REGIONAL DISTRICT OF NANAIMO

2022 Annual Report

Greater Nanaimo Pollution Control Centre

February 2023

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/

www.rdn.bc.ca

Executive Summary

The Regional District of Nanaimo (RDN) owns and operates the Greater Nanaimo Pollution Control Centre (GNPCC), located at 4600 Hammond Bay Road in Nanaimo. GNPCC provides secondary treatment using Modified Ludzack-Ettinger (MLE) activated sludge process. In 2017, construction began on the Secondary Treatment Upgrade Project. Construction achieved substantial completion in September 2020. Treated effluent from GNPCC is discharged to the Strait of Georgia.

Operation of GNPCC is regulated by Environmental Management Permit No. PE00338, most recently amended by the BC Ministry of Environment and Climate Change Strategy in 2020. The authorized treatment works include a screening facility; grit and skimmings removal systems; primary sedimentation tanks; secondary treatment bioreactors; secondary clarifiers; sludge digestion systems; sludge dewatering facility; reuse of digester gas for fueling boilers; a cogeneration system which produces electricity for treatment operations and sells excess electricity back to BC Hydro; an outfall extending 2 km out from mean low water to a maximum depth of 70 m below mean low water; a diffuser; and related appurtenances.

This report was written by RDN staff as a permit requirement and summarizes and interprets the GNPCC monitoring data for 2022. The summary of 2022 monitoring data at GNPCC is as follows:

Summary of Compliance	Permit	2022	Permit Exceedances
Maximum Daily Flow	80,870 m^3/day	104,451 m^3/day	4
Average Daily Flow	40,950 m^3/day	32,290 m^3/day	0
Average Daily $cBOD_5$	130 mg/L	7.69 mg/L	0
Average Daily TSS	130 mg/L	9.28 mg/L	0

- **Flow –** The total flow discharged from GNPCC in 2022 was 11,785,797 m^3, at an average daily flow of 32,290 m^3/day. GNPCC had four maximum daily flow non-compliances.
- **5-day Carbonaceous Biochemical Oxygen Demand** – The influent and effluent average 5-day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$) concentration for 2022 was 283 mg/L and 7.69 mg/L, respectively. The average removal efficiency in 2022 was 97.1%. There were no $cBOD_5$ non-compliances in 2022.
- **Total Suspended Solids** – The influent and effluent average Total Suspended Solids (TSS) concentration in 2022 was 579 mg/L and 9.28 mg/L, respectively. The average TSS removal efficiency in 2022 was approximately 98.0 %. There was no TSS non-compliances in 2022.
- **General parameters, metals, volatile and semi-volatile compounds** – 2022 results were all consistent with historical data. Several parameters showed reductions after commissioning of the secondary process.
- **Biosolids** – The biosolids generated by the GNPCC in 2022 met the standards for Class B biosolids given in Schedules 3 and 4 of the Organic Matter Recycling Regulation. Biosolids are currently being land applied in a Forest Fertilization Program and used in a Soil Fabrication Program used in landfill closure.

Table of Contents

1) Introduction

The Regional District of Nanaimo (RDN) owns and operates the Greater Nanaimo Pollution Control Centre (GNPCC) located at 4600 Hammond Bay Road in Nanaimo. Treated effluent from GNPCC is discharged to the Salish Sea. Operation of the treatment plant is regulated by the Ministry of Environment and Climate Change Strategy (ENV) under Environmental Management Permit No. PE00338 ("the Permit"), issued on April 15, 1970 and most recently amended on December 11, 2020 (see Appendix A).

The authorized treatment works include a screenings facility, grit and scum removal systems, primary sedimentation tanks, secondary treatment bioreactors, secondary clarifiers, sludge thickening systems, sludge digestion systems, sludge dewatering facility, and outfall extending 2,030 m from mean low water to a minimum depth of 70 m, diffusers, and related appurtenances.

Since 2009, GNPCC has been operating with Chemically Enhanced Primary Treatment (CEPT). In 2009, two gravity thickeners were added to the treatment process. In September 2012, the cogeneration system came online and began producing electricity. The electricity generated by cogeneration is sold to BC Hydro. A third digester and fourth sedimentation tank were added in 2013. In 2016, the RDN commissioned the replacement of the marine and land sections of the outfall from GNPCC.

In 2017, construction began on the Secondary Treatment Upgrade Project. Construction achieved substantial completion in 2020. In October 2020, the secondary treatment process commenced operation.

This report was written by RDN staff as a requirement of the Environmental Management Permit No. PE00338 and summarizes and interprets GNPCC monitoring data for 2022.

1.1 Environmental Management System

The RDN's Wastewater Services department's Environmental Management System is ISO 14001:2015 certified. ISO 14001 is an international Environmental Management System 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 GNPCC is located at 4600 Hammond Bay Road on the corner of McGuffie Road. Walley Creek runs in front of the treatment facility parallel to Hammond Bay Road.

The surrounding neighbourhood is predominately a single and multifamily residential area. There are approximately 1,000 residential properties within a 1 km radius of the treatment facility. Ecole Hammond Bay School is also nearby. Neck Point Park borders the property to the northeast. There were no significant changes to the layout of the neighbourhood in 2022.

3) Permit Requirements

3.1 Minor Permit Amendment

On September 12, 2019, the Permit was amended to include a screenings facility, secondary treatment bioreactors and secondary clarifiers among the authorized treatment works. On December 11, 2020, the Permit was amended to capture the commissioning of secondary treatment at GNPCC.

3.2 Authorized Discharges

Section 1.1.1 of the Permit states the following daily effluent discharge limits:

- 40,950 m^3/day for average annual flow
- 80,870 m^3/day for maximum daily flow.

Section 1.1.2 of the Permit states that the characteristics of the discharge shall not exceed:

- 5-Day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$): 130 mg/L
- Total Suspended Solids (TSS): 130 mg/L.

3.3 Monitoring Requirements

The Permit monitoring requirements are summarized in Table 1. Quarterly reports were submitted to the BC Ministry of the Environment and Climate Change Strategy (ENV) in 2022, reporting all required test results.

Table 1. Monitoring Requirements by Permit Subsection Number

3.1.1 Flow Measurement A flow-measuring device must be provided and maintained to record, once per day, the effluent volume discharged over the preceding 24-hour period.
3.1.2 Sampling and Analysis Suitable sampling facilities must be installed and maintained to obtain composite samples and analyses of the effluent.
3.2 Biosolids Monitoring A sample of the treated biosolids must be obtained once every quarter for chemical analysis.
3.3 Monitoring of the Receiving Environment The receiving environment in the vicinity of the treatment plant outfall shall be monitored, and the monitoring program is subject to approval by the Regional Waste Manager.

3.4.1 Sampling and Analytical Procedures

Sampling and flow measurement shall be carried out in accordance with the procedures described in the *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air Emission, Water, Wastewater, Sediment and Biological Samples (2013 Edition)*, or by suitable alternative procedures authorized by the Regional Waste Manager.

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

3.4.2 Toxicity

Toxicity analyses for effluent are conducted by an external laboratory.

Additional methodologies used for the analyses are described in the "*Standard Methods for the Examination of Water and Wastewater*," 23rd Edition, American Public Health Association, 2017.

An automatic sampler was used to withdraw effluent samples on a flow-proportioned basis over a 24-hour period. The effluent composite sampler was functional over the entire period.

3.4 Operational Certificate

The RDN has been in regular discussions with BC Ministry of the Environment and Climate Change Strategy (ENV) about establishing an Operational Certificate at GNPCC for the secondary treatment plant. A draft Operational Certificate has been provided to ENV for review.

3.5 Receiving Environment Monitoring

In 2022, the Receiving Environment Monitoring program was under review and did not include a field program.

3.6 Outfall Inspection

The Permit requires that the outfall for GNPCC be inspected every 5 years. The marine outfall for GNPCC was replaced in 2016. In 2017, the outfall was inspected by Remote Operated Vehicle (ROV) a year following construction by SeaVeyors Environmental and Marine Services and was found to be in good condition.

The outfall was inspected by GreatPacific Consulting Ltd. in November 2022 and found to be in good condition.

4) Flow Monitoring

Flow was measured in 2022 by a Parshall Flume. Flow measurements are totalized by GNPCC's SCADA system.

4.1 2022 Flows

Daily flow monitoring data for GNPCC in 2022 is presented in Appendix B. The total flow discharged from GNPCC in 2022 was 11,785,797 m^3, at an average daily flow of 32,290 m^3/day. Higher daily flows recorded in January and December were associated with seasonal patterns of rainfall.

The Average Dry Weather Flow (ADWF) for 2022 was determined to be 27,271 m^3/day based on average daily flow during August, the month with lowest total precipitation. The precipitation data from 2022 was obtained from the Nanaimo City Yard weather station (see Environment Canada).

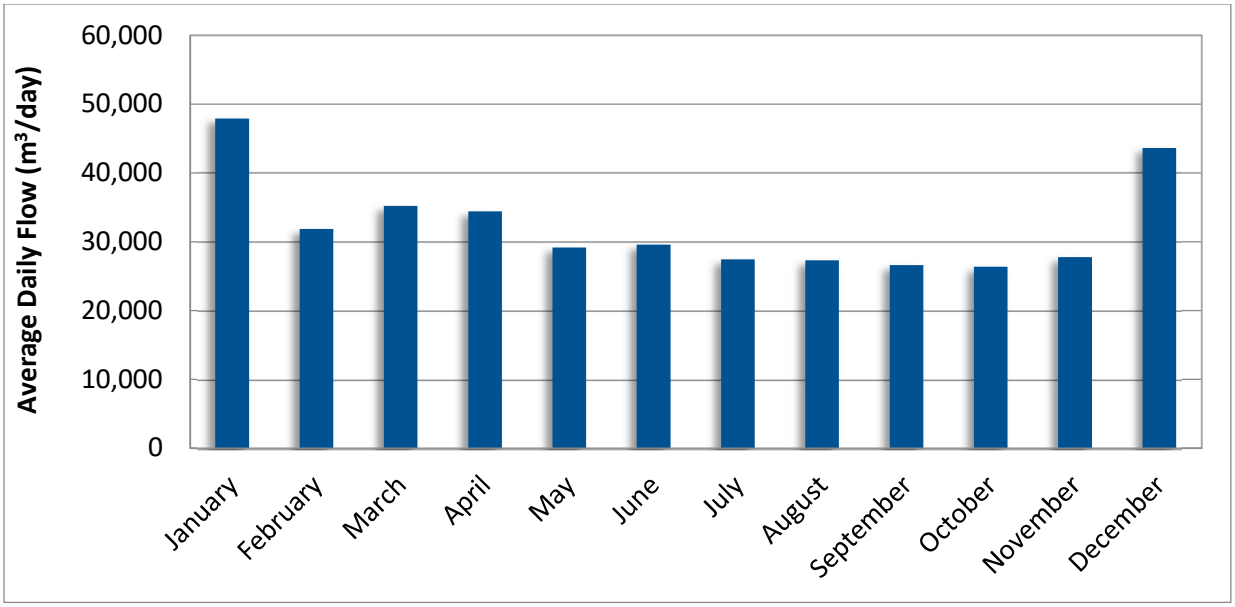
GNPCC had four maximum daily flow non-conformances in 2022 which both occurred during high precipitation events. These non-conformances are believed to be attributed to inflow and infiltration (I&I) entering the sanitary collection system. As part of the LWMP process, the RDN is working collaboratively with the City of Nanaimo to reduce I&I in the sanitary sewer collection system.

Appendix C contains more information on the flow non-conformance. Results are summarized in Table 2 and graphed in Figure 1.

Table 2. 2022 Summary of Flows from GNPCC

2022	Average Daily Flow (m^3/day)	Total Flow (m^3)	Maximum Flow (m^3/day)	Minimum Flow (m^3/day)	Non-Compliances (Max daily flow)	Total Monthly Precipitation (mm)
January	47,911	1,485,248	95,867	31,518	2	185.0
February	31,846	891,701	45,452	28,539	0	71.0
March	35,171	1,090,299	43,421	31,270	0	85.9
April	34,400	1,031,985	48,776	21,674	0	128.6
May	29,160	903,952	38,149	21,522	0	84.2
June	29,589	887,674	34,396	27,107	0	69.8
July	27,448	850,902	31,093	25,774	0	41.8
August	27,271	845,395	28,566	25,941	0	1.4
September	26,607	798,199	28,402	25,085	0	10.8
October	26,342	816,607	30,216	22,869	0	42.2
November	27,749	832,476	35,283	26,179	0	86.4
December	43,592	1,351,359	104,451	27,846	2	176.4
Average	**32,290**					
Total		**11,785,797**			**4**	**983.5**
Maximum			**104,451**			
Minimum				**21,522**		

Figure 1. 2022 Average Daily Flow Per Month



4.1.1 Historical Trends

Flow data reported over the past ten years are summarised in Table 3 and graphed in Figures 2 and 3.

Note, flow measurement techniques have varied over the years:

- Readings prior to December 2014 were measured using by a Parshall Flume.
- Flow was measured from December 2014 to January 2018 by an ISCO LaserFlow meter on an interim basis after the old Parshall Flume was removed from service during the secondary treatment upgrade. It is believed that the LaserFlow meter was reading high in terms of average daily flows.
- Flows after January 2018 were measured using a new Parshall Flume.

Table 3. Historical Trends: GNPCC Flows

Year	Average Daily Flow (m^3/day)	Total Flow (m^3)	Maximum Flow (m^3/day)	Non-Conformances (Max daily flow)
2013	28,381	10,328,600	79,200	0
2014	31,753	11,589,771	88,300	1
2015	34,991	12,736,880	105,400	2
2016	41,151	15,061,083	96,700	6
2017	42,535	15,525,250	133,200	3
2018	29,945	10,930,000	91,100	2
2019	28,189	10,289,016	102,400	1
2020	29,426	10,769,976	92,213	2
2021	32,112	11,720,796	90,730	2
2022	32,290	11,785,797	104,451	4

Figure 2. Historical Flows from GNPCC

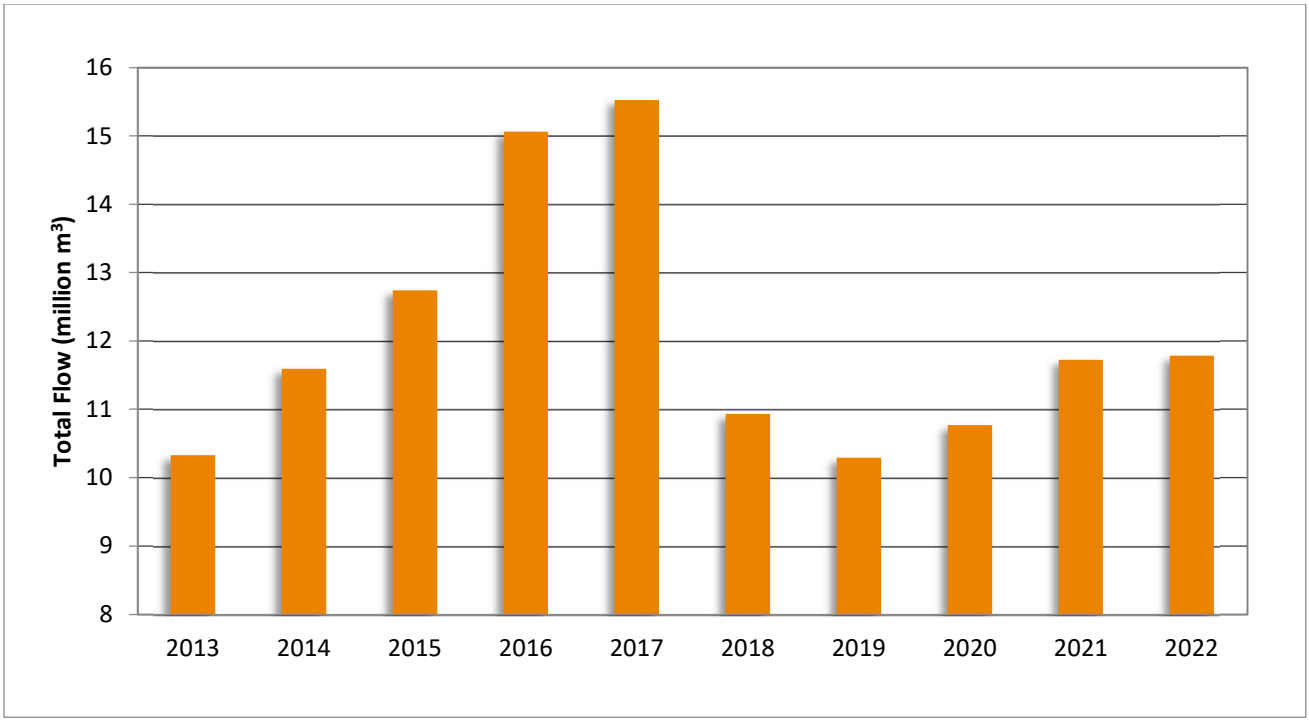
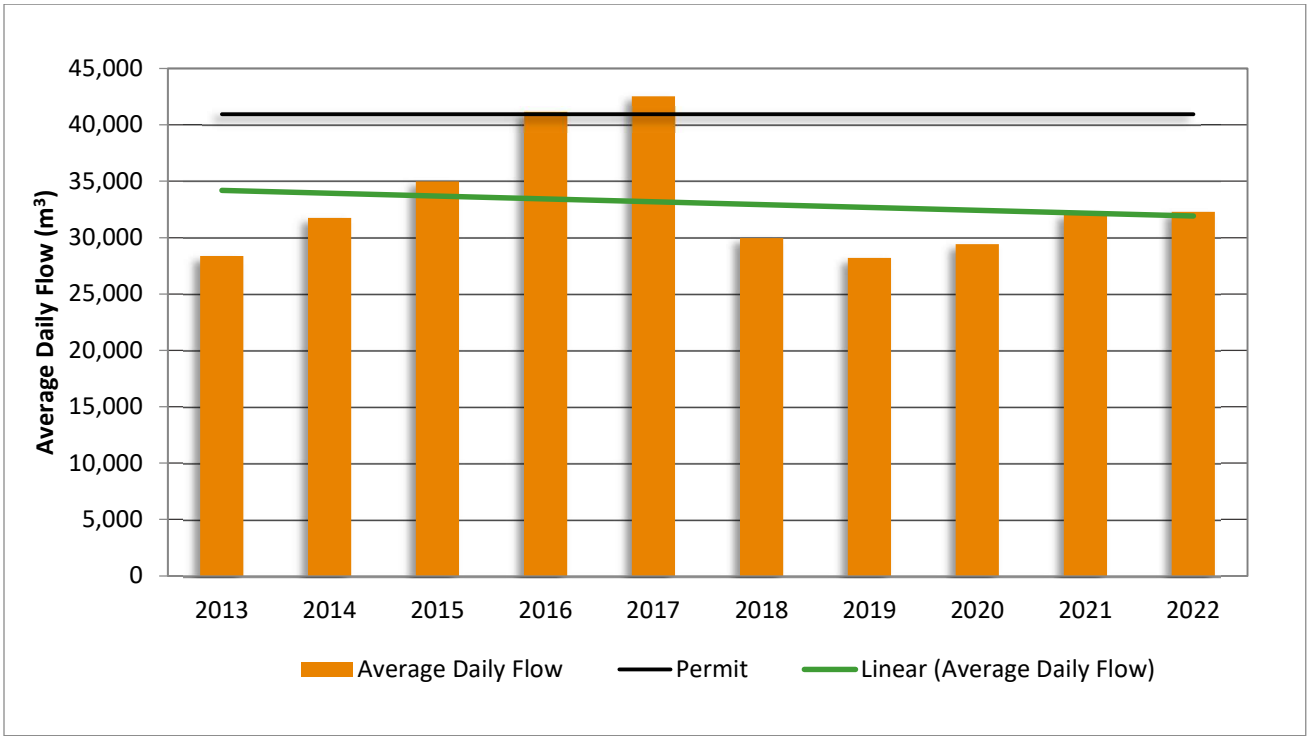


Figure 3. Historical Trends: Average Daily Flow by Year



4.2 Secondary Bypass Flows

Bypasses of the secondary treatment system were recorded on January 12, December 26, and December 27. Secondary bypass flows would have received primary treatment but not secondary treatment. The total secondary bypass flow in 2022 was 6,738 m^3. Secondary bypass flows and dates are tabulated in Appendix B.

5) Effluent Monitoring

5.1 5-Day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)

Five-day carbonaceous biochemical oxygen demand ($cBOD_5$) 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 $cBOD_5$ means less oxygen is available to support aquatic life. Thus, high $cBOD_5$ levels result in the contamination of the receiving environment.

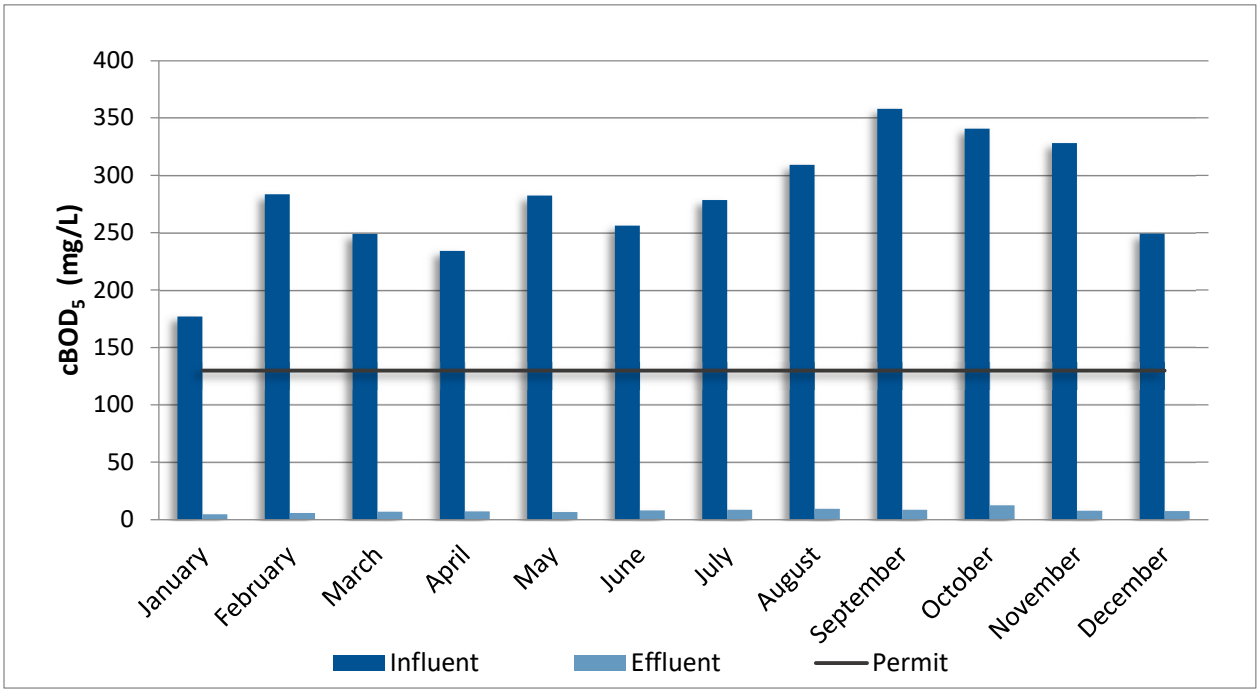
The Permit requires $cBOD_5$ testing of the effluent once per day and establishes the maximum permitted concentration at 130 mg/L (Appendix A). The average influent and effluent $cBOD_5$ concentration for 2022 was 283 mg/L and 7.69 mg/L, respectively. The average $cBOD_5$ removal efficiency was 97.1%. Appendix B contains the daily $cBOD_5$ test results. There were no $cBOD_5$ permit non-compliances in 2022.

Monthly averages are summarized Table 4 and graphed in Figure 4.

Table 4. 2022 Influent & Effluent $cBOD_5$ Concentrations

2022	Average $cBOD_5$ (mg/L)		Average % Reduction in $cBOD_5$	Non-Compliances
	Influent	Effluent		
January	177	4.61	97.4%	0
February	284	5.71	98.0%	0
March	249	6.67	97.1%	0
April	234	7.11	97.2%	0
May	282	6.57	97.8%	0
June	256	7.86	96.6%	0
July	279	8.53	97.0%	0
August	309	9.26	96.9%	0
September	358	8.41	97.4%	0
October	341	12.33	96.0%	0
November	328	7.70	97.5%	0
December	249	7.33	95.8%	0
Average	**283**	**7.69**	**97.1%**	
Total				**0**

Figure 4. 2022 Influent & Effluent Monthly Average $cBOD_5$ Concentration



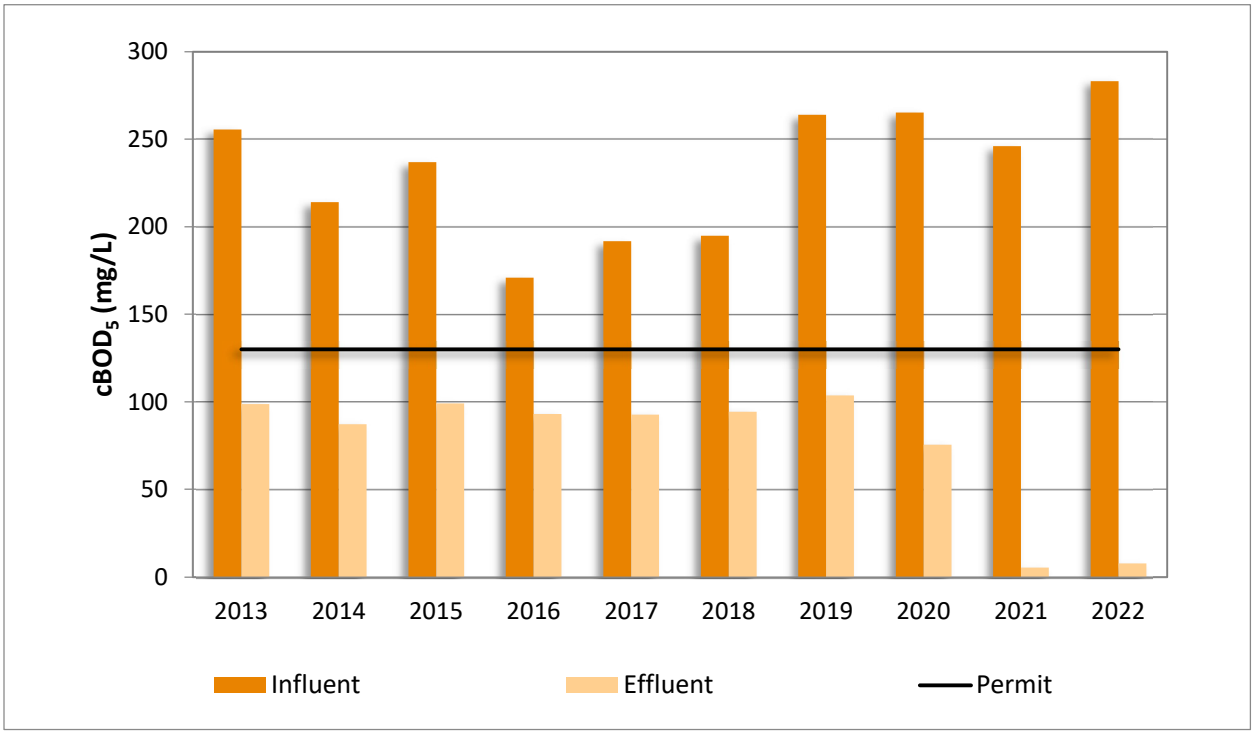
5.1.1 Historical Trends

Historical influent & effluent $cBOD_5$ concentrations, reduction efficiencies and the number non-compliances reported over the past ten years are summarised in the Table 5 and graphed in Figure 5. The addition of the secondary process since September 2020 has resulted in increased $cBOD_5$ removal.

Table 5. Historical Trends: Influent & Effluent $cBOD_5$ Concentrations

Year	Average $cBOD_5$ (mg/L)		Average % Reduction in $cBOD_5$	Non-Compliances
	Influent	Effluent		
2013	255	98.7	62.2%	13
2014	214	87.2	56.8%	5
2015	237	99.0	55.0%	15
2016	171	93.0	44.9%	3
2017	192	92.6	49.2%	7
2018	195	94.3	48.2%	3
2019	264	103.7	57.3%	4
2020	265	75.5	63.5%	11
2021	246	5.32	97.8%	0
2022	283	7.69	97.1%	0

Figure 5. Historical Trends: Influent & Effluent Yearly Average $cBOD_5$ 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 problems for aquatic life.

The Permit requires daily TSS testing of the effluent, with a maximum permitted concentration of 130 mg/L (See Appendix A). The influent and effluent average TSS concentration in 2022 was 579 mg/L and 9.28 mg/L, respectively. The average TSS removal efficiency in 2022 was 98.0%. Appendix B contains the daily TSS results. Results are summarized in Table 6 and graphed in Figure 6.

