Corbett Creek Water Pollution Control Plant

2017Annual 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) 2017 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Corbett Creek WPCP for 2017. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). 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 147,879 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 MOECC 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 458 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 is intended to lower 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 six 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 two 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 409 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 shipped 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 Corbett Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period except for one limit exceedance. During the month of December the monthly geometric mean density for E.coli exceeded the limit of 200 colony forming units per 100ml with a result of 231 colony forming units per 100ml. The plant operated at an average of 60.7% of its annual average rated flow capacity and received a maximum daily flow of 132,021 m^3/d on June 24th.

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

During late August and early September the plant experienced two high loading incidents from unidentified sources, the primary clarifiers in plant #4 became septic causing high suspended solids to carry over into other treatment processes resulting in higher than normal effluent suspended solids and total phosphorus. The two primary clarifiers in plant #4 were taken out of service for cleaning in October and returned to service end of November and early December. During the month of December extreme cold temperatures and difficulty maintaining dissolved oxygen within the aeration basin due to a programmable logic controller unit issue with the blower system caused incomplete nitrification in the process. Incomplete nitrification increased the chlorine demand reducing the disinfection effectiveness.

c) Maintenance of major equipment

Major maintenance items in 2017 included:

- Replaced operating mechanisms on primary clarifiers #3 and #4.
- Rebuilt two raw sludge pumps in plant #4.
- Rebuilt raw lift pump #1.
- Installed two new variable frequency drives on return activated sludge(RAS) pumps in plant #2.
- Rebuilt RAS pump #10 in plant #4.
- Installed two new knife gate valves complete with actuators on RAS system in plant #4.
- Installed travelling bridge drives on secondary clarifiers #5 and #6.
- Installed new chemical pumps for ferrous chloride and sodium hypochlorite

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 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

- Calibration of the flow meters was conducted in May, September and October of 2017.
- Calibration of the in house laboratory equipment was conducted in July of 2017.
- 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 strives to achieve the best effluent quality at all times, remaining below the ECA compliance limits.

The annual average daily flow did not exceed the rated capacity of 84,350 m^3/d.

The five day carbonaceous biological oxygen demand objective of 15.0 mg/L was exceeded once in 152 samples (0.7%), results are monitored regularly and adjustments are made to the process as required.

The total suspended solids objective of 15.0 mg/L was exceeded in 83 of 401 samples (20.7%).

The total phosphorus objective of 0.8 mg/L was exceeded in 30 of 294 samples (10.2%)

The majority of the elevated total suspended solids and total phosphorus levels occurred during the high loading events from an unidentified source in August and September. The two primary clarifiers in plant #4 were taken out of service for cleaning in October and returned to service at the end of November and early December.

The total ammonia nitrogen objective of 18.0 mg/L was exceeded once in 182 samples (0.5%), results are monitored regularly and if necessary adjustments are made to the process.

The total chlorine residual objective of “non-detect” was exceeded in 24 of 364 samples (6.6%). The ECA requests an objective concentration of “non-detect”, however the instrumentation used has a detection limit of 0.0012 mg/L so it is typical to have results detected. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals.

The pH objective of not less than 6.5 was exceeded four of 320 samples (1.3%). The pH meter was calibrated regularly.

The E.coli objective monthly geometric mean density of 150 colony forming units per 100ml was exceeded in one of 12 (8%) which coincided with the limit exceedance reported for December.

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

g) Biosolids Production:

Tabulation of Volume of Sludge Generated:

The volume of sludge removed from Corbett Creek WPCP in 2017 was 64,327 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:

Duffin Creek WPCP – 32,222 m^3 or 50.1%

Agricultural Fields – 32,105 m^3 or 49.9%

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

An odour complaint from a resident was received and investigated on July 26th but could not be confirmed as an odour from the WPCP. Additional complaints dated July 29th and 30thwere received from the MOECC on August 14th and could not be investigated properly.

i) By-passes and Spills

Two by-passes occurred at the plant in 2017. On June 23rd significant rainfall and high levels in Lake Ontario resulted in a bypass of the primary treatment facilities, flows were disinfected prior to the outfall but due to extreme flows the outfall had surcharged causing approximately 1000 m^3 to over flow onto the roadway and into the marshy area south of the plant. This event was reported to the MOECC as a bypass.

