Corbett Creek Water Pollution Control Plant

2019 Annual Performance Report

The Regional Municipality of Durham
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Environmental Compliance Approval (ECA): 7560-9PPRJC Dated November 12, 2014
Environmental Compliance Approval (Air): 1581-9URJFE Dated May 13, 2015

The Corbett Creek Water Pollution Control Plant (WPCP) 2019 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Corbett Creek WPCP. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of 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 Corbett Creek WPCP located in the Town of Whitby and is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA's. Corbett Creek WPCP treats wastewater from the Whitby, Brooklin and Oshawa service areas. The Corbett Creek WPCP services approximately 149,932 residents.

The Corbett Creek WPCP is designed to treat wastewater at an average daily flow rate of 84,350 cubic metres per day (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,
- phosphorus removal,
- secondary treatment,
- disinfection (chlorination/dechlorination), and
- solids management.

Raw Influent Pumping

Wastewater is collected from Whitby, Brooklin and Oshawa through approximately 529.4 kilometres of sanitary sewers. It is conveyed to the plant by gravity and by several sanitary sewage pumping stations located throughout the collection system.

Preliminary Treatment

Screening: Two mechanically cleaned screens remove rags and large debris that could harm pumps and process equipment. Screenings are compacted for disposal to landfill.

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 this process is dewatered and transported to landfill.

Primary Treatment

The four primary clarifiers utilize 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 sweep 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.

Phosphorous Removal

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

Secondary Treatment

Aeration: The seven aeration tanks are where 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 tanks is directed to the seven 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.

Disinfection (chlorination/dechlorination)

Chlorine in the form of liquid sodium hypochlorite is metered into the effluent stream for pathogen control. Adequate contact time is provided by the three chlorine contact chambers. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario through the 1,800 mm diameter outfall extending 773 m 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.

Sludge Management: All digested sludge produced is pumped to the biosolids holding facility. From there the treated biosolids can be utilized on approved agricultural fields or be hauled to Duffin Creek WPCP for incineration.

Environmental Compliance Approval (ECA)

Under Condition 10.(6) of ECA #7560-9PPRJC 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 plant operated at an average of 57.2 % of its annual average rated flow capacity and received a maximum daily flow of 98,739 m^3/d on April 27.

The Corbett Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period.

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

Small rocks and vivianite accumulate in the plant 4 primary raw sludge pumps. The pumps are rotated to stop the debris from accumulating. When rotating the pumps, the pumps must be jetted out and the debris removed before operating the pump.

When there was precipitation, the travelling bridge’s electrical limit switches short out. The bridges are halted and the sludge accumulates and causes the syphons to plug. Operators must manually work the syphons to remove the sludge. Waterproof limit switches were installed to rectify the problem.

When the lake level rises typically in the spring, there is not enough pump pressure to pump the effluent from Plants 2 and 3 to the lake. This condition causes overflow and flooding conditions at the plant. Larger pumps are being investigated to install in order to pump the high flows out of the plant.

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:

- rebuilt #9 secondary clarifier’s corner sweep assembly,
- rebuilt #4 secondary clarifier’s arms, springs, wheels and scraper assemble,
- primary #1 and #2 drained, inspected, cleaned and installed all new wheels and scrapers,
- overhauled #1 bar screen,

- replaced seal on biosolids truck loading pump #1,
- installed new #1 grit pump,
- installed new seal in #2 grit pump
- replaced guide rail systems on biosolids sump pump,
- repaired grit screw conveyor,
- rebuilt double disc raw sludge pump,
- installed raw sewage magmeter for Plant 2 and 3,
- rebuilt chemical sump pump,
- rebuilt cast iron process water discharge filter assembles,
- fabricated and installed intake and discharge lines for overflow pump,
- rebuilt three ferrous chloride pumps,
- rebuilt and installed headworks splitter gates to Plant 4,
- rebuilt chlorine pump #9,
- rebuilt pressure control lines for process water pump in Plants 2 and 3, and
- rebuilt sodium bisulphite loading station lines.

d) 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. Results were found to be in an acceptable 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 flow meters was conducted on May 2.
- Calibration of in-house laboratory equipment was conducted on July 24.
- Calibration of the pH meter was conducted regularly.

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

The Region of Durham strives to achieve the best effluent quality at all times and produce results below the ECA compliance limits.

