and upgrade existing technology to ensure the future carrying capacity of the treatment plant is adequate and permit levels are not exceeded.

In 2021, the combined average daily flow from FCPCC was 10,511.5 m³/day with a maximum daily discharge of 25,903.3 m³/day. The estimated population serviced in 2021 was 29,070 with a projected annual growth rate of approximately 1.40 %.

The LWMP states that FCPCC will likely need to be expanded between 2018 and 2025. In 2017, the RDN commissioned a preliminary design study to evaluate expansion options for FCPCC. The detailed design study for the FCPCC Stage 4 expansion and Odour Control Upgrades was ongoing in 2021. The RDN is planning to issue the project to tender in early-2023.

12) Environmental Incidents

As part of the RDN's ISO 14001 Environmental Management System certification, records are maintained regarding any environmental incidents that are associated with the RDN's wastewater infrastructure and treatment facilities including spills, leaks, and fires.

In 2021, there were no environmental incidents related to spills from the treatment plant, gravity sewer interceptor and force mains conveying wastewater to FCPCC.

13) Conditional Management Plan

On May 1, 2012, a Conditional Management Plan (CMP) for FCPCC came into effect. A CMP is an agreement between Canadian Food Inspection Agency, Environment Canada, Fisheries and Oceans Canada, the British Columbia Ministry of Environment, and the RDN.

The original CMP was renewed several times. The current agreement expires January 31, 2025.

The key objectives of the agreement are as follows:

- Provides enhanced management of shellfish harvesting in the Conditionally Classified Harvest Areas adjacent to the FCPCC.
- Outlines the roles and responsibilities of the signatories in the event of a discharge of wastewater into the marine environment from the collection system pump stations that carry wastewater to FCPCC.

No closures or re-openings occurred in 2021. Please refer to Appendix F the 2021 CMP Annual Report.

14) Facility Upgrades & Major Projects

14.1 Upgrades and Repairs Completed in 2021

- Influent and Final Effluent Sampler Replacement
- Primary air compressor replacement

14.2 Studies and Projects Completed in 2021

- Lee Road and Hall Road Operator Platform Replacement Design (ongoing)
- FCPCC Stage 4 Expansion and Odour Control Upgrade Detailed Design (ongoing)
- Bay Ave Pump Station Upgrade Design
- Reclaimed water study
- Qualicum Beach Hydraulic Modelling Study
- Contaminants of Emerging Concern Study
- Partnership with UVic and Pani Energy as part of a Covid-19 monitoring project.

14.3 Upgrades and Repairs Planned for 2022

- Bay Avenue Pump Station Replacement.

14.4 Studies and Projects Planned for 2022

- FCPCC Stage 4 Expansion and Odour Control Upgrade Detailed Design (ongoing). The tendering of this project is planned early 2023
- Contaminants of Emerging Concern Study

- Qualicum Beach manhole repairs
- ISO 14001:2015 Surveillance Audit.

15) Resource Recovery

15.1 Biosolids Reuse

Since 1999, RDN biosolids have been beneficially used in agriculture, landfill closures, mine reclamation, and forest fertilization. Biosolids management in 2021 is discussed in Section 6.5.

15.2 Effluent Reuse

The reuse of effluent in operational processes at FCPCC has decreased the plant's demand for potable water from the community's supply.

Additionally, effluent was reused to irrigate Morningstar Golf Course in 2021.

15.3 Solid Waste Recycling

Wastewater Services has a general recycling program at the treatment plant, initiated as part of the department's Environmental Management System, and continues to recycle waste oils, paints and paint thinners.

16) Education Programs

16.1 Source Control

In November 2015, the Board approved the new Source Control Bylaw No. 1730 which replaces the old Bylaw No. 1225. This bylaw regulates the discharge of waste into any sewer or drain connected to a sewage facility operated by the RDN. The new bylaw provides a process for issuing Waste Discharge Permits and a new fee structure based on waste strength and volume. The bylaw applies to discharges in municipal collection systems. The Bylaw also contains new prohibited waste items and new provisions for fees and enforcement.

In January 2017, the RDN Board adopted the new Trucked Liquid Waste Rates and Regulations Bylaw No. 1732 which replaces Bylaw Nos. 988, 1218, and 1224. Bylaw No. 1732 introduced more source control provisions including an expanded schedule of prohibited wastes and a new a schedule of restricted wastes. It also introduced more enforcement tools.

Wastewater Services has also been active in promoting the Medications Return Program at public events, including open houses and SepticSmart workshops (see: www.medicationsreturn.ca).

16.2 Water Conservation

The RDN has a water conservation and outreach program called Team WaterSmart for municipalities in the region and electoral areas.

The RDN's Board also recently approved a new Water Conservation Plan in 2020. This plan was completed in collaboration with water conservation planning work done by the City of Parksville, Town of Qualicum Beach, and other member municipalities.

16.3 Open House

Open houses provide the public with an opportunity to tour the facilities, learn about recent upgrades, browse informative posters, and display material, and forward questions and concerns to staff directly. There were no open houses in 2021 due to COVID-19 restrictions on gatherings.

16.4 SepticSmart

SepticSmart is an RDN educational program that provides information on septic system operation and maintenance. It aims to prolong the life of functioning systems in the region. The SepticSmart program includes an information package, annual workshops and a rebate program. More information on the SepticSmart Program is available at: <https://www.rdn.bc.ca/septicmart>.

No SepticSmart workshops were held in 2021 due to COVID-19 restrictions on gatherings.

In 2014, the RDN launched the Septic Maintenance Rebate program to: 1) make it easier for residents to manage septic system maintenance, 2) promote long-term maintenance habits, and 3) maximize the longevity of existing onsite systems. The SepticSmart rebate program was on hold in 2021 due to reduced staffing related to COVID-19. To date, more than \$260,000 in rebates have been issued to homeowners towards septic tank repairs and maintenance as part of this program.

16.5 Liquid Waste Management Plan

The RDN Liquid Waste Management Plan (LWMP) is a 20-year plan to support sustainable wastewater management in the region. This plan authorizes the RDN to find community-driven and cost-effective solutions to protect public health and achieve a standard level of wastewater treatment over a reasonable timeframe. The BC Ministry of the Environment and Climate Change Strategy approved the RDN's LWMP in October 2014. An annual report on LWMP implementation will also be submitted under separate cover in June.

16.6 Website

The RDN's Wastewater Services department website www.rdn.bc.ca/wastewater-services is regularly updated and provides education material related to wastewater treatment, environmental management, pollution prevention and septic system maintenance (the SepticSmart program).

The [Get Involved](#) portion of the RDN website is an online public engagement space that hosts outreach information specific to the regional projects. In 2021, the following FCPCC projects were highlighted on the Get Involved page:

- [FCPCC Expansion and Odour Control Upgrade Project](#)
- [Bay Avenue Pump Station Replacement](#).

17) Conclusions

Table 36 and 37 summarize the 2021 permit monitoring data for FCPCC and Morningstar Golf Course respectively:

Table 36: FCPCC Summary of Compliance

Summary of Compliance	Permit	2021	Non-compliances
Maximum Daily Flow (Outfall)	16,000 m ³ /day	25,903m ³ /day	3
Average Daily Flow	-	10,365 m ³ /day	
Average Daily cBOD ₅ (Outfall)	45 mg/L	22.8 mg/L	1
Average Daily TSS (Outfall)	60 mg/L	18.9 mg/L	0

Table 37: FCPCC Discharge to Morningstar Golf Course Summary of Compliance

Summary of Compliance	Permit	2021	Exceedances
Maximum Daily Flow	1,370 m ³ /day	920.2 m ³ /day	0
Average Daily cBOD ₅	20 mg/L	13.1 mg/L	0
Average Daily TSS	30 mg/L	10.0 mg/L	0

17.1 Flows

The average daily flow discharged from the treatment plant and outfall in 2021 was 10,365 m³/day. The total annual flow was 3,783,166 m³. The highest daily outfall flow was 25,903 m³/day. There were 3 flow non-compliances in 2021.

From June to September, effluent was discharged to lagoons on Morningstar Golf Course for irrigation for a total of 79 days. The Morningstar Golf Course effluent reuse program resumed in 2019. The maximum permitted flow of that can be discharged to the lagoons is 1,370 m³/day. The total volume of effluent discharged the Morningstar Golf Course effluent reuse program in 2021 was 53,549.8 m³. There were no permit non-compliances for flow to Morningstar Golf Course permit in 2021.

17.2 Carbonaceous Biochemical Oxygen Demand (cBOD₅)

The average cBOD₅ concentration for influent and outfall effluent was 201 mg/L and 22.8 mg/L, respectively. The average cBOD₅ removal efficiency in 2021 was approximately 88.1%.

There was 1 BOD non-compliance from the outfall effluent in 2021. There were no cBOD₅ non-compliances for discharge to the Morningstar Golf Course effluent reuse program.

17.3 Total Suspended Solids (TSS)

The average TSS concentration for influent and outfall effluent was 344 mg/L and 18.9 mg/L, respectively. The average TSS removal efficiency in 2021 was approximately 94.0%.

There were no TSS permit non-compliances in 2021 of the effluent to the outfall or of the discharge to the Morningstar Golf Course effluent reuse program.

17.4 General Parameters, Metals, Volatile and Semi-Volatile Compounds

Results reported for 2021 for all general parameters, metals, volatile and semi-volatile compounds were consistent with previous years. It should be noted that only one sample is taken per year so limited conclusions can be made on trending of the parameters.

17.5 Biosolids Quality

The biosolids generated by FCPCC met the standards for Class A biosolids given in Schedules 3 and 4 of OMRR based on sampling for the land application plan completed by SYLVIS Environmental (see Appendix G).

Based on the sampling program conducted the RDN, biosolids also met Class A standards for metals and for fecal coliforms.

Appendix A – Waste Management Permit No. PE-4200 & Amendments



Province of
British Columbia

Ministry of
Environment

Vancouver Island Region:
Regional Headquarters
2569 Kenworth Road
Nanaimo
British Columbia
V9T 4P7
Telephone: (604) 758-3951

JUL 10 1990

REGISTERED MAIL

File: PE-4200

Regional District of Nanaimo
6300 Hammond Bay Road
Lantzville, British Columbia
V0R 2H0

Gentlemen:

LETTER OF TRANSMITTAL

Enclosed is a copy of amended Permit No. PE-4200, issued under the provisions of the Waste Management Act, in the name of Regional District of Nanaimo. Your attention is respectfully directed to the terms and conditions outlined in the Permit. An annual fee for Permit No. PE-4200 will be determined on the basis of your industrial code and capacity in accordance with the Waste Management Fees Regulation.

The administration of this Permit will be carried out by staff from our Regional Office located at 2569 Kenworth Road, Nanaimo, British Columbia, V9T 4P7 (telephone 758-3951). Plans, data and reports pertinent to the Permit are to be submitted to the Regional Waste Manager at this address.

You will note that values have been expressed in the International System of Units (SI). These units are to be used in submitting monitoring results and any other information in connection with this Permit.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Permittee.

Yours very truly,

G. E. Oldham, P. Eng.
Regional Waste Manager

SM 28.05.90 Enclosure
28.5.90
RAB 09/06/90

Recycled Paper



MINISTRY OF ENVIRONMENT

PERMIT

Under the Provisions of the Waste Management Act

REGIONAL DISTRICT OF NANAIMO

6300 Hammond Bay Road


Lantzville, British Columbia

VOR 2H0

is hereby authorized to discharge effluent from a municipal
sewage system located within the Regional District of Nanaimo
to the Strait of Georgia and to storage lagoons at the
Morningstar Golf Course near Parksville, British Columbia

This permit has been issued under the terms and
conditions prescribed in the attached Appendices


01, 02, A-1, A-2, B-1, B-2, C-1 and C-2




Regional Waste Manager
Permit No. PE-4200

Date issued: January 16, 1976

Date amended: JUL 10 1990

 28.05.70

 20.5.90

 09/06/90

ENV 2093



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX 01

to Permit No. PE-4200

(Effluent)


- (a) The discharge of effluent to which this appendix is applicable is from a municipal sewage system servicing the Parksville and Qualicum Beach area as shown on the attached Appendix A-1.
- (b) The maximum rate at which effluent may be discharged is 16 000 m³/d.
- (c) The characteristics of the effluent shall be equivalent to or better than:
5-day Biochemical Oxygen Demand - 45 mg/L
Total Suspended Solids - 60 mg/L.
- (d) The works authorized are screening, degritting and ancilliary facilities, a secondary treatment plant, sludge digestion and dewatering facilities and an outfall with diffuser extending 2440 m from mean low water to a depth of 61 m below mean low water and related appurtenances approximately located as shown on the attached Appendix A-1.
- (e) The location of the facilities from which the effluent originates and to which this appendix is appurtenant is Lot 2, Plan 2570, District Lot 28, Nanoose District.
- (f) The location of the point of discharge and to which this appendix is appurtenant is the Strait of Georgia off the mouth of French Creek.
- (g) Those works authorized must be completed and in operation on and from the date of this appendix.

Date issued: January 16, 1976

Date amended: JUL 10 1990


Regional Waste Manager

 28.05.90

 28.5.90

PMB 02/04/90



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX 02

to Permit No. PE-4200


(Effluent)


- (a) The discharge of effluent to which this appendix is applicable is from a municipal sewage treatment facility as shown on the attached Appendix A-2.
- (b) The maximum rate at which effluent may be discharged is 1 370 m³/d.
- (c) The characteristics of the effluent shall be equivalent to or better than:
5-day Biochemical Oxygen Demand - 20 mg/L;
Total Suspended Solids - 30 mg/L.
- (d) The works authorized are a secondary sewage treatment plant, a pump station and pipeline, and related appurtenances approximately located as shown on the attached Appendix A-2.
- (e) The location of the facilities from which the effluent originates and to which this appendix is appurtenant is Lot 2, Plan 2570, District Lot 28, Nanoose District.
- (f) The location of the point of discharge and to which this appendix is appurtenant is a pipeline to storage lagoons (authorized works under Waste Management Permit No. PE-8195) situated on the northern half of District Lot 83, Nanoose Land District.
- (g) Those works authorized must be completed and in operation on and from the date of this appendix.


