



Harmony Creek Water Pollution Control Plant 2021 Annual Performance Report





The Regional Municipality of Durham

Harmony Creek Water Pollution Control Plant 2021 Annual Performance Report

Environmental Compliance Approval (ECA): 2407-AK8KJH Dated May 23, 2017

Environmental Compliance Approval (Air): 5562-AM9RPN Dated May 18, 2017

The Harmony Creek Water Pollution Control Plant (WPCP) 2021 Performance Report provides staff, stakeholders and customers a performance overview of the Harmony Creek WPCP. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment, Conservation and Parks (MECP). This report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

Water Pollution Control Plant Process Description

General

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

The Harmony Creek WPCP treats wastewater from the Oshawa and Courtice (Municipality of Clarington) service area. The Harmony Creek WPCP shares its catchment area flows with the Courtice WPCP. The Harmony Creek WPCP services approximately 62,216 residents or 33.5 % 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 (m³/d). The plant is a MECP Class 4 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), and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 643 kilometres of sanitary sewers in Oshawa and Courtice and is conveyed to the Harmony Creek WPCP and the Harmony Creek Sanitary Sewage Pumping Station (SSPS). Approximately 66.5% of the influent flow is diverted to the Harmony Creek Sanitary Sewage Pumping Station and conveyed to the Courtice Water Pollution Control Plant (WPCP). The remaining flow (33.5%) is treated at the Harmony Creek WPCP.



Preliminary Treatment

Screening: One mechanically cleaned screen and one emergency manual screen remove rags and large debris that could harm pumps and process equipment. Screenings are compacted for landfill disposal.

Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the aerated grit tank. The velocity of the wastewater flowing 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.

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 is also removed to the digester.

Phosphorus Removal

The phosphorus removal system lowers the total phosphorus level in the final effluent by adding a chemical coagulant, ferrous chloride, into the primary clarifier effluent.

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 one large aeration tank. The effluent from the primary clarifier flows into the aeration tanks. Fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater.

Secondary Clarifier: The effluent from the aeration tank 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 aeration tank and the excess activated sludge is wasted to the primary clarifier.

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 chlorine contact chamber. 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 supernatant is returned to the head of the plant for further treatment. The methane is used for heating of the digester to offset the natural gas requirements or is flared off.

Sludge Management: All digested sludge produced at the Harmony Creek Water Pollution Control Plant (WPCP) is pumped to the sludge holding facility. From there, the treated sludge can be utilized on approved agricultural fields or be transferred to the Duffin Creek WPCP for incineration.

Environmental Compliance Approval (ECA)

Under Condition 11.(4) of ECA 2407-AK8KJH 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 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 plant operated at an average of 53.8% of its annual average rated flow capacity and received a maximum daily flow of 28,697 cubic metres per day (m³/d) on September 23, 2021. Tables 1 and 2 summarize the flow and raw wastewater characteristics during the reporting period.

b) Summary and interpretation of all Final Effluent monitoring data and a comparison to the compliance limits condition;

The Harmony Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. See Tables 3 and 4 for effluent results.

c) Description of any operating problems encountered and corrective actions taken;

There were no operating problems during the reporting period.

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

Major maintenance items in 2021 included:

- Replaced waste activated sludge pump 2,
- Cleaned out west contact chamber,
- Repaired digester transfer pump 2,
- Repaired pump 150 at the Harmony Creek Sanitary Sewage Pumping Station.



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e) 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 an acceptable range.

f) Summary of the calibration and maintenance carried out on all influent and final effluent monitoring equipment;

Calibration of the secondary effluent flow meter occurred on February 12.

Calibration of the in-house laboratory equipment was conducted regularly.

g) Description of efforts made and results achieved in meeting the design objectives condition;

The Region continually strives to achieve the best effluent quality at all times and remain below the limits specified in the Environmental Compliance Approval.

- The average daily rated flow capacity of 34,100 cubic metres per day (m^3/d) was not exceeded,
- The pH objective of less than 6.5 was exceeded in 1 of 246 samples (0.4%). Calibration of the pH probe is performed regularly.

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

h) Biosolids Production;

Tabulation of volume of sludge generated:

The volume of sludge generated at the Harmony Creek Water Pollution Control Plant (WPCP) in 2021 was 21,624 cubic metres (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:

All digested sludge produced at the Harmony Creek WPCP is pumped to the sludge holding facility. All sludge produced at this facility was transferred to Duffin Creek WPCP for incineration.

i) Summary of any complaints received during the reporting period and any steps taken to address the complaints;

A summary of complaints received from the public is administered through a central database. No complaints were received in 2021.



