Nonquon Water Pollution Control Plant

2018 Annual Performance Report

The Regional Municipality of Durham

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

The Nonquon Water Pollution Control Plant (WPCP) 2018 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Nonquon WPCP in 2018. 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. The plant is operated according to the terms and conditions of the ECA. This MECP Class Three 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 (m3/d). The Nonquon WPCP has a service population of 8,274 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 and
- disinfection.

Raw Influent Pumping

Wastewater is collected through approximately 49.3 km of sanitary sewers in the Port Perry service area and is conveyed to the Nonquon WPCP by three sanitary sewage pumping stations: Water Street Pumping Station, Reach Street Pumping Station and Canterbury Common Pumping Station.

Influent Pumping Station

Raw wastewater enters the influent pumping station. Any flow in excess of the design flow of 5900 m^3/d will passively overflow to the inlet chamber and be directed to one of the five equalization lagoons for storage. A gravity sewer pipe allows for lagoon effluent to be returned back 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: Vortex grit removal is provided to remove sand and small stones (grit) for 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 phosphorous removal system lowers the total phosphorous 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 sections. The first section 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. Biological activity is controlled to assimilate the organic material. 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.

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.

Storage

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 cells. During low flow conditions the lagoon effluent can be returned to the influent pumping station for treatment.

Solids Treatment: waste activate sludge (WAS) is pumped from the WAS chamber to lagoon cell number six for storage and settling, the solid levels are monitored and removed for disposal as needed.

Environmental Compliance Approval

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 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 49.7% of its rated capacity and received a maximum daily flow of 7,185 m^3/d on April 16, 2018.

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

The current design of the scum removal system continued to be problematic during the reporting period. The secondary clarifiers sludge collection systems were modified to collect and remove floating sludge from the process. The improved process is anticipated to be fully operational in 2019.

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

Inspections as well as routine and preventative maintenance was performed on all major equipment as required. No major or emergency maintenance was required during the reporting period.

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. Results were found to be in an acceptable range.

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

- Calibration of the flow meter was conducted in May 28 and October 17 of 2018.
- Calibration of the in-house laboratory equipment was conducted on July 30, 2018.
- Calibration of the pH meter is conducted regularly.

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

The Regional Municipality of Durham strives to achieve the best effluent quality at all times, and produce results below the ECA compliance limits.

The Nonquon WPCP effluent objectives were met in 2018 except for:

- The effluent objective of 8 mg/L for total suspended solids was exceeded in 14 of 306 samples (4.6%).
- The effluent objective of 0.08 mg/L for total phosphorus was exceeded in 22 of 306 samples (7.2%).

  The total suspended solids and total phosphorus exceedances were caused by excessive scum, grease and floating solids accumulation flowing from the secondary clarifiers into the tertiary filter inlet. The results were monitored daily and the alum dosing and frequency of filter cleaning were increased as required.
- The effluent objective of 1.2 mg/L for total ammonia nitrogen was exceeded on July 4. The sample collected was analyzed at the Regional Environmental laboratory and the inhouse laboratory resulting in two exceedances of 306 samples (0.7%)

  Best efforts and process adjustments will continue to be applied as the Region of Durham endeavours to maintain results below objectives.

g) Tabulation of the volume of sludge generated

There was no removal of biosolids during the reporting period.

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

A summary of complaints received from the public is administered through a central database. There were no complaints received in 2018.

i) Summary of all By-pass, Spill or Abnormal Discharge Events

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 was submitted in 2018.

k) Report summarizing modifications (Schedule B Section 3)

Modifications were made to the sludge collection system on the secondary clarifiers for the collection and removal of floating sludge.

l) Information required by MECP Water Supervisor

No additional information was requested.

MECP Inspection

This plant was last inspected by the MECP in November of 2013.

Table 1 Final Effluent Flows

Month	Total Plant Flow metered at the Final Effluent cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	96,110	3,100	6,543
February	87,031	3,108	5,503
March	101,029	3,259	3,795
April	154,447	5,148	7,185
May	105,479	3,403	4,681
June	77,323	2,577	3,391
July	71,437	2,304	3,176
August	82,874	2,673	3,231
September	57,071	1,902	2,348
October	71,409	2,304	3,500
November	80,694	2,690	3,867
December	88,275	2,848	3,591
Total	1,073,179		
Annual Average	89,431	2,940	
Minimum	57,071		
Maximum	154,447		7,185
ECA Limit		5,900*	
Met Compliance		Yes	

