Lake Simcoe Water Pollution Control Plant

2024 Annual Performance Report

The Regional Municipality of Durham
Lake Simcoe Water Pollution Control Plant 2024 Annual Performance Report

Environmental Compliance Approval (ECA):5292-8CYHTQ Dated June 28, 2012
Environmental Compliance Approval (ECA):7423-CJT8GQ Dated March 7, 2024
Environmental Compliance Approval (Air): 8-3041-95-006 Dated February 5, 1996

The Lake Simcoe Water Pollution Control Plant (WPCP) 2024 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 and 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 4,550 cubic metres per day (m^3/d). The Lake Simcoe WPCP has a service population of approximately 4,956 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
- Solids management

Raw Influent Pumping

Wastewater is collected through approximately 27.2 kilometres of sanitary sewers in Beaverton and is conveyed to the WPCP by gravity and two sanitary sewage pumping stations (SSPS), Harbour Street and Cedar Beach located in the collection system. Flow from the two SSPS 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: The vortex grit tank 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 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 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 is added into the aeration tank.

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 two secondary clarifiers 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

Ultraviolet (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 Management

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 sewage pumping station.
Sludge Management: Stabilized biosolids from the digester are transported to Duffin Creek WPCP for further treatment and incineration.

Environmental Compliance Approval (ECA)

Under Condition 9(5) of ECA # 5292-8CYHTQ 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 conditions in the ECA. Table 2 Raw Influent Analyses summarizes the raw wastewater characteristics during the reporting period.

The plant operated at 43.4% of its rated capacity and received a maximum daily flow of 4,294 cubic metres per day (m^3/d) on July 11, 2024.

Tables 3-5 provide a tabulation of effluent results.

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

No operational problems occurred during the reporting period.

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 2024 included:

- Replaced rubber on secondary scum collectors
- Jetted lines from aeration tanks to secondary tanks
- Secondary lagoon pump rebuilt and reinstalled

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 effluent flow meter occurred on June 12, 2024.

Calibration of the laboratory equipment was conducted on November 27, 2024.
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 total phosphorus monthly objective of 0.12 mg/L was exceeded in 3 of 12 samples (25%). Total phosphorus results are monitored daily, and coagulant adjustments are made to the process as required.

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

The volume of sludge removed from Lake Simcoe WPCP in 2024 was 4,556 m^3.

All sludge produced was transported to Duffin Creek WPCP for further treatment and incineration. 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 are administered, investigated and documented using a central database. No complaints were received in 2024.

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

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

j) Status Update of Initial Effluent Characterization

The initial effluent characterization report was submitted to MECP in 2015.

k) Information required by Ministry of the Environment, Conservation and Parks District Manager

No additional information was requested.

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

This plant was last inspected by the MECP on March 6, 2019.

Table 1 Effluent Flows

Month	Total Plant Flow* cubic metre (m^3)	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	65,062	2,099	3,510
February	61,725	2,128	2,834
March	75,472	2,435	3,281
April	101,997	3,400	4,136
May	92,223	2,975	4,081
June	64,412	2,147	3,396
July	69,254	2,234	4,294
August	53,703	1,732	2,181
September	37,947	1,265	1,683
October	34,599	1,116	1,450
November	29,872	996	1,503
December	36,347	1,172	2,630
Total	722,613		
Average	60,218	1,974	
Minimum	29,872		
Maximum	101,997		4,294
ECA Limit		4,550**	
Met Compliance		Yes	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	Alkalinity calcium carbonate mg/L
January	70	117	1.7	308
February	71	93	1.8	307
March	55	72	1.6	306
April	65	67	1.5	297
May	74	76	1.6	289
June	79	98	2.3	274
July	93	128	2.4	273
August	97	114	3.0	233
September	114	163	4.2	268
October	127	120	4.4	258
November	110	158	4.7	268
December	103	95	4.2	289
Average	88	108	2.8	281
Minimum	55	67	1.5	233
Maximum	127	163	4.7	308
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average concentration milligrams per litre	pH minimum	pH maximum
January	18.18	7.1	7.5
February	18.18	7.1	7.5
March	14.38	6.7	7.4
April	13.06	6.8	7.5
May	14.10	7.0	7.5
June	20.20	7.0	7.3
July	19.52	7.1	7.7
August	23.10	7.0	7.5
September	33.55	6.9	7.2
October	38.98	6.6	7.2
November	40.40	6.7	8.8
December	37.33	6.7	8.1
Average	24.25		
Minimum	13.06	6.6	
Maximum	40.40		8.8
Sampling Frequency Requirement Met	Yes	Yes	Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligrams per litre (mg/L)*	Total Suspended Solids (TSS) avg. conc. mg/L*
January	2.8	1.5
February	2.6	1.7
March	2.8	3.9
April	2.0	2.1
May	2.2	1.8
June	1.7	2.0
July	1.8	2.0
August	1.5	1.9
September	1.7	2.7
October	2.0	2.7
November	2.2	3.2
December	3.6	4.1
Average	2.2	2.5
Minimum	1.5	1.5
Maximum	3.6	4.1
ECA Limit	10*	10*
ECA Objective	5	5
Within Compliance	Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes