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j) Summary of By-passes, Overflows, reportable spills or abnormal discharge events;
There were no by-pass, overflow, reportable spills or abnormal discharge events for the reporting period.

k) Schedule 'B', Section 1 Notice of Modifications and Status Update;
No schedule 'B', Section 1 Notice of Modifications were submitted in 2021.

l) Schedule 'B', Section 3 Modifications;
No schedule 'B', Section 3 Modifications were completed in 2021.

m) Information Required by Ministry of the Environment, Conservation and Parks (MECP) Water Supervisor.

No additional information was requested.

MECP Inspection

This plant was last inspected by the MECP on January 26, 2016.



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Table 1 Final Effluent Flows

| Month | Total Flow to Plant metered at the secondary clarifier – cubic metre (m ³) | Average Day Flow cubic metre per day (m ³ /d) | Maximum Day Flow m ³ /d |
|-----------------|--|--|------------------------------------|
| January | 560,656 | 18,086 | 20,289 |
| February | 482,802 | 17,243 | 18,961 |
| March | 536,889 | 17,319 | 20,825 |
| April | 569,580 | 18,986 | 23,479 |
| May | 532,030 | 17,162 | 18,955 |
| June | 578,202 | 19,273 | 25,210 |
| July | 617,655 | 19,924 | 22,821 |
| August | 598,525 | 19,307 | 20,216 |
| September | 573,230 | 19,108 | 28,697 |
| October | 574,898 | 18,545 | 21,876 |
| November | 525,031 | 17,501 | 19,185 |
| December | 568,047 | 18,324 | 22,562 |
| Total | 6,717,545 | | |
| Average | 559,795 | 18,404 | |
| Minimum | 482,802 | | |
| Maximum | 617,655 | | 28,697 |
| ECA Requirement | | 34,100 | |
| Met Compliance | | Yes | |



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Table 2 Raw Influent Analyses

| Month | Biochemical Oxygen Demand (BOD ₅) average (avg.) concentration (conc.) milligram per litre (mg/L) | Total Suspended Solids (TSS) avg. conc. mg/L | Total Phosphorus (TP) avg. conc. mg/L | Total Kjeldahl Nitrogen (TKN) average avg. conc. mg/L |
|------------------------------------|---|--|---------------------------------------|---|
| January | 172 | 180 | 4.4 | 41.23 |
| February | 175 | 188 | 4.8 | 50.00 |
| March | 169 | 184 | 4.5 | 46.10 |
| April | 189 | 169 | 4.0 | 39.45 |
| May | 184 | 201 | 4.5 | 42.20 |
| June | 190 | 255 | 5.8 | 47.98 |
| July | 156 | 205 | 4.6 | 45.78 |
| August | 169 | 236 | 4.7 | 47.90 |
| September | 137 | 193 | 4.0 | 43.93 |
| October | 132 | 180 | 3.8 | 34.55 |
| November | 122 | 164 | 4.0 | 38.44 |
| December | 121 | 164 | 3.8 | 36.35 |
| Average | 160 | 193 | 4.4 | 42.82 |
| Minimum | 121 | 164 | 3.8 | 34.55 |
| Maximum | 190 | 255 | 5.8 | 50.00 |
| Sampling Frequency Requirement Met | Yes | Yes | Yes | Yes |



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Table 3 Final Effluent Analyses

| Month | Carbonaceous Biochemical Oxygen Demand (CBOD ₅) average (avg.) concentration (conc.) milligram per litre (mg/L) | CBOD ₅ loading kilogram per day (kg/d) | Total Suspended Solids (TSS) avg. conc. mg/L | TSS loading kg/d | Total Phosphorus (TP) avg. conc. mg/L | TP loading kg/d | Total Ammonia Nitrogen (TAN) avg. conc. mg/L |
|------------------------------------|---|---|--|------------------|---------------------------------------|-----------------|--|
| January | 4.5 | 80.7 | 4.9 | 88.7 | 0.46 | 8.4 | 4.33 |
| February | 5.0 | 86.4 | 7.8 | 134.6 | 0.40 | 6.9 | 2.79 |
| March | 5.8 | 100.5 | 6.7 | 116.0 | 0.47 | 8.2 | 2.43 |
| April | 4.7 | 89.0 | 8.6 | 163.9 | 0.40 | 7.6 | 1.15 |
| May | 3.1 | 53.2 | 7.0 | 119.8 | 0.60 | 10.2 | 0.73 |
| June | 3.4 | 65.7 | 10.0 | 192.3 | 0.75 | 14.4 | 0.27 |
| July | 2.7 | 54.6 | 7.5 | 150.0 | 0.44 | 8.7 | 0.52 |
| August | 1.2 | 23.0 | 5.3 | 101.8 | 0.60 | 11.6 | 0.20 |
| September | 1.4 | 27.5 | 4.0 | 75.6 | 0.48 | 9.2 | 0.25 |
| October | 1.1 | 19.9 | 3.1 | 57.0 | 0.26 | 4.8 | 0.13 |
| November | 1.9 | 32.5 | 3.8 | 65.8 | 0.24 | 4.3 | 0.25 |
| December | 2.2 | 40.7 | 4.9 | 90.4 | 0.38 | 7.0 | 0.25 |
| Average | 3.1 | 56.6 | 6.1 | 112.5 | 0.46 | 8.4 | 1.11 |
| Minimum | 1.1 | 19.9 | 3.1 | 57.0 | 0.24 | 4.3 | 0.13 |
| Maximum | 5.8 | 100.5 | 10.0 | 192.3 | 0.75 | 14.4 | 4.33 |
| ECA Limit | 25.0 | 852.5 | 25.0 | 852.5 | 1.0 | 34.1 | |
| ECA Objective | 15.0 | | 15.0 | | 0.8 | | |
| Within Compliance | Yes | Yes | Yes | Yes | Yes | Yes | |
| Sampling Frequency Requirement Met | Yes | | Yes | | Yes | | Yes |



