Nonquon Water Pollution Control Plant

2017 Annual Performance Report

The Regional Municipality of Durham

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

4143-7NCKSG Dated June 18, 2009

The Nonquon Water Pollution Control Plant (WPCP) 2017 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Nonquon WPCP in 2017. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). 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 new activated sludge and tertiary treatment plant was in full operation as of February 28th, 2017. The plant obtained substantial completion as of May 5, 2017. The plant is operated according to the terms and conditions of the ECA's.

As of March 1, 2017 the MOECC reclassified Nonquon WPCP as a Class Three wastewater treatment plant, designed to treat wastewater at an average daily flow rate of 5900 m^3/d utilizing an extended aeration process with tertiary treatment. Prior to March 1, 2017 this system was an MOECC Class Two wastewater treatment plant designed to for an average flow rate of 3,870 cubic metres per day (m^3/d) utilizing two aerated lagoon cells and six seasonal facultative retention ponds.

The Nonquon WPCP has a service population of 8,270 residents. The treated effluent is discharged to the Nonquon River in accordance with the conditions listed in the ECA.

Raw Influent

Wastewater is collected through approximately 47.3 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.

Lagoon Treatment (January and February)

Aerated Cells

Influent wastewater enters the Nonquon WPCP through the aerated cell inlet chamber where the flow is split and directed into two aerated cells. These cells are aerated by mechanical surface aerators to mix the contents and provide oxygen to maintain biological activity.

Seasonal Retention Ponds

Partially treated wastewater from the aerated cells flows by gravity to cell number six for solids settling. The flow from cell number six is transferred through a distribution chamber to one of the five retention stabilization lagoons. The ECA permits discharge ten months of the year excluding July and August. Prior to and during discharging to the Nonquon River samples are collected to verify the effluent meets the limits established in the ECA.

Extended Aeration and Tertiary Treatment Plant (March through December)

Influent Pumping Station

Raw wastewater enters the influent pumping station. Any flows in excess of the design flow of 5900 m^3/d will passively overflow to the inlet chamber and is 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.

Preliminary Treatment

Screening: There are two 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 is intended to lower 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 within 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 typically operated as an anoxic zone, where no oxygen is introduced and allows for potential denitrification. 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 for solids separation and disposal.

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 two banks of UV lamps connected in series. The treated final effluent is discharged to the Nonquon River.

Storage

Equalization Storage: During high flow conditions excess flow from the influent pumping station is diverted to the aerated cell inlet chamber from where it is directed to one of the five storage cells. During low flow conditions the lagoon effluent is returned back to the influent pumping station for treatment.

Solids Treatment: WAS is pumped from the WAS chamber to lagoon cell number six for storage and settling, solids 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's. 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 57.7% of its rated capacity and received a maximum daily flow of 6,595 m^3/d on May 6, 2017.

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

The scum removal system design for the new treatment plant allows excessive scum and grease to flow through the secondary clarifiers and accumulate in the sand filter inlet channels. Continuous monitoring and manual cleaning are required to prevent filter clogging.

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

No maintenance was performed on major equipment 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 a comparable range.

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

- Calibration of the flow meter was conducted in May and November of 2017.
- Calibration of the in-house laboratory equipment was conducted in July of 2017.
- Calibration of the pH meter is conducted regularly.

f) Description of efforts made and results achieved in meeting the effluent objectives of Condition 6

- The Regional Municipality of Durham strives to achieve the best effluent quality at all times, remaining below the ECA compliance limits.
- The Nonquon WPCP effluent objectives were met in 2017 except for:
  The effluent objective prior to substantial completion was 11 mg/L for total suspended solids, it was exceeded on January 4th. The sample collected was analyzed at the Regional Environmental Laboratory and the Uxbridge Brook WPCP in house laboratory resulting in two exceedances.
  The effluent objective after substantial completion of 8 mg/L for total suspended solids was exceeded in 10 of 266 samples (3.8%).
  The effluent objective after substantial completion of 0.08 mg/L for total phosphorus was exceeded in 17 of 266 samples (6.4%).
  The total suspended solids and total phosphorus exceedances were caused by excessive scum and grease accumulation flowing from the secondary clarifiers into the tertiary filter inlet channel causing the tertiary filters to plug. The results were monitored daily and the alum dosing and frequency of filter cleaning were increased as required.
- Best efforts and process adjustments will continue to be applied 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 2017.

