Harmony Creek Water Pollution Control Plant

2024 Annual Performance Report

The Regional Municipality of Durham
Harmony Creek Water Pollution Control Plant 2024 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) 2024 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 56,381 residents or 27.6% 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)
- Solids management

Raw Influent Pumping

Wastewater is collected through approximately 666 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 72.4% of the influent flow is diverted to the Harmony Creek Sanitary Sewage Pumping Station and conveyed to the Courtice WPCP. The remaining flow (27.6%) 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 55% of its annual average rated flow capacity and received a maximum daily flow of 38,270 cubic metres per day (m^3/d) on April 4, 2024. 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

The Harmony Creek WPCP experienced high primary digester volatile acids during the primary clarifier bypass in the second half of December. While the primary clarifier was out of service and waste activated sludge (WAS) was not being produced, the digester was batch fed with truckloads of sludge from Newcastle WPCP. This quick feeding resulted in a buildup of volatile acids from the first step of digestion. The digester returned to normal conditions once the primary clarifier was back in service and WAS was being fed in a slower, more consistent manner.

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 2024 included:

- Replaced 2 pumping station check valves
- Repaired 1 pumping station sewage pump
- Rebuilt secondary scum pump
- Rebuilt digester recirculation pump

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 June 25, 2024.
Calibration of the in-house laboratory equipment was conducted on November 26, 2024.
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 2024.

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 2024 was 23,352 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 – 8,404 m^3 or 36.0%

Duffin Creek WPCP – 14,948 m^3 or 64.0%

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 2024.

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

- On April 12, approximately 32,305 cubic metres (m^3) of primary effluent bypassed secondary treatment during a 15.25-hour bypass event due to heavy precipitation. The bypassed flow was disinfected and dechlorinated before being discharged to Lake Ontario through the normal outfall. Ministry of the Environment, Conservation and Parks (MECP) Incident Report #1-5NW7J2.
- On July 16, approximately 8,510 m^3 of sewage bypassed primary treatment and 21,241 m3 of primary effluent bypassed secondary treatment during a 10-hour bypass event due to heavy precipitation. Bypassed flow disinfected and dechlorinated before being discharged to Lake Ontario through the normal outfall. MECP Incident Report #1-904QXW.
- On December 16, approximately 404,582 m^3 of sewage bypassed primary treatment during a 43-day bypass event for primary clarifier repairs. The bypassed flow received secondary treatment, disinfection and de-chlorination before being discharged to Lake Ontario via the outfall. MECP Incident Report #1-EUZZ30.

Due to the extreme nature of the weather events and unforeseeable nature of the clarifier failure, 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 2024.

l) Schedule ‘B’, Section 3 Modifications

No schedule ‘B’, Section 3 Modifications were completed in 2024.

MECP Inspection

This plant was last inspected by the MECP on January 20, 2024.

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	536,510	17,307	25,193
February	506,482	17,465	18,750
March	601,463	19,402	22,382
April	699,198	22,555	69,691
May	541,091	17,455	21,143
June	573,532	19,118	21,375
July	622,995	20,097	31,372
August	658,936	21,256	24,832
September	658,246	21,942	25,363
October	561,151	18,102	20,364
November	486,397	16,213	17,223
December	422,669	13,634	22,305
Total	6,868,670		
Average	572,389	18,818**	
Minimum	422,669		
Maximum	699,198		69,691
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	133	174	3.4	34.12
February	146	193	3.7	39.23
March	97	128	3.2	33.83
April	142	150	2.8	28.98
May	142	145	3.6	39.35
June	142	144	4.5	43.98
July	104	141	4.1	34.66
August	118	167	4.1	37.28
September	176	272	5.2	47.05
October	161	276	5.3	45.18
November	166	301	5.4	47.65
December	166	250	4.9	43.00
Average	141	195	4.2	39.53
Minimum	97	128	2.8	28.98
Maximum	176	301	5.4	47.65
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	1.6	27.3	3.2	54.5	0.2	4.2	0.09
February	2.3	39.5	3.2	56.2	0.3	5.1	0.31
March	1.1	21.9	2.8	55.1	0.3	4.9	0.23
April	3.6	80.1	5.3	120.2	0.3	6.1	0.37
May	1.4	24.3	2.1	36.3	0.2	3.7	0.08
June	1.9	36.9	2.9	55.8	0.4	7.5	0.10
July	2.5	49.8	3.8	76.4	0.4	7.4	0.11
August	1.9	40.2	3.0	62.9	0.5	10.8	0.14
September	2.5	54.0	4.0	88.0	0.5	10.8	0.12
October	2.3	41.6	3.6	64.3	0.4	6.9	0.10
November	2.3	37.3	3.1	49.9	0.4	5.7	0.10
December	2.7	37.2	3.8	51.1	0.4	5.0	0.18
Average	2.2	40.7	3.4	63.6	0.3	6.4	0.16
Minimum	1.1	21.9	2.1	36.3	0.2	3.7	0.08
Maximum	3.6	80.1	5.3	120.2	0.5	10.8	0.37
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	7.5	14.0
February	0.00	0.00	7.0	7.4	14.9
March	0.00	0.00	7.0	7.8	15.0
April	0.00	0.00	7.2	7.7	15.1
May	0.00	0.00	7.0	7.6	18.0
June	0.00	0.00	7.1	7.6	20.0
July	0.00	0.00	7.1	7.7	21.3
August	0.00	0.00	7.2	7.8	21.9
September	0.00	0.00	7.0	7.7	21.2
October	0.00	0.00	7.2	7.6	19.2
November	0.00	0.00	7.3	7.8	17.9
December	0.00	0.00	7.2	7.8	15.2
Average	0.00	0.00			17.8
Minimum	0.00	0.00	7.0		14.0
Maximum	0.00	0.00		7.8	21.9
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	9	16
February	8	5
March	9	6
April	9	32
May	10	3
June	8	17
July	9	11
August	9	5
September	8	6
October	9	15
November	9	2
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	15,525	12,396	6,227	637,416	13,146
February	17,497	13,386	5,886	525,471	11,917
March	16,841	14,150	6,713	552,736	10,423
April	15,192	16,052	8,092	625,378	10,125
May	15,622	13,264	6,869	467,276	6,383
June	15,749	12,952	7,307	434,113	4,961
July	17,495	15,281	6,829	474,350	2,611
August	20,356	16,167	6,628	476,248	2,272
September	27,955	18,516	7,800	444,538	2,593
October	31,174	16,295	6,677	462,726	4,362
November	27,889	14,248	5,690	461,903	6,126
December	21,450	11,525	5,735	551,555	12,254
Total	242,745	174,232	80,453	6,113,711	87,173