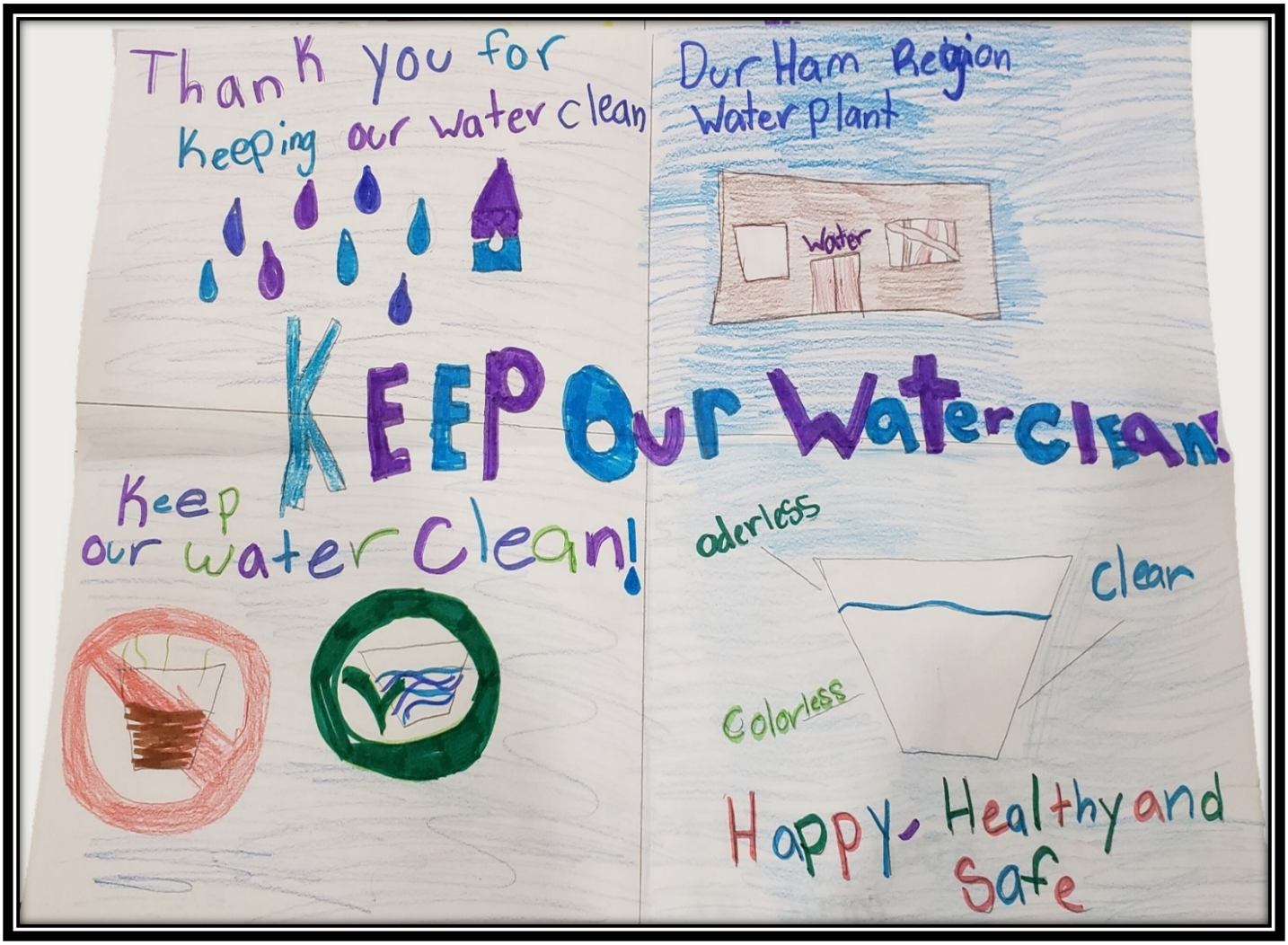
Courtice Water Pollution Control Plant

2019 Annual Performance Report



The Regional Municipality of Durham
Courtice Water Pollution Control Plant 2019 Annual Performance Report