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 were submitted in 2017.

k) Report summarizing modifications (Schedule B)

There were no modifications to the plant during the reporting period.

l) Information required by MOECC Water Supervisor

No additional information was requested.

MOECC Inspection

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

Table 1 Raw Influent Flows

Month	Total Plant Flow * m^3	Average Daily Flow m^3/d	Maximum Daily Flow m^3/d
January	97,838	3,156	4,789
February	78,818	2,815	4,420
March	91,035	2,937	4,300
April	105,893	3,530	5,375
May	128,261	4,137	6,595
June	136,329	4,544	5,506
July	151,155	4,876	6,018
August	136,573	4,406	5,603
September	75,135	2,504	3,815
October	71,254	2,299	2,750
November	90,781	3,026	4,722
December	79,448	2,563	2,967
Total	1,242,519		
Annual Average	103,543	3,404	
Minimum	71,254		
Maximum	151,155		6,595
ECA Limit January and February		3,870**	
ECA Limit March through December		5,900**	
Met Compliance		Yes	

*January and February flows metered at the lagoon inlet, March through December flows metered at the effluent outlet.

**Annual Average

Table 2 Raw Influent Analyses

Month	BOD_5 avg. conc. mg/L	TSS avg conc. mg/L	TSS loading kg/d	TP avg conc. mg/L	TP loading kg/d	TKN avg. conc. mg/L
January	149	222	701	2.8	9	32.38
February	197	299	842	4.9	14	52.00
March	142	254	747	4.0	12	31.77
April	186	292	1,029	3.5	12	27.73
May	247	339	1,403	3.6	15	27.96
June	196	330	1,498	3.2	15	24.40
July	183	242	1,180	2.7	13	20.13
August	143	235	1,037	2.9	13	23.06
September	184	233	584	4.1	10	33.15
October	206	207	476	4.9	11	42.53
November	161	191	577	4.4	13	33.80
December	183	186	476	4.7	12	32.35
Average	181	252	857	3.8	13	31.77
Minimum	142	186	476	2.7	9	20.13
Maximum	247	339	1,498	4.9	15	52.00
Sampling Frequency Requirement Met	Yes	Yes		Yes		Yes

Table 3 Lagoon Effluent Discharge Volumes

Month	Total Flow Discharged metered at outlet m^3	Monthly Max Objective m^3	Daily Average Discharge m^3	Daily Maximum Discharge m^3	Maximum Daily Flow Objective m^3/d
January	60,982	130,000	2,772	4,224	4,600
February	No Discharge	100,000	No Discharge	No Discharge	No Discharge
Total	60,982	230,000			