*Monthly Average Concentration

Table 3 Final Effluent Analyses continued

Month	Total Phosphorus (TP) average (avg.) concentration milligrams per litre	TP avg. loading kilograms per month
January	0.03	2
February	0.04	2
March	0.08	6
April	0.05	5
May	0.04	4
June	0.04	3
July	0.05	3
August	0.04	2
September	0.09	3
October	0.16	6
November	0.18	5
December	0.16	6
Annual Loading		48
Annual Average	0.08	4.8
Minimum	0.03	2.0
Maximum	0.18	6.0
ECA Limit	0.3**	190*
ECA Objective	0.12	190
Lake Simcoe Phosphorus Reduction Strategy	0.15***	190*
Within Compliance	Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes

*Total Annual Loading, kilograms per year (kg/year)
**Monthly Average Concentration
***Annual Average Concentration

Table 3 Final Effluent Analyses continued

Month	Total Ammonia Nitrogen (TAN) average (avg.) concentration (conc.) milligrams per litre (mg/L) summer	TAN avg. conc. mg/L winter
January		0.03
February		0.04
March		0.10
April		0.13
May		0.29
June	0.59	
July	1.09	
August	1.07	
September		0.13
October		0.20
November		0.15
December		0.13
Average	0.92	0.13
Minimum	0.59	0.03
Maximum	1.09	0.29
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 Degree Celsius average
January	6.9	7.2	9.4
February	6.9	7.3	9.5
March	6.9	7.3	10.1
April	6.8	7.5	11.3
May	6.7	7.1	14.1
June	6.7	7.1	17.9
July	6.5	7.5	19.3
August	6.5	7.3	20.0
September	6.6	6.9	19.2
October	6.8	7.1	15.8
November	6.6	7.3	13.1
December	6.8	7.7	10.2
Minimum	6.5		9.4
Maximum		7.7	20.0
ECA Objective	6.5	9.0	
Sampling Frequency Requirement Met	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Monthly Geometric Mean Density	Number of Samples
January	2	10
February	2	7
March	1	8
April	1	9
May	1	9
June	1	8
July	1	10
August	1	8
September	3	8
October	3	10
November	4	8
December	5	8
ECA Objective	40 organisms/100ml\L	
Sampling Frequency Requirement Met		Yes

Table 5 Chemical and Energy Usage

Month	Aluminum Sulphate litres	Hydro kilowatt hours	Natural Gas cubic metres
January	12,991	51,363	18,353
February	11,775	51,016	16,048
March	16,174	57,828	14,484
April	21,190	58,825	16,359
May	12,731	55,470	5,939
June	8,333	56,166	1,217
July	10,296	55,006	332
August	8,102	63,323	4,638
September	4,925	50,697	1,230
October	3,996	54,664	4,598
November	4,988	52,696	4,640
December	5,529	72,057	16,038
Total	121,030	679,109	103,876

Table 6 Sludge Analysis

Parameter	Concentration (mg/L)
Total Solids	24,267
Total Phosphorus	528
Total Ammonia Nitrogen	29.04
Nitrate as Nitrogen	0.8
Arsenic	0.052
Cadmium	0.0181
Cobalt	0.26
Chromium	0.216
Copper	6.014
Lead	0.162
Mercury	0.00459
Molybdenum	0.274
Nickel	0.189
Potassium	53
Selenium	0.096
Zinc	10.393