## Lake Simcoe Water Pollution Control Plant

# 2023 Annual Performance Report

# The Regional Municipality of Durham
# Lake Simcoe Water Pollution Control Plant 2023 Annual Performance Report

**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) 2023 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 4,958 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 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 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 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

**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 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 44.9% of its rated capacity and received a maximum daily flow of 5,218 cubic metres per day ($m^3$/d) on April 1, 2023.

- The Total Ammonia Nitrogen limit of 5 milligrams per litre (mg/L) from June 1 to August 31 was exceeded in 1 of 3 months (33.3%) and 15 mg/L from September 1 to May 31 was exceeded in 1 of 9 monthls (11.1%)

Tables 3-5 provide a tabulation of effluent results.

**b) Description of any operating problems encountered and corrective actions taken;**
Higher than normal Total Ammonia Nitrogen results were observed from August 6, 2023 to October 7, 2023 due to a mechanical failure of the aerator in tank 2 on July 31. While the aerator was being repaired, all flow was diverted to aeration tank 1 and an air compressor and pump were set up to increase the dissolved oxygen content. Mixed liquor from Uxbridge Brook WPCP was also brought in to aid the biological processes. The aerator was returned to service on October 9, 2023 and Total Ammonia Nitrogen levels returned to normal, compliant levels.

**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:

**Operations**

- Repaired and replaced mixer and draft tube on aeration tank 2,
- Installed new pump in raw lagoon wet well,

- Installed new pump in secondary lagoon wet well,

**Cedar Beach sanitary sewage pumping station**

- Replaced guide rails for pump.

**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 29, 2023 and November 30, 2023.
Calibration of the laboratory balance scale was conducted on August 8, 2023.
Verification 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 carbonaceous biochemical oxygen demand objective of 5 milligrams per litre (mg/L) was exceeded in 3 of 102 samples (2.9%)
- The total suspended solids objective of 5 mg/L was exceeded in 9 of 361 samples (2.5%). Total suspended solids results are monitored daily, and adjustments such as coagulant dosage or pump rates are made to the process as required.
- The total phosphorus objective of 0.12 mg/L was exceeded in 9 of 361 samples (2.5%). Total phosphorus results are monitored daily, and coagulant adjustments are made to the process as required.
- The total ammonia nitrogen objective of 3 mg/L from June 1 to August 31 was exceeded in 28 of 92 samples (30.4%) and 10 mg/L from September 1 to December 31 was exceeded in 39 of 118 samples (33.1%). These exceedances occurred due to an aerator malfunction which was fixed by maintenance.

**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 2023 was 4,296 $m^3$.

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.

All sludge produced was transported to Duffin Creek WPCP for further treatment and incineration.