Date issued: JUL 10 1990

Date amended: _____


Regional Waste Manager

 20.05.90

 28.5.90

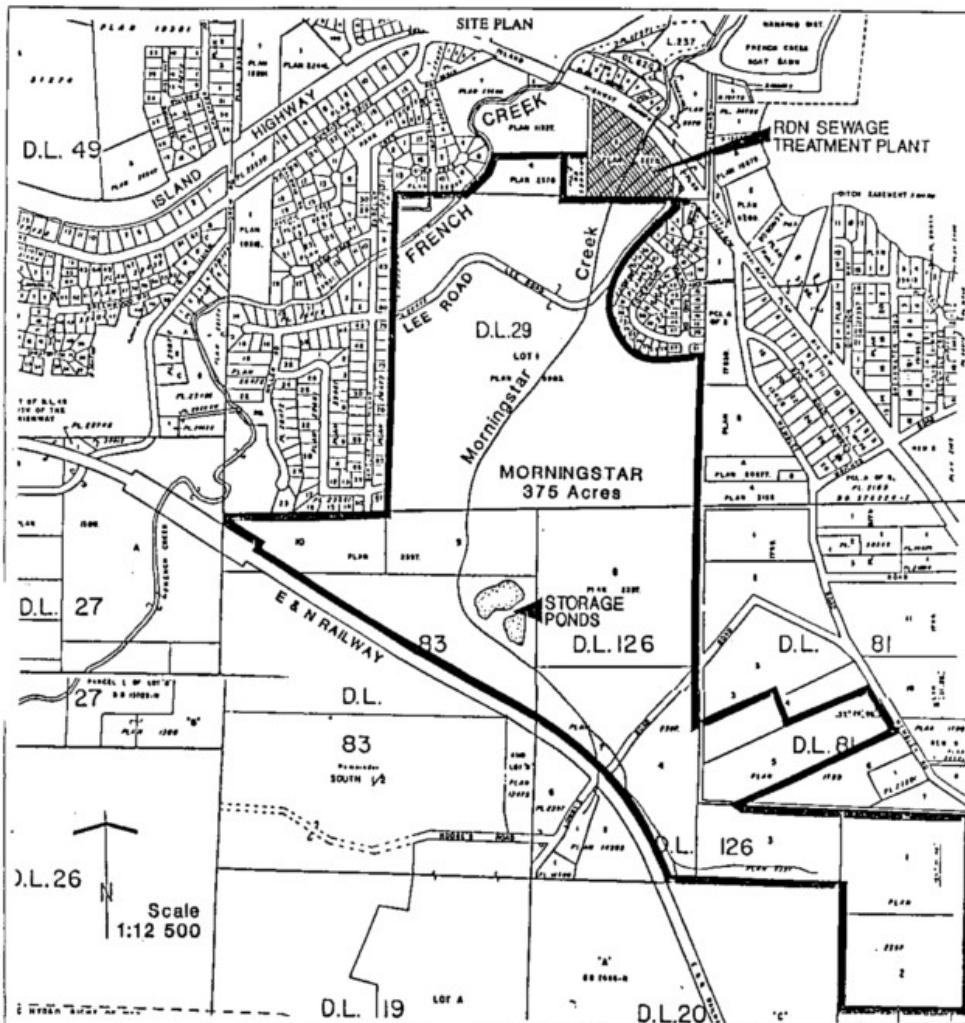
 09/04/90



Province of
British Columbia

Ministry of
Environment

WASTE MANAGEMENT



Regional District of Nanaimo	
(Name of applicant(s))	
(Date)	(Signature of applicant(s) or agent)
(FOR OFFICE USE ONLY)	
JUL 10 1990	
Date Issued	Regional Waste Manager
Date Amended	
Appendix A-2 to Permit No. PE-4200	
Approval No.	

LOCATION MAP

The location map shows the regional district of Nanaimo on Vancouver Island. It includes labels for 'PORT HARDY', 'NANAIMO', 'VANCOUVER', 'SEATTLE', 'PORT VICTORIA', 'NANAIMO', 'VANCOUVER', 'SEATTLE', 'PORT VICTORIA', 'NANAIMO', 'VANCOUVER', 'SEATTLE', 'PORT VICTORIA'. A box labeled 'FRENCH CREEK WATER POLLUTION CONTROL CENTRE' is shown on the map.

ENV 1987
08.05.90
22.5.90
RAB 02/06/90



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX B-1
to Permit No. PE-4200

A. MAINTENANCE OF WORKS

The Permittee shall inspect the pollution control works regularly and maintain them in good working order. Notify the Regional Waste Manager of any malfunction of these works.

B. EMERGENCY PROCEDURES

In the event of an emergency or condition beyond the control of the Permittee which prevents continuing operation of the approved method of pollution control, the Permittee shall immediately notify the Regional Waste Manager and take appropriate remedial action.

C. BYPASSES

The discharge of effluent which has bypassed the authorized works is prohibited unless the approval of the Director or the Regional Waste Manager is obtained and confirmed in writing.

D. PROCESS MODIFICATIONS

The Permittee shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

E. OUTFALL INSPECTION

The Permittee shall conduct a dye test on the outfall line authorized in Appendix 01 (or inspect by another method approved by the Regional Waste Manager) once every five years or as may otherwise be required by the Regional Waste Manager.


F. DISINFECTION

Although disinfection of the effluent discharge authorized by Appendix 01 is not required at this time, suitable provisions should be made to include disinfection facilities in the future. If disinfection is by chlorination, dechlorination facilities may also be required.

Date issued: JUL 10 1990

Date amended: _____


Regional Waste Manager

 28.05.90
+ 28.5.90
RAB 09/04/90

ENV. 2096 w417



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX B-2
to Permit No. PE-4200

G. SLUDGE WASTING AND DISPOSAL

Sludge wasted from the treatment plant shall be disposed of to a site and in a manner approved by the Regional Waste Manager.

H. EFFLUENT UPGRADING

Based on receiving environment monitoring data and/or other information obtained in connection with this discharge, the Permittee may be required to provide additional treatment facilities.

Date issued: JUL 10 1990

Date amended: _____

MM 28.05.90
PD 28.5.90
RAB 09/06/90


Regional Waste Manager



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX C-1

to Permit No. PE-4200

A. SAMPLING AND ANALYSIS

The Permittee shall install a suitable sampling facility and obtain a grab sample of the effluent once every day. The sample shall be analyzed on a daily basis for Total Suspended Solids and on a weekly basis for 5-day Biochemical Oxygen Demand.

Once per year a composite sample, over an eight-hour period, shall be taken during a low flow period in July or August and analyzed for parameters such as metals, volatile organics, phenolics, organochlorine pesticides, acid extractable herbicides, anions, and inorganics. The Regional Waste Manager shall advise the Permittee in writing of the specific parameters to be analyzed.

B. FLOW MEASUREMENT

For the discharge authorized by Appendix 01, provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over a 24-hour period.

C. SAMPLING AND ANALYTICAL PROCEDURES

Sampling and flow measurement shall be carried out in accordance with the procedures described in "Field Criteria for Sampling Effluents and Receiving Waters", April 1989.

Analyses are to be carried out in accordance with procedures described in "A Laboratory Manual for the Chemical Analysis of Waters, Wastewaters, Sediments and Biological Materials, (1976 edition including updates)", April 1989.

Copies of the above manuals are available from the Data Standards Group, Ministry of Environment, 3800 Westbrook Mall, Vancouver, British Columbia, V6S 2L9, at a cost of \$20.00 and \$70.00, respectively, and are also available for inspection at all Waste Management offices.

Date issued: JUL 10 1990

Date amended: _____

SEO
Regional Waste Manager

V. 2096 w817

2447 05/07/90

4.7.90

04.07.90



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX C-2
to Permit No. PE-4200

D. RECEIVING ENVIRONMENT MONITORING

At the discretion of the Regional Waste Manager, the Permittee may be required to conduct a receiving environment monitoring program for the discharge authorized by Appendix 01. The program shall be established in consultation with the Regional Waste Manager, who will advise the Permittee in writing of the program requirements.

E. REPORTING

Maintain data of analyses and flow measurements for inspection and once per month submit the data, suitably tabulated, to the Regional Waste Manager for the previous month's monitoring. The first report is to be submitted by September 30, 1990.

Date issued: JUL 10 1990

Date amended: _____


Regional Waste Manager

ENV. 2096 w817

For 05/07/90
4-7-90
01.07.90



Province of
British Columbia
Ministry of
Environment,
Lands and Parks

BC
Environment

Environmental Protection Division
777 Broughton Street
Victoria
British Columbia
V8V 1X5

COPY

Telephone: (604) 387-9974

Facsimile: (604) 356-9836

File: PE-4200

June 17, 1993

Regional District of Nanaimo
6300 Hammond Bay Road
Lantzville, British Columbia
V0R 2H0

Dear Permittee:

Re: Notification of Amendment to Permit No. PE-4200

Please note that Permit No. PE-4200, issued under the provisions of the Waste Management Act, in the name of Regional District of Nanaimo is amended by adding to Appendix B-2 the following clauses:

(h) FACILITY CLASSIFICATION

The Permittee shall classify the wastewater treatment facility authorized in part (d) of Appendix No. 01 (the facility) and the classification shall be maintained with the "British Columbia Water and Wastewater Operators Certification Program Society" (BCWWOCPS). The Permittee shall submit an application to classify the facility to BCWWOCPS by **August 1, 1993**. Although the facility may have already been voluntarily classified previously, an application for classification must be submitted by the above date.

(i) OPERATOR CERTIFICATION

If the facility is classified by the BCWWOCPS (the Program) at Level II or higher, the Permittee shall ensure that all operators of the facility shall be certified by the Program to a Class I level, at a minimum, by **December 1, 1994**.

Operators in Training:

The Permittee shall ensure that all operators in training (OIT) working at the facility classified by the BCWWOCPS at Level II or higher shall be required to successfully pass an OIT examination within three (3)

.. /2

months of commencement of employment at the facility. The OIT certificate shall be valid for fifteen (15) months from the date of issue. Prior to the expiry date of the OIT certificate, but not sooner than twelve (12) months from the date when the OIT commenced facility operation, the OIT shall successfully complete a Class I certification examination in order to continue to operate at the facility.

Chief Operator: Level II or higher

If the facility is classified by the BCWWOCPS at Level II or higher, the Permittee shall designate at least one operator to be the "Chief Operator" of the facility by **December 1, 1996**. The "Chief Operator" shall be certified at a Class II level, at a minimum.

After **December 1, 1996**, no person shall have "Direct Responsible Charge", as defined by the BCWWOCPS, of a municipal wastewater treatment facility classified at Level II or higher unless they possess a valid operator's certificate not more than one level below the classification level of the facility.

Chief Operator: Level III and IV


If the facility is classified by the BCWWOCPS at Level III, the Permittee shall designate a "Chief Operator", certified at a Class III level by **December 1, 1998**.

If the facility is classified by the BCWWOCPS at Level IV, the Permittee shall designate a "Chief Operator", certified at a Class IV level by **December 1, 1998**.

All other terms and conditions of Permit No. PE-4200 remain in full force and effect. If you have any questions regarding this amendment please contact John Finnie at 751-3183.

Yours truly,

R.J. Driedger,
Deputy Director of Waste Management

cc: Ted Oldham 
BCWWOCPS

DB
ACL
Bmm

August 24, 1994

File: PE-4200

Regional District of Nanaimo
6300 Hammond Bay Rd
PO Box 40
Lantzville BC V0R 2H0

ATTENTION: Mike Donnelly
Manager of Operations

Dear Mike Donnelly:

Re: Monitoring of French Creek
Pollution Control Centre Effluent

As outlined in Appendix C-1 to Permit PE-4200, the Regional District of Nanaimo is required to obtain a composite sample of the effluent once per year during July or August and have the sample analyzed for several parameters. The exact parameters were listed in our letter to you dated July 17, 1990 (copy enclosed). Our records indicate that the Regional District last sampled for these specific parameters on July 16, 1992.

Environmental Protection staff have reviewed the results of your July, 1992 sampling. Since the analysis shows that the levels meet the ministry's 1994 Approved and Working Criteria for Water Quality, we advise you that repeating this sampling procedure is not necessary at this time, although it may be required in the future.

If you have any questions or concerns, please contact Al Leuschen, P. Eng., or Bernie MacKay of this office at 751-3100.

Yours truly,



J. O. Finnie, P.Eng.
Head, Municipal & Environmental
Safety Sections
Environmental Protection
DB/dpc
monitor.db
Enclosure

940825

Appendix B – Internal Flow Monitoring and Laboratory Raw Data (Permit Data)

2021 Combined Flows to Outfall and Morningstar Golf Course (Cubic Metres)

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	14,342	10,750	9,676	9,514	9,051	9,408	10,101	9,977	10,117	10,037	11,033	11,953
2	16,001	10,513	9,484	9,563	9,084	9,421	10,450	10,165	10,010	10,129	13,266	11,129
3	13,548	10,320	9,351	9,961	9,179	9,383	10,214	10,406	10,042	9,963	13,474	11,075
4	13,940	10,311	10,004	9,506	9,043	9,338	10,313	10,213	10,120	10,217	13,099	11,266
5	15,821	10,118	10,453	9,630	9,061	9,164	10,476	9,987	9,848	10,750	12,616	10,966
6	12,791	10,215	9,974	9,363	9,036	9,424	10,384	10,178	10,010	10,493	11,966	11,429
7	11,498	10,140	10,000	9,478	8,927	10,102	10,330	10,026	9,773	10,165	13,112	11,487
8	11,121	10,186	9,922	9,099	8,955	9,265	10,040	10,116	9,883	10,299	12,500	11,302
9	11,148	9,980	9,595	9,414	8,968	9,091	10,614	10,073	9,958	10,414	12,648	10,977
10	11,313	9,920	8,328	9,277	9,163	8,418	10,450	10,056	9,865	10,354	11,666	14,282
11	12,322	9,924	9,375	9,364	9,264	9,415	10,411	10,259	9,870	10,105	12,017	13,917
12	15,469	10,026	9,470	9,234	9,179	9,785	10,629	10,112	9,918	10,197	11,701	12,798
13	13,433	9,987	9,333	9,005	9,157	9,827	10,375	10,038	9,681	10,008	14,022	13,706
14	11,802	10,150	9,775	9,127	9,239	9,643	10,390	10,227	9,848	9,954	18,846	12,398
15	11,142	10,839	9,506	9,029	9,235	9,581	10,487	10,106	9,619	10,145	25,903	11,876
16	10,880	10,547	9,519	8,974	9,570	9,572	10,067	10,305	9,727	13,447	14,281	11,466
17	10,627	10,265	9,536	8,954	9,541	9,521	10,057	10,277	11,992	11,702	12,505	11,613
18	10,357	9,812	9,739	9,258	9,263	9,615	10,371	10,450	10,376	10,889	13,943	13,152
19	10,093	9,635	10,058	9,130	9,225	9,621	10,438	10,558	10,390	10,990	12,546	11,908
20	9,883	9,663	9,798	9,157	9,159	9,836	10,178	10,507	9,966	10,203	11,829	11,632
21	9,870	9,885	9,717	9,357	9,092	10,047	10,584	10,428	9,999	10,341	11,321	11,327
22	9,604	9,732	9,849	9,024	9,106	10,157	10,596	10,413	9,737	10,484	11,370	12,970
23	9,914	9,915	9,496	9,194	9,457	10,128	10,402	10,873	9,656	10,583	11,050	12,422
24	10,482	9,829	9,764	9,603	9,526	10,171	10,374	10,710	9,660	11,298	10,782	13,072
25	11,236	8,821	9,763	9,677	9,522	10,243	10,222	10,333	9,899	12,573	11,781	11,572
26	10,542	9,487	9,778	9,339	9,481	10,348	10,519	10,925	10,639	11,679	10,975	11,287
27	10,984	9,505	9,746	9,394	9,848	10,194	10,273	10,220	10,706	11,296	13,764	11,527
28	10,717	9,587	10,117	9,392	9,435	10,305	10,107	9,680	10,321	12,821	13,600	11,304
29	10,528		9,648	9,220	9,433	10,430	10,408	10,223	10,740	11,159	12,223	11,040
30	10,813		9,567	9,221	9,440	10,051	10,348	10,181	10,161	10,860	11,982	10,925
31	10,746		9,548		9,522		9,821	10,008		10,345		11,205
Total:	362,967	280,058	299,888	279,456	287,159	291,504	320,429	318,026	302,530	333,900	391,818	368,980
Average:	11,709	10,002	9,674	9,315	9,263	9,717	10,336	10,259	10,084	10,771	13,061	11,903
Minimum:	9,604	8,821	8,328	8,954	8,927	8,418	9,821	9,680	9,619	9,954	10,782	10,925
Maximum:	16,001	10,839	10,453	9,961	9,848	10,430	10,629	10,925	11,992	13,447	25,903	14,282

2021 Morningstar Flows (Cubic Metres)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	0	0	0	0	0	0	791	852	791	0	0	0
2	0	0	0	0	0	0	701	849	792	0	0	0
3	0	0	0	0	0	0	855	671	0	0	0	0
4	0	0	0	0	0	0	855	0	0	0	0	0
5	0	0	0	0	0	0	794	0	0	0	0	0
6	0	0	0	0	0	0	852	848	0	0	0	0
7	0	0	0	0	0	0	845	778	116	0	0	0
8	0	0	0	0	0	0	6	729	69	0	0	0
9	0	0	0	0	0	0	847	6	169	0	0	0
10	0	0	0	0	0	0	6	0	420	0	0	0
11	0	0	0	0	0	0	848	787	293	0	0	0
12	0	0	0	0	0	0	848	852	768	0	0	0
13	0	0	0	0	0	0	848	383	155	0	0	0
14	0	0	0	0	0	0	849	713	337	0	0	0
15	0	0	0	0	0	0	845	859	0	0	0	0
16	0	0	0	0	0	691	849	605	639	0	0	0
17	0	0	0	0	0	711	851	0	693	0	0	0
18	0	0	0	0	0	847	852	0	698	0	0	0
19	0	0	0	0	0	780	853	164	685	0	0	0
20	0	0	0	0	0	851	853	636	710	0	0	0
21	0	0	0	0	0	850	853	0	359	0	0	0
22	0	0	0	0	0	765	0	0	862	0	0	0
23	0	0	0	0	0	854	710	49	0	0	0	0
24	0	0	0	0	0	694	709	0	862	0	0	0
25	0	0	0	0	0	685	729	0	598	0	0	0
26	0	0	0	0	0	655	0	0	864	0	0	0
27	0	0	0	0	0	815	0	0	857	0	0	0
28	0	0	0	0	0	920	0	0	863	0	0	0
29	0		0	0	0	815	617	0	0	0	0	0
30	0		0	0	0	776	0	0	0	0	0	0
31	0		0		0		0	794		0		0
Total:	0	0	0	0	0	11,709	18,665	10,575	12,600	0	0	0
Average:	0	0	0	0	0	390	602	341	420	0	0	0
Minimum:	0	0	0	0	0	0	0	0	0	0	0	0
Maximum:	0	0	0	0	0	920	855	859	864	0	0	0
Non compliance (max flow)	0	0	0	0	0	0	0	0	0	0	0	0
No. Discharge Days	0	0	0	0	0	15	25	17	22	0	0	0

Maximum permitted daily flow: 1,370 cubic metres/day

Flows were sent to Morningstar Golf Course for 79 days between July and September.