Environmental Compliance Approval (ECA): 3393-68RLD4 Dated January 28, 2005
Amendment: Dated April 18, 2007
Environmental Compliance Approval (Air): 7446-6AGNQZ Dated April 30, 2005
The Courtice Water Pollution Control Plant (WPCP) 2019 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Courtice 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 Courtice WPCP is located in the Municipality of Clarington (Courtice) and is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECAs.
The Courtice WPCP treats wastewater from the Oshawa and Courtice service areas in the Region. 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 148,012 residents or 81.0% 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 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 collected through approximately 691 km of sanitary sewers in Oshawa and Courtice is conveyed to the Harmony Creek SSPS located at the Harmony Creek WPCP. Approximately 81.0% of the Harmony Creek WPCP influent flow is diverted to the Harmony Creek SSPS and conveyed 6.4 kilometres in a 1,050 mm diameter forcemain to the Courtice WPCP.

In addition, an existing small service area in Courtice is serviced by gravity to the Courtice WPCP which includes the Durham York Energy Centre, and surrounding businesses and industries.

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 is also removed to the digester.

Secondary Treatment

Aeration Tank: The aeration tanks are comprised of two distinct zones. The first is an anoxic zone, where no oxygen is introduced and allows for potential denitrification. Subsequently, the wastewater leaves the anoxic zone and enters the aerated zone where fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics, and nutrients. Biological activity is controlled to assimilate the organic material.
Secondary Clarifier: The effluent from the aeration tanks 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 tanks and the excess activated sludge is wasted to the primary clarifiers.

Phosphorus Removal

The phosphorous removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant, ferrous chloride, at various 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 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 metres 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 supernatant 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.
Sludge Management: All digested sludge produced at the Courtice 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

Under Condition 10.(6) of ECA #3393-68RLD4 the Region 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. 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 74.9% of its annual average rated flow capacity and received a maximum daily flow of 111,223 m^3/d on April 22, 2019. See tables 3 and 4 for effluent results.

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

On June 2, 2019 staff identified that no sodium bisulphite was being dosed to the final effluent. A valve on the chemical feed line was discovered to be closed. The valve was opened, and the system was restored to normal operation. The Region is identifying and implementing changes to monitoring alarms at various locations in the plant related to chemical addition. Plant staff have received training on chemical feed systems.

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 2019 included:

- replaced level transducer on biosolids cell 1,
- replaced flights and cross collector chains on primary clarifiers 100 and 200,
- replaced mixer 1103 in digester,
- repaired grit conveyor screw,
- replaced variable frequency drive on return activated sludge pump 1102,
- replaced breaker on grit blower 4,
- replaced actuator 4103 in digester,
- replaced batteries in diesel generator,
- replaced grit pump 4102,
- replaced batteries in Uninterruptible Power Supply in Energy Motor Control Centre,
- replaced conveyor lining in headworks,
- repaired flights and hubs in secondary clarifiers 100 and 200,
- installed new chlorine analyzer,
- installed plate on anoxic zone outlet,
- rebuilt effluent pump 2,
- repaired soft-start on blower 4,
- rebuilt raw influent pump 1101, and
- rebuilt bearing in blower 3.

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 was conducted April 17 and October 9.
- Calibration of in-house laboratory equipment was conducted on July 24.
- Calibration of the in-house lab pH meter was conducted regularly.

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

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 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 64 of 259 samples (24.7%). This was due primarily to annual clarifier maintenance and one of the digesters being taken out of service for cleaning, resulting in reduced sludge storage capacity.
- The total ammonia nitrogen summer objective of 8.0 mg/L was exceeded in 3 of 289 samples (1.0%).

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

g) Biosolids Production;

Tabulation of Volume of Sludge Generated;

The volume of sludge removed from Courtice WPCP in 2019 was 110,184 m^3.

