Harmony Creek Water Pollution Control Plant

2023 Annual Performance Report

The Regional Municipality of Durham
Harmony Creek Water Pollution Control Plant 2023 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) 2023 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 our commitment to 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. Harmony Creek WPCP treats wastewater from the Oshawa and Courtice (Municipality of Clarington) service areas. The plant shares its catchment area flows with the Courtice WPCP. The Harmony Creek WPCP services approximately 56,275 residents or 27.8% of the total catchment population. The plant is designed to treat wastewater at an average flow rate of 34,100 cubic metres per day (m^3/d). Harmony Creek WPCP 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,
- phosphorus removal,
- secondary treatment,
- disinfection (chlorination/dechlorination), and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 658 kilometers 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 72.2% of the influent flow is diverted to the Harmony Creek Sanitary Sewage Pumping Station and conveyed to the Courtice WPCP. The remaining flow (27.8%) 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 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.

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. This coagulant enhances the settling of solids in the clarifier, thereby increasing the removal of phosphorus.

Secondary Treatment

Aeration: The flexible aeration system 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 on top. 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 Management

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 biosolids, water, carbon dioxide, methane, and hydrogen sulphide. The supernatant is returned to the head of the plant for further treatment. The digester gas is used for heating of the digester to offset the natural gas requirements.
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 54% of its annual average rated flow capacity and received a maximum daily flow of 35,907 cubic metres per day (m^3/d) on April 1, 2023. Tables 1 and 2 summarize the flow and 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.

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 the final 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 2023 included:

- Replaced 2 bar screens,
- Rebuilt 1 pumping station check valve,
- Rebuilt digester heat loop pump,
- Rebuilt blower 1,
- Replaced return flow meter,
- Cleaned out contact chamber.

e) Summary of any effluent quality assurance or control measures undertaken in the reporting period;

In-house laboratory (lab) test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy.

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

Calibration of the influent flow meter occurred on May 17, 2023.

Calibration of the in-house laboratory equipment was conducted on December 12, 2023.

Calibration of the in-house laboratory pH meter 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 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,
- There were no objective exceedances for 2023.

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

h) 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 generated at the Harmony Creek Water Pollution Control Plant (WPCP) in 2023 was 23,820 cubic metres (m^3).

Even with the increase in population on a year-to-year basis, no significant changes to flows or processing and anticipated. Therefore, no significant changes in sludge generation are expected for the next year.

The sludge produced at this facility was applied on agricultural fields or transferred to Duffin Creek WPCP for incineration.

Receiving facilities included:

Agricultural Fields – 5,884 m^3 or 24.7%

Duffin Creek WPCP – 17,936 m^3 or 75.3%

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 2023.

j) Summary of By-passes, Overflows, reportable spills or abnormal discharge events;

- On January 4, approximately 2,611 cubic metres (m^3) of influent bypassed primary treatment and 1,006 m^3 bypassed secondary treatment during a 4-hour bypass event due to heavy precipitation. The bypass flow was disinfected before mixing with plant effluent and being discharged to Lake Ontario. Ministry of the Environment, Conservation and Parks (MECP) Incident Report #1-2FX02Z,
- On February 9-10, approximately 11,814 m^3 of primary effluent bypassed secondary treatment during a 5-hour bypass event due to heavy precipitation. Bypassed flow was directed to the contact chamber where it was disinfected and de-chlorinated before being discharged to Lake Ontario through the normal outfall. MECP Incident Report #1-2HSZHP,
- On March 25, approximately 6,105 m^3 of primary effluent bypassed secondary treatment during a 3 hour and 10-minute bypass event due to heavy precipitation. The bypassed flow was directed to the chlorine contact chamber where it received chlorination and de-chlorination before being released to Lake Ontario through the normal outfall. MECP Incident Report #1-33NY7X,
- On June 24, approximately 1,241 m^3 of primary effluent bypassed secondary treatment during a 1 hour and 50-minute bypass event due to heavy precipitation. The bypassed flow was disinfected and de-chlorinated before being discharged to Lake Ontario via the normal outfall. MECP Incident Report #1-3KPABQ.

Due to the extreme nature of the weather events, it was determined that the bypass events were unavoidable and no changes to operational procedures or equipment were required to prevent future occurrences.

k) Schedule ‘B’, Section 1 Notice of Modifications and Status Update;

No schedule ‘B’, Section 1 Notice of Modifications were submitted in 2023.

l) Schedule ‘B’, Section 3 Modifications;

No schedule ‘B’, Section 3 Modifications were completed in 2023.