2021 Outfall Flows (Cubic Metres)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	14,341.7	10,749.5	9,675.8	9,513.9	9,051.3	9,408.0	9,310.7	9,125.0	9,325.7	10,037.4	11,032.6	11,953.4
2	16,000.9	10,512.7	9,484.3	9,563.0	9,084.1	9,420.7	9,748.4	9,315.7	9,218.3	10,128.8	13,265.7	11,128.7
3	13,548.4	10,319.5	9,350.5	9,961.4	9,179.0	9,382.8	9,358.6	9,734.6	10,041.7	9,962.8	13,474.4	11,074.8
4	13,940.1	10,310.7	10,003.8	9,506.0	9,043.4	9,338.3	9,457.9	10,212.9	10,120.3	10,216.6	13,099.0	11,265.9
5	15,820.7	10,117.7	10,453.2	9,629.7	9,060.5	9,164.1	9,681.6	9,986.6	9,848.3	10,750.0	12,615.5	10,965.5
6	12,791.0	10,214.5	9,973.7	9,363.1	9,035.5	9,423.6	9,531.9	9,329.5	10,009.6	10,492.5	11,965.7	11,429.3
7	11,497.7	10,139.9	10,000.3	9,477.8	8,927.2	10,102.1	9,485.5	9,248.0	9,657.3	10,165.1	13,111.8	11,486.7
8	11,120.5	10,185.7	9,921.6	9,098.9	8,954.6	9,264.9	10,033.9	9,387.0	9,814.0	10,298.5	12,500.0	11,302.2
9	11,147.5	9,980.1	9,595.2	9,413.7	8,967.5	9,091.4	9,766.4	10,067.2	9,789.4	10,414.0	12,648.3	10,976.5
10	11,313.4	9,920.2	8,328.2	9,276.6	9,163.4	8,418.1	10,444.2	10,055.7	9,444.6	10,354.0	11,665.5	14,281.9
11	12,322.3	9,923.6	9,374.5	9,364.4	9,263.8	9,414.8	9,563.2	9,471.4	9,576.7	10,105.1	12,017.1	13,916.8
12	15,468.9	10,025.8	9,470.4	9,233.6	9,178.9	9,785.4	9,781.6	9,259.7	9,150.9	10,196.8	11,700.9	12,798.1
13	13,433.2	9,987.1	9,333.2	9,005.3	9,156.7	9,827.1	9,527.2	9,654.9	9,526.3	10,008.3	14,022.2	13,705.5
14	11,801.8	10,150.0	9,775.2	9,127.3	9,238.7	9,642.6	9,540.6	9,514.0	9,511.2	9,953.6	18,845.5	12,397.7
15	11,142.1	10,839.3	9,505.8	9,028.8	9,235.3	9,581.1	9,641.8	9,247.3	9,619.1	10,145.4	25,903.3	11,876.3
16	10,880.4	10,547.1	9,519.3	8,973.9	9,570.3	8,880.7	9,217.7	9,700.0	9,087.7	13,447.4	14,281.0	11,466.0
17	10,627.4	10,265.4	9,535.6	8,954.3	9,540.7	8,810.1	9,206.0	10,276.7	11,299.0	11,702.0	12,504.5	11,612.9
18	10,357.2	9,811.5	9,739.3	9,257.6	9,262.5	8,767.5	9,519.6	10,450.4	9,677.9	10,889.4	13,942.9	13,151.5
19	10,092.6	9,634.8	10,058.2	9,130.4	9,225.0	8,840.6	9,585.5	10,393.8	9,704.2	10,990.0	12,545.7	11,907.6
20	9,882.9	9,663.3	9,797.8	9,157.0	9,158.5	8,985.2	9,324.6	9,870.8	9,255.8	10,202.5	11,829.0	11,631.5
21	9,870.3	9,884.6	9,716.5	9,356.7	9,091.6	9,196.9	9,731.0	10,428.3	9,640.2	10,341.4	11,320.5	11,327.2
22	9,604.1	9,731.9	9,849.0	9,024.2	9,106.2	9,392.5	10,596.4	10,412.7	8,874.7	10,483.7	11,369.7	12,970.4
23	9,913.6	9,914.8	9,496.0	9,193.5	9,456.7	9,273.9	9,692.5	10,824.0	9,655.5	10,583.1	11,049.7	12,421.6
24	10,481.9	9,828.9	9,764.4	9,602.5	9,526.4	9,477.1	9,664.9	10,710.3	8,797.3	11,298.0	10,781.8	13,072.3
25	11,236.0	8,820.5	9,763.1	9,676.7	9,522.2	9,558.3	9,492.9	10,332.5	9,301.2	12,572.5	11,781.3	11,572.1
26	10,541.5	9,487.2	9,778.0	9,339.3	9,481.4	9,693.1	10,519.0	10,924.5	9,774.5	11,679.4	10,975.2	11,286.9
27	10,984.3	9,504.6	9,745.7	9,394.2	9,847.8	9,379.1	10,272.8	10,219.7	9,848.6	11,295.8	13,764.3	11,527.4
28	10,717.3	9,587.0	10,116.6	9,391.5	9,434.7	9,384.4	10,106.8	9,680.3	9,458.3	12,821.1	13,600.0	11,303.8
29	10,527.7		9,647.8	9,219.5	9,433.4	9,615.3	9,791.6	10,223.3	10,740.0	11,159.1	12,223.1	11,039.9
30	10,813.4		9,567.1	9,221.0	9,439.8	9,275.0	10,348.1	10,180.5	10,161.2	10,860.3	11,981.9	10,924.7
31	10,746.0		9,548.1		9,522.3		9,821.4	9,213.3		10,345.4		11,205.2
Total:	362,967	280,058	299,888	279,456	287,159	279,795	301,764	307,451	289,929	333,900	391,818	368,980
Average:	11,709	10,002	9,674	9,315	9,263	9,326	9,734	9,918	9,664	10,771	13,061	11,903
Minimum:	9,604	8,821	8,328	8,954	8,927	8,418	9,206	9,125	8,797	9,954	10,782	10,925
Maximum:	16,001	10,839	10,453	9,961	9,848	10,102	10,596	10,925	11,299	13,447	25,903	14,282
Non compliance (max flow)	1	0	0	0	0	0	0	0	0	0	2	0

Maximum permitted daily flow: 16,000 cubic metres/day

2021 Influent 5-day Biochemical Oxygen Demand (BOD ₅) (mg/L)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1						212	201					
2		180	261		198				205		186	185
3	128					214		212				
4		162	188		187		195				151	
5	124							233		163		178
6				279	201	168	246					
7	169	195	175						293	181	162	177
8				324		192	113					
9		222	192		188			228	278		153	187
10	155					212		268				
11		183	171	194	220		157				221	
12	116							298				163
13				262		157	247					
14	142		118							215		141
15				248		177	230	248			124	
16		219	168		216				184		122	202
17	155					210		334				
18		203	212	286	186		210				133	
19	178							284		195		169
20				256	200	191	238					
21	284	168	177						260	230	152	205
22				201		185	222					
23		182	176						201		204	210
24	194					319		197				
25		197	220	126							178	
26	210							268				
27				206	160	168	212		175			
28	175	172	220						189	179	143	305
29				176		215	258	223				
30			262		199						182	246
31	135							275				
Average	167	189	195	233	196	202	211	256	223	194	162	197

2021 Effluent 5-day Biochemical Oxygen Demand (BOD ₅) (mg/L)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1						25.8	14.1					
2		28.8	27.2		19.6				18.7		25.2	22.6
3	20.9					23.5		24.4				
4		26.3	23.8	22.3	22.4		15.3				29.0	
5	29.2							20.6		12.4		17.6
6				35.2	23.4	15.4	21.8					
7	20.1	24.8	21.2						23.8	14.8	18.1	22.7
8				24.2		25.9	33.0					
9		28.5	29.3		17.5			11.7	14.5		25.1	22.7
10	21.4					18.0		19.6				
11		27.3	27.4	25.4	24.9		13.9				18.6	
12	25.8							20.5				16.4
13	18.5			29.5		12.7	21.8					
14	22.6		25.3	27.2						21.0		18.7
15				27.3		17.6	16.9	14.7			19.9	
16		34.6	31.1			12.3			13.1		15.8	25.0
17	18.5					15.8		29.5				
18		25.5	23.2	24.7			12.7				19.1	
19	25.5			24.7	20.1			22.5		24.5		22.2
20				31.0	22.7	16.2	18.0					
21	27.8	24.2	22.8	27.6					21.8	20.9	13.2	29.1
22				22.9		29.5	24.8					
23		31.6	31.1						16.3		25.5	30.1
24	24.7					21.2		24.0				
25		27.7	28.7	23.0							27.5	
26	28.6				17.1			20.9				
27				34.0	23.1	15.8	25.4		13.4			
28	27.5	23.4	32.8						18.6	13.6	17.7	46.0
29				24.0		21.8		13.6				
30			31.4		17.5						25.4	41.1
31	22.0							18.8				
Average	23.8	27.5	27.3	26.9	20.8	19.4	19.8	20.1	17.5	17.9	21.5	26.2
Non compliance	0	0	0	0	0	0	0	0	0	0	0	1

FCPCC Outfall Maximum cBOD₅: 45 mg/L

2021 Morningstar 5-day Biochemical Oxygen Demand (BOD ₅) (mg/L)				
Day	June	July	Aug	Sept
1				
2		9.8		11.5
3				
4				
5		13.0	13.3	
6			11.2	
7				
8		18.3		
9		14.3		8.1
10				9.5
11				
12		10.6	11.3	
13			13.4	
14		14.4		
15				
16				8.3
17	11.2			8.7
18	13.3			
19			13.8	
20			12.7	
21				
22		16.2		10.9
23		16.9		
24	16.6			11.1
25	18.0			
26			15.5	
27			11.8	
28				
29		17.9		
30	13.1	18.9		
31				
Count	5	10	8	7
Average:	14.4	15.0	12.9	9.7
Non-compliances	0	0	0	0
Minimum:	11.2	9.8	11.2	8.1
Maximum:	18.0	18.9	15.5	11.5

FCPCC Morningstar Discharge Maximum cBOD₅: 20 mg/L

2021 Influent Total Suspended Solids (TSS) (mg/L)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	180	305	319	414	276	530	306	268	376	314	205	276
2	156	505	768	360	304	359	351	284	365	258	321	331
3	190	391	922	298	360	325	278	293	397	235	481	345
4	229	374	451	324	312	377	277	447	700	259	200	219
5	256	394	512	364	443	269	331	306	482	295	259	252
6	229	294	299	432	432	279	325	271	705	333	217	261
7	293	247	333	351	626	476	296	250	966	256	220	277
8	333	300	301	457	295	356	345	256	1060	287	299	172
9	239	336	444	425	305	328	313	346	746	259	272	192
10	250	271	345	326	290	312	254	362	422	258	273	287
11	269	291	332	319	271	341	285	374	280	340	223	196
12	312	470	296	375	393	229	305	369	321	274	317	158
13	230	322	301	398	490	267	328	472	350	297	247	239
14	287	268	315	683	570	353	376	378	280	352	196	211
15	297	248	474	375	470	324	376	290	275	385	150	269
16	304	320	321	578	276	276	442	372	312	289	588	303
17	267	337	393	322	308	294	395	353	441	229	465	222
18	289	422	494	412	363	252	359	343	1420	351	258	381
19	399	350	561	389	381	287	315	354	268	320	267	263
20	321	395	306	363	342	283	315	441	324	272	208	346
21	735	287	332	359	475	317	372	281	469	306	289	348
22	369	343	457	358	472	290	370	295	867	320	284	231
23	546	320	332	383	312	290	303	314	316	425	319	320
24	283	279	417	433	283	509	188	321	310	250	406	192
25	279	324	297	286	341	499	228	290	352	286	308	199
26	381	311	422	475	289	266	309	299	246	244	362	253
27	286	303	513	420	323	280	353	254	286	250	255	320
28	296	317	301	411	371	306	369	358	341	359	312	572
29	334		367	387	268	323	347	325	314	235	317	415
30	152		546	344	280	242	287	425	259	196	229	294
31	291		570		339		323	446		240		229
Average:	299	333	421	394	363	328	323	337	475	289	292	277

