## Cannington Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Cannington Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 8730-8CYU2X Dated June 28, 2012

The Cannington Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers an overview of the performance of the Cannington WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### Water Pollution Control Plant Process Description

### General

The Cannington WPCP located in the Community of Cannington in the Township of Brock is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA. This MOECC Class One wastewater treatment plant is designed to treat wastewater at a rated capacity of 1,068 cubic metres per day ($m^3$/d) and utilizes two seasonal wastewater stabilization lagoons. The Cannington WPCP has a service population of 2,292 residents. The treated effluent is discharged to the Beaver River in accordance with the conditions listed in the ECA.

### Raw Influent Pumping

Wastewater is collected in approximately 12.7 km of sanitary sewers in the Cannington service area and is conveyed to the treatment facility by a sanitary sewage pumping station located on Laidlaw Street. Aluminum sulphate is added at Laidlaw Street Pumping Station to enhance the settling of solids and phosphorus removal.

### Lagoon Treatment

The Cannington WPCP is a seasonal wastewater stabilization lagoon facility consisting of a two cell lagoon system that is operated as a seasonal retention facultative waste stabilization pond providing a retention time of approximately 190 days. Flow to the Cannington WPCP is distributed to each cell through an influent distribution chamber. Each cell is equipped with an outlet chamber and one outfall pipe. The ECA permits two seasonal discharge periods per year. Spring discharge is from March 1st to May 31st and fall discharge is from October 1st to December 31st. Prior to and during discharging to the Beaver River, samples are collected to verify the effluent meets the limits established in the ECA.

## Environmental Compliance Approval

Under Condition 9 (4) of ECA #8730-8CYU2X the Region of Durham must produce an annual 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 Cannington WPCP is analyzed for its chemical and physical composition. Monitoring of the raw wastewater is performed in accordance with the conditions in the ECA.

The Cannington WPCP effluent was determined to be compliant with the approval limits during the reporting period. The plant operated at 77.5% of its rated capacity and received a maximum daily flow of 2,853 $m^3$/d on March 31, 2016. An Inflow and Infiltration study is proposed in 2017. The total treated effluent discharged to the Beaver River in 2016 was calculated to be 315,489 $m^3$.

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

No operating problems were encountered in 2016.

**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 influent flow meter located at Laidlaw Street Pumping Station was conducted in May and November, 2016.
- Temperature and pH are monitored in the field, all other routine process control tests are performed at the Lake Simcoe WPCP laboratory in Beaverton. All monitoring and laboratory equipment is calibrated and maintained according to manufacturer's specifications.

**f) Estimate of the sludge settling capacity of the lagoons and its annual depletion**

The annual depletion of the sludge settling capacity is negligible. There was no removal of biosolids during the reporting period.

**g) 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 consistently remaining well below ECA limits.
- All effluent objectives were met in 2016 except for $CBOD_5$ and Total Suspended Solids on March 14, 2016 during spring discharge. In house lab test results were below the

objectives, the discharge was discontinued for an odour issue prior to receiving results from the Regional Environmental Laboratory.

- Best efforts will continue to be applied to maintain results below objectives.

**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. Two odour complaints were received during spring discharge on March 9th and 14th, the odour is deemed to be caused by the melting of ice on the lagoon allowing trapped gases to escape. The discharge was closed March 14th upon receipt of complaints.

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

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

**j) Status Update of the Initial Effluent Characterization**

The initial effluent characterization report was submitted in April of 2016.

**k) Information required by MOECC District Manager**

No additional information was requested.

**MOECC Inspection**

This plant was not inspected by the MOECC in 2016.

## Summary of Tables

### Table 1 Raw Influent Flows

| Month | Total Flow to Plant -metered at the Laidlaw Street Pumping Station $m^3$ | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ | Minimum Daily Flow $m^3/d$ |
|---|---|---|---|---|
| January | 28,252 | 911 | 1,265 | 638 |
| February | 29,190 | 1,007 | 1,347 | 757 |
| March | 47,446 | 1,531 | 2,853 | 899 |
| April | 43,527 | 1,451 | 2,752 | 950 |
| May | 25,397 | 819 | 980 | 709 |
| June | 19,590 | 653 | 783 | 526 |
| July | 18,756 | 605 | 698 | 508 |
| August | 19,141 | 617 | 1,379 | 486 |
| September | 16,934 | 564 | 655 | 471 |
| October | 17,096 | 551 | 610 | 434 |
| November | 17,347 | 578 | 625 | 510 |
| December | 20,395 | 658 | 1,060 | 528 |
| Total | 303,070 | | | |
| Annual Average | 25,256 | 828 | | |
| Minimum | 16,934 | | | 434 |
| Maximum | 47,446 | | 2,853 | |
| ECA Requirement | | 1068* | | |
| Met Compliance | | Yes | | |

*Annual Average

**Table 2 Raw Influent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 90 | 82 | 138 | 126 | 186 | 170 | 4.8 | 4.4 |
| February | 78 | 78 | 109 | 110 | 153 | 154 | 3.7 | 3.8 |
| March | 88 | 135 | 110 | 169 | 256 | 391 | 3.3 | 5.0 |
| April | 65 | 94 | 78 | 113 | 101 | 147 | 3.3 | 4.7 |
| May | 107 | 88 | 132 | 108 | 172 | 141 | 4.9 | 4.0 |
| June | 179 | 117 | 211 | 138 | 257 | 168 | 7.7 | 5.0 |
| July | 189 | 114 | 242 | 146 | 242 | 146 | 6.4 | 3.8 |
| August | 152 | 94 | 243 | 150 | 226 | 140 | 6.7 | 4.1 |
| September | 183 | 103 | 243 | 137 | 241 | 136 | 7.0 | 3.9 |
| October | 172 | 95 | 226 | 125 | 247 | 136 | 7.8 | 4.3 |
| November | 156 | 90 | 195 | 113 | 200 | 116 | 7.0 | 4.1 |
| December | 125 | 82 | 154 | 101 | 191 | 126 | 6.2 | 4.1 |
| Average | 132 | 109 | 173 | 144 | 206 | 171 | 5.7 | 4.7 |
| Minimum | 65 | 78 | 78 | 101 | 101 | 116 | 3.3 | 3.8 |
| Maximum | 189 | 135 | 243 | 169 | 257 | 391 | 7.8 | 5.0 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TKN loading kg/d | TAN avg. conc. mg/L | TAN loading kg/d | pH min. | pH max. | Temp. Degrees Celsius Min | Temp. Degrees Celsius Max |
|---|---|---|---|---|---|---|---|---|---|
| January | 2.4 | 41.75 | 38 | 23.15 | 21 | 7.46 | 8.00 | 9.8 | 11.0 |
| February | 1.6 | 30.16 | 30 | 18.84 | 19 | 7.36 | 7.90 | 9.0 | 10.7 |
| March | 1.4 | 25.53 | 39 | 13.53 | 21 | 7.27 | 7.90 | 8.6 | 10.5 |
| April | 1.7 | 28.35 | 41 | 16.71 | 24 | 7.26 | 8.00 | 7.8 | 10.2 |
| May | 2.3 | 44.78 | 37 | 28.17 | 23 | 7.40 | 8.01 | 10.0 | 13.8 |
| June | 4.0 | 58.38 | 38 | 37.39 | 24 | 7.50 | 8.00 | 12.8 | 15.2 |
| July | 3.5 | 56.18 | 34 | 40.76 | 25 | 7.65 | 8.11 | 14.8 | 18.8 |
| August | 3.7 | 58.38 | 36 | 39.56 | 24 | 8.09 | 8.12 | 16.8 | 17.4 |
| September | 3.9 | 64.18 | 36 | 41.59 | 23 | 7.81 | 8.24 | 16.7 | 25.0 |
| October | 4.5 | 71.60 | 39 | 47.35 | 26 | 7.94 | 8.34 | 14.5 | 17.1 |
| November | 4.1 | 66.65 | 39 | 48.49 | 28 | 7.73 | 8.12 | 13.5 | 15.9 |
| December | 3.7 | 53.18 | 35 | 35.36 | 23 | 7.28 | 7.90 | 10.6 | 13.4 |
| Average | 3.1 | 49.92 | 41 | 32.57 | 27 | | | | |
| Minimum | 1.4 | 25.53 | 30 | 13.53 | 19 | 7.26 | | 7.8 | |
| Maximum | 4.5 | 71.60 | 41 | 48.49 | 28 | | 8.34 | | 25.0 |
| Sampling Frequency Requirement Met | | | | Yes | | Yes | Yes | Yes | Yes |

**Table 3 Calculated Effluent Flows**

| Month | Effluent Flow $m^3$ |
|---|---|
| January | |
| February | |
| March | 95,249 |
| April | 97,466 |
| May | 20,087 |
| June | |
| July | |
| August | |
| September | |
| October | 74,246 |
| November | 13,180 |
| December | 15,261 |
| Total | 315,489 |
| Annual Average | 52,581 |
| Minimum | 13,180 |
| Maximum | 97,466 |

**Table 4 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | TP loading kg/month |
|---|---|---|---|---|---|---|---|---|---|
| January | | | | | | | | | |
| February | | | | | | | | | |
| March | 9.4 | 69 | 11.6 | 84 | 13.8 | 100.6 | 0.18 | 1.3 | 17.3 |
| April | 3.2 | 28 | 3.6 | 31 | 7.4 | 65.8 | 0.10 | 0.9 | 9.4 |
| May | 4.6 | 24 | 5.3 | 27 | 6.1 | 31.4 | 0.07 | 0.4 | 1.4 |
| June | | | | | | | | | |
| July | | | | | | | | | |
| August | | | | | | | | | |
| September | | | | | | | | | |
| October | 3.5 | 34 | 6.1 | 59 | 8.4 | 81.2 | 0.12 | 1.1 | 8.6 |
| November | 2.7*** | 10*** | 5.9*** | 23*** | 15.9 | 61.4 | 0.22 | 0.8 | 2.9 |
| December | 6.7 | 49 | 9.5 | 70 | 8.3 | 61.2 | 0.14 | 1.1 | 2.2 |
| Total | | | | | | | | | 41.7 |
| Average | 5.0 | 39 | 7.0 | 54 | 10.0 | 76.7 | 0.14 | 1.1 | 8.1 |
| Minimum | 2.7 | 10 | 3.6 | 23 | 6.1 | 31.4 | 0.07 | 0.4 | 1.4 |
| Maximum | 9.4 | 69 | 11.6 | 84 | 15.9 | 100.6 | 0.22 | 1.3 | 17.3 |
| ECA Limit | 25** | | | | 30** | | | | 117* |
| ECA Objective | 15 | | | | 20 | | 0.5 | | |
| LSPRS | | | | | | | 0.25** | | 97* |
| Within Compliance | Yes | | | | Yes | | Yes | | Yes |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | | Yes |

*Total Annual Loading, kg/year

**Annual Average Concentration

*** October 31st results, no samples were submitted in November as the discharge stopped November 4th.The weekly sampling requirement was met.

**Table 4 Final Effluent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TAN avg. conc. mg/L | TAN loading kg/d | Un-ionized Ammonia avg. conc. mg/L | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|---|
| January | | | | | | | | | |
| February | | | | | | | | | |
| March | 0.03 | 15.23 | 14.4 | 105.5 | 0.02 | 6.8 | 7.6 | 2.4 | 6.1 |
| April | 0.01 | 6.92 | 5.4 | 47.6 | 0.05 | 7.3 | 7.9 | 4.5 | 15.8 |
| May | 0.01 | 13.30 | 12.8 | 66.1 | 0.11 | 7.3 | 7.8 | 13.4 | 18.2 |
| June | | | | | | | | | |
| July | | | | | | | | | |
| August | | | | | | | | | |
| September | | | | | | | | | |
| October | 0.01 | 7.56 | 6.02 | 58.5 | 0.04 | 7.6 | 7.7 | 4.2 | 9.4 |
| November | 0.00*** | 7.72*** | 6.61 | 25.5 | 0.01 | 7.1 | 7.1 | 6.7 | 10.0 |
| December | 0.02 | 17.40 | 15.1 | 110.7 | 0.02 | 6.8 | 7.1 | 2.1 | 3.0 |
| Average | 0.01 | 11.35 | 10.1 | 77.2 | 0.04 | | | | |
| Minimum | 0.00 | 6.92 | 5.4 | 25.5 | 0.01 | 6.8 | | 2.1 | |
| Maximum | 0.03 | 17.40 | 15.1 | 110.7 | 0.11 | | 7.9 | | 18.2 |
| ECA Limit | | | | | | 6.0 | 9.5 | | |
| ECA Objective | | | | | | 6.5 | 8.0 | | |
| Within Compliance | | | | | | Yes | Yes | | |
| Sampling Frequency Requirement Met | | | Yes | | Yes | Yes | Yes | Yes | Yes |

**Table 5 Chemical Usage**

| Month | Aluminum Sulphate (litres) |
|---|---|
| January | 8,395 |
| February | 9,794 |
| March | 20,383 |
| April | 11,357 |
| May | 11,117 |
| June | 9,107 |
| July | 7,503 |
| August | 4,369 |
| September | 2,132 |
| October | 7,562 |
| November | 7,373 |
| December | 7,228 |
| Total | 106,320 |

## Glossary of Terms

### Annual Average Concentration

An arithmetic mean of the seasonal average concentrations of a contaminant in the effluent calculated for any particular year.

### Annual Average Loading

The value obtained by multiplying the seasonal average concentration of a contaminant by the Average Daily Flow over the same calendar year.

### Average Daily Flow

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

### $BOD_5$ Five Day Biochemical Oxygen Demand

(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**

Any discharge from any portion of the works other than in accordance with the conditions of the ECA.

**$CBOD_5$ -Five Day Carbonaceous Biochemical Oxygen Demand**

Means a five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

**Conc. Concentration**

The abundance of a constituent divided by the total volume of a mixture.

**Daily Concentration**

Means the concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required.

**DP – Dissolved Reactive Phosphorus**

This is the soluble form of phosphorus present in the wastewater.

**ECA Environmental Compliance Approval**

The primary regulatory instrument for each water pollution control plant.

**E. coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Means sewage discharge via the water pollution control plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, when tested provides a snapshot of the conditions at the time the sample was retrieved.

**kg - kilogram**

Basic unit of mass in the metric system

**kg/d – kilogram per day**

**LSPRS - Lake Simcoe Phosphorus Reduction Strategy**

The ECA issued on June 28, 2012 introduced additional phosphorus objectives to comply with the requirements of the Lake Simcoe Phosphorus Reduction Strategy (2010) prepared under the Lake Simcoe Protection Plan (2009).

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3/d$ - (Cubic Metre Per Day)**

Flow measurement, $1m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max-Maximum**

The peak or highest value recorded during a specific time period usually a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in water, sometimes referred to as parts per million (ppm).

**Min-Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm-(millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**

Means the arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Loading**

Is calculated by multiplying the monthly average concentration of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**N/A - Not Applicable**

**N/D - No Discharge**

**Peak Flow Rate**

The maximum rate of sewage flow for which the plant or process unit was designed.

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The average daily flow for which the works are approved to handle**.**

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Seasonal Average Concentration**

Means the arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured or both during the seasonal discharge period.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN - Total Ammonia Nitrogen**

Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**Total Annual Loading**

Is calculated by summarizing the total monthly loadings within a calendar year**.**

**Total Monthly Loading**

Is calculated by multiplying the total monthly flow by the monthly average concentration.

**TP - Total Phosphorus**

A laboratory analyses to determine the total amount of non-soluble and soluble phosphorus present in the wastewater.

**TSS - Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS - Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**WPCP - Water Pollution Control Plant**

A facility composed of a variety of treatment processes that collectively treat wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Corbett Creek Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Corbett Creek Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 7560-9PPRJC Dated November 12, 2014

**Environmental Compliance Approval (Air)**: 1581-9URJFE Dated May 13, 2015

The Corbett Creek Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers a performance overview of the Corbett Creek WPCP for 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### Water Pollution Control Plant Process Description

### General

The Corbett Creek WPCP located in the Town of Whitby and is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA.

Corbett Creek WPCP treats wastewater from the Whitby, Brooklin and Oshawa service areas. The Corbett Creek WPCP services approximately 143,238 residents.

The Corbett Creek WPCP is designed to treat wastewater at an average daily flow rate of 84,350 cubic metres per day ($m^3$/d). The plant is an MOECC Class Four conventional activated sludge treatment plant that utilizes the following processes to treat wastewater:

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- phosphorus removal
- secondary treatment,
- disinfection (chlorination/dechlorination),
- solids treatment.

### Raw Influent Pumping

Wastewater is collected through approximately 450 km of sanitary sewers in the Town of Whitby, the Brooklin urban area, and the City of Oshawa. It is conveyed to the plant by gravity and by several sanitary sewage pumping stations located in the collection system.

### Preliminary Treatment

**Screening**: Two automatic, mechanically cleaned screens remove paper products and large material that could harm pumps and process equipment. Screenings removed in this process are compacted for landfill disposal.

**Grit Removal**: Heavy suspended material such as sand and small stones (grit) is removed in the two aerated grit tanks. The velocity of the wastewater rolling in the tanks is controlled by the quantity of air added to produce conditions that allow heavy grit material to settle, while keeping the lighter organic material in suspension to proceed to the next process tank. The grit removed in this process is dewatered and transported to landfill.

### Primary Treatment

The four primary clarifiers utilize the physical process of sedimentation which allows suspended material to settle to the bottom of the tank as sludge. This raw sludge, along with excess activated sludge from the secondary treatment process is collected by a sweep mechanism which pushes the sludge into hoppers. The sludge is then pumped to the anaerobic digesters for further treatment. Any material floating on the surface of the clarifier (scum) is also removed to the digester.

### Secondary Treatment

**Aeration**: The aeration tank is where fine bubbled air is diffused into the sewage to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the bioreactors is directed to the seven secondary clarifiers where the solids settle quickly to the bottom as activated sludge leaving clear supernatant. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the bioreactors and the excess activated sludge is wasted to the primary clarifiers.

### Phosphorous Removal

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding a chemical coagulant (ferrous chloride). Ferrous chloride is added at the primary effluent.

### Disinfection (chlorination/dechlorination)

Chlorine in the form of liquid sodium hypochlorite is metered into the effluent stream for pathogen control. Adequate contact time is provided by the two chlorine contact chambers. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario through the 1,800 mm diameter outfall extending 409 m into Lake Ontario.

### Solids Treatment

**Anaerobic Digestion**: The raw sludge that is collected from the primary clarifiers is pumped into the anaerobic digesters where anaerobic bacteria reduce the volume of sludge. As a result of digestion the plant produces a more stabilized sludge, water, carbon dioxide, methane, and hydrogen sulphide. The water is returned to the head of the plant for further treatment.

**Biosolids:** All digested sludge produced is pumped to the biosolids holding facility. From there the treated biosolids can be utilized on approved agricultural fields or be shipped to Duffin Creek WPCP for incineration. Biosolids are transported plant to plant in accordance with ECA #A820250 and ECA #4400-4LBLXD for land application.

## Environmental Compliance Approval

Under Condition 10 (6) of ECA #7560-9PPRJC the Region of Durham must produce an annual report that contains 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 summarizes the raw wastewater characteristics during the reporting period.

The Corbett Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period except for one limit exceedance noted below. The plant operated at an average of 56% of its annual average rated flow capacity and received a maximum daily flow of 94,674 $m^3$/d on January 11.

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

- A process difficulty occurred in December on one of the aeration tanks causing extremely high nitrites. This resulted in a large chlorine demand and caused two high individual E.coli results. The monthly geometric mean average for December exceeded the limit of 200cfu/100ml with a result of 205cfu/100ml. The MOECC was notified on January 4, 2017.

### c) Maintenance of major equipment

Major maintenance items in 2016 included:

- Rebuilt raw sludge pump #4.
- Rewired travelling bridge #6.
- Rebuilt raw lift pump #1.
- Installed new Variable Frequency Drive (VFD) on Return Activated Sludge (RAS) pump #1.
- Rebuilt RAS pump #1.
- Installed new scum pump in building I.
- Installed new screenings packer auger.
- Rebuilt RAS pump #5 in building I.
- Conducted electrical substation maintenance.
- Installed secondary travelling bridge drives on #5 and #6.

### d) Summary of any effluent quality assurance or control measures

- 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

- Calibration of the raw influent flow meters was conducted in April and September 2016.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted on July 28th 2016.
- Calibration of the in-house lab pH meter was conducted regularly.

### f) Effluent Objectives

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

The annual average daily flow did not exceed the rated capacity of 84,350 $m^3$/d.

The total suspended solids objective of 15.0 mg/L was exceeded in 37 of 397 samples (9%). These exceedances were investigated and no direct cause could be found. The plant was operating properly and the exceeding samples were sporadic through the year.

Total phosphorus objective of 0.8 mg/L was exceeded in 42 of 301 samples (14%). This was due primarily to chemical feed pump issues. Chemical dosing was increased accordingly for all events.

The total chlorine residual objective of “non-detect” was exceeded in 64 of 340 samples (19%). The ECA requests an objective concentration of “non-detect”, however the instrumentation used has a detection limit of 0.0012 mg/L so it is typical to have results detected. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals..

The pH objective of not less than 6.5 was exceeded 3 of 310 samples (1%). The pH meter was calibrated regularly.

The E.coli objective of 150cfu/100ml was exceeded in 1 of 12 (8%) monthly geometric mean averages which coincided with the limit exceedance reported for December.

Best efforts and process adjustments will continue to be applied to maintain results below objectives.

### g) Biosolids Production:

**Tabulation of Volume of Sludge Generated:**

The volume of sludge removed from Corbett Creek WPCP in 2016 was 81,236 $m^3$.

**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:**

Duffin Creek WPCP – 40,790 $m^3$ or 50.2%

Agricultural Fields – 40,446 $m^3$ or 49.8%

### h) Summary of Complaints and Steps Taken to Address the Complaint:

One odour complaint was received in August from a local resident. The concern was investigated and could not be confirmed as an odour from the treatment plant. The MOECC was notified of the incident.

### i) By-passes and Spills

No by-passes occurred at the plant in 2016.

### j) Notice of Modifications submitted to Water Supervisor and Status Report of Limited Operational Flexibility

No modifications under “Limited Operational Flexibility” were conducted.

**k) Modifications Arising under section 3 of Schedule A**

No modifications under section 3 of Schedule A were conducted.

**l) Information Required by MOECC Water Supervisor**

No additional information was requested.

**MOECC Inspection**

No MOECC inspection occurred in 2016.

**Table 1 Raw Influent Flows**

| Month | Total Flow to Plant -metered at the final effluent $m^3$ | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ |
|---|---|---|---|
| January | 1,669,898 | 53,868 | 94,674 |
| February | 1,521,684 | 52,472 | 66,350 |
| March | 1,708,183 | 55,103 | 67,953 |
| April | 1,796,377 | 59,879 | 89,784 |
| May | 1,447,975 | 46,709 | 54,459 |
| June | 1,312,223 | 43,741 | 47,605 |
| July | 1,316,728 | 42,475 | 52,410 |
| August | 1,340,882 | 43,254 | 53,538 |
| September | 1,259,437 | 41,981 | 46,580 |
| October | 1,304,521 | 42,081 | 46,957 |
| November | 1,251,234 | 41,708 | 48,767 |
| December | 1,367,260 | 44,105 | 57,641 |
| Total | 17,296,402 | | |
| Average | 1,441,367 | 47,258* | |
| Maximum | 1,796,377 | | 94,674 |
| ECA Limit | | 84,350 | |
| Met Compliance | | Yes | |

*Annual Average Daily Flow

**Table 2 Raw Influent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 62 | 3,314 | 82 | 4,390 | 113 | 6,062 | 3.7 | 197 |
| February | 66 | 3,442 | 79 | 4,161 | 112 | 5,887 | 3.2 | 167 |
| March | 79 | 4,352 | 115 | 6,354 | 114 | 6,277 | 3.1 | 173 |
| April | 49 | 2,298 | 83 | 3,890 | 141 | 6,591 | 2.8 | 131 |
| May | 115 | 5,352 | 128 | 5,988 | 171 | 7,974 | 3.9 | 180 |
| June | 132 | 5,791 | 159 | 6,935 | 193 | 8,463 | 4.0 | 177 |
| July | 121 | 5,128 | 150 | 6,371 | 187 | 7,960 | 4.1 | 176 |
| August | 111 | 4,799 | 140 | 6,056 | 158 | 6,834 | 4.3 | 185 |
| September | 129 | 5,416 | 144 | 6,035 | 175 | 7,360 | 4.0 | 169 |
| October | 88 | 3,689 | 127 | 5,324 | 106 | 4,444 | 4.1 | 172 |
| November | 97 | 4,054 | 128 | 5,355 | 146 | 6,075 | 3.9 | 162 |
| December | 98 | 4,326 | 141 | 6,211 | 102 | 4,497 | 4.8 | 212 |
| Average | 95 | 4,513 | 123 | 5,811 | 143 | 6,765 | 3.8 | 181 |
| Minimum | 49 | 2,298 | 79 | 3,890 | 102 | 4,444 | 2.8 | 131 |
| Maximum | 132 | 5,791 | 159 | 6,935 | 193 | 8,463 | 4.8 | 212 |
| Sampling Frequency Requirement Met | | | Yes | | Yes | | Yes | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TAN avg. conc. mg/L | TAN loading kg/d | pH min. | pH max. |
|---|---|---|---|---|---|---|
| January | 1.94 | 31.05 | 26 | 1,374 | 6.63 | 7.80 |
| February | 1.81 | 32.48 | 18 | 962 | 7.20 | 7.75 |
| March | 1.85 | 41.62 | 22 | 1,209 | 7.30 | 8.43 |
| April | 1.53 | 27.10 | 15 | 685 | 6.60 | 7.85 |
| May | 1.83 | 33.95 | 23 | 1,054 | 6.70 | 7.89 |
| June | 1.88 | 39.22 | 24 | 1,068 | 7.67 | 7.96 |
| July | 1.79 | 35.53 | 23 | 966 | 7.27 | 7.91 |
| August | 2.12 | 41.36 | 25 | 1,103 | 7.41 | 8.02 |
| September | 1.82 | 36.40 | 25 | 1,055 | 7.56 | 7.90 |
| October | 2.09 | 34.48 | 24 | 990 | 7.60 | 8.06 |
| November | 2.06 | 35.36 | 28 | 1,184 | 7.60 | 7.98 |
| December | 2.26 | 39.28 | 38 | 1,672 | 7.56 | 8.20 |
| Average | 1.91 | 35.65 | 24 | 1,144 | | |
| Minimum | 1.53 | 27.10 | 15 | 685 | 6.60 | |
| Maximum | 2.26 | 41.62 | 38 | 1,672 | | 8.43 |
| Sampling Frequency Requirement Met | | Yes | | | | |

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | TAN avg. conc. mg/L summer | TAN avg. conc. mg/L winter | TAN loading kg/d |
|---|---|---|---|---|---|---|---|---|---|
| January | 2.8 | 151 | 6.7 | 359 | 0.61 | 32.8 | 2.16 | -- | 116.2 |
| February | 3.0 | 160 | 6.6 | 344 | 0.55 | 28.9 | 0.55 | -- | 28.6 |
| March | 3.2 | 179 | 7.4 | 408 | 0.37 | 20.1 | 0.54 | -- | 29.6 |
| April | 5.0 | 234 | 12.5 | 584 | 0.50 | 23.5 | 1.79 | -- | 83.5 |
| May | 3.4 | 158 | 7.8 | 363 | 0.48 | 22.3 | -- | 0.38 | 17.6 |
| June | 3.3 | 144 | 11.1 | 486 | 0.47 | 20.6 | -- | 0.74 | 32.3 |
| July | 2.9 | 124 | 8.8 | 374 | 0.40 | 16.9 | -- | 0.46 | 19.7 |
| August | 2.8 | 121 | 9.8 | 425 | 0.71 | 30.8 | -- | 0.53 | 22.9 |
| September | 2.7 | 113 | 8.9 | 372 | 0.76 | 32.0 | -- | 0.41 | 17.1 |
| October | 2.6 | 110 | 6.8 | 287 | 0.57 | 23.8 | -- | 0.61 | 25.9 |
| November | 3.0 | 127 | 7.5 | 314 | 0.65 | 27.0 | 0.91 | -- | 37.8 |
| December | 3.0 | 133 | 10.7 | 474 | 0.74 | 32.8 | 0.22 | -- | 9.9 |
| Average | 3.2 | 149 | 8.7 | 412 | 0.57 | 26.8 | 1.03 | 0.52 | 36.8 |
| Minimum | 2.6 | 110 | 6.6 | 287 | 0.37 | 16.9 | 0.22 | 0.38 | 9.9 |
| Maximum | 5.0 | 234 | 12.5 | 584 | 0.76 | 32.8 | 2.16 | 0.74 | 116.2 |
| ECA Requirement | 25 | 2108 | 25 | 2108 | 1.0 | 84 | 16 | 24 | 1350 (summer) /2024 (winter) |
| ECA Objective | 15 | | 15 | | 0.8 | | 8 | 18 | |
| Within Compliance | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | Yes | |

**Table 3 Final Effluent Analyses continued**

| Month | Unionized NH3 avg. conc. mg/L | TKN avg. conc. mg/L | DP avg. conc. mg/L | TCR avg. conc. mg/L | TCR loading kg/d | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|---|
| January | 0.0 | 3.42 | 0.31 | 0.01 | 0.3 | 7.25 | 7.80 | 13.0 | 15.5 |
| February | 0.0 | 2.05 | 0.24 | 0.00 | 0.0 | 7.20 | 7.80 | 11.2 | 14.7 |
| March | 0.0 | 2.47 | 0.16 | 0.00 | 0.0 | 6.89 | 7.83 | 12.0 | 14.5 |
| April | 0.0 | 3.96 | 0.29 | 0.01 | 0.3 | 6.30 | 7.30 | 11.9 | 15.2 |
| May | 0.0 | 1.99 | 0.28 | 0.00 | 0.0 | 6.34 | 7.80 | 12.0 | 17.8 |
| June | 0.0 | 3.29 | 0.21 | 0.01 | 0.5 | 6.95 | 7.50 | 17.9 | 20.4 |
| July | 0.0 | 1.86 | 0.17 | 0.00 | 0.1 | 6.89 | 7.57 | 12.0 | 22.0 |
| August | 0.0 | 2.93 | 0.39 | 0.01 | 0.3 | 7.21 | 7.80 | 22.0 | 23.0 |
| September | 0.0 | 2.06 | 0.55 | 0.00 | 0.0 | 6.96 | 7.50 | 21.6 | 24.5 |
| October | 0.0 | 2.08 | 0.37 | 0.00 | 0.0 | 7.10 | 7.60 | 12.0 | 23.0 |
| November | 0.0 | 2.46 | 0.46 | 0.00 | 0.0 | 7.00 | 7.75 | 16.7 | 20.0 |
| December | 0.0 | 1.90 | 0.41 | 0.00 | 0.1 | 7.17 | 7.55 | 15.0 | 18.0 |
| Average | 0.0 | 2.54 | 0.32 | 0.00 | 0.1 | | | | |
| Minimum | 0.0 | 1.86 | 0.16 | 0.00 | 0.0 | 6.30 | | 11.2 | |
| Maximum | 0.0 | 3.96 | 0.55 | 0.01 | 0.5 | | 7.83 | | 24.5 |
| ECA Requirement | | | | 0.02 | | 6.0 | 9.0 | | |
| ECA Objective | | | | Non-detect | | 6.5 | 8.5 | | |
| Within Compliance | | | | Yes | | Yes | Yes | | |
| Sampling Frequency Requirement Met | Yes | | | Yes | | Yes | Yes | Yes | Yes |

**Table 4 Escherichia Coliform Sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 4 | 14 |
| February | 4 | 32 |
| March | 5 | 20 |
| April | 4 | 26 |
| May | 4 | 17 |
| June | 4 | 36 |
| July | 4 | 44 |
| August | 5 | 45 |
| September | 4 | 37 |
| October | 4 | 59 |
| November | 5 | 130 |
| December | 6 | 205 |
| ECA Requirement | | 200 |
| ECA Objective | | 150 |
| Within Compliance | | No |
| Sampling Frequency Requirement Met | Yes | |

**Table 6 Energy and Chemical Usage**

| Month | Total Plant Flow (cubic metres) | Ferrous Chloride (litres) | Sodium Hypochlorite (kilograms as chlorine) | Sodium Bisulphite (Litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|---|---|---|
| January | 1,669,898 | 183,950 | 7,513 | 17,579 | 739,078 | 59,244 |
| February | 1,521,684 | 152,640 | 7,067 | 14,921 | 736,197 | 46,579 |
| March | 1,708,183 | 176,490 | 9,387 | 16,440 | 770,147 | 43,305 |
| April | 1,796,377 | 154,740 | 10,167 | 19,856 | 732,518 | 49,336 |
| May | 1,447,975 | 177,060 | 8,181 | 19,625 | 758,339 | 32,662 |
| June | 1,312,223 | 175,020 | 8,465 | 23,058 | 703,560 | 24,536 |
| July | 1,316,728 | 169,360 | 8,804 | 28,154 | 710,566 | 24,473 |
| August | 1,340,882 | 157,470 | 9,433 | 34,723 | 722,277 | 20,323 |
| September | 1,259,437 | 166,060 | 7,482 | 9,917 | 715,567 | 20,333 |
| October | 1,304,521 | 170,680 | 5,827 | 8,412 | 713,438 | 29,845 |
| November | 1,251,234 | 141,000 | 6,187 | 7,582 | 711,819 | 33,230 |
| December | 1,367,260 | 163,710 | 9,238 | 9,854 | 757,639 | 41,190 |
| Total | 17,296,402 | 1,988,180 | 97,751 | 210,121 | 8,771,145 | 425,056 |

## Glossary of Terms

**Aeration Tank**
A vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms. This encompasses a combination of aerobic, and anoxic processes.