*Annual Average

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand (BOD_5) average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids (TSS) avg conc. mg/L	TSS loading kilogram per day (kg/d)	Total Phosphorus (TP) avg conc. mg/L	TP loading kg/d	Total Kjeldahl Nitrogen avg. conc. mg/L
January	183	192	594	4.2	13	33.00
February	150	165	512	3.8	12	28.10
March	175	179	582	3.8	12	30.35
April	109	164	843	2.7	14	22.00
May	152	193	658	3.5	12	30.14
June	210	279	718	4.8	12	40.03
July	253	369	850	5.2	12	42.68
August	269	366	978	5.0	13	39.60
September	175	280	533	5.4	10	41.25
October	176	209	480	5.0	12	35.96
November	153	210	565	4.4	12	33.63
December	155	213	607	4.0	11	27.60
Average	180	235	688	4.3	13	33.69
Minimum	109	164	480	2.7	10	22.00
Maximum	269	369	978	5.4	14	42.68
Sampling Frequency Requirement Met	Yes	Yes		Yes		Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Oxygen Demand ($CBOD_5$) average(avg.) concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading avg. kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading avg. kg/d	Total Phosphorus (TP) avg. conc. mg/L	TP loading avg. kg/d	TP loading avg. kilogram per month (kg/mth)
January	1.2	3.7	7.1	22.2	0.06	0.19	0.2
February	1.0	3.1	6.2	19.3	0.05	0.17	0.2
March	1.0	3.3	3.4	11.2	0.03	0.09	0.1
April	1.0	5.1	5.0	25.8	0.03	0.18	0.2
May	1.0	3.4	4.0	13.6	0.03	0.11	0.1
June	1.0	2.6	5.8	14.9	0.08	0.20	0.2
July	0.8	1.8	2.7	6.3	0.03	0.08	0.1
August	1.0	2.7	2.0	5.5	0.03	0.08	0.1
September	1.0	1.9	1.7	3.3	0.04	0.07	0.1
October	1.0	2.3	2.0	4.5	0.04	0.09	0.1
November	1.0	2.7	3.4	9.2	0.04	0.12	0.1
December	1.0	2.8	4.4	12.6	0.05	0.15	0.1
Average	1.0	2.9	4.0	11.7	0.04	0.13	0.1
Minimum	0.8	1.8	1.7	3.3	0.03	0.07	0.1
Maximum	1.2	5.1	7.1	25.8	0.08	0.20	0.2
ECA Limit	5.0*	29.5**	10.0*	59.0**		170kg/ Year**	14.2 kg/mth May-Oct***
ECA Objective	4.0		8.0		0.08		
Within Compliance	Yes	Yes	Yes	Yes		Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Annual Average Concentration

**Annual Average Loading

***Monthly Average Loading

Table 3 Final Effluent Analyses continued

Month	Total Kjeldahl Nitrogen avg. conc. mg/L	Un-ionized Ammonia avg. conc. mg/L	pH minimum	pH maximum	Temperature degree Celcius avg.
January	0.95	0.0	7.0	7.3	11.2
February	1.02	0.0	7.0	7.2	11.4
March	0.85	0.0	6.9	7.2	11.1
April	0.74	0.0	7.0	7.2	11.7
May	0.88	0.0	7.0	7.2	15.4
June	0.95	0.0	7.0	7.2	18.1
July	1.45	0.0	7.0	7.3	20.3
August	0.74	0.0	7.1	7.4	21.1
September	0.78	0.0	7.1	7.3	20.4
October	0.82	0.0	7.0	7.3	16.6
November	0.80	0.0	7.1	7.3	14.7
December	0.86	0.0	7.0	7.3	13.5
Average	0.90	0.0			15.5
Minimum	0.74	0.0	6.9		11.1
Maximum	1.45	0.0		7.4	21.1
ECA Limit			6.0	9.5	
ECA Objective			6.0	9.5	
Within Compliance			Yes	Yes	
Sampling Frequency Requirement Met		Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Ammonia Nitrogen (TAN) average (avg.) concentration (conc.) milligram per litre (mg/L)	TAN Effluent Objective conc. mg/L	TAN Effluent Limit Monthly avg. conc. mg/L
January	0.1	4.0	5.0
February	0.1	4.0	5.0
March	0.1	4.0	5.0
April	0.1	4.0	5.0
May	0.0	2.4	3.0
June	0.0	1.2	1.5
July	0.2	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	0.1		
Maximum	0.2		
Within Compliance	Yes		

Table 5 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	1
February	4	2
March	4	1
April	4	2
May	5	0
June	4	3
July	4	1
August	5	1
September	4	1
October	5	1
November	4	1
December	4	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 litre (L)	Hydro kilowatt hours (kWh)
January	18,290	38,520
February	16,657	31,800
March	17,497	113,760
April	16,471	35,040
May	16,424	83,040
June	16,237	90,240
July	17,311	66,720
August	14,558	76,320
September	15,211	66,720
October	17,217	62,880
November	20,530	78,240
December	22,910	114,720
Total	209,313	858,000