2021 Effluent Total Suspended Solids (TSS) (mg/L)

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	17.5	22.5	18.5	18.5	15.0	15.0	10.8	15.0	17.4	15.5	14.6	21.4
2	27.5	26.5	18.0	14.5	12.5	12.5	24.0	16.4	18.2	12	30.0	21.2
3	23.5	22.5	19.5	19.5	11.0	12.5	16.8	24.4	16.6	11	16.6	25.0
4	20.5	22.0	15.5	18.0	15.0	20.5	15.4	23.8	11.2	15.6	26.8	21.6
5	23.5	26.5	21.5	16.0	17.5	18.5	21.2	22.2	9.6	16	24.8	17.4
6	17.0	17.5	16.5	20.5	13.5	14.5	22.0	11.5	9.0	11.2	24.8	17.6
7	14.5	15.5	13.5	19.5	12.0	28.0	25.0	12.0	18.2	18.0	17.0	19.4
8	19.5	24.5	17.5	15.0	14.5	15.5	25.0	14.0	13.2	17.5	20.2	13.4
9	24.5	16.0	18.0	18.5	13.5	16.0	19.2	18.2	15.2	19.2	18.6	13.6
10	19.5	20.5	21.0	18.0	14.0	11.0	17.0	16.0	13.0	13.4	25.2	20.8
11	26.5	17.5	18.0	28.0	13.5	13.5	15.8	11.2	14.0	12.6	20.8	16.4
12	37.5	21.0	24.5	24.0	10.5	12.5	18.0	16.8	11.2	23.4	19.0	12.6
13	23.5	19.0	26.5	17.0	14.5	15.0	20.2	21.4	13.4	22.0	24.8	26.8
14	23.5	20.5	15.0	16.5	20.0	11.0	17.2	20.8	13.6	20.6	24.4	17.2
15	20.5	17.0	23.2	17.0	16.0	10.5	13.6	14.4	11.2	20	53.8	20.2
16	19.0	22.0	21.0	28.0	10.0	8.5	16.2	20.4	13.4	18	21.0	21.8
17	14.0	20.5	20.5	25.5	14.0	11.4	15.6	24.0	17.6	13	25.0	27.4
18	21.0	15.0	16.5	13.0	15.0	11.0	13.2	20.2	14.4	15.6	20.2	16.2
19	17.5	15.5	21.0	16.0	14.0	14.6	21.2	20.8	14.4	28.4	17.0	26.6
20	18.0	15.0	19.5	16.5	16.5	16.0	17.4	17.2	16.2	17.4	16.5	30.8
21	20.5	12.0	16.5	15.5	22.0	16.8	20.8	20.0	19.8	14.4	14.4	28.0
22	25.0	21.0	19.0	14.0	17.5	24.0	22.2	14.2	16.2	14.4	13.2	26.4
23	29.0	32.5	18.5	17.5	15.5	14.6	14.5	14.0	12.8	18.6	19.2	28.0
24	22.0	41.0	21.5	17.0	10.5	16.2	17.5	21.0	12.2	14.2	33.8	34.8
25	23.5	17.5	27.0	16.5	16.5	12.0	13.0	19.4	15.6	23.0	32.0	
26	22.0	19.0	27.0	18.5	15.0	17.0	23.4	20.0	11.0	10.8	22.4	21.4
27	20.5	14.0	29.5	30.5	20.0	15.2	22.6	17.0	15.6	18.4	34.8	41.8
28	21.5	15.5	21.0	20.0	14.5	19.2	20.4	20.8	12.6	13.6	17.0	42.0
29	22.0		21.0	14.0	17.0	19.8	24.0	13.4	13	17.2	21.4	42.8
30	29.0		20.0	16.5	14.0	15.6	22.4	21.4	10.4	18.6	25.8	31.6
31	19.5		17.0		13.5		17.6	23.0		12.2		33.8
Average:	22.0	20.3	20.1	18.7	14.8	15.3	18.8	18.2	14.0	16.7	23.2	24.6
Non-compliances (Morningstar)	0	0	0	0	0	0	0	0	0	0	0	0
Non-Compliance (Outfall)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Compliances	0	0	0	0	0	0	0	0	0	0	0	0

FCPCC Outfall Maximum TSS: 60 mg/L

Days highlighted in yellow were days in which TSS exceed levels in the outfall permit.

2021 Morningstar Total Suspended Solids (TSS) (mg/L)				
Day	June	July	Aug	September
1		8.8	10.0	9.6
2		7.2	9.6	8.4
3		8.0	10.0	8.0
4		8.8	12.0	5.6
5		8.4	9.2	9.0
6		12.8	13.6	
7		17.2	6.4	10.4
8		12.8	12.0	7.6
9		9.6	12.8	8.8
10		9.2	9.6	9.2
11		9.6	8.4	8.4
12		10.4	10.0	6.8
13		9.2	9.7	7.2
14		10.0	12.4	9.2
15		7.6	13.6	7.6
16	8.0	7.6	8.8	7.6
17	6.0	15.0	8.0	7.6
18	7.6	10.8	12.4	13.2
19	8.4	14.0	8.4	14.4
20	8.4	10.8	9.6	7.2
21	6.8	12.4	17.0	11.6
22	9.2	9.6	14.0	8.0
23	10.8	12.4	6.4	18.4
24	10.0	10.0	7.2	7.6
25	10.4	16.8		9.6
26	13.2	9.2	11.2	10.4
27	10.4	12.0	12.8	9.2
28	9.6	10.2	7.6	7.6
29	8.8	12.0		10.0
30	8.4	13.6	8.4	
31		9.6	10.8	
Count	15	31	29	28
Average:	9.1	10.8	10.4	9.2
Non-compliances	0	0	0	0
Minimum:	6.0	7.2	6.4	5.6
Maximum:	13.2	17.2	17.0	18.4

FCPCC Morningstar Discharge Maximum TSS: 30 mg/L

2021 Influent Ammonia (NH₃) (mg/L)

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Sample 1	16.8	24.4	25.5	31.0	34.7	29.8	30.7	28.1	32.5	36.1	27.4	24.0
Sample 2	20.6	24.8	24.5	36.3	34.4	35.7	31.7	36.2	32.9	11.2	25.6	21.3
Sample 3	20.8	26.3	27.5	35.7	31.6	29.0	30.4	42.1		24.5	10.6	29.4
Sample 4	19.4	27.1		36.1	29.7	27.7	35.8	39.2			26.3	32.0
Sample 5								38.5			10.0	
Sample 6												
Average	19.4	25.7	25.8	34.8	32.6	30.6	32.2	36.8	32.7	23.9	20.0	26.7

2021 Effluent Ammonia (NH₃) (mg/L)

Day	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Sample 1	16.9	32.2	29.2	27.9	37.6	30.3	32.8	36.0	35.1	26.6	28.7	29.2
Sample 2	30.0	30.5	31.8	38.2	32.9	31.6	37.1	39.6	35.5	21.0	24.6	24.2
Sample 3	28.3	27.0	35.2	34.9	29.2	24.9	30.2	41.5		29.0	13.5	30.9
Sample 4	25.0	27.8	22.7	38.5	30.3	33.9	34.0	39.4			25.4	33.4
Sample 5		32.1	24.5	33.6	29.9	35.6	36.9	39.4			24.4	
Sample 6					33.2		42.1					
Sample 7												
Average	25.1	29.9	28.7	34.6	32.2	31.3	35.5	39.2	35.3	25.5	23.3	29.4
% reduction	-29.1	-16.6	-11.0	0.4	1.3	-2.3	-10.5	-6.4	-8.0	-6.7	-16.7	-10.3

Regular Ammonia testing is not required for permit, regular testing is completed internally and has historically been reported in this section of the Annual Report.

2021 Influent Temperature												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	13.2	13.5	12.4	14.4	14.8	18.4	20.3	21.1	21.2	18.7	16.5	14.6
2	12.4	13.4	12.4	14.8	15.8	18.0	20.3	21.6	21.0	18.9	16.6	14.6
3	12.3	12.6	13.5	14.3	16.3	18.2	19.6	21.3	20.6	18.7	16.3	14.2
4	13.0	13.8	12.7	12.7	16.3	17.5	19.7	21.5	20.2	19.4	17.1	13.2
5	12.7	13.0	12.8	13.8	15.4	17.4	20.1	21.6	20.8	18.3	16.7	14.5
6	12.8	11.8	13.0	12.7	16.6	16.8	20.3	21.8	20.3	18.0	15.9	13.6
7	13.0	11.0	13.2	13.9	15.4	17.4	20.1	20.6	20.2	17.8	15.4	13.9
8	12.8	13.8	12.7	14.7	15.9	17.8	19.9	20.6	20.5	17.4	15.8	13.8
9	12.1	12.0	12.5	13.5	15.6	17.3	20.3	21.7	21.1	17.5	15.4	13.9
10	12.8	12.8	12.5	14.6	15.6	18.2	19.8	21.4	20.5	18.2	16.5	13.8
11	13.0	11.8	13.6	14.4	15.8	17.4	20.4	21.9	21.2	16.8	16.3	12.6
12	13.2	11.7	12.6	13.3	15.8	18.5	20.7	21.4	20.9	18.4	16.5	13.5
13	12.8	12.8	12.5	14.1	16.3	17.0	20.9	21.5	21.1	18.1	15.0	13.6
14	13.0	12.9	13.1	13.8	16.6	18.3	20.8	21.0	19.8	17.9	14.5	13.4
15	12.9	13.3	13.0	14.0	15.8	18.1	21.0	21.0	20.9	17.6	14.0	13.4
16	12.9	12.6	13.3	14.0	16.4	17.9	21.1	21.9	20.7	17.0	14.7	13.4
17	12.0	13.0	12.5	13.7	17.1	17.8	20.0	21.7	19.9	16.5	14.5	13.3
18	12.4	12.6	13.0	14.8	16.6	18.1	20.2	21.6	18.6	17.3	14.8	12.6
19	12.9	12.5	13.4	14.9	16.5	17.6	21.2	21.8	20.0	17.4	14.2	13.4
20	132.0	12.1	13.4	16.4	16.1	17.9	20.8	21.5	19.2	17.6	12.7	13.0
21	14.0	13.4	12.9	14.8	16.8	18.4	21.0	21.0	19.9	17.7	13.9	12.6
22	14.1	12.8	14.3	15.7	16.5	18.7	21.0	20.5	19.4	17.2	14.4	13.0
23	12.1	13.1	12.7	15.4	16.6	18.9	20.8	21.0	19.8	17.1	14.5	12.7
24	12.0	12.8	14.7	14.3	16.8	19.3	19.8	21.3	19.5	16.4	15.4	12.6
25	12.6	13.1	12.8	14.7	17.7	19.1	19.8	20.9	19.7	17.8	14.4	12.6
26	12.5	13.2	13.1	15.4	17.0	18.9	21.5	21.7	18.8	17.5	14.3	11.4
27	13.0	10.9	12.9	15.5	17.2	20.1	20.9	21.6	19.7	17.5	15.2	13.1
28	14.1	12.6	13.9	16.2	16.8	19.9	20.9	21.0	19.7	16.7	14.0	12.4
29	13.6		13.3	16.1	16.7	19.7	21.1	20.1	20.2	17.0	14.6	13.5
30	12.7		13.8	16.0	17.1	20.1	21.1	21.2	18.8	16.2	14.7	11.9
31	12.6		13.1		17.1		21.0	21.5		15.1		13.0
Average:	16.7	12.7	13.1	14.6	16.4	18.3	20.5	21.3	20.1	17.5	15.2	13.3
Minimum:	12.0	10.9	12.4	12.7	14.8	16.8	19.6	20.1	18.6	15.1	12.7	11.4
Maximum:	132.0	13.8	14.7	16.4	17.7	20.1	21.5	21.9	21.2	19.4	17.1	14.6

2021 Effluent Temperature

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	13.5	14.0	13.7	14.0	16.3	18.9	21.6	21.8	21.0	18.6	15.9	15.7
2	13.5	13.3	12.0	15.4	15.8	19.5	21.3	22.6	21.0	18.8	16.3	14.9
3	13.2	14.4	13.4	14.1	16.3	19.2	20.8	22.7	21.2	18.6	16.3	14.2
4	13.5	13.9	13.4	13.9	16.6	19.3	20.4	22.7	21.1	18.8	16.8	14.1
5	13.5	13.7	13.5	18.0	16.1	18.0	21.7	22.9	21.1	19.1	16.5	13.7
6	12.9	13.3	13.2	14.3	16.4	NT	21.6	22.8	21.0	18.2	16.2	13.2
7	13.2	13.0	13.6	14.8	16.3	18.4	20.9	21.8	20.9	18.5	15.6	13.8
8	13.6	12.9	13.6	14.5	15.8	18.4	21.2	21.6	21.7	18.4	15.5	14.1
9	13.7	12.6	13.3	14.4	15.9	18.1	21.5	22.2	21.6	18.0	15.7	13.6
10	13.7	12.3	13.4	14.0	16.7	18.4	20.8	22.4	21.6	17.7	15.2	13.9
11	13.9	12.3	13.0	14.1	16.7	19.1	21.2	22.6	21.3	17.7	16.1	13.7
12	14.5	12.6	13.5	14.4	17.3	18.3	22.0	22.7	20.9	17.9	15.9	14.0
13	13.3	12.9	13.6	14.5	17.2	18.4	21.9	22.5	20.6	17.9	15.6	13.4
14	13.6	12.6	13.7	15.1	17.9	18.9	22.2	22.3	21.0	18.1	15.3	13.3
15	13.7	13.5	13.4	15.1	17.3	18.9	22.0	22.1	20.3	18.4	14.8	13.5
16	13.6	12.8	13.6	15.4	17.3	19.4	22.0	22.8	20.2	17.8	14.1	13.6
17	13.3	12.8	13.6	15.0	17.4	19.4	21.3	22.1	20.3	17.5	14.2	13.4
18	13.6	13.6	13.8	15.2	17.6	19.2	20.9	22.3	19.7	17.0	14.4	13.5
19	13.6	12.6	14.4	16.5	17.3	19.0	21.4	22.4	19.9	17.4	14.2	13.4
20	13.8	12.9	14.0	16.9	17.1	19.2	21.5	22.1	20.0	17.9	14.0	13.3
21	14.1	13.4	13.7	16.2	17.7	20.0	21.3	21.8	20.1	17.6	14.3	12.9
22	13.2	13.5	13.7	16.8	17.0	20.2	21.2	21.5	20.3	18.0	14.6	13.6
23	12.7	13.1	14.0	16.3	17.9	20.5	21.7	21.8	20.1	17.4	15.1	13.4
24	12.8	13.0	14.4	16.0	18.0	20.5	20.9	21.5	20.0	17.6	14.5	13.4
25	12.7	13.4	14.1	16.6	17.8	20.8	21.1	21.1	19.7	17.5	14.7	13.7
26	12.5	13.5	14.2	16.0	18.0	19.9	22.2	22.1	20.3	17.1	15.0	12.5
27	13.1	12.6	13.7	16.1	17.8	20.7	21.9	22.1	20.0	17.4	14.7	11.9
28	13.6	13.0	14.2	16.5	17.6	21.8	21.8	20.7	19.9	16.9	14.5	12.5
29	13.1		14.2	16.3	17.4	21.8	22.4	21.5	19.6	16.7	15.0	12.3
30	13.9		14.1	17.7	17.6	22.0	22.6	21.4	19.3	16.3	14.9	12.6
31	14.0		13.9		18.5		22.0	21.1		14.7		12.6
Average:	13.4	13.1	13.7	15.5	17.1	19.5	21.5	22.1	20.5	17.7	15.2	13.5
Minimum:	12.5	12.3	12.0	13.9	15.8	18.0	20.4	20.7	19.3	14.7	14.0	11.9
Maximum:	14.5	14.4	14.4	18.0	18.5	22.0	22.6	22.9	21.7	19.1	16.8	15.7