On October 20th permission was granted by the MOECC to bypass the primary clarifiers in plant # 4 due to heavy loading received from an unidentified source, it was deemed necessary to isolate the clarifiers to allow settling and removal of solids to be treated in the solids treatment process.

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 MOECC Water Supervisor

No additional information was requested.

MOECC Inspection

The MOECC conducted an inspection on November 15th, 2017. The final report is pending.

Table 1 Raw Influent Flows

Month	Total Flow to Plant -metered at the final effluent m^3	Average Daily Flow m^3/d	Maximum Daily Flow m^3/d
January	1,649,272	53,202	71,268
February	1,409,568	50,342	68,239
March	1,622,466	52,338	81,322
April	1,817,093	60,570	97,559
May	2,299,802	74,187	130,149
June	1,788,417	59,614	132,021
July	1,539,000	49,645	62,250
August	1,382,445	44,595	51,794
September	1,326,947	44,232	60,962
October	1,302,451	42,015	48,261
November	1,281,339	42,711	50,936
December	1,319,499	42,564	46,953
Total	18,738,299		
Average	1,561,525	51,198*	
Maximum	2,299,802		132,021
ECA Limit		84,350	
Met Compliance		Yes	

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	$CBOD_5$ avg. conc. mg/L	$CBOD_5$ loading kg/d	BOD_5 avg. conc. mg/L	TSS avg. conc. mg/L	TSS loading kg/d	TP avg. conc. mg/L	TP loading kg/d
January	80	4,268	109	157	8,372	3.1	165
February	85	4,298	116	105	5,298	3.6	181
March	97	5,074	126	141	7,405	4.2	222
April	61	3,669	68	106	6,400	2.9	177
May	55	4,104	79	91	6,776	2.4	178
June	56	3,309	64	92	5,456	2.9	173
July	113	5,599	139	117	5,800	3.6	180
August	129	5,768	137	153	6,809	4.4	198
September	162	7,154	221	226	9,999	4.5	199
October	125	5,257	203	196	8,229	4.3	182
November	114	4,880	129	131	5,585	4.3	183
December	139	5,899	180	151	6,425	4.6	194
Average	101	5,187	131	139	7,107	3.7	192
Minimum	55	3,309	64	91	5,298	2.4	165
Maximum	162	7,154	221	226	9,999	4.6	222
Sampling Frequency Requirement Met			Yes	Yes		Yes	

Table 2 Raw Influent Analyses continued

Month	TKN avg. conc. mg/L	TAN avg. conc. mg/L	TAN loading kg/d	pH min.	pH max.
January	28.13	24.4	1,297	7.50	8.40
February	33.35	24.2	1,217	7.19	8.31
March	35.38	22.9	1,198	7.70	8.20
April	27.93	25.6	1,550	7.70	8.18
May	24.52	15.7	1,165	7.65	8.10
June	28.20	19.6	1,166	7.25	7.99
July	34.13	21.6	1,071	7.32	7.83
August	36.32	22.4	997	7.18	7.76
September	38.08	24.9	1,103	7.10	7.75
October	36.75	21.6	909	7.20	7.70
November	36.00	24.1	1,029	6.80	7.90
December	45.48	32.9	1,402	6.56	8.00
Average	33.69	23.3	1,194		
Minimum	24.52	15.7	909	6.56	
Maximum	45.48	32.9	1,550		8.40
Sampling Frequency Requirement Met	Yes				