**Anaerobic Digestion**
Is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

**Average Daily Flow**
The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

**Biosolids**
Organic material recovered from wastewater sludge.

**$BOD_5$ Five Day Biochemical Oxygen Demand**
(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**
A diversion of sewage around one or more unit processes within the Sewage Treatment Plant with the diverted sewage flows being returned to the Sewage Treatment Plant treatment train upstream of the Final effluent sampling location, and discharging to the environment through the Sewage Treatment Plant outfall.

**$CBOD_5$ -Five day Carbonaceous Biochemical Oxygen Demand**
A five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

**conc. – Concentration**
A measure of the amount of dissolved substance contained per unit of volume.

**DP – Dissolved Phosphorus**
This is the soluble form of phosphorus present in the wastewater.

**ECA - Environmental Compliance Approval**
The primary regulatory instrument for each WPCP.

**E. coli - (Escherichia coli)**
Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**
Sewage discharge via the WPCP outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**
Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**
A single sample taken at a specific moment in time, a snapshot of the conditions at the time the sample was retrieved.

**$m^3$ - (Cubic Metre)**
Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metres Per Day)**
Flow measurement, $1m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**
The peak or highest value recorded during a specific time period usually in a day.

**Maximum Flow Rate**
The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**
This is a measure of the concentration of a parameter in water or wastewater, sometimes referred to as parts per million (ppm).

**Min. – Minimum**
The lowest value recorded during a specific time period usually in a day.

**mm - (millimetre)**
Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**
The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**
The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Loading**
Calculated by multiplying the monthly average concentration of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**N/A - Not Applicable**

**pH**
Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Raw Influent**
Raw wastewater entering the water pollution control plant before treatment.

**Septage**
Partially treated sludge from a septic tank.

**Sludge**
The settleable solids separated from liquids during processing.

**TAN -Total Ammonia Nitrogen**

Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**TCR -Total Chlorine Residual**

The total amount of chlorine in water, including the combined chlorine and the free available chlorine.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**TP -Total Phosphorus**

A laboratory analyses to determine the total amount of particulate and soluble phosphorus present in the wastewater.

**TSS -Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS -Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**WPCP - Water Pollution Control Plant**

Is typically a facility composed of a variety of treatment processes that collectively treat the wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Courtice Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Courtice Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 3393-68RLD4 Dated January 28, 2005

**Environmental Compliance Approval (Air)**: 7446-6AGNQZ Dated April 30, 2005

The Courtice Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers a performance overview of the Courtice WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### Water Pollution Control Plant Process Description

### General

The Courtice WPCP is located in the Municipality of Clarington (Courtice) and is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA.

The Courtice WPCP treats wastewater from the Oshawa and Courtice service areas in the Regional Municipality of Durham. The Courtice WPCP receives the majority of its flow from the Harmony Creek catchment area via the Harmony Creek Sanitary Sewage Pumping Station (SSPS), servicing approximately 122,133 residents or 70% of the total catchment population.

The Courtice WPCP is designed to treat wastewater at an average daily flow rate of 68,200 cubic metres per day ($m^3$/d) with a peak flow rate of 180,000 $m^3$/d. The plant is an MOECC Class Four conventional activated sludge treatment plant that utilizes the following processes to treat wastewater:

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- secondary treatment,
- phosphorus removal,
- disinfection (chlorination/dechlorination),
- solids treatment.

### Raw Influent Pumping

Wastewater collected through approximately 656 km of sanitary sewers in Oshawa and Courtice is conveyed to the Harmony Creek SSPS located at the Harmony Creek WPCP. Approximately 70% of the Harmony Creek WPCP influent flow is diverted to the Harmony Creek SSPS and conveyed 6.4 km in a 1050 mm diameter force main to the Courtice WPCP.

In addition, an existing small service area in Courtice is serviced by the Courtice WPCP which includes the Durham/York Energy center, OPG office building and the OPG Darlington Generating Station.

### Preliminary Treatment

**Screening**: Two automatic, mechanically cleaned screens remove paper products and large material that could harm pumps and process equipment. Screenings removed in the process are compacted for landfill disposal.

**Grit Removal**: Heavy suspended material such as sand and small stones (grit) is removed in the two aerated grit tanks. The velocity of the wastewater rolling in the tanks is controlled by the quantity of air added to produce conditions that allow heavy grit material to settle, while keeping the lighter organic material in suspension to proceed to the next process tank. The grit removed in the process is dewatered and transported to landfill.

### Primary Treatment

The two primary clarifiers utilize the physical process of sedimentation which allows the suspended material to settle to the bottom of the tank as sludge. This raw sludge, along with excess activated sludge from the secondary treatment process is collected by a flight and chain mechanism which pushes the sludge into hoppers. The sludge is then pumped to the anaerobic digesters for further treatment. Any material floating on the surface of the clarifier (scum) is also removed to the digester.

### Secondary Treatment

**Aerated Bioreactor**: The bioreactors are comprised of two distinct sections. The first section is an anoxic zone, where no oxygen is introduced and allows for potential denitrification. Subsequently, the flow leaves the anoxic zone and enters the aerated zone where fine bubbled air is diffused into the sewage to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the bioreactors is directed to the two secondary clarifiers where the solids settle quickly to the bottom as activated sludge leaving clear supernatant. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the bioreactors and the excess activated sludge is wasted to the primary clarifiers.

### Phosphorus Removal

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding a chemical coagulant (ferrous chloride). Ferrous chloride can be added at multiple locations within the plant.

**Disinfection**: Chlorine in the form of liquid sodium hypochlorite is metered into the secondary effluent stream for pathogen control. Adequate contact time is provided by the two chlorine contact chambers. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged through the 1,676 mm diameter outfall extending 770 meters into Lake Ontario.

### Solids Treatment

**Anaerobic Digestion**: The raw sludge that is collected from the primary clarifiers is pumped into the anaerobic digesters where anaerobic bacteria reduce the volume of sludge. As a result of digestion

the plant produces a more stabilized sludge, water, carbon dioxide, methane, and hydrogen sulphide. The water is returned to the head of the plant for further treatment and the methane is used to meet the heating requirements of the digesters and for heating areas of the treatment facility.

**Biosolids management:** All digested sludge produced at the Courtice WPCP is pumped to the biosolids holding facility. From there the treated biosolids can be utilized on approved agricultural fields or be shipped to Duffin Creek WPCP for incineration. Biosolids are transported plant to plant in accordance with ECA #A820250 and ECA #4400-4LBLXD for land application.

### Environmental Compliance Approval

Under Condition 10 (6) of ECA #3393-68RLD4 the Region of Durham must produce an annual report that must contain the following information:

**a) Summary and interpretation of all monitoring data and a comparison to the effluent limits, 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 Courtice WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at 69% of its annual average rated flow capacity and received a maximum daily flow of 91,226 $m^3$/d on January 11, 2016.

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

There were no operating issues encountered in 2016.

**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 2016 included:

- Insulated all flight and chain gear boxes.
- Repaired waste gas burner stack, motor, and replaced thermocouple.
- Repaired motor on bioreactor blower #4.
- Replaced drive motor on north primary cross collector.
- Conducted maintenance on north secondary clarifier cross collector.
- Replaced liners on grit conveyor.
- Repaired cross collector on north primary clarifier.
- Emptied and cleaned the south chlorine contact chamber.
- Repaired mixer on secondary digester.

**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. All results were found to be within 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 and the secondary clarifier flow meters was conducted in June and September 2016.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted July 28, 2016.
- Calibration of the in-house lab pH meter was conducted monthly.

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

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

The average daily rated flow capacity of 68,200 $m^3$/d was not exceeded. The rated peak flow capacity of 180,000 $m^3$/d was not exceeded.

The total phosphorus objective of 0.8 mg/L was exceeded in 32 of 259 samples (12%). This was due primarily to insufficient ferrous chloride dosing. Ferrous chloride feed was increased as required.

One of 12 (8%) E.coli samples exceeded the objective of 200 cfu/100 ml. This occurred due to one elevated sample. Chlorine dosage was increased to maintain a higher chlorine residual.

Best efforts and process adjustments will continue to be applied to maintain results below objectives.

**g) Tabulation of Volume of Sludge Generated:**

The volume of sludge removed from Courtice WPCP in 2016 was 62,660$m^3$.

**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:**

Duffin Creek WPCP – 28,032 $m^3$ or 44.7%

Agricultural Fields – 34,628 $m^3$ or 55.3%

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

No odour complaints were made regarding the treatment plant in 2016.

**i) Summary of all By-pass, spill or abnormal discharge events.**

There were no by-passes during the reporting period. There are no anticipated by-passes planned during the next reporting period.

There were no spills during the reporting period.

**j) Any other information the District Manager requires from time to time.**

No additional information was requested.

**MOECC Inspection**

No MOECC inspection occurred in 2016.

**Table 1 Raw Influent Flow**

| Month | Total Flow to Plant - metered at the final effluent $m^3$ | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ |
|---|---|---|---|
| January | 1,561,224 | 50,362 | 91,226 |
| February | 1,187,644 | 40,953 | 49,239 |
| March | 1,496,586 | 48,277 | 56,946 |
| April | 1,563,399 | 52,113 | 87,303 |
| May | 1,090,575 | 35,180 | 43,372 |
| June | 869,316 | 28,977 | 35,148 |
| July | 794,194 | 25,619 | 32,079 |
| August | 877,933 | 28,320 | 39,578 |
| September | 1,005,438 | 33,515 | 38,255 |
| October | 1,008,537 | 32,533 | 36,934 |
| November | 1,058,254 | 35,275 | 38,478 |
| December | 1,227,865 | 39,609 | 55,355 |
| Total | 13,740,964 | | |
| Average | 1,145,080 | 37,544* | |
| Minimum | 794,194 | | |
| Maximum | 1,563,399 | | 91,226 |
| ECA Requirement | | 68,200 | 180,000 |
| Met Compliance | | Yes | Yes |

*Annual Average Daily Flow

**Table 2 Raw Influent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ avg. loading kg/d | BOD5 avg. conc. mg/L | BOD5 avg. loading kg/d | TSS avg. conc. mg/L | TSS avg. loading kg/d | TP avg. conc. mg/L | TP avg. loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 138 | 6,925 | 225 | 11,331 | 242 | 12,174 | 4.0 | 201 |
| February | 116 | 4,740 | 207 | 8,467 | 260 | 10,640 | 4.1 | 169 |
| March | 91 | 4,413 | 146 | 7,056 | 235 | 11,359 | 3.7 | 177 |
| April | 70 | 3,657 | 103 | 5,375 | 209 | 10,916 | 3.2 | 165 |
| May | 171 | 6,025 | 290 | 10,185 | 320 | 11,242 | 5.0 | 176 |
| June | 150 | 4,347 | 239 | 6,937 | 314 | 9,091 | 6.3 | 182 |
| July | 167 | 4,285 | 276 | 7,071 | 415 | 10,640 | 7.1 | 181 |
| August | 183 | 5,190 | 292 | 8,277 | 395 | 11,193 | 7.4 | 210 |
| September | 268 | 8,989 | 388 | 12,990 | 518 | 17,346 | 8.3 | 277 |
| October | 244 | 7,922 | 327 | 10,630 | 571 | 18,577 | 5.7 | 185 |
| November | 240 | 8,466 | 319 | 11,235 | 497 | 17,516 | 7.1 | 251 |
| December | 209 | 8,286 | 320 | 12,675 | 752 | 29,797 | 7.0 | 278 |
| Average | 171 | 6,406 | 261 | 9,796 | 394 | 14,791 | 5.7 | 215 |
| Minimum | 70 | 3,657 | 103 | 5,375 | 209 | 9,091 | 3.2 | 165 |
| Maximum | 268 | 8,989 | 388 | 12,990 | 752 | 29,797 | 8.3 | 278 |
| Sampling Frequency Requirement Met | | | Yes | | Yes | | Yes | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TAN avg. conc. mg/L | TAN avg. loading kg/d | pH min. | pH max. | Temp. min. | Temp. max. | Alkalinity avg. conc. mg/L |
|---|---|---|---|---|---|---|---|---|---|
| January | 2.25 | 40.78 | 24.37 | 1,227 | 6.93 | 7.88 | 9.7 | 17.8 | 308 |
| February | 2.27 | 38.98 | 26.71 | 1,094 | 6.32 | 8.01 | 3.2 | 18.2 | 267 |
| March | 2.06 | 36.28 | 25.27 | 1,220 | 7.07 | 8.07 | 7.9 | 17.2 | 307 |
| April | 1.68 | 30.33 | 21.32 | 1,111 | 7.42 | 7.98 | 7.3 | 20.0 | 285 |
| May | 2.71 | 48.50 | 29.13 | 1,025 | 7.05 | 7.95 | 14.4 | 20.9 | 274 |
| June | 3.23 | 46.90 | 32.01 | 927 | 6.47 | 8.19 | 17.5 | 25.1 | 296 |
| July | 3.46 | 56.60 | 32.67 | 837 | 7.18 | 7.91 | 13.2 | 23.0 | 281 |
| August | 3.51 | 48.33 | 33.06 | 936 | 6.00 | 7.81 | 13.8 | 24.4 | 273 |
| September | 3.73 | 59.36 | 34.03 | 1,140 | 6.88 | 7.90 | 11.6 | 24.8 | 310 |
| October | 2.93 | 51.78 | 33.42 | 1,087 | 6.79 | 7.80 | 12.0 | 22.7 | 255 |
| November | 3.56 | 52.95 | 36.43 | 1,285 | 6.99 | 7.90 | 14.4 | 21.2 | 306 |
| December | 2.77 | 47.34 | 32.83 | 1,300 | 6.48 | 8.23 | 12.2 | 17.7 | 292 |
| Average | 2.85 | 46.51 | 30.10 | 1,130 | | | | | 288 |
| Minimum | 1.68 | 30.33 | 21.32 | 837 | 6.00 | | 3.2 | | 255 |
| Maximum | 3.73 | 59.36 | 36.43 | 1,300 | | 8.23 | | 25.1 | 310 |
| Sampling Frequency Requirement Met | Yes | Yes | Yes | | Yes | Yes | Yes | Yes | Yes |

**Table 3 Final Effluent Analyses**

**Summary of the final effluent sample analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ avg. loading kg/d | TSS avg. conc. mg/L | TSS avg. loading kg/d | TP avg. conc. mg/L | TP avg. loading kg/d | TAN avg. conc. mg/L winter | TAN avg. conc. mg/L summer | TAN avg. loading kg/d |
|---|---|---|---|---|---|---|---|---|---|
| January | 2.2 | 111 | 3.3 | 164 | 0.60 | 30.3 | 0.16 | -- | 8.0 |
| February | 2.0 | 81 | 2.8 | 117 | 0.52 | 21.2 | 0.18 | -- | 7.5 |
| March | 2.1 | 101 | 2.9 | 139 | 0.60 | 28.9 | 0.35 | -- | 16.9 |
| April | 1.5 | 77 | 4.4 | 230 | 0.63 | 32.6 | 0.16 | -- | 8.1 |
| May | 2.0 | 69 | 2.4 | 83 | 0.58 | 20.4 | -- | 0.16 | 5.8 |
| June | 1.5 | 45 | 3.7 | 107 | 0.59 | 17.1 | -- | 0.45 | 13.0 |
| July | 2.0 | 52 | 3.8 | 96 | 0.68 | 17.4 | -- | 0.17 | 4.4 |
| August | 2.0 | 57 | 4.4 | 124 | 0.61 | 17.4 | -- | 0.16 | 4.4 |
| September | 1.5 | 50 | 2.3 | 76 | 0.59 | 19.9 | -- | 0.21 | 7.2 |
| October | 1.7 | 54 | 3.4 | 111 | 0.59 | 19.1 | -- | 1.13 | 36.6 |
| November | 1.8 | 64 | 3.9 | 138 | 0.64 | 22.5 | 0.09 | -- | 3.2 |
| December | 1.9 | 75 | 3.8 | 151 | 0.74 | 29.3 | 0.06 | -- | 2.4 |
| Average | 1.8 | 69 | 3.4 | 128 | 0.61 | 23.0 | 0.17 | 0.38 | 9.8 |
| Minimum | 1.5 | 45 | 2.3 | 76 | 0.52 | 17.1 | 0.06 | 0.16 | 2.4 |
| Maximum | 2.2 | 111 | 4.4 | 230 | 0.74 | 32.6 | 0.35 | 1.13 | 36.6 |
| ECA Requirement | 25 | | 25 | | 1.0 | | 24 | 15 | |
| ECA Objective | 15 | | 15 | | 0.8 | | 12 | 8 | |
| Within Compliance | Yes | | Yes | | Yes | | Yes | Yes | |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | Yes | |

**Table 3 Final Effluent Analyses continued**

| Month | Unionized NH3 avg. conc. mg/L | TKN avg. conc. mg/L | DP avg. conc. mg/L | Nitrate avg. conc. mg/L | Alkalinity avg. conc. mg/L |
|---|---|---|---|---|---|
| January | 0.0 | 1.31 | 0.59 | 21.53 | 113 |
| February | 0.0 | 1.53 | 0.43 | 20.40 | 91 |
| March | 0.0 | 1.49 | 0.54 | 19.58 | 109 |
| April | 0.0 | 1.24 | 0.53 | 21.41 | 159 |
| May | 0.0 | 1.47 | 0.53 | 20.35 | 80 |
| June | 0.0 | 1.66 | 0.55 | 23.07 | 48 |
| July | 0.0 | 1.56 | 0.63 | 23.84 | 51 |
| August | 0.0 | 1.47 | 0.56 | 22.60 | 34 |
| September | 0.0 | 1.39 | 0.61 | 22.46 | 59 |
| October | 0.0 | 1.96 | 0.78 | 23.56 | 43 |
| November | 0.0 | 1.64 | 0.71 | 24.90 | 44 |
| December | 0.0 | 1.36 | 0.74 | 22.80 | 40 |
| Average | 0.0 | 1.51 | 0.60 | 22.21 | 73 |
| Minimum | 0.0 | 1.24 | 0.43 | 19.58 | 34 |
| Maximum | 0.0 | 1.96 | 0.78 | 24.90 | 159 |
| ECA Requirement | 0.2 | | | | |
| ECA Objective | 0.1 | | | | |
| Within Compliance | Yes | | | | |
| Sampling Frequency Requirement Met | Yes | | Yes | Yes | Yes |

**Table 3 Final Effluent Analyses continued**

| Month | TCR avg. conc. mg/L | TCR avg. loading kg/d | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|
| January | 0.00 | 0.1 | 7.04 | 7.46 | 13.7 | 15.9 |
| February | 0.00 | 0.1 | 7.05 | 7.95 | 7.7 | 15.9 |
| March | 0.00 | 0.1 | 7.14 | 7.51 | 12.0 | 15.2 |
| April | 0.00 | 0.1 | 6.96 | 7.55 | 11.7 | 15.6 |
| May | 0.00 | 0.0 | 7.12 | 7.49 | 15.0 | 19.0 |
| June | 0.00 | 0.1 | 6.74 | 7.44 | 17.6 | 20.3 |
| July | 0.00 | 0.0 | 7.03 | 7.59 | 19.6 | 22.1 |
| August | 0.00 | 0.1 | 6.88 | 7.52 | 21.2 | 23.8 |
| September | 0.00 | 0.1 | 6.64 | 7.62 | 21.1 | 23.6 |
| October | 0.00 | 0.0 | 6.78 | 7.52 | 17.4 | 22.7 |
| November | 0.00 | 0.1 | 6.81 | 7.61 | 16.2 | 19.1 |
| December | 0.00 | 0.1 | 6.91 | 7.30 | 13.2 | 17.8 |
| Average | 0.00 | 0.1 | | | | |
| Minimum | 0.00 | 0.0 | 6.64 | | 7.7 | |
| Maximum | 0.00 | 0.1 | | 7.95 | | 23.8 |
| ECA Requirement | | | 6.0 | 9.5 | | |
| ECA Objective | | | 6.5 | 9.0 | | |
| Within Compliance | | | Yes | Yes | | |
| Sampling Frequency Requirement Met | Yes | | Yes | Yes | Yes | Yes |

**Table 4 Escherichia Coliform Sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 4 | 27 |
| February | 4 | 6 |
| March | 5 | 110 |
| April | 4 | 61 |
| May | 4 | 4 |
| June | 6 | 43 |
| July | 5 | 114 |
| August | 4 | 62 |
| September | 5 | 9 |
| October | 4 | 7 |
| November | 4 | 295 |
| December | 5 | 74 |
| ECA Requirement | | N/A |
| ECA Objective | | 200 |
| Within Compliance | | Yes |
| Sampling Frequency Requirement Met | Yes | |

**Table 5 Energy and Chemical Usage**

| Month | Total Plant Flow (cubic metres) | Ferrous Chloride (litres) | Sodium Hypochlorite (kilograms as chlorine) | Sodium Bisulphite (Litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|---|---|---|
| January | 1,561,224 | 99,260 | 4,072 | 8,685 | 632,506 | 10,972 |
| February | 1,187,644 | 112,840 | 3,763 | 7,139 | 616,564 | 16,469 |
| March | 1,496,586 | 87,920 | 4,851 | 7,765 | 716,992 | 2,629 |
| April | 1,563,399 | 102,200 | 5,072 | 8,685 | 636,386 | 1,264 |
| May | 1,090,575 | 85,540 | 3,793 | 6,624 | 663,940 | 2,124 |
| June | 869,316 | 103,740 | 2,940 | 5,152 | 708,114 | 1,093 |
| July | 794,194 | 76,720 | 3,352 | 5,336 | 584,529 | 1,238 |
| August | 877,933 | 91,700 | 3,263 | 6,330 | 589,529 | 910 |
| September | 1,005,438 | 106,680 | 2,749 | 6,403 | 616,919 | 2,413 |
| October | 1,008,537 | 108,780 | 2,778 | 6,661 | 712,586 | 1,823 |
| November | 1,058,254 | 93,380 | 2,822 | 6,771 | 702,726 | 1,799 |
| December | 1,227,865 | 84,980 | 3,690 | 8,170 | 776,652 | 5,928 |
| Total | 13,740,964 | 1,153,740 | 43,145 | 83,720 | 7,957,443 | 48,662 |

## Glossary of Terms

### Anaerobic Digestion

A series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

### Average Daily Flow

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

### Biosolids

Organic material recovered from wastewater sludge.

### Bioreactor

A bioreactor is a vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms. This encompasses a combination of aerobic, and anoxic processes.

**$BOD_5$ Five Day Biochemical Oxygen Demand**

(also known as total $BOD_5$) Five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**

Any discharge from the Works that does not undergo any treatment or only undergoes partial treatment before it is discharged to the environment.

**$CBOD_5$ -Five day Carbonaceous Biochemical Oxygen Demand**

A five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

**conc. – Concentration**

A measure of the amount of dissolved substance contained per unit of volume.

**District Manager**

The District Manager of the York-Durham District Office of the Ministry.

**DP – Dissolved Phosphorus**

The soluble form of phosphorus present in the wastewater.

**Denitrification -**

The biological process of nitrate reduction to nitrogen gases occurring in low dissolved oxygen environments.

**ECA - Environmental Compliance Approval**

The primary regulatory instrument for each WPCP.

**E. coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Sewage discharge via the Sewage Treatment Plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, a snapshot of the conditions at the time the sample was retrieved.

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metres Per Day)**

Flow measurement, $1m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**

The peak or highest value recorded during a specific time period usually a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in wastewater, sometimes referred to as parts per million (ppm).

**Min. – Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm - (millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly average concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly average loading**

is calculated by multiplying the monthly average concentration of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**N/A - Not Applicable**

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The average daily flow for which the works are approved to handle.

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Septage**

Partially treated sludge from a septic tank.

**Sludge**

The settleable solids separated from liquids during processing.
**Substantial completion** – has the same meaning as “substantial performance” in the Construction Lien Act.

**TAN -Total Ammonia Nitrogen**

Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**TCR -Total Chlorine Residual**

The total amount of chlorine in water, including the combined chlorine and the free available chlorine.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**TP -Total Phosphorus**

A laboratory analyses to determine the total amount of particulate and soluble phosphorus present in the wastewater.

**TSS -Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS -Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**Works**

The sewage works described in the owner’s application, and the ECA, and includes both proposed works and previous works.

**WPCP - Water Pollution Control Plant**

Is typically a facility composed of a variety of treatment processes that collectively treat the wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

# Duffin Creek Water Pollution Control Plant
# Annual Performance Report 2016

# Duffin Creek Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 5531-9FJJT5 Dated March 3, 2014

**Environmental Compliance Approval (Air)**: 1110-9AJP5C Dated September 13, 2013

**International Organization for Standardization (ISO) 14001 Certification**: CA05/3563/E

The Duffin Creek Water Pollution Control Plant (WPCP) Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Duffin Creek WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance 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 Duffin Creek WPCP is jointly owned by the Regional Municipality of Durham and the Regional Municipality of York and operated in accordance with the terms and conditions of the ECA noted above. The Regional Municipality of Durham is responsible for all plant operations at the Duffin Creek WPCP. The plant is located in the City of Pickering, and operated by the Regional Municipality of Durham. This MOECC Class Four conventional activated sludge treatment plant is designed to treat wastewater at an average daily flow rate of 630,000 cubic metres per day ($m^3$/d) with a limit of 520,000 $m^3$/d as noted in the outfall capacity limitations in the ECA. Duffin Creek WPCP is ISO 14001 certified.

Duffin Creek WPCP treats wastewater from the Town of Ajax and the City of Pickering service areas in the Regional Municipality of Durham as well as the following service areas in the Regional Municipality of York: Vaughan, King, Newmarket, Whitchurch-Stouffville, Aurora, East Gwillimbury, Richmond Hill, and Markham.

The Duffin Creek WPCP utilizes the following processes to treat wastewater:

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- phosphorous removal,
- secondary treatment,
- disinfection (chlorination/dechlorination)
- solids treatment,
- incineration.

### Raw Influent Pumping

Wastewater collected through approximately 654 km of sanitary sewers in Ajax and Pickering is conveyed to the treatment plant by gravity and by the following sanitary sewage pumping stations located in the collection system: Bayly St., Jodrel Rd., Toy Ave., Finch Av. and Liverpool Rd. Wastewater collected from the Regional Municipality of York is conveyed to the WPCP via the Primary Trunk Sewer and South East Collector which are part of the York Durham Sewage System

(YDSS). This accounted for an estimated 81.9% of the wastewater treated in 2016. The remaining 18.1% (estimated) was generated by the Town of Ajax and the City of Pickering. The combined flows enter a diversion chamber which then splits the flow between Stages 1 & 2 and Stage 3 at the Duffin Creek WPCP.

**Stages 1 & 2:**

### Preliminary Treatment

**Screening**: Twelve automatic, mechanically cleaned bar screens remove paper products and large material that could harm pumps and process equipment. The bar screens discharge the screenings onto a series of conveyers which in turn discharge into bins for landfill disposal.

**Grit Removal**: The eight grit tanks are sized such that the flow-through velocity will allow the grit material such as sand and small stones to settle to the bottom of the tanks. The grit collecting mechanism, which has rotating arms with blades, scrapes the grit into a collection pit where a rake deposits the grit onto a series of conveyers and into bins for landfill disposal.

