Nonquon Water Pollution Control Plant

2023 Annual Performance Report

The Regional Municipality of Durham
Nonquon Water Pollution Control Plant 2023 Annual Performance Report

Environmental Compliance Approval (ECA): 2207-9LKHLM Dated July 17, 2014

The Nonquon Water Pollution Control Plant (WPCP) 2023 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Nonquon WPCP in 2023. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of Environment, Conservation and Parks (MECP). This report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

Water Pollution Control Plant Process Description
General

The Nonquon WPCP located in the Community of Port Perry in the Township of Scugog is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECA. This MECP Class 3 wastewater treatment plant utilizes an extended aeration process with tertiary treatment and is designed to treat wastewater at a rated capacity of 5,900 cubic metres per day (m^3/d). The Nonquon WPCP has a service population of 9,370 residents.
Nonquon WPCP treats wastewater from the Port Perry service area utilizing the following processes;

- raw influent pumping,
- preliminary treatment,
- phosphorus removal,
- secondary treatment,
- tertiary treatment,
- disinfection, and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 51.4 kilometres of sanitary sewers in the Port Perry service area and is conveyed to the Nonquon WPCP by three sanitary sewage pumping stations (SSPS): Water Street, Reach Street and Canterbury Common SSPS.
The influent pumping station at the Nonquon WPCP allows raw wastewater flow more than the design flow of 5,900 m^3/d to passively overflow to the inlet chamber and be directed to one of the five equalization lagoons for storage. A gravity sanitary sewer pipe allows for lagoon effluent to be returned to the influent pumping station during periods of low flows, for full treatment.

Preliminary Treatment

Screening: There are two bar screens in the screening room for the removal of paper products and large material that could harm pumps and process equipment. One channel contains an automatic, mechanically cleaned bar screen and the other is equipped with a manually raked bar screen to provide screening on an emergency basis. A screenings washer/compacter utilizes plant effluent water to wash and compact the screenings. Screenings are removed in this process and transported to landfill for disposal.
Grit Removal: The vortex grit removal removes sand and small stones (grit) for the protection of mechanical equipment from unnecessary wear and reduce formation of heavy deposits in pipelines, channels and process tanks. The vortex grit removal chamber uses centrifugal force to separate the grit from the wastewater. Grit is collected in the lower portion of the grit tank and is pumped to a grit classifier for dewatering. The dewatered grit is conveyed to the grit/screenings bin for landfill disposal.

Phosphorus Removal

The phosphorus removal system lowers the total phosphorus level in the final effluent by adding a chemical coagulant, aluminum sulphate, as part of the treatment process. Aluminum sulphate can be added at multiple locations throughout the plant.

Secondary Treatment

Aeration Tanks: Preliminary effluent flow is directed to two aeration tanks comprised of two distinct zones. The first is a swing zone equipped with fine bubble diffusers. This zone is capable of being operated as an anoxic zone where no oxygen is introduced and allows for potential denitrification or an aerated zone where fine bubbled air is diffused into the wastewater. It is typically operated as an anoxic zone. The flow leaves the swing zone and enters the aerated zone where fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics and nutrients. Prior to entering the secondary clarifiers, the two aeration tanks are equipped with a rotating slotted pipe for removal of any excess activated sludge, the waste activated sludge (WAS) is decanted manually to the WAS chamber and pumped to a storage lagoon.
Secondary Clarifiers: The effluent from the aeration tank is directed to the two secondary clarifiers where solids settle quickly as activated sludge leaving a clear effluent. The activated sludge collected on the bottom of the clarifiers is pumped back to the front of the aeration tanks. The clear effluent continues to tertiary treatment.

Tertiary Treatment

Tertiary Sand Filter: Effluent from the secondary clarifiers is filtered through four upflow filter cells operated in parallel. The tertiary influent flow is directed to the bottom of the cells and upward through the sand media. The automatic backwash is initiated by an increase in head pressure or on a

programmed timer. The backwash water is returned to the influent pumping station for further treatment.

Disinfection

Ultra Violet (UV) Irradiation: The effluent flow from the sand filter is then directed to the UV channel for disinfection. The effluent passes through two banks of UV lamps connected in series. The treated final effluent is discharged to the Nonquon River.

Solids Management

Equalization Storage Lagoons: During high flow conditions excess flow from the influent pumping station is diverted to the aerated cell inlet chamber, from here it is directed to one of the five storage lagoons. During low flow conditions the lagoon effluent can be returned to the influent pumping station for treatment.
Solids Treatment: Waste activated sludge (WAS) is pumped from the WAS chamber to lagoon number six for storage and settling, the solid levels are monitored and removed for disposal as needed.