Table 4 Final Effluent Analyses

Month	$CBOD_5$ avg. conc. mg/L	$CBOD_5$ loading avg. kg/d	TSS avg. conc. mg/L	TSS loading avg. kg/d	TP avg. conc. mg/L	TP loading avg. kg/d	TP loading avg. kg/mth
January	3.6	11.2	6.2	19.4	0.05	0.16	5
February	ND*	ND	ND	ND	ND	ND	ND
March	2.7	8.0	4.1	12.1	0.07	0.20	6
April	4.0	14.2	6.0	21.0	0.05	0.19	6
May	2.7	11.3	5.2	21.3	0.04	0.16	5
June	2.3	10.6	3.8	17.4	0.03	0.14	4
July	1.4	6.6	3.6	17.4	0.03	0.15	5
August	1.8	7.8	4.2	18.4	0.03	0.13	4
September	1.3	3.1	4.0	10.1	0.05	0.12	4
October	1.3	2.9	3.7	8.6	0.06	0.14	4
November	1.0	3.0	5.4	16.2	0.05	0.14	4
December	1.5	3.9	7.6	19.4	0.09	0.22	7
Total							53
Average	2.1	7.3	4.9	16.6	0.05	0.17	5
Minimum	1.0	2.9	3.6	8.6	0.03	0.12	4
Maximum	4.0	14.2	7.6	21.3	0.09	0.22	7
ECA Limit Prior to November 5th, 2017	10**	37.1***	12.0**	44.5***	0.3****	1.1***	
ECA Objective Prior to November 5th, 2017	8.0		11.0		0.21		
ECA Limit as of November 5th, 2017	5.0	29.5	10.0	59.0***		170kg/ year	14.2 kg/mth May-Oct
ECA Objective as of November 5th, 2017	4.0		8.0		0.08		
Within Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*No discharge
**Annual Average Concentration
***Annual Average Loading, kg/day
****Monthly Average Concentration

Table 4 Final Effluent Analyses continued

Month	TAN avg. conc. mg/L	TKN avg. conc. mg/L	Un-ionized ammonia avg. conc. mg/L	pH min.	pH max.	Temp. °C avg.
January	2.88	4.73	0.0	6.73	8.50	3.7
February	ND	ND	ND	ND	ND	ND
March	0.33	1.14	0.0	7.10	7.88	10.5
April	0.72	1.55	0.0	7.09	7.51	13.3
May	0.07	1.02	0.0	6.93	7.23	14.4
June	0.03	0.98	0.0	6.72	7.30	18.1
July	0.02	0.88	0.0	6.83	7.89	19.5
August	0.02	0.94	0.0	7.04	7.21	20.1
September	0.02	0.91	0.0	7.15	7.28	18.8
October	0.02	0.88	0.0	7.12	7.45	17.4
November	0.01	0.79	0.0	7.01	7.32	14.5
December	0.02	0.99	0.0	7.00	7.23	11.7
Average	0.99	1.35	0.0			
Minimum	0.02	0.79	0.0	6.72		3.7
Maximum	2.88	4.73	0.0		8.50	20.1
ECA Limit	Refer to Table 4			6.0	9.5	
ECA Objective	Refer to Table 4			6.0	9.5	
Within Compliance	Yes			Yes	Yes	
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes	Yes

Table 5 Effluent Objectives for Total Ammonia Nitrogen

Month	TAN Effluent Objective conc. mg/L	TAN Effluent Limits conc. mg/L
January	8.4	
February	8.6	
March	8.6	
April	7.8	
May	2.4	
June	2.1	
July	2.1*	
August	2.1*	
September	2.3	
October	3.4	
November	4.0	5.0**
December	4.0	5.0**

* Substantial completion achieved May 5, 2017. The ECA objectives for 6 months prior to substantial completion and after 6 months of sustantial do not list values for July and August. The most stringent value listed was used.
**Monthly average

Table 6 Escherichia Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January		
February		
March	4	2
April	4	1
May	5	1
June	4	1
July	4	1
August	5	1
September	4	0
October	4	0
November	5	1
December	4	1
ECA Objective Post 6 months substantial completion		100 organisms/ 100ml
ECA Limit Post 6 months substantial completion		200 organisms/ 100ml
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 7 Energy and Chemical Usage

Month	Aluminum Sulphate (m^3)	Hydro kWh
January	24	33,231
February	21	16,424
March	5,319	15,660
April	15,491	12,732
May	14,371	0*
June	13,624	27,374
July	13,764	0*
August	12,785	206,768*
September	11,898	18,589
October	12,925	19,480
November	14,651	24,191
December	16,937	32,721
Total	131,810	407,169

*Inconsistent hydro metering values are due to upgrading the plant metering system.