### Primary Treatment

Eight primary clarifiers each equipped with a travelling bridge system utilize the physical process of sedimentation which causes heavy particles to settle to the bottom of the tank as raw sludge and lighter particles to float to the surface as scum. The sludge, along with return activated sludge from the secondary treatment process is collected by scraper blades which push the sludge into hoppers. The sludge is then pumped to the digester tanks or to the dewatering building. The scum is collected by the travelling bridge and sent to the digesters.

### Phosphorous Removal

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding chemicals (ferrous chloride) as part of the treatment process. It also improves the settling of solids which reduces the total solids concentration in the final effluent. Ferrous chloride can be added at multiple locations throughout the WPCP.

### Secondary Treatment

**Aerated Bioreactor**: Effluent from the primary clarifiers is treated with ferrous chloride in order to aid in phosphorus removal. There are eight aerated bioreactors each containing anoxic and aerobic zones. In the first part of the tank no oxygen introduced (anoxic), this is for denitrification. The second part of the tank is where fine bubbled air is diffused into the sewage (aerobic) to remove dissolved and suspended organics and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the aerated bioreactor 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 bioreactor and any excess activated sludge is pumped to the primary clarifier to co-settle.

### Disinfection (chlorination/dechlorination)

Chlorine in the form of liquid sodium hypochlorite is metered into the effluent stream for pathogen control. Adequate contact time is provided by the chlorine contact chambers. Disinfected effluent is

dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario through a 3.05 m diameter outfall pipe, approximately 1,100 m long with a 183 m long diffuser pipe.

**Stage 3:**

**Preliminary Treatment**

**Screening**: Six automatic, mechanically cleaned screens remove paper products and large material that could harm pumps and process equipment. Screenings are compacted for disposal to landfill.

**Grit Removal**: There are four grit tanks equipped with coarse bubble diffusers to provide aeration in the grit removal process. Heavy suspended material such as sand and small stones (grit) is settled to the bottom of the tanks while lighter organic particles are kept in suspension and passed through the tanks for further treatment. The grit removed is dewatered for landfill disposal.

**Primary Treatment**

Six primary clarifiers each equipped with a travelling bridge system utilize the physical process of sedimentation which causes heavy particles to settle to the bottom of the tank as raw sludge and lighter particles to float to the surface as scum. The sludge, along with return activated sludge from the secondary treatment process is collected by scraper blades which push the sludge into hoppers. The sludge is then pumped to the digester tanks or to the dewatering building. The scum is collected by the travelling bridge and sent to the digesters.

**Phosphorous Removal**

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding chemicals (ferrous chloride) as part of the treatment process. It also improves the settling of solids which reduces the total solids concentration in the final effluent. Ferrous chloride can be added at multiple locations throughout the WPCP.

**Secondary Treatment**

**Aerated Bioreactor**: Effluent from the primary clarifiers is treated with ferrous chloride in order to aid in phosphorus removal. There are six aerated bioreactors each containing anoxic and aerobic zones. In the first part of the tank no oxygen introduced (anoxic), this is for denitrification. The second part of the tank is where fine bubbled air is diffused into the sewage (aerobic) to remove dissolved and suspended organics and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the aerated bioreactor 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 bioreactor and any excess activated sludge is ‘wasted’ to the primary clarifier to co-settle.

**Disinfection (chlorination/dechlorination)**

Chlorine in the form of liquid sodium hypochlorite is metered into the effluent stream for pathogen control. Adequate contact time is provided by the chlorine contact chambers. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario through a 3.05 m diameter outfall pipe, approximately 1,100 m long with a 183 m long diffuser pipe.

## Solids Management

**Anaerobic Digestion:** The sludges that are collected from the primary clarifiers are pumped into one of the four primary digesters followed by two secondary digesters. There are four blending tanks where raw sludges are blended with digested sludges before they are pumped to be dewatered. All solids produced are dewatered and incinerated on site.

## Imported Biosolids

Durham's Regional Biosolids Management Program (ECA #H120110009-03) imports sludges from facilities in the Regional of Municipality of York and the Regional Municipality of Durham. Durham's biosolids are transported by Terratec Environmental Ltd. under C of A # A820250 and York's biosolids are transported by GFL Environmental Corp. under C of A # A841293.

## Dewatering

Duffin Creek WPCP utilizes eight dewatering solid bowl centrifuges in order to separate the heavier material and the liquid supernatant. All dewatered solids (sludge cake) are sent to incineration.

## Incineration

There are four fluidized bed process trains which through the combustion process burns the organic substances contained in the sludge cake and converts the cake into ash and flue gas. Steam boilers are utilized for waste heat recovery. All solids at Duffin Creek WPCP were incinerated during the reporting period.

The ash from the incineration process is sent to St. Mary's Cement in Bowmanville, Ontario for reuse. No land application or landfill of biosolids occurred in 2016. Ash disposal was hauled to St. Mary's Cement by BFI Canada Inc. under ECA #A840506.

## Environmental Compliance Approval

Under Condition 10. (6) of ECA # 5531-9FJJT5 the Region of Durham must produce an annual performance report that contains the following information:

**a) Summary and interpretation of all monitoring data and a comparison to the effluent limits**

- The Duffin Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period.
- The plant operated at 61.1% of its approved capacity for this reporting period. The plant received a maximum daily flow of 579,279 $m^3$ on April 1, 2016.

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

- Challenges arose when accommodating ongoing construction with processes being offline, electrical interruptions, flow diversions etc. These challenges were overcome with careful planning and communication.
- Stage1 was restarted in December of 2016 after completion of the liquid process upgrades. Challenges arose with reseeding in the winter months. Close monitoring, pumping and testing made the startup possible.

- Plant computer server upgrades required multiple coordinated shut downs and created unexpected plant wide communication issues. Plant staff along with contracted personnel worked to successfully integrate the updated software with existing software.

### c) Maintenance of major equipment

Major maintenance items in 2016 included:

**Operations**

- Stage 1 & 2 and 3 Substation Maintenance – servicing of all 4,160V and certain 600V switches, breakers, transformers/protection relays etc.
- Generators 1100, 1200, 1300, 1400, 5401, 5501,5601 – regular monthly runs as well as all oils and filters changed, fuel system checks.
- Digester preventative maintenance, Waste Gas Burners – servicing of all gas protection, including; pressure relief valves, gas valves, flame arrestors, roof pressure tests etc.
- Stage 3 Influent pumping station – all eight pumps lifted and inspected.
- Repaired and re-chained secondary clarifiers #19 & 22.
- Repaired and re-chained primary cross collector #14.
- Replaced Stage 3 grit pump screw gear boxes
- Repaired chlorination piping and fittings in underground chemical containment vaults.
- Repaired influent pumping station (IPS) biofilters.

**Dewatering**

- Repaired centrifuge screw.
- Completed repairs/upgrades to filtrate station platforms and piping.
- Modified/upgrade odour control system.

**Incineration**

- Replacement of scrubber piping.
- #1 Auxiliary boiler, refractory replacement.
- Replacement of boiler tube in #4 hot water boiler.
- Installation of equipment guarding.
- Replacement of effluent piping in south incineration building.

### d) Summary of any effluent quality assurance or control measures

- In-house lab test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy. All results were found to be within a comparable range.
- On-line instrumentation is verified by WPCP operators using various field or laboratory test equipment.
- Analytical balances are calibrated by Fisher Scientific Company Ltd.

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

Plant flows are measured at the influent of this plant.

- All influent flow meters were calibrated in February, 2016.
- All monitoring and laboratory equipment is calibrated and maintained according to manufacturer's specifications.

**f) Efforts made and results achieved in meeting effluent objectives**

The objective for pH was exceeded in the months of January and February. A new pH meter was purchased when efforts to alleviate drifting were unsuccessful. Best efforts and process adjustments were and will continue to be applied to maintain results below objectives.

g) The average E.coli count exceeded the objective in August. Investigation revealed multiple fractures on PVC fittings and corroded hose clamps in underground chemical containment vaults. Leaks were repaired and a procedure was created to inspect all lines and vaults.

**h) An outline of anticipated volumes of sludge to be generated in the next reporting period.**

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

**i) Summary of any complaints received during the reporting period**

Noise complaint – On March 18, 2016, a noise concern that was originally being dealt with by the Town of Ajax was forwarded to the attention of the Region of Durham. A resident from Ajax raised a concern that there was a persistent high frequency hum that was perceived to be emanating from the Duffin Creek WPCP. Notification of the concern was provided to the MOECC. There was no abnormal noise or major maintenance activities undertaken during the period in question. Noise levels outside of the plant and residential area were measured. Results were typical of industrial and residential areas. Technical Support staff is continuing to work with the resident to establish when the resident feels the noise is of concern so that plant conditions can be monitored.

**j) Summary of all by-passes, spill or abnormal discharge events**

There is no mechanism for by-passing untreated wastewater at this facility. There are no anticipated by-passes planned for the next reporting period.

**Spill**

On September 20, 2016 the Stage 3 headworks building experienced an overflow of influent wastewater. The influent flow flooded the basement, up to the ground floor, out of the doors of the building and onto the road. Once on the road, it flowed to stormwater catch basins. Standard operating procedures for spill response were followed and as a result less than 100 cubic meters reached Lake Ontario.

A variety of conditions contributed to the spill including, annual substation maintenance, construction and emergency repairs. An internal review and corrective actions have been implemented.

The MOECC was notified of the spill on September 20, 2016.

**k) Notice of modifications and any implementation of Limited Operational Flexibility**

No notice of modifications were submitted in 2016.

**l) Extra Information**

The fixed bed carbon adsorption units in the incineration complex were by-passed. The MOECC was notified on October 13, 2015. Investigations continue in 2017 in order to determine better operating conditions for the units.

## Proposed Alterations, Extensions or Replacements

- Replacement of the Stage 1 and 2 Headworks and influent pumping station Contract T-13-50 (in progress, estimated completion date March, 2017).
- Improvements to Stage 1 and 2 Contract T-13-86 (Stage 2 complete and returned to service, Stage 1 off-line, estimated completion date March, 2017).
- Capital restoration plan for damaged sludge blending tank and biofilter works. Construction estimated to start in 2018.
- Standby power closed transition modifications to Stage 3 electrical substation (completion date March 2017).
- Stage 1 and 2 digester mixing improvements and motor control center replacements (detailed design to begin June 2017).
- Detailed design is planned to commence the summer of 2017 for replacement of incineration facility reactor 1 and 2, subject to Regional Council approval.
- Facility phosphorous optimization trials to begin April 2017 as a component of the outfall EA program.

## MOECC Inspection

This plant was inspected by the MOECC on February 12, 2015. No action items were identified in the report.

**Table 1 Raw Influent Flows**

| Month | York Region Plant Flow $m^3$ | Durham Region Plant Flow $m^3$ | Total Flow to Plant metered at the raw influent $m^3$ | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ | Minimum Daily Flow $m^3/d$ |
|---|---|---|---|---|---|---|
| January | 8,342,229 | 1,843,643 | 10,185,872 | 328,577 | 455,638 | 300,859 |
| February | 7,828,970 | 1,730,212 | 9,559,182 | 329,627 | 412,100 | 299,109 |
| March | 9,218,475 | 2,037,294 | 11,255,769 | 363,089 | 464,915 | 320,834 |
| April | 9,128,634 | 2,017,439 | 11,146,074 | 371,536 | 579,279 | 321,820 |
| May | 8,097,647 | 1,789,590 | 9,887,236 | 318,943 | 340,532 | 298,896 |
| June | 7,601,386 | 1,679,916 | 9,281,302 | 309,377 | 337,732 | 295,820 |
| July | 7,649,784 | 1,690,612 | 9,340,396 | 301,303 | 330,112 | 281,219 |
| August | 8,020,023 | 1,772,435 | 9,792,458 | 315,886 | 365,251 | 281,253 |
| September | 7,083,632 | 1,565,491 | 8,649,124 | 288,304 | 309,969 | 267,989 |
| October | 7,465,581 | 1,649,902 | 9,115,483 | 294,048 | 318,636 | 278,963 |
| November | 7,136,072 | 1,577,081 | 8,713,153 | 290,438 | 332,610 | 276,364 |
| December | 7,658,535 | 1,692,546 | 9,351,081 | 301,648 | 405,588 | 277,903 |
| Total (percentage (%)) * | 95,230,969 (81.9%) | 21,046,161 (18.1%) | 116,277,130 (100%) | | | |
| Average * | 7,935,914 | 1,753,847 | 9,689,761 | 317,731 | | |
| Minimum | 7,083,632 | 1,565,491 | 8,649,124 | | | 267,989 |
| Maximum | 9,218,475 | 2,037,294 | 11,255,769 | | 579,279 | |
| ECA Requirement | | | | 520,000 | | |
| ECA Objective | | | | | | |
| Met Compliance | | | | Yes | | |

*Note – total and average reflect rounding of decimal places

**Table 2 Raw Influent Analyses**

| Month | $BOD_5$ average conc. mg/L | $BOD_5$ average loading kg/d | TSS average conc. mg/L | TSS average loading kg/d | TP average conc. mg/L | TP average loading kg/d | DP average conc. mg/L | TKN average conc. mg/L |
|---|---|---|---|---|---|---|---|---|
| January | 174 | 57,172 | 268 | 88,059 | 5.4 | 1,774 | 2.5 | 44.10 |
| February | 200 | 65,925 | 300 | 98,888 | 5.7 | 1,889 | 2.7 | 46.60 |
| March | 194 | 70,439 | 322 | 116,915 | 6.2 | 2,248 | 3.0 | 46.90 |
| April | 198 | 73,564 | 269 | 99,943 | 5.8 | 2,166 | 2.9 | 47.00 |
| May | 224 | 71,443 | 323 | 103,019 | 6.7 | 2,127 | 3.5 | 50.40 |
| June | 224 | 69,300 | 300 | 92,813 | 7.0 | 2,153 | 3.7 | 55.80 |
| July | 213 | 64,178 | 287 | 86,474 | 6.8 | 2,043 | 3.6 | 52.88 |
| August | 300 | 94,766 | 298 | 94,134 | 7.2 | 2,271 | 3.7 | 49.84 |
| September | 247 | 71,211 | 344 | 99,177 | 7.2 | 2,073 | 3.9 | 53.94 |
| October | 215 | 63,220 | 320 | 94,095 | 7.1 | 2,088 | 4.0 | 52.00 |
| November | 218 | 63,315 | 309 | 89,745 | 7.3 | 2,120 | 5.2 | 51.80 |
| December | 196 | 59,123 | 292 | 88,081 | 6.7 | 2,021 | 3.7 | 49.80 |
| Average | 217 | 69,103 | 303 | 96,420 | 6.6 | 2,098 | 3.5 | 50.09 |
| Minimum | 174 | 57,172 | 268 | 86,474 | 5.4 | 1,774 | 2.5 | 44.10 |
| Maximum | 300 | 94,766 | 344 | 116,915 | 7.3 | 2,271 | 5.2 | 55.80 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | | Yes |

**Table 2 Raw Influent Analyses continued**

| Month | TAN average conc. mg/L | TAN average loading kg/d | pH min. | pH max. | Temperature min. °C | Temperature max. °C |
|---|---|---|---|---|---|---|
| January | 27.6 | 9,069 | 7.10 | 7.80 | 10.7 | 15.9 |
| February | 28.6 | 9,427 | 6.74 | 7.70 | 10.1 | 17.1 |
| March | 29.6 | 10,729 | 6.80 | 8.06 | 10.1 | 17.9 |
| April | 31.3 | 11,637 | 7.06 | 7.75 | 10.9 | 17.8 |
| May | 36.2 | 11,555 | 6.83 | 7.70 | 14.0 | 20.4 |
| June | 38.8 | 11,988 | 6.90 | 7.60 | 15.8 | 19.3 |
| July | 35.4 | 10,666 | 6.94 | 7.59 | 19.2 | 24.7 |
| August | 34.5 | 10,898 | 7.14 | 7.43 | 19.8 | 24.0 |
| September | 36.4 | 10,491 | 6.67 | 7.69 | 19.7 | 23.7 |
| October | 36.7 | 10,792 | 6.63 | 7.56 | 16.5 | 21.2 |
| November | 36.2 | 10,514 | 6.80 | 7.47 | 13.4 | 20.7 |
| December | 32.1 | 9,683 | 6.92 | 7.77 | 8.0 | 18.0 |
| Average | 33.6 | 10,708 | | | | |
| Minimum | 27.6 | 9,069 | 6.63 | | 8.0 | |
| Maximum | 38.8 | 11,988 | | 8.06 | | 24.7 |

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ average conc. mg/L | $CBOD_5$ average loading kg/d | TSS average conc. mg/L | TSS average loading kg/d | TP average conc. mg/L | TP average loading kg/d | TAN average conc. mg/L summer | TAN average conc. mg/L winter | TAN average loading kg/d |
|---|---|---|---|---|---|---|---|---|---|
| January | 2.4 | 772 | 7.3 | 2,399 | 0.51 | 168 | | 0.58 | 191 |
| February | 2.8 | 936 | 7.6 | 2,505 | 0.42 | 138 | | 0.27 | 89 |
| March | 3.7 | 1,333 | 9.4 | 3,399 | 0.46 | 167 | | 0.74 | 89 |
| April | 4.3 | 1,609 | 10.0 | 3,704 | 0.58 | 215 | | 0.70 | 269 |
| May | 3.0 | 970 | 9.3 | 2,966 | 0.54 | 172 | 1.44 | | 459 |
| June | 2.1 | 656 | 5.4 | 1,680 | 0.53 | 164 | 0.38 | | 118 |
| July | 1.8 | 542 | 5.0 | 1,507 | 0.55 | 166 | 0.47 | | 142 |
| August | 2.6 | 812 | 6.5 | 2,053 | 0.51 | 161 | 0.46 | | 145 |
| September | 3.4 | 969 | 8.2 | 2,364 | 0.55 | 159 | 1.52 | | 438 |
| October | 2.2 | 647 | 6.0 | 1,764 | 0.50 | 147 | 0.39 | | 115 |
| November | 1.9 | 537 | 5.6 | 1,626 | 0.53 | 154 | | 0.36 | 105 |
| December | 2.0 | 603 | 5.5 | 1,659 | 0.52 | 157 | | 0.42 | 127 |
| Average | 2.7 | 853 | 7.1 | 2,277 | 0.52 | 165 | 0.78 | 0.51 | 205 |
| Minimum | 1.8 | 537 | 5.0 | 1,507 | 0.42 | 138 | 0.38 | 0.27 | 89 |
| Maximum | 4.3 | 1,609 | 10.0 | 3,704 | 0.58 | 215 | 1.52 | 0.74 | 459 |
| ECA Requirement | 25.0 | | 25.0 | | 0.8 | 311 | 6.0 | 10.0 | |
| ECA Objective | 15.0 | | 15.0 | | 0.6 | | 5.0 | 5.0 | |
| Within Compliance | Yes | | Yes | | Yes | Yes | Yes | Yes | |
| Sampling Requirement Frequency Met | Yes | | Yes | | Yes | | Yes | Yes | |

**Table 3 Final Effluent Analyses continued**

| Month | Unionized Ammonia Nitrogen average conc. mg/L | TKN average conc. mg/L | DP average conc. mg/L | TCR average conc. mg/L | TCR average loading kg/d | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|---|
| January | 0.0 | 1.76 | 0.33 | 0.00 | 0.00 | 6.2 | 7.3 | 9.7 | 17.4 |
| February | 0.0 | 1.47 | 0.26 | 0.00 | 0.00 | 6.4 | 7.3 | 7.1 | 17.6 |
| March | 0.0 | 2.16 | 0.27 | 0.00 | 0.00 | 6.9 | 7.4 | 8.5 | 18.8 |
| April | 0.0 | 2.09 | 0.37 | 0.00 | 0.00 | 6.7 | 7.1 | 8.2 | 18.1 |
| May | 0.0 | 2.65 | 0.36 | 0.00 | 0.00 | 6.7 | 7.0 | 15.2 | 21.2 |
| June | 0.0 | 1.41 | 0.42 | 0.00 | 0.00 | 6.5 | 7.0 | 16.9 | 22.4 |
| July | 0.0 | 1.55 | 0.44 | 0.00 | 0.00 | 6.6 | 7.1 | 18.7 | 23.8 |
| August | 0.0 | 1.62 | 0.37 | 0.00 | 0.00 | 6.7 | 7.2 | 20.8 | 24.6 |
| September | 0.0 | 2.61 | 0.36 | 0.00 | 0.00 | 6.7 | 7.8 | 20.2 | 24.2 |
| October | 0.0 | 1.57 | 0.34 | 0.00 | 0.00 | 6.7 | 7.2 | 11.2 | 23.2 |
| November | 0.0 | 1.46 | 0.39 | 0.00 | 0.00 | 6.6 | 7.3 | 15.0 | 20.6 |
| December | 0.0 | 1.51 | 0.36 | 0.00 | 0.00 | 6.5 | 7.2 | 11.6 | 18.1 |
| Average | 0.0 | 1.82 | 0.36 | 0.00 | 0.00 | | | | |
| Minimum | 0.0 | 1.41 | 0.26 | 0.00 | 0.00 | 6.2 | | 7.1 | |
| Maximum | 0.0 | 2.65 | 0.44 | 0.00 | 0.00 | | 7.8 | | 24.6 |
| ECA Requirement | 0.2 | | | 0.02 | | 6.0 | 9.5 | | |
| ECA Objective | 0.1 | | | Non-detectable | | 6.5 | 8.5 | | |
| Within Compliance | Yes | | | Yes | | Yes | Yes | | |
| Sampling Frequency Requirement Met | Yes | | | Yes | | Yes | Yes | Yes | Yes |

**Table 4 Escherichia Coliform Sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 20 | 58 |
| February | 20 | 100 |
| March | 21 | 26 |
| April | 21 | 74 |
| May | 21 | 40 |
| June | 22 | 70 |
| July | 20 | 38 |
| August | 24 | 144 |
| September | 20 | 93 |
| October | 19 | 22 |
| November | 21 | 22 |
| December | 20 | 41 |
| ECA Requirement | 52 | 200 |
| ECA Objective | | 100 |
| Within Compliance | | Yes |
| Sampling Frequency Requirement Met | Yes | |

**Table 5 Imported Wastewater Analyses**

| Month | $BOD_5$ average conc. mg/L | TSS average conc. mg/L | TKN average conc. mg/L | TP average conc. mg/L |
|---|---|---|---|---|
| January | 4604 | 7102 | 1219.13 | 185.5 |
| February | 3201 | 7345 | 721.25 | 204.1 |
| March | 5035 | 23260 | 811.10 | 168.2 |
| April | 5261 | 10938 | 1140.00 | 100.4 |
| May | 2878 | 4183 | 857.78 | 64.0 |
| June | 3026 | 13414 | 750.00 | 187.3 |
| July | 2737 | 29862 | 828.75 | 96.9 |
| August | 2017 | 10439 | 443.00 | 124.5 |
| September | 3814 | 10810 | 1381.00 | 224.0 |
| October | 6966 | 24270 | 744.00 | 162.0 |
| November | 7209 | 37585 | 1400.00 | 175.8 |
| December | 5013 | 16262 | 972.00 | 122.0 |
| Average | 4313 | 16289 | 939.00 | 151.2 |
| Minimum | 2017 | 4183 | 443.00 | 64.0 |
| Maximum | 7209 | 37585 | 1400.00 | 224.0 |
| Sampling Requirement Frequency Met | Yes | Yes | Yes | Yes |

**Table 6 Energy and Chemical Usage**

| Month | Plant Flow $m^3$ | Ferrous Chloride L | Sodium Hypochlorite L | Sodium Bisulphite L | Hydro kWh | Natural Gas $m^3$ |
|---|---|---|---|---|---|---|
| January | 10,185,872 | 859,959 | 206,289 | 34,688 | 5,287,203 | 305,601 |
| February | 9,559,182 | 732,777 | 190,477 | 27,328 | 4,657,885 | 291,486 |
| March | 11,255,769 | 697,232 | 263,457 | 37,209 | 5,042,572 | 252,189 |
| April | 11,146,074 | 828,278 | 310,573 | 41,898 | 4,880,240 | 201,925 |
| May | 9,887,236 | 972,020 | 167,765 | 26,185 | 5,200,472 | 53,404 |
| June | 9,281,302 | 890,632 | 166,588 | 22,983 | 5,181,579 | 133,644 |
| July | 9,340,396 | 754,086 | 152,998 | 21,449 | 5,159,514 | 10,174 |
| August | 9,792,458 | 1,026,184 | 206,648 | 28,947 | 5,609,280 | 91,575 |
| September | 8,649,124 | 1,130,121 | 220,014 | 28,005 | 5,122,303 | 124,615 |
| October | 9,115,483 | 1,075,486 | 180,676 | 24,710 | 5,041,775 | 183,285 |
| November | 8,713,153 | 947,909 | 137,545 | 18,020 | 4,607,086 | 192,107 |
| December | 9,351,081 | 1,103,749 | 145,541 | 16,690 | 5,016,907 | 279,097 |
| Total | 116,277,130 | 11,018,435 | 2,348,572 | 328,113 | 60,806,816 | 2,119,102 |

**Table 7 Summary of sludge produced and imported**

| Month | York Influent Solids (dry tonnes) | Durham Influent Solids (dry tonnes) | Total Influent Solids (dry tonnes) | York Imported Solids (dry tonnes) | Durham Imported Solids (dry tonnes) | Total Imported Solids (dry tonnes) |
|---|---|---|---|---|---|---|
| January | 2,236 | 494 | 2,730 | 83 | 451 | 534 |
| February | 2,349 | 519 | 2,868 | 81 | 411 | 492 |
| March | 2,968 | 656 | 3,624 | 89 | 366 | 455 |
| April | 2,456 | 543 | 2,998 | 109 | 384 | 493 |
| May | 2,616 | 578 | 3,194 | 107 | 105 | 212 |
| June | 2,280 | 504 | 2,784 | 106 | 65 | 171 |
| July | 2,195 | 485 | 2,681 | 115 | 147 | 262 |
| August | 2,390 | 528 | 2,918 | 110 | 58 | 168 |
| September | 2,437 | 539 | 2,975 | 93 | 97 | 190 |
| October | 2,389 | 528 | 2,917 | 91 | 101 | 192 |
| November | 2,205 | 487 | 2,692 | 95 | 260 | 355 |
| December | 2,236 | 494 | 3,164 | 97 | 483 | 580 |
| Total | 28,757 | 6,355 | 35,546 | 1,176 | 2,928 | 4,104 |

**Table 8 Summary Hauled Septage & Incinerated Sludge**

| Month | York Septage Solids (dry tonnes) | Durham Septage Solids (dry tonnes) | Total Septage Solids (dry tonnes) | Dewatered Sludge Incinerated (dry tonnes) | Ash Produced (tonnes) |
|---|---|---|---|---|---|
| January | 1.7 | 4.7 | 6.4 | 2,724 | 1,002 |
| February | 2.1 | 5.0 | 7.1 | 1,934 | 664 |
| March | 6.7 | 20.0 | 26.7 | 2,147 | 819 |
| April | 3.6 | 12.1 | 15.7 | 2,008 | 844 |
| May | 1.5 | 5.0 | 6.5 | 2,327 | 958 |
| June | 5.2 | 17.2 | 22.4 | 2,489 | 1,005 |
| July | 10.0 | 30.8 | 40.8 | 1,898 | 693 |
| August | 4.3 | 13.9 | 18.2 | 2,020 | 760 |
| September | 2.4 | 12.2 | 14.6 | 1,895 | 786 |
| October | 6.9 | 29.3 | 36.2 | 2,292 | 817 |
| November | 11.5 | 44.7 | 56.2 | 1,732 | 676 |
| December | 5.4 | 11.6 | 17.0 | 1,859 | 681 |
| Total | 61.2 | 206.7 | 267.9 | 25,324 | 9,705 |

**Table 9 Dewatering Summary**

| Month | Average Feed Solids % TS | Average Sludge Cake % TS | Average Polymer Dosage kg/tonne | Total Sludge Output dry tonnes |
|---|---|---|---|---|
| January | 3.3 | 20.3 | 7.0 | 2,433 |
| February | 3.6 | 23.3 | 6.9 | 2,400 |
| March | 3.3 | 19.0 | 7.1 | 2,535 |
| April | 3.4 | 26.1 | 7.6 | 2,796 |
| May | 3.1 | 25.8 | 7.6 | 3,186 |
| June | 2.9 | 26.6 | 7.4 | 3,012 |
| July | 2.6 | 26.2 | 7.3 | 2,648 |
| August | 2.5 | 25.6 | 6.7 | 2,198 |
| September | 2.3 | 25.1 | 7.7 | 1,695 |
| October | 2.3 | 26.1 | 6.9 | 2,532 |
| November | 2.5 | 24.7 | 7.6 | 2,561 |
| December | 2.0 | 25.4 | 7.7 | 3,955 |
| Total | | | | 31,951 |
| Average | 2.8 | 24.5 | 7.3 | 2,663 |
| Min | 2.0 | 19.0 | 6.7 | 1,695 |
| Max | 3.6 | 26.6 | 7.7 | 3,955 |

# Glossary of Terms

### Aerated Bioreactor

A vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms. This encompasses a combination of aerobic, anoxic, and anaerobic processes.

### Anaerobic Digestion

Is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

### Annual Average Concentration

An arithmetic mean of the monthly average concentrations of a contaminant in the effluent calculated for any particular year.

### Annual Average Loading

The value obtained by multiplying the Annual Average Concentration of a contaminant by the Average Daily Flow over the same calendar year.

### Average Daily Flow

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

### Biosolids

Organic material recovered from wastewater sludge.

### $BOD_5$ Five Day Biochemical Oxygen Demand

(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

### By-pass

Means a diversion of sewage around one or more unit processes within the Sewage Treatment Plant with the diverted sewage flows being returned to the Sewage Treatment Plant treatment train upstream of the Final effluent sampling location, and discharging to the environment through the Sewage Treatment Plant outfall.

### $CBOD_5$ - Five day Carbonaceous Biochemical Oxygen Demand

Means a five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

### conc. - Concentration

A measure of the amount of a dissolved substance contained per unit of volume.

**DP - Dissolved Phosphorus**

This is the soluble form of phosphorus present in the wastewater.

**ECA - Environmental Compliance Approval**

The primary regulatory instrument for each WPCP.

**E. coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Sewage discharge via the WPCP outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, a snapshot of the conditions at the time the sample was retrieved.

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3/d$ - (Cubic Metres Per Day)**

Flow measurement, $1m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**

The peak or highest reading recorded during a specific time period (usually in a day)

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period (usually in a day).

**mg/L - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in water or wastewater, sometimes referred to as parts per million (ppm).