Environmental Compliance Approval (ECA)

Under Condition 10.(6) of ECA #2207-9LKHLM the Region must produce an annual performance report that must contain the following information:

a) Summary and interpretation of all monitoring data and a comparison to the effluent limits;

The raw wastewater flowing into the plant is analyzed for its chemical and physical composition. Monitoring of the raw wastewater is performed in accordance with the plant's ECA. Table 2 Raw Influent Analyses summarizes the raw wastewater characteristics during the reporting period.

The Nonquon WPCP effluent was determined to be compliant with the approval limits during the reporting period. The plant operated at 54.1% of its rated capacity and received a maximum daily flow of 6,026 cubic metres per day (m^3/d) on March 26, 2023.

b) Description of any operating problems encountered and corrective actions taken;

- Higher than normal total phosphorous and total suspended solids were observed between February and April as well as the end of December. These results are due to the tertiary filters plugging frequently with algae, grease, and solids. All four filters were rotated out for service including cleaning the sand. Three of the filters were returned to service, while more sand was ordered to top up filter #2. Filter #2 was returned to service in early 2024. Further upgrades to aid removal of solids and grease are being planned. Routine maintenance of the filters is conducted to ensure filters remain operational,

- Foaming issues occurred at the Reach Street sanitary sewage pumping station (SSPS) as well as in the plant at the inlet to the sand filters. The Sewer Use Bylaw Office has been working with local industries to reduce the foaming agents used for cleaning.
- Higher than normal final effluent carbonaceous biochemical oxygen demand (cBOD) results were obtained between July and August. Replacement of the final effluent sampler hose resolved the issue.

c) Summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works;

Major maintenance items in 2023 included:

- Replaced all ultraviolet bulbs in bank #2 and cleaned the sleeves,
- Performed diesel generator fuel and exhaust upgrades at the Reach Street SSPS and Canterbury SSPS.

d) Summary of any effluent quality assurance or control measures undertaken in the reporting period;

In-house lab test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy. On-line instrumentation is verified by WPCP operators using various field or laboratory test equipment.

e) Summary of the calibration and maintenance carried out on all effluent monitoring equipment;

Calibration of the flow meter was conducted on June 28 and November 29, 2023,
Calibration of the in-house laboratory scale was conducted on October 13, 2023,
Calibration of the Hach equipment was conducted on November 6, 2023,
Calibration of the pH meter is conducted regularly.

f) Description of efforts made and results achieved in meeting the effluent objectives;

The Region continually strives to achieve the best effluent quality at all times and remain below the objectives specified in the ECA.

The Nonquon WPCP effluent objectives were met in 2023 except for:

- The monthly total phosphorus objective of 0.08 milligrams per litre (mg/L) was exceeded in 2 of 12 months (16.7%),

Filter maintenance was conducted frequently to reduce total suspended solids and total phosphorous values to maintain results below objectives.

g) A tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed;

Waste Activated Sludge is discharged into the lagoons on-site. No sludge was removed during the reported period. The volume of biosolids will be calculated and reported in the year when sludge is removed from the site for final treatment or disposal.

Even with the increase in population on a year-to year basis, no significant changes to flows or processing are anticipated. Therefore, no significant changes in sludge generation are expected for the next year.

h) Summary of any complaints received during the reporting period and any steps taken to address the complaints;

All complaints received from the public are administered and tracked through a central database. No complaints were received in 2023.

i) Summary of all By-pass, spill or abnormal discharge;

No by-passes or spills occurred during the reporting period.

j) Copy of all Notice of Modifications and any implementation of Limited Operational Flexibility (Schedule B);

No notice of modifications were submitted in 2023.

k) Report summarizing modifications (Schedule B, Section 3);

A new raw composite sampler was installed downstream from the bar screen May 25, 2023.

l) Information required by Ministry of the Environment, Conservation and Parks Water Supervisor;

No additional information was requested.

Ministry of the Environment, Conservation and Parks (MECP) Inspection

The plant was inspected by the MECP on March 5, 2019.

Table 1 Final Effluent Flows

Month	Total Plant Flow* cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	113,405	3,658	5,940
February	110,959	3,963	5,997
March	126,710	4,087	6,026
April	126,288	4,210	5,939
May	104,482	3,370	4,781
June	103,176	3,439	5,149
July	98,436	3,175	4,025
August	90,764	2,928	3,413
September	78,393	2,613	2,785
October	66,801	2,155	2,784
November	65,112	2,170	2,691
December	79,995	2,580	4,241
Total	1,164,521		
Annual Average	97,043	3,190	
Minimum	65,112		
Maximum	126,710		6,026
ECA Limit		5,900**	
Met Compliance		Yes	