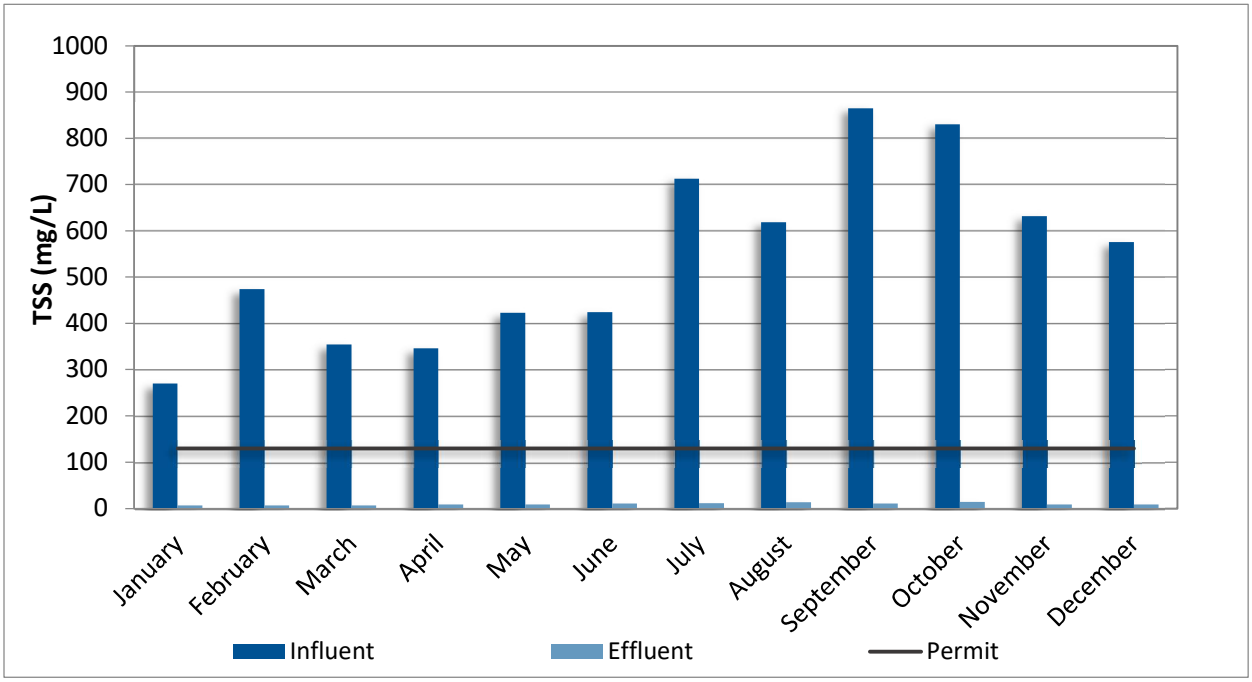
The addition of the secondary process since September 2020 has resulted in increased TSS removal.

There were no TSS non-compliances from GNPCC in 2022.

Table 6. 2022 Influent & Effluent TSS Concentrations

2022	Average TSS (mg/L)		Average % Reduction in TSS	Non-Compliances
	Influent	Effluent		
January	270	6.06	97.3%	0
February	474	6.41	98.6%	0
March	355	6.29	98.1%	0
April	346	8.08	98.1%	0
May	423	8.06	98.1%	0
June	424	10.6	97.4%	0
July	713	11.05	98.2%	0
August	618	13.45	97.2%	0
September	865	10.21	98.5%	0
October	830	13.85	98.4%	0
November	632	8.42	98.5%	0
December	576	8.63	97.5%	0
Average	**579**	**9.28**	**98.0%**	
Total				**0**

Figure 6. 2022 Influent & Effluent Monthly Average TSS



5.2.1 Historical Trends

Historical influent and effluent average TSS concentration, reduction efficiencies and the number of non-compliances reported over the past ten years are summarised in Table 7 and graphed in Figure 7. 2022 data are consistent with historical data.

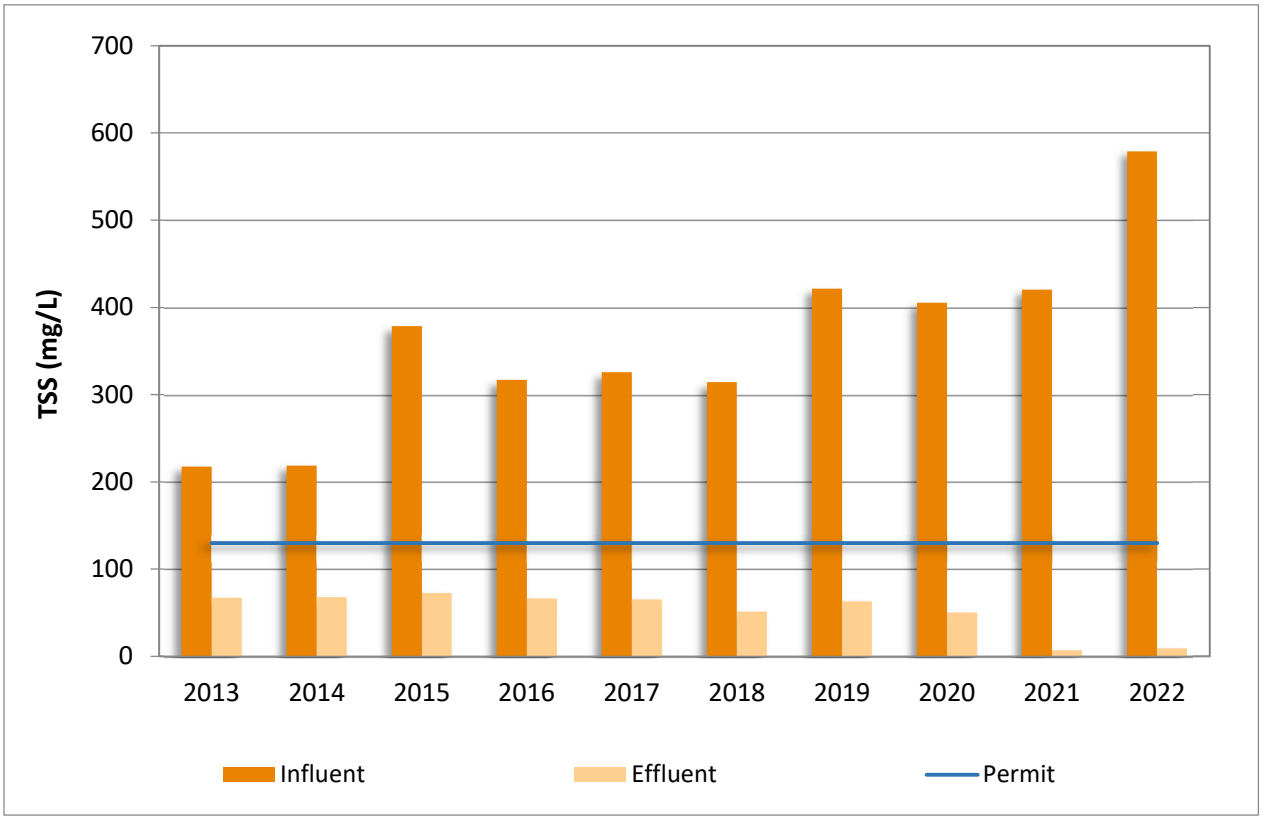
August 2011 to July 2013 and May to December 2014 influent data were less representative due to the grab sampling method. The influent TSS concentrations were higher after 2015 due to the composite sampling method. The composite sampling method would yield higher results due to the inclusion in the composite of higher concentrated night flows.

Effluent TSS results decreased after the secondary treatment was operational after October 2020.

Table 7. Historical Trends: Influent & Effluent TSS

Year	Average TSS (mg/L)		Average % Reduction in TSS	Non-Compliances
	Influent	Effluent		
2013	218	67.2	67.6%	0
2014	219	67.8	67.9%	1
2015	379	72.8	79.1%	1
2016	317	66.4	77.8%	0
2017	326	65.5	78.6%	0
2018	314	51.3	82.1%	0
2019	421	63.0	82.8%	0
2020	405	50.2	83.3%	1
2021	420	7.09	98.0%	1
2022	579	9.28	98.0%	0

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



5.3 Ammonia and Toxicity

Ammonia is one of the typical constituents found in domestic wastewater. Ammonia can be harmful to both freshwater and marine fish and is monitored along with toxicity to determine potential impacts to the receiving environment.

Toxicity testing, or a bioassay, is used to determine the strength of a material by studying the reaction of a living organism exposed to it. The accepted method used to determine the toxicity of water and wastewater is called an LC_{50} 96-hour test. This means the lethal concentration at which 50% of test organisms die within 96 hours. The result is given as a percentage, referring to the amount of effluent, in relation to dilution water, used in the test. A toxicity result of 100% is not acutely toxic. The lower the toxicity result (expressed as a percentage), the more toxic the effluent.

Ammonia testing is completed internally at the GNPCC lab on composite samples from the effluent. Table 8 contains the average of the 2022 Ammonia testing results for each month. Appendix B contains weekly test results. The average ammonia nitrogen concentration in the effluent for 2022 was 19.1 mg/L.

The following trends were observed in the monthly Ammonia results. Results were lower in October and December due to dilution due to inflow and infiltration. Ammonia results also decreased after September 2020 due to ammonia nitrification in the secondary wastewater treatment process.

Table 8. 2022 Effluent Ammonia Nitrogen Concentrations

2022	Effluent Ammonia Nitrogen (mg/L)
January	15.1
February	17.8
March	16.3
April	17.3
May	17.0
June	19.7
July	15.6
August	29.0
September	24.8
October	17.6
November	21.3
December	18.3
AVERAGE	**19.1**

*Total as N

The GNPCC laboratory conducts daily testing of un-ionized ammonia levels to exceed the requirements of its Wastewater Systems Effluent Regulations (WSER) transitional authorization. Un-ionized ammonia levels were lower than the WSER limit of 1.25 mg N/L. Table 9 contains the average monthly un-ionized ammonia testing results. Appendix B contains the weekly test results.

Table 9. 2022 Un-ionized Ammonia Results

2022	Un-ionized Ammonia (mg/L)
January	0.044
February	0.059
March	0.057
April	0.057
May	0.056
June	0.079
July	0.059
August	0.253
September	0.179
October	0.081
November	0.092
December	0.065
AVERAGE	**0.090**

*Total as N

The Permit requires the toxicity of the effluent to be tested quarterly. Toxicity testing is conducted by an external laboratory (see Appendix D for test reports) based on % survival of rainbow trout in undiluted effluent. Table 10 contains the LC50 Toxicity testing results. The average LC_{50} toxicity of the effluent was non acutely toxic with >100% survival of rainbow trout as determined in 4 tests.

Table 10. 2022 LC_{50} Toxicity Results

2022	Effluent LC_{50} Toxicity (%)
March	>100%
June	>100%
September	>100%
December	>100%
Average	**>100%**
test organisms = rainbow trout	

5.3.1 Historical Trends

Historical average ammonia nitrogen and toxicity results for effluent reported over the past ten years are summarised in Table 11 and graphed in Figure 8.

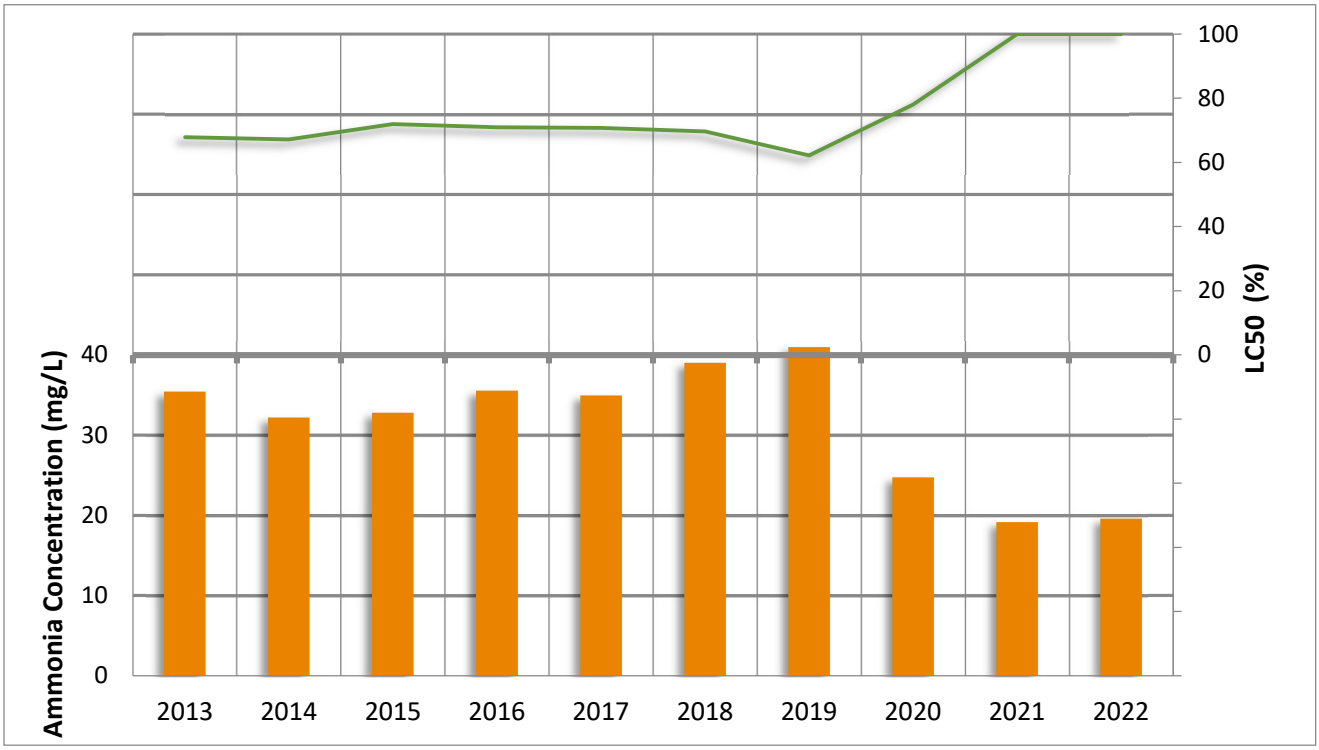
Ammonia results since 2021 are lower than historical values due to ammonia nitrification occurring in the secondary treatment process. Results after October 2020 reflect the secondary process in operation.

The effluent has consistently tested non-acutely toxic since the addition of a secondary treatment process in September 2020.

Table 11. Historical Trends: Effluent Average Ammonia Nitrogen Concentrations and LC_{50} Toxicity

Year	Effluent Average Ammonia (mg/L)	Effluent Average LC50 (%)
2013	35.4	67.8
2014	32.2	67.2
2015	32.8	71.9
2016	35.5	70.9
2017	35.0	70.7
2018	39.0	69.7
2019	41.0	62.2
2020	24.7	78.0
2021	19.1	>100
2022	19.6	>100

Figure 8. Historical Trends: Effluent Yearly Average Ammonia Nitrogen and LC_{50} Toxicity



The > symbols were removed for graphing.

5.4 Alkalinity and Total Phosphorous

The Total Phosphorous and Alkalinity were tested by the internal laboratory in 2022. In previous years, these parameters were tested by an external laboratory.

Monthly average results for 2022 are tabulated in Table 12 and charted in Figure 9 and 10.

Table 12. Effluent Total Phosphorous and Alkalinity Results

2022	Total Phosphorous (mg/L)	Effluent Average Alkalinity (mg/L)
January	3.83	93.9
February	4.72	90.1
March	4.80	101.3
April	2.71	97.2
May	3.05	95.6
June	2.78	104.2
July	-	89.0
August	-	152.9
September	-	137.4
October	4.45	83.1
November	3.98	103.4
December	3.50	112.8
Average*	**3.85**	**205.5**

Figure 9. Effluent Monthly Total Phosphorous Results

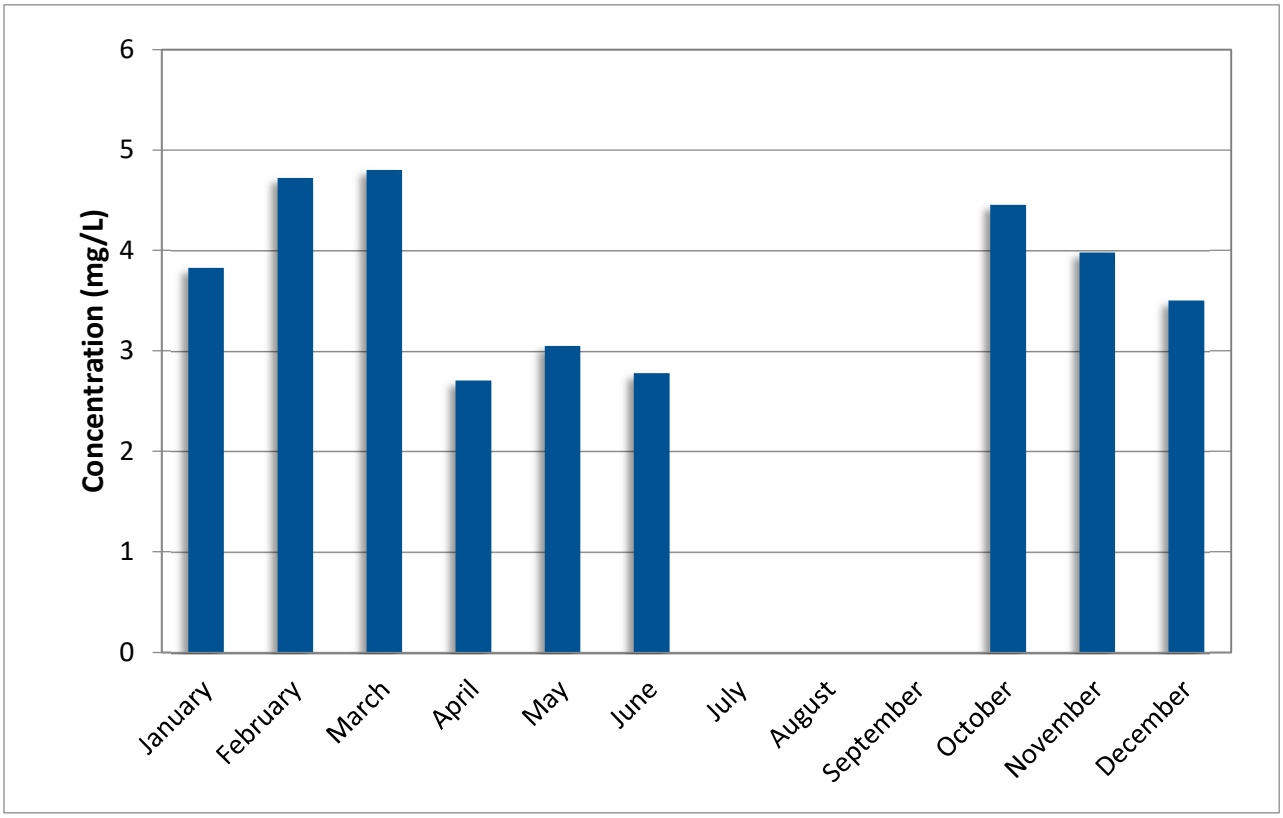
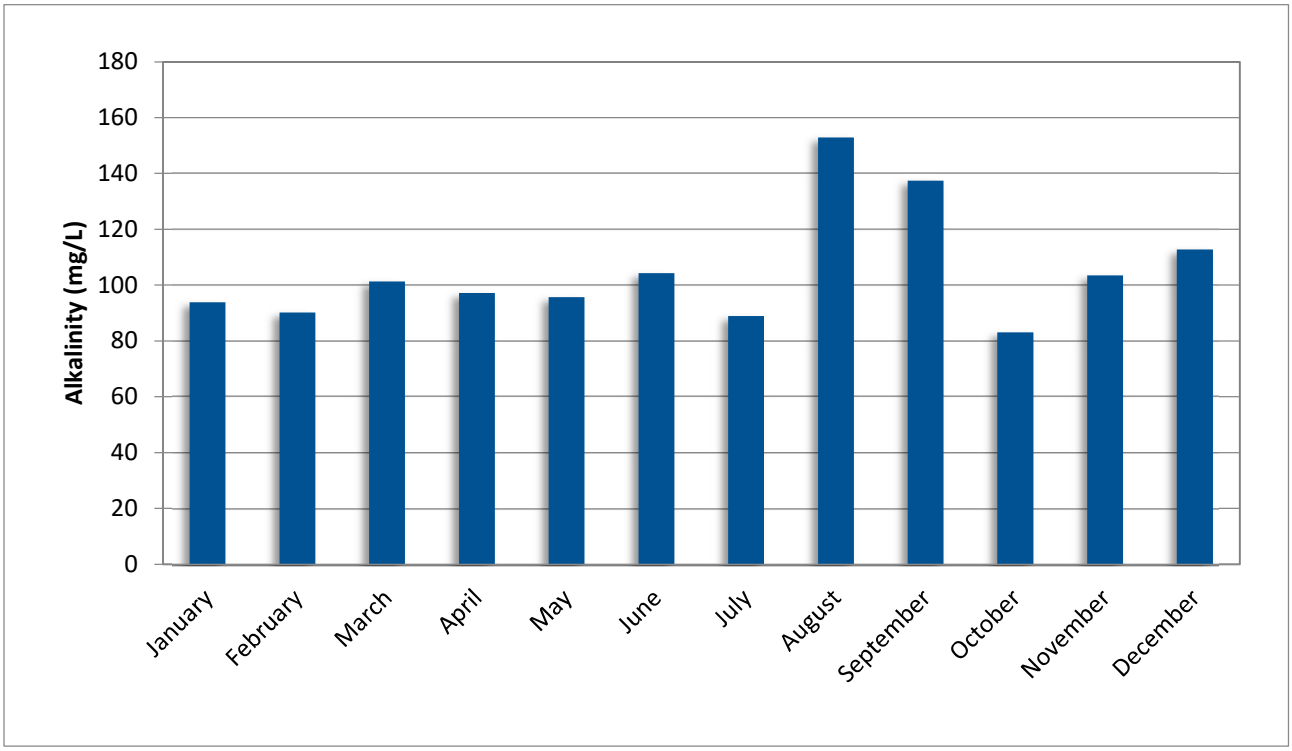


Figure 10. Effluent Monthly Alkalinity Results



5.5 Other General Parameters

The Permit requires testing of the effluent for the following parameters every six months:

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

Samples of the effluent are tested in June and December of each year by an external laboratory (see Appendix D for test results). Historical trends of the general parameters reported over the past ten years are summarised in Table 13.

Decreases in pH, alkalinity, oil and grease, and Total Kjeldahl Nitrogen were observed after 2020 due to the secondary treatment process.

Total Alkalinity and Total Phosphorous were tested by the internal laboratory in 2022. However, they were historically tested by an external lab. pH data can be found in Table 27.

Table 13. Historical Trends: Effluent General Parameters

Parameter	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
pH	-	7.36	7.16	7.17	7.63	7.29	7.22	7.22	7.51	7.17	-
Total Alkalinity	mg/L	172	176	133	153	153	128	214	157	107	-
Dissolved Chloride	mg/L	183	277	158	165	150	133	220	104	200	150
Total Kjeldahl Nitrogen	mg/L	48.0	28.6	36.5	45.6	37.3	40.4	45.7	35.7	13.2	18.9
Total Oil and Grease	mg/L	16.2	35.0	19.5	8.1	7.9	4.9	14.8	<9.6	<1.0	<1.0
Dissolved Sulphate	mg/L	60	67	46	52	48	53	70	42	39	35
Dissolved Sulphide (total)	mg/L	0.1528	<0.05	0.08	0.059	0.082	0.064	0.100	0.053	0.013	0.022
Total Cyanide	mg/L	0.0080	0.0060	0.0040	0.0017	0.0015	<0.0050	0.0058	<1.86	0.0018	0.00154
Dissolved Fluoride	mg/L	0.094	0.100	0.105	0.051	0.043	0.037	0.109	<0.085	<0.056	<0.053
Total Organic Carbon	mg/L	52	63	64	33	47	33	35	25	32	15
Total Phosphorus	µg/L	2,140	3,500	2,415	2,845	3,125	2,770	2,680	2,510	2,550	-

5.6 Metals

The Permit requires testing of the effluent for the following metals every six months:

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)		

Samples of the effluent are tested in June and December of each year by an external laboratory (see Appendix D for test reports). The average concentrations of the metals reported over the past ten years are summarised in Tables 14 and 15.

The Total Aluminum concentration after October 2020 due to the discontinuation of Chemically Enhanced Primary Treatment (CEPT) and the use Aluminum Sulphate in the wastewater treatment process.

Table 14. Historical Trends: Effluent Total Metal Concentrations

Total Metals	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Aluminum	µg/L	2,850	2,095	2,160	2,260	2,980	2,780	3,110	1,770	14	16
Arsenic	µg/L	1.79	0.85	0.70	1.06	0.50	0.49	0.76	0.44	0.49	0.47
Chromium	µg/L	3.60	3.65	0.88	1.35	2.00	2.25	3.27	<1.9	0.39	<1.2
Lead	µg/L	1.6	1.7	1.4	1.1	1.1	0.9	1.9	<0.74	<0.22	<0.29
Mercury	µg/L	0.026	0.02	<0.02	<0.016	<0.017	<0.032	<0.012	<0.015	<0.020	<0.027
Molybdenum	µg/L	2.2	1	0.95	<1.1	<1.0	1.1	1.515	1.9	<1.3	<1.5
Selenium	µg/L	1.95	1.3	<0.7	0.31	0.27	0.34	<0.40	<0.31	0.12	0.15
Silver	µg/L	0.27	0.14	0.065	0.077	0.076	0.132	0.120	<0.049	<0.020	<0.024
Tin	µg/L	<5	1.08	0.80	<5.0	<5.0	<5.0	3.20	<2.9	<5.0	<5.0
Zinc	µg/L	50	42	53.5	48.6	51.7	45.25	117.5	75.5	31.1	30.6

Table 12. Historical Trends: Effluent Dissolved Metal Concentrations

Dissolved Metals	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Barium	µg/L	7.39	8.5	62.7	208.5	235.0	246.0	174.4	<4.4	5.1	3.6
Boron	µg/L	180	192	161	184.5	217.5	240	178.5	178.5	183.5	204
Cadmium	µg/L	0.06	0.075	<0.03	0.067	0.0635	0.0355	0.0825	0.0475	<0.017	<0.014
Cobalt	µg/L	<0.5	0.52	0.51	<0.50	0.42	0.45	0.64	0.61	0.39	0.54
Copper	µg/L	54	66	24.15	44	10.6	8.67	11.00	7.96	8.69	14.0
Iron	µg/L	712	2480	449	427	346	418	306	194	91	126
Manganese	µg/L	72.4	91.5	79.0	80.1	68.3	72.9	85.5	39.1	36.2	55.9
Nickel	µg/L	2.4	2.6	2.3	2.0	1.9	2.3	3.7	3.3	1.4	2.0

5.7 Volatile and Semi-Volatile Compounds

The Permit requires effluent be tested for these volatile and semi-volatile compounds every six months:

Benzene	Ethylbenzene	1,1,1-Trichloroethane
Di(2-ethylhexyl)phthalate	Methyl chloride	1,1,2-Trichloroethane
Chloroform	Napthalene	Trichloroethylene
Dichlorobromoethane	PCB's	Toluene
Dichloromethane	Tetrachloroethylene	Total Phenols
Di-n-butyl phthalate		

Samples of the effluent are tested in June and December of each by an external laboratory (see Appendix D for test reports). The average concentrations of the volatile and semi-volatile compounds reported over the past ten years are summarised in Table 16. 2022 data are consistent with historical data.

Table 16. Historical Trends: Effluent Semi Volatile and Volatile Compounds

Parameter	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Benzene	µg/L	<0.5	<0.5	<0.5	<0.40	<0.52	<0.40	<0.5	<0.5	<0.40	<0.40
Di(2-ethylhexyl) phthalate	µg/L	4.5	1.7	1.6	<10	<7.0	<5.2	<6.3	<2.4	<6.0	<2.0
Chloroform	µg/L	3.9	3.5	1.5	2.75	4	3.25	4.0	2.8	2.5	2.9
Dichlorobromomethane	µg/L	<1.0	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloromethane	µg/L	<2	<1	<1	<2.0	<2.0	<2.0	<2.5	<2.5	<2.0	<2.0
Di-N-Butyl Phthalate	µg/L	<1	<0.2	0.52	<10	<6.0	<5.0	<6.3	<1	<6.0	<2.0
Ethylbenzene	µg/L	<0.5	<0.5	<0.5	<0.40	<0.40	<0.40	<0.70	<0.70	<0.40	<0.40
Methyl Chloride	µg/L	<1.0	<1	<1	<1.0	<1.0	<1.0	<6.2	<4.5	<1.0	<1.0
PCB's	µg/L	<0.1	<0.010	<0.009	<0.28	<0.53	<0.15	<0.050	<0.050	<0.050	<0.050
Tetrachloroethylene	µg/L	<1.0	<1	<1	<0.50	<0.50	<0.50	<0.075	<0.80	<0.50	<0.50
Toluene	µg/L	0.8	0.9	<0.7	<0.52	<0.64	0.54	1.545	<0.80	<0.40	<0.40
Total Phenols	mg/L	0.058	0.020	0.015	0.024	0.032	0.044	0.020	0.497	<0.0027	<0.0015
1,1, 1-Trichloroethane	µg/L	<0.75	<1	<1	<0.50	<0.50	<0.50	<0.075	<0.75	<0.50	<0.50
1,1, 2-Trichloroethane	µg/L	<0.75	<1	<1	<0.50	<0.50	<0.50	<1.0	<0.75	<0.50	<0.50
Trichloroethylene	µg/L	<1.0	<1	<1	<0.50	<0.50	<0.50	<0.075	<075	<0.50	<0.50
Naphthalene	µg/L	<0.7	<0.06	0.07	<0.10	<0.10	<0.10	<2.6	<2.6	<0.10	<0.10

6) Biosolids

6.1 Biosolids Production

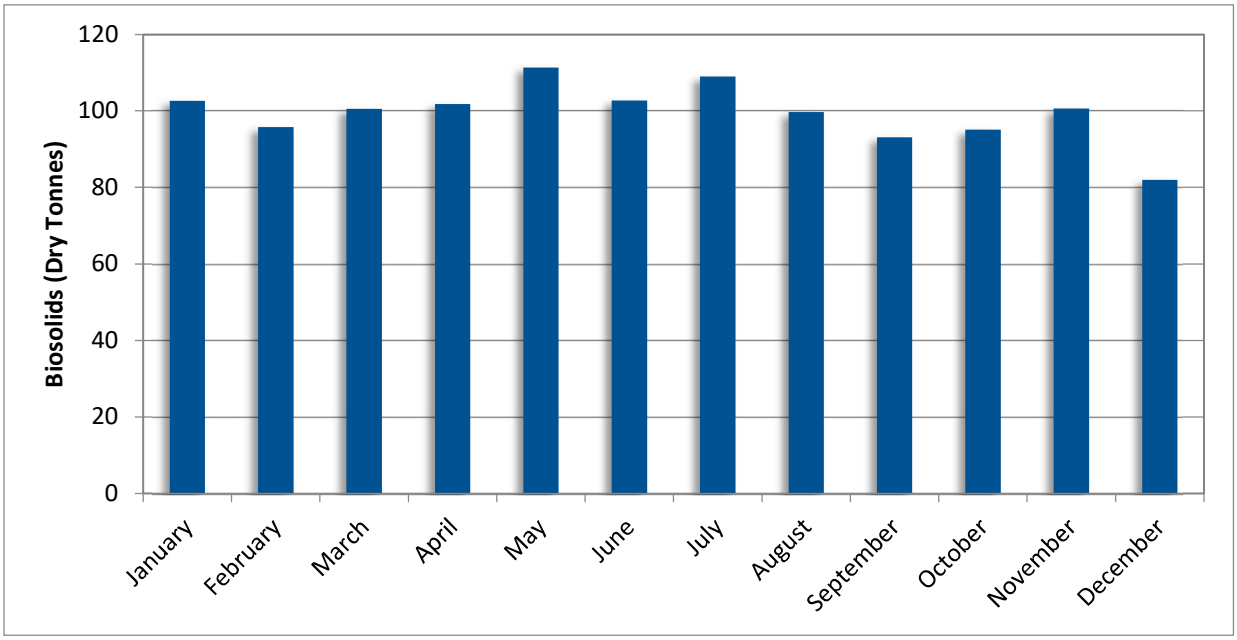
GNPCC produces Class B Biosolids. The average monthly production of biosolids in 2022 is summarized in Table 17 and graphed in Figure 11. Monthly Biosolids production increased after October 2020 with the secondary treatment process.