**Min. – Minimum**

The lowest reading recorded during a specific time period (usually in a day)

**mm - (millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater facilities in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Loading**

Calculated by multiplying the monthly average concentration of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**N/A - Not Applicable**

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Septage**

Partially treated sludge from a septic tank.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN -Total Ammonia Nitrogen**

Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**TCR -Total Chlorine Residual**

The total amount of chlorine in water, including the combined chlorine and the free available chlorine.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identifies as degrees Celsius.

**TP -Total Phosphorus**

A laboratory analyses to determine the total amount of particulate and soluble phosphorus present in the wastewater.

**TSS -Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS -Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**WPCP - Water Pollution Control Plant**

Is typically a facility composed of a variety of treatment processes that collectively treat the wastewater.

## Harmony Creek Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Harmony Creek Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 3580-9PXLVG Dated December 3, 2014

**Environmental Compliance Approval (Air)**: 0488-6X5PZD Dated November 16, 2007

The Harmony Creek Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers a performance overview of the Harmony Creek WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### Water Pollution Control Plant Process Description

### General

The Harmony Creek WPCP located in the City of Oshawa and is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA.

The Harmony Creek WPCP treats wastewater from the Oshawa and Courtice service areas in the Regional Municipality of Durham. The Harmony Creek WPCP shares its catchment area flows with the Courtice WPCP. The Harmony Creek WPCP services approximately 52,343 residents or 30% of the total catchment population.

The Harmony Creek WPCP is designed to treat wastewater at an average flow rate of 34,100 cubic metres per day ($m^3$/d). The plant is an MOECC Class Four conventional activated sludge treatment plant that utilizes the following processes to treat wastewater:

- raw influent,
- preliminary treatment,
- primary treatment,
- secondary treatment,
- phosphorus removal,
- disinfection (chlorination/dechlorination),
- solids treatment.

### Raw Influent

Wastewater is collected through approximately 655 km of sanitary sewers in Oshawa and Courtice and is conveyed to the Harmony Creek WPCP and Harmony Creek sanitary sewage pumping station (SSPS). Approximately 70% of the influent flow is diverted to the Harmony Creek SSPS and conveyed to the Courtice WPCP. The remaining flow is treated at the Harmony Creek WPCP.

### Preliminary Treatment

**Grit Removal**: Heavy suspended material such as sand and small stones (grit) is removed in the aerated grit tank. The velocity of the wastewater rolling in the tanks is controlled by the quantity of air added to produce conditions that allow heavy grit material to settle, while keeping the lighter organic material in suspension to proceed to the next process tank. The grit removed in this process is transported to landfill.

**Screening**: One automatic, mechanically cleaned screen removes paper products and large material that could harm pumps and process equipment. Screenings are removed in this process and transported to landfill for disposal.

### Primary Treatment

The primary clarifier utilizes the physical process of sedimentation which allows suspended material to settle to the bottom of the tank as sludge. This raw sludge, along with excess activated sludge from the secondary treatment process is collected by a flight and chain mechanism which pushes the sludge into hoppers. The sludge is then pumped to the anaerobic digester for further treatment. Any material floating on the surface of the clarifier (scum) is also removed to the digester.

### Secondary Treatment

**Aeration**: The Harmony Creek WPCP has a flexible aeration system which can operate as two individual aeration tanks or as one large aeration tank. The current configuration is as one large aeration tank. The effluent from the primary clarifier flows into the aeration tanks. Here fine bubbled air is diffused into the sewage to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the bioreactor is directed to the secondary clarifier where the solids settle quickly to the bottom as activated sludge leaving clear supernatant. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the bioreactor and the excess activated sludge is wasted to the primary clarifier.

### Phosphorus Removal

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding a chemical coagulant (ferrous chloride). Ferrous chloride is added at the primary clarifier effluent.

### Disinfection (chlorination/dechlorination)

**Disinfection**: Chlorine, in the form of liquid sodium hypochlorite, is metered into the secondary effluent stream for pathogen control. Adequate contact time is provided by the two chlorine contact chambers. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario.

### Solids Treatment

**Anaerobic Digestion**: The raw sludge that is collected from the primary clarifier is pumped into the anaerobic digester where anaerobic bacteria reduce the volume of sludge. As a result of digestion the plant produces a more stabilized sludge, water, carbon dioxide, methane, and hydrogen sulphide. The water is returned to the head of the plant for further treatment and the methane is used to offset the natural gas requirements of the digester.

**Biosolids:** All sludge produced is pumped to the biosolids holding facility. From there the treated biosolids can be utilized on approved nurseries, approved agricultural fields, or be shipped to Duffin Creek WPCP for incineration. Biosolids are transported plant to plant in accordance with ECA #A820250 and ECA #4400-4LBLXD for land application.

## Environmental Compliance Approval

Under Condition 9 (5) of the ECA #3580-9PXLVG the Region of Durham must produce an annual report that contains 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 summarizes the raw wastewater characteristics during the reporting period.

The Harmony Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at an average of 42% of its annual average rated flow capacity and received a maximum daily flow of 24,142 $m^3$/d on April 1, 2016.

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

No major operating problems were encountered in 2016.

**c) Maintenance of major equipment**

Major maintenance items in 2016 included:

- Repaired west secondary clarifier flight and chain drive shaft.
- Repaired west secondary scum trough.
- Replaced boiler #1 tubes.
- Rebuilt Plant #2 bar screen.
- Rebuilt plant #2 by-pass bar screen.
- Rebuilt pumping station pump #210.
- Rebuilt #1 sludge transfer pump.
- Rebuilt #1 sludge recirculation pump.
- Replaced ferrous chloride feed pump #2.

**d) Summary of any effluent quality assurance or control measures**

- In-house lab test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy. All results were found to be within a comparable range.

**e) Summary of the calibration and maintenance carried out**

- Calibration of the secondary clarifier flow meter occurred in September 2016.
- The effluent flow meter was replaced on July 5 by Monitario.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted July 28, 2016.
- Calibration of the in-house lab pH meter was conducted regularly.

**f) Effluent Objectives**

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

The average daily rated flow capacity of 34,100 $m^3$/d was not exceeded.

The total suspended solids objective of 15.0 mg/L was exceeded in eight of 288 samples (3%). This was the result of additional loading from Port Darlington WPCP sludge to the plant, and the accumulation of solids on the chlorine contact chamber due to excessive retention time. Half of the chlorine contact chamber was removed from service to reduce solids accumulation, while still maintaining required contact time.

The total phosphorus objective of 1 mg/L was exceeded in nine of 293 (3%) samples. This is also attributed to the additional sludge loading to the plant. Samples were monitored and ferrous chloride was increased as required.

The E.coli monthly average objective of 200 cfu/100 ml was exceeded on four occasions. These results occurred during the non-disinfection period of January to April prior to the new disinfection system being operational.

Best efforts and process adjustments will continue to be applied to maintain results below objectives.

**g) Tabulation of Volume of Sludge Generated:**

The volume of sludge removed from Harmony Creek WPCP in 2016 was 21,994 $m^{3.}$

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

There is a decrease of sludge volume expected in the next reporting period due to Port Darlington sludge no longer being received at Harmony Creek WPCP.

**Summary of Locations to Where Sludge is Disposed:**

Duffin Creek WPCP – 19,892 $m^3$ or 90.4%

Agricultural Fields – 738 $m^3$ or 3.4%

Nursery – 1,364 $m^3$ or 6.2%

**h) Summary of Complaints and Steps Taken to Address the Complaint:**

There were no documented complaints in 2016.

**i) Summary of By-passes and Spills**

A planned by-pass was approved by the MOECC on November 14th allowing the influent raw flow to be diverted around the primary clarifier so that raw sewage could go directly to the aeration tank. This was done so that the primary digester could undergo approved essential maintenance. The influent sewage was being fully treated through the preliminary and secondary processes and sampling was conducted to ensure compliance with the ECA. Approval for the by-pass commenced November 14th 2016 and is permitted to carry through until March 2018.

There were no spills during the reporting period.

**j) Schedule 'A', Section 1 Notice of Modifications and Status Update**

No schedule 'A', Section 1 Notice of Modifications were submitted in 2016.

**k) Schedule 'A', Section 3 Notice of Modifications**

No schedule 'A', Section 3 Notice of Modifications were submitted in 2016.

**l) Additional Information Required by MOECC Water Supervisor**

No additional information was requested.

**MOECC Inspection**

An MOECC inspection occurred January 26, 2016. MOECC recommendation to have operating chlorination/dechlorination facilities was completed in 2016.

**Table 1 Raw Influent Flows**

| Month | Total Flow to Plant -metered at the final effluent $m^3$ | Average Day Flow $m^3/d$ | Maximum Day Flow $m^3/d$ |
|---|---|---|---|
| January | 468,031 | 15,098 | 20,903 |
| February | 477,219 | 16,456 | 22,257 |
| March | 430,370 | 13,883 | 18,449 |
| April | 475,899 | 15,863 | 24,142 |
| May | 460,665 | 14,860 | 16,570 |
| June | 455,186 | 15,173 | 16,769 |
| July | 445,477 | 14,370 | 18,389 |
| August | 475,562 | 15,341 | 18,578 |
| September | 436,869 | 14,562 | 15,296 |
| October | 420,344 | 13,559 | 14,878 |
| November | 364,427 | 12,148 | 15,052 |
| December | 370,722 | 11,959 | 14,051 |
| Total | 5,280,770 | | |
| Average | 440,064 | 14,428* | |
| Minimum | 364,427 | | |
| Maximum | 477,219 | | 24,142 |
| ECA Requirement | | 34,100 | |
| Met Compliance | | Yes | |

*Annual Average Daily Flow

**Table 2 Raw Influent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 141 | 2,131 | 229 | 3,454 | 306 | 4,618 | 6.6 | 99 |
| February | 149 | 2,449 | 276 | 4,534 | 381 | 6,266 | 6.5 | 107 |
| March | 128 | 1,777 | 307 | 4,262 | 428 | 5,938 | 7.2 | 100 |
| April | 140 | 2,221 | 256 | 4,057 | 388 | 6,154 | 5.8 | 92 |
| May | 226 | 3,358 | 399 | 5,929 | 496 | 7,367 | 6.0 | 90 |
| June | 167 | 2,526 | 325 | 4,937 | 441 | 6,692 | 6.8 | 104 |
| July | 168 | 2,414 | 212 | 3,043 | 260 | 3,742 | 5.3 | 76 |
| August | 144 | 2,209 | 168 | 2,580 | 202 | 3,105 | 4.7 | 72 |
| September | 120 | 1,747 | 168 | 2,439 | 235 | 3,428 | 5.3 | 77 |
| October | 151 | 2,047 | 190 | 2,580 | 260 | 3,527 | 6.1 | 83 |
| November | 119 | 1,446 | 212 | 2,578 | 296 | 3,590 | 6.0 | 72 |
| December | 122 | 1,453 | 276 | 3,301 | 365 | 4,361 | 6.6 | 79 |
| Average | 148 | 2,133 | 251 | 3,628 | 338 | 4,879 | 6.1 | 88 |
| Minimum | 119 | 1,446 | 168 | 2,439 | 202 | 3,105 | 4.7 | 72 |
| Maximum | 226 | 3,358 | 399 | 5,929 | 496 | 7,367 | 7.2 | 107 |
| Sampling Frequency Requirement Met | | | Yes | | Yes | | Yes | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | COD avg. conc. mg/L | TKN avg. conc. mg/L | TAN avg. conc. mg/L | TAN loading kg/d* | Nitrate plus Nitrite mg/L | pH min. | pH max. |
|---|---|---|---|---|---|---|---|---|
| January | 1.44 | 608 | 42.35 | 25.20 | 380 | 0.18 | 6.42 | 7.57 |
| February | 1.52 | 537 | 48.25 | 24.73 | 407 | 0.22 | 6.61 | 7.43 |
| March | 0.77 | 590 | 49.04 | 24.57 | 341 | 0.20 | 6.71 | 7.54 |
| April | 0.99 | 536 | 40.40 | 21.04 | 334 | 0.22 | 6.96 | 7.49 |
| May | 1.81 | 455 | 49.70 | 27.48 | 408 | 0.25 | 7.17 | 7.62 |
| June | 1.82 | 463 | 53.36 | 31.06 | 471 | 0.20 | 6.59 | 7.69 |
| July | 2.09 | 367 | 47.25 | 32.98 | 474 | 0.16 | 6.73 | 7.44 |
| August | 1.64 | 255 | 35.46 | 26.41 | 405 | 0.26 | 7.02 | 7.41 |
| September | 1.72 | 404 | 43.20 | 29.61 | 431 | 0.19 | 6.95 | 7.39 |
| October | 2.04 | 327 | 42.00 | 29.46 | 399 | 0.27 | 6.83 | 7.31 |
| November | 2.38 | 330 | 48.24 | 32.91 | 400 | 0.25 | 6.97 | 7.39 |
| December | 1.70 | 477 | 48.98 | 26.72 | 319 | 0.27 | 6.98 | 7.42 |
| Average | 1.66 | 446 | 45.69 | 27.68 | 399 | 0.22 | | |
| Minimum | 0.77 | 255 | 35.46 | 21.04 | 319 | 0.16 | 6.42 | |
| Maximum | 2.38 | 608 | 53.36 | 32.98 | 474 | 0.27 | | 7.69 |
| Sampling Frequency Requirement Met | | Yes | Yes | | | Yes | Yes | Yes |

*Annual Average loading

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | TAN avg. conc. mg/L | TAN loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 2.4 | 36.6 | 5.6 | 84.4 | 0.54 | 8.2 | 0.32 | 1.84 |
| February | 4.5 | 73.2 | 9.7 | 158.9 | 0.46 | 7.6 | 0.19 | 3.59 |
| March | 2.5 | 35.3 | 4.3 | 59.7 | 0.31 | 4.3 | 0.12 | 1.60 |
| April | 2.4 | 37.7 | 5.9 | 93.7 | 0.29 | 4.6 | 0.16 | 1.59 |
| May | 5.5 | 82.1 | 12.2 | 181.4 | 0.69 | 10.2 | 0.38 | 2.83 |
| June | 3.4 | 51.0 | 8.2 | 124.4 | 0.81 | 12.3 | 0.58 | 2.09 |
| July | 3.1 | 43.8 | 6.9 | 99.6 | 0.83 | 11.9 | 0.67 | 2.02 |
| August | 4.0 | 61.4 | 7.3 | 111.5 | 0.54 | 8.2 | 0.35 | 2.19 |
| September | 2.1 | 30.6 | 7.4 | 108.3 | 0.38 | 5.6 | 0.19 | 2.31 |
| October | 2.1 | 28.5 | 3.5 | 47.9 | 0.48 | 6.5 | 0.36 | 2.17 |
| November | 3.6 | 44.2 | 5.0 | 60.1 | 0.74 | 9.0 | 0.58 | 2.70 |
| December | 3.7 | 44.5 | 6.6 | 79.0 | 0.53 | 6.4 | 0.26 | 2.48 |
| Average | 3.3 | 47.4 | 6.9 | 99.6 | 0.55 | 8.0 | 0.35 | 2.28 |
| Minimum | 2.1 | 28.5 | 3.5 | 47.9 | 0.29 | 4.3 | 0.12 | 1.59 |
| Maximum | 5.5 | 82.1 | 12.2 | 181.4 | 0.83 | 12.3 | 0.67 | 3.59 |
| ECA Requirement | 25.0 | 852.5* | 25.0 | 852.5* | 1.0 | 34.1 | | |
| ECA Objective | 15.0 | | 15.0 | | 1.0 | | | |
| Within Compliance | Yes | Yes | Yes | Yes | Yes | Yes | Yes | |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | |

*Annual Average loading

**Table 3 Final Effluent Analyses continued**

| Month | Unionized NH3 avg. conc. mg/L | TKN avg. conc. mg/L | DP avg. conc. mg/L | TCR avg. conc. mg/L | Nitrate plus Nitrite mg/L | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|---|
| January | 0.00 | 1.84 | 0.32 | N/A | 21.83 | 6.61 | 7.32 | 10.2 | 16.1 |
| February | 0.00 | 3.59 | 0.19 | N/A | 21.60 | 6.65 | 7.26 | 8.2 | 16.0 |
| March | 0.00 | 1.60 | 0.12 | N/A | 24.44 | 6.83 | 7.42 | 8.6 | 13.5 |
| April | 0.00 | 1.59 | 0.16 | N/A | 23.73 | 6.61 | 7.49 | 10.0 | 19.1 |
| May | 0.00 | 2.83 | 0.38 | 0.00 | 23.03 | 7.07 | 7.50 | 14.7 | 19.2 |
| June | 0.00 | 2.09 | 0.58 | 0.00 | 24.92 | 6.60 | 7.58 | 17.5 | 20.9 |
| July | 0.00 | 2.02 | 0.67 | 0.01 | 30.88 | 6.69 | 7.23 | 20.9 | 23.3 |
| August | 0.00 | 2.19 | 0.35 | 0.00 | 21.54 | 6.48 | 7.21 | 22.0 | 24.6 |
| September | 0.00 | 2.31 | 0.19 | 0.00 | 24.40 | 6.70 | 7.22 | 20.5 | 24.2 |
| October | 0.00 | 2.17 | 0.36 | 0.00 | 22.13 | 6.66 | 7.16 | 15.3 | 22.0 |
| November | 0.00 | 2.70 | 0.58 | 0.00 | 22.88 | 6.69 | 7.36 | 15.7 | 18.9 |
| December | 0.00 | 2.48 | 0.26 | 0.00 | 17.08 | 6.89 | 7.29 | 10.8 | 17.2 |
| Average | 0.0 | 2.28 | 0.35 | 0.00 | 23.20 | | | | |
| Minimum | 0.0 | 1.59 | 0.12 | 0.00 | 17.08 | 6.48 | | 8.2 | |
| Maximum | 0.0 | 3.59 | 0.67 | 0.01 | 30.88 | | 7.58 | | 24.6 |
| ECA Requirement | | | | | | | | | |
| ECA Objective | | | | 0.5 | | 6.0 | 9.5 | | |
| Within Compliance | | | | | | | | | |
| Sampling Frequency Requirement Met | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | Yes |

**Table 4 Escherichia coliform Sampling**

- Seasonal disinfection period is from May 15 to October 15.

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 4 | 3,911 |
| February | 4 | 11,537 |
| March | 5 | 1,773 |
| April | 4 | 2,752 |
| May | 4 | 108 |
| June | 5 | 46 |
| July | 4 | 20 |
| August | 5 | 28 |
| September | 4 | 39 |
| October | 4 | 19 |
| November | 5 | 40 |
| December | 4 | 109 |
| ECA Requirement (Seasonal) | | N/A |
| ECA Objective (Seasonal) | | 200 |
| Within Compliance | | N/A |
| Sampling Frequency Requirement Met | Yes | |

**Table 5 Energy and Chemical Usage**

| Month | Total Plant Flow (cubic metres) | Ferrous Chloride (litres) | Sodium Hypochlorite (kilograms as chlorine) | Sodium Bisulphite (Litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|---|---|---|
| January | 468,031 | 11,798 | 0 | 0 | 638,546 | 23,191 |
| February | 477,219 | 25,553 | 0 | 0 | 516,271 | 15,361 |
| March | 430,370 | 17,039 | 0 | 0 | 593,930 | 15,782 |
| April | 475,899 | 16,017 | 0 | 0 | 537,136 | 10,084 |
| May | 460,665 | 18,053 | 753 | 1,398 | 444,773 | 3,010 |
| June | 455,186 | 25,158 | 1134 | 1,569 | 424,506 | 3,936 |
| July | 445,477 | 31,525 | 1093 | 1,089 | 475,171 | 8,126 |
| August | 475,562 | 41,185 | 1052 | 1,450 | 380,055 | 3,471 |
| September | 436,869 | 37,562 | 1065 | 1,238 | 379,034 | 10,237 |
| October | 420,344 | 39,187 | 933 | 1,277 | 422,165 | 14,122 |
| November | 364,427 | 24,027 | 774 | 1,130 | 434,473 | 19,544 |
| December | 370,722 | 31,949 | 1495 | 1,283 | 504,996 | 19,658 |
| Total | 5,280,770 | 319,053 | 8,300 | 10,435 | 5,751,056 | 146,522 |

## Glossary of Terms

### Aeration Tank

Is a vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms. This encompasses a combination of aerobic, anoxic processes.

### Anaerobic Digestion

Is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

### Annual Average Concentration

An arithmetic mean of the monthly average concentrations of a contaminant in the effluent calculated for any particular year.

**Annual Average Loading**

The value obtained by multiplying the Annual Average Concentration of a contaminant by the Average Daily Flow over the same calendar year.

**Average Daily Flow**

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

**Biosolids**

Organic material recovered from wastewater sludge.

**$BOD_5$ Five Day Biochemical Oxygen Demand**

(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**

A diversion of sewage around one or more unit processes within the Sewage Treatment Plant with the diverted sewage flows being returned to the Sewage Treatment Plant treatment train upstream of the Final effluent sampling location, and discharging to the environment through the Sewage Treatment Plant outfall.

**$CBOD_5$ -Five day Carbonaceous Biochemical Oxygen Demand**

A five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

**conc. – Concentration**

A measure of the amount of dissolved substance contained per unit of volume.

**DP – Dissolved Phosphorus**

This is the soluble form of phosphorus present in the wastewater.

**ECA - Environmental Compliance Approval**

The primary regulatory instrument for each WPCP.

**E. coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius. Calculated using a monthly geometric mean density.

**Final Effluent**

Sewage discharge via the WPCP outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, a snapshot of the conditions at the time the sample was retrieved.

**$m^3$ - (Cubic Metre)**

Volume measurement, 1 $m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metres Per Day)**

Flow measurement, 1 $m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**

The peak or highest value recorded during a specific time period usually in a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in wastewater, sometimes referred to as parts per million (ppm).

**Min. – Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm - (millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Daily Flow**

The cumulative total sewage flow to the sewage works during a calendar month divided by the number of days during which sewage was flowing to the sewage works that month.

**Monthly Average Loading**

Calculated by multiplying the monthly average concentration of a contaminant in the effluent sampled or measured, or both, during a calendar month by the monthly average daily flow.

**N/A - Not Applicable**

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The Average Daily Flow for which the works are approved to handle.

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Septage**

Partially treated sludge from a septic tank.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN -Total Ammonia Nitrogen**

Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**TCR -Total Chlorine Residual**

The total amount of chlorine in water, including the combined chlorine and the free available chlorine.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**TP -Total Phosphorus**

A laboratory analyses to determine the total amount of particulate and soluble phosphorus present in the wastewater.

**TSS -Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS -Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +). Calculated using the methodology specified in the MOECC's Guideline and Policies document titled "Provincial Water Quality Objectives" (July 1994).

**WPCP - Water Pollution Control Plant**

Is typically a facility composed of a variety of treatment processes that collectively treat the wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Lake Simcoe Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Lake Simcoe Water Pollution Control Plant 2016 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) Performance Report provides staff, stakeholders and customers an overview of the performance of the Lake Simcoe WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### 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. The plant is operated according to the terms and conditions of the ECA. This MOECC 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 3,809 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 treatment.

### Raw Influent Pumping

Wastewater is collected through approximately 23.9 km of sanitary sewers in Beaverton and is conveyed to the WPCP by gravity or by two sanitary sewage pumping stations Harbour Street and Cedar Beach located in the collection system. The two flows 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 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

**Aerated Bioreactors**: Preliminary effluent flow is directed to two aerated bioreactors. Surface mechanical aerators mix air into the sewage to assist bacteria in removing dissolved and suspended organics and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the aerated bioreactors 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 bioreactors 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 next process and the thickened sludge is pumped to the aerobic digester.

**Tertiary Sand Filter:** Effluent flow from the tertiary clarifier flows into an automatic self- 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 for further treatment.

**Biosolids Management:** Stabilized biosolids from the digester are transported to Duffin Creek Water Pollution Control Plant 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 38.3% of its rated capacity and received a maximum daily flow of 5,891$m^3$/d on April 2$^{nd}$ , 2016. 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 2016.

**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 2016 included:

- A new pump was installed to replace duty pump #2 at Cedar Beach Pumping Station
- Three new Variable Frequency Drives were installed at Cedar Beach Pumping Station
- A new radio alarm unit was installed at Cedar Beach 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 in May and November 2016.
- Calibration of the in-house laboratory equipment was conducted in July 2016.
- Calibration of the pH meter is conducted weekly.

**f) Efforts made and results achieved in meeting the effluent objectives of Condition 4**

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

- The Lake Simcoe WPCP effluent met all ECA objectives except for:
  The effluent objective for total suspended solids was exceeded in eight of 309 samples (2.6%).
  The effluent objective for total phosphorus was exceeded in five of 312 samples (1.6%).
  Results were monitored and adjustments were made to the treatment process when required.
  On March 28th we experienced heavier than usual flows due to wet weather conditions resulting in higher total suspended solids and total phosphorus levels. Adjustments were made to the plant processes to accommodate these conditions.
- Best efforts and process adjustments will continue to be applied to maintain results below objectives.

**g) Tabulation of Volume of Sludge Generated**

The volume of sludge removed from Lake Simcoe WPCP in 2016 was 1,840$m^3$ .

**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**

Duffin Creek WPCP- 1,840$m^3$.

**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 during the reporting period.

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

On March 28th secondary effluent overflowed to the environment due to wet weather conditions. This event was reported to the MOECC as a bypass.

**j) Status Update of Initial Effluent Characterization**

The effluent characterization report was submitted in 2015.

**k) Information required by MOECC District Manager**

No additional information was requested.

**MOECC Inspection**

This plant was not inspected by the MOECC in 2016.

## Summary of Tables

### Table 1 Flows

| Month | Total Plant Flow $m^3$ | Average Day Flow $m^3/d$ | Maximum Day Flow $m^3/d$ |
|---|---|---|---|
| January | 48,750 | 1,573 | 2,495 |
| February | 58,470 | 2,016 | 2,795 |
| March | 89,338 | 2,882 | 5,837 |
| April | 94,140 | 3,138 | 5,891 |
| May | 56,299 | 1,816 | 3,038 |
| June | 35,173 | 1,172 | 1,495 |
| July | 42,973 | 1,386 | 2,736 |
| August | 58,796 | 1,897 | 3,609 |
| September | 55,141 | 1,838 | 2,674 |
| October | 37,846 | 1,221 | 2,511 |
| November | 27,068 | 902 | 1,155 |
| December | 34,280 | 1,106 | 1,923 |
| Total | 638,273 | | |
| Average | 53,189 | 1,744* | |
| Minimum | 27,068 | | |
| Maximum | 94,140 | | 5,891 |
| ECA Requirement | | 4,550 | 15,110 |
| Met Compliance | | Yes | Yes |

*Annual Average

**Table 2 Raw Influent Analyses**

| Month | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | DP avg. conc. mg/L | Alkal-inity $CaCO_3$ mg/L |
|---|---|---|---|---|---|---|---|---|
| January | 59 | 93 | 78 | 122 | 1.9 | 3.1 | 1.2 | 288 |
| February | 57 | 115 | 65 | 131 | 1.3 | 2.7 | 0.9 | 287 |
| March | 31 | 89 | 48 | 138 | 0.9 | 2.5 | 0.5 | 275 |
| April | 64 | 201 | 96 | 301 | 1.5 | 4.6 | 0.6 | 276 |
| May | 77 | 140 | 76 | 138 | 2.1 | 3.8 | 1.0 | 304 |
| June | 82 | 97 | 80 | 94 | 2.7 | 3.1 | 1.7 | 277 |
| July | 94 | 130 | 102 | 142 | 2.6 | 3.6 | 1.4 | 242 |
| August | 79 | 150 | 98 | 186 | 2.0 | 3.8 | 1.1 | 213 |
| September | 92 | 169 | 115 | 211 | 2.4 | 4.5 | 1.4 | 207 |
| October | 112 | 137 | 117 | 143 | 2.9 | 3.5 | 1.7 | 246 |
| November | 112 | 101 | 91 | 82 | 3.3 | 3.0 | 2.2 | 289 |
| December | 78 | 86 | 75 | 83 | 2.6 | 2.8 | 1.7 | 263 |
| Average | 78 | 136 | 87 | 151 | 2.2 | 3.8 | 1.3 | 264 |
| Minimum | 31 | 86 | 48 | 82 | 0.9 | 2.5 | 0.5 | 207 |
| Maximum | 112 | 201 | 117 | 301 | 3.3 | 4.6 | 2.2 | 304 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | | Yes |

**Table 2 Raw Influent Analyses continued**

| Month | TKN avg. conc. mg/L | TKN loading kg/d | TAN avg. conc. mg/L | TAN loading kg/d | pH min. | pH max. | Temp. Degrees Celsius min. | Temp. Degrees Celsius max. |
|---|---|---|---|---|---|---|---|---|
| January | 16.13 | 25 | 13.08 | 20.6 | 7.50 | 7.98 | 4.5 | 11.5 |
| February | 14.10 | 28 | 8.09 | 16.3 | 7.54 | 8.05 | 4.9 | 10.3 |
| March | 7.74 | 22 | 5.09 | 14.7 | 7.66 | 7.93 | 5.3 | 11.8 |
| April | 12.90 | 40 | 6.02 | 18.9 | 7.66 | 8.19 | 3.3 | 11.0 |
| May | 18.90 | 34 | 11.50 | 20.9 | 7.37 | 7.84 | 8.9 | 16.0 |
| June | 24.64 | 29 | 7.18 | 8.4 | 7.15 | 7.60 | 13.1 | 17.4 |
| July | 24.68 | 34 | 17.83 | 24.7 | 7.07 | 7.30 | 15.8 | 19.2 |
| August | 18.88 | 36 | 13.83 | 26.2 | 6.46 | 7.53 | 17.4 | 22.0 |
| September | 23.08 | 42 | 16.58 | 30.5 | 6.90 | 7.35 | 16.5 | 20.6 |
| October | 27.30 | 33 | 22.44 | 27.4 | 6.67 | 7.46 | 12.9 | 18.1 |
| November | 31.16 | 28 | 25.35 | 22.9 | 7.03 | 7.50 | 10.6 | 15.7 |
| December | 25.08 | 28 | 18.49 | 20.4 | 7.26 | 7.86 | 7.8 | 13.5 |
| Average | 20.38 | 36 | 13.79 | 24.1 | | | | |
| Minimum | 7.74 | 22 | 5.09 | 8.4 | 6.46 | | 3.3 | |
| Maximum | 31.16 | 42 | 25.35 | 30.5 | | 8.19 | | 22.0 |
| Sampling Frequency Requirement Met | Yes | | | | Yes | Yes | | |