Outline of Anticipated Volumes to be Generated in the next Reporting Period;

The volume of sludge generated in the next reporting period may be affected by the commissioning of existing digesters at the Harmony Creek WPCP and the Courtice WPCP.

Summary of Locations to Where Sludge was Disposed;

All digested sludge produced at the Courtice WPCP is pumped to the sludge holding facility. From there 33,342 m^3 (30.0%) was utilized on approved agricultural fields and 76,842 m^3 (70.0%) was transferred to the Duffin Creek WPCP for incineration.

h) 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 2019.

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

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

k) Ministry of the Environment, Conservation and Parks (MECP) Inspection

This plant was last inspected by the MECP on June 22, 2017.

Table 1 Final Effluent Flows

Month	Total Flow to Plant - metered at the final effluent cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	1,793,703	57,861	73,496
February	1,465,655	52,345	73,044
March	1,815,972	58,580	93,778
April	2,341,151	78,038	111,223
May	2,042,877	65,899	105,083
June	1,474,161	49,139	62,199
July	1,142,819	36,865	54,704
August	1,114,999	35,968	43,827
September	1,093,415	36,447	41,388
October	1,218,072	39,293	76,804
November	1,503,605	50,120	81,074
December	1,639,733	52,895	78,604
Total	18,646,161		
Average	1,553,847	51,085*	
Minimum	1,093,415		
Maximum	2,341,151		111,223
ECA Limit		68,200	180,000
Met Compliance		Yes	Yes