Percentage Solids (%) of the centrifuged biosolids decreased after October with secondary treatment. This trend is due to the consistency of the secondary sludge which retains moisture and tends to be more difficult to dewater.

Table 13. 2022 Biosolids Production

2022	Trucked Biosolids (Dry Tonnes)	Trucked Biosolids (Wet Tonnes)	% Solids (Pressed Solids)
January	102.6	524.36	19.6%
February	95.8	514.06	18.6%
March	100.5	524.77	19.2%
April	101.8	503.20	20.2%
May	111.3	524.38	21.2%
June	102.7	470.43	21.8%
July	109.0	478.94	22.8%
August	99.7	463.31	21.5%
September	93.1	472.53	19.7%
October	95.1	500.89	19.0%
November	100.7	500.79	20.1%
December	82.0	419.41	19.6%
Average	**99.5**	**491.42**	**20.3%**
Total	**1,198.7**	**5,897.1**	

Figure 11. 2022 Monthly Biosolids Production (Trucked Dry Tonnes)



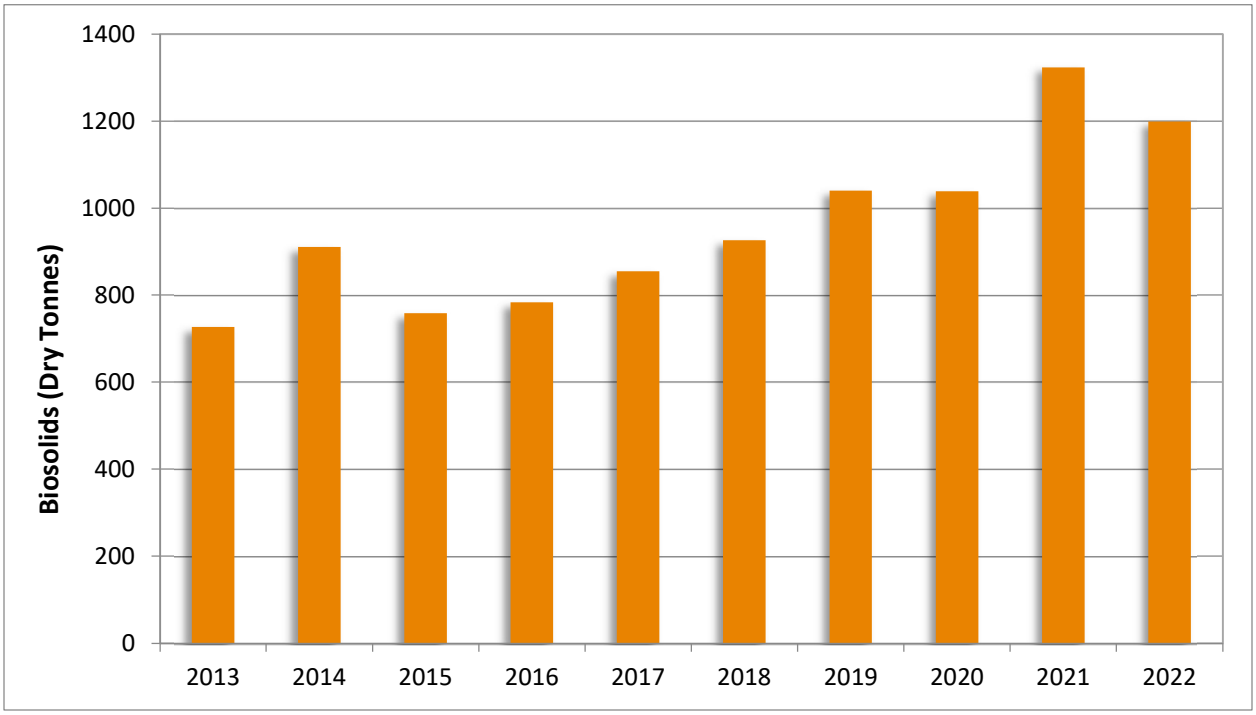
6.1.1 Historical Trends

Historical average polymer usage, total trucked solids (wet tonnes and dry tonnes) and yearly average percent solids reported for biosolids produced over previous years are summarized in Table 18 and graphed in Figure 12. Biosolids production and polymer use increased after October 2020 when the secondary process was in operation.

Table 14. Historical Trends: Biosolids Production

Year	Polymer Usage (Kg/year)	Trucked Biosolids (Dry Tonnes/year)	Trucked Biosolids (Wet Tonnes/year)	% Solids (Average Pressed Solids)
2013	10,525.0	727.00	2,764.20	26.0%
2014	9,741.7	910.82	3,544.47	25.7%
2015	8,816.7	758.28	3,087.21	24.6%
2016	10,537.5	783.34	3,094.13	25.3%
2017	10,800.0	854.86	3,337.46	25.6%
2018	12,925.0	926.13	3,657.78	25.3%
2019	18,422.2	1,040.48	4,337.13	24.0%
2020	22,429.1	1,038.66	4,360.87	23.8%
2021	42,379.7	1,323.26	6,271.83	21.1%
2022	40,407.8	1,198.66	5,897.07	20.3%

Figure 12. Historical Trends: Biosolids Production per Year (Trucked Dry Tonnes)



6.2 Biosolids Analysis

The Permit requires quarterly testing of the biosolids for the following parameters:

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

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

Samples of the biosolids are typically tested quarterly by an external laboratory. Average concentrations of these parameters reported in previous years are summarised in Table 19.

2022 data are consistent with historical data.

All 2022 samples from GNPCC met the Class B regulatory limits for metals in the Organic Matter Recycling Regulation (OMRR).

Table 19. Historical Trends: Biosolids General Parameters

Parameter	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	OMRR Limit (Class B)
Total Solids	%	25.5	25.9	24.7	32.7	26.1	27.5	24.5	23.1	21.6	20.3	-
Volatile Solids	%	68.2	65.1	69.3	67.275	64.05	64.575	67.9	70	74.4	76.8	-
Moisture	%	73.8	74.1	75	75	75	73	76	76	78	80	-
Total Kjeldahl Nitrogen	% dry weight	4.84	4.71	6.90	8.23	9.33	5.23	5.31	5.40	7.03	8.0	-
Phosphorus	µg/g	20,163	29,150	26,700	24,800	29,500	30,000	23,500	27,500	23,700	18,700	-
PCB's	µg/g	<0.5	<2.6	<0.05	<12	<15	<4.4	<8.5	<4.1	<1.6	<2.7	
Arsenic	µg/g	3.1	3.3	3.2	3.2	3.4	2.8	2.4	2.7	2.5	2.26	**75**
Cadmium	µg/g	2.58	2.67	2.17	2.62	2.43	1.73	2.10	1.98	1.31	1.52	**20**
Chromium	µg/g	36.3	49.8	33.8	26.4	30.6	34.5	29.1	30.9	32.0	23.2	**1,060**
Cobalt	µg/g	2.52	3.00	3.43	3.27	3.84	3.39	2.86	2.68	3.12	2.87	**150**
Copper	µg/g	839	980	1095	797	618	525	457	478	559	575	**2,200**
Iron	µg/g	15,600	-	-	30,000	38,700	35,100	28,000	31,000	42,100	28,500	**-**
Lead	µg/g	32	37	34	33	32	29	24	23	24	25.2	**500**
Mercury	µg/g	2.86	1.89	1.46	1.80	1.55	1.76	1.29	1.47	0.89	0.801	**15**
Molybdenum	µg/g	6.74	6.58	6.78	6.63	7.46	6.55	6.09	6.37	7.76	7.57	**20**
Nickel	µg/g	15.2	16.8	17.2	16.3	18.4	18.0	16.1	15.3	13.9	12.0	**180**
Potassium	µg/g	1,006	-	-	892	1,010	985	891	920	925	927	**-**
Selenium	µg/g	4.90	3.90	4.95	4.32	4.96	4.50	3.65	3.93	4.76	5.01	**14**
Zinc	µg/g	964	903	991	972	1,050	980	824	871	912	928	**1,850**

6.3 Fecal Coliforms

Twelve discrete samples of biosolids were sent to an external laboratory in 2022 for fecal coliform analysis (see Appendix D for test reports). The geometric mean of the biosolids fecal coliform results in 2022 was 60,000 MPN/g dry biosolids. For Class B biosolids, OMRR requires a fecal coliform level of <2,000,000 MPN per gram of total solids (dry weight basis) to be met for the geometric mean of seven discrete samples, once per year or every 1,000 tonnes of dry weight, whichever comes first. Biosolids from GNPCC in 2022 met these requirements. Note, sampling in this report was conducted by the RDN to meet permit conditions. SYLVIS Environmental conducts a separate sampling program which is used for the Land Application Plan to meet OMRR requirements (see Appendix G).

A reduction in fecal coliform levels has been observed since the commission of the secondary treatment process. 2022 fecal coliform analysis are summarised in Table 20.

Table 20. 2022 Biosolids Fecal Coliforms Concentrations

2022	Fecal Coliforms (MPN / g dry)	External Laboratory
26-Jan-22	87,000	Bureau Veritas
2-Feb-22	130,000	Bureau Veritas
09-Mar-22	110,000	Bureau Veritas
06-Apr-22	260,000	Bureau Veritas
12-May-22	80,000	Bureau Veritas
06-Jun-22	110,000	Bureau Veritas
11-Jul-22	23,000	Bureau Veritas
11-Aug-22	36,000	Bureau Veritas
14-Sep-22	27,000,000	Bureau Veritas
26-Oct-22	1,200	Bureau Veritas
09-Nov-22	1,700	Bureau Veritas
08-Dec-22	17,000	Bureau Veritas
Geometric Mean	**60,000**	

6.4 Stabilization and Dewatering

Biosolids at GNPCC are stabilized by anaerobic digesters. The sludge collected from the bottom of the sedimentation tanks is pumped via gravity thickeners and heat exchangers to two digesters. The sludge is held in the tanks 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. Pathogen reduction is achieved in the anaerobic digesters to create Class B biosolids (according to parameters identifies in OMRR). Stabilization and Dewatering process data are presented in Tables 21 and 22.

Table 21. 2022 Stabilization Process Data

Stabilization Process		
Total Mass of Sludge Delivered for Stabilization	2,801	Tonnes (dry)
% of TSS as VSS in Sludge Feed	74.2	%
Mass of Biosolids Remaining after Stabilization	1701.9	Tonnes (dry)

Table 22. 2022 Dewatering Process Data

Dewatering Process		
Volume of Biosolids delivered for dewatering	108,077	m^3
% Solids in biosolids dewatering feed	1.57	%
% Solids in dewatered biosolids	20.3	%
Polymer dosage to aid dewatering	0.374	kg/m^3

6.5 Biosolids Management

In 2022, RDN biosolids from GNPCC were beneficially managed in two programs:

- Forest Fertilization
- Soil Fabrication.

6.5.1 Forest Fertilization

Forest fertilization occurs on private forested land located southwest of Nanaimo. The land is owned by TimberWest and managed by Mosaic Forest Management (Mosaic).

The biosolids were land applied in a forest fertilization project managed by SYLVIS Environmental. The SYLVIS Environmental 2022 Biosolids Management Summary, attached in Appendix G (Section 4 page 6), provides a summary and interpretation of the effects of biosolids discharges on the receiving environment.

6.5.2 Soil 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. More details of the soil fabrication program are provided in the 2022 Biosolids Management Summary, 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 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 Biogas Production

A by-product of the anaerobic sludge digestion process is biogas which consists mostly of methane gas. Gas production is recorded daily at GNPCC. The average daily biogas production rate in 2022 was 4,512m^3/day. The total volume produced in 2022 was approximately 1,646,897 m^3. Of the total produced, 452,131 m^3 (27.45% of total production) was used as fuel for the boilers to heat operations and wastewater treatment process water and for cogeneration. The remaining 1,183,649 m^3 (71.87 % of total production) was wasted (flared).

7.1.1 Historical Trends

Historical biogas production, usage and waste rates reported over previous years are summarized in Tables 23 and 24. Biogas production rates seem to have gradually increased except for 2012, which is

lower than other years as use, and flared amounts were based on only 10 months of data collection. The trend towards increased biogas production is attributed to the installation of Digester #3 after 2013.

The cogeneration system was commissioned in mid-2012. Refer to Cogeneration section for details on the Cogeneration Facility project. The cogeneration system has been offline since 2018. Servicing was completed on the cogeneration system in 2022, however.

Table 23. Historical Trends: Biogas Production

Year	Average Daily Biogas Production (m^3/day)	Total Biogas Production (m^3)	Average Daily Biogas Wasted (m^3/day)	Total Biogas Wasted (m^3)	Average Daily Biogas Useage (m^3/day)	Biogas Useage Cogen (total)	Biogas Useage Boiler (m^3)	Total Biogas Used Total (m^3)
2013	3,351	1,125,976	2,018	716,486	1,333	36,528	372,962	409,491
2014	3,601	1,297,475	1,834	661,897	1,768	336,477	299,101	635,578
2015	4,040	1,458,586	2,209	797,449	1,831	478,766	182,371	661,137
2016	3,942	1,407,176	2,578	920,357	1,364	191,697	295,122	486,819
2017	4,090	1,492,730	2,471	902,057	1,618	285,450	305,224	590,674
2018	3,950	1,441,721	2,780	1,014,539	1,170	90,601	336,581	427,181
2019	3,746	1,367,432	2,742	1,000,857	1,004	1,765	364,811	366,575
2020	3,976	1,451,406	2,884	1,052,755	1,092	3,231	395,421	398,651
2021	4,491	1,639,123	3,212	1,172,274	1,279	2,254	464,595	466,849
2022	4,512	1,646,897	3,243	1,183,649	1,269	11,118	452,131	463,249

* Represents approximately a 10-month estimate, from March 3 – December 31, 2012.

Table 24. Historical Trends: Percentage Biogas Consumption and Wasting

Year	% Biogas Wasted	% Biogas Used (Boiler)	% Biogas Used (Cogen)
2013	60.22%	33.12%	3.24%
2014	50.92%	23.05%	25.93%
2015	54.67%	12.50%	32.82%
2016	65.40%	20.97%	13.62%
2017	60.43%	20.45%	19.12%
2018	70.37%	23.35%	6.28%
2019	73.19%	26.68%	0.13%
2020	72.53%	27.24%	0.22%
2021	71.52%	28.34%	0.14%
2022	71.87%	27.45%	0.68%

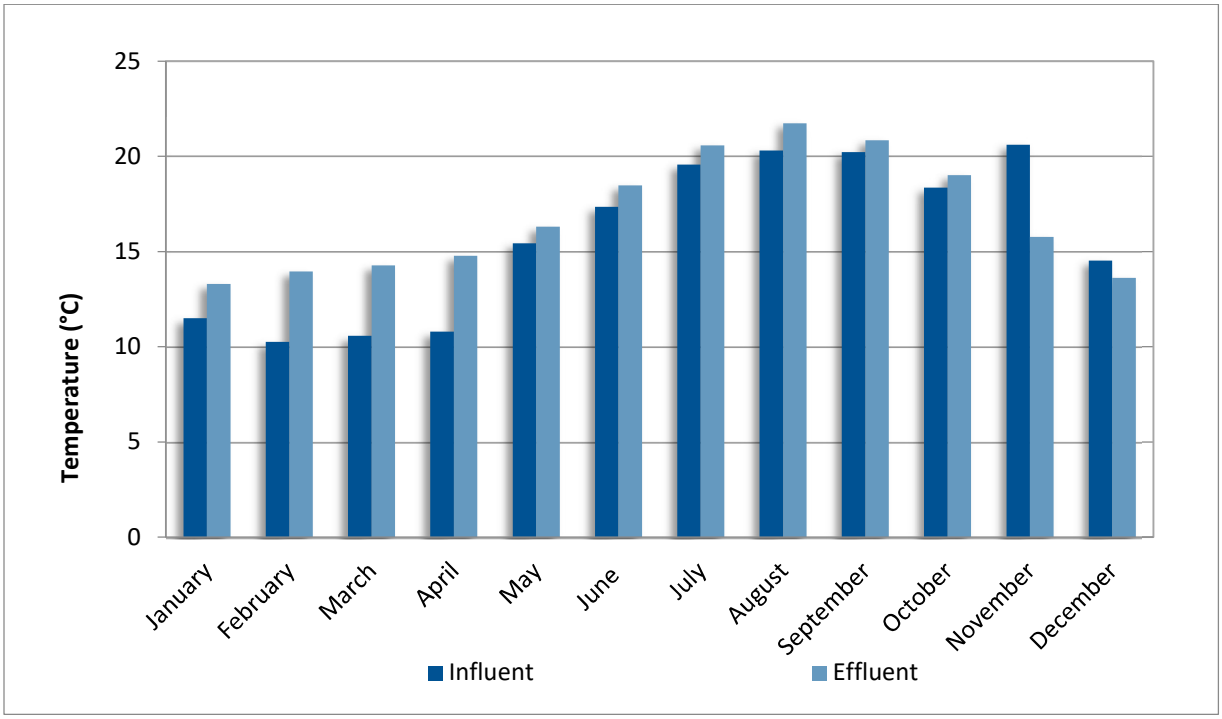
7.2 Temperature

RDN staff conduct temperature testing of the influent and effluent daily. Temperature monitoring data for GNPCC from 2022 is presented in Appendix B. The average temperature data for each month are summarized in Table 25 and graphed in Figure 13.

Table 25. 2022 Influent & Effluent Temperatures

2022	Average Temperature (°C)	
	Influent	Effluent
January	11.5	13.3
February	10.3	14.0
March	10.6	14.3
April	10.8	14.8
May	15.4	16.3
June	17.4	18.5
July	19.6	20.6
August	20.3	21.7
September	20.2	20.9
October	18.4	19.0
November	20.6	15.8
December	14.5	13.6
Average	**16.7**	**16.9**

Figure 9. 2022 Influent & Effluent Monthly Average Temperature



7.2.1 Historical Trends

Historical average temperatures for influent and effluent reported over the past ten years are summarized in Table 25. 2022 data are consistent with historical data.

Table 15. Historical Trends: Influent & Effluent Average Temperature

Year	Average Temperature (°C)	
	Influent	Effluent
2013	15.6	15.6
2014	15.3	15.2
2015	16.5	16.3
2016	16.5	16.0
2017	15.7	15.3
2018	15.7	15.7
2019	15.7	15.8
2020	15.5	15.7
2021	16.5	16.9
2022	16.7	16.9

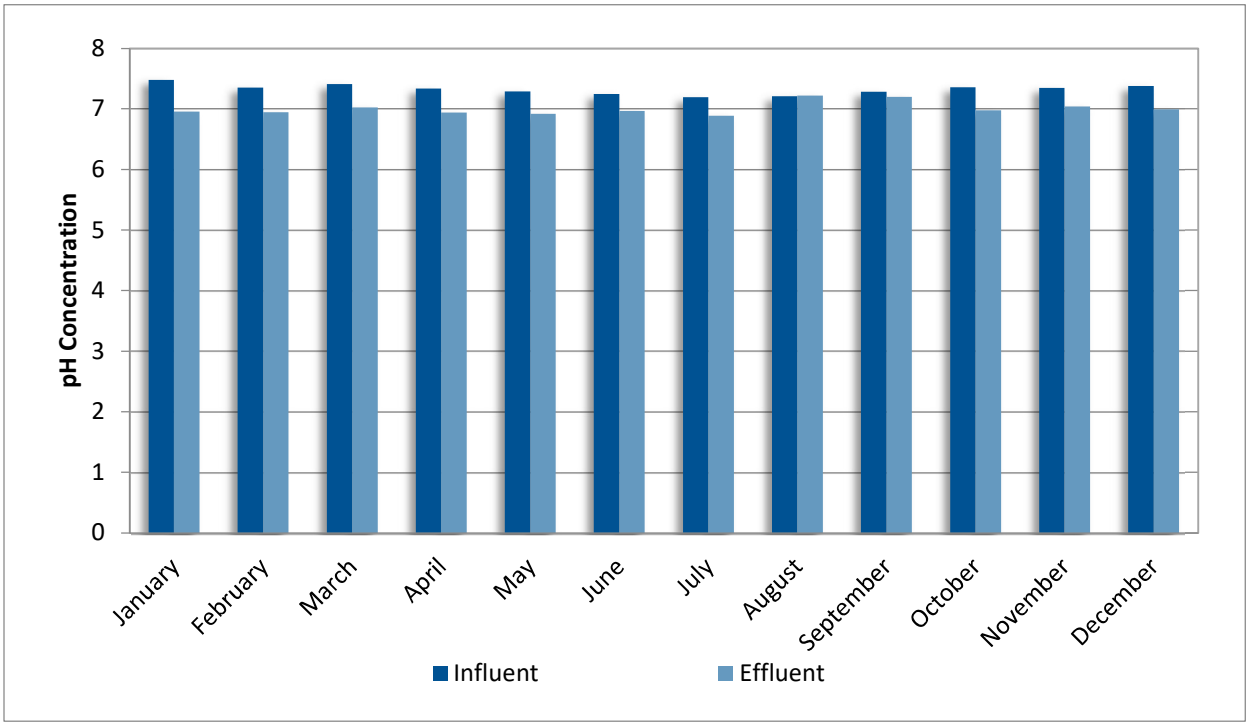
7.3 pH

RDN conducts pH testing of the influent week, and the effluent daily. The pH monitoring data for GNPCC from 2022 is presented in Appendix B. The average pH concentrations for each month are summarized in Table 27 and graphed in Figure 14.

Table 16. 2022 Influent & Effluent Average pH Concentration

2022	Average pH	
	Influent	Effluent
January	7.48	6.96
February	7.35	6.95
March	7.41	7.03
April	7.33	6.94
May	7.29	6.92
June	7.25	6.97
July	7.19	6.89
August	7.21	7.22
September	7.28	7.20
October	7.36	6.98
November	7.35	7.04
December	7.38	6.99
Average	**7.32**	**7.01**

Figure 10. 2022 Influent & Effluent Monthly Average pH Concentration



7.3.1 Historical Trends

Historical average influent and effluent pH concentration reported over the past ten years are summarized in Table 28. 2022 data are consistent with historical data.

Table 17. Historical Trends: Influent & Effluent pH Concentration

Year	Average pH	
	Influent	Effluent
2013	7.30	7.20
2014	7.18	7.02
2015	7.18	7.04
2016	7.30	7.18
2017	7.30	7.16
2018	7.25	7.08
2019	7.28	7.09
2020	7.38	7.13
2021	7.42	7.00
2022	7.32	7.01

7.4 Volatile Solids in the Thickeners and Digesters

The construction and commissioning of two gravity thickeners at GNPCC was completed in 2008. Prior to the addition of the gravity thickeners, sludge was held in the primary sedimentation tanks to thicken to approximately 3-4%, with the aid of alum sulphate (coagulant). From there the sludge was conveyed to the digesters for stabilization.

With the addition of the gravity thickeners, the sludge from the primary sedimentation tanks is conveyed to the gravity thickeners at a lower percent solid and thickened to approximately 5% solids before conveyance to the digesters for stabilization. There are several advantages to this; sludge is held in the primary sedimentation tanks for less time; less chemicals are required in the sedimentation tanks to keep the sludge coagulated; it maintains the effluent total suspended solids within permitted limits for discharge; and the higher percent solids reduces the volume loading on the digesters.

The average total solids and volatile solids in the sludge from the thickeners and the digesters as well as the average percent volatile solids reduction are summarized in Table 28. The volatile solids reduction increased after 2015 due to Digester #3 functioning well and thickened primary sludge entering the digesters in a stable solids level (refer to Table 29).

In 2022, the digestion process at GNPCC achieved a 61.5% reduction in volatile solids. This is a slight reduction to previous years due to increased sludge loading from the secondary process. Secondary sludge is also more difficult to breakdown (fewer volatile solids) than primary solids.

Table 18. Historical Trends: Sludge Volatile Solids Reduction

Year	Average Solids in Sludge from Thickeners (%)	Average Volatile Solids in Sludge from Thickeners (%)	Average Solids in Digested Sludge (%)	Average Volatile Solids in Digested Sludge (%)	Average Reduction in Volatile Solids in Digesters (%)
2013	3.9	85.9	1.8	69.1	63.1
2014	3.5	80.3	1.7	64.6	54.6
2015	4.7	86.8	1.7	63.7	74.8
2016	4.6	86.6	1.8	65.1	72.3
2017	4.6	86.3	1.7	64.4	68.4
2018	4.4	86.2	1.7	63.1	67.0
2019	4.1	85.9	1.6	65.7	65.5
2020	4.0	86.4	1.3	67.3	65.7
2021	4.1	88.9	1.6	72.7	58.8
2022	4.3	90.4	1.6	75.1	61.5

8) Resource Consumption

8.1 Chemical Consumption

Table 30 summarizes the consumption and costs of chemicals used in the treatment process and at the pump stations for the Southern Communities in 2022.

The total cost of chemicals purchased at GNPCC in 2022 was consistent to usage in 2021. Pricing for many chemicals increased in 2020-2021 due to ongoing market trends and supply chain issues.

The dewatering polymer increase after secondary treatment to dewater the secondary sludge in the secondary treatment process. The dewatering polymer was also changed to Wes-Floc 6816 A which is more effective dewatering the secondary sludge.

Aluminum Sulphate and the Superfloc A-1883RS are used in the CEPT process. The use of these chemicals has been discontinued since October when the secondary treatment process was operational.

With the secondary treatment process, dewatering polymer was changed from Zetag 7557 to Wes-Floc 6816 A, and the thickening polymer used in 2022 was Wes-Floc 7610 A supplied by Alumichem Canada Ltd.

Table 30. 2022 Chemical Consumption

Chemical 2022	Consumption	Units	Cost	Use
Wes-Floc 6816 A	40,408	kg	$349,169	Dewatering
Wes-Floc 7510 A	17,324	kg	$101,321	DAFT Polymer
Other DAFT Polymer	684	kg	$4,971	DAFT Polymer (for chemical trials)
Ferrous Chloride*	217,833	kg	$52,389	Odour Control
KemFoam X	-	-	$10,618	Defoamer
Other Chemicals	-	-	$24,500	Corrosion and Scale Inhibitor
TOTAL			**$542,968**	

* Used at Chase River Pump Station

8.1.1 Historical Trends

Historical annual costs of chemicals consumed in over previous years are summarized in Table 31. A reduction in ferrous chloride consumption occurred in 2010-2011 due to issues with availability and delivery of this product. Ferric chloride was used temporarily in 2011 to bridge the gap until ferrous chloride procurement issues got resolved.

The use of Aluminum Sulphate and Superfloc A-1883 has been discontinued since October 2020 with the secondary treatment process. Dewatering polymer was changed from Zetag 7557 to Wes-Floc 6816 A to treat secondary sludge, and Wes-Floc 6510 A was used as the thickening polymer.

Table 19. Historical Trends: Chemical Consumption

Year	Dewatering Polymer	Kemira Superfloc A-1883RS	DAFT Polymer	Ferrous Chloride	Kemira PAX XL6**	Aluminum Sulphate	Secondary Polymer	Defoamer	Odour Control	Other	Total Cost
2013	$86,831	$45,596		$31,451	$50,690	$269,185					$483,753
2014	$80,369	$41,323		$36,978	-	$328,853					$487,522
2015	$72,738	$17,521		$58,562	-	$243,620					$392,440
2016	$86,934	$18,616		$58,346	-	$271,384					$435,280
2017	$89,100	$25,906		$51,131	-	$279,749					$445,887
2018	$106,631	$39,421		$52,163	-	$320,279					$518,494
2019	$146,456	$40,180		$66,054	-	$394,943				$8,660	$656,293
2020	$178,311	$27,664		$50,978	-	$316,817	$27,332	$7,448	$2,065	$4,696	$615,311
2021	$326,666	-	$115,622	$48,392	-	-	-	$13,087	$6,628	$873	$511,268
2022	$349,169	-	$106,292	$52,389	-	-	-	$10,618	-	$24,500	$542,968

8.2 Electrical Consumption

Historical annual electrical consumption and costs are summarized in Table 32 and graphed in Figure 15. In general, electrical consumption increases in years where there are major construction projects. Additionally, although not directly measured, the increased reliance on mechanical mixing in the digesters accounts for increases in electrical consumption in recent years, the pumps that do this mixing use substantial electricity.

Due to a connection issue that prevented BC Hydro from reading GNPCC's electrical meter in the secondary upgrade, the RDN did not receive invoices. Electrical consumption and cost in 2020 and 2021 were estimated based on metered consumption data from BC Hydro from July 22, 2021 to present.

No consumption information or invoices were received for 2020. 2020 consumption and invoicing were based on the 2021 trend, and commissioning of secondary treatment on October 2020.

