Lake Simcoe Water Pollution Control Plant

2018 Annual Performance Report

The Regional Municipality of Durham

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Environmental Compliance Approval (ECA): 5292-8CYHTQ Dated June 28, 2012
Environmental Compliance Approval (Air): 8-3041-95-006 Dated February 5, 1996

The Lake Simcoe Water Pollution Control Plant (WPCP) 2018 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Lake Simcoe WPCP. 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 Lake Simcoe WPCP located in the Community of Beaverton in the Township of Brock 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 Three wastewater treatment plant utilizes an extended aeration process with tertiary treatment and is designed to treat wastewater at a rated capacity of 4,550 cubic metres per day (m^3/d). The Lake Simcoe WPCP has a service population of approximately 3,980 residents.

Lake Simcoe WPCP treats wastewater from the Community of Beaverton service area utilizing the following processes;

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

Raw Influent Pumping

Wastewater is collected through approximately 24.8 km of sanitary sewers in Beaverton and is conveyed to the WPCP by gravity and two sanitary sewage pumping stations; Harbour Street and Cedar Beach located in the collection system. Flow from the two pumping stations are combined in the raw sewage inlet channel.

Preliminary Treatment

Screening: There are two screen channels in the screen 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 bar rack to provide screening on an emergency basis. Screenings are removed in this process and transported to landfill for disposal.

Grit Removal: Vortex grit removal is provided to remove sand, gravel, etc. for protection of mechanical equipment from unnecessary wear and reduce formation of heavy deposits in pipelines, channels and process tanks. The vortex grit tank 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 within the plant.

Secondary Treatment

Aeration Tanks: Preliminary effluent flow is directed to two aeration tanks. Surface mechanical aerators mix air into the wastewater to assist bacteria in removing dissolved and suspended organics and nutrients from the wastewater.

Secondary Clarifier: The effluent from the aeration tanks is directed to its associated secondary clarifier where solids settle quickly as activated sludge leaving a clear effluent. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the aeration tanks and the excess activated sludge is wasted to the aerobic digester.

Tertiary Treatment

Tertiary Clarifier: The secondary effluent is directed to the tertiary clarifier. The helical flow pattern in the clarifier separates the solids from the liquid, the effluent flows over to the tertiary sand filter and the thickened sludge is pumped to the aerobic digester.

Tertiary Sand Filter: Effluent flow from the tertiary clarifier flows into an automatic cleaning sand filter. The automatic backwash is initiated by an increase in head pressure or a programmed timer. The backwash water is returned to the beginning of the plant 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 flow passes two banks of UV lamps connected in series before being discharged to Lake Simcoe through the 400mm diameter outfall extending 314 metres into Lake Simcoe.

Solids Treatment

Aerobic Digester: Activated sludge from the secondary clarifiers is pumped to an aerobic digester for stabilization. A mechanical mixer and a fixed header diffused aeration system provide oxygen for the microorganisms. The mixer and diffusers are turned off to allow solids to settle for removal and the supernatant to be decanted and flow by gravity to the raw equalization lagoon.

Biosolids Management: Stabilized biosolids from the digester are transported to Duffin Creek WPCP within the Region of Durham for incineration in accordance with ECA #A820250.

Environmental Compliance Approval

Under Condition 9 (5) of ECA # 5292-8CYHTQ the Region of Durham 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 outlined in Condition 5, including an overview of the success and adequacy of the works**

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 conditions in the ECA. Table 2 summarizes the raw wastewater characteristics during the reporting period.

The Lake Simcoe WPCP effluent was compliant with the approval limits during the reporting period. The plant operated at 38.6% of its rated capacity and received a maximum daily flow of 5,781 m^3/d on April 28, 2018. Tables 3-5 provide a tabulation of effluent results.

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

No operating problems were encountered in 2018.

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 2018 included:

- New variable frequency drive (VFD) installed on activated sludge pump #201
- New wasting valves installed
- Rebuilt the primary lagoon raw sludge return pump
- Replaced ultra violet lamps
- New programmable logic controller (PLC) installed at Cedar Beach pumping station
- New check ball and VFD installed on pump #3 at Harbour Street pumping station

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. 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 effluent flow meter occurred on May 29 and October 17, 2018.
- Calibration of the in-house laboratory equipment was conducted on July 30, 2018 and the analytical scales were done on December 13, 2018.
- Calibration of the pH meter is conducted regularly.

f) Description of efforts made and results achieved in meeting the effluent objectives of Condition 4

- The Region strives to achieve the best effluent quality at all times, remaining below the ECA compliance limits.
- The effluent objective for total suspended solids was exceeded in 10 of 309 samples (3.2%)
- The effluent objective for total phosphorus was exceeded in 13 of 310 samples (4.2%)

  Results for total suspended solids and total phosphorus were monitored and adjustments were made to the treatment process.
- The lower objective of 6.5 for pH was exceeded in 1 of 258 samples. (0.4%)

g) Tabulation of Volume of Sludge Generated

The volume of sludge removed from Lake Simcoe WPCP in 2018 was 2,812 m^3.

