Corbett Creek Water Pollution Control Plant

2018 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) 2018 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 146,053 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 an MECP Class Four 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 treatment.

Raw Influent Pumping

Wastewater is collected from Whitby, Brooklin and Oshawa through approximately 471.7 km 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 (scum) 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). Ferrous chloride is added at 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 water is returned to the head of the plant for further treatment.

Biosolids: 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

Under Condition 10 (6) of ECA #7560-9PPRJC the Region must produce an annual 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 58.0 % of its annual average rated flow capacity and received a maximum daily flow of 196,879 m^3/d on April 17.

The Corbett Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period with the exception of four (4) instances where the pH was below the lower limit of 6.0. These instances were reported on January 28, 2019 when operations staff discovered they had not been reported to the MECP. The pH readings that occurred were as follows February 13, pH 4.8, February 14, pH 5.2, March 26, pH 5.7 and May 6, pH 5.8. All other readings taken in 2018 were in compliance and the monthly average pH results were within normal operating range. After review, the work instructions and standard operating procedures have been updated, new methods of identifying all objective and limit exceedances at the time of sample analysis have been initiated and the installation of an on-line pH meter is being investigated.

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

Small rocks were found accumulating in the plant 4 primary raw sludge pumps. Further investigation found the center well and feed pipes were full of an iron phosphate precipitate known as vivianite. As a result, the clarifier pipes and center well were cleaned.

c) Maintenance of major structure, equipment, apparatus, mechanism or thing forming part of the works

Major maintenance items in 2018 included:

- Replaced the packer/conveyor gear box
- Replaced the scraper arm assemblies on secondary clarifiers #9
- Refurbished the scraper arm assemblies on secondary clarifier #8
- Installed a new gear box on the travelling bridge in secondary clarifier #6
- Installed travelling bridge drives on secondary clarifiers #5 and #6.

- Rebuilt the primary sludge double disc pumps in plants #2/3 and #4.
- Rebuilt raw lift pump #1
- Rebuilt the return activated sludge(RAS) pumps #8 and #3/4 in plant #4
- Installed two new knife gate valves complete with actuators on RAS system in plant
- The chlorine contact chambers in plant # 2/3 and #4 were dewatered and cleaned
- The dewatering valves in the chlorine contact chamber for plant #2/3 were rebuilt and replaced with stainless steel
- Installed a new chemical feed pump to deliver sodium bisulfite to plant #4
- Rebuilt the sodium bisulfite feed pump for plant #2/3
- Rebuilt chemical pump #2 for sodium hypochlorite in plant #2/3
- Repaired the three way hot water heater exchange valve for primary digester #2
- Rebuilt the basement sump pump in the digestor building
- Rebuilt the ferrous chemical loading station

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 in May 15 and 16 of 2018.
- Calibration of the in house laboratory equipment was conducted on July 31 of 2018.
- Calibration of the pH meter was conducted regularly.

f) Description of efforts made and results achieved in meeting the effluent objectives of Condition 6

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 47 of 400 samples (11.8%). 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 7 of 295 samples (2.4%). 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 49 of 361 samples (13.6%). The ECA requests 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 26 of 354 samples (7.3%). The pH meter was calibrated regularly.

Best efforts and process adjustments will continue to be applied as the Region of Durham endeavours 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 2018 was 85,068 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 – 33,112 m^3 or 38.9%
Duffin Creek WPCP – 51,956 m^3 or 61.1%

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

There were no complaints received during the reporting period.

i) By-passes and Spills

On April 16 and 17 significant winter precipitation contributed to extraordinary flows resulting in a by-pass of the primary and secondary treatment facilities, disinfection and dichlorination were achieved prior to the plant outfall. This event was reported to the MECP as a by-pass.

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 MECP Water Supervisor

The construction of the Corbett Creek digester facilities phase 1 upgrades reached substantial completion as of April 30, 2018.

MECP 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	1,473,265	47,525	72,367
February	1,416,328	50,583	76,910
March	1,470,881	47,448	56,886
April	2,142,801	71,427	196,879
May	1,591,630	51,343	63,952
June	1,320,780	44,026	49,818
July	1,341,080	43,261	52,407
August	1,372,568	44,276	54,462
September	1,296,421	43,214	51,097
October	1,326,837	42,801	48,539
November	1,549,444	51,648	76,014
December	1,567,622	50,568	62,907
Total	17,869,657		
Average	1,489,138	48,956*	
Maximum	2,142,801		196,879
ECA Limit		84,350	
Met Compliance		Yes	