2021 Influent pH

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	7.40	7.37	7.58	7.87	7.45	7.77	7.50	7.79	7.57	7.53	7.43	7.30
2	7.41	7.48	7.57	7.77	7.84	7.64	7.48	7.88	7.44	7.96	7.57	7.04
3	7.40	7.60	7.39	7.96	7.72	7.64	7.89	7.64	7.76	8.06	7.74	7.55
4	7.45	7.63	7.70	7.60	7.75	7.60	7.47	7.26	7.52	7.88	8.09	7.44
5	7.45	7.66	7.60	7.54	7.38	8.00	7.49	7.49	7.74	7.66	7.72	7.91
6	7.58	7.82	7.60	7.47	7.51	7.43	7.64	7.63	7.47	7.21	7.91	7.18
7	7.56	7.56	7.54	7.75	7.74	7.49	7.74	7.37	7.41	7.67	7.89	7.38
8	7.42	7.89	7.61	7.93	7.95	7.86	7.53	7.44	7.51	7.37	7.70	7.48
9	7.50	7.56	7.52	7.49	7.56	7.36	7.99	7.71	7.61	7.79	7.65	7.13
10	7.63	7.64	7.53	7.58	7.64	7.51	7.70	7.80	7.47	8.03	7.44	7.62
11	7.54	7.55	7.69	8.09	7.40	7.52	7.78	7.62	7.87	7.62	8.01	7.49
12	7.17	7.57	7.43	7.66	7.64	7.80	7.27	7.38	7.70	7.95	7.82	7.58
13	7.42	7.82	7.79	7.84	7.55	7.49	7.47	7.13	7.59	8.07	7.71	7.55
14	7.51	7.83	7.65	7.57	7.64	7.41	7.58	7.57	7.66	7.89	7.52	7.49
15	7.55	7.82	7.96	7.72	7.75	7.72	7.32	7.63	7.73	7.76	7.14	7.03
16	7.71	7.50	7.98	7.66	7.79	7.35	7.35	7.65	7.61	7.54	7.38	8.00
17	7.50	7.68	7.87	7.83	7.62	7.47	7.69	7.56	7.66	7.50	7.12	7.43
18	7.48	7.91	7.68	7.65	7.70	7.47	7.47	7.69	7.66	7.73	7.88	7.45
19	7.52	7.40	8.04	7.51	7.51	7.39	7.64	7.72	8.00	7.78	7.26	7.80
20	7.44	7.43	7.92	7.84	7.40	7.39	7.51	7.61	7.65	7.40	7.54	7.08
21	7.51	7.63	7.43	7.50	7.49	7.44	7.76	7.66	7.75	7.50	7.57	7.48
22	7.58	7.44	7.89	7.55	7.43	7.45	8.00	7.53	7.65	7.90	7.50	7.46
23	7.02	7.47	7.68	7.57	7.86	7.46	7.60	7.62	7.86	7.96	7.53	7.58
24	7.54	7.61	8.05	7.55	7.58	7.58	7.24	7.53	7.88	7.47	7.30	7.00
25	7.62	7.45	7.50	7.55	7.41	7.41	7.46	7.65	6.85	7.99	8.54	7.58
26	7.58	7.48	7.58	7.95	7.41	7.46	7.57	7.28	7.50	7.75	7.60	7.56
27	7.63	7.35	7.97	7.52	7.73	7.37	7.46	7.45	7.85	7.67	8.00	7.84
28	7.61	7.40	8.00	7.99	7.65	7.30	7.41	8.02	7.68	7.69	7.61	7.43
29	7.71		7.62	7.94	7.64	7.55	7.77	7.36	8.08	7.83	7.60	7.83
30	7.45		7.69	7.90	7.91	7.48	7.77	7.82	7.77	7.60	7.64	7.61
31	7.52		7.69		7.67		7.86	6.65		7.48		7.83
Average:	7.50	7.59	7.70	7.71	7.62	7.53	7.60	7.55	7.65	7.72	7.65	7.49
Minimum:	7.02	7.35	7.39	7.47	7.38	7.30	7.24	6.65	6.85	7.21	7.12	7.00
Maximum:	7.71	7.91	8.05	8.09	7.95	8.00	8.00	8.02	8.08	8.07	8.54	8.00

2021 Effluent pH

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	7.33	7.35	7.26	7.29	7.35	7.23	7.32	7.37	7.34	7.30	7.40	7.58
2	7.23	7.30	7.24	7.23	7.34	7.28	7.30	7.31	7.33	7.26	7.39	7.38
3	7.18	7.36	7.35	7.30	7.23	7.36	7.30	7.33	7.18	7.33	7.02	7.35
4	7.25	7.31	7.31	7.30	7.22	7.30	7.25	7.35	7.39	7.37	7.32	7.40
5	7.39	7.36	7.35	7.94	7.32	7.26	7.30	7.33	7.26	7.23	7.31	7.34
6	7.23	7.33	7.26	7.30	7.29	NT	7.28	7.32	7.22	7.28	7.14	7.36
7	7.32	7.37	7.20	7.33	7.29	7.28	7.25	7.32	7.31	7.35	7.31	7.37
8	7.35	7.32	7.33	7.36	7.33	7.10	7.23	7.30	7.30	7.32	7.34	7.35
9	7.30	7.40	7.34	7.23	7.33	7.24	7.26	7.35	7.31	7.25	7.33	7.30
10	7.16	7.28	7.36	7.41	7.28	7.25	7.24	7.37	7.28	7.29	7.32	7.39
11	7.33	7.38	7.39	7.38	7.26	7.29	7.30	7.36	7.32	7.38	7.35	7.32
12	7.29	7.35	7.37	7.20	7.30	7.36	7.25	7.38	7.32	7.10	7.42	7.32
13	7.21	7.27	7.24	7.33	7.30	7.34	7.16	7.35	7.31	7.18	7.38	7.30
14	7.29	7.33	7.27	7.24	7.36	7.12	7.31	7.36	7.52	7.10	7.35	7.28
15	7.31	7.31	7.17	7.30	7.31	7.18	7.31	7.32	7.32	7.19	7.17	7.32
16	7.30	7.32	7.21	7.34	7.35	7.28	7.33	7.33	7.31	7.37	7.39	7.33
17	7.31	7.34	7.15	7.21	7.25	7.28	7.39	7.33	7.34	7.28	7.34	7.37
18	7.40	7.23	7.26	7.25	7.27	7.33	7.38	7.37	7.30	7.30	7.35	7.36
19	7.32	7.34	7.17	7.25	7.27	7.34	7.26	7.40	7.28	7.12	7.30	7.28
20	7.33	7.30	7.33	7.44	7.29	7.34	7.29	7.32	7.24	7.39	7.29	7.29
21	7.33	7.32	7.34	7.32	7.28	7.31	7.32	7.37	7.37	7.19	7.27	7.30
22	7.31	7.24	7.32	7.32	7.40	7.28	7.36	7.32	7.25	7.23	7.40	7.37
23	7.37	7.30	7.38	7.32	7.30	7.23	7.28	7.34	7.41	7.18	7.37	7.23
24	7.36	7.28	7.41	7.40	7.31	7.27	7.35	7.24	7.30	7.27	7.36	7.30
25	7.39	7.30	7.39	7.37	7.34	7.24	7.34	7.12	7.44	7.34	7.44	7.53
26	7.34	7.38	7.39	7.22	7.22	7.23	7.34	7.12	7.36	7.12	7.29	7.31
27	7.31	7.21	7.29	7.28	7.24	7.30	7.28	7.35	7.26	7.19	7.34	7.37
28	7.39	7.22	7.30	7.23	7.27	7.28	7.26	7.36	7.34	7.06	7.43	7.33
29	7.34		7.22	7.24	7.23	7.30	7.34	7.38	7.25	7.07	7.30	7.32
30	7.42		7.28	7.29	7.45	7.28	7.33	7.28	7.41	7.33	7.38	7.38
31	7.37		7.37		7.23		7.38	7.36		7.39		7.41
Average:	7.31	7.31	7.30	7.32	7.30	7.27	7.30	7.33	7.32	7.25	7.33	7.35
Minimum:	7.16	7.21	7.15	7.20	7.22	7.10	7.16	7.12	7.18	7.06	7.02	7.23
Maximum:	7.42	7.40	7.41	7.94	7.45	7.36	7.39	7.40	7.52	7.39	7.44	7.58

Appendix C – Permit Non-Conformance Report

Permit Non-Compliances:

Date of Non-compliance	Describe the Issue	What was the Immediate Resolution?	Describe the Suspected Cause or Solution	Investigation Results
FCPCC Flow (3)				
January 2, 2021	Total Effluent Flow 16000.9m3/d, permit is 16000m3/d. High flow attributed to heavy rainfall.			Heavy rain fall resulted in a flow permit exceedance at FCPCC. Where the permit was exceeded by 900L. Historian reported the flow for that day as 15,997m3.
November 14, 2021	On 2021 November 14 the FCPCC flow was 18,845.5 m3, which exceeds the permit allowance of 16,000 m3.	The FCPCC Chief Operator was notified.		High flows due to large amount of rain. November 13th rain fall 22.2mm and Nov 14th 26.6mm.
November 15, 2021	On 2021 November 15 the FCPCC flow was 25,903.3 m3, which exceeds the permit allowance of 16,000 m3.	The FCPCC Chief Operator was notified.		Hi flow event due to large amount of rain fall. Nov 14 rain fall total 26.6mm Nov 15 rain fall total 42mm. Flow total is unknown due to effluent channel level being higher than the weir that is used to calculate flow. Flow was likely less than reported.
FCPCC SAMPLING (x1)				
December 25, 2021	The 2021 December 25th FCPCC effluent composite sample was not collected due to sampler issues. When this has occurred in the past an effluent grab sample is collected and analyzed for TSS to satisfy permit requirements; however this did not occur and there is no TSS result for 2021 December 25th.	The FCPCC Chief Operator was notified when the issue was discovered.		

FCPCC BOD (x1)				
December 28, 2021	On 2021 December 28 the FCPCC effluent cBOD was 46.0 mg/L, which exceeded the permit allowance of 45 mg/L.	The FCPCC Chief Operator was notified		Attributed to the sudden freezing temperatures which affected the biological organisms in the Trickling Filter. The cold air passing through the media reduced the biological activity resulting in higher BOD in the effluent.
FCPCC VOLATILE SOLIDS REDUCTION (x2)				
March 29, 2021	The FCPCC Volatile Solids Reduction was calculated in Water Traxx to be 28.7%, not meeting the minimum requirement of 38%.	FCPCC Chief Operator was informed VSR not meeting minimum requirement.		1 sample yielded results of less than 38% VSR. Samples were taken and analyzed over the next couple of days and all other results came back at over 38%. Likely a non-representative sample was collected.
April 19, 2021	The FCPCC Volatile Solids Reduction was calculated in Water Traxx to be 36.5%, not meeting the minimum requirement of 38%.	FCPCC Chief Operator was informed VSR not meeting minimum requirement.		Investigation with Chris Kerman and Lyndsey Parry occurred on April 29, 2021, and the following corrective actions were determined: 1. Inconsistent ATAD Out samples were causing unusual volatile solids results and in turn low VSR results. It was determined that the centrifuge must be running for at least 60 minutes prior to the ATAD Out sample being collected to obtain a representative sample. The corrective action will be documented on CPAR 01631. 2. Currently, the volatile solids of the ATAD Out is used to calculate the VSR. It is possible that the FCPCC biosolids may provide a more representative VSR value as it is the final product of the digestion process. This will be investigated, and the corrective action documented in CPAR 01632.

Appendix D – External Laboratory Test Results

FCPCC INFLUENT & EFFLUENT (ANNUAL) –September 14, 2021

Parameter	Unit	Influent	Effluent
AMMONIA NITROGEN	mg/L	37	35
pH	pH Units	7.66	7.94
ALKALINITY	mg/L	190	220
DISSOLVED CHLORIDE	mg/L	1,700	1,700
TOTAL KJELDAHL NITROGEN	mg/L	-	-
TOTAL NITROGEN	mg/L	49.6	41.7
OIL AND GREASE	mg/L	12	12
SULPHATE (D)	mg/L	220	250
SULPHIDE (T)	mg/L	0.10	0.038
CYANIDE (T)	mg/L	<0.0050	<0.0050
FLUORIDE (D)	mg/L	0.14	0.14
TOTAL PHENOLS	mg/L	0.034	0.0033
TOTAL ORGANIC CARBON	mg/L	33	22
PHOSPHOROUS (T)	µg/L	6.7	2.1

METALS

Parameter	Unit	Influent	Effluent
ALUMINUM (T)	µg/L	245	41
ARSENIC (T)	µg/L	0.77	0.72
BARIUM (D)	µg/L	12.1	78.7
BORON (D)	µg/L	500	550
CADMIUM (D)	µg/L	<0.50	<0.50
CHROMIUM (T)	µg/L	<5.0	<5.0
COBALT (D)	µg/L	<1.0	<1.0
COPPER (D)	µg/L	35.9	23
IRON (D)	µg/L	323	169
LEAD (T)	µg/L	1.9	<1.0
MANGANESE (D)	µg/L	57.6	110
MERCURY (T)	µg/L	<0.038	0.068
MOLYBDENUM (T)	µg/L	<5.0	<5.0
NICKEL (D)	µg/L	<5.0	<5.0
SELENIUM (T)	µg/L	0.50	<0.50
SILVER (T)	µg/L	0.32	<0.10
TIN (T)	µg/L	<25	<25
ZINC (T)	µg/L	131	<25

VOLATILE ORGANIC COMPOUNDS, PCBs, and PHTHALATES

Parameter	Unit	Influent	Effluent
BENZENE	µg/L	<0.40	<0.40
CHLOROFORM	µg/L	1.5	1.2
CHLOROMETHANE	µg/L	<1.0	<1.0
DICHLOROBROMOMETHANE	µg/L	<1.0	<1.0
DICHLOROMETHANE	µg/L	<1.0	<1.0
ETHYLBENZENE	µg/L	<0.40	<0.40
TETRACHLOROETHYLENE	µg/L	<0.50	<0.50
TOLUENE	µg/L	0.48	<0.40
1,1,1-TRICHLOROETHANE	µg/L	<0.50	<0.50
1,1,2-TRICHLOROETHANE	µg/L	<0.50	<0.50
TRICHLOROETHYLENE	µg/L	<0.50	<0.50
DI(2-ETHYLHEXYL)PHTHALATE	µg/L	<20	<2.0
DI-N-BUTYLPHTHALATE	µg/L	<20	<2.0
NAPHTHALENE	µg/L	<0.10	<0.10
PCB'S	µg/L	<0.56	<0.056

FCPCC Biosolids				
Parameter	Unit	12-Jan	13-Jul	Average
TOTAL SOLIDS	%	32.6	34.8	33.7
VOLATILE SOLIDS	%	69.9	75.0	72.5
MOISTURE	%	67	65	66
TOTAL KJELDAHL NITROGEN	% dry wt.	5.00	6.00	5.50
ARSENIC (T)	µg/g	2.06	2.62	2.34
CADMIUM (T)	µg/g	1.40	1.77	1.59
CHROMIUM (T)	µg/g	36.2	38.0	37.1
COBALT (T)	µg/g	1.95	2.98	2.47
COPPER (T)	µg/g	537	668	603
IRON (T)	µg/g	33,000	54,500	43,800
LEAD (T)	µg/g	13.6	12.6	13.1
MERCURY (T)	µg/g	0.861	0.783	0.822
MOLYBDENUM (T)	µg/g	6.82	5.70	6.26
NICKEL (T)	µg/g	13.6	13.1	13.4
PHOSPHOROUS (T)	µg/g	19,300	28,400	23,900
POTASSIUM (T)	µg/g	963	1,010	987
SELENIUM (T)	µg/g	2.74	3.31	3.03
ZINC (T)	µg/g	907	1,310	1,110

FCPCC Biosolids	
Parameter	Fecal Coliforms
Unit	MPN / g dry
12-Jan-21	<20
2-Mar-21	<20
18-May-21	<20
14-Jul-21	<20
10-Aug-21	<20
7-Oct-21	<20
9-Dec-21	<20
Average	<20

Note: Fecal coliform samples for FCPCC biosolids were taken from ATAD 6

Appendix E – Odour Complaint Reports

Odour Complaints

Date of Occurrence	Location	Incident Description	Extent of damage (if applicable)	Preventative Measures Identified	Conclusion for this Environmental Incident
Incident Type: FCPCC - Odour (x6)					
3/17/2021	FCPCC	Complainant went outside at 9:25 am, odor out of plant is disgusting, stronger than usual odor generated everyday.		Checked odor control systems, plant SCADA and trends & work activities at this time, everything normal except centrifuge bowl being loaded on truck.	Plant was noted to be running normally and on site staff believe odours that were noticed on and off site were coming from the top area of the TF. A number of temporary repairs to the housing around the TF have been done until this can be properly addressed in the plant upgrade. The need to possibly remove the TF work from the plant upgrade and do separately is being looked at due to the high priority of getting this work done.
4/16/2021	FCPCC	Voice mail from [REDACTED] Lee Rd [REDACTED]. After hours call. Call was experiencing odour.			It is believed that the odours detected in the area were due to the limited wind and also that the Chemical scrubber fan was out of service on this day due to maintenance that was being performed on the fan unit.
6/17/2021	FCPCC	Call from [REDACTED] Neden Way [REDACTED] Another fine night destroyed by shi* Heading inside.			As complaint came in after hours and plant was closed up and odour control system operating, it is difficult to determine the cause of the odour. The odour detected by the gate by staff was not able to be specifically identified other than a slightly stronger smell then normal around the plant. Low wind speeds is believed to have contributed.
6/17/2021	FCPCC	Call from [REDACTED] Lee Rd [REDACTED] Wind 20:30 3km/h SSE 21:00 2km/h SE 21:30 2 km/h ESE. Sitting out on the patio. Detected strong sewer smell.			As complaint came in after hours and plant was closed up and odour control system operating, it is difficult to determine the cause of the odour. The odour detected at the gate in the morning by staff was not able to be specifically identified other than a slightly stronger smell then normal around the plant. Low wind speeds is believed to have contributed.