Outline of Anticipated Volumes to be Generated in the Next Reporting Period

There is no increase of sludge volume expected in the next reporting period.

Summary of Locations to Where Sludge was Disposed

A total of 2,812 m^3 sludge was shipped to Duffin Creek WPCP for incineration.

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. A complaint was received from a customer concerning a continuous beeping noise coming from the treatment plant. Upon investigation it was determined to be emanating from the oxygen sensor in the preliminary building gas detection system. The issue was resolved immediately.

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

There were no bypasses reported in 2018.

j) Status Update of Initial Effluent Characterization

The initial effluent characterization report was submitted in 2015.

k) Information required by MECP District Manager

No additional information was requested.

MECP Inspection

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

Table 1 Effluent Flows

Month	Total Plant Flow metered at the final effluent in cubic metre (m^3)	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	51,349	1,656	3,172
February	48,961	1,749	2,979
March	71,691	2,313	3,522
April	101,832	3,394	5,781
May	79,072	2,551	5,119
June	40,432	1,348	2,339
July	31,506	1,016	1,432
August	37,845	1,221	1,684
September	27,903	930	1,231
October	35,369	1,141	1,915
November	53,666	1,789	3,043
December	60,703	1,958	2,888
Total	640,330		
Average	53,361	1,754	
Minimum	27,903		
Maximum	101,832		5,781
ECA Limit		4,550*	
Met Compliance		Yes	Yes

*Annual Average

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand (BOD_5) average concentration (conc.) milligram per litre (mg/L)	BOD_5 loading kilogram per day (kg/d)	Total Suspended Solids average conc. mg/L	Total Suspended Solids loading (kg/d)	Total Phosphorous (TP) average conc. mg/L	TP average loading (kg/d)	Alkalinity $CaCO_3$ mg/L
January	72	119	51	84	2.0	3.4	307
February	51	90	64	112	1.6	2.8	250
March	63	145	72	167	1.5	3.4	263
April	54	185	37	124	0.8	2.6	258
May	38	97	44	113	1.2	2.9	249
June	57	76	60	80	1.8	2.4	216
July	79	80	69	70	2.7	2.7	215
August	77	94	76	93	2.4	2.9	227
September	63	59	70	65	2.9	2.7	217
October	82	93	258	294	4.6	5.3	219
November	60	108	74	132	1.5	2.7	247
December	55	107	60	117	1.4	2.7	271
Average	63	109	78	136	2.0	3.6	245
Minimum	38	59	37	65	0.8	2.4	215
Maximum	82	185	258	294	4.6	5.3	307
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average concentration (conc.) milligram per litre (mg/L)	Total Ammonia Nitrogen (TAN) average conc. mg/L	TAN loading kilogram per day	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	17.62	16.9	28.0	7.3	7.9	7.6
February	15.47	10.4	18.1	7.4	7.9	7.6
March	16.63	10.1	23.4	7.4	7.9	7.3
April	8.12	4.8	16.3	7.5	7.8	7.6
May	12.32	8.6	22.0	7.2	7.6	13.2
June	18.38	14.2	19.2	7.1	7.7	7.6
July	25.23	17.8	18.1	7.0	7.2	18.2
August	21.24	14.9	18.2	7.0	7.5	7.6
September	25.85	19.3	18.0	7.0	7.3	18.1
October	35.52	17.7	20.1	7.0	7.6	7.6
November	15.58	10.9	19.5	6.7	7.7	12.8
December	15.55	10.8	21.1	6.3	7.7	7.6
Average	18.96	13.0	22.9			
Minimum	8.12	4.8	16.3	6.3		7.3
Maximum	35.52	19.3	28.0		7.9	18.2
Sampling Frequency Requirement Met	Yes			Yes	Yes	

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading kilogram per day (kg/d)	Total Suspended Solids (TSS) average conc. mg/L	TSS loading kg/d
January	1.0	1.7	1.5	3
February	1.0	1.7	1.1	2
March	1.0	2.3	1.3	3
April	1.0	3.4	1.6	5
May	1.0	2.6	0.8	2
June	1.0	1.3	0.8	1
July	1.0	1.0	0.6	1
August	1.0	1.2	0.6	1
September	1.0	0.9	0.5	1
October	1.0	1.1	2.8	3
November	1.0	1.8	0.7	1
December	1.0	2.0	0.8	1
Total				
Average	1.0	1.8	1.1	2
Minimum	1.0	0.9	0.5	1
Maximum	1.0	3.4	2.8	5
ECA Limit	10**		10**	
ECA Objective	5		5	
Lake Simcoe Phosphorous Reduction Strategy				
Within Compliance	Yes		Yes	
Sampling Frequency Requirement Met	Yes		Yes	