Table 3 Final Effluent Analyses

Month	$CBOD_5$ avg. conc. mg/L	$CBOD_5$ loading kg/d	TSS avg. conc. mg/L	TSS loading kg/d	TP avg. conc. mg/L	TP loading kg/d	TAN avg. conc. mg/L summer	TAN avg. conc. mg/L winter	TAN loading kg/d
January	3.4	180	8.6	456	0.40	21.2	0.51		27.2
February	3.6	183	9.4	474	0.42	21.2	1.23		61.7
March	8.7	456	11.0	578	0.94	49.0	2.11		110.2
April	3.0	180	9.1	549	0.45	27.1	0.65		39.7
May	3.3	248	8.2	607	0.30	22.4		0.43	31.8
June	2.5	148	9.1	540	0.40	23.6		0.48	28.4
July	2.3	114	8.6	429	0.47	23.3		1.31	65.2
August	3.5	155	13.5	604	0.65	28.9		0.41	18.3
September	2.9	127	17.2	762	0.72	31.8		0.47	20.8
October	3.3	138	19.5	821	0.84	35.2		0.77	32.3
November	3.9	167	13.4	574	0.48	20.7	0.61		26.2
December	3.1	132	12.3	522	0.47	20.1	1.06		45.2
Average	3.6	185	11.7	597	0.54	27.9	1.03	0.64	42.2
Minimum	2.3	114	8.2	429	0.30	20.1	0.51	0.41	18.3
Maximum	8.7	456	19.5	821	0.94	49.0	2.11	1.31	110.2
ECA Limit	25	2,108	25	2,108	1.0	84	16	24	1,350 (summer)/ 2,024 (winter)
ECA Objective	15		15		0.8		8	18	
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	Unionized NH3 avg. conc. mg/L	TKN avg. conc. mg/L	TCR avg. conc. mg/L	pH min.	pH max.	Temp. °C avg
January	0.0	2.54	0.00	7.60	7.60	14.4
February	0.0	3.79	0.00	7.05	7.62	14.2
March	0.0	29.76	0.00	6.60	8.04	13.5
April	0.0	2.22	0.00	7.19	7.73	14.7
May	0.0	2.36	0.00	7.04	7.81	15.6
June	0.0	1.78	0.00	6.92	7.74	17.7
July	0.0	3.92	0.00	6.77	7.40	20.2
August	0.0	2.26	0.00	6.60	7.38	21.3
September	0.0	2.34	0.00	6.53	7.37	22.3
October	0.0	2.97	0.01	6.50	7.27	20.2
November	0.0	2.17	0.00	6.56	7.90	17.9
December	0.0	2.74	0.00	6.00	7.49	14.9
Average	0.0	4.90	0.00			
Minimum	0.0	1.78	0.00	6.00		13.5
Maximum	0.0	29.76	0.01		8.04	22.3
ECA Requirement			0.02	6.0	9.0	
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 Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	4	19
February	4	27
March	6	43
April	4	17
May	5	10
June	4	56
July	4	22
August	5	36
September	4	103
October	5	142
November	4	70
December	4	231
ECA Requirement		200
ECA Objective		150
Within Compliance		No
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Ferrous Chloride (litres)	Sodium Hypochlorite (kilograms as chlorine)	Sodium Bisulphite (litres)	Hydro (kWh)	Natural Gas (cubic metres)
January	185,650	9,516	10,576	766,044	36,328
February	161,570	7,896	11,091	734,373	46,234
March	164,990	9,589	12,369	779,210	35,990
April	174,080	9,549	13,996	745,705	36,550
May	179,090	9,954	17,376	761,549	31,110
June	172,600	8,386	14,586	679,134	36,260
July	184,620	8,518	10,601	697,763	30,197
August	182,520	7,519	11,165	678,469	18,436
September	182,740	7,644	9,407	702,043	25,597
October	180,940	8,113	9,030	690,823	23,419
November	154,400	6,974	9,696	703,096	34,156
December	196,077	7,108	8,996	821,976	38,828
Total	2,119,277	100,767	138,889	8,760,183	393,105