Date of Occurrence	Location	Incident Description	Extent of damage (if applicable)	Preventative Measures Identified	Conclusion for this Environmental Incident
8/24/2021	FCPCC	Emailed odor complaint stating lives a few blocks from the plant and this summer there has been a strong odor much worse than usual almost every day.			As no specifics have been given, staff are unable to narrow down or identify the source of the odour that has been noted.
9/4/2021	FCPCC	Unpleasant odor, has hydrogen sulfide smell.		Checked all odor control equipment was functioning, all windows, doors, and hatches closed, no abnormal work activities occurring,	Staff investigating were unable to identify the odour that was reported. Treatment plant was operating normally with potential odour escape areas properly closed and mitigated.

Appendix F – Conditional Management Plan 2021 Annual Report

January 4, 2021

File: 2240-20-CMP

Elysha Gordon
Resource Management Biologist
Fisheries and Oceans Canada
3225 Stephenson Point Road
Nanaimo, BC, V9T 1K3
VIA EMAIL: Elysha.Gordon@dfo-mpo.gc.ca

Dear Ms. Gordon,

**Re: 2021 Annual Report
French Creek Pollution Control Centre – Conditional Management Plan**

The Regional District of Nanaimo (RDN) has a Conditional Management Plan (CMP) for two pump stations associated with the French Creek Pollution Control Centre (FCPCC) near Parksville, British Columbia:

- Hall Road Pump Station, 300 Hall Road
- Bay Avenue Pump Stations, 385 Bay Avenue.

The original CMP was established in 2012 and has since been renewed several times. The current agreement expires on January 31, 2022.

According to the agreement, the RDN shall report CMP activities annually. This letter summarizes CMP activities from January 1, 2021 to December 31, 2021. It also lists notable upgrades and activities at FCPCC and suggests proposed changes, if any, to future versions of the CMP.

CMP Activities

There were no trigger events from January 1, 2021 to December 31, 2021.

FCPCC Upgrades and Activities

Notable upgrades and activities at FCPCC in 2021 include:

- Completed detailed design of the FCPCC Expansion and Odour Control Upgrade Project.
- Began a value engineering review of the FCPCC Expansion and Odour Control Upgrade.
- Cleared the site for the future upgrade.
- Replaced sludge storage cell #3 tank.
- Replaced air lines in the trickling filter.
- Converted main influent screen from 10 mm to 6 mm openings.
- Replaced the windows and main outside door by the headworks.
- Replaced some expansion joints in the roof of the headworks/primary treatment area.
- Performed roof and roof drain repairs.
- Completed detailed design and began construction on the Bay Avenue Pump Station Upgrade Project.

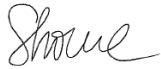
- Maintained a website of current capital projects related to wastewater, located at: <https://www.getinvolved.rdn.ca/rdn-wastewater>. Related projects include information the FCPCC Expansion and Odour Control Upgrade project and the Bay Avenue Pump Station Upgrade Project.

Proposed CMP Changes

The RDN is participating in the renewal of the CMP beyond 2022 and recommendations for changes to the CMP will be addressed in future revisions.

If you have any questions regarding this annual report, please do not hesitate to contact me at 250-390-6575 or snorum@rdn.bc.ca.

Sincerely,



Shelley Norum
Wastewater Program Coordinator
T: 250-390-6575 | Email: snroum@rdn.bc.ca

Appendix G – 2021 Biosolids Management Summary

Regional District of Nanaimo

2021 Biosolids Management Summary and Compliance Report

February 2022

Prepared for:

Regional District of Nanaimo
6300 Hammond Bay Road
Nanaimo, BC
V9T 6N2

Prepared by:

SYLVIS Environmental
427 Seventh Street
New Westminster, BC
Canada, V3M 3L2
Phone: 1.800.778.1377
Fax: 604.777.9791
www.SYLVIS.com

SYLVIS DOCUMENT #1510-22
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1 PROGRAM OVERVIEW

The Regional District of Nanaimo (RDN) operates two wastewater treatment plants that produce municipal biosolids:

1. French Creek Pollution Control Centre (FCPCC) - Class A biosolids
2. Greater Nanaimo Pollution Control Centre (GNPCC) - Class B biosolids

In 2021, RDN biosolids were managed at three sites in the Nanaimo area: private forest lands on Weigles Road ("TimberWest Properties") and off Nanaimo River Road ("Blackjack") both managed by Mosaic Forest Management, and at the Nanaimo Forest Products Harmac Mill (Harmac).

At the TimberWest Properties biosolids were used in a forest fertilization and reclamation program. RDN biosolids have been managed at this site since 2003. The objectives of biosolids forest fertilization were to increase soil quality and tree growth; and for reclamation to return application trails to productive forest and habitat.

In 2021, management of RDN biosolids by SYLVIS began at the new Blackjack site, which will be used for a long-term forest fertilization program. The new site, Blackjack, is on private forest lands managed by Mosaic Forest Management on Nanaimo River Road in Nanaimo, BC. Delivery of RDN biosolids began to Blackjack in December 2021. The objectives of biosolids forest fertilization at Blackjack are to increase soil quality and tree growth and in reclamation to return cut trails to productive forest.

RDN biosolids were also managed in soil fabrication projects at Harmac. Biosolids managed at Harmac were used to fabricate reclamation growing medium (RGM) for use in landfill closure and biosolids growing medium (BGM) for distribution. The Harmac site can also serve as a contingency site for management of RDN biosolids during periods of inclement weather when management at the TimberWest Properties or Blackjack sites is not possible.

A total of 7,571 wet tonnes (wt) of RDN biosolids were produced in 2021: 6,272 wt from the GNPCC and 1,299 wt from the FCPCC. Of the 7,571 wt produced, 5,060 wt (67% of annual production in 2021) were delivered to the TimberWest Properties, 317 wt (4%) were delivered to Blackjack, and 2,194 wt (29%) were delivered to Harmac (Table 3).

2 REGULATORY AUTHORIZATION

RDN biosolids were managed at the TimberWest Properties under the *2021 TimberWest Properties (Weigles Road) Forest Fertilization Land Application Plan* (SYLVIS Documents # 1339-20), Authorization #110596, valid February 7, 2021 to August 4, 2021) and *2021 TimberWest Properties (Weigles Road) Reclamation & Forest Fertilization Land Application Plan* (SYLVIS Document #1439-21, Authorization #110825, valid August 5, 2021 to August 4, 2022).

RDN biosolids were delivered to Blackjack starting in mid-December 2021, under site Authorization #110732, valid May 16, 2021 to May 15, 2022). A Land Application Plan will be finalized prior to commencement of applications at Blackjack.

Biosolids used to fabricate RGM at Harmac were managed under the *Nanaimo Forest Products – Harmac Mill Reclamation Growing Medium Land Application Plan* (SYLVIS Document # 1341-20, Authorization #110574). Class A biosolids used in production of BGM were managed according to regulatory requirements in the *Organic Matter Recycling Regulation* (OMRR) and do not require a land application plan (LAP).

3 REPORT OBJECTIVES

This report summarizes the RDN's biosolids management program. It also contains a Qualified Professional Certification of Compliance for the two 2021 biosolids LAPs for the TimberWest Properties as required under *Organic Matter Recycling Regulation* (OMRR) section 5 (3). A Qualified Professional Certification of Compliance will be issued after the term of the LAP for Blackjack for 2021 as applications have not begun as of the date of writing.

While a terse summary of management of RDN biosolids at Harmac is provided in this report, a detailed discussion of the regulatory details of the RGM LAP is not included here. A separate compliance report for this project (*Nanaimo Forest Products – Harmac Mill Residuals Growing Medium Land Application Plan 2021 (Authorization #110574) Qualified Professional Certification of Compliance*, SYLVIS Document #1483-22) has been provided to Harmac.

No certification of compliance is required for BGM production.

4 2021 BIOSOLIDS MANAGEMENT

This document contains information on the management of 2021 RDN biosolids including a summary of contractual requirements for the forest fertilization and reclamation programs (Table 1 and Table 2), a biosolids program management summary (Table 3, Figure 1, Figure 2, and Figure 3), a biosolids quality summary (Table 4), a summary of historical management (Table 5), a map of areas applied in 2021 at the TimberWest Properties (Figure 4), and photographs from the biosolids management projects (Photographs 1 to 3).

4.1 BIOSOLIDS MANAGEMENT SUMMARY

In 2021, the majority of RDN biosolids were managed at the TimberWest Properties on Weigles Road in Nanaimo, BC. All contractual tasks relating to biosolids quality monitoring, biosolids delivery coordination, biosolids beneficial use, site safety, environmental monitoring, public engagement, reporting, coordination with the Nanaimo Mountain Bike Club, and adherence to the conditions of site use under the RDN land-use agreement with TimberWest were completed for 2021 (Table 1).

RDN biosolids were first delivered to the new site, Blackjack, on Nanaimo River Road in mid-December 2021. Contractual tasks relating to biosolids quality monitoring, biosolids delivery coordination, site safety, environmental monitoring, and reporting were completed for 2021 (Table 2).

RDN biosolids delivered to Harmac were managed under contract by Harmac, with SYLVIS providing qualified professional oversight for production of reclamation growing medium (RGM) for use in landfill reclamation and biosolids growing medium (BGM) for distribution.

4.2 BIOSOLIDS PROGRAM TRANSPORTATION SUMMARY

In 2021, 5,060 wt of RDN biosolids (0 wt from FCPCC; 5,060 wt from GNPCC) were transported by DBL Disposal to the TimberWest Properties (Table 3). Monthly tonnage delivered to this site in 2021 is shown in Figure 1.

In 2021, 317 wt of RDN biosolids (0 wt from FCPCC; 317 wt from GNPCC) were transported by DBL Disposal to Blackjack (Table 3). Monthly tonnage delivered to this site in 2021 is shown in Figure 2.

In 2021, 2,194 wt of RDN biosolids (1,299 wt from FCPCC; 895 wt from GNPCC) were transported by DBL Disposal to Harmac (Table 3). Monthly tonnage delivered to this site in 2021 is shown in Figure 3.

Total RDN biosolids production in 2021 (7,571 wt) was above the five-year average annual production of 5,668 wt due to implementation of secondary treatment at the GNPCC (Table 5).

4.3 BIOSOLIDS STORAGE

Four storage areas exist at the TimberWest Properties and one large storage area exists at Blackjack, each consisting of an asphalt base with lock blocks delineating three sides of the stockpiles (Photograph 1 and 3). All five storage areas were utilized for biosolids stockpiling in 2021. Biosolids storage conformed to OMRR requirements for Vancouver Island where biosolids are required to be covered from October 1 to March 31 of every year.

Harmac does not cover the stored biosolids as biosolids are typically quickly incorporated into a fabricated soil medium (BGM or RGM). Details of RGM storage are discussed in the Harmac Compliance Report. BGM is not subject to regulatory storage requirements in the OMRR.

4.4 2021 PRE-APPLICATION MEASURES

At the TimberWest Properties, site inspections were carried out by a SYLVIS Qualified Professional or designate prior to biosolids fertilization. During site inspections, water features and other sensitive site features were identified, mapped, and appropriate setback distances were determined. Pre-application soil samples were collected in order to determine an appropriate agronomic rate of biosolids application. Groundwater depth was assessed using a soil auger or visually in road cuts and was confirmed to be in excess of 1 metre (m) prior to commencing biosolids applications.

No applications occurred at Blackjack in 2021; site inspections will be carried out by a SYLVIS Qualified Professional or designate prior to biosolids fertilization and reclamation in 2022.

At Harmac, a site inspection was carried out prior to initiating soil fabrication operations to confirm the suitability of the storage facility, mixing methodology, and soil storage area. Landfill areas to

be reclaimed using RGM were assessed prior to applications to ensure suitability for applications. Details of site inspections for the RGM project are detailed in the Harmac Compliance Report.

At Harmac, currently stockpiled BGM is primarily the product of Class A biosolids deliveries starting in October 2021, with a small amount of previously mixed and certified BGM remaining to be distributed.

4.5 BIOSOLIDS LAND APPLICATION

In 2021, 4,426 wt of RDN biosolids (0 wt from FCPCC; 4,426 wt from GNPCC) were applied as a fertilizer and soil amendment to the TimberWest Properties (Table 3, Figure 1). Biosolids were land-applied to 74 hectares (ha) of forested lands for forest fertilization and reclamation at the TimberWest Properties at application rates specific to the individual fertilization units based on their history of previous biosolids land applications. Across the site, the biosolids application rate was an average of 12.3 dt/ha which does not exceed the application rate specified in the LAP (20 dry tonnes per ha). At the end of 2021, 800 wt (0 wt from FCPCC; 800 wt from GNPCC) remained in storage facilities at the TimberWest Properties in preparation for fertilization in 2022 (Table 3).

Biosolids were land-applied using a side-discharge spreader equipped with a hydraulic fan which propels the biosolids up to 30 m into forest stands. All biosolids applications adhered to a 30-m setback distance from permanent water features and identified ephemeral water features. Biosolids land applications were completed every 2-4 weeks throughout 2021 except during periods of extreme weather (i.e., snowfall, heavy rainfall) or when the ground was snow-covered; land application operations were suspended during these times. For example, biosolids land applications did not occur in January and February of 2021 when periods of snowfall or snow cover occurred.

No applications occurred at Blackjack in 2021.

Biosolids incorporated into RGM were land-applied at the Harmac landfill as a topsoil cover during landfill closure operations. In 2021, 4,200 m³ RGM containing approximately 1,140 wt of biosolids were used in landfill closure (Table 3, Figure 3). Volumes of RGM produced and land-applied at Harmac are detailed in the Harmac Compliance Report.

BGM containing RDN Class A biosolids was distributed offsite.

4.6 BIOSOLIDS QUALITY

Biosolids quality was characterized throughout 2021 to ensure that it met quality requirements for trace element concentrations, foreign matter, and pathogen reduction set forth in the OMRR. A total of six composite samples, each composed of eight equal-volume subsamples, were collected by SYLVIS from the FCPCC and the GNPCC. The biosolids were analyzed for physical parameters, nutrients, and trace elements (Table 4). All RDN biosolids samples collected in 2021 met the respective OMRR Class A and B criteria for trace elements.

The OMRR requires that a set of seven discrete samples be collected for fecal coliform analysis for every 1,000 dry tonnes of biosolids or annually, whichever comes first.

In 2021, 427 dry tonnes (dt) of biosolids were produced by the FCPCC. For Class A biosolids each individual sample must meet the Class A criterion of 1,000 most probable number per gram (MPN/g). There was no scope for biosolids sampling at the FCPCC in the latter third of the year and therefore five fecal samples were collected in 2021. The fecal coliform density of the last seven samples collected by SYLVIS in 2020 and 2021 was <10 MPN/g in all samples (Table 4).

In 2021, 1,286 dt of biosolids were produced by the GNPCC, requiring two sets of fecal coliforms samples. For Class B biosolids the geometric mean of each set must meet the Class B criterion of 2,000,000 MPN/g. SYLVIS collected 14 samples, the geometric mean of the sampling sets was 33,600 MPN/g (Table 4).