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.

Table 1 Final Effluent Flows

Month	Total Flow to Plant* cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	587,899	18,964	26,092
February	562,382	20,085	27,124
March	670,249	21,621	30,621
April	652,429	21,748	35,907
May	592,021	19,097	33,864
June	599,629	19,988	25,162
July	562,356	18,141	23,432
August	539,437	17,401	20,482
September	544,595	18,153	20,107
October	477,375	15,399	20,659
November	420,114	14,004	14,838
December	477,373	15,399	17,314
Total	6,685,859		
Average	557,155	18,317**	
Minimum	420,114		
Maximum	670,249		35,907
ECA Limit		34,100	
Met Compliance		Yes	

*Metered at the secondary clarifier

**Annual Average Daily Flow

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	127	161	3.6	38.40
February	112	135	3.1	29.38
March	87	119	2.8	28.48
April	83	95	2.7	25.62
May	119	130	3.3	31.86
June	86	139	3.7	33.70
July	133	155	4.1	37.13
August	127	164	4.4	40.50
September	145	212	4.8	47.48
October	205	262	4.9	44.78
November	196	217	4.5	48.00
December	154	197	4.0	44.68
Average	131	166	3.8	37.50
Minimum	83	95	2.7	25.62
Maximum	205	262	4.9	48.00
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

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	1.7	32.2	3.9	74.0	0.47	8.9	0.92
February	3.2	64.3	5.6	112.5	0.48	9.6	3.43
March	2.3	49.7	3.7	80.0	0.37	8.0	1.03
April	1.3	28.3	2.7	58.7	0.46	10.0	1.33
May	1.2	22.9	2.7	51.6	0.55	10.5	0.07
June	1.6	32.0	3.2	64.0	0.57	11.4	0.57
July	1.3	23.6	4.1	74.4	0.63	11.4	0.14
August	1.0	17.4	3.3	57.4	0.52	9.0	0.14
September	1.4	25.4	3.8	69.0	0.62	11.3	0.12
October	1.1	16.9	3.2	49.3	0.60	9.2	0.44
November	2.0	28.0	3.0	42.0	0.42	5.9	0.12
December	1.6	24.6	3.1	47.7	0.37	5.7	0.11
Average	1.6	30.0	3.5	64.4	0.51	9.2	0.70
Minimum	1.0	16.9	2.7	42.0	0.37	5.7	0.07
Maximum	3.2	64.3	5.6	112.5	0.63	11.4	3.43
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

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	0.00	0.00	7.0	8.1	14.2
February	0.01	0.00	6.9	7.4	13.5
March	0.00	0.00	7.0	7.4	14.1
April	0.00	0.00	7.0	7.3	15.9
May	0.00	0.00	7.0	7.3	16.5
June	0.00	0.00	6.9	7.4	19.3
July	0.00	0.00	6.7	7.4	21.3
August	0.00	0.00	6.9	7.2	21.4
September	0.00	0.00	6.9	7.1	20.7
October	0.00	0.00	6.9	7.3	19.5
November	0.00	0.00	6.7	7.1	17.9
December	0.00	0.00	6.9	8.1	16.3
Average	0.00	0.00			17.5
Minimum	0.00	0.00	6.7		13.5
Maximum	0.01	0.00		8.1	21.4
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

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Geometric Mean Density
January	10	26
February	8	15
March	11	6
April	8	21
May	9	19
June	10	10
July	8	7
August	9	5
September	9	9
October	8	11
November	9	6
December	9	8
ECA Limit		200
ECA Objective		150
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

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	12,460	18,367	6,729	557,221	13,824
February	8,780	11,691	6,259	504,456	11,085
March	10,029	12,949	7,414	556,001	12,128
April	8,529	11,231	7,141	498,144	6,294
May	14,485	12,645	6,915	470,070	3,433
June	17,487	12,266	6,126	428,210	2,460
July	25,261	13,461	5,768	420,182	2,673
August	24,070	10,820	6,034	408,274	4,451
September	20,058	12,042	5,706	390,565	5,218
October	21,468	10,016	4,963	425,759	7,611
November	15,685	9,458	4,634	447,742	11,453
December	14,708	10,040	5,607	505,371	12,559
Total	193,020	144,986	73,296	5,611,996	96,020