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | TP loading kg/month |
|---|---|---|---|---|---|---|---|
| January | 0.5 | 0.8 | 0.7 | 1 | 0.03 | 0.0 | 1.2 |
| February | 0.6 | 1.3 | 0.8 | 2 | 0.03 | 0.1 | 1.6 |
| March | 1.4 | 4.1 | 4.1 | 12 | 0.05 | 0.1 | 4.3 |
| April | 0.9 | 2.7 | 4.8 | 15 | 0.04 | 0.1 | 3.8 |
| May | 1.1 | 2.0 | 1.0 | 2 | 0.07 | 0.1 | 4.1 |
| June | 0.6 | 0.7 | 0.8 | 1 | 0.08 | 0.1 | 2.8 |
| July | 0.5 | 0.7 | 0.9 | 1 | 0.04 | 0.1 | 1.8 |
| August | 0.4 | 0.8 | 0.9 | 2 | 0.03 | 0.1 | 1.6 |
| September | 0.5 | 0.9 | 1.1 | 2 | 0.03 | 0.0 | 1.4 |
| October | 0.8 | 1.0 | 0.9 | 1 | 0.03 | 0.0 | 1.0 |
| November | 0.5 | 0.5 | 0.7 | 1 | 0.05 | 0.0 | 1.3 |
| December | 0.5 | 0.6 | 0.7 | 1 | 0.03 | 0.0 | 0.9 |
| Total | | | | | | | 26* |
| Average | 0.7 | 1.2 | 1.5 | 3 | 0.04 | 0.1 | 2.2 |
| Minimum | 0.4 | 0.5 | 0.7 | 1 | 0.03 | 0.0 | 0.9 |
| Maximum | 1.4 | 4.1 | 4.8 | 15 | 0.08 | 0.1 | 4.3 |
| ECA Limit | 10** | | 10** | | 0.3** | | 190* |
| ECA Objective | 5 | | 5 | | 0.12 | | 190 |
| LSPRS | | | | | 0.15*** | | 190* |
| Within Compliance | Yes | | Yes | | Yes | | Yes |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | |

*Total Annual Loading, kg/year

**Monthly Average Concentration

***Annual Average Concentration

**Table 3 Final Effluent Analyses continued**

| Month | DP avg. conc. mg/L | TAN Summer avg. conc. mg/L | TAN Winter avg. conc. mg/L | TAN loading kg/d | TKN avg. conc. mg/L | Un-ionized ammonia avg. conc. mg/L |
|---|---|---|---|---|---|---|
| January | 0.02 | | 0.02 | 0.0 | 0.50 | 0.0 |
| February | 0.02 | | 0.03 | 0.1 | 0.50 | 0.0 |
| March | 0.02 | | 0.10 | 0.3 | 0.75 | 0.0 |
| April | 0.02 | | 0.08 | 0.2 | 0.66 | 0.0 |
| May | 0.04 | | 0.04 | 0.1 | 0.64 | 0.0 |
| June | 0.05 | 0.04 | | 0.1 | 0.73 | 0.0 |
| July | 0.03 | 0.03 | | 0.0 | 0.65 | 0.0 |
| August | 0.02 | 0.02 | | 0.0 | 0.66 | 0.0 |
| September | 0.01 | | 0.03 | 0.1 | 0.78 | 0.0 |
| October | 0.01 | | 0.03 | 0.0 | 0.72 | 0.0 |
| November | 0.03 | | 0.03 | 0.0 | 0.72 | 0.0 |
| December | 0.02 | | 0.03 | 0.0 | 0.62 | 0.0 |
| Average | 0.02 | 0.03 | 0.04 | 0.1 | 0.66 | 0.0 |
| Minimum | 0.01 | 0.02 | 0.02 | 0.0 | 0.50 | 0.0 |
| Maximum | 0.05 | 0.04 | 0.10 | 0.3 | 0.78 | 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 min. | pH max. | Temp. Degrees Celsius min. | Temp. Degrees Celsius max. |
|---|---|---|---|---|
| January | 7.23 | 7.47 | 6.8 | 9.8 |
| February | 7.29 | 7.67 | 5.2 | 12.4 |
| March | 7.18 | 7.51 | 5.3 | 10.8 |
| April | 7.24 | 7.58 | 7.3 | 12.3 |
| May | 7.23 | 7.74 | 10.2 | 17.2 |
| June | 6.90 | 7.49 | 14.0 | 18.9 |
| July | 6.56 | 7.17 | 18.2 | 23.1 |
| August | 6.75 | 7.49 | 19.5 | 22.7 |
| September | 6.71 | 7.43 | 16.3 | 23.2 |
| October | 6.67 | 7.13 | 11.8 | 18.3 |
| November | 6.91 | 7.19 | 8.4 | 14.7 |
| December | 7.04 | 7.39 | 5.2 | 13.0 |
| Minimum | 6.56 | | 5.2 | |
| Maximum | | 7.74 | | 23.2 |
| ECA Objective | 6.5 | 9.0 | | |
| Sampling Frequency Requirement Met | Yes | Yes | Yes | Yes |

**Table 4 Escherichia Coliform Sampling**

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

**Table 5 Total Coliform Sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 4 | 1 |
| February | 4 | 0 |
| March | 5 | 5 |
| April | 4 | 1 |
| May | 4 | 0 |
| June | 5 | 10 |
| July | 4 | 2 |
| August | 5 | 0 |
| September | 4 | 1 |
| October | 4 | 2 |
| November | 5 | 2 |
| December | 4 | 1 |
| Sampling Frequency Requirement Met | Yes | |

**Table 6 Energy and Chemical Usage**

| Month | Alum (litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|
| January | 4,882 | 87,851 | 17,387 |
| February | 4,869 | 72,954 | 17,472 |
| March | 9,971 | 78,302 | 16,146 |
| April | 7,447 | 71,427 | 13,348 |
| May | 1,954 | 76,010 | 7,455 |
| June | 2,416 | 68,371 | 0 |
| July | 3,450 | 70,281 | 0 |
| August | 7,066 | 71,808 | 0 |
| September | 5,881 | 67,989 | 0 |
| October | 3,369 | 72,572 | 2,432 |
| November | 3,045 | 74,482 | 10,158 |
| December | 4,188 | 90,906 | 15,605 |
| Total | 58,538 | 902,953 | 100,003 |

## Glossary of Terms

**Annual Average Concentration**

An arithmetic mean of the monthly average concentrations of a contaminant in the effluent calculated for any particular year.

**Annual Average Loading**

The value obtained by multiplying the annual average concentration of a contaminant by the average daily flow over the same calendar year.

**Average Daily Flow**

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

**Avg – Average**

An arithemetic mean of the average concentrations and loadings.

**Biosolids**

Organic material recovered from wastewater sludge.

**Bioreactor**

A bioreactor is a vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms.

**$BOD_5$ Five Day Biochemical Oxygen Demand**

(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**

Any discharge from the works that does not undergo any treatment or only receives partial treatment before it is discharged to the environment.

**$cBOD_5$ -Five Day Carbonaceous Biochemical Oxygen Demand**

Means a five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample..

**Conc. - Concentration**

The abundance of a constituent divided by the total volume of a mixture.

**Daily Concentration**

The concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required.

**DP - Dissolved Reactive Phosphorus**

This is the soluble form of phosphorus present in the wastewater.

**ECA - Environmental Compliance Approval**

The primary regulatory instrument for each water pollution control plant.

**E. - coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Sewage discharge through the water pollution control plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, when tested provides a snapshot of the conditions at the time the sample was retrieved.

**kg - kilogram**

Basic unit of mass in the metric system

**kg/d – kilogram per day**

**LSPRS - Lake Simcoe Phosphorus Reduction Strategy**

The ECA issued on June 28, 2012 introduced additional phosphorus objectives to comply with the requirements of the Lake Simcoe Phosphorus Reduction Strategy (2010) prepared under the Lake Simcoe Protection Plan (2009).

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metre Per Day)**

Flow measurement, $1m^3$ = 1000litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max-Maximum**

The peak or highest value recorded during a specific time period usually a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in water, sometimes referred to as parts per million (ppm).

**Min-Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm.-(millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Loading**

Is calculated by multiplying the monthly average concentration of a contaminant by the monthly average daily flow over the same calendar month.

**N/A - Not Applicable**

**Peak Flow Rate**

The maximum rate of sewage flow for which the plant or process unit was designed.

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The average daily flow for which the works are approved to handle**.**

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Septage**

Partially treated sludge from a septic tank.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN - Total Ammonia Nitrogen**

Ammonia exists in two forms in the wastewater: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**Total Annual Loading**

Is calculated by adding the calculated total monthly load discharged for each calendar year.

**Total Monthly Loading**

Is calculated by multiplying the total monthly flow by the monthly average concentration.

**TP - Total Phosphorus**

A laboratory analyses to determine the total amount of non-soluble and soluble phosphorus present in the wastewater.

**TSS - Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS - Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**WPCP - Water Pollution Control Plant**

A facility composed of a variety of treatment processes that collectively treat wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Lake Simcoe Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Lake Simcoe Water Pollution Control Plant 2016 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) Performance Report provides staff, stakeholders and customers an overview of the performance of the Lake Simcoe WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### 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. The plant is operated according to the terms and conditions of the ECA. This MOECC 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 3,809 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 treatment.

### Raw Influent Pumping

Wastewater is collected through approximately 23.9 km of sanitary sewers in Beaverton and is conveyed to the WPCP by gravity or by two sanitary sewage pumping stations Harbour Street and Cedar Beach located in the collection system. The two flows 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 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

**Aerated Bioreactors**: Preliminary effluent flow is directed to two aerated bioreactors. Surface mechanical aerators mix air into the sewage to assist bacteria in removing dissolved and suspended organics and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the aerated bioreactors 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 bioreactors 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 next process and the thickened sludge is pumped to the aerobic digester.

**Tertiary Sand Filter:** Effluent flow from the tertiary clarifier flows into an automatic self- 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 for further treatment.

**Biosolids Management:** Stabilized biosolids from the digester are transported to Duffin Creek Water Pollution Control Plant 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 38.3% of its rated capacity and received a maximum daily flow of 5,891$m^3$/d on April 2$^{nd}$ , 2016. 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 2016.

**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 2016 included:

- A new pump was installed to replace duty pump #2 at Cedar Beach Pumping Station
- Three new Variable Frequency Drives were installed at Cedar Beach Pumping Station
- A new radio alarm unit was installed at Cedar Beach 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 in May and November 2016.
- Calibration of the in-house laboratory equipment was conducted in July 2016.
- Calibration of the pH meter is conducted weekly.

**f) Efforts made and results achieved in meeting the effluent objectives of Condition 4**

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

- The Lake Simcoe WPCP effluent met all ECA objectives except for:
  The effluent objective for total suspended solids was exceeded in eight of 309 samples (2.6%).
  The effluent objective for total phosphorus was exceeded in five of 312 samples (1.6%).
  Results were monitored and adjustments were made to the treatment process when required.
  On March 28th we experienced heavier than usual flows due to wet weather conditions resulting in higher total suspended solids and total phosphorus levels. Adjustments were made to the plant processes to accommodate these conditions.
- Best efforts and process adjustments will continue to be applied to maintain results below objectives.

**g) Tabulation of Volume of Sludge Generated**

The volume of sludge removed from Lake Simcoe WPCP in 2016 was 1,840$m^3$ .

**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**

Duffin Creek WPCP- 1,840$m^3$.

**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 during the reporting period.

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

On March 28th secondary effluent overflowed to the environment due to wet weather conditions. This event was reported to the MOECC as a bypass.

**j) Status Update of Initial Effluent Characterization**

The effluent characterization report was submitted in 2015.

**k) Information required by MOECC District Manager**

No additional information was requested.

**MOECC Inspection**

This plant was not inspected by the MOECC in 2016.

## Summary of Tables

### Table 1 Flows

| Month | Total Plant Flow $m^3$ | Average Day Flow $m^3/d$ | Maximum Day Flow $m^3/d$ |
|---|---|---|---|
| January | 48,750 | 1,573 | 2,495 |
| February | 58,470 | 2,016 | 2,795 |
| March | 89,338 | 2,882 | 5,837 |
| April | 94,140 | 3,138 | 5,891 |
| May | 56,299 | 1,816 | 3,038 |
| June | 35,173 | 1,172 | 1,495 |
| July | 42,973 | 1,386 | 2,736 |
| August | 58,796 | 1,897 | 3,609 |
| September | 55,141 | 1,838 | 2,674 |
| October | 37,846 | 1,221 | 2,511 |
| November | 27,068 | 902 | 1,155 |
| December | 34,280 | 1,106 | 1,923 |
| Total | 638,273 | | |
| Average | 53,189 | 1,744* | |
| Minimum | 27,068 | | |
| Maximum | 94,140 | | 5,891 |
| ECA Requirement | | 4,550 | 15,110 |
| Met Compliance | | Yes | Yes |

*Annual Average

**Table 2 Raw Influent Analyses**

| Month | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | DP avg. conc. mg/L | Alkal-inity $CaCO_3$ mg/L |
|---|---|---|---|---|---|---|---|---|
| January | 59 | 93 | 78 | 122 | 1.9 | 3.1 | 1.2 | 288 |
| February | 57 | 115 | 65 | 131 | 1.3 | 2.7 | 0.9 | 287 |
| March | 31 | 89 | 48 | 138 | 0.9 | 2.5 | 0.5 | 275 |
| April | 64 | 201 | 96 | 301 | 1.5 | 4.6 | 0.6 | 276 |
| May | 77 | 140 | 76 | 138 | 2.1 | 3.8 | 1.0 | 304 |
| June | 82 | 97 | 80 | 94 | 2.7 | 3.1 | 1.7 | 277 |
| July | 94 | 130 | 102 | 142 | 2.6 | 3.6 | 1.4 | 242 |
| August | 79 | 150 | 98 | 186 | 2.0 | 3.8 | 1.1 | 213 |
| September | 92 | 169 | 115 | 211 | 2.4 | 4.5 | 1.4 | 207 |
| October | 112 | 137 | 117 | 143 | 2.9 | 3.5 | 1.7 | 246 |
| November | 112 | 101 | 91 | 82 | 3.3 | 3.0 | 2.2 | 289 |
| December | 78 | 86 | 75 | 83 | 2.6 | 2.8 | 1.7 | 263 |
| Average | 78 | 136 | 87 | 151 | 2.2 | 3.8 | 1.3 | 264 |
| Minimum | 31 | 86 | 48 | 82 | 0.9 | 2.5 | 0.5 | 207 |
| Maximum | 112 | 201 | 117 | 301 | 3.3 | 4.6 | 2.2 | 304 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | | Yes |

**Table 2 Raw Influent Analyses continued**

| Month | TKN avg. conc. mg/L | TKN loading kg/d | TAN avg. conc. mg/L | TAN loading kg/d | pH min. | pH max. | Temp. Degrees Celsius min. | Temp. Degrees Celsius max. |
|---|---|---|---|---|---|---|---|---|
| January | 16.13 | 25 | 13.08 | 20.6 | 7.50 | 7.98 | 4.5 | 11.5 |
| February | 14.10 | 28 | 8.09 | 16.3 | 7.54 | 8.05 | 4.9 | 10.3 |
| March | 7.74 | 22 | 5.09 | 14.7 | 7.66 | 7.93 | 5.3 | 11.8 |
| April | 12.90 | 40 | 6.02 | 18.9 | 7.66 | 8.19 | 3.3 | 11.0 |
| May | 18.90 | 34 | 11.50 | 20.9 | 7.37 | 7.84 | 8.9 | 16.0 |
| June | 24.64 | 29 | 7.18 | 8.4 | 7.15 | 7.60 | 13.1 | 17.4 |
| July | 24.68 | 34 | 17.83 | 24.7 | 7.07 | 7.30 | 15.8 | 19.2 |
| August | 18.88 | 36 | 13.83 | 26.2 | 6.46 | 7.53 | 17.4 | 22.0 |
| September | 23.08 | 42 | 16.58 | 30.5 | 6.90 | 7.35 | 16.5 | 20.6 |
| October | 27.30 | 33 | 22.44 | 27.4 | 6.67 | 7.46 | 12.9 | 18.1 |
| November | 31.16 | 28 | 25.35 | 22.9 | 7.03 | 7.50 | 10.6 | 15.7 |
| December | 25.08 | 28 | 18.49 | 20.4 | 7.26 | 7.86 | 7.8 | 13.5 |
| Average | 20.38 | 36 | 13.79 | 24.1 | | | | |
| Minimum | 7.74 | 22 | 5.09 | 8.4 | 6.46 | | 3.3 | |
| Maximum | 31.16 | 42 | 25.35 | 30.5 | | 8.19 | | 22.0 |
| Sampling Frequency Requirement Met | Yes | | | | Yes | Yes | | |

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | TP loading kg/month |
|---|---|---|---|---|---|---|---|
| January | 0.5 | 0.8 | 0.7 | 1 | 0.03 | 0.0 | 1.2 |
| February | 0.6 | 1.3 | 0.8 | 2 | 0.03 | 0.1 | 1.6 |
| March | 1.4 | 4.1 | 4.1 | 12 | 0.05 | 0.1 | 4.3 |
| April | 0.9 | 2.7 | 4.8 | 15 | 0.04 | 0.1 | 3.8 |
| May | 1.1 | 2.0 | 1.0 | 2 | 0.07 | 0.1 | 4.1 |
| June | 0.6 | 0.7 | 0.8 | 1 | 0.08 | 0.1 | 2.8 |
| July | 0.5 | 0.7 | 0.9 | 1 | 0.04 | 0.1 | 1.8 |
| August | 0.4 | 0.8 | 0.9 | 2 | 0.03 | 0.1 | 1.6 |
| September | 0.5 | 0.9 | 1.1 | 2 | 0.03 | 0.0 | 1.4 |
| October | 0.8 | 1.0 | 0.9 | 1 | 0.03 | 0.0 | 1.0 |
| November | 0.5 | 0.5 | 0.7 | 1 | 0.05 | 0.0 | 1.3 |
| December | 0.5 | 0.6 | 0.7 | 1 | 0.03 | 0.0 | 0.9 |
| Total | | | | | | | 26* |
| Average | 0.7 | 1.2 | 1.5 | 3 | 0.04 | 0.1 | 2.2 |
| Minimum | 0.4 | 0.5 | 0.7 | 1 | 0.03 | 0.0 | 0.9 |
| Maximum | 1.4 | 4.1 | 4.8 | 15 | 0.08 | 0.1 | 4.3 |
| ECA Limit | 10** | | 10** | | 0.3** | | 190* |
| ECA Objective | 5 | | 5 | | 0.12 | | 190 |
| LSPRS | | | | | 0.15*** | | 190* |
| Within Compliance | Yes | | Yes | | Yes | | Yes |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | |

*Total Annual Loading, kg/year

**Monthly Average Concentration

***Annual Average Concentration

**Table 3 Final Effluent Analyses continued**

| Month | DP avg. conc. mg/L | TAN Summer avg. conc. mg/L | TAN Winter avg. conc. mg/L | TAN loading kg/d | TKN avg. conc. mg/L | Un-ionized ammonia avg. conc. mg/L |
|---|---|---|---|---|---|---|
| January | 0.02 | | 0.02 | 0.0 | 0.50 | 0.0 |
| February | 0.02 | | 0.03 | 0.1 | 0.50 | 0.0 |
| March | 0.02 | | 0.10 | 0.3 | 0.75 | 0.0 |
| April | 0.02 | | 0.08 | 0.2 | 0.66 | 0.0 |
| May | 0.04 | | 0.04 | 0.1 | 0.64 | 0.0 |
| June | 0.05 | 0.04 | | 0.1 | 0.73 | 0.0 |
| July | 0.03 | 0.03 | | 0.0 | 0.65 | 0.0 |
| August | 0.02 | 0.02 | | 0.0 | 0.66 | 0.0 |
| September | 0.01 | | 0.03 | 0.1 | 0.78 | 0.0 |
| October | 0.01 | | 0.03 | 0.0 | 0.72 | 0.0 |
| November | 0.03 | | 0.03 | 0.0 | 0.72 | 0.0 |
| December | 0.02 | | 0.03 | 0.0 | 0.62 | 0.0 |
| Average | 0.02 | 0.03 | 0.04 | 0.1 | 0.66 | 0.0 |
| Minimum | 0.01 | 0.02 | 0.02 | 0.0 | 0.50 | 0.0 |
| Maximum | 0.05 | 0.04 | 0.10 | 0.3 | 0.78 | 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 min. | pH max. | Temp. Degrees Celsius min. | Temp. Degrees Celsius max. |
|---|---|---|---|---|
| January | 7.23 | 7.47 | 6.8 | 9.8 |
| February | 7.29 | 7.67 | 5.2 | 12.4 |
| March | 7.18 | 7.51 | 5.3 | 10.8 |
| April | 7.24 | 7.58 | 7.3 | 12.3 |
| May | 7.23 | 7.74 | 10.2 | 17.2 |
| June | 6.90 | 7.49 | 14.0 | 18.9 |
| July | 6.56 | 7.17 | 18.2 | 23.1 |
| August | 6.75 | 7.49 | 19.5 | 22.7 |
| September | 6.71 | 7.43 | 16.3 | 23.2 |
| October | 6.67 | 7.13 | 11.8 | 18.3 |
| November | 6.91 | 7.19 | 8.4 | 14.7 |
| December | 7.04 | 7.39 | 5.2 | 13.0 |
| Minimum | 6.56 | | 5.2 | |
| Maximum | | 7.74 | | 23.2 |
| ECA Objective | 6.5 | 9.0 | | |
| Sampling Frequency Requirement Met | Yes | Yes | Yes | Yes |

**Table 4 Escherichia Coliform Sampling**

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

**Table 5 Total Coliform Sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 4 | 1 |
| February | 4 | 0 |
| March | 5 | 5 |
| April | 4 | 1 |
| May | 4 | 0 |
| June | 5 | 10 |
| July | 4 | 2 |
| August | 5 | 0 |
| September | 4 | 1 |
| October | 4 | 2 |
| November | 5 | 2 |
| December | 4 | 1 |
| Sampling Frequency Requirement Met | Yes | |

**Table 6 Energy and Chemical Usage**

| Month | Alum (litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|
| January | 4,882 | 87,851 | 17,387 |
| February | 4,869 | 72,954 | 17,472 |
| March | 9,971 | 78,302 | 16,146 |
| April | 7,447 | 71,427 | 13,348 |
| May | 1,954 | 76,010 | 7,455 |
| June | 2,416 | 68,371 | 0 |
| July | 3,450 | 70,281 | 0 |
| August | 7,066 | 71,808 | 0 |
| September | 5,881 | 67,989 | 0 |
| October | 3,369 | 72,572 | 2,432 |
| November | 3,045 | 74,482 | 10,158 |
| December | 4,188 | 90,906 | 15,605 |
| Total | 58,538 | 902,953 | 100,003 |

## Glossary of Terms

**Annual Average Concentration**

An arithmetic mean of the monthly average concentrations of a contaminant in the effluent calculated for any particular year.

**Annual Average Loading**

The value obtained by multiplying the annual average concentration of a contaminant by the average daily flow over the same calendar year.

**Average Daily Flow**

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

**Avg – Average**

An arithemetic mean of the average concentrations and loadings.

**Biosolids**

Organic material recovered from wastewater sludge.

**Bioreactor**

A bioreactor is a vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms.

**$BOD_5$ Five Day Biochemical Oxygen Demand**

(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**

Any discharge from the works that does not undergo any treatment or only receives partial treatment before it is discharged to the environment.

**$cBOD_5$ -Five Day Carbonaceous Biochemical Oxygen Demand**

Means a five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample..

**Conc. - Concentration**

The abundance of a constituent divided by the total volume of a mixture.

**Daily Concentration**

The concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required.

**DP - Dissolved Reactive Phosphorus**

This is the soluble form of phosphorus present in the wastewater.

**ECA - Environmental Compliance Approval**

The primary regulatory instrument for each water pollution control plant.

**E. - coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Sewage discharge through the water pollution control plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, when tested provides a snapshot of the conditions at the time the sample was retrieved.

**kg - kilogram**

Basic unit of mass in the metric system

**kg/d – kilogram per day**

**LSPRS - Lake Simcoe Phosphorus Reduction Strategy**

The ECA issued on June 28, 2012 introduced additional phosphorus objectives to comply with the requirements of the Lake Simcoe Phosphorus Reduction Strategy (2010) prepared under the Lake Simcoe Protection Plan (2009).

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metre Per Day)**

Flow measurement, $1m^3$ = 1000litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max-Maximum**

The peak or highest value recorded during a specific time period usually a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in water, sometimes referred to as parts per million (ppm).

**Min-Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm.-(millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Loading**

Is calculated by multiplying the monthly average concentration of a contaminant by the monthly average daily flow over the same calendar month.

**N/A - Not Applicable**

**Peak Flow Rate**

The maximum rate of sewage flow for which the plant or process unit was designed.

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The average daily flow for which the works are approved to handle**.**

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Septage**

Partially treated sludge from a septic tank.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN - Total Ammonia Nitrogen**

Ammonia exists in two forms in the wastewater: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**Total Annual Loading**

Is calculated by adding the calculated total monthly load discharged for each calendar year.

**Total Monthly Loading**

Is calculated by multiplying the total monthly flow by the monthly average concentration.

**TP - Total Phosphorus**

A laboratory analyses to determine the total amount of non-soluble and soluble phosphorus present in the wastewater.

**TSS - Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS - Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**WPCP - Water Pollution Control Plant**

A facility composed of a variety of treatment processes that collectively treat wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Newcastle Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Newcastle Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 3-2189-87-946 Dated July 26, 1994
Amendments: Dated June 21, 2006
May 10, 1998
June 11, 1996

**Environmental Compliance Approval (Air)**: 8-3083-93-006 Dated March 22, 1993

The Newcastle Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers a performance overview of the Newcastle WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### Water Pollution Control Plant Process Description

### General

The Newcastle WPCP is located in the Municipality of Clarington (Newcastle) and is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA.

The plant treats wastewater from the Newcastle service area in the Regional Municipality of Durham, servicing approximately 10,477 residents.

The Newcastle WPCP is designed to treat wastewater at an average flow rate of 4,086 cubic metres per day ($m^3$/d) with a peak flow rate of 12,300 $m^3$/d. The plant is an MOECC Class Three conventional activated sludge treatment plant that utilizes the following processes to treat wastewater:

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- secondary treatment,
- phosphorus removal,
- disinfection (chlorination/dechlorination),
- solids treatment.

### Raw Influent Pumping

Wastewater collected through approximately 38 km of sanitary sewers in Newcastle is conveyed to the Newcastle WPCP by gravity and by two sanitary sewage pumping stations located in the collection system.

### Preliminary Treatment

**Screening**: One automatic, mechanically cleaned screen removes paper products and large material that could harm pumps and process equipment. Screenings removed in this process are transported to landfill.

**Grit Removal**: Heavy suspended material such as sand and small stones (grit) is removed in the aerated grit tank. The velocity of the wastewater rolling in the tanks is controlled by the quantity of air added to produce conditions that allow heavy grit material to settle, while keeping the lighter organic material in suspension to proceed to the next process tank. The grit removed in this process is dewatered and transported to landfill.

### Primary Treatment

The primary clarifier utilizes the physical process of sedimentation which allows suspended material to settle to the bottom of the tank as sludge. This raw sludge, along with excess activated sludge from the secondary treatment process is collected by a sweep arm mechanism which pushes the sludge into a hopper. The sludge is then pumped to the sludge holding tank for transportation to Courtice WPCP. Any material floating on the surface of the clarifier (scum) is also removed to the holding tank.

### Secondary Treatment

**Aerated Bioreactor**: The bioreactors are comprised of two distinct sections. The first section is an anoxic zone, where no oxygen is introduced and allows for potential denitrification. Subsequently, the flow leaves the anoxic zone and enters the aerated zone where fine bubbled air is diffused into the sewage to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the bioreactor is directed to the secondary clarifier where the solids settle quickly to the bottom as activated sludge leaving clear supernatant. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the bioreactor and the excess activated sludge is wasted to the primary clarifier.

### Phosphorus Removal

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding a chemical coagulant (aluminum chloride). Aluminum chloride can be added at multiple locations within the plant

### Disinfection (chlorination/dechlorination)

Chlorine in the form of liquid sodium hypochlorite is metered into the secondary effluent stream for pathogen control. Adequate contact time is provided by the single chlorine contact chamber. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged through a 900 mm diameter outfall extending 130 m to a 600 mm pipe extending 800 m into Lake Ontario.

### Solids Treatment

All sludge produced at the Newcastle WPCP is stored in a sludge holding tank. The sludge is shipped to the Courtice WPCP for anaerobic digestion. Sludge is transported plant to plant in accordance with ECA #A820250.

## Environmental Compliance Approval

Under Condition 17 (1) of ECA #3-2189-87-946 the Region of Durham must produce an annual report that contains 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 summarizes the raw wastewater characteristics during the reporting period.

The Newcastle WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at an average of 63% of its annual average rated flow capacity and received a maximum daily flow of 6,417 $m^3$/d on January 11$^{th}$, 2016. See tables for effluent results.

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

No operating problems were encountered at the Newcastle WPCP in 2016.

**c) Maintenance of major equipment**

Major maintenance items in 2016 included:

- Rebuilt raw sewage pump #2.
- Installed upgraded plant-wide SCADA system.

**d) Summary of any effluent quality assurance or control measures**

- In-house lab test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy. All results were found to be within a comparable range.
- Online instrumentation is verified by WPCP operators using field or laboratory test equipment.

**e) Summary of the calibration and maintenance carried out**

- Calibration of the raw influent flow meter was conducted in May and September 2016.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted on July 29, 2016.
- Calibration of the in-house lab pH meter was conducted monthly.

**f) Effluent Objectives**

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

The average daily rated flow capacity of 4,086$m^3$/d was not exceeded. The maximum rated flow rate of 12,300 $m^3$/d was not exceeded.

The total chlorine residual monthly average objective was exceeded on five of 12 occasions (42%). The ECA requests an objective concentration of 0 mg/L, however the instrumentation used has a detection limit of 0.0012 mg/L so it is typical to have results above 0 mg/L. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals.

Best efforts and process adjustments will continue to be applied to maintain results below objectives.

**g) Sludge Production:**

**Tabulation of Volume of Sludge Generated:**

The volume of sludge removed from Newcastle WPCP in 2016 was 6,956 $m^3$ at an average concentration of 2.5% total solids. See table 5 Sludge Quality and Disposal.