Though it did not occur in 2021, deliveries of FCPCC and GNPCC biosolids could co-occur into the same storage areas at the TimberWest Properties and/or Blackjack sites in cases when Class A deliveries cannot occur to Harmac. Biosolids would be mixed prior to land application, and both would be managed as a Class B product.

4.7 SOIL MONITORING

Ongoing soil monitoring was carried out at the TimberWest Properties throughout 2021. Soil samples, each composed of 10 sub-samples from the top 0-15 cm at random varying distances from the roadside, were collected by SYLVIS. On average, soil trace element concentrations remain below 75% of applicable OMRR soil criteria for this site. Further details on soil sampling and nutrient concentrations can be found in the LAP.

RGM quality at Harmac is discussed in the Harmac Compliance Report.

4.8 REGULATORY COMPLIANCE

Biosolids management activities at the TimberWest Properties were carried out under Authorizations #110596 and #110825, and in accordance with the LAP applicable at the time of applications (SYLVIS Document #1339-20 and #1439-21). All regulatory requirements of the OMRR and specifications of the LAP were met including the requirements for rainy season storage, agronomic application rate, groundwater level during application, water feature buffers, biosolids quality, pre-application and predicted post-application soil concentration limits, and signage. A Declaration of Land Application Compliance of biosolids applications at the TimberWest Properties along Weigles Road is provided in Appendix Four.

Details of regulatory compliance of biosolids land applications as part of RGM at Harmac are detailed in the Harmac Compliance Report.

5 SUMMARY AND INTERPRETATION OF THE EFFECTS OF BIOSOLIDS DISCHARGES ON THE RECEIVING ENVIRONMENT

The objectives of biosolids forest fertilization at the TimberWest Properties are to increase soil quality and tree growth while remaining compliant with the OMRR. Biosolids fertilization has generally increased surface horizon organic matter content and available nutrients (e.g., phosphorus). These enriched soils store more carbon and enable accelerated tree growth, which has been documented at this site and other biosolids forest fertilization sites. Trace element

concentrations in the soil have increased as a result of additions from biosolids. It has been observed¹ at this site that deer browse of trees is increased in biosolids-fertilized areas, underlining a finding from many biosolids sites that increases in vegetation biomass can lead to increases in animal populations that consume or inhabit the vegetation. The objectives of reclamation activities at the TimberWest Properties were to return application trails to productive vegetation and establish wildlife habitat.

Biosolids forest fertilization at Blackjack has the same objectives as those at the TimberWest Properties. The Blackjack site will benefit from the addition of organic matter and available nutrients resulting in increased carbon storage and accelerated tree growth.

The fabrication of growing media (BGM and RGM) at Harmac produces a material that can be used for landfill closure (RGM) or in projects on and off site that require topsoil (BGM). These growing media provide a fertile substrate upon which vegetation can grow to achieve site objectives such as protection of underlying landfill layers or site restoration. Like other organic amendments, their use sequesters carbon in the soil and eliminates the need to import soil from other sites.

6 CONCLUSION

RDN biosolids were managed at the Weigles Road TimberWest Properties, Blackjack, and at Harmac in 2021. 5,060 wt (67% of annual production in 2021) were delivered to the TimberWest Properties, 317 wt (4%) were delivered to Blackjack, and 2,194 wt (29%) were delivered to Harmac.

All biosolids land application activities at the TimberWest Properties occurred as specified in the current LAP and according to management requirements under the OMRR. Soil quality data remain below 75% of applicable OMRR soil criteria for this site.

The TimberWest Properties have accepted over 51,000 wt of biosolids since 2007 (Table 5). SYLVIS looks forward to continuing this productive relationship and providing biosolids management services and support to the RDN throughout 2022 and beyond at the new site, Blackjack.

¹ Danjou, B. 2014. Effect of Biosolid on Vegetation Development Within Two Douglas-fir Plantations: Third Year Progress Report - DRAFT. Vancouver Island University, Nanaimo, B.C.

APPENDIX ONE – TABLES

Table 1: Summary of SYLVIS 2021 deliverables as outlined in the RDN-SYLVIS 2017-2021 and 2021-2022 extension contracts for biosolids management at the TimberWest Properties.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality was monitored throughout 2021 through the collection of six full suite samples and 14 fecal coliform samples. Increased sampling occurred in 2021 compared to previous years at GNPCC due to implementation of secondary treatment leading to increased production.
Biosolids Quantity	5,060 tonnes of RDN biosolids were transported to the TimberWest Properties by DBL Disposal in 2021. 4,426 tonnes of biosolids were land-applied in 2021. 800 tonnes remained stored at the TimberWest Properties at the end of 2021.
Biosolids Transportation and Delivery Coordination	SYLVIS coordinated biosolids deliveries to the TimberWest Properties with DBL Disposal throughout 2021.
Access Maintenance	SYLVIS conducted road maintenance and snow removal on internal roads at the TimberWest Properties in 2021.
Contingency	2,194 tonnes of RDN biosolids were sent to the Harmac contingency site in 2021, in part for contingency during snowy road conditions and in part to fulfill RDN's contract with Harmac.
Storage of Biosolids	Biosolids were stored in four storage facilities at the TimberWest Properties and covered with tarps from October 1 to March 31 as per OMRR requirements.
Invoicing	Biosolids were invoiced on a monthly basis.
Environmental Incidents	No environmental incidents occurred in 2021.
Site Safety	No safety incidents occurred at the TimberWest Properties in 2021. SYLVIS maintained COR and BC Forest SAFE safety accreditations in 2021.
Public and Media Relations	No open houses were held in 2021 due to COVID-19.
Complaints Management	There were no complaints received about the biosolids forest fertilization program at the TimberWest Properties in 2021.
Annual Reporting	This summary report fulfills the regulatory requirement for written certification under OMRR Section 5(3).
Storage Facility Management	SYLVIS managed storage facilities throughout 2021. Containment walls at the storage facilities were enhanced in 2021.
Application Planning	SYLVIS mapped, planned, and notified all fertilized areas in 2021.
Nanaimo Mountain Bike Club Land Use Coordination	An application map for use by site recreational users was produced in 2021.

Table 1 (continued): Summary of SYLVIS 2021 deliverables as outlined in the RDN-SYLVIS 2017-2021 and 2021-2022 extension contracts for biosolids management at the TimberWest Properties.

Task or Activity	Description
Biosolids Beneficial Use	Biosolids were managed under the 2021 Land Application Plans applicable at the time of applications (SYLVIS Document #1339-20 and #1439-21) and ENV Authorizations #110596 and #110825. 4,426 tonnes of biosolids were land-applied to 74 ha of forest under this authorization in 2021.
Record-Keeping	SYLVIS kept detailed records of all fertilization activities and environmental monitoring in 2021.
Environmental Monitoring	Soil sampling to measure pre- and post- application nutrient and trace elements concentrations was completed in 2021. Scope for water sampling was removed in consultation with the RDN due to the transition to a new long-term management site (Blackjack).
TimberWest Rules	SYLVIS maintained its BC Forest SAFE accreditation in 2021.
Construction	No works were constructed by SYLVIS at the TimberWest Properties in 2021.
Fires	SYLVIS followed a fire prevention protocol throughout 2021.
Hazardous Substance	No hazardous substances were introduced by SYLVIS to the TimberWest Properties in 2021.
Condition of TimberWest Lands	SYLVIS maintained the condition of the TimberWest Properties in 2021.
Equipment Storage	Except for temporary storage of heavy equipment during fertilization activities, SYLVIS did not store any equipment at the TimberWest Properties in 2021.

Table 2: Summary of SYLVIS 2021 deliverables as outlined in the Mosaic-SYLVIS 2021-2026 Agreement for biosolids management at Blackjack.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality was monitored throughout 2021 through the collection of six full suite samples and 14 fecal coliform samples. Increased sampling occurred at GNPCC due to increased production.
Biosolids Quantity	317 tonnes of RDN biosolids were transported to the Blackjack site by DBL Disposal in 2021. 0 tonnes of biosolids were land-applied in 2021. 317 tonnes remained stored at the Blackjack site at the end of 2021.
Biosolids Transportation and Delivery Coordination	SYLVIS provided biosolids deliveries to the Blackjack site through DBL Disposal in December 2021.
Contingency	A Contingency Plan was written for the 2021-2026 biosolids management contract and the following contingency sites were developed for use in 2021: TimberWest Properties, Harmac, Hamm Road, 155-A Pit, Haslam Pit and Old Nanaimo River Camp. No deliveries were required to contingency sites in 2021.
Invoicing	Biosolids deliveries were invoiced on a monthly basis.
Environmental Incidents	No environmental incidents occurred in 2021.
Site Safety	No safety incidents occurred at the Blackjack site in 2021. SYLVIS maintained COR and BC Forest SAFE safety accreditations in 2021.
Odour Management Plan	An Odour Management Plan was written and followed in 2021.
Communications Plan	A Communications Plan was written and followed in 2021.
Public and Media Relations	No open houses were held in 2021 as the site was not active.
Complaints Management	There were no complaints received about the biosolids forest fertilization program at the Blackjack site in 2021.
Annual Reporting	This summary report fulfills the regulatory requirement for written certification under OMRR Section 5(3).
Biosolids Beneficial Use	No applications occurred at the Blackjack site in 2021.
Record-Keeping	SYLVIS kept detailed records of all stockpile related activities and environmental monitoring in 2021.
Environmental Monitoring	Soil sampling to measure pre-application nutrient and trace elements concentrations was completed in 2021.

Table 3: Regional District of Nanaimo biosolids management summary - 2021.

Site	TimberWest Properties			Blackjack			Harmac BGM ^a		Harmac RGM ^b			Total
WWTP	GNPCC	FCPCC	Subtotal	GNPCC	FCPCC	Subtotal	FCPCC	Subtotal	GNPCC	FCPCC	Subtotal	
Class	B	A		B	A		A		B	A		
Carry-over from 2020	166	0	166	0	0	0	1,007	1,007	1,189	369	1,558	
Delivered	5,060	0	5,060	317	0	317	1,299	1,299	895	0	895	7,571
Applied or removed from site	4,426	0	4,426	0	0	0	998	998	771	369	1,140	6,564
Carry-over to 2022	800	0	800	317	0	317	1,308	1,308 ^c	1,312	0	1,313 ^d	3,421

Note: All values in units of wet tonnes.

a FCPCC biosolids are used at the Nanaimo Forest Products Harmac Mill as a feedstock in the production of a biosolids growing medium (BGM). No GNPCC biosolids were used to produce BGM.

b GNPCC biosolids are used at the Nanaimo Forest Products Harmac Mill as a feedstock in the production of a reclamation growing medium (RGM) used for landfill closure.

c FCPCC Class A biosolids as a component of BGM remained stored at the Harmac site at the end of 2021.

d GNPCC Class B biosolids as a component of RGM remained stored at the Harmac site at the end of 2021. This value represents biosolids which have been incorporated into the RGM but which have not yet been land-applied.

Table 4: Regional District of Nanaimo biosolids quality summary - 2021.

Parameter	FCPCC	GNPCC	Regulatory Criteria		Units
	Class A	Class B	Class A ^b	Class B ^c	
# of samples	2	4	-	-	
Available Nutrients, Physical Properties, Acidity					
Total Nitrogen - TKN	49,700	54,675	-	-	µg/g
Ammonia + Ammonium- N (available)	3,020	5,998	-	-	µg/g
Nitrate - N	2	2	-	-	µg/g
Phosphorus (available)	230	1,425	-	-	µg/g
Potassium (available)	689	872	-	-	µg/g
Organic Matter	65.1	65.6	-	-	%
Total Solids	32.9	20.5	-	-	%
pH	7.1	7.0	-	-	pH
Electrical Conductivity	6.9	4.6	-	-	dS/m
Trace Elements					
Arsenic	2.6	2.8	75	75	µg/g
Cadmium	1.3	1.3	20	20	µg/g
Chromium	35	31	-	1,060	µg/g
Cobalt	2.0	3.2	150	150	µg/g
Copper	565	518	-	2,200	µg/g
Lead	12	21	500	500	µg/g
Mercury	0.64	0.60	5	15	µg/g
Molybdenum	5.0	8.0	20	20	µg/g
Nickel	11	13	180	180	µg/g
Selenium	3.3	5.0	14	14	µg/g
Zinc	985	928	1,850	1,850	µg/g
Microbiological Analysis - Fecal Coliforms					
Fecal Coliforms	10 ^d	33,600 ^e	1,000	2,000,000	MPN/g

Note: All analyses based on dry weight.

- a Weighted average is based on GNPCC production of 83% and FCPCC production of 17% of total 2021 biosolids production.
- b Class A trace element criteria specified in Trade Memorandum T-4-93, Standards for Metals in Fertilizers and Supplements as of August 2017, and microbiological criteria specified in Schedule 3 of the BC *Organic Matter Recycling Regulation*.
- c Class B trace element criteria specified in Schedule 4 and microbiological criteria in Schedule 3 of the BC *Organic Matter Recycling Regulation*.
- d Value is the maximum of seven samples collected by SYLVIS.
- e Value is the geometric mean of 14 samples collected by SYLVIS.

Table 5: Historical management of Regional District of Nanaimo biosolids at the TimberWest Properties, Harmac Landfill, and Blackjack from 2007 to 2021.

Year	TimberWest Properties	Harmac	Blackjack	Total Production
2007	1,150 wt	-	-	1,150 wt
2008	3,350 wt	-	-	3,350 wt
2009	3,000 wt	-	-	3,000 wt
2010	1,560 wt	-	-	1,560 wt
2011	1,350 wt	-	-	1,350 wt
2012	1,280 wt	-	-	1,280 wt
2013	3,930 wt	-	-	3,930 wt
2014	4,812 wt	-	-	4,812 wt
2015	4,383 wt	-	-	4,383 wt
2016	4,263 wt	-	-	4,263 wt
2017	3,662 wt	797 wt	-	4,459 wt
2018	4,802 wt	164 wt	-	4,966 wt
2019	4,871 wt	719 wt	-	5,590 wt
2020	3,773 wt	1,850 wt	-	5,623 wt
2021	5,060 wt	2,194 wt	317 wt	7,571 wt
Total	51,246 wt	5,724 wt	317 wt	57,287 wt

APPENDIX TWO – FIGURES

Figure 1: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) dewatered biosolids delivered and applied at the TimberWest Properties by month in 2021.

