Corbett Creek Water Pollution Control Plant

2020 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) 2020 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, 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 153,298 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 533 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 raw 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 and pumped to the anaerobic digesters.

Phosphorus Removal

The phosphorus removal system lowers the total phosphorus level in the final effluent by adding a chemical coagulant, ferrous chloride, into the primary effluent which aids in settling in the secondary clarifiers.

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.
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 liquid 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

Water Pollution Control Plant (WPCP) for incineration. A portion of the digested sludge was used to seed the Harmony Creek WPCP primary digester.

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 60% of its annual average rated flow capacity and received a maximum daily flow of 169,507 m^3/d on January 11.

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;

The plant experienced ongoing excess foaming in the primary digesters. Operations reduced the feed rate and mixing times to help reduce the foam. Volatile acid and alkalinity tests were performed regularly to monitor the issue.

The plant received a defective load of ferrous chloride which plugged the feed pumps and delivery lines. Operations cleaned the lines, pumps, and hired a contractor to clean both ferrous chloride holding tanks. The ferrous chloride feed lines were rebuilt with new strainers.

During the cold weather months, the plant had issues with nitrification. Operations adjusted flow rates, dissolved oxygen levels, waste and return activated sludge rates, and sodium hypochlorite feed rate to help aid the nitrification process. Ammonia, nitrite, and nitrate tests were performed regularly to help monitor the process.

A request for Pandemic Related Temporary Relief (Alternative Arrangement) for Municipal Wastewater Systems was submitted to the Ministry of Environment, Conservation and Parks on March 31, 2020. The request was made for relief of influent sampling to assist in managing workload and for the health and safety of staff. The Director granted relief on April 29, 2020. Corbett Creek WPCP returned to normal sampling practices on June 1, 2020

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 2020 included:

- Rebuilt primary sludge pump #4,

- Performed maintenance on substation and transfer switch,
- Installed new basket strainers for ferrous chloride line,
- Rebuilt return activated sludge pump #9,
- Cleaned out final contact chambers biannually,
- Rebuilt blower motor #2,
- Rebuilt discharge piping for raw lift pumps in building D,
- Replaced primary drive mechanisms in gearboxes for primaries clarifiers #3 and #4,
- Rebuilt dewatering pump in building K,
- Rebuilt primary sweeper arm assembly for primary clarifier #3,
- Rebuilt 3 ferrous chloride pumps,
- Rebuilt scum pump for secondary clarifier #5/6,
- Rebuilt double disk pump in building I
- Rebuilt double disk pumps #3 and #4 in tunnel #3.

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 Water Pollution Control Plant 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 December 14 and December 21, 2020,
- Calibration of in-house laboratory equipment on August 17, 2020,
- 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 always strives to achieve the best effluent quality and produce results below the Environmental Compliance Approval objectives.

- The annual average daily flow did not exceed the rated capacity of 84,350 m^3/d,
- The total suspended solids (TSS) objective of 15.0 mg/L was exceeded in 27 of 484 samples (5.6%). Operational variances contributed to high results. TSS results are monitored daily, adjustments are made to the process as required,
- The total phosphorus (TP) objective of 0.8 mg/L was exceeded in 33 of 340 samples (9.7%). TP results are monitored daily, adjustments are made to the process as required,
- Total ammonia nitrogen (TAN) objective of 8.0 mg/L during the summer months was exceeded in 1 of 104 samples (1.0%). There were 0 TAN objective exceedances in the

winter months. Total Ammonia Nitrogen results are monitored, adjustments are made to the process as required,

- The total chlorine residual objective of “non-detect” was exceeded in 4 of 364 samples (1.1%). The Environmental Compliance Approval states an objective concentration of “non-detect”, however, the instrumentation has a detection limit of 0.0012 mg/L. Dechlorination via Sodium bisulphite dosing is monitored to ensure low total chlorine residuals,
- The E.coli objective was exceeded in 1 of 12 samples (8.3%). Chlorine residuals are monitored daily, adjustments are made to the process as required.

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 Water Pollution Control Plant (WPCP) in 2020 was 127,022 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, transferred to Duffin Creek WPCP for incineration, and transferred to Harmony Creek WPCP to seed the primary digester.

Receiving facilities included:

Agricultural Fields – 57,918 m^3 or 45.6%

Duffin Creek WPCP – 67,656 m^3 or 53.3%

Harmony Creek WPCP – 1,448 m^3 or 1.1%

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

There was one noise concern received by the Ministry of Environment, Conservation and Parks (MECP). The complainant indicated they could hear a mechanical noise coming from the plant during the day on May 26, 2020. Corbett Creek WPCP staff determined the noise would have been related to work completed in the afternoon to perform non-routine essential maintenance on a plugged scum line from the scum removal system. This work necessitated using a contracted vacuum truck to remove the contents of the scum pit and a second contractor to jet clean and vacuum the remaining lines of the scum removal system. As this was a result of a plugged line and not routine maintenance it is not anticipated that any further noise of this nature will be occurring at Corbett Creek WPCP.

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

A significant winter precipitation event contributed to significant influent flow resulting in a bypass event on January 11 and 12, 2020. Primary and secondary treatment was bypassed.