**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 is Disposed:**

Courtice WPCP -100%

**h) Summary of Complaints and Steps Taken to Address the Complaints:**

There were two odour complaints received from the same homeowner in 2016. Once on August 20 and another on December 2. The MOECC was notified regarding the August 20 complaint for informative purposes only and the homeowner could not identify a specific period regarding the second complaint. Additional steps to reduce odourous air from leaving the headworks building were put in place and staff continue to monitor for odours from this facility. No further complaints have been received.

**i) By-passes and Spills**

An MOECC approved by-pass of the chlorine contact chamber was conducted on October 19, 2016 for annual cleaning. The MOECC supervisor was notified once the bypass was complete.

There were no spills during the reporting period.

**j) Proposed Alterations, Extensions or Replacements**

A plant-wide SCADA system upgrade was completed in 2016.

**k) Information Required by MOECC Water Supervisor**

Table 7 provides a Bacterial analysis of the Newcastle Water Supply Plant raw water for 2016.

**MOECC Inspection**

No MOECC inspection occurred in 2016.

**Table 1 Raw Influent Flows**

| Month | Total Flow to Plant -metered at the raw influent $m^3$ | Average Day Flow $m^3/d$ | Maximum Day Flow $m^3/d$ |
|---|---|---|---|
| January | 116,673 | 3,764 | 7,007 |
| February | 97,148 | 3,350 | 4,332 |
| March | 118,647 | 3,827 | 5,544 |
| April | 103,436 | 3,448 | 5,900 |
| May | 79,882 | 2,577 | 3,130 |
| June | 71,506 | 2,384 | 3,217 |
| July | 67,451 | 2,176 | 2,741 |
| August | 68,376 | 2,206 | 2,714 |
| September | 64,939 | 2,165 | 2,731 |
| October | 64,224 | 2,072 | 2,440 |
| November | 61,953 | 2,065 | 2,439 |
| December | 74,033 | 2,388 | 3,162 |
| Total | 988,268 | | |
| Average | 82,356 | 2,700* | |
| Minimum | 61,953 | | |
| Maximum | 118,647 | | 7,007 |
| ECA Requirement | | 4,086 | |
| Met Compliance | | Yes | |

*Annual Average Daily Flow

**Table 2 Raw Influent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 76 | 287 | 180 | 677 | 188 | 706 | 3.4 | 13 |
| February | 76 | 255 | 170 | 569 | 204 | 684 | 3.8 | 13 |
| March | 81 | 309 | 133 | 508 | 187 | 716 | 3.5 | 14 |
| April | 80 | 275 | 140 | 481 | 186 | 641 | 3.3 | 11 |
| May | 114 | 294 | 176 | 454 | 235 | 607 | 5.1 | 13 |
| June | 108 | 257 | 162 | 386 | 217 | 518 | 5.1 | 12 |
| July | 149 | 323 | 172 | 374 | 221 | 481 | 5.0 | 11 |
| August | 118 | 261 | 183 | 403 | 235 | 518 | 5.3 | 12 |
| September | 133 | 288 | 178 | 386 | 215 | 465 | 5.6 | 12 |
| October | 162 | 335 | 244 | 506 | 274 | 568 | 6.7 | 14 |
| November | 149 | 307 | 190 | 393 | 237 | 489 | 5.9 | 12 |
| December | 106 | 252 | 141 | 336 | 252 | 601 | 5.2 | 13 |
| Average | 113 | 304 | 172 | 465 | 221 | 596 | 4.8 | 13 |
| Minimum | 76 | 252 | 133 | 336 | 186 | 465 | 3.3 | 11 |
| Maximum | 162 | 335 | 244 | 677 | 274 | 716 | 6.7 | 14 |
| Sampling Frequency Requirement Met | | | | | | | | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TKN loading kg/d | TAN avg. conc. mg/L | TAN loading kg/d | pH min. | pH max. |
|---|---|---|---|---|---|---|---|
| January | 1.38 | 27.95 | 105 | 18.75 | 71 | 7.10 | 7.55 |
| February | 1.72 | 32.38 | 108 | 20.88 | 70 | 5.30 | 7.50 |
| March | 1.42 | 29.62 | 113 | 19.38 | 74 | 7.10 | 7.98 |
| April | 1.44 | 28.83 | 99 | 17.83 | 61 | 6.70 | 7.80 |
| May | 2.29 | 37.28 | 96 | 23.62 | 61 | 6.86 | 7.72 |
| June | 2.05 | 41.60 | 99 | 26.02 | 62 | 6.92 | 7.90 |
| July | 2.21 | 41.73 | 91 | 26.85 | 58 | 6.42 | 7.23 |
| August | 2.26 | 39.96 | 88 | 25.21 | 56 | 6.60 | 7.23 |
| September | 2.31 | 40.08 | 87 | 26.33 | 57 | 6.86 | 7.60 |
| October | 2.76 | 47.38 | 98 | 29.73 | 62 | 6.89 | 7.90 |
| November | 2.79 | 44.70 | 92 | 30.94 | 64 | 7.01 | 7.80 |
| December | 2.42 | 38.65 | 92 | 28.61 | 68 | 6.20 | 7.49 |
| Average | 2.09 | 37.51 | 101 | 24.51 | 66 | | |
| Minimum | 1.38 | 27.95 | 87 | 17.83 | 56 | 5.30 | |
| Maximum | 2.79 | 47.38 | 113 | 30.94 | 74 | | 7.98 |
| Sampling Frequency Requirement Met | | | | | | | |

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | TAN avg. conc. mg/L summer | TAN avg. conc. mg/L winter | TAN loading kg/d |
|---|---|---|---|---|---|---|---|---|---|
| January | 1.5 | 6 | 4.9 | 18 | 0.32 | 1.2 | | 0.20 | 0.8 |
| February | 1.7 | 6 | 5.9 | 20 | 0.28 | 0.9 | | 0.47 | 1.6 |
| March | 2.0 | 8 | 5.5 | 21 | 0.25 | 1.0 | | 0.32 | 1.2 |
| April | 1.6 | 6 | 6.6 | 23 | 0.42 | 1.5 | 0.23 | | 0.8 |
| May | 2.1 | 5 | 6.3 | 16 | 0.38 | 1.0 | 0.53 | | 1.4 |
| June | 2.5 | 6 | 5.7 | 14 | 0.30 | 0.7 | 0.67 | | 1.6 |
| July | 1.9 | 4 | 4.8 | 10 | 0.23 | 0.5 | 0.07 | | 0.2 |
| August | 1.9 | 4 | 5.3 | 12 | 0.22 | 0.5 | 0.18 | | 0.4 |
| September | 1.6 | 3 | 4.9 | 11 | 0.20 | 0.4 | 0.59 | | 1.3 |
| October | 2.3 | 5 | 6.4 | 13 | 0.30 | 0.6 | 0.99 | | 2.1 |
| November | 2.0 | 4 | 7.2 | 15 | 0.26 | 0.5 | 3.93 | | 8.1 |
| December | 1.8 | 4 | 6.1 | 15 | 0.17 | 0.4 | | 4.76 | 11.4 |
| Average | 1.9 | 5 | 5.8 | 16 | 0.28 | 0.8 | 0.90 | 1.44 | 2.6 |
| Minimum | 1.5 | 3 | 4.8 | 10 | 0.17 | 0.4 | 0.07 | 0.20 | 0.2 |
| Maximum | 2.5 | 8 | 7.2 | 23 | 0.42 | 1.5 | 3.93 | 4.76 | 11.4 |
| ECA Requirement | 25.0 | 102 | 25.0 | 102 | | | 15 | 20 | |
| ECA Objective | 15.0 | 61.29 | 15.0 | 61.29 | 1.0 | 4.1 | 10 | 15 | |
| Within Compliance | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | Yes | |

**Table 3 Final Effluent Analyses continued**

| Month | Unionized NH3 avg. conc. mg/L | TKN avg. conc. mg/L | DP avg. conc. mg/L | TCR avg. conc. mg/L | Nitrate plus Nitrite mg/L | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|---|
| January | 0.00 | 1.02 | 0.06 | 0.00 | 12.11 | 6.40 | 7.18 | 11.4 | 15.3 |
| February | 0.00 | 1.72 | 0.09 | 0.00 | 12.90 | 6.20 | 7.12 | 10.2 | 13.1 |
| March | 0.00 | 1.14 | 0.09 | 0.00 | 12.24 | 6.40 | 7.52 | 10.2 | 12.8 |
| April | 0.00 | 1.18 | 0.19 | 0.00 | 12.20 | 6.20 | 7.11 | 10.8 | 13.5 |
| May | 0.00 | 1.70 | 0.13 | 0.01 | 14.18 | 6.00 | 7.09 | 12.3 | 17.2 |
| June | 0.00 | 1.90 | 0.10 | 0.01 | 14.00 | 5.90 | 6.94 | 15.5 | 21.3 |
| July | 0.00 | 1.18 | 0.05 | 0.00 | 14.23 | 6.30 | 6.77 | 18.0 | 20.2 |
| August | 0.00 | 1.35 | 0.05 | 0.00 | 14.66 | 5.71 | 6.90 | 20.3 | 22.0 |
| September | 0.00 | 1.56 | 0.04 | 0.01 | 14.48 | 6.00 | 6.51 | 19.8 | 22.4 |
| October | 0.00 | 2.66 | 0.05 | 0.01 | 16.70 | 5.50 | 6.80 | 17.1 | 21.7 |
| November | 0.01 | 4.53 | 0.02 | 0.01 | 15.96 | 6.20 | 6.98 | 15.1 | 18.6 |
| December | 0.01 | 6.36 | 0.02 | 0.00 | 13.75 | 6.20 | 6.99 | 12.8 | 16.7 |
| Average | 0.00 | 2.19 | 0.07 | 0.00 | 13.95 | | | | |
| Minimum | 0.00 | 1.02 | 0.02 | 0.00 | 12.11 | 5.50 | | 10.2 | |
| Maximum | 0.01 | 6.36 | 0.19 | 0.01 | 16.70 | | 7.52 | | 22.4 |
| ECA Requirement | | | | 0.04 | | | | | |
| ECA Objective | | | | 0 | | | | | |
| Within Compliance | | | | Yes | | | | | |
| Sampling Frequency Requirement Met | | Yes | | Yes | Yes | Yes | Yes | Yes | Yes |

**Table 4 Escherichia Coliform Sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 4 | 50 |
| February | 4 | 103 |
| March | 5 | 8 |
| April | 4 | 6 |
| May | 5 | 0 |
| June | 4 | 48 |
| July | 4 | 17 |
| August | 5 | 13 |
| September | 4 | 0 |
| October | 4 | 0 |
| November | 5 | 0 |
| December | 4 | 0 |
| ECA Requirement | | N/A |
| ECA Objective | | 200 |
| Within Compliance | | N/A |
| Sampling Frequency Requirement Met | Yes | |

**Table 4(a) Summary of the Faecal Streptococcus sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 2 | 155 |
| February | 2 | 90 |
| March | 2 | 10 |
| April | 2 | 25 |
| May | 2 | 9 |
| June | 2 | 80 |
| July | 2 | 26 |
| August | 2 | 187 |
| September | 2 | 259 |
| October | 2 | 152 |
| November | 2 | 17 |
| December | 2 | 11 |
| ECA Requirement | | N/A |
| ECA Objective | | N/A |
| Within Compliance | | N/A |
| Sampling Frequency Requirement Met | Yes | |

**Table 4(b) Summary of the Total Coliform sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 2 | 1,296 |
| February | 2 | 620 |
| March | 2 | 99 |
| April | 2 | 962 |
| May | 2 | 62 |
| June | 2 | 1,022 |
| July | 2 | 794 |
| August | 2 | 1,032 |
| September | 2 | 4 |
| October | 2 | 83 |
| November | 2 | 95 |
| December | 2 | 26 |
| ECA Requirement | | N/A |
| ECA Objective | | N/A |
| Within Compliance | | N/A |
| Sampling Frequency Requirement Met | Yes | |

**Table 5 Sludge Quality and Disposal**

| Month | Avg. Sludge TS (%) | Total Volume Removed ($m^3$) | Total Volume Hauled to Courtice WPCP ($m^3$) | Total Volume Hauled to Duffin Creek WPCP ($m^3$) |
|---|---|---|---|---|
| January | 2.99 | 532 | 532 | 0 |
| February | 3.05 | 570 | 570 | 0 |
| March | 3.30 | 564 | 564 | 0 |
| April | 2.76 | 572 | 572 | 0 |
| May | 1.83 | 572 | 572 | 0 |
| June | 3.82 | 648 | 648 | 0 |
| July | 1.99 | 568 | 568 | 0 |
| August | 1.73 | 612 | 612 | 0 |
| September | 1.42 | 610 | 610 | 0 |
| October | 1.87 | 528 | 528 | 0 |
| November | 2.62 | 572 | 572 | 0 |
| December | 2.37 | 608 | 608 | 0 |
| Total | | 6,956 | 6,956 | 0 |
| Average | 2.48 | 580 | 580 | 0 |

**Table 6 Energy and Chemical Usage**

| Month | Total Plant Flow (cubic metres) | Alum (litres) | Sodium Hypochlorite (kilograms as chlorine) | Sodium Bisulphite (Litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|---|---|---|
| January | 116,673 | 6,556 | 513 | 4,984 | 74,864 | 16,616 |
| February | 97,148 | 6,135 | 444 | 3,027 | 103,893 | 16,732 |
| March | 118,647 | 6,410 | 463 | 3,330 | 98,291 | 18,512 |
| April | 103,436 | 6,223 | 402 | 3,801 | 96,254 | 8,738 |
| May | 79,882 | 6,356 | 454 | 2,855 | 88,105 | 4,069 |
| June | 71,506 | 6,134 | 373 | 2,474 | 84,540 | 262 |
| July | 67,451 | 6,494 | 272 | 2,247 | 90,143 | 236 |
| August | 68,376 | 7,117 | 810 | 2,280 | 97,782 | 256 |
| September | 64,939 | 8,397 | 942 | 2,653 | 93,708 | 239 |
| October | 64,224 | 7,324 | 428 | 2,606 | 98,291 | 7,226 |
| November | 61,953 | 7,749 | 266 | 2,612 | 89,124 | 10,375 |
| December | 74,033 | 7,725 | 288 | 2,647 | 112,042 | 19,235 |
| Total | 988,268 | 41,822 | 3,278 | 15,115 | 1,127,037 | 102,496 |

**Table 7 Summary of the raw Water Bacteriological analyses at the Newcastle Water Supply Plant**

| Month | E.coli cfu/100ml (min-max result) | E.coli (number of samples) | Total Coliform cfu/100ml (min-max result) | Total Coliform (number of samples) |
|---|---|---|---|---|
| January | <1-4 | 16 | <1-480 | 16 |
| February | <1 | 16 | <1-68 | 16 |
| March | <1-1 | 18 | <1- 48 | 18 |
| April | <1 | 16 | <1-1 | 16 |
| May | <1 | 17 | <1-25 | 17 |
| June | <1 | 18 | <1-10 | 18 |
| July | <1-1 | 16 | <1-24 | 16 |
| August | <1-3 | 18 | <1-37 | 18 |
| September | <1-1 | 16 | 1-1400 | 16 |
| October | <1-1 | 16 | <1-8 | 16 |
| November | <1-1 | 18 | <1-2 | 18 |
| December | <1-1 | 15 | <1-11 | 15 |

## Glossary of Terms

**Aeration tank**
An aeration tank is a vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms. This encompasses a combination of aerobic and anoxic processes.

**Anaerobic digestion**
Is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

**Average Concentration**
The arithmetic mean concentration of a parameter within a specified period of operation.

**Average Daily Flow**
The total volume of sewage flow to the plant over twelve consecutive calendar months divided by the number of days over the same period of time.

**$BOD_5$ - Five day Biochemical Oxygen Demand**
(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**
A diversion of sewage around one or more unit processes within the Sewage Treatment Plant with the diverted sewage flows being returned to the Sewage Treatment Plant treatment train upstream of the Final effluent sampling location, and discharging to the environment through the Sewage Treatment Plant outfall.

**$CBOD_5$ -Five day Carbonaceous Biochemical Oxygen Demand**
A five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

**conc. – Concentration**
A measure of the amount of dissolved substance contained per unit of volume.

**DP – Dissolved Phosphorus**
This is the soluble form of phosphorus present in the wastewater.

**Denitrification -**
The biological process of nitrate reduction to nitrogen gases occurring in low dissolved oxygen environments.

**ECA**
Environmental Compliance Approval. The primary governing document for each WPCP.

**E. coli - (Escherichia coli)**
Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius. Calculated using a monthly geometric mean density.

**Final Effluent**
sewage discharge via the Sewage Treatment Plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric mean density**
Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**
A single sample taken at a specific moment in time, a snapshot of the conditions at the time the sample was retrieved.

**Loading**
Volume of a parameter that is present in a given volume of wastewater, is calculated by multiplying the annual average concentration by the average daily flow as kg/day.

**$m^3$ - (Cubic Metre)**
Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metre Per Day)**
Flow measurement, $1m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**
The peak or highest value recorded during a specific time period usually in a day.

**Maximum Flow Rate**
The peak or highest flow recorded during a specific time period usually in a day.

**Mg/L - (Milligram Per Litre)**
This is a measure of the concentration of a parameter in water, sometimes referred to as parts per million (ppm).

**Min. – Minimum**
The lowest value recorded during a specific time period usually in a day.

**mm.- (millimetre)**
Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**
The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly average concentration**
Calculated as an arithmetic mean of all daily concentrations analyzed for the month.

**Monthly average loading**
Calculated by multiplying the monthly average concentration by the monthly average daily flow.

**N/A - Not applicable**
**NH3 – Unionized Ammonia**
Is a compound of nitrogen and hydrogen with the formula NH3. It is a colourless gas with a characteristic pungent smell

**pH**
Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. A solution of pH from 0-7 is acidic, 7 is neutral, and 7-14 is alkaline.

**Raw Influent**
Raw wastewater entering the water pollution control plant before treatment.

**Rated Capacity**
The average daily flow for which the works is approved to handle.

**Septage**
Partially treated sludge from a septic tank.

**Sludge**
A Semi-solid material that is produced as a by-product during sewage treatment. Similar to biosolids.

**TAN -Total Ammonia Nitrogen**
Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**TCR -Total Chlorine Residual**
The sum of the free and combined chlorine residual

**Temp. – Temperature**
A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**Total loading**
Calculated by multiplying the average concentration by the average flow.

**TP -Total Phosphorus**
A laboratory analyses to determine the total amount of particulate and soluble phosphorus present in the wastewater.

**TSS -Total Suspended Solids**
A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS -Total Solids**
Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Un-ionized Ammonia nitrogen**
Calculated using the methodology specified in the MOECC's Guideline and Policies document titled "Provincial Water Quality Objectives" (July 1994).

**WPCP - Water Pollution Control Plant**
Is typically a facility composed of a variety of treatment processes that collectively treat the wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Nonquon Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Nonquon Water Pollution Control Plant 2016 Annual Performance Report

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

4143-7NCKSG Dated June 18, 2009

The Nonquon Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers an overview of the performance of the Nonquon WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### 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 MOECC Class Two wastewater treatment plant is designed to treat wastewater at 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 8,157 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 48.7 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. Additional flow is added to the forcemain by two private pumping systems: a recreational complex and a small lakefront community of 16 individual homes. Aluminum sulphate is added at the Water Street Pumping Station to enhance the settling of solids and phosphorus removal.

### Lagoon Treatment

### 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.

## Environmental Compliance Approval

Under Condition 10 (6) of ECA #2207-9LKHLM 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**

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.

The Nonquon WPCP effluent was determined to be compliant with the approval limits during the reporting period. The plant operated at 63.9% of its rated capacity and received a maximum daily flow of 6,927 $m^3$/d on April 1, 2016. The total treated effluent discharged to the Nonquon River in 2016 was 846,328 $m^3$.

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

No operating problems were encountered in 2016.

**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 influent flow meter was conducted in June and November, 2016.
- Temperature and pH are monitored in the field, all other routine process control tests are performed at the Uxbridge Brook WPCP laboratory in Uxbridge. All monitoring and laboratory equipment is calibrated and maintained according to manufacturer's specifications.

**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.
- All effluent objectives were met in 2016 except for:
  The effluent objective for total phosphorus was exceeded in two of 150 samples (1.3%). The effluent objective for total suspended solids was exceeded in nine of 152 samples (5.9%). To assist in total suspended solids and total phosphorus removal, the aluminum

sulphate dosage at the Water Street sanitary sewage pumping station was increased and additional aluminum sulphate was added to the lagoons.
The effluent objective for total ammonia nitrogen was exceeded in 78 of 152 samples (51.3%).The removal of total ammonia nitrogen is difficult to achieve in a lagoon treatment system. The new Nonquon WPCP activated sludge and tertiary treatment plant is expected to be commissioned in the winter of 2017

- All effluent flows met the flow objectives with the exception of June where an emergency discharge request to increase effluent flows was approved by the MOECC.
- Best efforts will continue to be applied to maintain results below objectives.

**g) Tabulation of the volume of sludge generated**

The annual depletion of the sludge settling capacity is negligible. 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 2016.

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

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

**Additional Discharge**

The Region of Durham requested an emergency discharge to increase the treated effluent discharge rate to 8,200$m^3$/day during the month of June. The MOECC approved an increased discharge rate in a letter dated May 19, 2016.

**j) Copy of all Notice of Modifications and any implementation of Limited Operational Flexibility(Schedule B)**

No notice of modifications were submitted in 2016.

**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 not inspected by the MOECC in 2016.

**Table 1 Raw Influent Flows**

| Month | Total Flow to Plant -metered at lagoon inlet $m^3$ | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ |
|---|---|---|---|
| January | 88,125 | 2,843 | 4,949 |
| February | 82,184 | 2,834 | 3,498 |
| March | 108,129 | 3,488 | 6,017 |
| April | 109,321 | 3,644 | 6,927 |
| May | 76,392 | 2,464 | 2,820 |
| June | 65,054 | 2,168 | 2,473 |
| July | 61,249 | 1,976 | 2,228 |
| August | 60,386 | 1,948 | 2,314 |
| September | 60,122 | 2,004 | 2,230 |
| October | 61,701 | 1,990 | 2,122 |
| November | 61,296 | 2,043 | 2,240 |
| December | 71,125 | 2,294 | 3,085 |
| Total | 905,086 | | |
| Annual Average | 75,424 | 2,473* | |
| Minimum | 60,122 | | |
| Maximum | 109,321 | | 6,927 |
| ECA Requirement | | 3870* | |
| Met Compliance | | Yes | |

*Annual Average

**Table 2 Raw Influent Analyses**

| Month | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg conc. mg/L | TSS loading kg/d | TP avg conc. mg/L | TP loading kg/d |
|---|---|---|---|---|---|---|
| January | 161 | 456 | 206 | 586 | 3.3 | 9 |
| February | 141 | 400 | 198 | 561 | 2.7 | 8 |
| March | 150 | 522 | 161 | 560 | 2.4 | 8 |
| April | 113 | 413 | 179 | 651 | 3.1 | 11 |
| May | 159 | 392 | 165 | 407 | 3.4 | 8 |
| June | 240 | 521 | 265 | 576 | 4.4 | 10 |
| July | 223 | 441 | 180 | 355 | 3.5 | 7 |
| August | 225 | 438 | 189 | 369 | 4.5 | 9 |
| September | 228 | 457 | 240 | 482 | 4.7 | 9 |
| October | 279 | 555 | 251 | 499 | 4.6 | 9 |
| November | 242 | 494 | 241 | 493 | 5.3 | 11 |
| December | 154 | 354 | 222 | 509 | 4.5 | 10 |
| Average | 193 | 477 | 208 | 515 | 3.9 | 10 |
| Minimum | 113 | 354 | 161 | 355 | 2.4 | 7 |
| Maximum | 279 | 555 | 265 | 651 | 5.3 | 11 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TKN loading kg/d |
|---|---|---|---|
| January | 0.7 | 36.60 | 104 |
| February | 0.3 | 35.65 | 101 |
| March | 0.3 | 28.72 | 100 |
| April | 0.2 | 30.85 | 112 |
| May | 0.9 | 38.48 | 95 |
| June | 1.3 | 48.24 | 105 |
| July | 0.7 | 44.48 | 88 |
| August | 1.0 | 46.28 | 90 |
| September | 1.0 | 48.43 | 97 |
| October | 1.2 | 46.20 | 92 |
| November | 1.6 | 51.34 | 105 |
| December | 1.6 | 46.20 | 106 |
| Average | 0.9 | 41.79 | 103 |
| Minimum | 0.2 | 28.72 | 88 |
| Maximum | 1.6 | 51.34 | 112 |
| Sampling Frequency Requirement Met | | Yes | |

**Table 3 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 | DP avg. conc. mg/L |
|---|---|---|---|---|---|---|---|
| January | 4.0 | 14.4 | 5.8 | 20.8 | 0.07 | 0.266 | 0.01 |
| February | 5.5 | 16.7 | 9.7 | 29.4 | 0.13 | 0.408 | 0.01 |
| March | 6.5 | 17.2 | 7.9 | 21.0 | 0.17 | 0.452 | 0.33 |
| April | 3.1 | 13.3 | 6.2 | 26.5 | 0.07 | 0.304 | 0.01 |
| May | 1.8 | 2.0 | 2.3 | 2.6 | 0.05 | 0.055 | 0.01 |
| June | 3.4 | 23.5 | 3.0 | 21.2 | 0.09 | 0.647 | 0.02 |
| July | | | | | | | |
| August | | | | | | | |
| September | 1.3 | 3.0 | 3.2 | 7.2 | 0.05 | 0.106 | 0.01 |
| October | 2.7 | 8.8 | 6.3 | 20.9 | 0.13 | 0.422 | 0.03 |
| November | 3.9 | 15.5 | 4.5 | 17.6 | 0.06 | 0.244 | 0.01 |
| December | 2.0 | 2.8 | 3.5 | 5.0 | 0.03 | 0.043 | 0.03 |
| Average | 3.4 | 11.6 | 5.2 | 17.7 | 0.09 | 0.290 | 0.05 |
| Minimum | 1.3 | 2.0 | 2.3 | 2.6 | 0.03 | 0.043 | 0.01 |
| Maximum | 6.5 | 23.5 | 9.7 | 29.4 | 0.17 | 0.647 | 0.33 |
| ECA Limit | 10* | 37.1** | 12.0* | 44.5** | 0.3*** | 1.1** | |
| ECA Objective | 8.0 | | 11.0 | | 0.21 | | |
| Within Compliance | Yes | Yes | Yes | | Yes | Yes | |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | Yes | |

*Annual Average Concentration

**Annual Average Loading, kg/day

***Monthly Average Concentration

**Table 3 Final Effluent Analyses continued**

| Month | TAN avg. conc. mg/L | TAN loading ave kg/d | TKN avg. conc. mg/L | Un-ionized ammonia avg. conc. mg/L | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|
| January | 5.40 | 19.4 | 7.75 | 0.0 | 6.12 | 8.39 | 1.4 | 3.9 |
| February | 17.54 | 53.1 | 24.60 | 0.2 | 6.40 | 8.49 | 3.4 | 6.1 |
| March | 16.72 | 44.3 | 19.30 | 0.0 | 6.28 | 7.37 | 4.8 | 6.9 |
| April | 10.11 | 43.0 | 9.64 | 0.1 | 6.98 | 8.50 | 3.8 | 14.6 |
| May | 4.31 | 4.8 | 5.10 | 0.0 | 6.54 | 8.00 | 10.4 | 21.7 |
| June | 1.84 | 12.8 | 3.38 | 0.0 | 7.16 | 8.87 | 16.4 | 23.1 |
| July | | | | | | | | |
| August | | | | | | | | |
| September | 0.51 | 1.1 | 1.76 | 0.0 | 6.50 | 8.60 | 14.8 | 24.6 |
| October | 5.56 | 18.6 | 6.79 | 0.1 | 7.00 | 7.78 | 6.8 | 18.5 |
| November | 3.28 | 12.9 | 4.74 | 0.0 | 6.91 | 8.03 | 7.1 | 15.6 |
| December | 4.20 | 5.9 | 5.12 | 0.0 | 7.54 | 8.13 | 1.5 | 6.8 |
| Average | 6.95 | 23.4 | 8.82 | 0.1 | | | | |
| Minimum | 0.51 | 1.1 | 1.76 | 0.0 | 6.12 | | 1.4 | |
| Maximum | 17.54 | 53.1 | 24.60 | 0.2 | | 8.87 | | 24.6 |
| ECA Limit | | | | | 6.0 | 9.5 | | |
| ECA Objective | Refer to Table 4 | Refer to Table 4 | | | 6.0 | 9.5 | | |
| Within Compliance | | | | | Yes | Yes | | |
| Sampling Frequency Requirement Met | Yes | | | | Yes | Yes | Yes | Yes |

**Table 4 Effluent Objectives for Total Ammonia Nitrogen**

| Month | TAN Effluent Objective conc. mg/L |
|---|---|
| January | 8.4 |
| February | 8.6 |
| March | 8.6 |
| April | 7.8 |
| May | 2.4 |
| June | 2.1 |
| July | |
| August | |
| September | 2.3 |
| October | 3.4 |
| November | 5.7 |
| December | 7.9 |

**Table 5 Effluent Discharge Flows**

| 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 | 100,387 | 130,000 | 3,585 | 4,085 | 4,600 |
| February | 72,675 | 100,000 | 3,028 | 3,618 | 3,900 |
| March | 50,330 | 130,000 | 2,649 | 4,221 | 4,600 |
| April | 127,690 | 150,000 | 4,256 | 5,412 | 5,500 |
| May | 34,710 | 40,000 | 1,120 | 1,235 | 1,400 |
| June | 209,058 | 70,000 | 6,969* | 7,472* | 2,600 |
| July | | | | | |
| August | | | | | |
| September | 68,029 | 70,000 | 2,268 | 2,411 | 2,600 |
| October | 103,514 | 145,000 | 3,339 | 4,579 | 5,100 |
| November | 63,127 | 290,000 | 3,945 | 8,944 | 10,700 |
| December | 16,808 | 230,000 | 1,401 | 4,356 | 8,200 |
| Total | 846,328 | 1,355,000 | | | |

*Additional Discharge Approved

**Table 6 Energy and Chemical Usage**

| Month | Aluminum Sulphate ($m^3$) | Hydro kWh |
|---|---|---|
| January | 18.8 | 36,032 |
| February | 18.4 | 55,130 |
| March | 26.5 | 51,055 |
| April | 25.1 | 42,270 |
| May | 17.5 | 51,310 |
| June | 14.8 | 42,143 |
| July | 12.8 | 40,870 |
| August | 12.9 | 32,085 |
| September | 11.4 | 32,084 |
| October | 11.0 | 27,119 |
| November | 11.6 | 27,119 |
| December | 12.7 | 31,703 |
| Total | 193.5 | 468,920 |

## Glossary of Terms

### Annual Average Concentration

An arithmetic mean of the monthly average concentrations of a contaminant in the effluent calculated for any particular year.