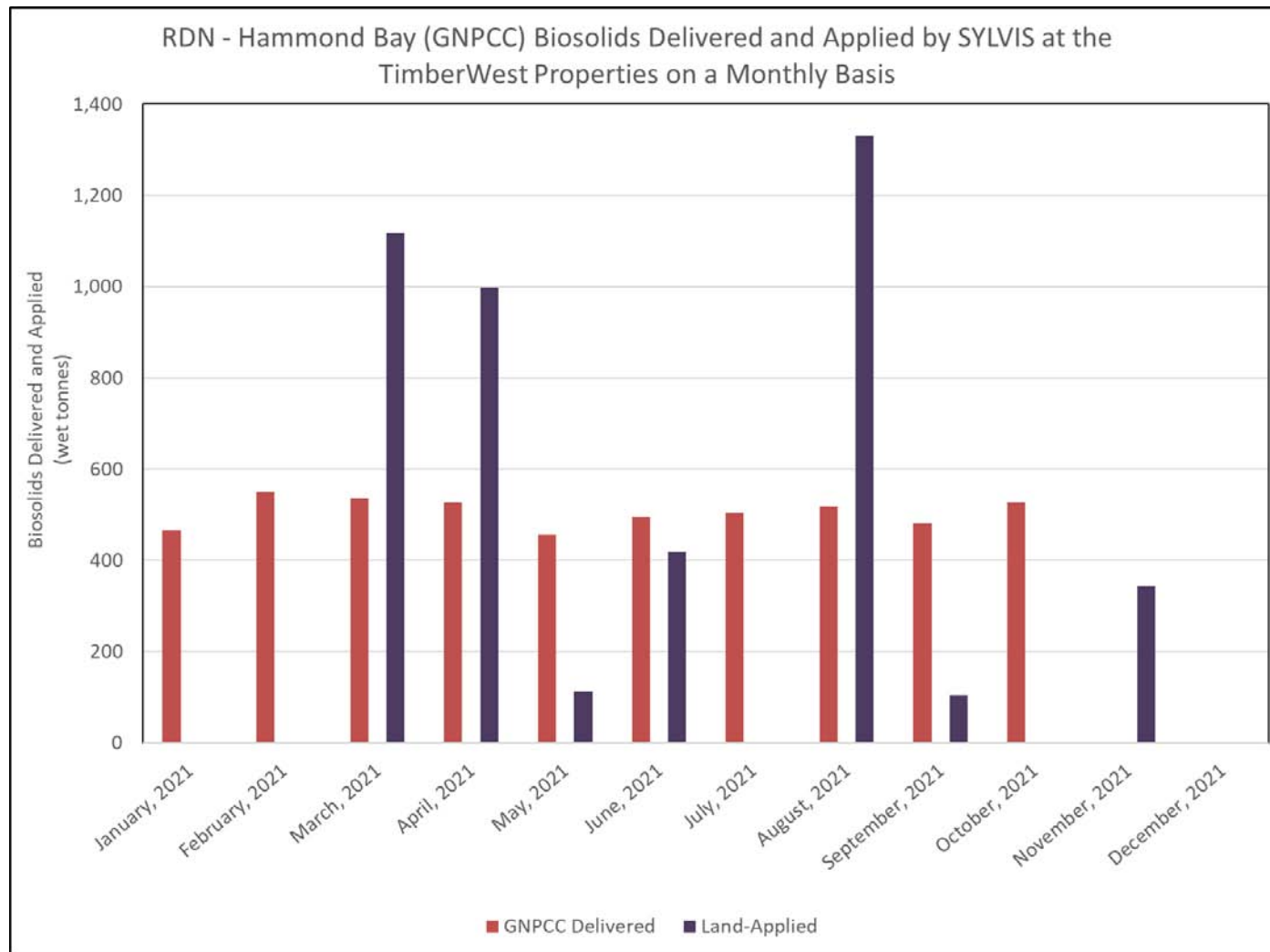


Figure 2: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) dewatered biosolids delivered to Blackjack by month in 2021.

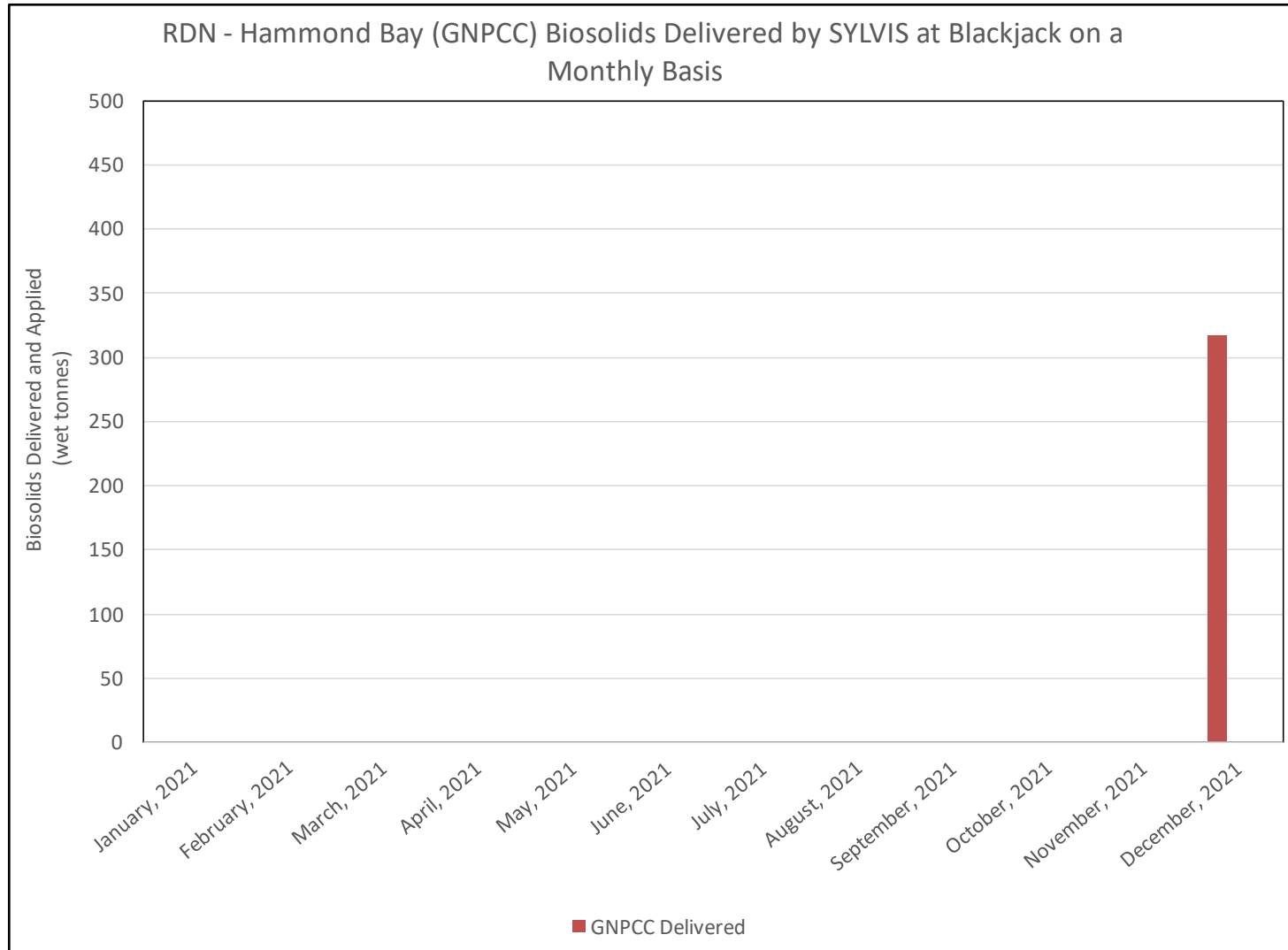


Figure 3: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) and French Creek Pollution Control Centre (FCPCC) dewatered biosolids delivered to Harmac by month in 2021.

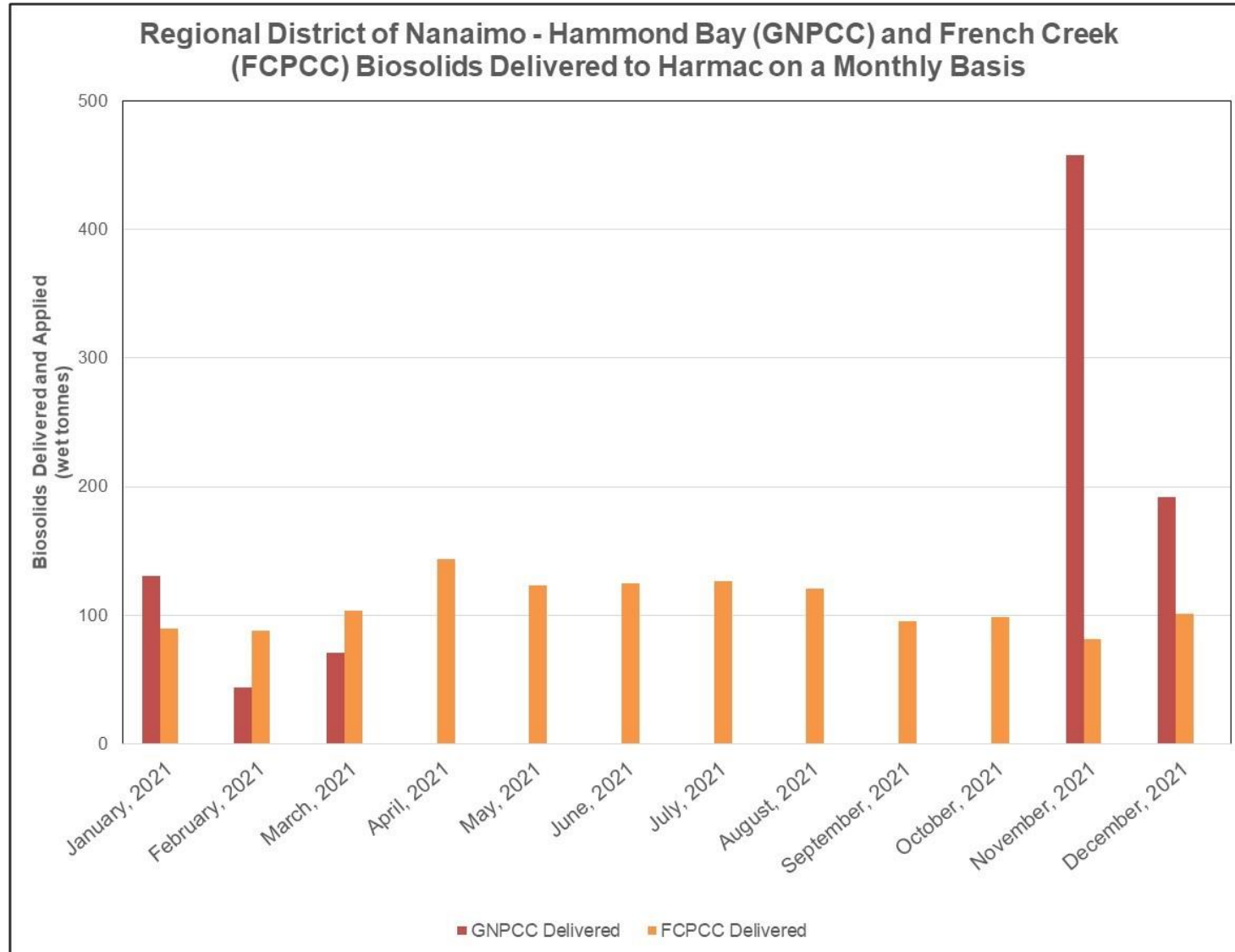
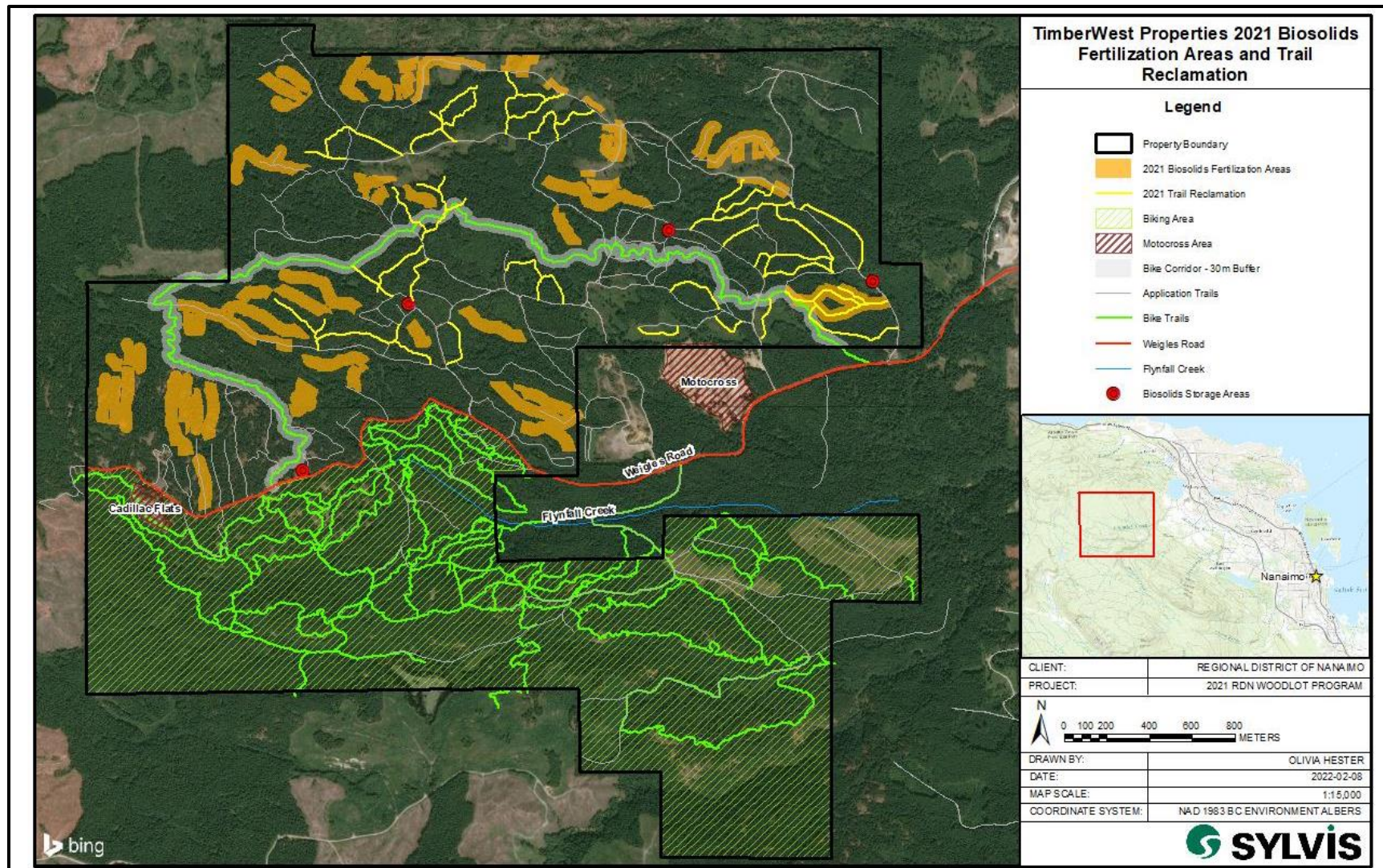


Figure 4: TimberWest Properties application areas fertilized with Regional District of Nanaimo biosolids in 2021.



APPENDIX THREE – PHOTOGRAPHS



Photograph 1: RDN biosolids are stockpiled in storage areas at the TimberWest Properties.
(September 2021)



Photograph 2: Trail reclamation using biosolids at the TimberWest Properties.
(November 2021)



Photograph 3: Stockpile at Blackjack constructed using concrete lock blocks.
(November 2021)

APPENDIX FOUR – DECLARATION OF LAND APPLICATION COMPLIANCE

DECLARATION OF LAND APPLICATION COMPLIANCE AT THE TIMBERWEST PROPERTIES

I, Christian Evans, PAg, confirm by signature and seal below that, to the best of my knowledge, biosolids were land applied at the TimberWest properties according to the information contained in the *2021 TimberWest Properties Forest Fertilization Land Application Plan*, (SYLVIS Documents #1339-20, Authorization #110596) and *2021 TimberWest Properties Reclamation and Forest Fertilization Land Application Plan*, (SYLVIS Document #1439-21, Authorization #110825). These applications are considered a beneficial use of the resource and to the best of my knowledge were completed in accordance with the *Organic Matter Recycling Regulation*.

This certification is valid only if it bears the original signature and seal of the author.

Signature:

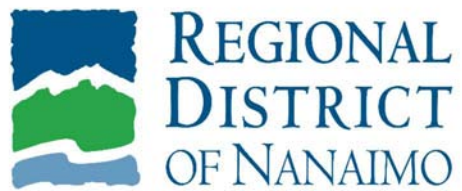




Date:

February 16th, 2022

Professional Seal





 250-390-6560 | 250-954-3792 | 1-877-607-4111  rcu@rdn.bc.ca

www.rdn.bc.ca