*Metered at the Final Effluent

**Annual Average

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand (BOD_5) average (avg.) concentration (conc.) milligrams per litre (mg/L)	Total Suspended Solids (TSS) avg conc. mg/L	Total Phosphorus (TP) avg conc. mg/L	Total Kjeldahl Nitrogen avg. conc. mg/L
January	131	167	3.3	30.44
February	147	203	3.5	29.20
March	129	171	3.1	23.45
April	128	197	3.3	23.63
May	130	166	3.7	28.80
June	79	96	2.5	22.85
July	103	84	2.7	28.57
August	94	86	2.8	27.66
September	113	197	3.1	27.30
October	147	187	4.0	37.30
November	150	173	4.1	36.88
December	134	202	4.0	34.70
Average	124	161	3.3	29.23
Minimum	79	84	2.5	22.85
Maximum	150	203	4.1	37.30
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligrams per litre (mg/L)	$CBOD_5$ loading kilograms per day (kg/d) year to date avg.	Total Suspended Solids (TSS) avg. conc. mg/L	TSS kg/d year to date avg.
January	1.0	3.7	4.6	16.8
February	1.1	4.0	5.7	19.6
March	1.0	4.0	7.8	23.5
April	1.0	4.1	5.0	23.0
May	1.0	3.9	4.5	21.3
June	1.0	3.8	3.8	19.8
July	3.8	5.2	3.6	18.5
August	3.8	6.2	2.9	17.0
September	1.0	5.7	3.7	16.1
October	1.0	5.3	3.8	15.2
November	1.1	5.0	4.6	14.8
December	1.2	4.8	8.1	15.4
Annual Loading		4.8**		15.4**
Average	1.5*		4.8*	
Minimum	1.0	3.7	2.9	14.8
Maximum	3.8	6.2	8.1	23.5
ECA Limit	5.0*	29.5**	10.0*	59.0**
ECA Objective	4.0		8.0	
Within Compliance	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	

*Annual Average Concentration

**Annual Average Loading

Table 3 Final Effluent Analyses continued

Month	Total Phosphorus (TP) average (avg.) concentration (conc.) milligrams per litre (mg/L)	TP kilograms per month (kg/m) monthly avg.	TP kilograms per year (kg/year) to date avg.
January	0.06	6.6	7
February	0.07	8.3	15
March	0.11	14.1	29
April	0.06	7.4	36
May	0.06	6.5	42
June	0.04	3.9	46
July	0.04	4.1	50
August	0.03	3.1	52
September	0.06	4.5	57
October	0.05	3.2	59
November	0.06	4.1	64
December	0.09	6.9	71
Annual Loading			71**
Average	0.06		
Minimum	0.03	3.1	
Maximum	0.11	14.1	
ECA Limit		14.2* May to October	170**
ECA Objective	0.08		
Within Compliance		Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes	Yes

*Monthly Average Loading

**Annual Average Loading

Table 3 Final Effluent Analyses continued

Month	pH minimum	pH maximum	Temperature Degree Celsius average (avg.)
January	7.0	7.4	12.3
February	7.1	7.3	11.5
March	7.0	7.7	12.1
April	7.0	7.2	13.3
May	7.0	7.3	15.5
June	7.0	7.4	19.0
July	6.9	7.5	20.3
August	7.0	7.4	20.4
September	6.9	7.2	20.3
October	6.9	7.4	18.3
November	7.1	7.4	15.1
December	7.0	7.3	14.0
Average			
Minimum	6.9		11.5
Maximum		7.7	20.4
ECA Limit	6.0	9.5	
Within Compliance	Yes	Yes	N/A
Sampling Frequency Requirement Met	Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Ammonia Nitrogen (TAN) average (avg.) concentration (conc.) milligrams per litre (mg/L)	TAN Effluent Objective conc. mg/L	TAN Effluent Limit Monthly avg. conc. mg/L
January	0.0	4.0	5.0
February	0.0	4.0	5.0
March	0.0	4.0	5.0
April	0.0	4.0	5.0
May	0.0	2.4	3.0
June	0.0	1.2	1.5
July	0.0	1.2	1.5
August	0.0	1.2	1.5
September	0.0	1.2	1.5
October	0.0	2.4	3.0
November	0.0	4.0	5.0
December	0.0	4.0	5.0
Average	0.0		
Minimum	0.0		
Maximum	0.0		
Within Compliance	Yes		

Table 5 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	9	1
February	8	1
March	9	4
April	8	2
May	10	2
June	8	2
July	8	2
August	9	3
September	8	9
October	9	31
November	9	50
December	7	1
ECA Objective		100 organisms/100mL
ECA Limit		200 organisms/100mL
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 6 Energy and Chemical Usage

Month	Aluminum Sulphate litres	Hydro kilowatt hours
January	18,224	97,569
February	16,132	100,031
March	20,975	93,751
April	18,903	91,518
May	19,145	82,390
June	17,970	77,264
July	19,055	68,205
August	15,917	63,935
September	16,265	62,288
October	18,607	78,403
November	15,756	81,086
December	20,363	99,512
Total	217,312	995,951