**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 2023.

**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 | 72,407 | 2,336 | 4,790 |
| February | 64,766 | 2,313 | 4,029 |
| March | 88,100 | 2,842 | 4,843 |
| April | 103,338 | 3,445 | 5,218 |
| May | 81,096 | 2,616 | 4,198 |
| June | 66,620 | 2,221 | 3,910 |
| July | 62,710 | 2,023 | 2,493 |
| August | 44,295 | 1,429 | 2,062 |
| September | 29,126 | 971 | 1,255 |
| October | 36,013 | 1,162 | 1,880 |
| November | 40,917 | 1,364 | 2,045 |
| December | 56,806 | 1,832 | 3,186 |
| Total | 746,195 | | |
| Average | 62,183 | 2,044 | |
| Minimum | 29,126 | | |
| Maximum | 103,338 | | 5,218 |
| 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 | 58 | 71 | 1.7 | 289 |
| February | 62 | 77 | 1.8 | 277 |
| March | 54 | 92 | 2.0 | 274 |
| April | 36 | 57 | 1.3 | 281 |
| May | 46 | 61 | 1.7 | 288 |
| June | 58 | 80 | 2.2 | 275 |
| July | 82 | 94 | 2.3 | 284 |
| August | 101 | 103 | 3.0 | 284 |
| September | 119 | 123 | 3.9 | 282 |
| October | 110 | 89 | 3.2 | 290 |
| November | 129 | 116 | 2.8 | 298 |
| December | 79 | 115 | 2.1 | 303 |
| Average | 78 | 90 | 2.3 | 285 |
| Minimum | 36 | 57 | 1.3 | 274 |
| Maximum | 129 | 123 | 3.9 | 303 |
| 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 | 20.02 | 7.4 | 7.7 |
| February | 18.93 | 7.5 | 7.9 |
| March | 16.48 | 7.3 | 7.9 |
| April | 12.08 | 7.2 | 7.9 |
| May | 14.55 | 7.0 | 7.5 |
| June | 16.73 | 6.8 | 7.4 |
| July | 23.50 | 6.9 | 7.4 |
| August | 29.38 | 7.1 | 7.5 |
| September | 34.83 | 7.0 | 7.6 |
| October | 29.30 | 7.1 | 7.5 |
| November | 30.28 | 7.1 | 7.4 |
| December | 21.68 | 7.1 | 7.4 |
| Average | 22.31 | | |
| Minimum | 12.08 | 6.8 | |
| Maximum | 34.83 | | 7.9 |
| 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 | 1.0 | 2.5 |
| February | 1.0 | 1.8 |
| March | 1.0 | 2.1 |
| April | 1.0 | 2.1 |
| May | 1.0 | 2.4 |
| June | 1.0 | 1.5 |
| July | 1.0 | 1.3 |
| August | 1.1 | 1.4 |
| September | 3.5 | 2.3 |
| October | 3.1 | 2.0 |
| November | 3.6 | 1.3 |
| December | 3.6 | 1.5 |
| Average | 1.8 | 1.9 |
| Minimum | 1.0 | 1.3 |
| Maximum | 3.6 | 2.4 |
| 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 | 0.05 | 3.6 |
| February | 0.05 | 3.2 |
| March | 0.06 | 5.3 |
| April | 0.05 | 5.2 |
| May | 0.07 | 5.7 |
| June | 0.06 | 4.0 |
| July | 0.10 | 6.3 |
| August | 0.09 | 4.0 |
| September | 0.09 | 2.6 |
| October | 0.04 | 1.4 |
| November | 0.03 | 1.2 |
| December | 0.04 | 2.3 |
| Annual Loading | | 45* |
| Annual Average | 0.06 | 3.8 |
| Minimum | 0.03 | 1.2 |
| Maximum | 0.10 | 6.3 |
| 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 | | 0.06 |
| February | | 0.08 |
| March | | 0.07 |
| April | | 0.07 |
| May | | 0.04 |
| June | 0.09 | |
| July | 0.08 | |
| August | 8.51 | |
| September | | 18.66 |
| October | | 4.66 |
| November | | 0.03 |
| December | | 0.03 |
| Average | 2.89 | 2.63 |
| Minimum | 0.08 | 0.03 |
| Maximum | 8.51 | 18.66 |
| ECA Limit | 5* | 15* |
| ECA Objective | 3 | 10 |
| Within Compliance | No | No |
| 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 | 7.0 | 7.4 | 9.4 |
| February | 7.0 | 7.5 | 8.4 |
| March | 7.1 | 7.8 | 8.5 |
| April | 6.8 | 7.7 | 10.6 |
| May | 6.7 | 7.3 | 13.4 |
| June | 6.6 | 7.0 | 17.2 |
| July | 6.9 | 7.5 | 19.6 |
| August | 6.8 | 7.3 | 19.3 |
| September | 7.0 | 7.3 | 19.0 |
| October | 6.9 | 7.6 | 16.8 |
| November | 6.9 | 7.2 | 12.3 |
| December | 6.7 | 7.3 | 11.2 |
| Minimum | 6.6 | | 8.4 |
| Maximum | | 7.8 | 19.6 |
| 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 | 1 | 9 |
| February | 2 | 8 |
| March | 7 | 9 |
| April | 1 | 8 |
| May | 2 | 10 |
| June | 1 | 8 |
| July | 1 | 8 |
| August | 2 | 9 |
| September | 2 | 8 |
| October | 1 | 9 |
| November | 1 | 9 |
| December | 2 | 7 |
| ECA Objective | 40 organisms/100ml\L | |
| Sampling Frequency Requirement Met | | Yes |

**Table 5 Total Coliform Sampling**

| Month | Monthly Geometric Mean Density | Number of Samples |
|---|---|---|
| January | 4.0 | 9 |
| February | 13.0 | 8 |
| March | 29.0 | 9 |
| April | 3.0 | 8 |
| May | 4.0 | 10 |
| June | 2.0 | 8 |
| July | 2.0 | 8 |
| August | 3.0 | 8 |
| September | 4.0 | 8 |
| October | 1.0 | 9 |
| November | 3.0 | 9 |
| December | 2.0 | 7 |
| Sampling Frequency Requirement Met | | Yes |

**Table 6 Chemical and Energy Usage**

| Month | Aluminum Sulphate litres | Hydro kilowatt hours | Natural Gas cubic metres |
|---|---|---|---|
| January | 12,344 | 56,622 | 17,119 |
| February | 12,969 | 59,098 | 17,124 |
| March | 14,427 | 57,658 | 17,248 |
| April | 10,735 | 61,825 | 12,830 |
| May | 9,750 | 59,077 | 13,016 |
| June | 7,792 | 61,847 | 1,240 |
| July | 5,964 | 55,059 | 1,159 |
| August | 5,553 | 43,616 | 1,320 |
| September | 6,493 | 37,929 | 1,199 |
| October | 7,701 | 56,253 | 1,320 |
| November | 7,779 | 50,369 | 10,142 |
| December | 10,289 | 57,994 | 13,593 |
| Total | 111,795 | 657,346 | 107,310 |