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Table 3 Final Effluent Analyses continued

| Month | Unionized Ammonia average (avg.) concentration (conc.) milligram per litre (mg/L) | Total Chlorine Residual avg. conc. mg/L | pH minimum | pH maximum | Temperature degree Celsius avg. |
|------------------------------------|---|---|------------|------------|---------------------------------|
| January | 0.02 | 0.00 | 6.7 | 7.6 | 13.9 |
| February | 0.01 | 0.00 | 6.3 | 7.3 | 12.7 |
| March | 0.01 | 0.00 | 6.9 | 7.5 | 13.6 |
| April | 0.01 | 0.00 | 7.1 | 7.8 | 13.9 |
| May | 0.01 | 0.00 | 7.2 | 7.6 | 16.5 |
| June | 0.00 | 0.00 | 7.2 | 7.5 | 19.0 |
| July | 0.00 | 0.00 | 7.0 | 7.5 | 20.2 |
| August | 0.00 | 0.00 | 7.2 | 7.5 | 21.7 |
| September | 0.00 | 0.00 | 7.0 | 7.7 | 20.4 |
| October | 0.00 | 0.00 | 7.1 | 7.8 | 18.8 |
| November | 0.00 | 0.00 | 7.5 | 7.8 | 16.7 |
| December | 0.00 | 0.00 | 7.6 | 7.8 | 16.1 |
| Average | 0.01 | 0.00 | | | 17.0 |
| Minimum | 0.00 | 0.00 | 6.3 | | 12.7 |
| Maximum | 0.02 | 0.00 | | 7.8 | 21.7 |
| ECA Limit | | 0.02 | 6.0 | 9.5 | |
| ECA Objective | | 0.01 | 6.5 | 8.5 | |
| Within Compliance | | Yes | Yes | Yes | |
| Sampling Frequency Requirement Met | | Yes | Yes | Yes | Yes |



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Table 4 *Escherichia coli* Sampling

| Month | Number of Samples | Geometric Mean Density |
|------------------------------------|-------------------|------------------------|
| January | 8 | 2 |
| February | 8 | 4 |
| March | 9 | 14 |
| April | 8 | 2 |
| May | 8 | 1 |
| June | 9 | 1 |
| July | 9 | 5 |
| August | 8 | 11 |
| September | 9 | 8 |
| October | 9 | 3 |
| November | 8 | 2 |
| December | 10 | 2 |
| ECA Limit | | 200 |
| ECA Objective | | 150 |
| Within Compliance | | Yes |
| Sampling Frequency Requirement Met | Yes | |



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Table 5 Energy and Chemical Usage

| Month | Ferrous Chloride litre (L) | Sodium Hypochlorite (L) | Sodium Bisulphite (L) | Hydro kilowatt hour | Natural Gas cubic metres |
|--------------|----------------------------|-------------------------|-----------------------|---------------------|--------------------------|
| January | 24,407 | 11,640 | 5,514 | 480,784 | 10,733 |
| February | 21,511 | 9,012 | 4,597 | 460,691 | 12,921 |
| March | 18,256 | 12,934 | 4,822 | 481,067 | 7,228 |
| April | 23,581 | 16,665 | 6,164 | 446,455 | 6,624 |
| May | 15,033 | 15,406 | 5,475 | 419,269 | 3,805 |
| June | 21,387 | 15,037 | 5,805 | 369,226 | 2,558 |
| July | 24,859 | 14,664 | 6,100 | 383,578 | 0 |
| August | 20,068 | 16,133 | 6,803 | 396,549 | 6,751 |
| September | 22,658 | 16,739 | 6,179 | 406,212 | 1,284 |
| October | 23,526 | 15,851 | 6,055 | 420,655 | 9,504 |
| November | 19,923 | 13,477 | 5,976 | 440,484 | 14,539 |
| December | 17,125 | 15,884 | 6,008 | 486,806 | 18,324 |
| Total | 252,334 | 173,442 | 69,498 | 5,191,776 | 94,271 |