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	Carbonaceous Biochemical Oxygen Demand average concentration (conc.) milligram per litre (mg/L)	Biochemical Oxygen Demand average conc. mg/L	Total Suspended Solids average conc. mg/L	Total Phosphorus average conc. mg/L	Dissolved Phosphorus average conc. mg/L
January	200	348	584	5.6	2.90
February	322	405	546	5.5	2.65
March	349	439	616	5.0	2.80
April	183	273	377	2.9	1.50
May	216	311	433	3.5	1.80
June	266	390	592	5.2	2.40
July	300	394	450	6.2	2.93
August	248	287	401	6.0	3.10
September	198	325	429	6.1	3.30
October	215	337	425	5.4	2.90
November	157	207	320	4.0	2.30
December	187	309	460	4.4	2.30
Average	237	335	469	5.0	2.57
Minimum	157	207	320	2.9	1.50
Maximum	349	439	616	6.2	3.30
Sampling Frequency Requirement Met		Yes	Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average concentration (conc.) milligram per litre (mg/L)	Total Ammonia Nitrogen average conc. mg/L	pH minimum	pH maximum	Temperature degree Celsius average	Alkalinity average conc. mg/L
January	42.06	45.7	7.3	8.0	12.8	367
February	48.93	37.0	7.0	8.4	11.6	348
March	50.33	27.0	7.3	8.8	12.7	286
April	33.63	19.4	7.1	8.0	13.0	280
May	36.96	19.6	7.2	8.1	14.2	312
June	44.45	26.6	7.6	8.0	17.0	278
July	55.80	29.2	7.3	8.0	20.0	269
August	46.78	29.3	7.2	7.9	20.4	265
September	52.43	33.4	7.4	8.1	20.2	263
October	47.38	31.8	7.4	8.1	18.3	310
November	37.70	26.5	7.7	8.2	15.6	297
December	44.68	26.8	7.6	8.7	13.6	294
Average	45.09	29.4			15.8	297
Minimum	33.63	19.4	7.0		11.6	263
Maximum	55.80	45.7		8.8	20.4	367
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand average concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids average conc. mg/L	Total Phosphorus average conc. mg/L	Total Ammonia Nitrogen average conc. mg/L winter	Total Ammonia Nitrogen average conc. mg/L summer
January	2.1	4.0	0.75	0.43	
February	2.0	2.4	0.73	0.26	
March	2.0	3.2	0.74	0.20	
April	2.0	3.3	0.47	0.36	
May	2.0	3.1	0.56		0.15
June	2.0	3.6	0.85		0.25
July	2.0	3.7	0.80		0.14
August	2.0	3.2	0.72		2.16
September	2.0	2.7	0.73		0.33
October	2.0	2.3	0.68		0.16
November	2.0	3.0	0.71	0.16	
December	2.0	2.0	0.72	0.06	
Average	2.0	3.0	0.71	0.25	0.53
Minimum	2.0	2.0	0.47	0.06	0.14
Maximum	2.1	4.0	0.85	0.43	2.16
ECA Limit	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 Ammonia Nitrogen average concentration (conc.) milligram per litre (mg/L)	Total Kjeldahl Nitrogen average conc. mg/L	Dissolved Phosphorus average conc. mg/L	Nitrate average conc. mg/L	Alkalinity average conc. mg/L
January	0.0	1.84	0.71	23.36	123
February	0.0	1.44	0.64	23.04	86
March	0.0	1.41	0.75	19.61	88
April	0.0	1.19	0.43	14.98	147
May	0.0	1.23	0.53	16.14	161
June	0.0	1.46	0.79	17.74	108
July	0.0	1.18	0.74	23.11	58
August	0.0	1.22	0.62	21.64	67
September	0.0	1.23	0.69	23.21	55
October	0.0	1.16	0.63	23.95	95
November	0.0	1.00	0.64	20.94	105
December	0.0	0.95	0.66	19.26	110
Average	0.0	1.28	0.65	20.58	100
Minimum	0.0	0.95	0.43	14.98	55
Maximum	0.0	1.84	0.79	23.95	161
ECA Limit	0.2				
ECA Objective	0.1				
Within Compliance	Yes				
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Chlorine Residual average concentration (conc.) milligram per litre (mg/L)	pH minimum	pH maximum	Temperature degree Celsius average
January	0.00	6.7	7.4	13.6
February	0.00	6.8	7.3	12.8
March	0.00	6.8	7.2	12.3
April	0.00	6.9	7.4	13.4
May	0.01	7.0	7.4	14.9
June	0.05	6.9	7.3	18.0
July	0.00	6.5	7.1	20.8
August	0.00	6.8	7.5	21.7
September	0.00	6.5	7.2	20.7
October	0.00	6.6	7.2	18.6
November	0.00	6.9	7.3	15.2
December	0.00	6.8	7.7	13.4
Average	0.01			16.3
Minimum	0.00	6.5		12.3
Maximum	0.05		7.7	21.7
ECA Limit		6.0	9.5	
ECA Objective		6.5	9.0	
Within Compliance		Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	7
February	4	12
March	4	11
April	4	19
May	5	5
June	4	8
July	5	33
August	4	4
September	4	2
October	5	15
November	4	15
December	4	8
ECA Objective		200
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Total Flow to Plant - metered at the final effluent cubic metre (m^3)	Ferrous Chloride Litres (L)	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite L	Hydro kilowatt hours	Natural Gas m^3
January	1,793,703	70,700	4,572	8,906	694,863	72,584
February	1,465,655	64,260	3,851	8,464	624,486	58,885
March	1,815,972	80,080	4,822	10,672	699,373	65,196
April	2,341,151	29,820	3,851	12,218	669,991	44,178
May	2,042,877	53,620	4,542	11,592	687,922	19,472
June	1,474,161	112,280	4,043	11,224	668,832	12,673
July	1,142,819	108,220	4,175	9,715	673,479	
August	1,114,999	74,060	3,249	9,642	680,945	5,882
September	1,093,415	82,740	3,543	5,483	631,038	2,261
October	1,218,072	75,460	6,630	5,998	655,382	34,046
November	1,503,605	73,080	3,704	6,918	648,937	16,348
December	1,639,733	75,600	4,284	7,360	671,779	25,213
Total	18,646,161	899,920	51,265	108,192	8,007,027	356,738