- The annual average daily flow did not exceed the rated capacity of 84,350 m^3/d.
- The total suspended solids objective of 15.0 mg/L was exceeded in 15 of 410 samples (3.7%). Operational variances contributed to high results. Total suspended solids results are monitored daily, adjustments are made to the process as required.
- The total phosphorus objective of 0.8 mg/L was exceeded in 3 of 303 samples (1.0%). Total phosphorus results are monitored daily, adjustments are made to the process as required.

- The total chlorine residual objective of “non-detect” was exceeded in 13 of 365 samples (3.6%). The ECA states an objective concentration of “non-detect”, however, the instrumentation has a detection limit of 0.0012 mg/L. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals.
- The effluent pH was below the minimum effluent objective of 6.5 in 2 of 361 samples (0.6%). The pH meter was calibrated regularly.

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 Corbett Creek WPCP in 2019 was 91,738 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;

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

Receiving facilities included:

Agricultural Fields – 37,514 m^3 or 40.9%

Duffin Creek WPCP – 54,224 m^3 or 59.1%

h) Summary of Complaints and Steps Taken to Address the Complaint;

There was one odour complaint received by the Spills Action Centre on March 22, 2019. There were no abnormal operating conditions at the time of the complaint. The wind direction was checked, and it was determined that Corbett Creek WPCP was not the cause of the odour.

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) Notice of Modifications submitted to Water Supervisor and Status Report of Limited Operational Flexibility;

No modifications under “Limited Operational Flexibility” were conducted.

k) Modifications Arising under section 3 of Schedule A;

No modifications under section 3 of Schedule A were conducted.

l) Information Required by Ministry of the Environment, Conservation and Parks Water Supervisor.

No additional information was requested.

Ministry of the Environment, Conservation and Parks Inspection

This plant was last inspected by the MECP on November 15, 2017. The inspection report dated April 4, 2018 recommended to continue to use best practices to meet the effluent objectives.

Table 1 Raw Influent Flows

Month	Total Plant Flow metered at the Raw Influent cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	1,555,588	50,180	65,855
February	1,323,937	47,283	63,981
March	1,621,683	52,312	78,583
April	1,980,008	66,000	98,739
May	1,821,333	58,753	89,777
June	1,516,066	50,536	66,315
July	1,274,624	41,117	48,676
August	1,182,151	38,134	41,562
September	1,124,904	37,497	43,025
October	1,202,295	38,784	55,763
November	1,416,718	47,224	70,237
December	1,578,953	50,934	74,426
Total	17,598,260		
Average	1,466,522	48,214*	
Maximum	1,980,008		98,739
ECA Limit		84,350	
Met Compliance		Yes	

*Annual Average Daily Flow

Table 2 Raw Influent 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)	Biochemical Oxygen Demand avg. conc. mg/L	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d	Total Phosphorus (TP) avg. conc. mg/L	TP loading kg/d
January	151	7,557	203	211	10,598	5.0	250
February	99	4,676	122	179	8,459	4.5	213
March	117	6,126	200	245	12,832	4.8	251
April	68	4,501	96	119	7,861	3.3	218
May	114	6,674	189	192	11,263	3.8	223
June	85	4,290	164	185	9,349	4.4	222
July	136	5,600	171	236	9,704	5.0	206
August	113	4,298	148	205	7,817	4.2	160
September	117	4,398	166	245	9,190	4.7	176
October	104	4,034	133	190	7,365	4.5	175
November	124	5,846	164	191	9,020	4.2	198
December	121	6,153	161	207	10,528	4.4	224
Average	112	5,416	160	200	9,663	4.4	212
Minimum	68	4,034	96	119	7,365	3.3	160
Maximum	151	7,557	203	245	12,832	5.0	251
Sampling Frequency Requirement Met			Yes	Yes		Yes	