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	Carbonaceous Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading kilogram per day (kg/d)	Biochemical Oxygen Demand (BOD_5) 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	133	6,326	172	137	6,519	4.4	211
February	102	5,177	126	133	6,728	4.1	207
March	90	4,280	161	161	7,627	4.2	199
April	77	5,478	107	117	8,330	3.1	221
May	105	5,397	128	144	7,415	3.7	192
June	149	6,550	167	156	6,846	4.6	201
July	93	4,020	125	130	5,635	4.6	198
August	99	4,367	117	133	5,886	4.1	182
September	64	2,750	103	127	5,471	4.0	173
October	105	4,492	125	175	7,487	4.6	198
November	126	6,518	170	159	8,202	4.1	210
December	133	6,728	170	229	11,598	4.2	215
Average	106	5,190	139	150	7,325	4.1	202
Minimum	64	2,750	103	117	5,471	3.1	173
Maximum	149	6,728	172	229	11,598	4.6	221
Sampling Frequency Requirement Met			Yes	Yes		Yes	

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen (TKN) 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	40.56	21.9	1,039	7.1	8.3
February	39.10	19.7	995	6.5	7.8
March	39.58	25.0	1,185	6.9	7.8
April	29.65	19.3	1,380	6.2	7.5
May	32.72	19.4	996	6.4	7.6
June	35.13	20.8	915	7.2	7.6
July	35.58	31.0	1,339	6.9	8.0
August	33.32	24.0	1,064	7.0	7.8
September	31.98	17.9	774	7.1	7.8
October	36.04	25.4	1,086	6.7	7.8
November	34.93	24.4	1,261	5.5	7.9
December	41.85	28.1	1,422	6.9	7.8
Average	35.87	23.1	1,126		
Minimum	29.65	17.9	774	5.5	
Maximum	41.85	31.0	1,422		8.3
Sampling Frequency Requirement Met	Yes				

Table 3 Final Effluent Analyses

Month	Carbonaceous 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	4.6	217	13.0	616	0.6	27	1.5		69
February	3.3	167	9.8	494	0.5	24	0.6		31
March	3.7	176	10.5	496	0.5	22	0.6		29
April	3.5	248	9.2	657	0.4	29	0.7		50
May	3.4	174	8.7	445	0.4	20		0.7	38
June	3.8	169	13.0	571	0.5	24		0.6	27
July	2.8	120	10.4	448	0.5	20		0.3	14
August	1.9	86	6.3	279	0.4	16		0.3	14
September	2.0	86	10.0	434	0.4	16		0.5	23
October	2.4	101	8.1	347	0.4	17		0.4	15
November	3.6	184	7.3	375	0.4	20	0.6		30
December	3.7	185	7.2	366	0.4	21	0.3		16
Average	3.2	157	9.4	461	0.4	21	0.7	0.5	30
Minimum	1.9	86	6.3	279	0.4	16	0.3	0.3	14
Maximum	4.6	248	13.0	657	0.6	29	1.5	0.7	69
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 (TKN) avg. conc. mg/L	Total Chlorine Residual (TCR) avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.0	3.30	0.02	6.4	7.8	13.1
February	0.0	2.76	0.02	4.8	7.3	13.1
March	0.0	2.84	0.01	5.7	7.2	13.2
April	0.0	2.39	0.02	6.0	7.3	12.8
May	0.0	2.91	0.00	5.8	7.7	15.9
June	0.0	2.32	0.00	6.4	7.3	19.4
July	0.0	2.00	0.00	6.5	7.5	21.7
August	0.0	1.86	0.00	6.8	7.4	22.6
September	0.0	2.27	0.00	6.8	7.5	23.2
October	0.0	1.88	0.00	6.7	7.5	20.8
November	0.0	1.72	0.00	6.4	7.5	17.7
December	0.0	1.70	0.00	6.4	7.3	16.0
Average	0.0	2.33	0.01			17.5
Minimum	0.0	1.70	0.00	4.8		12.8
Maximum	0.0	3.30	0.02		7.8	23.2
ECA Requirement			0.02	6.0	9.5	
ECA Objective			Non-detect	6.5	8.5	
Within Compliance			Yes	No	Yes	
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	7	118
February	4	35
March	4	2
April	6	26
May	5	38
June	4	12
July	4	28
August	5	31
September	4	48
October	5	100
November	6	105
December	4	30
ECA Requirement		200
ECA Objective		150
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Ferrous Chloride (litre)	Sodium Hypochlorite (kilogram as chlorine)	Sodium Bisulphite (litre)	Hydro Kilowatt hour (kWh)	Natural Gas (cubic metre)
January	159,417	9,037	9,500	828,460	36,668
February	180,920	9,328	8,210	667,556	65,020
March	173,650	9,702	9,989	733,376	52,347
April	155,690	9,663	12,821	858,805	72,861
May	180,300	6,668	9,222	808,546	21,120
June	170,710	7,567	9,230	724,313	5,554
July	223,780	7,702	6,400	750,095	3,626
August	209,850	8,509	9,454	714,662	11,294
September	181,740	7,911	5,272	714,839	14,358
October	244,690	9,541	20,318	777,064	10,293
November	183,620	9,185	20,360	735,428	40,826
December	174,330	11,439	13,101	784,445	36,172
Total	2,238,697	106,252	133,876	9,097,588	370,139