### Annual Average Loading

The value obtained by multiplying the annual average concentration of a contaminant by the Average Daily Flow over the same calendar year.

### Average Daily Flow

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

### Biosolids

Organic material recovered from wastewater sludge.

### $BOD_5$ Five Day Biochemical Oxygen Demand

(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

### By-pass

A diversion of sewage around one or more unit processes within the water pollution control plant with the diverted sewage flows being returned to the water pollution control plant treatment train upstream of the final effluent sampling location, and discharging to the environment through the water pollution control plant outfall.

### $CBOD_5$ -Five Day Carbonaceous Biochemical Oxygen Demand

Means a five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

### Conc. Concentration

The abundance of a constituent divided by the total volume of a mixture.

### Daily Concentration

The concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required.

### DP – Dissolved Reactive Phosphorus

This is the soluble form of phosphorus present in the wastewater.

### ECA Environmental Compliance Approval

The primary regulatory instrument for each water pollution control plant.

**Final Effluent**

Sewage discharge via the water pollution control plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, when tested provides a snapshot of the conditions at the time the sample was retrieved.

**kg - kilogram**

Basic unit of mass in the metric system.

**kg/d – kilogram per day**

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metre Per Day)**

Flow measurement, $1m^3$ = 1000litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**

The peak or highest value recorded during a specific time period usually a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L. - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in water, sometimes referred to as parts per million (ppm).

**Min. – Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm.-(millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Loading**

Is calculated by multiplying the monthly average concentration of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**N/A - Not Applicable**

**N/D - No Discharge**

**Peak Flow Rate**

The maximum rate of sewage flow for which the plant or process unit was designed.

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The average daily flow for which the works are approved to handle**.**

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Seasonal Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured or both during the seasonal discharge period.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN - Total Ammonia Nitrogen**

Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**Total Annual Loading**

Is calculated by summarizing the total monthly loadings within a calendar year**.**

**Total Monthly Loading**

Is calculated by multiplying the total monthly flow by the monthly average concentration.

**TP - Total Phosphorus**

A laboratory analyses to determine the total amount of non-soluble and soluble phosphorus present in the wastewater.

**TSS - Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS - Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**WPCP - Water Pollution Control Plant**

A facility composed of a variety of treatment processes that collectively treat wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Port Darlington Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Port Darlington Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 0114-8S8RTA Dated April 24, 2012

**Environmental Compliance Approval (Air)**: 2242-8TFNN3 Dated June 19, 2012

The Port Darlington Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers a performance overview of the Port Darlington WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### Water Pollution Control Plant Process Description

### General

The Port Darlington WPCP is located in the Municipality of Clarington (Bowmanville) and is owned and operated by the Regional Municipality of Durham. The plant is operating according to the terms and conditions of the ECA.

Port Darlington WPCP treats wastewater from the Bowmanville service area in the Regional Municipality of Durham. The Port Darlington WPCP has been undergoing construction in order to provide additional capacity. Two new process trains have been added as of November 2015 and are treating all incoming wastewater. The four existing trains were removed from service for refurbishment before substantial completion can be granted. The Port Darlington WPCP services 40,115 residents.

The Port Darlington WPCP is designed to treat wastewater at an average daily flow rate of 13,638 cubic metres per day ($m^3$/d) with an increased rating of 27,276 $m^3$/d once the plant expansion is completed and substantial completion is recognized. The plant is an MOECC Class Three conventional activated sludge treatment plant that utilizes the following processes to treat wastewater:

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- secondary treatment,
- phosphorus removal,
- disinfection (chlorination/dechlorination),
- solids treatment.

### Raw Influent Pumping

Wastewater is collected through approximately 140 km of sanitary sewers in Bowmanville and is conveyed to the Port Darlington WPCP by gravity to a sanitary sewage pumping station located at the WPCP.

### Preliminary Treatment

**Screening**: Two automatic, mechanically cleaned screens remove paper products and large material that could harm pumps and process equipment. Screenings removed in this process are compacted for landfill disposal.

**Grit Removal**: Heavy suspended material such as sand and small stones (grit) is removed in the two vortex grit tanks. The velocity of the wastewater swirling in the tanks is controlled by the velocity of influent flow to allow heavy grit material to settle, while keeping the lighter organic material in suspension to proceed to the next process tank. The grit removed in this process is dewatered and transported to landfill.

### Primary Treatment

The two primary clarifiers utilize the physical process of sedimentation which allows suspended material to settle to the bottom of the tank as sludge. This raw sludge, along with excess activated sludge from the secondary treatment process is collected by a flight and chain mechanism which pushes the sludge into hoppers. The sludge is then pumped to the anaerobic digesters for further treatment. Any material floating on the surface of the clarifier (scum) is also removed to the digester.

### Secondary Treatment

**Aerated Bioreactor**: The bioreactors are comprised of two distinct sections. The first section is an anoxic zone, where no oxygen is introduced and allows for potential denitrification. Subsequently, the flow leaves the anoxic zone and enters the aerated zone where fine bubbled air is diffused into the sewage to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifier**: The effluent from the bioreactors is directed to the two secondary clarifiers where the solids settle quickly to the bottom as activated sludge leaving clear supernatant. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the bioreactors and the excess activated sludge is wasted to the primary clarifiers.

### Phosphorus Removal

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding a chemical coagulant (ferrous chloride). Ferrous chloride can be added at multiple locations throughout the WPCP.

### Disinfection (chlorination/dechlorination)

Chlorine in the form of liquid sodium hypochlorite is metered into the secondary effluent stream for pathogen control. Adequate contact time is provided by the single chlorine contact chamber. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged through the 1,350 mm diameter outfall extending 1,100 meters into Lake Ontario.

## Solids Treatment

**Anaerobic Digestion**: The raw sludge that is collected from the primary clarifiers is pumped into the anaerobic digesters where anaerobic bacteria reduce the volume of sludge. The primary digester is currently being used as a sludge holding tank until the plant upgrades are completed.

**Biosolids management:** All sludge produced at the Port Darlington WPCP is hauled to either the Harmony Creek WPCP, the Courtice WPCP or the Duffin Creek WPCP for further processing. Sludges are transported plant to plant in accordance with ECA #A820250.

## Environmental Compliance Approval

Under Condition 10 (6) of ECA #0114-8S8RTA the Region of Durham must produce an annual report that contains the following information:

**a) Summary and interpretation of all monitoring data and a comparison to the effluent limits, 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 Port Darlington WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at an average of 81% of its annual average rated flow capacity based on the existing pre-construction plant capacity and received a maximum daily flow of 29,294 $m^3$/d on January 11, 2016. See tables 3 and 4 for effluent results.

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

There were no operating problems encountered in 2016.

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

- Due to the construction, no major maintenance was completed outside of the expansion and refurbishment scope of work.

**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. All results were found to be within 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;**

- The new raw influent flow meter was not calibrated in 2016 due to the ongoing construction during the plant expansion project.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted July 28th 2016.

- Calibration of the in-house lab pH meter is conducted regularly.

**f) A description of efforts made and results achieved in meeting the Effluent Objectives;**

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

The annual average daily flow did not exceed the rated capacity of 13,638 $m^3$/d during the reporting period.

The pH objective of not less than 6.5 was exceeded 17 of 311 samples (5.5%). The pH meter was calibrated regularly.

The total suspended solids objective of 15 mg/L was exceeded on one of 12 monthly results (8%) with a monthly average result of 15.9 mg/L.

Best efforts and process adjustments will continue to be applied to maintain results below objectives.

**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 Port Darlington WPCP in 2016 was 31,344 $m^3$.

**Outline of anticipated volumes to be generated in the next reporting period:**
There is a 30% reduction of sludge volume expected in the next reporting period due to new digesters being on-line.

**Summary of locations to where sludge was disposed:**
Duffin Creek WPCP – 2,032 $m^3$ or 6.5%
Harmony Creek WPCP – 16,164 $m^3$ or 51.6%
Courtice WPCP – 13,148 $m^3$ or 41.9%

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

There were no documented complaints received about the Port Darlington WPCP in 2016.

**i) A summary of all By-pass, Spills or abnormal discharge events;**

There were no by-passes during the reporting period. There are no anticipated by-passes planned during the next reporting period.

There were no spills during the reporting period.

**MOECC Inspection**

No MOECC inspection occurred in 2016.

**Table 1 Influent Flows**

| Month | Total Flow to Plant -metered at the final effluent $m^3$ | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ |
|---|---|---|---|
| January | 402,805 | 12,994 | 29,294 |
| February | 339,098 | 11,693 | 16,682 |
| March | 408,629 | 13,182 | 17,038 |
| April | 444,970 | 14,832 | 25,476 |
| May | 358,434 | 11,562 | 13,751 |
| June | 308,732 | 10,291 | 12,503 |
| July | 300,629 | 9,698 | 11,109 |
| August | 306,499 | 9,887 | 11,330 |
| September | 286,002 | 9,533 | 11,329 |
| October | 273,108 | 8,810 | 10,326 |
| November | 296,462 | 9,882 | 11,144 |
| December | 308,149 | 9,940 | 14,561 |
| Total | 4,033,516 | | |
| Average | 336,126 | 11,051* | |
| Minimum | 273,108 | | |
| Maximum | 444,970 | | 29,294 |
| ECA Requirement | | 13,638 | |
| Met Compliance | | Yes | |

*Annual Average Daily Flow

**Table 2 Raw Influent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ avg. loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ avg. loading kg/d | TSS avg. conc. mg/L | TSS avg. loading kg/d | TP avg. conc. mg/L | TP avg. loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 111 | 1,436 | 143 | 1,857 | 261 | 3,395 | 3.8 | 50 |
| February | 138 | 1,611 | 188 | 2,201 | 248 | 2,896 | 4.7 | 55 |
| March | 103 | 1,352 | 149 | 1,967 | 219 | 2,887 | 3.7 | 49 |
| April | 107 | 1,590 | 149 | 2,214 | 249 | 3,693 | 4.1 | 60 |
| May | 133 | 1,538 | 187 | 2,160 | 297 | 3,430 | 4.9 | 56 |
| June | 288 | 2,964 | 396 | 4,075 | 840 | 8,641 | 5.3 | 55 |
| July | 262 | 2,541 | 334 | 3,237 | 853 | 8,276 | 5.5 | 53 |
| August | 151 | 1,495 | 195 | 1,923 | 328 | 3,247 | 7.2 | 71 |
| September | 171 | 1,628 | 252 | 2,400 | 487 | 4,645 | 8.6 | 82 |
| October | 329 | 2,896 | 448 | 3,942 | 939 | 8,277 | 5.9 | 52 |
| November | 402 | 3,975 | 476 | 4,706 | 857 | 8,465 | 5.8 | 58 |
| December | 198 | 1,972 | 239 | 2,378 | 497 | 4,941 | 5.4 | 53 |
| Average | 199 | 2,203 | 263 | 2,906 | 506 | 5,595 | 5.4 | 60 |
| Minimum | 103 | 1,352 | 143 | 1,857 | 219 | 2,887 | 3.7 | 49 |
| Maximum | 402 | 3,975 | 476 | 4,706 | 939 | 8,641 | 8.6 | 82 |
| Sampling Frequency Requirement Met | | | Yes | | Yes | | Yes | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TAN avg. conc. mg/L | TAN avg. loading kg/d | pH min. | pH max. |
|---|---|---|---|---|---|---|
| January | 1.61 | 34.70 | 22.5 | 292 | 7.10 | 8.00 |
| February | 1.82 | 41.35 | 26.0 | 304 | 7.10 | 8.09 |
| March | 1.47 | 35.68 | 23.3 | 307 | 6.80 | 8.00 |
| April | 1.93 | 37.88 | 22.5 | 334 | 7.02 | 8.07 |
| May | 1.73 | 44.64 | 28.9 | 334 | 7.18 | 7.97 |
| June | 1.99 | 51.53 | 32.7 | 337 | 7.00 | 7.89 |
| July | 2.49 | 48.55 | 35.1 | 341 | 7.10 | 8.10 |
| August | 2.68 | 51.14 | 36.8 | 364 | 7.08 | 7.99 |
| September | 4.35 | 70.98 | 50.9 | 486 | 7.10 | 8.20 |
| October | 3.20 | 63.15 | 26.4 | 232 | 7.31 | 8.50 |
| November | 2.10 | 51.88 | 36.2 | 358 | 7.00 | 8.60 |
| December | 2.14 | 46.73 | 36.1 | 359 | 7.28 | 8.50 |
| Average | 2.29 | 48.18 | 31.4 | 348 | | |
| Minimum | 1.47 | 34.70 | 22.5 | 232 | 6.80 | |
| Maximum | 4.35 | 70.98 | 50.9 | 486 | | 8.60 |
| Sampling Frequency Requirement Met | | Yes | Yes | | Yes | Yes |

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ avg. loading kg/d | TSS avg. conc. mg/L | TSS avg. loading kg/d | TP avg. conc. mg/L | TP avg. loading kg/d | TAN avg. conc. mg/L | TAN avg. loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 4.8 | 62.7 | 11.3 | 146.9 | 0.55 | 7.09 | 0.34 | 4.44 |
| February | 5.7 | 66.9 | 10.6 | 124.5 | 0.66 | 7.68 | 0.58 | 6.77 |
| March | 5.3 | 69.3 | 9.3 | 122.0 | 0.51 | 6.75 | 0.45 | 5.92 |
| April | 3.7 | 54.5 | 6.9 | 102.7 | 0.60 | 8.83 | 0.53 | 7.92 |
| May | 3.9 | 45.6 | 6.4 | 73.8 | 0.83 | 9.60 | 0.52 | 5.99 |
| June | 4.6 | 47.1 | 8.3 | 85.2 | 0.74 | 7.60 | 0.19 | 1.98 |
| July | 4.5 | 43.9 | 8.7 | 84.4 | 0.49 | 4.77 | 0.27 | 2.64 |
| August | 3.8 | 37.8 | 10.0 | 99.1 | 0.36 | 3.60 | 0.20 | 1.93 |
| September | 4.3 | 40.8 | 15.9 | 151.4 | 0.81 | 7.72 | 0.83 | 7.95 |
| October | 4.9 | 42.9 | 11.6 | 102.3 | 0.83 | 7.29 | 0.30 | 2.61 |
| November | 4.1 | 40.1 | 9.0 | 88.6 | 0.43 | 4.20 | 0.28 | 2.80 |
| December | 4.7 | 47.0 | 7.7 | 76.4 | 0.46 | 4.58 | 1.30 | 12.94 |
| Average | 4.5 | 49.9 | 9.6 | 106.5 | 0.60 | 6.68 | 0.48 | 5.34 |
| Minimum | 3.7 | 37.8 | 6.4 | 73.8 | 0.36 | 3.60 | 0.19 | 1.93 |
| Maximum | 5.7 | 69.3 | 15.9 | 151.4 | 0.83 | 9.60 | 1.30 | 12.94 |
| ECA Requirement | 25.0 | | 25.0 | | 1 | | | |
| ECA Objective | 15.0 | | 15.0 | | 1 | | 14 | |
| Within Compliance | Yes | | Yes | | Yes | | | |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | |

**Table 3 Final Effluent Analyses continued**

| Month | Unionized NH3 avg. conc. mg/L | TKN avg. conc. mg/L | DP avg. conc. mg/L | TCR avg. conc. mg/L | TCR avg. loading kg/d | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|---|
| January | 0.00 | 2.43 | 0.26 | 0.01 | 0.18 | 6.40 | 7.60 | 10.3 | 12.6 |
| February | 0.00 | 3.25 | 0.34 | 0.01 | 0.07 | 6.50 | 7.77 | 6.6 | 13.9 |
| March | 0.00 | 2.94 | 0.27 | 0.00 | 0.00 | 6.50 | 7.41 | 4.3 | 20.2 |
| April | 0.00 | 2.09 | 0.38 | 0.00 | 0.04 | 6.70 | 7.98 | 9.5 | 13.4 |
| May | 0.00 | 2.20 | 0.61 | 0.00 | 0.01 | 6.80 | 7.69 | 8.7 | 16.3 |
| June | 0.00 | 2.20 | 0.43 | 0.03 | 0.32 | 6.70 | 7.06 | 10.1 | 18.9 |
| July | 0.00 | 1.87 | 0.23 | 0.00 | 0.05 | 6.70 | 7.40 | 11.0 | 20.5 |
| August | 0.00 | 1.89 | 0.13 | 0.00 | 0.05 | 6.70 | 7.28 | 11.7 | 28.0 |
| September | 0.00 | 3.68 | 0.49 | 0.01 | 0.06 | 5.96 | 7.40 | 10.8 | 21.9 |
| October | 0.00 | 2.31 | 0.54 | 0.02 | 0.16 | 6.30 | 7.20 | 13.6 | 21.9 |
| November | 0.00 | 1.71 | 0.21 | 0.00 | 0.03 | 6.20 | 7.50 | 11.3 | 20.9 |
| December | 0.00 | 3.21 | 0.29 | 0.00 | 0.05 | 6.36 | 7.60 | 7.3 | 18.0 |
| Average | 0.00 | 2.48 | 0.35 | 0.01 | 0.09 | | | | |
| Minimum | 0.00 | 1.71 | 0.13 | 0.00 | 0.00 | 5.96 | | 4.3 | |
| Maximum | 0.00 | 3.68 | 0.61 | 0.03 | 0.32 | | 7.98 | | 28.0 |
| ECA Requirement | | | | | | 5.5 | 9.5 | | |
| ECA Objective | | | | 0.5 | | 6.5 | 9.0 | | |
| Within Compliance | | | | | | Yes | Yes | | |
| Sampling Frequency Requirement Met | Yes | | | Yes | | Yes | Yes | Yes | |

**Table 4 Escherichia Coliform Sampling**

| Month | Number of Samples | Geometric Mean Density |
|---|---|---|
| January | 4 | 184* |
| February | 4 | 444* |
| March | 5 | 3,208* |
| April | 4 | 160 |
| May | 5 | 4 |
| June | 4 | 2 |
| July | 4 | 0 |
| August | 5 | 4 |
| September | 4 | 3 |
| October | 4 | 3 |
| November | 5 | 12 |
| December | 4 | 8 |
| ECA Requirement | | 200* |
| ECA Objective | | N/A |
| Within Compliance | | N/A |
| Sampling Frequency Requirement Met | Yes | |

NOTE: *ECA limit of 200 organisms per 100 ml is not required until the disinfection system upgrade is completed.

**Table 5 Energy and Chemical Usage**

| Month | Total Plant Flow (cubic metres) | Ferrous Chloride (litres) | Sodium Hypochlorite (kilograms as chlorine) | Sodium Bisulphite (Litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|---|---|---|
| January | 402,805 | 26,258 | 753 | 978 | 296,524 | 35,444 |
| February | 339,098 | 26,378 | 258 | 451 | 272,686 | 40,520 |
| March | 408,629 | 26,378 | - | - | 279,732 | 25,787 |
| April | 444,970 | 21,222 | 1,032 | 1,842 | 269,925 | 22,419 |
| May | 358,434 | 20,623 | 1,699 | 1,316 | 269,740 | 10,056 |
| June | 308,732 | 28,177 | 1,161 | 1,354 | 239,494 | 1,500 |
| July | 300,629 | 29,735 | 1,026 | 1,579 | 221,399 | 671 |
| August | 306,499 | 33,572 | 1,011 | 1,824 | 215,616 | 932 |
| September | 286,002 | 24,340 | 1,054 | 1,842 | 208,539 | 1,728 |
| October | 273,108 | 30,934 | 933 | 1,466 | 220,922 | 3,569 |
| November | 296,462 | 50,598 | 796 | 1,354 | 233,900 | 22,252 |
| December | 308,149 | 32,013 | 946 | 1,278 | 270,236 | 33,523 |
| Total | 4,033,516 | 350,228 | 10,669 | 15,284 | 2,998,713 | 198,401 |

**Table 6 Summary of Raw Water Bacteriological Analyses at the Bowmanville Water Supply Plant**

| Month | E.coli cfu/100ml (min-max result) | E.coli (number of samples) | Total Coliform cfu/100ml (min-max result) | Total Coliform (number of samples) |
|---|---|---|---|---|
| January | <1 | 16 | <1-12 | 16 |
| February | <1 | 16 | <1-5 | 16 |
| March | <1 | 18 | <1-16 | 18 |
| April | <1-2 | 16 | <1-18 | 16 |
| May | <1-1 | 17 | <1-16 | 17 |
| June | <1-1 | 18 | <1-19 | 18 |
| July | <1-1 | 16 | <1-67 | 16 |
| August | <1-1 | 18 | <1-35 | 18 |
| September | <1-2 | 16 | 1-93 | 16 |
| October | <1-2 | 16 | <1-14 | 16 |
| November | <1 | 18 | <1-3 | 18 |
| December | <1-1 | 15 | <1-30 | 15 |

## Glossary of Terms

**Aeration Tank**
A vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms. This encompasses a combination of aerobic, anoxic, and anaerobic processes.

**Anaerobic Digestion**
Is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

**Annual Average Concentration**
An arithmetic mean of the monthly average concentrations of a contaminant in the effluent calculated for any particular year.

**Annual Average Loading**
The value obtained by multiplying the Annual Average Concentration of a contaminant by the Average Daily Flow over the same calendar year.

**Average Daily Flow**
The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

**Biosolids**
Organic material recovered from wastewater sludge.

**$BOD_5$ Five Day Biochemical Oxygen Demand**
(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**
A diversion of sewage around one or more unit processes within the Sewage Treatment Plant with the diverted sewage flows being returned to the Sewage Treatment Plant treatment train upstream of the Final effluent sampling location, and discharging to the environment through the Sewage Treatment Plant outfall.

**$CBOD_5$ -Five day Carbonaceous Biochemical Oxygen Demand**
A five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

**conc. – Concentration**
A measure of the amount of dissolved substance contained per unit of volume.

**DP – Dissolved Phosphorus**
The soluble form of phosphorus present in the wastewater.

**ECA - Environmental Compliance Approval**
The primary regulatory instrument for each WPCP.

**E. coli - (Escherichia coli)**
Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Sewage discharge via the Sewage Treatment Plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, a snapshot of the conditions at the time the sample was retrieved.

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metres Per Day)**

Flow measurement, $1m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**

The peak or highest value recorded during a specific time period usually in a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**

A measure of the concentration of a parameter in water or wastewater, sometimes referred to as parts per million (ppm).

**Min. – Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm - (millimetre)**

A unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly average concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly average loading**

Is calculated by multiplying the monthly average concentration of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**N/A - Not Applicable**

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**
The average daily flow for which the works are approved to handle.

**Raw Influent**
Raw wastewater entering the water pollution control plant before treatment.

**Septage**
Partially treated sludge from a septic tank.

**Sludge**
The settleable solids separated from liquids during processing.

**Substantial completion**
Has the same meaning as "substantial performance" in the Construction Lien Act.

**TAN -Total Ammonia Nitrogen**
Ammonia exists in two forms in the water: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**TCR -Total Chlorine Residual**
The total amount of chlorine in water, including the combined chlorine and the free available chlorine.

**Temp. – Temperature**
A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**TP -Total Phosphorus**
A laboratory analyses to determine the total amount of particulate and soluble phosphorus present in the wastewater.

**TSS -Total Suspended Solids**
A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS -Total Solids**
Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**
Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**Works**
The sewage works described in the owner's application, and the ECA, and includes both proposed works and previous works.

**WPCP - Water Pollution Control Plant**
Is typically a facility composed of a variety of treatment processes that collectively treat the wastewater.

## Sunderland Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Sunderland Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 9252-8CUNBZ Dated June 28, 2012

The Sunderland Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers an overview of the performance of the Sunderland WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### General

The Sunderland WPCP located in the Community of Sunderland in the Township of Brock is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA. This MOECC Class One wastewater treatment plant is designed to treat wastewater at a rated capacity of 632 cubic metres per day ($m^3$/d) and utilizes a seasonal wastewater stabilization lagoon system. The Sunderland WPCP has a service population of 1,217 residents.

### Raw Influent

Wastewater is collected through 7.7 km of sanitary sewers in the Sunderland service area and is conveyed to the treatment facility by a single sanitary sewage pumping station located on River Street.

### Lagoon Treatment

The Sunderland WPCP is a two cell lagoon system where the influent raw sewage enters a retention stabilization lagoon and overflows into an exfiltration cell giving a combined retention time of approximately 182.5 days. The ECA permits two seasonal discharges per year. Spring discharge is for 20 days in May and fall discharge is for 20 days in November. Prior to and during discharge to the Beaver River, samples are collected to verify the effluent meets the limits established in the ECA.

### Environmental Compliance Approval

Under Condition 9 (4) of ECA #9252-8CUNBZ 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.

The Sunderland WPCP effluent was determined to be compliant with the approval limits during the reporting period. The plant operated at 63.1% of its rated capacity and received a

maximum daily flow of 921 $m^3$/d on March 31, 2016.The total treated effluent discharged to the Beaver River in 2016 was calculated to be 82,142 $m^3$.

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

The River Street Sanitary Sewage Pumping Station flow meter was found to be inaccurate in the fall of 2015. Replacement of the flow meter was completed in February 2016.

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

- A new Variable Frequency Drive was installed at River Street Pumping Station.
- A new radio alarm unit was installed at River 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 within a comparable range.

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

- Calibration of the influent flow meter located at River Street Pumping Station was conducted in May and November, 2016.
- Temperature and pH are monitored in the field, all other routine process control tests are performed at the Lake Simcoe WPCP laboratory in Beaverton. All monitoring and laboratory equipment is calibrated and maintained according to manufacturer's specifications.

**f) Estimate of sludge settling capacity of the lagoons and its annual depletion**

The annual depletion of the sludge settling capacity is negligible. There was no removal of solids from the lagoons in 2016. The construction of a maintenance lagoon is expected to begin in 2017.

**g) Efforts made and results achieved in meeting the effluent objectives of Condition 4**

- The Regional Municipality of Durham strives to achieve the best effluent quality at all times consistently remaining well below ECA limits.
- All effluent objectives were met in 2016 except for the maximum objective for pH of 8.0 was exceeded 12 times during the spring discharge. The pH results ranged between 8.0 and 8.6. Due to the nature of wastewater treatment in a lagoon system pH is a difficult parameter to control.
- Best efforts will continue to be applied to maintain results below objectives.

**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.

No complaints were received during the reporting period regarding this plant.

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

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

**j) Status Update of the Initial Effluent Characterization**

The initial effluent characterization report was submitted in April of 2016.

**k) Information Required by MOECC District Manager**

No additional information was requested.

## MOECC Inspection

This plant was not inspected by the MOECC in 2016.