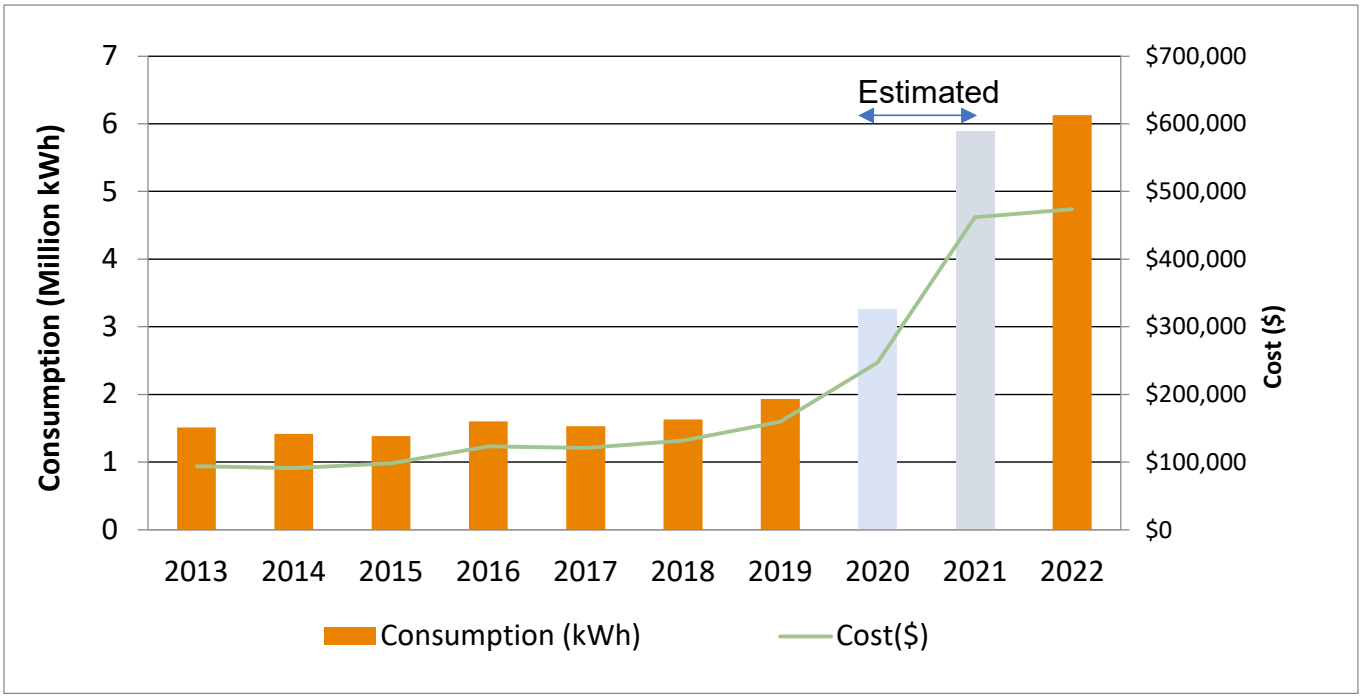
Electricity consumption at GNPCC increased after 2020 to the bioreactors and process equipment installed in the secondary upgrade. The increase in electricity use was mitigated by the installation of turbo-blowers which are more efficient assisted by a BC Hydro energy efficiency grant.

Table 20. Historical Trends: GNPCC Electrical Consumption

Year	Consumption (kWh)	Cost ($)
2013	1,513,800	$94,031
2014	1,416,600	$91,633
2015	1,386,000	$98,382
2016	1,602,000	$123,425
2017	1,533,600	$121,043
2018	1,631,700	$131,851
2019	1,931,400	$159,954
2020	3,252,043*	$247,216*
2021	5,893,329*	$461,730*
2022	6,127,665	$473,888

Note: Electrical consumption at the treatment plant only (pump stations are excluded).
* No electricity invoices were received for 2020. 2021 use was metered after July 22, 2021. Annual consumption and cost were estimated for both 2020 and 2021.
* Electricity costs do not include tax.

Figure 11. Historical Trends: GNPCC Electrical Consumption and Costs (Treatment Plant Only)



8.3 Water Consumption

The estimated water consumption at GNPCC for 2022 was estimated to be 90,848 m^3. Water consumption increased in 2020 and early- 2021 due to the commission of secondary treatment and filling of tanks to commissioning.

Historical treatment plant water consumption (pump stations excluded) is summarized in Table 33.

Table 21. Historical Trends: GNPCC Water Consumption

Year	Water Consumption (m^3)
2013	43,604
2014	53,914
2015	35,061
2016	35,994
2017	64,871
2018	70,852
2019	77,738
2020	105,500
2021	118,810
2022	90,848

9) Cogeneration

In 2005, Wastewater Services applied to the Federation of Canadian Municipalities (FCM) for a Green Municipal Fund grant to install a cogeneration system at GNPCC. A cogeneration system would convert wasted digester biogas into electricity to be used in treatment plant operations. It is estimated that a cogeneration system using 100% of wasted gas could produce enough electricity to satisfy 90-100% of the present electrical requirements of the plant. A cogeneration system would eliminate the emissions currently flared to the environment and result in electrical cost savings to GNPCC. FCM awarded Wastewater Services this grant in the summer of 2006. This grant money was only to be used for a field test, and not the full-scale implementation of a cogeneration system. Thus, Wastewater Services applied for another grant under the Gas Tax Program Incentive Fund to install a full-scale, permanent cogeneration system, including the construction of a cogeneration building to house the associated generators. The grant was awarded in July 2008.

Construction of the GNPCC Cogeneration Facility was commissioned in September 2012, producing methane gas to run the generator. All cogenerated electricity is sold to BC Hydro.

The cogeneration system was offline since 2019 because the system's gas skid was inoperable, and operator resources were taken up by the secondary upgrade. The RDN communicated with BC Hydro in May 2019 that the cogeneration facility would not be operated until after the upgrade is completed to optimize resources. The RDN is currently in discussions with BC Hydro about upgrades to the system.

The cogeneration system was run between June 15 and 20 in 2022 for a recommissioning test.

Table 34 contains a summary of the energy generated by the cogeneration unit and the revenue obtained from selling this electricity to BC Hydro.

Table 22. Historical Cogeneration Unit Electricity Production and Revenue Generated

Year	Eligible Energy (MWh)	Revenue ($) excluding GST/HST
2013	144.5	$15,672
2014	499.9	$54,926
2015	732.5	$72,399
2016	236.2	$24,044
2017	448.5	$50,429
2018	135.5	$13,583
2019	0.0	$0
2020	0.0	$0
2021	0.0	$0
2022	0.0	$0
Total	**2,246**	**$236,880**

10) Odour

There were six odour complaints received in 2022 for GNPCC, Pump Stations, and Interceptor. See Appendix E for individual incident reports. Table 35 summarizes the number of odour concerns received by month in 2022.

Table 23. 2022 Odour Complaints

2022	Odour Concerns	
	GNPCC	Pump Stations and Interceptor
January	0	0
February	0	1
March	2	0
April	0	0
May	0	0
June	0	0
July	1	1
August	0	1
September	0	0
October	0	0
November	0	0
December	0	0
Total	**3**	**3**

In 2022, GNPCC operations received six odour concerns in total (see summary below):

Three were from locations near GNPCC:

- Two concerns were received in March from near Ney Drive which were believed by the resident to be attributed to GNPCC. Operations investigated the complaints but were unable to attribute a source. Due to the resident's location, it was thought the odour did not arise at GNPCC.
- One concern was received in July after hours from near the GNPCC property. All foal air fans and biofilter systems were working properly at the time. As nothing was noted in the weather and plant logs, it was difficult to determine the source of the odour.

Three were from locations near Wellington Pump Station

- One concern was identified in February of odours near Wellington pump station. Operations investigated the pump station but could not identify the source of the odour (received after hours).
- Another odour concern received in July was attributed to hot weather and minimal air movement around the pump station.
- Another resident noted an odour from the Wellington pump station wet well exhaust fan (to remove foul airs from pump station). It was determined that the fan was left on. A sign has now been placed on the door to remind to remind turn off the fan when they leave. The installation of a carbon filter on the exhaust fan outlet is being investigated.

10.1 Historical Trends

The total number of odour complaints reported over the past ten years are summarized in Table 36.

Table 24. Historical Trends: GNPCC and Pump Stations – Number of Odour Complaints

Year	Odour Complaints
2013	2
2014	8
2015	9
2016	6
2017	11
2018	6
2019	6
2020	8
2021	10
2022	6

10.2 Odour Episode

An odour episode is a disruption in the regular operation of the treatment plant or operations that may cause odour. The other concerns were due to regular function however improvements. One odour episode was identified in the odour complaint records:

- The wet well exhaust fan was left on at Wellington pump station.

The other concerns received were attributed to the regular function of the wastewater system however improvements to odour control systems were recommended as corrective actions.

Several of the plant processes resulting in odour concerns have recently been installed in the secondary upgrade and optimizations with the odour control systems on these new processes are ongoing.

11) Septage Receiving

Septage and Pump and Haul are received at the Chase River Pump Station (CRPS) Septage Receiving Site. The total combined volume of Septage and Pump and Haul discharged in 2022 was 2,381,418 Imperial gallons (10,826 m^3).

Please note this volume does not include sludge from the Duke Point Pollution Control Centre (DPPCC) wastewater treatment process which undergoes further treatment at GNPCC. This volume is tabulated in the 2022 DPPCC Annual Report.

11.1 Historical Trends

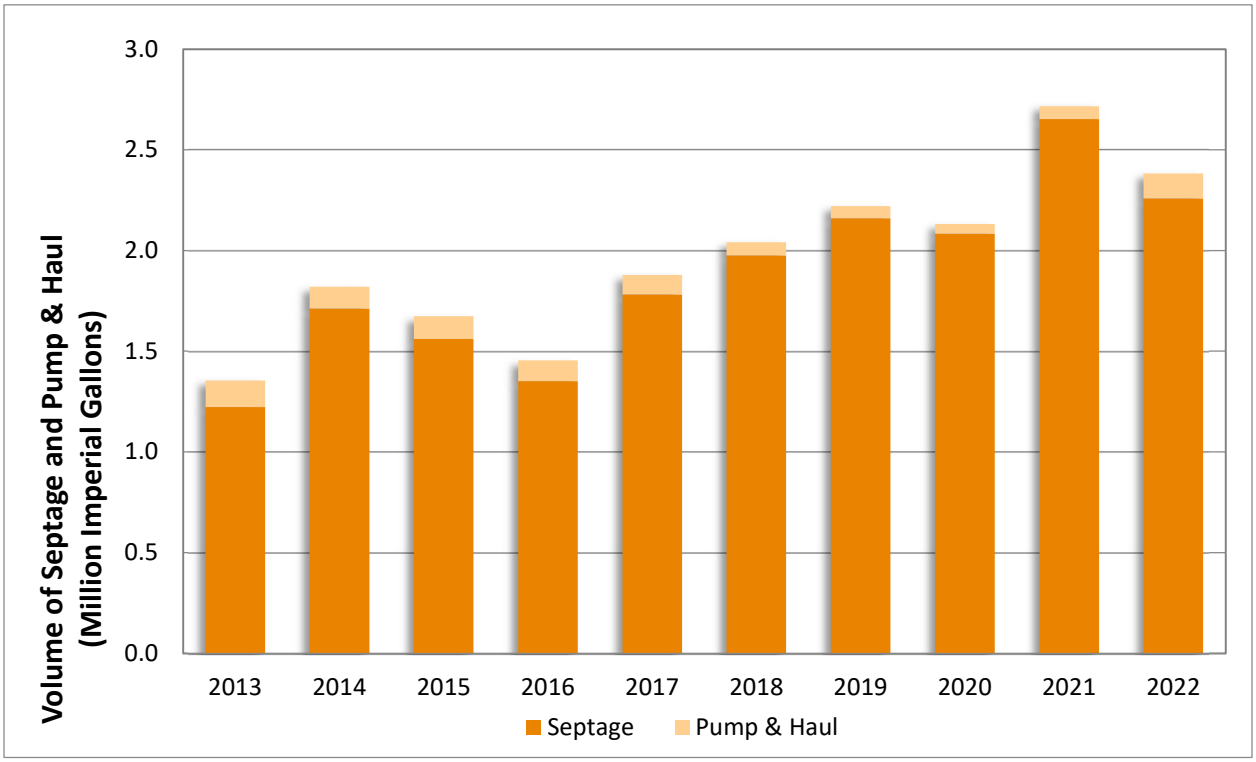
The volumes of septage and pump & haul discharged previous years are summarized in Table 37 and graphed in Figure 16.

At Chase River pump station, several policies were implemented over the last several years to improve tracking of septage deliveries including locking out the rock trap, and auditing pump and haul and reduced loads. It is worth noting that there has been a large amount of annual variability in the amount of septage and pump & haul discharged at CRPS.

Table 37. Historical Trends: Septage and Pump & Haul discharged at CRPS

Year	Total Gallons of Septage Discharged at CRPS	Total Gallons of Pump & Haul Discharged at CRPS	Combined Total (imperial gallons)	Combined Total (m^3)
2013	1,221,527	133,080	1,354,607	6,158
2014	1,711,490	108,560	1,820,050	8,274
2015	1,560,351	112,584	1,672,935	7,605
2016	1,351,493	103,382	1,454,875	6,614
2017	1,782,232	96,982	1,879,214	8,543
2018	1,974,861	66,036	2,040,897	9,278
2019	2,159,556	60,480	2,220,036	10,092
2020	2,084,085	46,637	2,130,722	9,686
2021	2,652,432	62,791	2,715,223	12,344
2022	2,259,010	122,408	2,381,418	10,826

Figure 12. Annual Volume of Septage and Pump & Haul Discharged at CRPS (GNPCC)



11.2 Septage Testing

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

- 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.
- Sufficient historical data created a reference and determined that septage had a negligible impact on overall effluent quality.
- 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 septage discharged by haulers at CRPS. One hauler per quarter were 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.

12) Contributory Population and Remaining Plant Capacity

The estimated population serviced in 2022 was 104,134 with a projected annual growth rate of approximately 1.97%. The population figure incorporates the 2021 Census data. In 2022, the average daily flow was 32,290 m^3/day and the maximum daily flow was 104,451 m^3/day.

The capacity of GNPCC has increased with the installation of a Digester #3 and Sedimentation Tank #4 in 2013. The secondary treatment upgrade will also increase plant capacity. The design capacity of the secondary upgrade was an average annual flow of 46,000 m^3/day and a maximum daily flow of 126,000 m^3/day. The secondary upgrade was designed to provide treatment for service population of 120,000.

The RDN 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.

13) Environmental Incidents

Records are maintained regarding any environmental incidents that are associated with the RDN's wastewater infrastructure and treatment facilities.

In 2022, one environmental incident was recorded:

- On July 7, the smoke/fire alarm sounded at the GNPCC dewatering building. The Nanaimo Fire Department cleared the building, and under investigation noted a hot spot from the centrifuge #1 control cabinet capacitor. This incident was related to a failed component in the capacitor for the Variable Frequency Drive (VFD). The component was replaced. A Corrective Action was for electrical staff to purchase spare capacitors for equipment with drives.

Appendix F contains additional details about these environmental incidents.

14) Facility Upgrades and Major Projects

14.1 Upgrades and Repairs Completed in 2022

- DBPS Worthington Pump Seal
- Ventilation Status Monitoring
- Chase River Pump Station Upgrade
- KSB Mixer Davit Lifter
- Centrifuge #1 Rotating Assembly Rebuild
- Northshore manhole repairs

14.2 Studies and Projects Completed in 2022

- Remote Operated Vehicle Underwater outfall inspection.
- VIU Odour monitoring study.
- GNPCC Hoffman Centrifugal Blower, Coupling, and Motor.
- Eelgrass Monitoring.
- Emerging Substances of Concern Study.
- Partnership agreement between GNPCC and BC Centre for Disease Control (BC CDC) for monitoring of Covid-19 in wastewater influent.

14.3 Upgrades and Repairs Planned for 2023

- Departure Bay Pump Station Worthington pump Rebuild.
- Wet Well Cleaning: Departure Bay and Wellington Pump Station.
- Facility Condition Assessment.

14.4 Studies and Projects Planned for 2023

- Grit Piping Design
- VIU Odour monitoring study
- GNPCC Clarifier Coating Condition Assessment
- Biogas Safety System Improvements.
- Wellington Pump Station Ventilation and Capacity Increase Engineering Design
- VIU Odour Monitoring
- Receiving Environment Monitoring Review
- Cogeneration System Review
- Basement MCC Replacement Study
- ISO14001:2015 Surveillance Audit.
- Continuation of Covid-19 monitoring study with BC CDC.

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 2022 is discussed in Section 6.5.

15.2 Effluent Reuse

GNPCC can reuse effluent in operational processes for diluting polymer, which decreases the demand for potable water from the community's supply. In 2022, effluent was used as process water. Potable water was used as wash down water due to the disinfection capacity of the effluent reuse system.

15.3 Solid Waste Recycling

Wastewater Services has a general recycling program at the treatment plant, initiated as part of the department's ISO 14001 Environmental Management System, and continues to recycle waste oils, paints, and paint thinners.

15.4 Cogeneration

Cogeneration is discussed in Section 9.

16) Education Programs

16.1 Source Control

In November 2015, the Board approved the Source Control Bylaw No. 1730 to replace 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 promotes the Medications Return Program at public open houses and SepticSmart workshops.

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 Nanaimo, District of Lantzville, and other member municipalities.

16.3 Open House

The RDN did not schedule an Open House at GNPCC in 2022. Open Houses are occasionally offered to 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.

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/septicsmart.

No SepticSmart workshops were held in 2022.

In 2014, the RDN launched the SepticSmart 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 offered in 2022. To date, more than $300,000 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 2022, the following GNPCC projects were highlighted on the Get Involved page:

- Chase River Pump Station and Haliburton Street Sanitary Sewer Forcemain Upgrades
- Departure Bay Forcemain Upgrade
- North Slope Interceptor Erosion Protection Works

17) Conclusions

Table 38 provides a summary of the 2022 GNPCC permit monitoring data:

Table 25. GNPCC Summary of Compliance

Summary of Compliance	Permit	2022	Permit Exceedances
Maximum Daily Flow	80,870 m^3/day	104,451 m^3/day	4
Average Daily Flow	40,950 m^3/day	32,290 m^3/day	0
Average Daily $cBOD_5$	130 mg/L	7.69 mg/L	0
Average Daily TSS	130 mg/L	9.28 mg/L	0

17.1 Flows

Daily flow monitoring data for GNPCC for 2022 are presented in Appendix B. The total flow discharged from GNPCC in 2022 was 11,785,797 m^3, at an average annual flow of 32,290 m^3/day. There were four maximum daily flow non-compliances. Details of the non-compliances are reported in Section 4.1 of this report and in Appendix C.

17.2 Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)

The influent and effluent average $cBOD_5$ concentration for 2022 was 283 mg/L and 7.69 mg/L, respectively. The average removal efficiency was 97.1%. There were no $cBOD_5$ non-compliances in 2022, where the maximum permitted $cBOD_5$ concentration was exceeded.

17.3 Total Suspended Solids (TSS)

The influent and effluent average TSS concentration was 579 mg/L and 9.28 mg/L, respectively. The average TSS removal efficiency in 2022 was approximately 98.0%.

There were no TSS non-compliances in 2022 where the maximum permitted TSS concentration was exceeded.

17.4 Ammonia Nitrogen and Toxicity

The average ammonia nitrogen concentration in the effluent for 2022 was 19.6mg/L and the average toxicity (LC_{50}) of the effluent for 2022 was determined to be >100% (non-acutely toxic).

2022 effluent ammonia levels were reduced in comparison to results primary treatment due to the ammonia nitrification occurring in the secondary treatment process.

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

Results reported for 2022 for all general parameters, metals, volatile and semi-volatile compounds were all consistent with historical data. Several parameters showed reductions after the secondary wastewater treatment process was commissioned.

17.6 Biosolids Quality

The biosolids generated by the GNPCC in 2022 contained concentrations of metals and fecal coliforms which met the standards for Class B biosolids given in Schedules 3 and 4 of the OMRR. Biosolids are currently being land applied in a Forest Fertilization and a Soil Fabrication program.

Appendix A – Waste Management Permit No. PE00338 & Amendments

Province of
British Columbia

MINISTRY OF
ENVIRONMENT,
LANDS AND PARKS

BC Environment

Vancouver Island Region
Environmental Protection
2569 Kenworth Road
Nanaimo, British Columbia
V9T 4P7
Telephone: (604) 751-3100
Fax: (604) 755-2473

REGISTERED MAIL

Date: JUN 0 2 1994

File: PE00338

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

Dear Permittee:

Enclosed is a copy of amended Permit No. PE00338 issued under the provisions of the Waste Management Act. Your attention is respectfully directed to the terms and conditions outlined in the Permit.

The Ministry of Environment, Lands and Parks has established the policy that secondary treatment is the minimum level of treatment required for municipal sewage discharges to surface waters. This policy will apply to existing discharges with no or primary treatment, in stages, taking into account the assimilative capacity of the receiving environment, the ability to finance the upgraded sewage treatment facilities, population growth and public input to the waste planning process. Liquid Waste Management Plans (LWMPs) may be used to determine the schedule for upgrading to secondary treatment. The Regional District of Nanaimo has indicated its intention to develop a LWMP for School District 68. Please note the requirements of Section 4.1 of the Permit and, if necessary, contact this office for further discussion on this matter.

Section 3.3 of the Permit requires the Permittee to undertake a receiving environment monitoring program. L.J. Erickson, P.Bio., of this office should be consulted during development of the program.

Section 1.1.1 of the permit specifies average and maximum discharge rates which correspond to the present population served and the design capacity of the treatment works. Section 4.4 of the Permit states that the Permittee may be required to undertake an infiltration and inflow control program.

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.

The Permittee shall ensure that any discharge under this Permit meets the requirements of other regulatory agencies including, but not restricted to, Environment Canada and the Department of Fisheries and Oceans (Canada).

. . . 2

ACL 94/5/31
01-Jun-94

An annual Permit fee will be determined according to the Waste Management Permit Fees Regulation.

This Permit may be appealed by persons who consider themselves aggrieved by this decision in accordance with Part 5 of the Waste Management Act. Written notice of intent to appeal must be received by the Regional Waste Manager within twenty-one (21) days.

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 751-3100). Plans, data, and reports pertinent to the Permit are to be submitted to the Environmental Protection office at this address.

Yours truly,

G.E. Oldham, P.Eng.
Regional Waste Manager
Vancouver Island Region

Enclosure

ACL 94/5/31
01-6-94

PROVINCE OF
BRITISH COLUMBIA

Environmental Protection
2569 Kenworth Road
Nanaimo
British Columbia, V9T 4P7
Telephone: (604) 751-3100

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE00338

Under the Provisions of the Waste Management Act

Regional District of Nanaimo

6300 Hammond Bay Road

PO Box 40

Lantzville, British Columbia

V0R 2H0

is authorized to discharge effluent from a municipal sewage treatment plant located in Nanaimo, British Columbia to the Strait of Georgia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

1. AUTHORIZED DISCHARGES

1.1 The discharge of effluent to which this Section is applicable is from a municipal sewage treatment plant as shown on the attached Site Plan A. The B.C. Environment reference number (S.E.A.M. site number) for this discharge is E100008.

1.1.1 The rate at which effluent may be discharged is:

Average - $27{,}730 \times (1.0417)^{(\text{calendar year} - 1994)}$ m^3/d
to a maximum of 40,950 m^3/d

Maximum Daily - 80,870 m^3/d

1.1.2 The characteristics of the discharge shall not exceed:

5-Day Biochemical Oxygen Demand - 130 mg/L
Total Suspended Solids - 130 mg/L

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

Date issued: April 15, 1970
Amendment Date: JUN 0 2 1994
(most recent)
Page: 1 of 9

PERMIT NO. : PE00338

10-5-94

1.1.3 The works authorized are a headworks channel, screening facilities, grit and scum removal facilities, primary sedimentation facilities, sludge digestion facilities, sludge dewatering facilities, an outfall extending 2,030 m from mean low water to a minimum depth of 70 m below mean low water, diffuser, and related appurtenances approximately located as shown on the attached Site Plan A.

1.1.4 The works authorized must be complete and in operation on and from the date of this amended Permit.

1.1.5 The location of the works authorized, excepting the outfall and diffuser, is Lot 1, Plan 26263, District Lot 51, Wellington Land District.

1.1.6 The location of the point of discharge is the Strait of Georgia approximately as shown on the attached Site Plan A.

2. GENERAL REQUIREMENTS

2.1 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.

2.2 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.

2.3 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the consent of the Regional Waste Manager is obtained and confirmed in writing.

2.4 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.

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

PERMIT NO. : PE00338

ACL 94/5/31
01-6-94

2.5 Posting of Outfall

The Permittee shall erect a sign along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign requires the consent of the Regional Waste Manager.

2.6 Disinfection

Although disinfection of the effluent 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 will also be required.

2.7 Sludge Wasting and Disposal

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

2.8 Outfall Inspection

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

2.9 Facility Classification

The Permittee shall classify the wastewater treatment facility authorized in Section 1 (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 October 31, 1994.

2.10 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.

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

ACL 94/5/31
01-6-94

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) 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.

3. MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Flow Measurement

Provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over the preceding 24-hour period.

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

ACL 94/5/31
01.6.94

3.1.2 Sampling and Analysis

The Permittee shall install, provide, and maintain suitable sampling facilities and obtain composite samples and analyses of the effluent as follows:

Contaminant	Frequency
5-Day Biochemical Oxygen Demand	Daily
Total Suspended Solids	Daily
Ammonia Nitrogen	Quarterly
Toxicity	Quarterly

The following contaminants at a frequency of once every six months:

pH,	Cyanide (total),	Tetrachloroethylene,
Alkalinity,	Fluoride (dissolved),	Trichloroethane,
Chloride,	Iron (dissolved),	Trichloroethylene,
Nitrogen (total kjeldahl),	Lead (total),	
Oil and Grease,	Manganese(dissolved),	Benzene,
Phosphorous (total),	Mercury (total),	Ethylbenzene,
Sulphate (dissolved),	Molybdenum (total),	Toluene,
Sulphide (dissolved),	Nickel (dissolved),	
	Selenium (total),	Phenols,
Aluminum (total),	Silver (total),	Total Organic Carbon,
Arsenic (total),	Tin (total),	
Barium (dissolved),	Zinc (total),	2-EthylHexyl Phthalate,
Boron (dissolved),		Di-N-Butyl Phthalate,
Cadmium (dissolved),	Chloroform,	
Chromium (total),	Dichlorobromo-methane,	Naphthalene,
Cobalt (dissolved),	Dichloromethane,	
Copper (dissolved),	Methylene Chloride,	Polychlorinated Biphenyls.

Samples shall be composited in proportion to effluent flow over 24 hours. All sampling facilities, locations, techniques and equipment require the consent of the Regional Waste Manager.

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

Date issued: April 15, 1970
Amendment Date: JUN 02 1994
(most recent)
Page: 5 of 9

PERMIT NO. : PE00338

ACL 94/5/31
01-94

3.2 Biosolids Monitoring

The Permittee shall obtain a representative sample of the treated biosolids once every quarter and obtain analyses of the sample for the following:

Total Solids,	Arsenic,	Molybdenum,
Moisture,	Cadmium,	Nickel,
Volatile Suspended	Chromium,	Phosphorous,
Solids,	Cobalt,	Selenium,
Polychlorinated	Copper,	Zinc.
Biphenyls,	Lead,	
Total Kjeldahl Nitrogen,	Mercury,	

3.3 Monitoring of the Receiving Environment

The Permittee shall monitor the receiving water quality and carry out chemical, physical and biological studies on the receiving environment as required by the Regional Waste Manager.

The Permittee shall submit a proposed receiving environment monitoring program to the Regional Waste Manager by October 31, 1994 for approval. The program should be established in consultation with the Regional Waste Manager. Based on the results of this monitoring program, the receiving environment monitoring requirements may be extended or altered by the Regional Waste Manager. The approved program shall commence by January 1, 1995.

3.4 Monitoring Procedures

3.4.1 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, or by suitable alternative procedures as authorized by the Regional Waste Manager.

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, or by suitable alternative procedures as authorized by the Regional Waste Manager.

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

ACL 94/5/31

Copies of the above manuals are available from the Environmental Protection Division, Ministry of Environment, Lands and Parks, 777 Broughton Street, Victoria, British Columbia, V8V 1X4, at a cost of $20.00 and $70.00 respectively, and are also available for inspection at all Environmental Protection offices.

Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

3.4.2 Toxicity

Analyses for determining the toxicity of liquid effluents to fish shall be carried out in accordance with the procedures described in the "Provincial Guidelines and Laboratory Proceedures for Measuring Acute Lethal Toxicity of Liquid Effluents to Fish" November 1982. The Regional Waste Manager will advise the Permittee which method of measurement for expressing lethal toxicity shall be used. The method of sampling and the method of bioassay will be determined by the Regional Waste Manager.

Copies of the above manual are available from the Environmental Protection Division, 777 Broughton Street, Victoria, British Columbia, V8V 1X4, at a cost of $5.00, and are also available for inspection at all Environmental Protection offices.

3.5 Reporting

Maintain data of analyses and flow measurements, collected under Sections 3.1 through 3.3, for inspection and every quarter submit the data, suitably tabulated in a machine readable format, for entry in the Ministry of Environment, Lands and Parks computer database, to the Regional Waste Manager for the previous quarter. All reports shall be submitted within 31 days of the end of each quarter. The first report is to be submitted by October 31, 1994. Based on the results of the monitoring program, the Permittee monitoring requirements may be extended or altered by the Regional Waste Manager.

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

ACL 94/5/31
01-6-94

3.6 Annual Report

The Permittee shall submit an annual report which shall include a summary and interpretation of the data submitted under Section 3.5, an interpretation of the effects of the effluent and biosolids discharges on the receiving environment, and a summary of treatment plant operations, for the preceding calendar year. In addition, the Regional Waste Manager may require that the annual report include summaries and progress reports of the matters identified in Sections 4.2 through 4.8, and any 5Rs (Reduce, Reuse, Recycle, Recover, Residual) activities, for the preceding calendar year. The annual report shall be submitted within 60 days of the end of each calendar year and shall be made available by the Regional District of Nanaimo to the public upon request. The first annual report shall be submitted by February 28, 1995.