*Total Annual Loading, kg/year
**Monthly Average Concentration
***Annual Average Concentration

Table 3 Final Effluent Analyses continued

Month	Total Phosphorous average conc. mg/L	Total Phosphorous average loading kg/d	Total Phosphorous average loading kilogram per month
January	0.05	0.1	2.8
February	0.03	0.1	1.5
March	0.03	0.1	1.9
April	0.02	0.1	2.4
May	0.03	0.1	2.2
June	0.03	0.0	1.2
July	0.08	0.1	2.4
August	0.04	0.1	1.6
September	0.03	0.0	0.8
October	0.08	0.1	2.9
November	0.04	0.1	2.1
December	0.05	0.1	3.2
Total			25*
Average	0.04	0.1	2.1
Minimum	0.02	0.0	0.8
Maximum	0.08	0.1	3.2
ECA Limit	0.3**		190*
ECA Objective	0.12		190
Lake Simcoe Phosphorous Reduction Strategy	0.15***		190*
Within Compliance	Yes		Yes
Sampling Frequency Requirement Met	Yes		Yes

*Total Annual Loading, kg/year
**Monthly Average Concentration
***Annual Average Concentration

Table 3 Final Effluent Analyses continued

Month	Total Ammonia Nitrogen (TAN) average concentration (conc.) milligram per litre (mg/L) summer	TAN average conc. mg/L winter	TAN loading kilogram per day	Total Kjeldahl Nitrogen average conc. mg/L	Unionized Ammonia Nitrogen average conc. mg/L
January		0.38	0.6	1.25	0.0
February		0.01	0.0	0.56	0.0
March		0.01	0.0	0.63	0.0
April		0.02	0.1	0.42	0.0
May		0.02	0.1	0.60	0.0
June	0.02		0.0	0.72	0.0
July	0.06		0.1	0.76	0.0
August	0.01		0.0	0.59	0.0
September		0.01	0.0	0.63	0.0
October		0.04	0.0	0.89	0.0
November		0.01	0.0	0.52	0.0
December		1.60	3.1	2.47	0.0
Average	0.03	0.24	0.3	0.83	0.0
Minimum	0.01	0.01	0.0	0.42	0.0
Maximum	0.06	1.60	3.1	2.47	0.0
ECA Limit	5**	15**			
ECA Objective	3	10			
Within Compliance	Yes	Yes			
Sampling Frequency Requirement Met	Yes	Yes			

**Monthly Average Concentration

Table 3 Final Effluent Analyses continued

Month	pH minimum	pH maximum	Temperature average Degree Celsius
January	6.9	7.5	7.5
February	7.1	7.5	7.6
March	7.1	7.6	7.7
April	7.1	7.4	8.9
May	6.9	7.5	13.4
June	6.8	7.1	17.3
July	6.6	7.1	19.9
August	6.8	7.3	20.5
September	6.5	7.1	19.1
October	6.7	7.2	14.0
November	6.6	7.5	12.2
December	6.5	7.2	11.6
Minimum	6.5		7.5
Maximum		7.6	20.5
ECA Objective	6.5	9.0	
Sampling Frequency Requirement Met	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	2
February	4	1
March	4	1
April	4	1
May	5	1
June	4	0
July	4	0
August	5	0
September	4	0
October	5	3
November	4	1
December	4	2
ECA Objective		40 organisms/100ml
Sampling Frequency Requirement Met	Yes	

Table 5 Total Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	6
February	4	4
March	4	2
April	4	2
May	5	2
June	4	4
July	4	2
August	5	1
September	4	1
October	5	12
November	4	3
December	4	17
Sampling Frequency Requirement Met	Yes	

Table 6 Energy and Chemical Usage

Month	Aluminum Sulphate litres	Hydro kilowatt hours	Natural Gas cubic metres
January	5,668	82,121	12,510
February	5,243	69,899	22,592
March	5,078	81,357	12,808
April	12,913	66,461	22,502
May	7,511	67,607	5,045
June	4,522	74,864	352
July	4,076	63,787	1,230
August	4,782	67,225	176
September	3,398	74,864	251
October	3,944	61,878	5,841
November	6,125	66,461	6,535
December	4,218	72,190	16,769
Total	67,477	848,714	106,611