All bypassed flow received disinfection. A total volume of 130,399 m^3 of influent was bypassed. Two Ministry of Environment, Conservation and Parks (MECP) incident reports were generated by the MECP Spills Action Centre or the event. Samples for the bypass were collected and submitted for analysis at the Region's accredited environmental laboratory as per the requirements of the Environmental Compliance Approval. Due to the nature of the extreme weather event, no changes to operational procedures would have prevented the bypass.

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	2,053,458	66,241	169,507
February	1,478,657	50,988	64,434
March	1,846,449	59,563	79,966
April	1,533,252	51,108	66,728
May	1,424,636	45,956	51,184
June	1,428,556	47,619	50,123
July	1,434,498	46,274	49,022
August	1,435,535	46,308	51,340
September	1,405,395	46,847	49,466
October	1,446,859	46,673	50,577
November	1,387,982	46,266	54,257
December	1,636,136	52,779	64,033
Total	18,511,413		
Average	1,542,618	50,578*	
Maximum	2,053,458		169,507
ECA Limit		84,350	
Met Compliance		Yes	

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids (TSS) avg. conc. mg/L	Total Phosphorus (TP) avg. conc. mg/L	Total Kjeldahl Nitrogen (TKN) avg. conc. mg/L
January	169	271	4.1	38.44
February	161	252	4.6	37.15
March	131	211	3.6	34.78
April	147	166	4.1	41.30
May	77	187	4.1	44.10
June	153	226	5.1	47.88
July	135	186	5.1	50.70
August	121	186	5.6	38.76
September	100	197	6.0	39.40
October	174	223	6.0	45.68
November	162	185	5.4	47.60
December	187	173	4.5	42.35
Average	143	205	4.9	42.35
Minimum	77	166	3.6	34.78
Maximum	187	271	6.0	50.70
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) Average (avg.) Concentration (conc.) milligrams 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	Unionized Ammonia mg/L
January	2.8	185	7.4	490	0.35	23	0.0
February	2.7	138	8.3	423	0.29	15	0.0
March	2.1	125	7.6	453	0.33	20	0.0
April	2.7	138	6.9	353	0.55	28	0.0
May	2.6	119	5.9	271	0.39	18	0.0
June	3.2	152	7.4	352	0.43	20	0.0
July	2.3	106	7.6	352	0.51	24	0.0
August	2.7	125	7.7	357	0.55	25	0.0
September	1.8	84	4.9	230	0.51	24	0.0
October	2.3	107	6.4	299	0.54	25	0.0
November	4.4	204	11.6	537	0.62	29	0.0
December	3.2	169	10.3	544	0.46	24	0.0
Average	2.7	139	7.7	389	0.46	23	0.0
Minimum	1.8	84	4.9	230	0.29	15	0.0
Maximum	4.4	204	11.6	544	0.62	29	0.0
ECA Limit	25.0	2,108	25.0	2,108	1.0	84	
ECA Objective	15.0		15.0		0.8		
Within Compliance	Yes	Yes	Yes	Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes

Table 3 Final Effluent Analyses continued

Month	Total Ammonia Nitrogen (TAN) Average (avg.) Concentration (conc.) milligrams per litre (mg/L) Winter	TAN avg. conc. (mg/L) Summer	TAN Loading kg/day Winter	TAN Loading kg/day Summer	Total Chlorine Residual avg. conc. mg/L	pH minimum	pH maximum	Temperature avg. Degree Celsius
January	0.43		28		0.00	6.8	7.6	13.2
February	1.69		86		0.00	6.7	7.6	12.7
March	2.03		121		0.00	6.8	7.5	12.7
April	1.52		78		0.00	6.9	7.4	13.7
May		0.46		21	0.00	6.8	7.5	15.4
June		2.00		95	0.00	7.0	7.6	18.2
July		1.60		74	0.00	6.7	7.3	20.8
August		1.29		60	0.00	6.6	7.3	21.7
September		0.80		37	0.00	6.7	7.1	21.8
October		1.13		53	0.00	6.5	7.3	20.1
November	0.83		38		0.00	6.5	7.5	18.1
December	1.09		58		0.00	6.7	7.4	15.7
Average	1.27	1.21	68	57	0.00			17.0
Minimum	0.43	0.46	28	21	0.00	6.5		12.7
Maximum	2.03	2.00	121	95	0.00		7.6	21.8
ECA Limit	24.0	16.0	2,024	1,350	0.02	6.0	9.5	
ECA Objective	18.0	8.0			Non-detect	6.5	8.5	
Within Compliance	Yes		Yes	Yes	Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes			Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	9	43
February	8	24
March	6	4
April	5	9
May	4	6
June	9	12
July	9	17
August	8	38
September	9	16
October	9	90
November	8	161
December	10	23
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	180,190	10,779	7,297	879,632	18,107
February	170,190	7,278	7,934	819,547	21,364
March	144,890	8,976	8,490	870,389	17,401
April	147,880	6,957	7,801	846,951	13,973
May	173,450	6,688	6,661	868,257	9,577
June	165,460	7,098	4,666	793,072	
July	168,010	7,424	7,495	812,363	
August	164,340	7,579	5,754	830,289	1,449
September	179,340	6,657	4,362	829,351	5,070
October	167,510	6,823	5,487	848,187	6,666
November	172,180	6,246	7,009	826,535	14,108
December	155,370	9,051	11,201	836,515	11,454
Total	1,988,810	91,556	84,157	10,061,088	119,169