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Ammonia Nitrogen (TAN) avg. conc. mg/L	TAN loading kilogram per day (kg/d)	pH minimum	pH maximum
January	42.90	29.8	1,497	7.1	7.8
February	38.80	24.8	1,173	7.5	8.0
March	43.85	26.4	1,381	7.4	8.1
April	27.28	19.6	1,294	7.5	8.0
May	31.72	21.2	1,246	7.4	8.1
June	32.18	20.4	1,031	7.1	8.0
July	43.08	22.9	942	7.5	8.0
August	39.68	23.5	896	7.4	8.0
September	38.95	27.0	1,012	7.7	8.1
October	42.86	27.1	1,051	7.1	8.1
November	47.08	26.0	1,228	7.5	8.2
December	41.10	24.3	1,238	7.5	8.1
Average	39.12	24.4	1,177		
Minimum	27.28	19.6	896	7.1	
Maximum	47.08	29.8	1,497		8.2
Sampling Frequency Requirement Met	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 summer	TAN avg. conc. mg/L winter	TAN loading kg/d
January	3.6	181	7.1	357	0.43	22		0.68	34
February	4.3	203	7.2	340	0.38	18		0.81	38
March	3.6	188	8.1	421	0.42	22		0.61	32
April	2.9	191	5.6	368	0.28	18		0.78	51
May	2.7	159	6.5	380	0.33	19	0.29		17
June	2.3	116	6.3	317	0.42	21	0.51		26
July	2.1	86	6.3	258	0.44	18	1.49		61
August	2.5	95	7.6	289	0.54	21	2.61		100
September	1.4	52	4.4	166	0.34	13	1.05		39
October	2.1	81	6.6	257	0.52	20	1.74		67
November	2.0	94	6.5	308	0.36	17		0.72	34
December	2.0	102	6.5	329	0.36	18		0.62	32
Average	2.6	127	6.5	316	0.40	19	1.28	0.70	44
Minimum	1.4	52	4.4	166	0.28	13	0.29	0.61	17
Maximum	4.3	203	8.1	421	0.54	22	2.61	0.81	100
ECA Limit	25.0	2,108	25.0	2,108	1.0	84	16.0	24.0	1,350 (summer) 2,024 (winter)
ECA Objective	15.0		15.0		0.8		8.0	18.0	
Within Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes	Yes	

Table 3 Final Effluent Analyses continued

Month	Un-ionized ammonia average (avg.) concentration (conc.) milligram per litre(mg/L)	Total Kjeldahl Nitrogen avg. conc. mg/L	Total Chlorine Residual avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.0	2.01	0.00	6.4	7.3	13.7
February	0.0	1.94	0.02	6.6	7.3	12.8
March	0.0	1.75	0.00	6.7	7.5	13.2
April	0.0	1.38	0.00	6.5	7.4	13.5
May	0.0	1.60	0.00	7.0	7.6	15.0
June	0.0	1.80	0.00	6.7	7.4	17.1
July	0.0	4.03	0.00	6.7	7.3	19.3
August	0.0	5.14	0.00	6.6	7.5	20.3
September	0.0	2.19	0.00	6.4	7.6	20.7
October	0.0	3.98	0.00	6.6	7.5	19.4
November	0.0	2.02	0.00	6.8	7.5	16.9
December	0.0	2.14	0.00	6.7	7.7	14.7
Average	0.0	2.50	0.00			16.4
Minimum	0.0	1.38	0.00	6.4		12.8
Maximum	0.0	5.14	0.02		7.7	20.7
ECA Requirement			0.02	6.0	9.5	
ECA Objective			Non-detect	6.5	8.5	
Within Compliance			Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	6	51
February	4	15
March	4	2
April	4	12
May	5	16
June	4	18
July	5	11
August	4	45
September	4	26
October	5	19
November	4	16
December	4	15
ECA Requirement		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 kilogram as chlorine	Sodium Bisulphite L	Hydro Kilowatt hour	Natural Gas cubic metre
January	187,280	10,606	12,485	822,115	52,771
February	158,450	10,902	7,796	786,475	63,954
March	184,940	11,639	22,141	852,064	51,965
April	181,540	10,275	31,710	776,218	48,108
May	171,010	7,647	33,530	778,149	25,006
June	185,960	7,269	30,373	737,463	4,157
July	200,460	6,840	28,286	723,308	3,766
August	160,230	7,835	8,038	711,031	3,467
September	179,160	6,054	7662	693,464	3,567
October	183,150	6,797	8,282	758,231	5,278
November	174,780	8,690	8,924	792,478	10,302
December	178,410	8,058	7,967	840,169	18,295
Total	2,145,370	102,612	207,194	9,271,165	290,636