4. ADDITIONAL REQUIREMENTS

4.1 Liquid Waste Management Plan

The Regional District of Nanaimo has indicated its intention to develop a Liquid Waste Management Plan for School District 68. Accordingly, the Permittee shall submit a proposed schedule for the development of a Liquid Waste Management Plan to the Regional Waste Manager by October 31, 1994 for approval. The Plan shall be developed in accordance with ministry guidelines and shall include, but not be limited to, a schedule to upgrade the discharge to secondary treatment, an infiltration and inflow control program, a source control program, a stormwater management program, a biosolids management program, and an odour control program. All aspects of the Plan shall be to the satisfaction of the Regional Waste Manager.

4.2 Effluent Upgrading

The Permittee may be required to submit a schedule, for upgrading of the discharge to secondary treatment, to the Regional Waste Manager for approval. 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 and/or upgrade the discharge to secondary treatment.

4.3 Land Requirements

The Permittee shall secure and hold in reserve sufficient land to allow for future expansion and upgrading of the sewage treatment facilities to secondary treatment.

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

ACL 94/5/31
01.6.94

4.4 Infiltration and Inflow Control Program

The Permittee may be required to develop, submit to the Regional Waste Manager for approval, and implement an identification, remediation, and control program to reduce the quantity of infiltration and inflow into the sewage collection system.

4.5 Source Control Program

The Permittee may be required to implement a source control program and/or develop a sewer use bylaw to control the quantity and quality of wastes discharged into the sewer system.

4.6 Stormwater Management Program

The Permittee may be required to develop, submit to the Regional Waste Manager for approval, and implement a stormwater management program.

4.7 Biosolids Management Program

The Permittee may be required to develop, submit to the Regional Waste Manager for approval, and implement a biosolids management program.

4.8 Odour

Should objectionable odours attributable to the operation of the treatment plant occur, the Regional Waste Manager may require steps to be taken or works to be provided to reduce the odours to acceptable levels.

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

Date issued: April 15, 1970
Amendment Date: JUN 0 2 1994
(most recent)
Page: 9 of 9

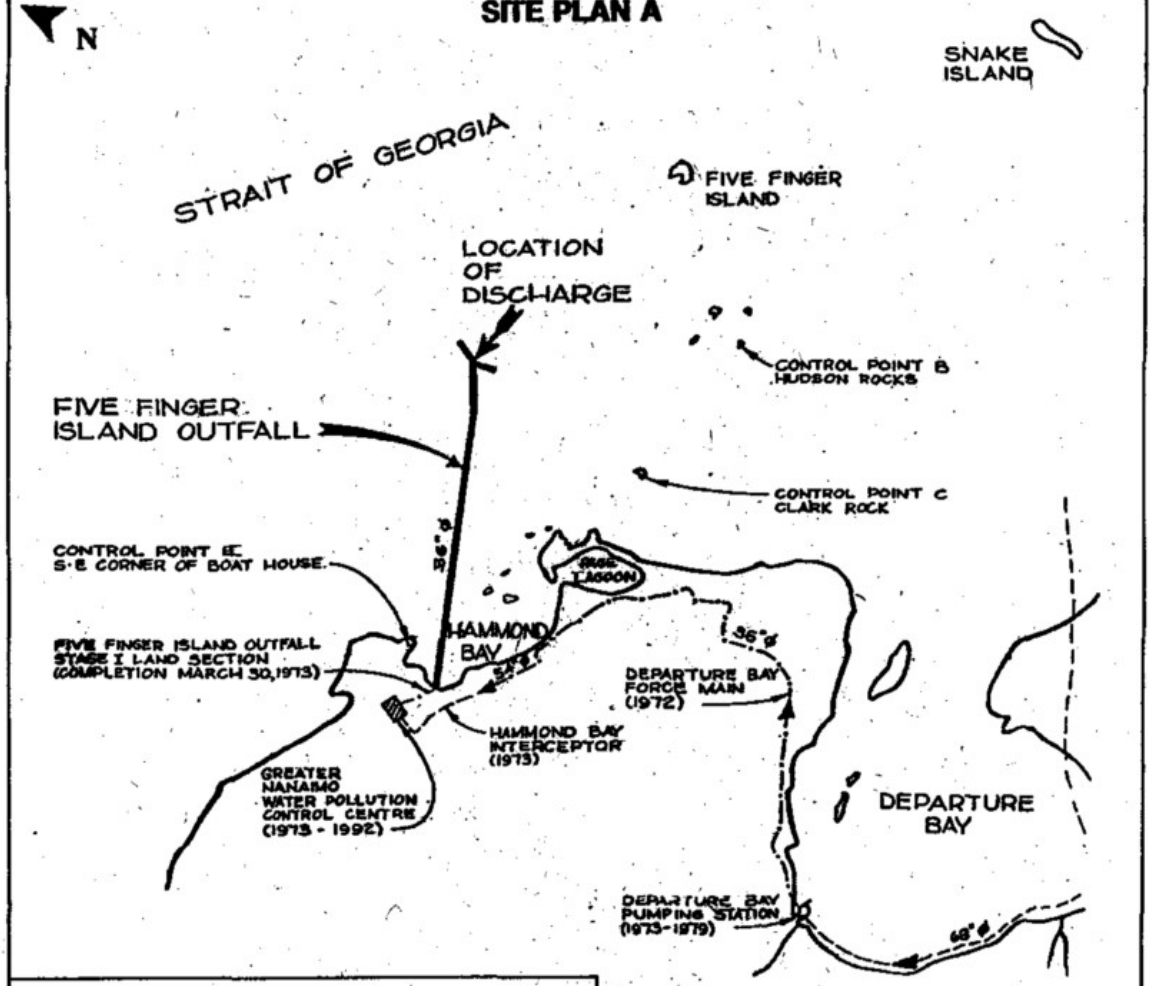
PERMIT NO. : PE00338

ACL 94/5/31
01-6-94

PROVINCE OF
BRITISH COLUMBIA

Environmental Protection

SITE PLAN A



Location Map

Scale: 1:36,000

Permit No.: PE00338

Date: JUN 0 2 1994

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

ACL 94/05/31
01-6-94

Province of
British Columbia

MINISTRY OF
ENVIRONMENT,
LANDS AND PARKS

BC Environment

Vancouver Island Region
Environmental Protection
2569 Kenworth Road
Nanaimo, British Columbia
V9T 4P7
Telephone: (604) 751-3100
Fax: (604) 755-2473

Date: AUG 11 1994

File: PE00338

REGISTERED MAIL

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

ATTENTION: W. R. Colclough, AScT
Director of Operational Services

Dear W. R. Colclough:

Re: Notice of Correction to Waste Management Permit No. PE00338, presently in the name of Regional District of Nanaimo

Further to recent related correspondence, we provide the following:

1. Section 1.1.1 of the permit has been corrected to specify a maximum daily effluent discharge rate of 80 870 m^3/day which corresponds to the maximum day design capacity of the treatment works.

   Please remove and destroy the original page in your permit package and replace it with the revised version enclosed.

2. Pursuant to Section 2.8 of the permit, your request to conduct video inspection of the outfall in lieu of dye testing is approved.

3. Your concerns regarding Sections 4.4 and 4.6 of the permit are noted. It is expected that a Liquid Waste Management Plan for School District 68 would address these items.

   Infiltration and inflow into the sewer collection system is a serious concern, and we remain supportive of efforts to address it.

. . . 2

Thank you for meeting with us. We understand that you have chosen not to proceed with your appeal, dated June 22, 1994, of the subject permit.

If you have any questions regarding the above, please contact A. C. Leuschen, Environmental Protection Officer, at 751-3100.

Yours truly,

G. E. Oldham, P.Eng.
Regional Waste Manager
Vancouver Island Region

GEO/acl/mg

encl.

BRITISH COLUMBIA

September 12, 2019

Tracking Number: 385715
Authorization Number: 338

REGIONAL DISTRICT OF NANAIMO
6300 HAMMOND BAY RD.
NANAIMO, BC V9T 6N2

Dear REGIONAL DISTRICT OF NANAIMO,

Re: Your application for an amendment to a Permit under the Environmental Management Act

Pursuant to Section 14(4) of the *Environmental Management* Act, Permit 338 is hereby amended as follows:

Adding the following to **Section 1.1.3**:

"After September 8, 2019, the works authorized are screening facility, grit and scum removal systems, primary sedimentation tanks, secondary treatment bioreactors, secondary clarifiers, sludge thickening systems, sludge digestion systems, sludge dewatering facility, an outfall extending 2,030m from mean low water to a minimum depth of 70m below mean low water, diffusers, and related appurtenances approximately located as shown in the attached Site Plan A."

All other terms and conditions of Permit 338 remain in effect.

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 rests with the permittee. This permit is issued pursuant to the provisions of the Environmental Management Act to ensure compliance with Section 120(3) of that statute, which makes it an offence to discharge waste, from a prescribed industry or activity, without proper authorization. It is also the responsibility of the permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties,and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the Environmental Management Act. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Ministry of Environment and Climate Change Strategy

Environmental Protection Division 2080-A Labieux Rd Nanaimo, B.C. V9T 6J9

Authorizations - South Region
Telephone: (250) 751-3100
Facsimile: (250) 751-3103

Administration of this permit will be carried out by staff from the Environmental Protection Division's Regional Operations Branch. Plans, data and reports pertinent to the permit are to be submitted by email or electronic transfer to the Director, designated Officer, or as further instructed.

Yours truly,

Bryan Vroom
for Director, Environmental Management Act

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

2022 Total Flows (Cubic Metres)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	40,521	33,634	43,421	31,723	24,107	29,241	26,045	27,597	27,592	25,978	26,528	27,928
2	89,592	33,369	42,508	31,189	24,191	28,417	25,774	27,770	27,071	26,213	26,289	27,846
3	70,939	33,664	38,975	39,545	23,360	31,704	30,118	27,459	25,902	26,889	32,166	28,955
4	55,379	32,777	36,596	48,776	22,991	31,851	31,093	26,817	25,492	26,417	30,884	28,906
5	48,406	31,819	34,985	41,202	25,135	33,812	28,246	27,309	27,490	26,742	29,795	28,409
6	47,305	32,260	34,336	37,376	30,651	31,528	30,046	26,376	27,097	26,388	35,283	28,486
7	50,248	31,744	33,464	35,343	30,240	29,936	27,949	27,248	26,549	26,469	28,301	35,296
8	46,549	32,070	32,191	38,250	22,241	29,454	27,720	27,521	25,406	25,919	28,343	37,141
9	48,456	31,238	31,702	32,799	22,155	34,396	27,889	27,461	26,330	25,835	27,852	51,361
10	58,423	30,945	31,413	42,157	21,522	31,840	27,977	27,387	25,187	26,642	26,499	68,071
11	76,383	30,537	31,270	37,548	28,636	30,678	27,396	26,960	26,956	26,494	26,836	45,806
12	95,867	30,083	31,837	40,034	34,463	31,188	27,680	27,541	27,278	26,215	26,211	39,085
13	66,295	30,730	32,403	37,277	30,186	29,232	27,111	26,253	28,402	26,230	27,016	35,113
14	53,703	29,356	33,891	40,623	29,992	28,963	26,724	27,338	27,102	25,599	26,756	34,054
15	47,164	29,668	33,115	33,573	38,149	30,099	27,644	27,387	27,384	25,457	26,892	32,719
16	44,053	30,740	32,483	32,409	35,161	30,614	26,456	27,439	26,316	26,412	26,526	31,347
17	41,031	29,529	36,475	32,332	33,054	28,812	27,230	27,580	26,126	22,869	26,495	30,468
18	39,560	29,000	35,601	44,440	33,331	28,453	26,612	27,206	26,731	25,259	26,179	29,978
19	40,876	29,200	34,684	37,797	31,590	28,998	27,263	27,433	27,184	26,238	26,251	28,916
20	40,924	29,055	34,403	37,575	32,405	28,791	27,068	27,038	26,493	25,910	26,813	28,568
21	38,230	30,365	40,555	38,683	30,491	29,527	27,031	27,387	26,450	26,232	26,750	28,414
22	36,703	29,059	40,496	34,842	30,360	28,462	27,039	28,157	26,964	25,583	28,173	28,821
23	36,523	29,082	37,361	30,372	31,743	28,092	26,168	27,518	26,417	26,335	26,692	32,282
24	33,171	28,581	35,338	24,359	31,084	27,939	27,183	26,424	25,976	27,224	26,578	70,269
25	35,599	28,539	34,751	23,823	29,689	27,196	27,745	28,566	27,090	27,024	27,103	75,919
26	31,518	35,779	35,892	22,814	30,276	27,826	27,213	26,389	26,792	26,336	27,119	94,915
27	34,520	43,426	36,373	21,905	28,995	27,909	27,451	25,941	26,410	30,216	28,251	104,451
28	32,298	45,452	34,953	21,674	28,776	27,827	27,231	26,375	25,085	26,636	27,450	62,114
29	32,745		33,758	27,653	29,396	27,782	27,117	27,554	26,306	26,411	27,813	54,491
30	36,856		32,960	33,892	30,151	27,107	26,270	28,209	26,621	28,204	28,632	54,689
31	35,411		32,109		29,431		26,413	27,755		26,231		46,541
Total:	**1,485,248**	**891,701**	**1,090,299**	**1,031,985**	**903,952**	**887,674**	**850,902**	**845,395**	**798,199**	**816,607**	**832,476**	**1,351,359**
Average:	**47,911**	**31,846**	**35,171**	**34,400**	**29,160**	**29,589**	**27,448**	**27,271**	**26,607**	**26,342**	**27,749**	**43,592**
Minimum:	**31,518**	**28,539**	**31,270**	**21,674**	**21,522**	**27,107**	**25,774**	**25,941**	**25,085**	**22,869**	**26,179**	**27,846**
Maximum:	**95,867**	**45,452**	**43,421**	**48,776**	**38,149**	**34,396**	**31,093**	**28,566**	**28,402**	**30,216**	**35,283**	**104,451**
Noncompliance (Max flow)	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**

Non-compliant days are highlighted in yellow.
Maximum daily flow: 80,870 m^3/day

Date	Secondary Bypass Flow (m3)
1/12/2022	2,185
12/26/2022	547
12/27/2022	6,191
Total	**8,923**

2022 Influent 5-day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$) (mg/L)

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1		244									388	
2								322				
3												
4	152				248					392		
5						188	252					
6									360			330
7												
8		298	299								347	
9								221				
10					324							
11	117									364		
12				223			266		452			
13												274
14						NR		292				
15			243								294	
16												
17					265							
18										222		
19				217		258	302					
20									300			311
21												
22		314	172					344			283	
23												
24					292							
25	262									385		
26				262			294					
27									320			81
28		278				322						
29			282								NR	
30								366				
31												
Average:	**177**	**284**	**249**	**234**	**282**	**256**	**279**	**309**	**358**	**341**	**328**	**249**

2022 Effluent 5-day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$) (mg/L)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	7.11	4.54	6.06	9.33	8.55	6.43	7.08	11.40	6.73	9.78	9.00	12.0
2	7.65	4.55	4.94	10.00	8.89	6.18	5.95	12.00	5.80	7.48	6.29	11.2
3	8.13	4.44	5.27	11.10	8.35	7.56	6.77	8.87	6.17	8.14	5.54	12.2
4	5.05	4.93	5.60	8.85	8.08	6.42	7.83	12.00	6.96	11.00	6.20	11.5
5	4.52	5.08	5.37	5.44	7.91	6.06	8.03	11.90	7.59	13.60	5.02	11.8
6	3.88	5.69	5.79	7.50	6.09	6.67	9.55	11.70	8.68	13.60	4.81	10.3
7	3.20	6.13	6.11	7.69	7.85	6.28	9.90	11.50	9.02	12.30	6.17	7.31
8	3.61	5.93	5.40	8.70	6.19	5.20	9.98	10.90	11.20	14.90	6.47	7.65
9	3.41	5.21	5.52	7.91	6.18	8.15	10.30	9.97	10.80	12.60	5.15	7.48
10	2.66	5.00	5.49	7.69	5.79	7.40	9.50	10.20	10.20	13.60	5.47	5.60
11	2.96	5.55	5.64	7.36	3.29	7.36	9.49	10.60	8.92	14.00	6.18	5.60
12	3.26	5.91	5.97	6.16	3.04	7.61	9.07	10.50	7.58	16.20	7.06	5.29
13	3.18	5.41	6.07	5.76	5.29	8.23	9.75	10.20	8.47	13.80	10.90	5.11
14	3.25	6.05	6.44	4.81	5.31	5.39	9.67	9.54	6.81	12.80	9.14	5.82
15	3.38	5.22	6.05	6.70	6.54	7.35	11.00	7.26	5.49	8.92	7.90	3.50
16	3.75	5.22	6.89	6.87	6.85	5.97	10.10	8.07	7.63	12.50	7.77	6.04
17	7.41	5.27	6.43	6.68	5.47	7.44	9.23	10.50	6.97	14.20	10.40	6.54
18	7.64	6.11	7.23	8.35	6.90	8.00	9.99	9.23	8.24	14.00	9.60	8.31
19	4.27	5.62	6.84	7.09	7.09	10.00	8.25	9.39	7.83	12.80	10.00	8.87
20	3.57	4.32	7.45	6.34	6.47	10.40	6.00	8.47	9.34	13.90	9.44	7.39
21	3.93	6.79	8.01	5.85	5.88	13.10	5.58	8.51	8.43	12.60	9.36	7.47
22	3.82	6.59	7.29	5.69	5.48	11.00	5.46	6.94	8.67	13.80	8.49	7.39
23	4.62	4.96	7.33	5.36	4.16	8.21	6.21	7.61	8.63	12.60	5.31	8.39
24	5.20	7.07	6.54	6.09	5.24	8.15	7.81	7.65	8.31	12.60	8.03	11.00
25	5.12	8.07	6.46	6.31	5.81	7.45	8.45	9.14	8.83	12.40	7.58	5.93
26	5.62	8.15	5.82	6.24	7.25	8.51	8.00	9.13	9.37	12.20	10.40	3.82
27	4.91	6.00	7.43	5.82	8.32	8.66	6.78	6.40	9.62	12.40	9.89	7.75
28	4.18	6.15	7.74	7.19	8.43	9.52	7.86	7.63	9.64	11.90	9.18	3.77
29	4.50		9.04	8.15	8.55	8.51	9.61	5.29	10.60	11.20	7.65	4.35
30	4.50		10.60	6.14	7.99	8.64	9.53	6.65	9.69	11.00	6.58	3.66
31	4.55		9.85		6.58		11.70	7.89		9.45		4.22
Average	**4.61**	**5.71**	**6.67**	**7.11**	**6.57**	**7.86**	**8.53**	**9.26**	**8.41**	**12.33**	**7.70**	**7.33**
Non compliance	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Non-compliant days are highlighted yellow,
GNPCC Maximum BOD_5: 130 mg/L

2022 Influent Total Suspended Solids (TSS) (mg/L)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1		392									617	
2								570				
3								533				
4	182				337			617		787		2050
5				270		413	627					723
6									1370		927	963
7											940	
8		623	390								500	
9								363				
10					433							
11										1060		307
12				445			437		1040			423
13											457	320
14						477		383			730	
15			340								657	
16												
17					463							
18										813		583
19				320		393	1350					597
20									490		447	397
21											543	
22		513	312					613			380	
23												
24					457							
25	358									470		270
26				348			437					137
27									560		797	137
28		367				413					743	
29			376								476	
30								1250		750		
31										1100		
Average:	**270**	**474**	**355**	**346**	**423**	**424**	**713**	**618**	**865**	**830**	**632**	**576**

2022 Effluent Total Suspended Solids (TSS) (mg/L)												
Day	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	10.3	8.34	5.00	10.8	7.70	10.5	9.20	13.4	7.12	8.66	11.2	15.2
2	10.1	8.00	3.84	11.5	8.12	9.17	8.50	14.8	6.34	12.4	8.80	15.6
3	11.5	7.34	4.50	11.6	8.00	9.80	10.3	13.8	6.50	12.2	6.40	12.0
4	6.38	6.50	5.00	10.0	9.82	9.80	9.68	15.8	8.50	14.3	6.40	14.0
5	5.40	6.84	4.16	6.3	8.50	9.00	11.4	18.4	9.88	16.3	4.20	13.6
6	5.00	6.30	4.20	8.8	8.83	6.40	16.0	18.5	10.8	15.2	5.50	10.8
7	5.50	7.70	4.20	11.2	8.00	7.75	19.2	16.8	12.6	15.4	4.86	9.71
8	4.67	5.80	3.60	12.0	6.50	11.2	22.2	18.0	14.0	14.8	6.20	8.20
9	4.80	6.00	3.33	8.50	7.12	10.5	18.0	21.2	14.8	17.2	5.80	9.00
10	4.00	7.50	3.34	8.66	7.17	9.16	13.9	19.5	11.0	13.4	6.28	6.80
11	3.50	6.33	4.17	9.34	3.50	9.66	11.4	17.0	12.4	16.0	9.20	6.28
12	5.66	7.34	6.00	5.50	5.50	9.25	12.0	14.2	10.0	20.4	8.20	6.00
13	1.50	7.67	4.90	6.00	7.00	9.25	13.6	12.5	10.7	17.0	7.80	7.00
14	5.50	6.00	5.80	5.34	5.83	7.84	12.0	13.8	10.8	16.4	8.00	7.86
15	4.16	5.50	5.84	5.34	7.38	8.83	13.0	13.6	10.5	16.0	8.00	6.14
16	3.84	5.50	6.50	6.00	8.62	8.16	9.50	12.2	12.5	13.8	9.40	7.28
17	4.50	5.67	8.16	7.60	7.50	9.50	8.80	16.4	9.5	14.8	8.80	6.42
18	8.16	7.00	7.50	8.50	7.33	9.50	10.2	15.2	10.0	12.0	10.8	7.71
19	7.84	4.50	6.84	5.80	7.83	11.5	8.80	12.2	9.65	13.6	10.3	9.86
20	5.33	6.34	7.30	7.50	8.50	11.6	7.40	12.2	10.2	14.6	9.2	10.2
21	5.00	5.00	8.40	7.33	10.8	13.4	6.67	13.6	8.33	14.2	10.0	9.43
22	6.34	5.30	7.50	4.17	4.00	12.8	7.00	8.2	6.66	13.8	8.43	9.28
23	5.80	6.00	10.0	7.84	5.75	11.0	7.66	13.2	8.66	12.8	9.80	8.20
24	6.10	5.83	5.00	6.10	6.84	12.6	8.14	12.0	8.33	11.8	9.40	7.71
25	6.66	8.00	6.00	6.00	8.00	14.0	9.43	7.60	8.84	12.0	8.80	6.86
26	6.50	6.33	6.34	7.00	9.98	14.0	8.16	8.00	10.7	11.6	8.00	3.86
27	6.83	5.83	8.10	8.34	12.80	14.2	8.00	9.20	11.5	13.2	8.57	14.0
28	7.84	5.00	8.60	9.65	12.00	14.6	9.00	7.84	12.0	15.8	10.0	5.00
29	6.84		10.30	9.67	10.70	12.0	10.0	9.00	12.2	10.0	11.4	3.90
30	6.40		9.85	9.82	9.40	9.8	11.2	10.2	11.2	10.4	12.8	4.30
31	6.00		10.80		10.8		12.2	8.50		9.20		5.30
Average:	**6.06**	**6.41**	**6.29**	**8.08**	**8.06**	**10.6**	**11.05**	**13.45**	**10.21**	**13.85**	**8.42**	**8.63**
Non-Compliance	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Non-compliant days are highlighted yellow.
GNPCC Maximum TSS: 130 mg/L

2022 Influent Temperature												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1		9.8									17.1	
2											18.1	
3								20.5				
4	12.5							19.4				
5				11.5	15.5			19.4		19.1		16.0
6						16.6	18.6					16.1
7									21.0		16.9	14.4
8		9.3	9.5								16.9	
9											16.0	
10								20.1				
11	10.8				15.7							
12				11.3						18.7		15.4
13							19.4		20.8			14.6
14											16.0	15.0
15			10.6			16.3		20.6			16.3	
16											16.1	
17												
18					15.1							
19				9.5						17.6		12.9
20						17.2	20.1					13.1
21									19.4		16.2	13.6
22		9.5	11.0								76.3	
23								21.4			16.3	
24												
25	11.2											
26				10.9						18.5		
27							20.2					14.0
28		12.4							19.7		15.7	14.7
29			11.2			19.3					15.8	
30											14.8	
31								20.8		17.9		
Average	**11.5**	**10.3**	**10.6**	**10.8**	**15.4**	**17.4**	**19.6**	**20.3**	**20.2**	**18.4**	**20.6**	**14.5**

2022 Effluent Temperature												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	12.1	13.1	14.6	14.8	15.4	17.6	20.2	22.1	22.4	20.3	16.9	13.6
2	13.8	14.2	13.9	15.0	15.3	18.6	20.2	21.6	22.3	20.6	16.0	14.3
3	11.4	13.5	13.6	14.8	15.8	17.4	19.5	21.2	21.8	20.6	17.6	14.6
4	12.4	13.6	13.8	15.2	15.3	17.3	18.6	20.9	21.5	20.4	17.1	13.3
5	11.9	14.0	14.0	14.4	15.2	17.3	19.4	20.6	21.4	20.4	16.4	13.9
6	13.0	13.8	14.1	14.8	15.9	18.2	19.6	21.4	21.2	20.9	16.3	15.6
7	12.8	13.7	14.0	14.0	15.9	17.8	19.8	21.8	21.5	20.3	15.2	14.8
8	12.3	13.6	14.0	15.0	15.4	18.5	20.0	21.9	20.8	20.4	15.6	15.4
9	14.1	13.4	14.0	14.6	16.0	17.6	20.0	22.6	20.7	20.0	15.4	13.4
10	12.7	14.4	14.0	14.1	16.0	18.4	20.2	21.7	20.7	20.8	16.6	13.4
11	13.2	14.4	14.0	14.2	16.2	18.5	20.6	21.4	21.5	19.4	16.2	13.2
12	12.0	14.2	14.3	13.8	15.5	17.7	20.8	21.5	21.4	19.2	16.1	14.3
13	14.4	13.8	14.5	14.4	16.3	17.9	19.8	21.1	21.4	19.0	16.0	14.0
14	14.4	14.1	14.4	14.2	16.1	18.0	20.6	21.3	21.1	19.7	15.7	14.2
15	13.1	14.4	15.0	14.5	15.7	17.7	20.0	21.4	21.3	20.0	16.1	13.6
16	13.2	14.2	13.9	14.2	16.6	17.5	20.0	21.8	20.1	19.0	15.6	13.8
17	13.2	14.7	14.4	15.4	16.4	17.8	18.9	22.0	20.0	18.4	15.6	13.7
18	14.0	14.4	14.6	14.2	15.8	17.9	20.2	22.3	20.0	18.2	14.8	12.8
19	14.8	14.9	14.4	14.2	16.2	19.0	20.4	21.8	20.0	18.8	15.0	12.2
20	13.8	14.2	14.4	13.6	16.5	18.5	20.6	21.6	20.8	19.3	15.0	11.8
21	13.8	14.9	13.2	15.3	16.9	18.1	20.6	21.8	20.3	17.9	16.0	11.5
22	13.3	12.8	13.8	15.0	16.5	19.2	20.7	22.0	20.2	18.0	16.0	12.8
23	13.6	11.8	14.6	15.6	17.6	18.4	20.7	22.6	20.4	17.6	15.4	13.8
24	14.0	14.4	14.3	15.2	17.2	19.5	21.0	22.0	20.0	17.4	16.0	14.0
25	13.8	13.8	14.6	15.6	16.6	19.4	21.5	22.0	20.4	17.0	15.9	13.7
26	13.0	13.8	14.7	15.2	17.0	20.2	22.5	22.0	21.1	18.4	15.3	14.5
27	13.2	14.4	14.8	15.4	17.4	20.8	21.6	21.2	20.4	17.6	14.9	12.3
28	13.6	14.2	14.2	15.1	17.0	20.5	22.3	21.4	20.2	16.6	15.2	14.0
29	14.2		14.5	15.8	17.0	19.5	22.2	22.0	20.1	17.8	14.7	12.6
30	13.6		15.0	15.5	17.4	19.6	23.0	22.4	20.5	17.4	14.7	13.2
31	13.4		14.6		17.2		22.4	22.5		17.8		13.6
Average	**13.3**	**14.0**	**14.3**	**14.8**	**16.3**	**18.5**	**20.6**	**21.7**	**20.9**	**19.0**	**15.8**	**13.6**

2022 Influent pH												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1											7.52	
2		7.30									7.32	
3								7.20				
4								7.20				
5	7.41				7.15			7.22		7.23		7.35
6				7.28		7.16	7.11					7.45
7									7.26		7.48	7.35
8											7.25	
9		7.38	7.33								7.38	
10								7.28				
11					7.38							
12	7.38									7.35		7.50
13				7.40			7.23		7.31			7.40
14											7.29	7.66
15						7.15		7.14			7.27	
16			7.38								7.40	
17												
18					7.33							
19										7.40		7.37
20				7.35		7.21	7.21					7.27
21									7.24		7.29	7.33
22											7.30	
23		7.37	7.47					7.26			7.24	
24												
25												
26	7.64									7.41		
27				7.30			7.22					7.20
28									7.32		7.29	7.27
29						7.46					7.53	
30			7.46								7.30	
31								7.15		7.39		
Average	**7.48**	**7.35**	**7.41**	**7.33**	**7.29**	**7.25**	**7.19**	**7.21**	**7.28**	**7.36**	**7.35**	**7.38**

