



**Harmony Creek Water Pollution Control Plant**  
**2018 Annual Performance Report**

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## The Regional Municipality of Durham

### Harmony Creek Water Pollution Control Plant 2018 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) 2018 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 35,313 residents or 19.6% 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<sup>3</sup>/d). The plant is an 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 treatment.

#### Raw Influent Pumping

Wastewater is collected through approximately 686 km 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 80.4% 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**

**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 (scum) is also removed to the digester. In November of 2016 the primary clarifier was taken out of service to facilitate the maintenance and construction upgrades planned for the anaerobic digester. Flows have been redirected to bypass the clarifier and go directly to the aeration tanks.

### **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 wastewater 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 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.

### **Phosphorus Removal**

The phosphorous removal system lowers 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)**

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 water 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. In November of 2016 the anaerobic digester was taken out of service for maintenance and upgrades. The waste activated sludge (WAS) flows are being directed to the Courtice WPCP through the Harmony Creek SSPS.

**Biosolids:** Due to digester maintenance, all sludge produced in the reporting period was pumped to the Courtice WPCP via the Harmony Creek SSPS.

## Environmental Compliance Approval

Under Condition 11 (4) of ECA 2407-AK8KJH the Region of Durham must produce an annual report that contains the following information:

**a) Summary and interpretation of all Influent monitoring data, including sewage characteristics, flow rates and a comparison to the values used in the design 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 plant operated at an average of 32.4% of its annual average rated flow capacity and received a maximum daily flow of 45,626 m<sup>3</sup>/d on April 17, 2018. 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:**

The secondary clarifier cross collector required emergency maintenance in June 2018. During the repairs all influent flow was pumped to the Courtice WPCP via the Harmony Creek SSPS.

**d) Maintenance of major equipment**

Major maintenance items in 2018 included:

- Rebuilt Harmony Creek SSPS Flygt pump,
- Rebuilt chopper pump,
- Repaired secondary cross collector,
- Sample collection building was relocated and rewired, and
- Construction of the plant upgrades is underway.



**e) 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.

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

- Calibration of the effluent flow meter occurred on April 10, 2018.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted on November 28, 2018.
- 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, remaining below the ECA compliance limits.

- The average daily rated flow capacity of 34,100 m<sup>3</sup>/d was not exceeded.
- The pH objective of not less than 6.5 was exceeded in 12 of 253 samples (4.7%). Calibration of the pH probe is performed regularly.
- The E. coli objective of 150 CFU/100 mL was exceeded in one of 12 (8.3%) monthly geometric mean averages. Chlorination was increased accordingly.
- The daily sampling frequency requirement for total chlorine residual (TCR) was not met. Two of 362 required samples (0.6%) were not collected. Additional ECA training will be provided to plant staff.

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

**h) Tabulation of volume of sludge generated:**

Due to digester maintenance, all sludge produced in the reporting period was pumped to the Courtice WPCP via the Harmony Creek SSPS.

**Outline of anticipated volumes to be generated in the next reporting period:**

Sludge treatment is expected to resume in the summer of 2019 after maintenance and upgrades on the digester and the digested sludge storage tank is complete.

**Summary of locations to where sludge was disposed:**

Due to digester maintenance, all sludge produced in the reporting period was pumped to the Courtice WPCP via the Harmony Creek SSPS.

**i) Summary of complaints and steps taken to address the complaints:**

There were no documented complaints in 2018.

**j) Summary of by-passes, overflows, reportable spills or abnormal discharge events:**

A significant precipitation event on April 16 and April 17, 2018 contributed to considerable inflows resulting in by-pass events at the Harmony Creek WPCP and the Harmony Creek SSPS. All by-passed flow received disinfection prior to discharge. These events were reported to the MECP.

There were no spills during the reporting period.

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**k) Schedule 'B', Section 1 Notice of Modifications and Status Update**

No schedule 'B', Section 1 Notice of Modifications were submitted in 2018.