## Summary of Tables

### Table 1 Raw Influent Flows

| Month | Total Flow to Plant - metered at the River Street Pumping Station $m^3$ | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ | Minimum Daily Flow $m^3/d$ |
|---|---|---|---|---|
| January | 6,721 | 217 | 247 | 176 |
| February | 11,066 | 382 | 512 | 210 |
| March | 18,232 | 588 | 921 | 450 |
| April | 20,069 | 669 | 896 | 508 |
| May | 15,053 | 486 | 571 | 413 |
| June | 11,749 | 392 | 437 | 325 |
| July | 10,622 | 343 | 401 | 296 |
| August | 10,355 | 334 | 405 | 272 |
| September | 9,892 | 330 | 385 | 283 |
| October | 10,211 | 329 | 379 | 235 |
| November | 10,132 | 338 | 384 | 285 |
| December | 11,468 | 370 | 548 | 296 |
| Total | 145,570 | | | |
| Annual Average | 12,131 | 399* | | |
| Minimum | 6,721 | | | 176 |
| Maximum | 20,069 | | 921 | |
| ECA Requirement | | 632* | | |
| Met Compliance | | Yes | | |

*Annual average daily flow

**Table 2 Raw Influent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg conc. mg/L | TSS loading kg/d | TP avg conc. mg/L | TP loading kg/d |
|---|---|---|---|---|---|---|---|---|
| January | 97 | 21 | 138 | 30 | 154 | 33 | 3.9 | 0.8 |
| February | 89 | 34 | 131 | 50 | 143 | 55 | 4.1 | 1.6 |
| March | 92 | 54 | 129 | 76 | 160 | 94 | 3.5 | 2.1 |
| April | 52 | 35 | 71 | 48 | 101 | 68 | 2.4 | 1.6 |
| May | 103 | 50 | 117 | 57 | 151 | 73 | 3.5 | 1.7 |
| June | 147 | 58 | 157 | 61 | 172 | 67 | 5.5 | 2.2 |
| July | 154 | 53 | 193 | 66 | 215 | 74 | 5.2 | 1.8 |
| August | 147 | 49 | 205 | 68 | 207 | 69 | 6.2 | 2.1 |
| September | 156 | 51 | 194 | 64 | 251 | 83 | 5.8 | 1.9 |
| October | 132 | 44 | 181 | 60 | 211 | 70 | 5.9 | 1.9 |
| November | 153 | 52 | 193 | 65 | 196 | 66 | 5.2 | 1.7 |
| December | 115 | 43 | 129 | 48 | 385 | 142 | 4.8 | 1.8 |
| Average | 120 | 48 | 153 | 61 | 196 | 78 | 4.7 | 1.9 |
| Minimum | 52 | 21 | 71 | 30 | 101 | 33 | 2.4 | 0.8 |
| Maximum | 156 | 58 | 205 | 76 | 385 | 142 | 6.2 | 2.2 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes | |

**Table 2 Raw Influent Analyses continued**

| Month | DP avg. conc. mg/L | TKN avg. conc. mg/L | TKN loading kg/d | TAN avg. conc. mg/L | TAN loading kg/d | pH min. | pH max. | Temp. Degrees Celsius min. | Temp. Degrees Celsius max. |
|---|---|---|---|---|---|---|---|---|---|
| January | 1.7 | 32.83 | 7 | 20.4 | 4.4 | 7.4 | 8.0 | 10.8 | 11.6 |
| February | 2.1 | 36.58 | 14 | 21.9 | 8.4 | 7.6 | 8.4 | 9.9 | 11.3 |
| March | 1.5 | 32.75 | 19 | 18.7 | 11.0 | 7.4 | 8.0 | 8.9 | 10.5 |
| April | 1.0 | 21.03 | 14 | 12.0 | 8.0 | 7.4 | 7.9 | 8.7 | 10.6 |
| May | 1.4 | 32.04 | 16 | 20.1 | 9.7 | 7.1 | 8.0 | 10.1 | 13.4 |
| June | 2.3 | 42.45 | 17 | 26.6 | 10.4 | 7.6 | 8.0 | 13.0 | 15.2 |
| July | 2.5 | 42.18 | 14 | 29.3 | 10.0 | 7.8 | 8.0 | 15.4 | 19.2 |
| August | 1.4 | 49.70 | 17 | 32.0 | 10.7 | 8.2 | 8.3 | 17.2 | 18.4 |
| September | 2.7 | 48.55 | 16 | 32.2 | 10.6 | 8.1 | 8.2 | 17.3 | 18.5 |
| October | 3.1 | 53.32 | 18 | 38.0 | 12.5 | 8.2 | 8.2 | 14.1 | 18.0 |
| November | 2.3 | 43.38 | 15 | 26.4 | 8.9 | 7.7 | 8.1 | 13.5 | 16.4 |
| December | 2.5 | 45.58 | 17 | 31.7 | 11.7 | 7.8 | 7.9 | 10.4 | 13.4 |
| Average | 2.0 | 40.03 | 16 | 25.8 | 10.3 | | | | |
| Minimum | 1.0 | 21.03 | 7 | 12.0 | 4.4 | 7.1 | | 8.7 | |
| Maximum | 3.1 | 53.32 | 19 | 38.0 | 12.5 | | 8.4 | | 19.2 |
| Sampling Frequency Requirement Met | | | | Yes | | Yes | Yes | Yes | Yes |

**Table 3 Calculated Effluent Flows**

| Month | Effluent Flow $m^3$ |
|---|---|
| January | |
| February | |
| March | |
| April | |
| May | 50,701 |
| June | |
| July | |
| August | |
| September | |
| October | |
| November | 31,441 |
| December | |
| Total | 82,142 |
| Annual Average | 41,071 |
| Minimum | 31,441 |
| Maximum | 50,701 |

**Table 4 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading kg/d | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | TP loading kg/ month |
|---|---|---|---|---|---|---|---|---|---|
| January | | | | | | | | | |
| February | | | | | | | | | |
| March | | | | | | | | | |
| April | | | | | | | | | |
| May | 4.5 | 12 | 5.9 | 16 | 8.6 | 23 | 0.07 | 0.2 | 3.4 |
| June | | | | | | | | | |
| July | | | | | | | | | |
| August | | | | | | | | | |
| September | | | | | | | | | |
| October | | | | | | | | | |
| November | 2.6 | 13 | 4.1 | 21 | 5.2 | 27 | 0.11 | 0.6 | 3.4 |
| December | | | | | | | | | |
| Total | | | | | | | | | 6.8 |
| Average | 3.6 | 12 | 5.0 | 16 | 6.9 | 23 | 0.09 | 0.3 | 0.9 |
| Minimum | 2.6 | 12 | 4.1 | 16 | 5.2 | 23 | 0.07 | 0.2 | 3.4 |
| Maximum | 4.5 | 13 | 5.9 | 21 | 8.6 | 27 | 0.11 | 0.6 | 3.4 |
| ECA Limit | 10** | | | | 15** | | 0.3** | | 69* |
| ECA Objective | 10 | | | | 15 | | 0.5 | | |
| LSPRS | | | | | | | 0.25* | | 58* |
| Within Compliance | Yes | | | | Yes | | Yes | | Yes |
| Sampling Frequency Requirement Met | Yes | | | | Yes | | Yes | | Yes |

*Total Annual Loading , kg/year

**Annual Average Concentration

**Table 4 Final Effluent Analyses continued**

| Month | DP avg. conc. mg/L | TAN avg. conc. mg/L | TAN loading kg/d | TKN avg. conc. mg/L | Un-ionized ammonia avg. conc. mg/L | pH min. | pH max. | Temp. °C min. | Temp. °C max. |
|---|---|---|---|---|---|---|---|---|---|
| January | | | | | | | | | |
| February | | | | | | | | | |
| March | | | | | | | | | |
| April | | | | | | | | | |
| May | 0.01 | 6.47 | 4.81 | 12.9 | 0.26 | 8.0 | 8.6 | 12.2 | 18.4 |
| June | | | | | | | | | |
| July | | | | | | | | | |
| August | | | | | | | | | |
| September | | | | | | | | | |
| October | | | | | | | | | |
| November | 0.02 | 3.70 | 1.56 | 8.0 | 0.00 | 6.9 | 7.4 | 6.3 | 8.5 |
| December | | | | | | | | | |
| Average | 0.01 | 5.08 | 3.18 | 10.5 | 0.13 | | | | |
| Minimum | 0.01 | 3.70 | 1.56 | 8.0 | 0.00 | 6.9 | | 6.3 | |
| Maximum | 0.02 | 6.47 | 4.81 | 12.9 | 0.26 | | 8.6 | | 18.4 |
| ECA Limit | | | | | | 6.0 | 9.5 | | |
| ECA Objective | | | | | | 6.5 | 8.0 | | |
| Within Compliance | | | | | | | | | |
| Sampling Frequency Requirement Met | | Yes | | | | Yes | Yes | Yes | Yes |

# Glossary of Terms

**Annual Average Concentration**

An arithmetic mean of the seasonal average concentrations of a contaminant in the effluent calculated for any particular year.

**Annual Average Loading**

The value obtained by multiplying the seasonal average concentration of a contaminant by the Average Daily Flow over the same calendar year.

**Average Daily Flow**

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

**Avg – Average**

An arithemetic mean of the average concentrations and loadings.

**$BOD_5$ Five Day Biochemical Oxygen Demand**

(also known as total $BOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

**By-pass**

Any discharge from any portion of the works other than in accordance with the conditions of the ECA.

**$CBOD_5$ -Five Day Carbonaceous Biochemical Oxygen Demand**

A five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

**Conc. Concentration**

The abundance of a constituent divided by the total volume of a mixture.

**Daily Concentration**

Means the concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required.

**DP – Dissolved Reactive Phosphorus**

This is the soluble form of phosphorus present in the wastewater.

**ECA Environmental Compliance Approval**

The primary regulatory instrument for each water pollution control plant.

**E. coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Sewage discharge through the water pollution control plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, when tested provides a snapshot of the conditions at the time the sample was retrieved.

**kg - kilogram**

Basic unit of mass in the metric system

**kg/d – kilogram per day**

**LSPRS - Lake Simcoe Phosphorus Reduction Strategy**

The ECA issued on June 28, 2012 introduced additional phosphorus objectives to comply with the requirements of the Lake Simcoe Phosphorus Reduction Strategy (2010) prepared under the Lake Simcoe Protection Plan (2009).

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3$/d - (Cubic Metre Per Day)**

Flow measurement, $1m^3$ = 1000 litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max. – Maximum**

The peak or highest value recorded during a specific time period usually a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L. - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in water, sometimes referred to as parts per million (ppm).

**Min. – Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm.-(millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly Average Loading**

Is calculated by multiplying the monthly average concentration of a contaminant in the effluent by the monthly average daily flow during a calendar month.

**N/A - Not Applicable**

**N/D - No Discharge**

**Peak Flow Rate**

The maximum rate of sewage flow for which the plant or process unit was designed.

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The average daily flow for which the works are approved to handle**.**

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Seasonal Average Concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured or both during the seasonal discharge period.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN - Total Ammonia Nitrogen**

Ammonia exists in two forms in the wastewater: NH3 (this is called unionized ammonia ) NH4+ ( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**Total Annual Loading**

Is calculated by adding the calculated total monthly load discharged each month during each seasonal dischargeperiod for each calendar year.

**Total Monthly Loading**

Is calculated by multiplying the total monthly flow by the monthly average concentration.

**TP - Total Phosphorus**

A laboratory analyses to determine the total amount of non-soluble and soluble phosphorus present in the wastewater.

**TSS - Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS - Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**WPCP - Water Pollution Control Plant**

A facility composed of a variety of treatment processes that collectively treat wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488

## Uxbridge Brook Water Pollution Control Plant

# Annual Performance Report 2016

# The Regional Municipality of Durham

## Uxbridge Brook Water Pollution Control Plant 2016 Annual Performance Report

**Environmental Compliance Approval (ECA)**: 8357-8CTQ5V Dated June 28, 2012

**Environmental Compliance Approval (Air)**: 6581-67GRPR Dated December 10, 2004

The Uxbridge Brook Water Pollution Control Plant (WPCP) Performance Report provides staff, stakeholders and customers an overview of the performance of the Uxbridge Brook WPCP in 2016. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). The performance report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

For a description of terms and abbreviations used in this report, refer to the glossary at the end of the report.

### Water Pollution Control Plant Process Description

### General

The Uxbridge Brook WPCP located in the Township of Uxbridge is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA. This MOECC Class Three wastewater treatment plant utilizes an extended aeration process with tertiary treatment and is designed to treat wastewater at a rated capacity of 5,221 cubic metres per day ($m^3$/d). The Uxbridge Brook WPCP has a service population of 11,467 residents.

Uxbridge Brook WPCP treats wastewater from the Uxbridge service area utilizing the following processes:

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

### Raw Influent Pumping

Wastewater is collected through approximately 50.2 km of sanitary sewers in Uxbridge and is conveyed to the WPCP by gravity and one sanitary sewage pumping station (Sandy Hook).

### 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. 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 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

**Aerated Bioreactors**: Preliminary effluent flow is directed to two aerated bioreactors. Fine bubbled air is diffused into the sewage to assist bacteria in removing dissolved and suspended organics and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.

**Secondary Clarifiers**: The effluent from the aerated bioreactor is directed to three 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 clarifiers is pumped back to the front of the bioreactors and any excess activated sludge is wasted to the aerobic digester.

### Tertiary Treatment

**Tertiary Sand Filter**: Effluent from the secondary clarifiers is filtered through two automatic self cleaning sand filters. The automatic backwash is initiated by an increase in head pressure or on a programmed timer. The backwash water is returned to the front 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 effluent passes two banks of UV lamps connected in series. The treated final effluent is discharged to the Uxbridge Brook.

### Solids Treatment

**Aerobic Digester**: Waste activated sludge from the secondary clarifiers is pumped to a two stage aerobic digester for stabilization. A coarse bubble diffuser provides oxygen for the microorganisms. The diffusers are turned off to allow solids to settle for removal and the supernatant is returned to the front of the plant for further treatment.

**Biosolids Management:** Stabilized biosolids from the digester is transported to Duffin Creek Water Pollution Control Plant in the Region of Durham for incineration in accordance with ECA #A820250.

### Environmental Compliance Approval

Under Condition 9 (5) of ECA #8357-8CTQ5V 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.

The Uxbridge Brook WPCP effluent was compliant with the approval limits during the reporting period. The plant operated at 62.1% of its rated capacity and received a maximum daily flow of 5,393 $m^3$/d on April 1st, 2016.

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

No operating problems were encountered in 2016

**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 2016 included:

- A new blower unit was installed for aerated bioreactor number one.
- Adjustments were made to the effluent flume to improve flow monitoring.
- Secondary clarifiers one, two and three were taken out of service for inspection and minor repairs.

**d) Summary of any effluent quality assurance or control measures**

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 plant flow meters was conducted in July and November 2016.
- Calibration of the in-house laboratory equipment was conducted in July 2016.
- Calibration of the pH meter is conducted daily.

**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, remaining below the ECA compliance limits.
- The Uxbridge Brook WPCP effluent met all ECA objectives except for:
  The effluent objective for total suspended solids was exceeded in six of 306 samples (1.9%).
  The effluent objective for total phosphorus was exceeded in six of 309 samples (1.9%).
  Results were monitored and adjustments were made to the treatment process when required.
  The minimum effluent objective for pH was exceeded in three of 260 samples (1.2%).
  Calibration, maintenance and cleaning of the pH electrode probe is performed regularly.
- Best efforts and process adjustments will continue to be applied to maintain results below objectives.

**g) Tabulation of Volume of Sludge Generated**

The volume of sludge removed from Uxbridge Brook WPCP in 2016 was 12,120m$^3$.

**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**

Duffin Creek WPCP- 12,120m$^3$.

**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. One odour complaint was received on March 24$^{th}$, 2016. The odour control unit for the aerobic digester was temporarily out of service due to freezing rain. Upon restoration the odour was resolved.

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

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

**j) Status Update of the Initial Effluent Characterization**

The initial effluent characterization report was submitted in 2016.

**k) Information Required by MOECC District Manager**

No additional information was requested.

**MOECC Inspection**

This plant was not inspected by the MOECC in 2016.

## Summary of Tables

### Table 1 Flows

| Month | Plant Flow - metered at the final effluent m3 | Average Daily Flow $m^3/d$ | Maximum Daily Flow $m^3/d$ |
|---|---|---|---|
| January | 117,990 | 3,806 | 4,704 |
| February | 98,686 | 3,403 | 4,726 |
| March | 117,438 | 3,788 | 5,336 |
| April | 129,337 | 4,311 | 5,393 |
| May | 109,683 | 3,538 | 3,968 |
| June | 97,030 | 3,234 | 3,687 |
| July | 87,952 | 2,837 | 3,451 |
| August | 89,353 | 2,882 | 3,667 |
| September | 83,248 | 2,775 | 3,011 |
| October | 89,387 | 2,883 | 4,077 |
| November | 79,841 | 2,661 | 3,844 |
| December | 86,078 | 2,777 | 3,433 |
| Total | 1,186,024 | | |
| Average | 98,835 | 3,241* | |
| Minimum | 79,841 | | |
| Maximum | 129,337 | | 5,393 |
| ECA Requirement | | 5,221 | 15,110 |
| Met Compliance | | Yes | Yes |

*Annual average

**Table 2 Raw Influent Analyses**

| Month | $BOD_5$ avg. conc. mg/L | $BOD_5$ loading kg/d | TSS avg. conc. mg/L | TSS loading kg/d | TP avg. conc. mg/L | TP loading kg/d | DP avg. conc. mg/L |
|---|---|---|---|---|---|---|---|
| January | 139 | 529 | 111 | 424 | 3.4 | 13 | 2.0 |
| February | 102 | 346 | 91 | 309 | 3.1 | 11 | 2.1 |
| March | 96 | 365 | 116 | 441 | 2.8 | 11 | 1.6 |
| April | 76 | 327 | 93 | 399 | 2.6 | 11 | 1.7 |
| May | 238 | 843 | 365 | 1292 | 3.6 | 13 | 1.9 |
| June | 191 | 619 | 281 | 908 | 3.7 | 12 | 2.3 |
| July | 258 | 732 | 269 | 762 | 4.0 | 11 | 2.5 |
| August | 267 | 770 | 269 | 776 | 4.2 | 12 | 2.5 |
| September | 244 | 677 | 279 | 776 | 4.3 | 12 | 2.6 |
| October | 278 | 800 | 552 | 1592 | 4.4 | 13 | 2.6 |
| November | 222 | 591 | 333 | 885 | 4.5 | 12 | 2.5 |
| December | 310 | 859 | 616 | 1710 | 4.4 | 12 | 2.7 |
| Average | 202 | 654 | 281 | 911 | 3.8 | 12 | 2.3 |
| Minimum | 76 | 327 | 91 | 309 | 2.6 | 11 | 1.6 |
| Maximum | 310 | 859 | 616 | 1710 | 4.5 | 13 | 2.7 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes |

**Table 2 Raw Influent Analyses continued**

| Month | TKN avg. conc. mg/L | TKN loading kg/d | TAN avg. conc. mg/L | TAN loading kg/d | Alkal-inity $CaCO_3$ mg/L | pH min. | pH max. | Temp. Degrees Celsius min. | Temp. Degrees Celsius max. |
|---|---|---|---|---|---|---|---|---|---|
| January | 32.23 | 123 | 22.0 | 83.8 | 293 | 7.1 | 8.5 | 10.9 | 16.2 |
| February | 30.13 | 103 | 24.4 | 83.1 | 340 | 7.7 | 8.6 | 6.3 | 14.6 |
| March | 27.40 | 104 | 18.7 | 70.9 | 341 | 7.7 | 8.4 | 10.6 | 16.0 |
| April | 24.10 | 104 | 19.6 | 84.5 | 322 | 7.0 | 8.4 | 10.7 | 14.1 |
| May | 31.25 | 111 | 22.4 | 79.3 | 345 | 7.6 | 8.4 | 13.2 | 18.3 |
| June | 33.94 | 110 | 25.6 | 82.9 | 326 | 7.6 | 8.8 | 16.1 | 20.7 |
| July | 36.43 | 103 | 24.0 | 68.0 | 312 | 7.4 | 8.3 | 13.1 | 20.3 |
| August | 39.94 | 115 | 26.4 | 76.0 | 320 | 7.8 | 8.4 | 18.1 | 21.3 |
| September | 40.03 | 111 | 27.5 | 76.4 | 354 | 7.1 | 8.4 | 18.4 | 22.0 |
| October | 37.08 | 107 | 26.0 | 74.9 | 326 | 7.0 | 8.4 | 12.0 | 20.0 |
| November | 39.50 | 105 | 27.5 | 73.1 | 339 | 7.8 | 8.7 | 15.5 | 18.3 |
| December | 41.83 | 116 | 27.3 | 75.9 | 327 | 7.5 | 8.6 | 10.0 | 17.4 |
| Average | 34.49 | 112 | 24.3 | 78.7 | 329 | | | | |
| Minimum | 24.10 | 103 | 18.7 | 68.0 | 293 | 7.0 | | 6.3 | |
| Maximum | 41.83 | 123 | 27.5 | 84.5 | 354 | | 8.8 | | 22.0 |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | Yes | Yes | Yes | Yes |

**Table 3 Final Effluent Analyses**

| Month | $CBOD_5$ avg. conc. mg/L | $CBOD_5$ loading monthly avg kg/d | TSS avg. conc. mg/L | TSS loading monthly avg. kg/d | TP avg. conc. mg/L | TP loading avg. kg/d | TP loading kg/month |
|---|---|---|---|---|---|---|---|
| January | 0.5 | 1.9 | 1.1 | 4.0 | 0.03 | 0.12 | 4 |
| February | 0.7 | 2.5 | 1.6 | 5.5 | 0.04 | 0.13 | 4 |
| March | 1.1 | 4.1 | 1.4 | 5.4 | 0.04 | 0.14 | 4 |
| April | 0.4 | 1.7 | 0.9 | 3.7 | 0.02 | 0.11 | 3 |
| May | 0.7 | 2.3 | 0.7 | 2.5 | 0.03 | 0.09 | 3 |
| June | 0.7 | 2.3 | 1.3 | 4.1 | 0.03 | 0.09 | 3 |
| July | 0.5 | 1.4 | 0.9 | 2.6 | 0.03 | 0.07 | 2 |
| August | 0.7 | 2.1 | 0.9 | 2.5 | 0.03 | 0.09 | 3 |
| September | 0.5 | 1.4 | 1.1 | 3.2 | 0.05 | 0.14 | 4 |
| October | 1.1 | 3.2 | 2.2 | 6.3 | 0.07 | 0.20 | 6 |
| November | 0.5 | 1.3 | 0.9 | 2.5 | 0.03 | 0.08 | 2 |
| December | 1.1 | 3.1 | 2.4 | 6.7 | 0.05 | 0.13 | 4 |
| Total | | | | | | | 42 |
| Average | 0.7 | 2.3 | 1.3 | 4.2 | 0.04 | 0.12 | 4 |
| Minimum | 0.4 | 1.3 | 0.7 | 2.5 | 0.02 | 0.07 | 2 |
| Maximum | 1.1 | 4.1 | 2.4 | 6.7 | 0.07 | 0.20 | 6 |
| ECA Limit | 8.5** | 30.9**** | 10** | 36.3**** | 0.15** | 0.78**** | 286* |
| ECA Objective | 5 | | 5 | | 0.1 | | |
| LSPRS | | | | | 0.15*** | | 286* |
| Within Compliance | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | Yes | |

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

**Table 3 Final Effluent Analyses continued**

| Month | DP avg. conc. mg/L | TAN Winter avg. conc. mg/L | TAN Winter loading monthly avg. kg/d | TAN Summer avg. conc. mg/L | TAN Summer loading monthly avg. kg/d | TKN avg. conc. mg/L | Un-ionized Ammonia Nitrogen avg. conc. mg/L |
|---|---|---|---|---|---|---|---|
| January | 0.03 | 0.02 | 0.09 | | | 0.61 | 0.0 |
| February | 0.02 | 0.03 | 0.11 | | | 0.72 | 0.0 |
| March | 0.02 | 0.05 | 0.18 | | | 0.65 | 0.0 |
| April | 0.02 | 0.03 | 0.13 | | | 0.53 | 0.0 |
| May | 0.02 | | | 0.03 | 0.10 | 0.58 | 0.0 |
| June | 0.02 | | | 0.04 | 0.13 | 0.64 | 0.0 |
| July | 0.01 | | | 0.04 | 0.11 | 0.61 | 0.0 |
| August | 0.01 | | | 0.04 | 0.11 | 0.60 | 0.0 |
| September | 0.02 | | | 0.08 | 0.22 | 0.75 | 0.0 |
| October | 0.03 | | | 0.14 | 0.41 | 1.07 | 0.0 |
| November | 0.01 | | | 0.03 | 0.08 | 0.66 | 0.0 |
| December | 0.03 | 0.08 | 0.22 | -- | -- | 0.90 | 0.0 |
| Average | 0.02 | 0.04 | 0.14 | 0.06 | 0.17 | 0.69 | 0.0 |
| Minimum | 0.01 | 0.02 | 0.09 | 0.03 | 0.08 | 0.53 | 0.0 |
| Maximum | 0.03 | 0.08 | 0.22 | 0.14 | 0.41 | 1.07 | 0.0 |
| ECA Limit | | 6** | 21.8***** | 3** | 10.9***** | | 0.1** |
| ECA Objective | | 5 | | 2 | | | |
| Within Compliance | | Yes | Yes | Yes | Yes | | Yes |
| Sampling Frequency Requirement Met | Yes | Yes | Yes | Yes | Yes | | Yes |

**Table 3 Final Effluent Analyses continued**

| Month | Nitrate Nitrogen avg. conc. mg/L | Alkal-inity $CaCO^3$. mg/L | pH min. | pH max. | Temp. Degrees Celsius min. | Temp. Degrees Celsius max. |
|---|---|---|---|---|---|---|
| January | 25.8 | 119 | 6.89 | 7.30 | 10.2 | 15.0 |
| February | 25.8 | 114 | 6.66 | 7.28 | 7.1 | 12.9 |
| March | 21.4 | 136 | 6.57 | 7.29 | 8.9 | 13.3 |
| April | 20.2 | 135 | 6.79 | 7.13 | 9.6 | 13.7 |
| May | 23.0 | 117 | 6.79 | 7.28 | 10.8 | 17.8 |
| June | 26.9 | 82 | 6.61 | 7.21 | 15.5 | 20.1 |
| July | 28.9 | 61 | 6.67 | 6.96 | 18.6 | 20.6 |
| August | 29.8 | 60 | 6.64 | 7.18 | 19.7 | 21.6 |
| September | 31.3 | 64 | 6.48 | 7.70 | 18.0 | 21.6 |
| October | 30.8 | 57 | 6.36 | 7.31 | 15.1 | 19.5 |
| November | 30.7 | 70 | 6.59 | 7.04 | 13.6 | 17.5 |
| December | 30.1 | 70 | 6.54 | 7.18 | 11.4 | 15.3 |
| Average | 27.0 | 90 | | | | |
| Minimum | 20.2 | 57 | 6.36 | | 7.1 | |
| Maximum | 31.3 | 136 | | 7.70 | | 21.6 |
| ECA Limit | | | 6.0 | 9.5 | | |
| ECA Objective | | | 6.5 | 9.0 | | |
| Within Compliance | | | | | | |
| Sampling Frequency Requirement Met | Yes | Yes | Yes | Yes | Yes | Yes |

**Table 4 Escherichia Coliform Sampling**

| Month | Number of Samples | Monthly Geometric Mean Density |
|---|---|---|
| January | 4 | 0 |
| February | 4 | 0 |
| March | 5 | 0 |
| April | 4 | 0 |
| May | 4 | 0 |
| June | 5 | 1 |
| July | 4 | 0 |
| August | 5 | 0 |
| September | 4 | 1 |
| October | 4 | 0 |
| November | 5 | 0 |
| December | 4 | 0 |
| ECA Objective | | 200 organisms/100ml |
| Sampling Frequency Requirement Met | Yes | |

**Table 5 Energy and Chemical Usage**

| Month | Aluminum Sulphate (litres) | Hydro (kWh) | Natural Gas (cubic metres) |
|---|---|---|---|
| January | 20,031 | 123,776 | 2,154 |
| February | 20,243 | 114,418 | 1,165 |
| March | 28,261 | 112,950 | 1,384 |
| April | 29,618 | 100,757 | 2,169 |
| May | 24,382 | 91,160 | 748 |
| June | 22,420 | 86,086 | 181 |
| July | 21,181 | 94,308 | 120 |
| August | 21,449 | 96,312 | 110 |
| September | 20,031 | 95,069 | 134 |
| October | 20,296 | 101,569 | 202 |
| November | 19,541 | 100,639 | 727 |
| December | 22,072 | 113,324 | 1,204 |
| Total | 269,525 | 1,230,368 | 10298 |

## Glossary of Terms

### Annual Average Concentration

An arithmetic mean of the monthly average concentrations of a contaminant in the effluent calculated for any particular calendar year.

### Annual Average Loading

The value obtained by multiplying the annual average concentration of a contaminant by the average daily flow over the same calendar year.

### Average Daily Flow

The cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year.

### Avg – Average

An arithemetic mean of the average concentrations and loadings.

### Biosolids

Organic material recovered from wastewater sludge.

### Bioreactor

A bioreactor is a vessel in which a biological process is carried out which involves bacterial organisms or biochemically active substances derived from such organisms.

### $BOD_5$ Five Day Biochemical Oxygen Demand

(also known as total $BOD_5$) a five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand.

### By-pass

Any discharge from the works that does not undergo any treatment or only undergoes partial treatment before it is discharged to the environment.

### $CBOD_5$ -Five Day Carbonaceous Biochemical Oxygen Demand

A five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample.

### Conc. - Concentration

The abundance of a constituent divided by the total volume of a mixture.

### Daily Concentration

The concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required.

**DP - Dissolved Reactive Phosphorus**

This is the soluble form of phosphorus present in the wastewater.

**ECA - Environmental Compliance Approval**

The primary regulatory instrument for each water pollution control plant.

**E. - coli - (Escherichia coli)**

Refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius.

**Final Effluent**

Sewage discharge through the water pollution control plant outfall after undergoing the full train of unit processes as listed in the Environmental Compliance Approval.

**Geometric Mean Density**

Is the nth root of the product of multiplication of the results of n number of samples over the period specified.

**Grab Sample**

A single sample taken at a specific moment in time, when tested provides a snapshot of the conditions at the time the sample was retrieved.

**kg - kilogram**

Basic unit of mass in the metric system

**kg/d – kilogram per day**

**LSPRS - Lake Simcoe Phosphorus Reduction Strategy**

The ECA issued on June 28, 2012 introduced additional phosphorus objectives to comply with the requirements of the Lake Simcoe Phosphorus Reduction Strategy (2010) prepared under the Lake Simcoe Protection Plan (2009).

**$m^3$ - (Cubic Metre)**

Volume measurement, $1m^3$ = 1000 litres or 220 imperial gallons.

**$m^3/d$ - (Cubic Metre Per Day)**

Flow measurement, $1m^3$ = 1000litres or 220 imperial gallons. Volume of liquid treated in a day.

**Max-Maximum**

The peak or highest value recorded during a specific time period usually a day.

**Maximum Flow Rate**

The peak or highest flow recorded during a specific time period usually in a day.

**mg/L - (Milligram Per Litre)**

This is a measure of the concentration of a parameter in water, sometimes referred to as parts per million (ppm).

**Min- Minimum**

The lowest value recorded during a specific time period usually in a day.

**mm.-(millimetre)**

Is a unit of length in the metric system, equal to one thousandth of a metre.

**MOECC - (Ministry of the Environment and Climate Change)**

The Provincial regulatory agency responsible for overseeing the water and wastewater industries in Ontario. Their primary functions include approval for new or expanding facilities, inspections and investigations.

**Monthly average concentration**

The arithmetic mean of all daily concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month.

**Monthly average loading**

Is calculated by multiplying the monthly average concentration of a contaminant by the monthly average daily flow over the same calendar month.

**Nitrate Nitrogen**

Is a salt or ester of nitric acid, containing the $NO_3$ ion. Nitrates are the most water soluble of salts, and play a major part in the nitrogen cycle and nitrate pollution.

**N/A - Not Applicable**

**Peak Flow Rate**

The maximum rate of sewage flow for which the plant or process unit was designed.

**pH**

Index of hydrogen ion activity, pH is defined as the negative logarithm of hydrogen ion concentration in moles per litre. The pH may range from 0 – 14, where 0 is most acidic, 14 most basic and 7 neutral.

**Rated Capacity**

The average daily flow for which the works are approved to handle**.**

**Raw Influent**

Raw wastewater entering the water pollution control plant before treatment.

**Septage**

Partially treated sludge from a septic tank.

**Sludge**

The settleable solids separated from liquids during processing.

**TAN - Total Ammonia Nitrogen**

Ammonia exists in two forms in the wastewater: NH3 (this is called unionized ammonia ) NH4+( this is called ionized ammonia ) Together, these two forms of ammonia are called TAN which means total ammonia nitrogen.

**Temp. – Temperature**

A measure of the warmth or coldness of an object or substance identified as degrees Celsius.

**Total Annual Loading**

Is calculated by adding the calculated total monthly load discharged for each calendar year.

**Total Monthly Loading**

Is calculated by multiplying the total monthly flow by the monthly average concentration.

**TP - Total Phosphorus**

A laboratory analyses to determine the total amount of non-soluble and soluble phosphorus present in the wastewater.

**TSS - Total Suspended Solids**

A laboratory analyses to measure particles that are larger than 2 microns found in the wastewater.

**TS - Total Solids**

Is a measure of the suspended and dissolved solids in the wastewater and in biosolids.

**Unionized Ammonia Nitrogen**

Un-ionized ammonia refers to all forms of ammonia in water with the exception of the ammonium ion (NH4 +).

**WPCP - Water Pollution Control Plant**

A facility composed of a variety of treatment processes that collectively treat wastewater.

If this information is required in an accessible format, please contact 1-800-372-1102 extension 3488