2022 Effluent pH												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	7.07	6.76	7.14	7.07	6.88	6.92	7.04	6.94	7.06	7.21	7.38	7.08
2	7.04	6.80	7.02	6.96	6.92	6.94	6.97	7.02	7.03	7.20	7.41	7.12
3	7.02	6.72	7.08	7.00	6.90	6.89	6.90	7.07	7.06	7.14	7.26	7.08
4	6.86	6.75	7.03	7.02	6.88	6.92	6.40	7.12	7.06	6.89	7.16	7.13
5	6.92	6.79	7.08	6.87	6.76	6.96	6.30	7.19	6.83	7.00	7.10	7.19
6	6.96	6.80	7.10	6.92	6.90	6.90	6.74	7.34	7.12	7.04	7.00	7.26
7	7.02	6.84	6.99	6.94	6.88	6.95	6.68	7.42	7.16	6.98	7.02	7.16
8	6.98	6.88	7.05	6.98	6.92	6.95	6.54	7.52	7.18	7.00	6.88	7.12
9	6.94	6.92	7.04	6.92	7.02	6.94	6.72	7.50	7.20	6.96	6.92	7.03
10	7.02	6.90	7.04	6.98	7.00	7.00	6.78	7.48	7.28	6.90	6.90	6.96
11	6.94	6.90	7.09	7.11	6.98	6.93	6.96	7.40	7.27	6.92	6.84	6.86
12	6.91	7.01	7.07	7.02	6.94	6.82	6.93	7.42	7.38	7.00	6.84	6.90
13	6.94	7.00	7.15	7.06	6.95	6.94	6.95	7.37	7.35	7.06	6.88	6.90
14	6.95	6.98	7.10	7.08	6.96	6.96	6.97	7.34	7.36	6.97	6.99	7.10
15	6.90	6.96	6.96	6.96	6.90	6.82	6.82	7.33	7.40	6.67	6.86	6.90
16	6.95	6.96	7.03	6.88	7.00	6.98	6.94	7.04	7.30	6.88	6.94	6.94
17	6.91	6.96	7.01	6.90	7.02	6.91	6.88	7.26	7.32	6.98	6.94	6.90
18	6.85	7.07	7.00	6.86	6.96	6.78	6.94	7.34	7.26	7.02	6.96	6.93
19	7.03	6.96	7.00	6.92	7.00	6.84	6.98	7.22	7.21	6.82	7.04	7.02
20	7.10	6.96	6.98	6.93	6.92	6.95	6.90	7.30	7.11	6.84	7.14	7.07
21	6.98	7.02	7.01	6.98	6.91	6.90	7.04	7.22	7.18	6.86	7.11	7.08
22	6.98	7.11	7.00	6.80	6.82	7.04	6.94	7.15	7.16	6.84	7.15	6.97
23	7.00	7.10	6.96	6.90	6.86	7.11	7.06	7.14	7.18	6.83	7.12	7.01
24	6.99	7.06	7.00	6.70	6.89	7.02	6.94	7.17	7.24	6.95	7.07	7.00
25	6.86	7.08	6.97	6.88	6.84	7.08	7.18	7.18	7.18	6.92	6.96	6.84
26	7.02	7.12	6.94	6.90	6.88	7.09	7.17	7.21	7.24	6.86	7.10	6.91
27	7.06	7.12	6.96	6.92	6.87	7.14	6.98	6.95	7.22	6.94	7.10	6.94
28	6.99	6.98	7.00	6.88	6.87	7.03	6.97	6.92	7.20	7.04	7.06	6.75
29	6.89		7.00	6.92	6.88	7.16	6.93	7.11	7.16	7.12	7.04	6.80
30	6.84		7.00	6.98	6.96	7.12	6.96	7.08	7.26	7.18	7.02	6.95
31	6.76		6.98		6.93		6.97	7.10		7.30		6.87
Average	**6.96**	**6.95**	**7.03**	**6.94**	**6.92**	**6.97**	**6.89**	**7.22**	**7.20**	**6.98**	**7.04**	**6.99**

2022 Effluent Ammonia (Total N as mg/L)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	17.6	11.9	16.6	17.9	14.0	19.4	23.6	16.0	16.1	26.5	31.1	26.6
2	16.6	13.2	21.8	17.6	15.2	20.0	21.6	17.0	15.9	22.6	33.6	25.8
3	11.1	15.2	19.2	16.8	18.0	17.0	18.9	19.6	16.8	20.4	32.7	24.7
4	10.0	14.3	14.4	16.2	16.1	20.6	14.9	21.0	15.3	17.9	24.2	23.6
5	13.2	14.2	17.6	13.3	14.2	18.4	13.9	26.1	16.2	20.2	24.8	23.4
6	17.3	14.4	16.7	15.9	16.0	14.6	15.6	36.7	21.6	21.3	20.8	25.1
7	17.8	14.3	15.5	17.8	NR	17.0	11.6	38.2	22.3	17.8	13.6	24.0
8	17.6	14.4	20.3	18.2	17.0	18.4	10.6	36.4	21.7	20.0	15.8	22.2
9	16.6	15.8	21.6	17.6	17.4	21.5	14.7	40.2	26.7	19.4	18.2	19.8
10	16.8	16.4	21.6	18.8	18.8	18.6	13.7	44.5	27.8	17.2	15.4	15.0
11	11.6	17.6	18.8	17.5	16.6	17.4	10.8	41.0	29.2	19.4	15.5	11.0
12	11.6	20.7	15.8	19.0	22.4	14.8	12.0	46.0	33.0	21.0	15.5	13.3
13	10.8	20.2	17.4	20.0	18.0	17.7	15.2	40.8	36.6	21.4	17.7	17.7
14	13.4	17.0	16.2	20.2	17.6	16.8	15.5	35.2	37.8	14.2	14.6	17.4
15	15.2	17.8	13.7	18.0	19.4	15.8	12.6	39.4	33.9	12.5	17.2	18.0
16	15.0	17.2	15.6	14.8	17.6	19.8	14.5	33.4	34.0	15.0	20.5	19.0
17	13.3	18.2	15.2	17.9	16.2	17.8	11.6	32.6	29.6	15.8	20.3	17.3
18	16.0	19.1	15.0	19.1	19.0	15.8	13.8	33.8	23.2	13.9	21.2	18.0
19	18.9	18.3	15.0	14.4	19.0	17.5	17.0	31.3	21.4	14.0	24.4	19.8
20	17.6	18.0	12.4	16.1	16.9	16.1	16.2	34.1	20.6	14.0	23.0	21.3
21	17.6	18.4	14.1	18.0	15.8	18.1	16.4	33.3	20.8	14.0	21.9	20.8
22	18.9	17.3	13.0	16.8	14.1	23.4	16.2	25.2	23.5	12.0	23.4	19.8
23	16.6	20.9	14.4	15.1	16.7	22.7	17.1	23.6	28.8	12.7	22.8	22.0
24	14.2	22.0	16.5	14.2	17.0	24.2	14.8	23.2	25.5	13.8	20.2	22.4
25	15.2	24.6	14.0	17.2	16.6	25.8	18.7	26.2	23.0	14.4	21.0	11.0
26	15.6	26.8	16.3	19.3	14.4	22.5	17.8	19.9	23.3	13.6	23.4	10.8
27	17.1	21.1	14.5	16.6	16.0	20.6	20.2	14.8	26.7	15.6	23.0	10.0
28	15.4	17.8	15.0	16.2	17.4	24.8	16.4	17.2	23.8	16.4	20.2	9.3
29	14.8		16.0	19.5	18.7	29.8	16.2	15.4	25.6	20.2	17.6	12.2
30	13.2		15.0	17.7	15.6	23.0	16.7	16.6	24.6	22.8	26.3	13.7
31	11.2		15.8		17.0		15.3	18.8		26.6		11.0
Average	**15.1**	**17.8**	**16.3**	**17.3**	**17.0**	**19.7**	**15.6**	**29.0**	**24.8**	**17.6**	**21.3**	**18.3**

** Tested by both the Hach TNT and ISE methodology in 2022.

2022 Un-ionized Ammonia (Total N as mg/L)												
Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	0.056	0.019	0.053	0.057	0.052	0.0718	0.0873	0.094	0.095	0.196	0.2100	0.110
2	0.071	0.020	0.074	0.060	0.049	0.0580	0.0799	0.092	0.068	0.167	0.250	0.096
3	0.038	0.030	0.083	0.062	0.072	0.0460	0.0265	0.100	0.072	0.088	0.220	0.091
4	0.027	0.027	0.058	0.044	0.055	0.0760	0.0253	0.113	0.046	0.091	0.120	0.150
5	0.033	0.027	0.070	0.039	0.048	0.0589	0.0320	0.209	0.076	0.103	0.099	0.138
6	0.047	0.036	0.062	0.040	0.040	0.0500	0.0328	0.4950	0.110	0.100	0.098	0.130
7	0.057	0.036	0.057	0.057	0.000	0.0680	0.0220	0.485	0.165	0.066	0.046	0.082
8	0.051	0.033	0.075	0.049	0.063	0.0534	0.0212	0.491	0.139	0.086	0.043	0.082
9	0.056	0.043	0.086	0.056	0.059	0.0731	0.0382	0.430	0.140	0.091	0.062	0.067
10	0.045	0.041	0.093	0.060	0.060	0.0595	0.0466	0.601	0.236	0.074	0.052	0.040
11	0.031	0.056	0.075	0.056	0.048	0.0500	0.0313	0.414	0.342	0.105	0.036	0.037
12	0.039	0.083	0.068	0.082	0.114	0.0503	0.0384	0.465	0.353	0.099	0.039	0.035
13	0.037	0.065	0.070	0.086	0.061	0.0655	0.0654	0.326	0.370	0.109	0.051	0.051
14	0.036	0.058	0.060	0.069	0.065	0.0450	0.0527	0.356	0.382	0.048	0.039	0.047
15	0.038	0.060	0.047	0.052	0.083	0.0430	0.0403	0.335	0.230	0.034	0.058	0.045
16	0.034	0.055	0.053	0.050	0.076	0.0670	0.0420	0.267	0.230	0.051	0.076	0.044
17	0.036	0.058	0.052	0.061	0.055	0.0480	0.0464	0.411	0.219	0.059	0.069	0.052
18	0.043	0.076	0.048	0.048	0.051	0.0427	0.0511	0.270	0.125	0.035	0.078	0.041
19	0.060	0.059	0.038	0.036	0.065	0.0560	0.0799	0.232	0.092	0.060	0.090	0.054
20	0.060	0.077	0.037	0.055	0.058	0.0440	0.0697	0.252	0.110	0.052	0.108	0.079
21	0.056	0.074	0.045	0.072	0.043	0.0724	0.0656	0.266	0.140	0.035	0.103	0.071
22	0.064	0.069	0.032	0.045	0.037	0.100	0.0697	0.171	0.160	0.030	0.094	0.079
23	0.053	0.098	0.046	0.041	0.067	0.134	0.0684	0.160	0.200	0.055	0.098	0.070
24	0.036	0.088	0.053	0.048	0.046	0.100	0.0799	0.125	0.170	0.037	0.065	0.076
25	0.038	0.098	0.045	0.074	0.045	0.139	0.1380	0.194	0.196	0.039	0.067	0.029
26	0.039	0.110	0.055	0.077	0.046	0.144	0.0908	0.094	0.186	0.034	0.087	0.035
27	0.058	0.084	0.046	0.056	0.046	0.140	0.0949	0.040	0.180	0.050	0.1170	0.037
28	0.042	0.077	0.048	0.055	0.047	0.110	0.0705	0.074	0.160	0.082	0.095	0.025
29	0.030		0.054	0.066	0.080	0.203	0.0648	0.072	0.218	0.117	0.070	0.045
30	0.026		0.048	0.053	0.053	0.108	0.0785	0.098	0.160	0.110	0.120	0.040
31	0.022		0.051		0.046		0.0658	0.111		0.197		0.024
Average	**0.044**	**0.059**	**0.057**	**0.057**	**0.056**	**0.079**	**0.059**	**0.253**	**0.179**	**0.081**	**0.092**	**0.065**

** Tested by both the Hach TNT and ISE methodology in 2022.

Appendix C – Permit Non-Conformance Reports

Permit Non-Conformances

Date of Non-compliance	Describe the Issue	What was the Immediate Resolution?	Describe the Suspected Cause or Solution	Investigation Results
GNPCC FLOW (x4)				
January 2, 2022	On 2022 January 2 the GNPCC effluent flow was 89,592 m3, which exceeded the permit allowance of 80,870 m3.	The GNPCC Chief Operator was notified	Infiltration due to rapid snow melt.	This permit flow exceedance was a result of heavy snow melt combined with an atmospheric river event. All four pumps were required at DBPS to prevent rising levels, and no spills occurred. Excessive inflow and infiltration entered the RDN sewer system during this event. The WWTP at GNPCC handled the high flows wells without any plant upset.
January 12, 2022	On 2022 January 12th the GNPCC effluent flow was 95,867 m3, which exceeds the permitted allowance of 80,870 m3/day.	The GNPCC Chief Operator was notified	Infiltration due to heavy rainfall	Flow was exceeded due to a wet weather atmospheric river event, and inflow and infiltration increased to allow excessive flow into the sanitary system. The RDN is working with the CON towards reduced I&I.
December 26, 2022	The flow rate for GCPCC on December 26, 2022, is recorded as 94915 m^3/d which is over permit.	Chief and senior operator plus the superintendent were notified via email		While the ground is saturated, above normal wet weather triggered the flow permit limit. This will be addressed in the new Operational Certificate that will be issues in the coming weeks for GNPCC. The requirements as per the new OC have incorporated these bypasses and the plant is allowed 35 days in a calendar year to bypass the flows in exceedance of 60,000 m3/day
December 27, 2022	Flow rate for December 27, 2022, is recorded as 104451 m^3/d which is over the limit.	Chief and senior operator and superintendent were notified.		While the ground is saturated, above normal wet weather triggered the flow permit limit. This will be addressed in the new Operational Certificate that will be issues in the coming weeks for GNPCC. The requirements as per the new OC have incorporated these bypasses and the plant is allowed 35 days in a calendar year to bypass the flows in exceedance of 60,000 m3/day

Appendix D – External Laboratory Test Results

2022 GNPCC EFFLUENT								
Parameter	Units	15-Mar-22	05-Jun-22	06-Jun-22	20-Sep-22	07-Dec-22	08-Dec-22	Year End
pH*	pH units	7.0	-	7.0	7.2	-	7.1	7.1
Survival Rate (Rainbow Trout)*	%	>100	-	>100	>100	-	>100	>100
Dissolved Chloride	mg/L	-	200	-	-	100	-	150
Total Kjeldahl Nitrogen / TKN	mg/L	-	13.0	-	-	24.8	-	18.9
Oil and Grease (total)	mg/L	-	<1.0	-	-	<1.0	-	<1.0
Dissolved Sulphate	mg/L	-	43	-	-	27	-	35
Nitrate (as N)	mg/L	-	9.10	-	-	5.37	-	7.24
Nitrite (as N)	mg/L	-	1.51	-	-	0.456	-	0.983
Sulphide (total)	mg/L	-	0.027	-	-	0.016	-	0.022
Cyanide (total)	mg/L	-	0.00196	-	-	0.00111	-	0.00154
Fluoride	mg/L	-	<0.050	-	-	0.056	-	<0.053
Total Organic Carbon / TOC	mg/L	-	12	-	-	17	-	15
Total Phenols	mg/L	-	<0.0015	-	-	<0.0015	-	<0.0015
Polychlorinated Biphenyls / PCBs	ug/L	-	<0.050	-	-	<0.050	-	<0.050
METALS Scan by ICP								
Aluminum (total)	ug/L	-	9.8	-	-	22.4	-	16.1
Arsenic (total)	ug/L	-	0.47	-	-	0.46	-	0.47
Barium (dissolved)	ug/L	-	1.8	-	-	5.4	-	3.6
Boron (dissolved)	ug/L	-	224	-	-	183	-	204
Cadmium (dissolved)	ug/L	-	0.017	-	-	<0.010	-	<0.014
Chromium (total)	ug/L	-	<1.0	-	-	1.4	-	<1.2
Cobalt (dissolved)	ug/L	-	0.66	-	-	0.41	-	0.54
Copper (dissolved)	ug/L	-	13.3	-	-	14.7	-	14.0
Iron (dissolved)	ug/L	-	132	-	-	119	-	126
Lead (total)	ug/L	-	<0.20	-	-	0.38	-	<0.29
Manganese (dissolved)	ug/L	-	73.0	-	-	38.7	-	55.9
Mercury (total)	ug/L	-	<0.019	-	-	0.0034	-	<0.011
Selenium (total)	ug/L	-	0.13	-	-	0.17	-	0.15
Molybdenum (total)	ug/L	-	<1.0	-	-	0.17	-	<0.59
Nickel (dissolved)	ug/L	-	2.2	-	-	1.8	-	2.0
Silver (total)	ug/L	-	<0.020	-	-	0.027	-	<0.024
Tin (total)	ug/L	-	<5.0	-	-	<5.0	-	<5.0
Zinc (total)	ug/L	-	25.8	-	-	35.3	-	30.6
VOC Scan								
Chloroform	ug/L	-	2.8	-	-	3.0	-	2.9
Dichloromethane	ug/L	-	<2.0	-	-	<2.0	-	<2.0
Chloromethane	ug/L	-	<1.0	-	-	<1.0	-	<1.0
Tetrachloroethylene	ug/L	-	<0.50	-	-	<0.50	-	<0.50
1,1,1-Trichloroethane	ug/L	-	<0.50	-	-	<0.50	-	<0.50
1,1,2-Trichloroethane	ug/L	-	<0.50	-	-	<0.50	-	<0.50
Trichloroethylene	ug/L	-	<0.50	-	-	<0.50	-	<0.50
Benzene	ug/L	-	<0.40	-	-	<0.40	-	<0.40
Ethylbenzene	ug/L	-	<0.40	-	-	<0.40	-	<0.40
Toluene	ug/L	-	<0.40	-	-	<0.40	-	<0.40
Naphthalene	ug/L	-	<0.10	-	-	<0.10	-	<0.10
Phthalate Esters								
Di(2-ethylhexyl)phthalate	ug/L	-	<2.0	-	-	<2.0	-	<2.0
Di-n-Butylphthalate	ug/L	-	<0.80	-	-	<0.80	-	<0.80

2022 GNPCC INFLUENT		
Parameter	Unit	05-Jun-22
pH	pH Units	-
Alkalinity (total, as CaCO3)	mg/L	-
Ammonia	mg/L	-
Chloride	mg/L	190
Total Kjeldahl Nitrogen / TKN	mg/L	41.0
Oil and Grease (total)	mg/L	11
Sulphate	mg/L	42
Fluoride	mg/L	<0.050
Nirate (plus Nitrite) (N)	mg/L	<0.020
Total Organic Carbon / TOC	mg/L	45
Phosphorus (total)	mg/L	4.0
Sulphide (total)	mg/L	0.27
Cyanide (total)	mg/L	0.00264
Polychlorinated Biphenyls / PCBs	ug/L	<0.50
Total Phenols*	mg/L	0.037
METALS Scan by ICP		
Aluminum (total)	ug/L	271
Arsenic (total)	ug/L	0.73
Barium (dissolved)	ug/L	52.1
Boron (dissolved)	ug/L	256
Cadmium (dissolved)	ug/L	0.071
Chromium (total)	ug/L	4.1
Cobalt (dissolved)	ug/L	0.62
Copper (dissolved)	ug/L	32
Iron (dissolved)	ug/L	2,310
Lead (total)	ug/L	2.40
Manganese (dissolved)	ug/L	74.8
Mercury (total)	ug/L	<0.019
Molybdenum (total)	ug/L	1.2
Nickel (dissolved)	ug/L	2.7
Selenium (total)	ug/L	0.40
Silver (total)	ug/L	3,750
Tin (total)	ug/L	<0.0050
Zinc (total)	ug/L	102
VOC Scan		
Chloroform	ug/L	4.8
Dichloromethane	ug/L	<2.0
Chloromethane	ug/L	<1.0
Tetrachloroethylene	ug/L	<0.50
1,1,1-Trichloroethane	ug/L	<0.50
1,1,2-Trichloroethane	ug/L	<0.50
Trichloroethylene	ug/L	<0.50
Benzene	ug/L	<0.40
Toluene	ug/L	0.81
Ethylbenzene	ug/L	<0.40
Naphthalene	ug/L	<0.10
Phthalate Esters		
Di(2-ethylhexyl)phthalate	ug/L	<20
Di-n-Butylphthalate	ug/L	<8.0

2022 GNPCC BIOSOLIDS															OMRR Regulatory Limits (Class B Biosolids)
Parameter	Unit	26-Jan-22	02-Feb-22	09-Mar-22	06-Apr-22	12-May-22	06-Jun-22	11-Jul-22	10-Aug-22	14-Sep-22	26-Oct-22	09-Nov-22	08-Dec-22	Average *	
Fecal coliforms nw (dry weight) (MPN / PA)	MPN/g	87,000	130,000	110,000	260,000	80,000	110,000	23,000	36,000	27,000,000	1,200	1,700	17,000	**60,000**	**2,000,000**
Percent Moisture	%	82	82	80	81	79	79	76	78	80	80	80	80	**79**	-
Total Solids	%	-	-	20.4	-	-	20.6	-	-	19.8	-	-	20.2	**20.3**	-
Volatile Solids	%	-	-	80.6	-	-	73.6	-	-	77.2	-	-	75.7	**76.8**	-
Total Kjeldahl Nitrogen / TKN	%	-	-	11.0	-	-	7.6	-	-	7.4	-	-	5.9	**7.98**	-
Phosphorus nw (total)	mg/kg	-	-	13,800	-	-	21,800	-	-	19,200	-	-	19,800	**18,700**	-
Polychlorinated Biphenyls / PCBs nw	mg/kg	-	-	<0.50	-	-	<2.5	-	-	<5.1	-	-	<2.5	**<1.6**	-
Arsenic nw (total)	mg/kg	-	-	2.18	-	-	2.52	-	-	2.39	-	-	1.93	**2.26**	**75**
Cadmium nw (total)	mg/kg	-	-	1.45	-	-	1.41	-	-	1.78	-	-	1.43	**1.52**	**20**
Chromium nw (total)	mg/kg	-	-	17.1	-	-	27.9	-	-	25.4	-	-	22.2	**23.2**	**1,060**
Cobalt nw (total)	mg/kg	-	-	3.13	-	-	2.56	-	-	2.67	-	-	3.11	**2.87**	**150**
Copper nw (total)	mg/kg	-	-	492	-	-	529	-	-	716	-	-	561	**575**	**2,200**
Iron nw (total)	mg/kg	-	-	11,300	-	-	37,700	-	-	31,400	-	-	33,700	**28,500**	-
Lead nw (total)	mg/kg	-	-	24.3	-	-	25.2	-	-	30.2	-	-	21.0	**25.2**	**500**
Mercury nw (total)	mg/kg	-	-	0.992	-	-	0.675	-	-	0.898	-	-	0.637	**0.801**	**15**
Molybdenum nw (total)	mg/kg	-	-	7.86	-	-	7.14	-	-	8.27	-	-	6.99	**7.57**	**20**
Nickel nw (total)	mg/kg	-	-	12.5	-	-	11.1	-	-	13.3	-	-	10.9	**12.0**	**180**
Potassium nw (total)	mg/kg	-	-	1030	-	-	872	-	-	958	-	-	847	**927**	-
Selenium nw (total)	mg/kg	-	-	4.74	-	-	4.89	-	-	5.69	-	-	4.72	**5.01**	**14**
Zinc nw (total)	mg/kg	-	-	808	-	-	874	-	-	1,140	-	-	889	**928**	**1,850**

* Note – Geometric Mean presented in this column for Fecal coliforms nw (dry weight) (MPN / PA)

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 Location: GNPCC - Odour (x3)					
3/7/2022	GNPCC	Resident at [redacted] Ney Drive experiences "strong and lingering foul smell (odor of sulphur similar to gas) quite often (2-3 times a week lasting hours) especially when wind is from S, SE." "There have been times when the smell was so strong that I was experiencing symptoms such as headaches and burning eyes." Resident moved from Burnaby in September and has been experiencing this unpleasant situation ever since. Resident has two children and is afraid to open windows on the smelly days as he is concerned about exposing them to the smell and other potential toxic fumes coming with the odor.	No Damage	Called the complainant and got his voicemail, left a message that his complaint was received and to call me back at the plant to discuss. Visited the residence and was unable to detect any odors when I was there. Wind was out of the South, Southeast. There appeared to be no one home when I was there. No other actions at this time.	Due to the distance from the plant and the lack of odour when staff go to investigate it is not possible to identify the odour that is being detected by the resident. As arrangements to have the resident come to site for a tour have so far fallen through, we are unable to further determine if the odour that is occasionally detected at the residence is in fact originating from the treatment facility.
3/16/2022	GNPCC	Odour concern submitted through RDN online communication: Your Name: [redacted] Your Phone Number: [redacted] Location of odour Greater Nanaimo Pollution Control Centre Description [redacted] Ney Drive Hi, It is 9:40 pm and there is a strong lingering smell in the neighbourhood. This is happening 3- 4 times a week in the neighborhood. Regards.			Due to the location of the odour complaint and follow up steps taken to investigate the possible source of the odour, it is thought that the odour is not originating from GNPCC.
7/1/2022	GNPCC	Resident at [redacted] Hammond bay Rd emailed RCU to complain of a "nasty raw sewage smell" on Friday July 1st.		GNPCC staff were informed on Monday July 4th and [redacted] investigated the odour complaint. All the foal air fans and biofilter systems were working properly at GNPCC. [redacted] attempted to contact the resident at home at 2:15pm but no one was home at the time. No odour was noticed during the investigation.	As there was only one odour complaint after hours and nothing noted in the weather or plant logs, it is very difficult to identify the possible source of the odour that was reported.

Incident Location: Nanaimo Pump Stations (x3)					
2/18/2022	Wellington Pump Station	[redacted] beside WPS, and she emailed [redacted] on Friday evening Feb 18/22 at 7:24pm as she noticed an odour in the area, which may have been from our pump station.			As this odour complaint came in after hours and staff did not notice any odours or possible concerns when investigating the next day and [redacted] has not noticed the odour again in the area it is difficult to determine the possible source of the odour on the evening of Feb. 18th.
7/18/2022	Wellington Pump Station	An odour concern was placed via web submission for WPS by [redacted] at 12:28pm on July 18/22. Weather was mild and not hot, will minimal wind.			It is believed that due to the weather and minimal air movement around the pump station that odours from the wet well area were causing some odours to be detected outside the pump station. As the wet well fan is now off, this should assist in reducing the odours that could possibly be detected.
8/30/2022	Wellington Pump Station	A resident, [redacted]), called the GNPCC regarding a concern of odour at WPS. The caller was concerned as the wetwell exhaust besides the stairwell to the beach was blowing odourous air. The caller was concerned about the air quality and pathogens in the air as they were with their children. [redacted] spoke with [redacted] and told her that the chief operator would contact her. [redacted] called [redacted] regarding her concern, and told her that the exhausted air was acceptable and not a health hazard. It was explained that WSBC allows workers in the wetwell environment and that WSBC has hygienist working with them to ensure workers are safe and that the atmosphere is acceptable to occupy.			It was determined that the wet well exhaust fan was left on. A sign has now been put on the MCC door reminding staff to be sure the fan is turned off. The installation of a carbon filter on the exhaust fan outlet is being investigated.

Appendix F – Environmental Incident Reports

Environmental Incidents

Date of Occurrence	Incident Title	Quantity of Material Spilled	Accident Location	Incident Description	Extent of damage (if applicable)	Preventative Measures Identified	Notes	Conclusion for this Environmental Incident
GNPCC Fire Alarm (1)								
July 2, 2022	July 2/22 Dewatering Centrifuge #1 Control Panel Smoke	0	GNPCC Dewatering Building	At 1500hrs on July 2/22 the smoke/fire alarm sounded at the GNPCC dewatering building, and the NFD responded to the site. Smoke from the centrifuge #1 control panel set off the alarm in the building.	The NFD cleared the building of smoke, and under investigation noted a hot spot from the centrifuge #1 control cabinet capacitor, in the MCC room. The NFD then gave the all-clear for workers to re-enter the building. [redacted] was unable to contact RDN E/I, so contacted SHAW electrical, and [redacted] attended the site to inspect the centrifuge controls. [redacted] confirmed the faulty capacitor, and locked out the centrifuge to safe the equipment until further work could be completed on July 4/22.		On July 4/22 [redacted] investigated the centrifuge #1 control cabinet further for additional damage, and confirmed that the main drive capacitor had caught fire and faulted, but no further damage was caused. [redacted] replaced the faulty part, and handed the equipment back over to operations again. Centrifuge #1 will be operated during the daytime hours only, so that the control panel can be monitored by operations. [redacted] Notes: Findings: We have found that the only failed component was the capacitor for the VFD. This is great news in that the part is easy to change and relatively inexpensive when compared with changing out the entire VFD itself. Our actions will remain the same however; as we conduct root cause failure analysis, seek quotes for replacement parts that are aging or legacy, look at what our PM strategy is for these parts and how we manage it going forward. Operationally: Centrifuge #1 is back online and running and we are at a significantly lower risk level now. #3 Centrifuge is still offline as we await parts/service.	A follow up meeting was held on July 20th at GNPCC to discuss/investigate the incident that occurred on July 4th. It was determined that the smoke and subsequent small fire was from a capacitor that had failed. Some corrective actions were for electrical staff to identify and purchase spare capacitors for equipment with drives, VFD's etc. It was also identified that the Fire alarm procedure needs to be updated to reflect the need to isolate the energy source to an incident area. Lockout procedure doesn't identify requirement for electrical contractor to use their own locks

Appendix G – 2022 Biosolids Management Summary and Compliance Report

Regional District of Nanaimo

2022 Biosolids Management Summary and Compliance Report

February 2023

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 #1596-23

SYLVIS

TABLE OF CONTENTS

APPENDIX ONE – TABLES

APPENDIX TWO – FIGURES

APPENDIX THREE – PHOTOGRAPHS

1 PROGRAM OVERVIEW

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

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

In 2022, RDN biosolids were managed at three sites in the Nanaimo area: private forest lands off Nanaimo River Road ("Blackjack") and on Weigles Road ("TimberWest Properties") both managed by Mosaic Forest Management (Mosaic), and at the Nanaimo Forest Products Harmac Mill (Harmac).