**l) Schedule 'B', Section 3 Modifications**

No schedule 'B', Section 3 Modifications were completed in 2018.

**m) Additional Information Required by 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 final effluent cubic metre (m <sup>3</sup> )	Average Day Flow cubic metre per day (m <sup>3</sup> /d)	Maximum Day Flow m <sup>3</sup> /d
January	398,657	12,860	18,603
February	314,311	11,225	14,841
March	350,496	11,306	13,094
April	440,169	14,672	45,626
May	310,814	10,026	12,169
June	246,540	9,131*	11,491
July	280,763	9,057	11,963
August	324,940	10,482	15,274
September	311,464	10,382	12,134
October	324,679	10,474	12,274
November	353,224	11,774	15,260
December	338,368	10,915	13,036
Total	3,994,425		
Average	332,869	11,034**	
Minimum	246,540		
Maximum	440,169		45,626
ECA Requirement		34,100	
Met Compliance		Yes	

\* Three days with no effluent discharge (See Page 4 “Description of any operating problems encountered and corrective actions taken”)

\*\* Annual average daily flow = total annual flow divided by 362



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**Table 2 Raw Influent Analyses**

Month	Carbonaceous Biochemical Oxygen Demand (CBOD <sub>5</sub> ) average (avg.) concentration (conc.) milligram per litre (mg/L)	CBOD <sub>5</sub> loading kg/d	Biochemical Oxygen Demand avg. conc. mg/L	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d	Total Phosphorous (TP) avg. conc. mg/L	TP loading kg/d
January	128	1,646	262	310	3,989	5.5	71
February	102	1,142	170	249	2,793	4.3	48
March	110	1,238	209	265	2,998	4.5	51
April	80	1,179	144	180	2,641	3.0	44
May	81	811	152	198	1,989	3.5	35
June	151	1,379	233	311	2,842	5.0	45
July	116	1,046	220	320	2,897	5.1	46
August	145	1,515	232	301	3,159	4.6	48
September	108	1,119	220	271	2,818	4.7	49
October	108	1,132	227	285	2,984	5.1	54
November	83	976	182	199	2,338	3.6	42
December	103	1,128	178	174	1,902	3.7	40
Average	109	1,208	202	255	2,818	4.4	48
Minimum	80	811	144	174	1,902	3.0	35
Maximum	151	1,646	262	320	3,989	5.5	71
Sampling Frequency Requirement Met			Yes	Yes		Yes	



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**Table 2 Raw Influent Analyses continued**

Month	Total Ammonia Nitrogen (TAN) average (avg.) concentration (conc.) milligram per litre (mg/L)	TAN avg. conc. mg/L	Nitrate plus Nitrite mg/L	pH minimum	pH maximum
January	50.28	24.77	0.5	6.7	7.6
February	35.95	20.58	0.7	7.1	7.6
March	39.58	19.95	0.4	7.0	7.7
April	26.05	14.55	2.0	7.1	7.6
May	31.14	19.21	0.7	7.1	7.5
June	48.00	27.08	1.3	7.0	7.5
July	44.15	27.68	0.4	7.0	7.3
August	40.44	22.59	0.4	6.7	7.3
September	38.98	22.48	0.4	6.9	7.4
October	42.80	23.44	0.5	6.9	7.8
November	32.63	17.81	0.9	6.6	7.6
December	37.15	19.46	0.5	6.9	8.0
Average	38.93	21.63	0.7		
Minimum	26.05	14.55	0.4	6.6	
Maximum	50.28	27.68	2.0		8.0
Sampling Frequency Requirement Met	Yes				