At the TimberWest Properties, Class B GNPCC biosolids were used by SYLVIS in a forest fertilization 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. 2022 was the final year of operations at the TimberWest Properties, the biosolids management program was transitioned to the new Blackjack site in 2022.

At Blackjack, Class B GNPCC biosolids were used by SYLVIS in a forest fertilization and reclamation program. 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.

RDN biosolids were also managed in soil fabrication projects at the Harmac Nanaimo Pulp Mill. Class A FCPCC biosolids were managed by Harmac in a biosolids growing medium (BGM) under supervision of SYLVIS. While no Class B / GNPCC biosolids were delivered to the Harmac site in 2022, reclamation growing medium (RGM) containing Class B biosolids which were delivered in 2021 were used in landfill closure.

A total of 7,188 wet tonnes (wt) of RDN biosolids were produced in 2022: 5,897 wt from the GNPCC and 1,291 wt from the FCPCC (Table 1). Of the 7,188 wt produced, 5,095 wt (71% of annual production in 2022) were delivered to Blackjack, 802 wt (11%) were delivered to the TimberWest Properties, and 1,291 wt (18%) were delivered to Harmac (Table 2). Total RDN biosolids production in 2022 is greater than the five-year average annual production though consistent with the increased production following the implementation of secondary treatment operations at the GNPCC (Table 1).

2 REGULATORY AUTHORIZATION

RDN biosolids were managed at Blackjack under the *2021 Blackjack – Forest Fertilization Land Application Plan* (SYLVIS Document #1516-22) associated with Authorization #110732 valid May 16, 2021 to April 23, 2022 and under the *2022 Blackjack – Forest Fertilization & Reclamation Land Application Plan* (SYLVIS document #1525-22) associated with Authorization #111152 valid April 24, 2022 to April 23, 2023.

RDN biosolids were managed at the TimberWest Properties under the *2021 TimberWest Properties (Weigles Road) Reclamation & Forest Fertilization Land Application Plan* (SYLVIS

Document #1439-21) associated with Authorization #110825 valid August 5, 2021 to August 4, 2022.

GNPCC biosolids used to fabricate RGM at Harmac were managed under the *2022 Nanaimo Forest Products Harmac Mill - Reclamation Growing Medium for Landfill Closure Land Application Plan* (SYLVIS Document # 1463-21) associated with Authorization #111016. Class A FCPCC 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) or Authorization.

3 2022 BIOSOLIDS MANAGEMENT

This document contains information on the management of RDN biosolids in 2022 including a summary of contractual requirements for the forest fertilization and reclamation programs (Table 3, Table 4, Table 5), a biosolids program management summary (Table 2, Figure 1, Figure 2, and Figure 3), a biosolids quality summary (Table 6), a summary of historical management (Table 2), a map of areas applied in 2022 at Blackjack (Figure 4) and the TimberWest Properties (Figure 5) and, and photographs from the biosolids management projects (Photographs 1 to 3).

3.1 BIOSOLIDS MANAGEMENT SUMMARY

RDN biosolids were managed at the TimberWest Properties on Weigles Road in Nanaimo, BC for a portion of 2022 to complete the 2021-2022 extension contract between the RDN and SYLVIS as well as contingency management under the 2021-2026 contract. Contractual tasks completed under the 2021-2022 extension contact 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 in 2022 are summarized in Table 3. The biosolids management program was transitioned from the TimberWest Properties to Blackjack in 2022. The TimberWest Properties remain available as a contingency storage site.

In 2022, the majority of GNPCC biosolids were managed at Blackjack, on Nanaimo River Road in Nanaimo, BC. Contractual tasks under the 2021-2026 contract relating to biosolids quality monitoring, biosolids delivery coordination, site safety, environmental monitoring, public engagement, First Nations communications, sustainability activities, and reporting were completed in 2022 are summarized in Table 4.

RDN biosolids delivered to Harmac were managed by Harmac for production and use of reclamation growing medium (RGM) in landfill closure and production of biosolids growing medium (BGM) (Table 5). SYLVIS provided qualified professional oversight under contract to the RDN.

3.2 BIOSOLIDS TRANSPORTATION

In 2022, 5,095 wt of RDN biosolids (all from GNPCC) were transported by DBL Disposal to Blackjack (Table 2). Monthly tonnage delivered to this site in 2022 is shown in Figure 1.

In 2022, 802 wt of RDN biosolids (all from from GNPCC) were transported by DBL Disposal to the TimberWest Properties (Table 2). Monthly tonnage delivered to this site in 2022 is shown in Figure 2.

In 2022, 1,291 wt of RDN biosolids (all from FCPCC) were transported by DBL Disposal to Harmac (Table 2). Monthly tonnage delivered to this site in 2022 is shown in Figure 3.

3.3 BIOSOLIDS STORAGE

One large storage area exists at Blackjack and four storage areas exist at the TimberWest Properties and each consisting of an asphalt base with lock blocks delineating three sides of the stockpiles (Photograph 1 and 2). All five storage areas were utilized for biosolids stockpiling in 2022. 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. Following the transition of the biosolids management program from TimberWest Properties to Blackjack, one TimberWest Properties storage facility was decommissioned by Mosaic. Three remain available for contingency storage.

Harmac is not required to cover the stored biosolids when biosolids are incorporated into a fabricated soil medium (BGM or RGM) within 2 weeks of deliveries. Details of RGM storage are discussed in the Harmac Compliance Report. BGM is not subject to regulatory storage requirements in the OMRR.

3.4 2022 PRE-APPLICATION MEASURES

At Blackjack and the TimberWest Properties, site inspections were carried out by a SYLVIS Qualified Professional or designate prior to biosolids forest fertilization and reclamation. 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.

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. Currently stockpiled BGM and pre-BGM (material that has not undergone final mixing or certification by SYLVIS) is the product of Class A biosolids deliveries starting in June 2022.

3.5 BIOSOLIDS LAND APPLICATION

In 2022, 5,262 wt of RDN biosolids (all from GNPCC) were applied as a fertilizer and soil amendment at Blackjack (Table 2, Figure 1, Figure 4). Biosolids were land-applied to 51 hectares (ha) of forested lands for forest fertilization. Application rates were specific to the individual fertilization units based on pre-application soil sampling and nutrient requirements of the trees, understory vegetation, and soils. The biosolids application rate for forested land averaged 20.6 dry tonnes per ha (dt/ha) which does not exceed the maximum application rate specified in the

LAP for forest land (38 dry tonnes per ha). 2.8 hectares of disturbed land were applied with biosolids for reclamation at Blackjack. The average application rate for reclamation was 50.7 dt/ha which does not exceed the maximum application rate specified in the LAP for reclamation (52 dt/ha). At the end of 2022, 150 wt (all from GNPCC) remained in storage facilities at Blackjack in preparation for fertilization in 2023 (Table 4).

In 2022, 1,602 wt of RDN biosolids (all from GNPCC) were applied as a fertilizer and soil amendment to the TimberWest Properties (Table 2, Figure 2, Figure 5). Biosolids were land-applied to 33 hectares (ha) of forested lands for forest fertilization 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 9.9 dt/ha which does not exceed the maximum application rate specified in the LAP (23 dt/ha). At the end of 2022, no biosolids remained in storage facilities at the TimberWest Properties (Table 2).

Biosolids were land-applied in forested and reclamation areas using a side-discharge spreader equipped with a hydraulic fan which propels the biosolids up to 30 m into forest stands or across a reclamation area. All biosolids applications adhered to a 30-m setback distance from permanent water features and identified ephemeral water features. Biosolids land applications occurred throughout 2022 except during periods of extreme weather (i.e., snowfall, heavy rainfall, heat waves) or when the ground was snow-covered; land application operations were suspended during these times. For example, biosolids land applications did not occur in weeks of November and December when periods of snowfall or snow cover occurred.

Biosolids incorporated into RGM were land-applied at the Harmac landfill as a topsoil cover during landfill closure operations. In 2022, 5,107 m^3 RGM containing approximately 1,386 wt of biosolids were used as landfill closure on 1.8 ha of land (Table 2, Figure 3). Volumes of RGM produced and land-applied at Harmac are detailed in the Harmac Compliance Report.

In May 2022 approximately 3,000 m^3 of BGM containing 640 tonnes of RDN FCPCC biosolids was distributed offsite, as indicated by Harmac staff. As of the data of this report, approximately 8,500 m^3 of BGM and loosely mixed soil remain on site comprised of approximately 1,850 tonnes of FCPCC biosolids.

3.6 BIOSOLIDS QUALITY

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

Biosolids quality was characterized throughout 2022 to ensure biosolids met quality requirements for trace element concentrations, foreign matter, and pathogen reduction set forth in the OMRR.

In 2022, 440 dry tonnes (dt) of biosolids were produced by the FCPCC and 1,205 dt by the GNPCC. Three composite samples, each composed of eight equal-volume subsamples, were collected by SYLVIS at each the FCPCC and the GNPCC for a total of six samples. Composite samples were analyzed for physical parameters, nutrients, and trace elements (Table 6). All RDN biosolids samples collected in 2022 met the respective OMRR Class A and B criteria for trace elements.

The fecal coliform density of the eight samples collected by SYLVIS from the FCPCC in 2022 was <10 MPN/g in all samples (Table 6). For Class A biosolids each individual sample must meet the Class A criterion of 1,000 most probable number per gram (MPN/g).

SYLVIS collected 19 fecal samples from the GNPCC, the geometric mean of the sampling sets was 88,300 MPN/g (Table 6). For Class B biosolids the geometric mean of each set must meet the Class B criterion of 2,000,000 MPN/g.

3.7 SOIL MONITORING

Soil monitoring was conducted in potential reclamation areas at Blackjack in 2022. Soil samples, each comprised of 10 sub-samples from the top 0-30 cm, were collected by SYLVIS. Soil trace element concentrations were below 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.

3.8 REGULATORY COMPLIANCE

Biosolids management activities at Blackjack were carried out under Authorizations #110732 and #111152, and in accordance with the LAP applicable at the time of applications (SYLVIS Documents #1516-22 and #1525-22).

Biosolids management activities at the TimberWest Properties were carried out under Authorization #110825, and in accordance with the LAP applicable at the time of applications (SYLVIS Document #1439-21).

Regulatory requirements of the OMRR and specifications of the LAP were met including the requirements for rainy season storage, groundwater level during application, water feature buffers, biosolids quality, agronomic application rates, pre-application and predicted post-application soil concentration limits, and signage with the exception of the agronomic application rate for reclamation applications. Declarations of Land Application Compliance was provided to the RDN for biosolids applied at the TimberWest Properties and to Mosaic for biosolids applied at Blackjack.

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

3.9 CARBON ACCOUNTING RELATED TO BIOSOLIDS MANAGEMENT

+55 t CO2e of GHG emissions are asserted for transport of GNPCC biosolids to the Woodlot and Blackjack during 2022 under the 2021-2022 extension and the 2021-2026 contracts, while the management of 6,864 bt GNPCC biosolids at these sites in 2022 resulted in -1,662 t/CO2e of net emissions (emissions and emissions removals).

This carbon emissions estimate does not include transport of biosolids delivered in 2021 that were stored for applications in 2022 at the TimberWest Properties or Blackjack as this was presented in the 2021 report. This carbon emissions estimate considers biosolids storage, land application, and soil carbon sequestration; carbon sequestration related to tree growth is accounted for

separately by Mosaic and vehicle (i.e., pickup truck) emissions related to project operations are accounted for externally by SYLVIS.

4 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 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 observed[1] 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 biosolids forest fertilization at Blackjack were similar to those at the TimberWest Properties. In addition, the objectives of reclamation activities at Blackjack were to return disturbed lands, including landings and camps, to productive forest.

Confirmation of beneficial use of the RDN's biosolids is provided in the Qualified Professional Certification of Compliance reports following the completion of an Authorization and on monthly invoices sent to the RDN.

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.

5 REVIEW OF BIOSOLIDS TECHNOLOGY IMPROVEMENTS & ALTERNATIVE MANAGEMENT

The RDN requested a review of advancements in biosolids technologies and Canadian biosolids management. Below are the updates during 2022:

<u>Advancements in Canadian Biosolids Policy and Technology</u>

- Biochar carbon quantification methodology:
    - Verra's Verified Carbon Standard Program developed a methodology for quantifying carbon emission reductions from the production (pyrolysis, gasification, biomass boilers) and use of biochar, which includes biosolids as a feedstock. This lays the groundwork for acquisition of verifiable carbon credits from biosolids thermal treatment processes.

[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.

- Renewable natural gas expansion:
    - Net Zero Waste Abbotsford's organic waste composting facility plans to add anaerobic digestion and biogas production capacity to the facility – the biogas will be sold to FortisBC.
- Composting facility expansion:
    - TransAqua looks to expand its Moncton biosolids composting operation.
- Wastewater treatment plant upgrade:
    - Anaergia was contracted to upgrade a Petawawa, ON, wastewater treatment plant to accept organics with biosolids and produce biogas, which will fuel a combined heat and power system to power the treatment plant.
- Biosolids dewatering facility:
    - Construction of the new Iona WWTP dewatering facility was completed. This is one of the first steps in the Iona plant upgrades that will eventually produce dried biosolids pellets.
- Treatment plant upgrade:
    - The City of Winnipeg received funding towards the Phase 2 upgrade of its largest sewage treatment plant which will allow it to produce biosolids.
- Decentralized wastewater treatment and biosolids production:
    - Proteus Waters is bringing its decentralized wastewater treatment solution to Canada, capable of serving 250 people per day (2-4 sea-cans) to 3,500 people per day (10-15 sea-cans). The technology uses a membrane bioreactor to produce clean water and biosolids that can be converted into fertilizer or biodiesel.

Changes to Canadian Biosolids Management Programs

- Site-greening initiative on biosolids-amended marginal land:
    - Algoma steel partnered with Sault College, planting trees in a wind berm along the St. Mary's River on land where biosolids had been previously applied.
- Guelph Biosolids Master Plan:
    - The City of Guelph, ON, developed a new Biosolids Master Plan, emphasizing consideration of new technologies to manage biogas and recover energy (combined heat and power) and enhanced filtration (disk filters) to improve tertiary treatment (phosphorus removal) capacity (currently, sand filtration is used).

6 CONCLUSION

RDN biosolids were managed at Blackjack, TimberWest Properties, and at Harmac in 2022. 5,095 wt (71% of annual production in 2022) were delivered to Blackjack, 802 wt (18%) were delivered to TimberWest Properties, and 1,291 wt (11%) were delivered to Harmac (Table 2).

All biosolids land application activities at the TimberWest Properties occurred as specified in the applicable LAP and according to management requirements under the OMRR. The TimberWest Properties accepted over 52,000 wt of biosolids from 2007 to 2022 (Table 1). The biosolids management program was transitioned to Blackjack in 2022. In its first full year as a beneficial use site, over 5,000 wt of biosolids were managed at Blackjack as per the applicable LAPs and the site is being set up to become a successful long-term management site. Biosolids management at Harmac was completed through the fabrication of RGM and BGM.

SYLVIS looks forward to continuing this productive relationship and providing biosolids management services and support to the RDN throughout 2023.

APPENDIX ONE – TABLES

Table 1: Historical management of Regional District of Nanaimo biosolids at the TimberWest Properties, Harmac Landfill, and Blackjack from 2013 to 2022.

Year	TimberWest Properties	Harmac	Blackjack	Total Production
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
2022	802 wt	1,291 wt	5,095 wt	7,188 wt
Total	52,048 wt	7,015 wt	5,412 wt	64,475 wt

Table 2: Regional District of Nanaimo biosolids management summary - 2022.

Site	TimberWest Properties	Blackjack	Harmac BGM[a]	Harmac RGM[b]	Total
WWTP	GNPCC	GNPCC	FCPCC	GNPCC	
Class	B	B	A	B	
Storage from 2021	800	317	1,308	1,312[d]	**3,737**
Delivered	802	5,095	1,291	0	**7,188**
Land applied at site	1,602	5,262	0	1,386[d]	**8,250**
Distributed offsite	0	0	640	0	**640**
Storage to 2023	0	150	1,959[c]	0	**2,109**

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 2022.

d Tonnages are estimates based on soil volumes managed since 2017, leading to a difference of 74 wt which is indicative of the variability of the estimation and not indicative of material left on site. All RGM and Class B biosolids were land applied as of the end of 2022.

Table 3: Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2021-2022 extension contract for GNPCC biosolids management.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality monitoring was completed through the 2021-2026 contract detailed in Table 4 below.
Biosolids Quantity	No biosolids were delivered in 2022 under this contract. 800 tonnes of biosolids remaining onsite at the end of 2021 were land-applied in 2022. No biosolids remained stored at the TimberWest Properties at the end of 2022.
Biosolids Transportation and Delivery Coordination	No biosolids were delivered in 2022 under this contract.
Access Maintenance	Road quality status was monitored, no road maintenance on internal roads at the TimberWest Properties was required in 2022.
Contingency	No contingency biosolids management was required under this contract.
Storage of Biosolids	Biosolids were stored in four storage facilities at the TimberWest Properties and covered with tarps from October 1st to March 31st as per OMRR requirements. SYLVIS managed storage facilities throughout 2022. No repairs were completed on storage facilities in 2022 and decommissioning work was not required when the program was completed at TimberWest Properties.
Invoicing	Biosolids were invoiced on a monthly basis.
Environmental Incidents	No environmental incidents occurred in 2022 at the biosolids management site (TimberWest Properties).
Site Safety	No near-miss or safety incidents occurred at the biosolids management site (TimberWest Properties) in 2022. SYLVIS maintained COR and BC Forest SAFE safety accreditations in 2022.
Complaints Management	There were no complaints received about the biosolids forest fertilization program at the TimberWest Properties in 2022.
Annual Reporting	A Qualified Professional Certification of Compliance report, fulfilling the regulatory requirement for written certification under OMRR Section 5(3), was provided to the RDN for land applications at the TimberWest Properties.
Application Planning	SYLVIS mapped, planned, and notified all fertilized areas in 2022.
Nanaimo Mountain Bike Club Land Use Coordination	The Nanaimo Mountain Bike Club was notified of the completion of the biosolids management program at the TimberWest Properties.
Biosolids Beneficial Use	A Land Application Plan (Authorization #110207) was submitted on August 05, 2021. Under this contract 800 wt biosolids were land applied to fertilize forests (16.5 ha) to increase tree growth, soil development, and understory growth.

Table 3 (continued): Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2021-2022 extension contract for GNPCC biosolids management.

Record-Keeping	SYLVIS kept detailed records of all fertilization activities and environmental monitoring in 2022.
TimberWest Rules	SYLVIS maintained its BC Forest SAFE accreditation in 2022.
Construction	No works were constructed by SYLVIS at the TimberWest Properties in 2022. It was agreed upon between Mosaic and the RDN that constructed works were not required to be removed from the TimberWest Properties and ownership was transferred to Mosaic following completion of the program at the site.
Fires	SYLVIS followed a fire prevention protocol throughout 2022.
Hazardous Substance	No hazardous substances were introduced by SYLVIS to the TimberWest Properties in 2022.
Condition of TimberWest Lands	SYLVIS maintained the condition of the TimberWest Properties in 2022.
Equipment Storage	Except for temporary storage of heavy equipment during fertilization activities, SYLVIS did not store any equipment at the TimberWest Properties in 2022.

Table 4: Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2021-2026 Agreement for GNPCC biosolids management.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality was monitored throughout 2022 through the collection of three full suite samples and 19 fecal coliform samples.
Biosolids Quantity	317 tonnes of GNPCC biosolids were delivered in December 2021with the intent of applications in spring 2022. 5,095 tonnes of GNPCC biosolids were transported to the Blackjack site by DBL Disposal in 2022. 5,262 tonnes of GNPCC biosolids were land-applied in 2022. 150 tonnes of GNPCC biosolids remained stored at Blackjack at the end of 2022. 802 tonnes of GNPCC biosolids were delivered and applied at the TimberWest Properties in March and April 2022.
Biosolids Transportation and Delivery Coordination	The RDN coordinated biosolids deliveries with DBL and SYLVIS throughout 2022.
Contingency Plan and Management	A Contingency Plan was written for the 2021-2026 biosolids management contract and the following contingency sites were available for use in 2022: TimberWest Properties, Harmac, Hamm Road, 155-A Pit, and Haslam Pit. 802 tonnes of GNPCC biosolids were delivered and applied at the TimberWest Properties in March and April under the existing site authorization. No biosolids remain stockpiled onsite.
Storage of Biosolids	Biosolids were stored at the main storage area at Blackjack and covered with tarps from October 1st to March 31st as per OMRR requirements. During contingency management at the TimberWest Properties, biosolids were stored in two storage facilities at the TimberWest Properties and covered with tarps until March 31st as per OMRR requirements
Invoicing	Biosolids deliveries were invoiced on a monthly basis.
Environmental Incidents	No environmental incidents occurred in 2022.
Site Safety	No safety incidents occurred at active management sites (Blackjack and TimberWest Properties) in 2022. SYLVIS maintained COR and BC Forest SAFE safety accreditations in 2022.
Complaints Management	There were no complaints received about the biosolids forest fertilization program in 2022.
Odour Management Plan	The program Odour Management Plan was adhered to in 2022.

Table 4 (continued): Summary of SYLVIS 2021 deliverables as outlined in the RDN-SYLVIS 2021-2026 Agreement for GNPCC biosolids management.

Task or Activity	Description
Communications Plan & Engagement	The program Communications Plan was adhered to in 2022. Four inquires were received from the public regarding biosolids quality, the program timeline for transitioning the biosolids management program from the TimberWest Properties to Blackjack, application rates and illegal dumping at the TimberWest Properties, and potential impacts to wild game and plant harvesting. The RDN was included on all stakeholder responses. First Nations engagement was carried out with the Snuneymuxw First Nation for the Blackjack site through Mosaic during 2022. No questions or concerns were raised by the Snuneymuxw First Nation or other First Nations in 2022.
Annual Reporting	Qualified Professional Certification of Compliance reports, fulfilling the regulatory requirement for written certification under OMRR Section 5(3), were provided to the RDN for land applications at the TimberWest Properties and to Mosaic for land applications at Blackjack.
Biosolids Beneficial Use	Two biosolids Land Application Plans for Authorizations #110732 and #111152 were submitted on April 22, 2022 and May 6, 2022 for Blackjack. 5,262 tonnes of biosolids were land-applied to 51 ha of forest and 2.8 ha of disturbed land. Under this contract, 802 wt biosolids were land applied to fertilize forests (16.5 ha) at the TimberWest Properties under the existing Authorization and LAP to increase tree growth, soil development, and understory growth.

Table 5: Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2022 contract for BGM and RGM production using FCPCC biosolids.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality monitoring was completed throughout 2022. FCPCC biosolids continued to meet OMRR Class A criteria.
Biosolids Quantity	1,291 tonnes of RDN FCPCC Class A biosolids were transported to the Harmac site by DBL Disposal in 2022 for use as a feedstock in BGM production. 640 tonnes of biosolids (as a component of BGM) were removed from the site in 2022. ~1,850 tonnes (as a component of BGM) remained stored at the Harmac site at the end of 2022.
	No GNPCC biosolids were transported to the Harmac site in 2022. 1,386 tonnes of biosolids (as a component of RGM) were land-applied in 2022. All Class B biosolids and RGM were used in 2022 and none remained in storage at the end of 2022.
BGM Certification	BGM quality certification was issued by SYLVIS for the batch of BGM including deliveries up to May 2022.
Annual Reporting	The Harmac Compliance Report fulfills the regulatory requirement for written certification under OMRR Section 5(3).

Table 6: Regional District of Nanaimo biosolids quality summary - 2022.

Parameter	FCPCC	GNPCC	Regulatory Criteria		Units
	Class A	Class B	Class A[a]	Class B[b]	
# of samples	**3**	**3**	**-**	**-**	
Available Nutrients, Physical Properties, Acidity					
Total Nitrogen - TKN	45,894	59,997	-	-	µg/g
Ammonia + Ammonium- N (available)	2,797	5,100	-	-	µg/g
Nitrate - N	4	6	-	-	µg/g
Phosphorus (available)	563	1,287	-	-	µg/g
Potassium (available)	718	757	-	-	µg/g
Organic Matter	65.0	66.0	-	-	%
Total Solids	34.1	20.4	-	-	%
pH	6.6	6.9	-	-	pH
Electrical Conductivity	5.3	2.3	-	-	dS/m
Trace Elements					
Arsenic	1.2	2.4	75	75	µg/g
Cadmium	1.5	1.4	20	20	µg/g
Chromium	40	37	-	1,060	µg/g
Cobalt	2.0	2.9	150	150	µg/g
Copper	603	587	-	2,200	µg/g
Lead	15	24	500	500	µg/g
Mercury	0.58	0.55	5	15	µg/g
Molybdenum	4.6	8.3	20	20	µg/g
Nickel	11	15	180	180	µg/g
Selenium	1.4	2.3	14	14	µg/g
Zinc	1080	867	1,850	1,850	µg/g
Microbiological Analysis - Fecal Coliforms					
Fecal Coliforms	10[c]	88,300[d]	1,000	2,000,000	MPN/g

Note: All analyses based on dry weight.

a 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*.

b Class B trace element criteria specified in Schedule 4 and microbiological criteria in Schedule 3 of the BC *Organic Matter Recycling Regulation*.

c Value is the maximum of eight samples collected by SYLVIS throughout 2022.

d Value is the geometric mean of 19 samples collected by SYLVIS throughout 2022.

APPENDIX TWO – FIGURES

Figure 1: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) dewatered biosolids delivered and applied at Blackjack by month in 2022.

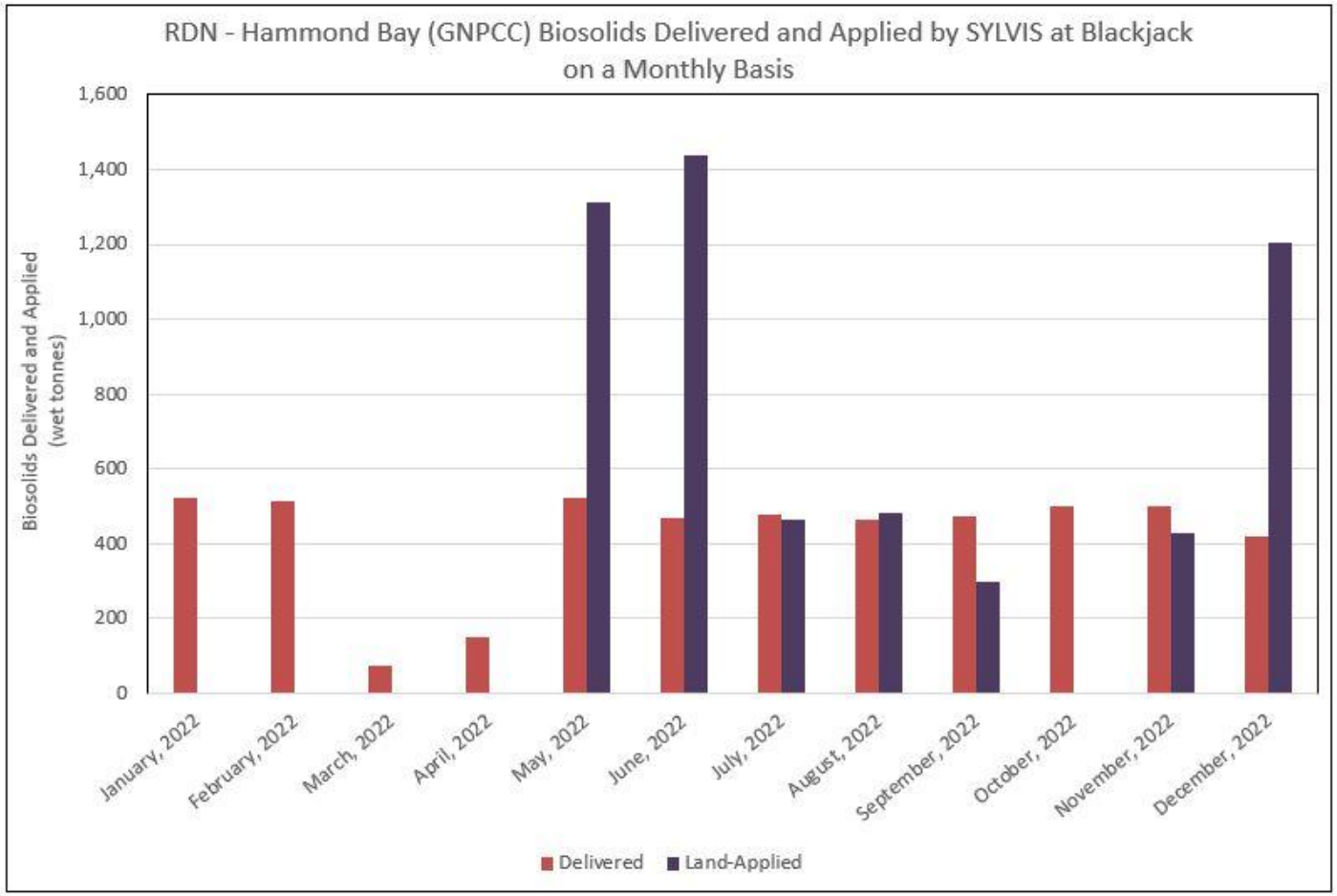
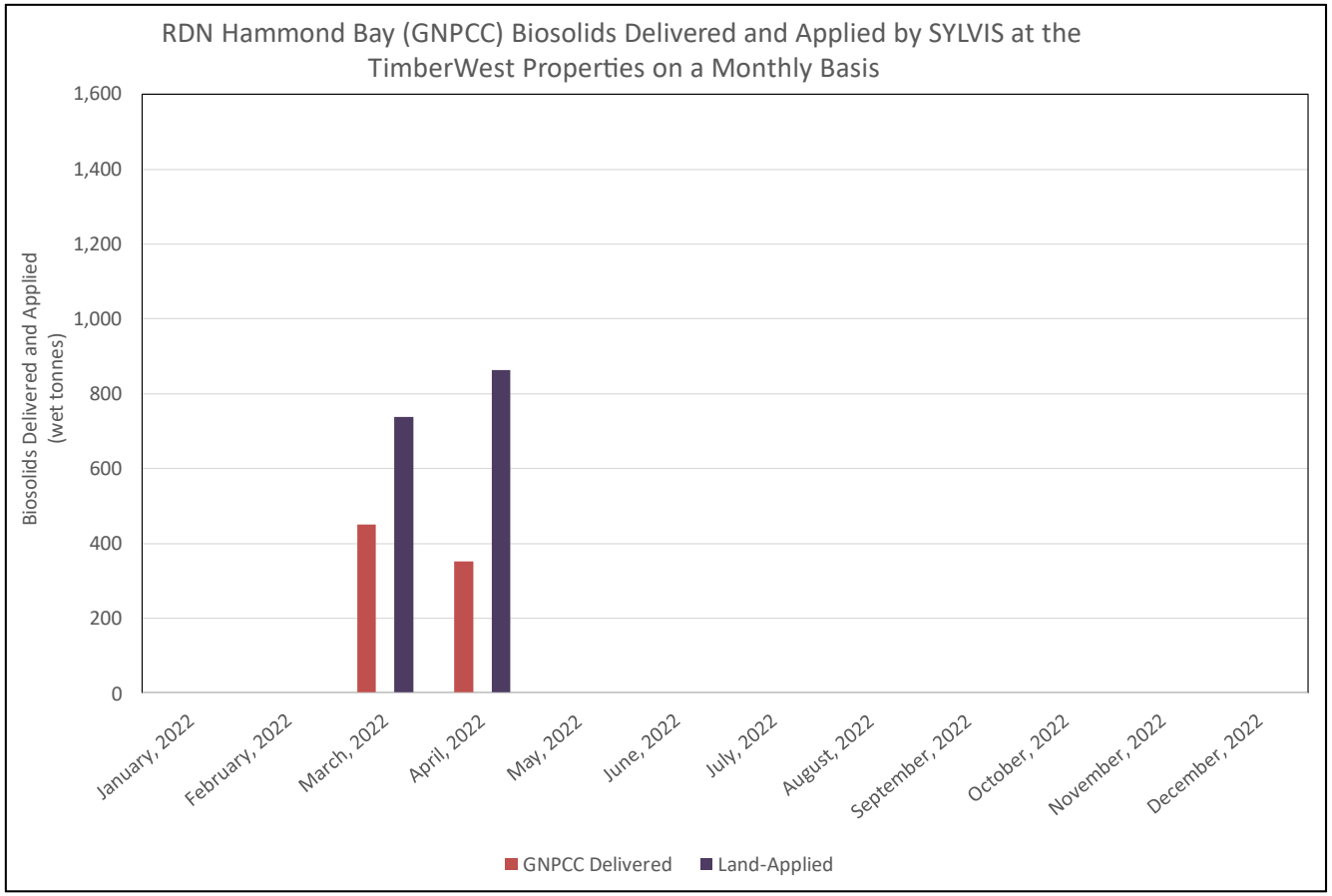
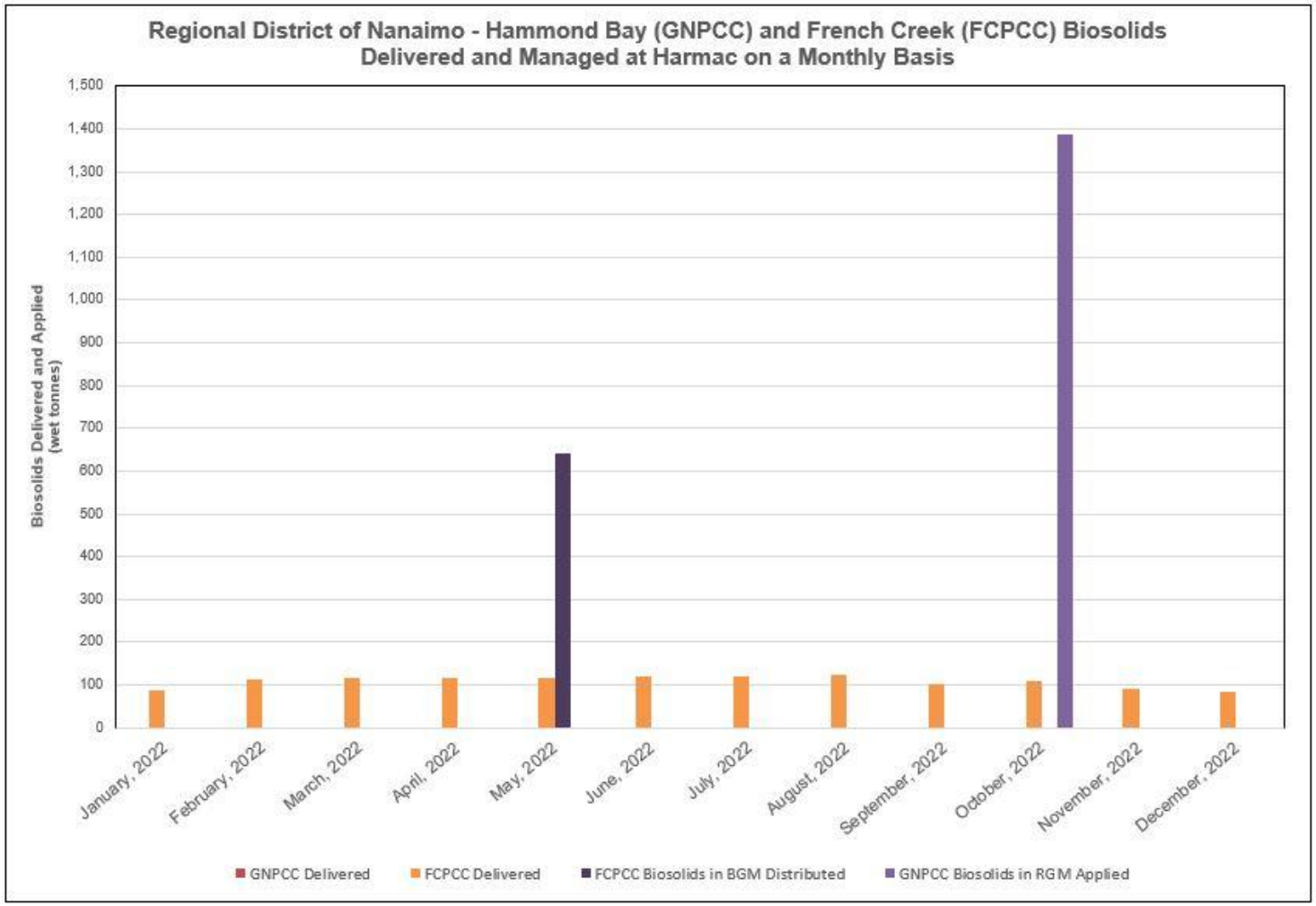


Figure 2: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) dewatered biosolids delivered and applied at the TimberWest Properties by month in 2022.



Note: 800 tonnes of GNPCC biosolids were stored from 2021 in anticipation of 2022 forest fertilization applications.

Figure 3: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) and French Creek Pollution Control Centre (FCPCC) dewatered biosolids delivered and managed at Harmac by month in 2022.



Note: The tonnages of biosolids applied/distributed are based on the volume of BGM and RGM distributed as indicated by Harmac.

Figure 4: Blackjack application areas fertilized with Regional District of Nanaimo biosolids in 2022.

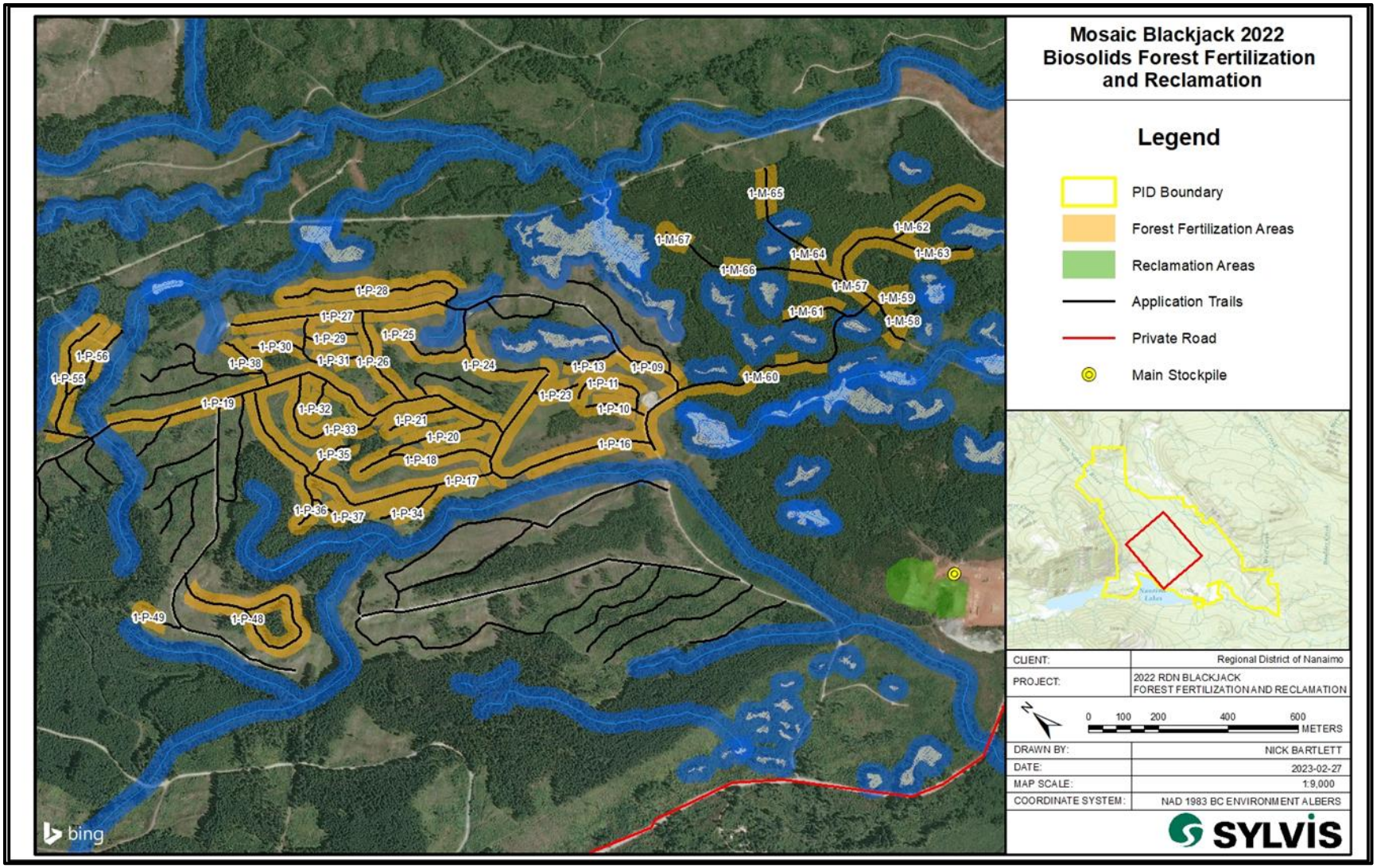
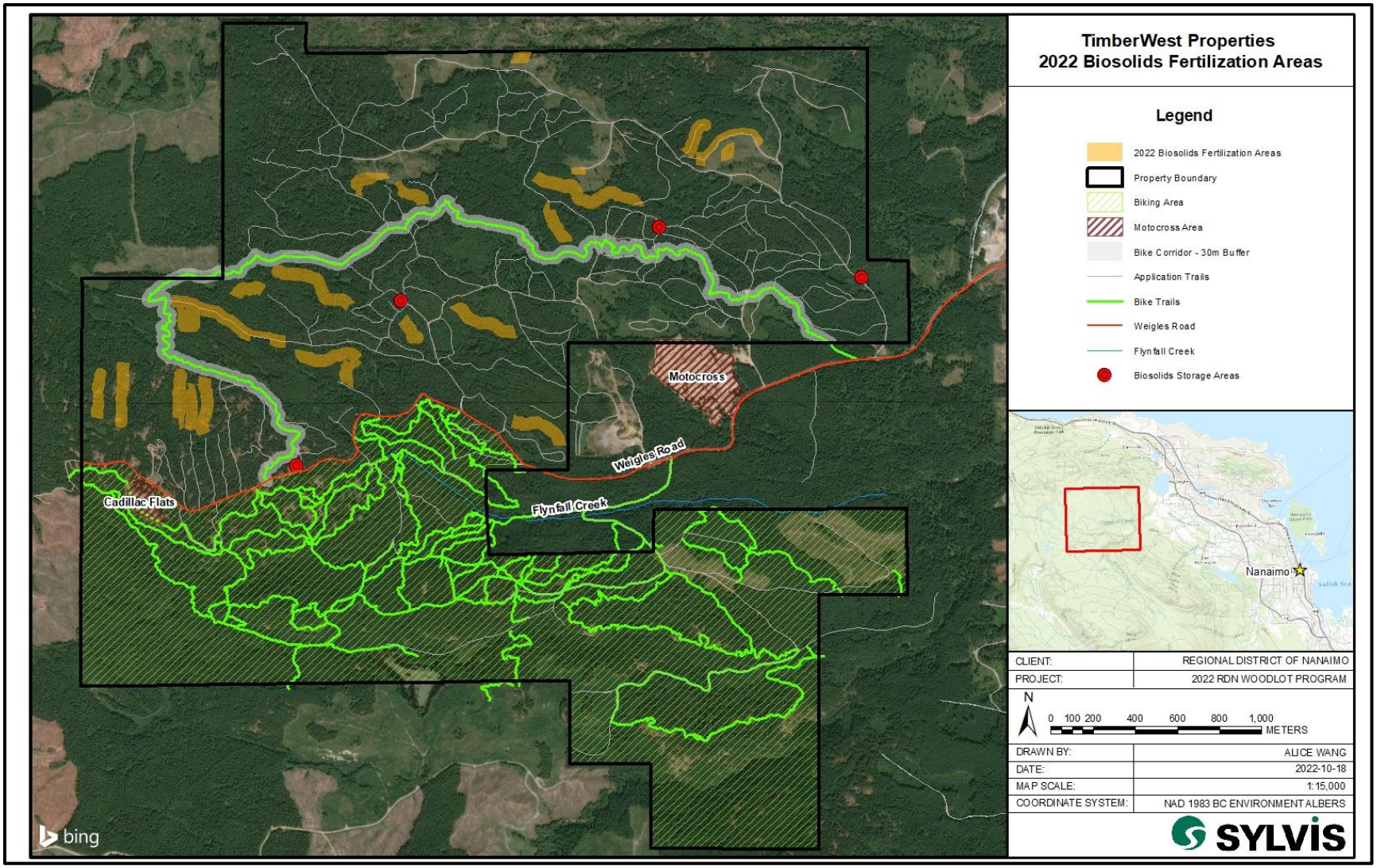


Figure 5: TimberWest Properties application areas fertilized with Regional District of Nanaimo biosolids in 2022.



APPENDIX THREE – PHOTOGRAPHS

Photograph 1: Storage area at the TimberWest Properties following completion of biosolids program. (June 2022)

Photograph 2: Main biosolids storage area at Blackjack. (September 2022)

Photograph 3: Forest fertilization using biosolids onto a mature forest block.
(July 2022)

Appendix H – GNPCC Annual Status Form (ASF)

Annual Compliance Status Form

AUTHORIZATION NUMBER: 338

AUTHORIZATION TYPE: Effluent, Permit

LEGAL AUTHORIZATION HOLDER NAME: Regional District of Nanaimo

PERIOD OF COMPLIANCE STATUS ASSESSMENT: 2022-01-01 to 2022-12-31

AUTHORIZED PERSON NAME: Adrian Limpus, Engineering Technologist - Wastewater Services

AUTHORIZED PERSON SIGNATURE: Adrian Limpus

SIGNATURE DATE: February 28, 2023

I understand that it is an offense to mislead a government official, and I declare that all of the information presented is accurate and true.
I have been given the authority by the authorization holder to sign this form.

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
1.1.1	The discharge of effluent to which this Section is applicable is from a municipal sewage treatment plant as shown on the attached Site Plan A. The B.C. Environment reference number (S.E.A.M. site number) for this discharge is E100008. 1.1.1 The rate at which effluent may be discharged is: Average - 27,730 X (1.0417)(calendar year-1994) m3/d to a maximum of 40,950 m3/d; Maximum Daily - 80,870 m3/d.	No	GNPCC had four non-compliances of the maximum daily flow permit limit of 80,870 m3/day in 2022 (January 2 - 89,592 m3/day, January 12 - 95,867 m3/day, December 26 - 94,915 m3/day, and December 27 - 104,451 m3/day). All of the non-compliances occurred during significant precipiation and/or during snowfall melt events. These non-conformances are believed to be attributed to inflow and infiltration (I&I) entering into the sanitary collection system. As part of the LWMP process, the RDN is working collaboratively with the City of Nanaimo to reduce I&I in the sanitary sewer collection system.	Section 4 - Flow Monitoring , Appendix B - Internal Flow Monitoring and Laboratory Data (Permit Data), and Appendix C - Permit Non-conformance reports.
1.1.1	The discharge of effluent to which this Section is applicable is from a municipal sewage treatment plant as shown on the attached Site Plan A. The B.C. Environment reference number (S.E.A.M. site number) for this discharge is E100008. 1.1.1 The rate at which effluent may be discharged is: Average - 27,730 X (1.0417)(calendar year-1994) m3/d to a maximum of 40,950 m3/d; Maximum Daily - 80,870 m3/day.	Yes	The average daily discharge for the facility to be 32,290 m3/day for 2022 which was below the maximum allowable average annual discharge of 40,950 m3/d.	Section 4 - Flow Monitoring and Appendix B - Internal Flow Monitoring and Laboratory Data (Permit Data)
1.1.2	The discharge of effluent to which this Section is applicable is from a municipal sewage treatment plant as shown on the attached Site Plan A. The B.C. Environment reference number (S.E.A.M. site number) for this discharge is E100008. 1.1.2 The characteristics of the discharge shall not exceed: 5-Day Biochemical Oxygen Demand - Total Suspended Solids - 130 mg/L, 130 mg/L	Yes	There were no BOD or TSS non-compliances in 2022	Section 5 .1 - Carbonaceous Biochemical Oxygen Demand and Section 5.2 - Total Suspended Solids
1.1.3	The discharge of effluent to which this Section is applicable is from a municipal sewage treatment plant as shown on the attached Site Plan A. The B.C. Environment reference number (S.E.A.M. site number) for this discharge is E100008. 1.1.3 After September 8, 2019, the works authorized are screening facility, grit and scum removal systems, primary sedimentation tanks, secondary treatment bioreactors,secondary clarifiers, sludge thickening systems, sludge digestion systems, sludgedewatering facility, an outfall extending 2,030m from mean low water to a minimum depth of 70m below mean low water, diffusers,	Yes	The authorized works are described as per the September 8, 2019 permit amendment.	Section 1 - Introduction
2.1	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.	Yes	On-site operators perform daily inspections and preventative maintenance on the pollution control works. There were no submitted notification reports of any malfunction of the works during the inspection period covered by this report.	
2.2	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.	Yes	There were no reported emergency events or conditions beyond the control of the Permittee which prevented the continuing operation of the approved method of pollution control during the inspection period; therefore, compliance with this requirement was not applicable.	Section 13 - Environmental Incidents and Appendix F - Environmental Incident Reports
2.3	The discharge of effluent which has bypassed the designated treatment works is prohibited unless the consent of the Regional Waste Manager is obtained and confirmed in writing.	Yes	No flow was discharged which bypassed the designated treatment works. However, there were secondary bypasses during high flow events on January 12, December 26, and 27 (see Section 4.2) . These flows received primary treatment. Permit requirements were met for the discharged final effluent (mixed primary and secondary effluent) The RDN is in conversations with the Ministry of the Environment and Climate Change Strategy (ENV) on a new draft Operational Certificate which will provide the ability for secondary bypasses during certain high flow conditions.	Section 4.2 - Secondary Bypass Flows and Appendix B - Internal Flow Monitoring and Laboratory Data (Permit Data)

Authorized Person Initial: AL

Date: Feb 28, 2023

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
2.4	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.	Yes	There were no changes to the treatment process in 2022. Secondary treatment was commissioned in October 2020. The RDN notified the BC Ministry of the Environment of this change as part of the permit amendment process.	Section 1 - Introduction
2.5	The Permittee shall erect a sign along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign requires the consent of the Regional Waste Manager.	Yes	An outfall sign reading "OUTFALL, 2100m LONG, 73 m DEEP" was installed on the shore along the alignment of the outfall line.	See 2022 GNPCC Outfall Inspection Report by GreatPacific Consulting Ltd.
2.7	Sludge wasted from the treatment plant shall be disposed of to a site and in a manner authorized by the Regional Waste Manager.	Yes	Biosolids generated by GNPCC in 2022 met Class B standards for biosolids in Schedule 3 and 4 of the Organic Matter Recycling Regulation (OMRR). Biosolids are currently being land applied in a Forest Fertilization and a Soil Fabrication program. The Annual Report also includes the 2022 Biosolids Management Summary from SYLVIS Environmental which includes a summary and interpretation of the effects of biosolids discharges on the receiving environment (Appendix G Section 4)	Appendix G (see Section 4 for a summary and interpretation of effects of biosolids discharged into the receiving environment).
2.8	The Permittee shall conduct a dye test on the outfall line (or inspect by another method approved by the Regional Waste Manager) every five years or as may otherwise be required by the Regional Waste Manager.	Yes	In November 2022, an outfall inspection was conducted and described in the Condition Inspection Report - Five Fingers Outfall prepared by Great Pacific Consulting, which will be submitted under separate cover to the Ministry. The inspection utilized a Remote Operated Vehicle (ROV) to record all notable features and components as it traveled along the entire exposed marine section of the pipe. A Ministry letter dated August 11, 1994 approves inspection "by another method" wherein Section 2. of the letter states, "Pursuant to Section 2.8 of the permit, your request to conduct video inspection of the outfall line in lieu of dye testing is approved".	Section 3.6 - Outfall Inspection
2.9	The Permittee shall classify the wastewater treatment facility authorized in Section 1 (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 October 31, 1994.	Yes	The Environmental Operators Certification Program (EOCP) database, which has since replaced the BCWWOCPS, confirms that the Facility is classified as a Level IV Municipal Waste Water Treatment (MWWT) system with the following facility details: Facility Number: 8 Classification Number: 103951, expiring on June 22, 2023.	EOCP Database

Authorized Person Initial: AL

Date: Feb 28, 2023

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
2.10	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) 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.	Yes	The EOCP database confirms the facility "Has Required Operator" and lists multiple operators of the Facility in employ with the RDN. There are two designated Chief Operators (both certified MWWT IV) listed in good standing and several certified MWWT II and MWWT III operators within the EOCP database, which satisfies the requirements of this section.	EOCP Database
3.1.1	Provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over the preceding 24-hour period.	Yes	A Parshall Flume flow meter was installed on January 2018 (replacing an ISCO Laserflow meter). Quarterly data reports submitted by the RDN include daily records of effluent volume discharged over the preceding 24-hour period.	Section 4 - Flow Monitoring
3.1.2	The Permittee shall install, provide, and maintain suitable sampling facilities and obtain composite samples and analyses of the effluent as follows: See PDF file "1994_06_02 338 - Section 3.1.2".	Yes	GNPCC is performing daily composite analysis for 5-Day Biochemical Oxygen Demand (cBOD5) and Total Suspended Solids (TSS), weekly composite sampling for Ammonia and quarterly grab samples for Toxicity(LC50). Comprehensive analysis of composite samples for all the remaining contaminants listed inthis section were conducted once every six months (June 5 2022 and December 7, 2022) as required by this section. Results are presented in Appendix D of the 2022 GNPCC Annual Report.	Section 5.1 5-Day Carbonaceous Biochemical Oxygen Demand (cBOD5), 5.2 Total Suspended Solids, Section 5.5 Other General Parameters, and Appendix D - External Laboratory Test Results.
3.2	The Permittee shall obtain a representative sample of the treated biosolids once every quarter and obtain analyses of the sample for the following: Total Solids, Moisture, Volatile Suspended Solids, Polychlorinated Biphenyls, Total Kjeldahl Nitrogen, Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molybdenum, Nickel, Phosphorous, Selenium, Zinc.	Yes	Quarterly sampling of treated biosolids was completed in 2022 which is of higher frequency than the quarterly sampling required in the permit. Samples were sent to Bureau Veritas for analysis which is an accredited lab.	Section 6.2 - Biosolids Analysis and Appendix D - External Laboratory Test Results

Authorized Person Initial: AL

Date: Feb 22, 23

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
3.3	The Permittee shall monitor the receiving water quality and carry out chemical, physical and biological studies on the receiving environment as required by the Regional Waste Manager. The Permittee shall submit a proposed receiving environment monitoring program to the Regional Waste Manager by October 31, 1994 for approval. The program should be established in consultation with the Regional Waste Manager. Based on the results of this monitoring program, the receiving environment monitoring requirements may be extended or altered by the Regional Waste Manager. The approved program shall commence by January 1, 1995.	Yes	The RDN Receiving Environment Monitoring Final Report (2017-2019) prepared by G3 Consulting was submitted to the Ministry on December 20, 2019. The RDN completed monitoring in 2020 and is undertaking a Receiving Environment Monitoring program review in 2021. The RDN submitted the 2020 REM report to the Ministry on December 17, 2020.	Section 3.5 - Receiving Environment Monitoring
3.4	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, or by suitable alternative procedures as authorized by the Regional Waste Manager. 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, or by suitable alternative procedures as authorized by the Regional Waste Manager. Copies of the above manuals are available from the Environmental Protection Division, Ministry of Environment, Lands and Parks, 777 Broughton Street, Victoria, British Columbia, V8V 1X4, at a cost of $20.00 and $70.00 respectively, and are also available for inspection at all Environmental Protection offices. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.	Yes	Flow was measured in 2022 by a Parshall Flume installed in the secondary upgrade. Flow measurements are totalized by GNPCC's SCADA system. Samples were obtained via automatic (composite) sampler that was used to withdraw effluent samples on a flow-proportioned basis over a 24-hour period which remained functional over the entire period.	Section 4 - Flow Monitoring
3.4.2	Analyses for determining the toxicity of liquid effluents to fish shall be carried out in accordance with the procedures described in the "Provincial Guidelines and Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluents to Fish" November 1982. The Regional Waste Manager will advise the Permittee which method ofmeasurement for expressing lethal toxicity shall be used. The method of sampling and the method of bioassay will be determined by the Regional Waste Manager.	Yes	Toxicity analysis is carried out as a an LC50 96-hour test (bioassay) . Samples were taken quarterly in 2022 and sent to Bureau Veritas which is an accredited lab. Toxicity test results are included as Appendix D in the Annual Report.	Section 5.3 Ammonia and Toxicity

Authorized Person Initial: AC

Date: Feb 28, 2023

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
3.5	3.5: Maintain data of analyses and flow measurements, collected under Sections 3.1 through 3.3, for inspection and every quarter submit the data, suitably tabulated in a machine readable format, for entry in the Ministry of Environment, Lands and Parks computer database, to the Regional Waste Manager for the previous quarter. All reports shall be submitted within 31 days of the end of each quarter. The first report is to be submitted by October 31, 1994. Based on the results of the monitoring program, the Permittee monitoring requirements may be extended or altered by the Regional Waste Manager.	Yes	Quarterly reports containing data and flow measurements were submitted to the Ministry throughout 2022 via the environmental reporting portal.	
3.6	The Permittee shall submit an annual report which shall include a summary and interpretation of the data submitted under Section 3.5, an interpretation of the effects of the effluent and biosolids discharges on the receiving environment, and a summary of treatment plant operations, for the preceding calendar year. In addition, the Regional Waste Manager may require that the annual report include summaries and progress reports of the matters identified in Sections 4.2 through 4.8, and any 5Rs (Reduce, Reuse, Recycle, Recover, Residual) activities, for the preceding calendar year. The annual report shall be submitted within 60 days of the end of each calendar year and shall be made available by the Regional District of Nanaimo to the public upon request. The first annual report shall be submitted by February 28, 1995.	Yes	The 2021 Annual Report was submitted to the Ministry on February 28, 2022 with the Annual Status Form (ASF) within the required 60 days of the end of each calendar year. The Receiving Environment Monitoring Final Report (2017-2019) was submitted as a separate document on December 20, 2019. The RDN submitted the 2020 REM report to the Ministry on December 17, 2020.	2022 GNPCC Annual Report and Annual Status Form. Section 3.5 Receiving Environment Monitoring.
4.1	The Regional District of Nanaimo has indicated its intention to develop a Liquid Waste Management Plan. Accordingly, the Permittee shall submit a proposed schedule for the development of a Liquid Waste Management Plan to the Regional Waste Manager by October 31, 1994 for approval. The Plan shall be developed in accordance with ministry guidelines and shall include, but not be limited to, a schedule to upgrade the discharge to secondary treatment, an infiltration and inflow control program, a source control program, a stormwater management program, a biosolids management program, and an odour control program. All aspects of the Plan shall be to the satisfaction of the Regional Waste Manager.	Yes	The Annual Report confirms that the RDN has a Liquid Waste Management Plan (LWMP). A Ministry letter dated October 30, 2014 confirms the Minister approval for an amended LWMP submitted in January 2014.	Section 16.5 Liquid Waste Management Plan
4.2	The Permittee may be required to submit a schedule, for upgrading of the discharge to secondary treatment, to the Regional Waste Manager for approval. 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 and/or upgrade the discharge to secondary treatment.	Yes	Secondary treatment achieved substantial completion in October 2020. A schedule for the upgrading of the discharge to secondary treatment was submitted as part of the approvals required for this project.	Section 1 - Introduction

Authorized Person Initial: AL

Date: Feb 28, 2023

REGIONAL DISTRICT OF NANAIMO

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

www.rdn.bc.ca