**Table 3 Final Effluent Analyses**

Month	Carbonaceous Biochemical Oxygen Demand (CBOD <sub>5</sub> ) average (avg.) concentration (conc.) milligram per litre (mg/L)	CBOD <sub>5</sub> loading kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d	Total Phosphorous (TP) avg. conc. mg/L	TP loading kg/d	Total Ammonia Nitrogen (TAN) avg. conc. mg/L
January	5.9	76.4	12.1	155.9	0.46	5.9	1.81
February	6.1	67.9	10.9	122.2	0.42	4.8	8.15
March	3.8	42.7	5.8	65.8	0.21	2.4	1.98
April	4.6	67.5	8.4	123.3	0.26	3.8	0.69
May	3.5	34.9	5.8	58.3	0.28	2.8	0.15
June	5.1	46.8	11.0	100.1	0.60	5.4	0.45
July	3.4	30.6	6.5	58.6	0.51	4.6	0.18
August	4.0	41.5	5.9	61.6	0.47	4.9	0.18
September	4.0	41.8	4.8	49.5	0.62	6.4	0.19
October	4.2	43.8	7.9	82.4	0.55	5.8	0.21
November	3.6	42.4	7.9	93.5	0.35	4.1	0.13
December	4.4	47.8	8.0	87.6	0.33	3.6	0.15
Average	4.4	48.3	7.9	87.3	0.42	4.6	1.19
Minimum	3.4	30.6	4.8	49.5	0.21	2.4	0.13
Maximum	6.1	76.4	12.1	155.9	0.62	6.4	8.15
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 Kjeldahl Nitrogen average avg. conc. mg/L	Total Chlorine Residual avg. conc. mg/L	Nitrate plus Nitrite mg/L	pH minimum	pH maximum	Temperature degree Celsius avg.
January	0.0	4.13	0.00	16.3	6.3	7.2	13.4
February	0.0	9.72	0.00	11.6	6.7	7.2	13.5
March	0.0	3.48	0.00	19.0	6.5	7.4	13.2
April	0.0	2.74	0.00	15.3	6.9	7.4	13.9
May	0.0	1.57	0.00	16.6	6.9	7.5	16.2
June	0.0	2.33	0.00	16.3	6.6	7.3	19.1
July	0.0	1.83	0.00	19.1	6.5	7.1	22.0
August	0.0	2.22	0.00	15.8	6.5	6.9	22.6
September	0.0	1.96	0.00	16.5	6.4	7.3	22.0
October	0.0	2.21	0.00	19.6	6.4	7.2	16.4
November	0.0	2.15	0.00	17.4	6.4	7.2	10.1
December	0.0	2.00	0.00	18.7	6.4	7.5	11.6
Average	0.0	3.03	0.00	16.8			16.2
Minimum	0.0	1.57	0.00	11.6	6.3		10.1
Maximum	0.0	9.72	0.00	19.6		7.5	22.6
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			No*		Yes	Yes	Yes

\* two of 362 required TCR samples were not collected



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**Table 4 *Escherichia coli* Sampling**

Month	Number of Samples	Geometric Mean Density
January	5	24
February	4	2
March	4	3
April	4	3
May	5	5
June	4	36
July	4	5
August	5	20
September	4	27
October	5	80
November	4	35
December	4	162
ECA Limit		200
ECA Objective		150
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	



Table 5 Energy and Chemical Usage

Month	Ferrous Chloride litre	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite litre	Hydro kilowatt hour	Natural Gas cubic metres
January	25,456	1,274	1,207	594,955	5,848
February	23,758	853	933	560,462	11,258
March	22,948	836	1,262	538,494	12,684
April	19,641	1,371	1,765	640,722	10,342
May	20,274	870	1,356	452,418	3,245
June	19,187	753	1,027	370,012	3
July	22,186	910	1,121	379,258	3
August	25,085	1,024	1,262	379,545	27
September	22,403	906	1,047	372,082	2,119
October	21,753	791	1,191	437,354	7,873
November	20,451	840	1,324	503,412	9,887
December	18,168	777	1,238	523,300	11,673
Total	261,310	11,204	14,732	5,752,013	74,962