Corbett Creek Water Pollution Control Plant

2022 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) 2022 Annual Performance Report provides staff, stakeholders, and customers a performance overview of the plant for the 2022 calendar year. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment, Conservation and Parks (MECP). This report demonstrates the commitment to ensuring that the WPCP delivers wastewater services to our customers in an environmentally responsible manner.

Water Pollution Control Plant Process Description
General

The Corbett Creek WPCP is located in the Town of Whitby and is owned and operated by the Regional Municipality of Durham (Region). The plant is operated in accordance with the terms and conditions of the ECA's noted above. Corbett Creek WPCP treats wastewater from the Whitby, Brooklin and Oshawa service areas. The plant services approximately 166,291 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 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 549 kilometres of sanitary sewers. It is conveyed to the plant by gravity and several sanitary sewage pumping stations located throughout the collection system.

Preliminary Treatment

Screening: Two mechanically cleaned screens and one manually cleaned screen 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) are 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 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.

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-millimetre diameter outfall that extends 773 metres into Lake Ontario.

Solids Management

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 biosolids, 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 is pumped to the biosolids holding facility. From there the treated biosolids can be utilized on approved agricultural fields or are hauled to Duffin Creek Water Pollution Control Plant (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 62% of its annual average rated flow capacity and received a maximum daily flow of 94,864 cubic metres per day on February 17th, 2022. 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;

Operating problems encountered and corrective actions taken in 2022 included:

- The Corbett Creek WPCP experienced ongoing excess foaming in the primary digesters. Operations reduced the primary sludge feed rate and mixing times to help reduce the foam as needed. Volatile acid and alkalinity tests were performed regularly to monitor the issue. A consulting firm has been retained to investigate and rectify this issue,
- The plant occasionally receives defective loads of ferrous chloride which can plug the feed pumps and delivery lines. Operations cleaned the lines and pumps in 2022 as needed,
- The level indicator radar units in the primary digesters failed due to excess foaming and moisture. Two of the units were replaced in 2022, with one remaining unit scheduled for replacement in 2023,
- Sweeper arms and a new pump were installed in secondary clarifier 10 to assist with the continued plugging of the waste activated sludge lines,
- The raw screen compactor auger was worn out and unable to auger the screenings. A new auger was installed in 2022,
- The boiler was failing to switch between natural gas and digester gas due to a bad contact inside an enclosed relay. One unit was repaired in 2022, with more controls added to mitigate this issue. This work continues in 2023 on the remaining units.

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 2022 included:

- Added sweeper arms, a new pump, and jetted siphons to secondary clarifier 10,
- Cleaned out final contact chambers biannually,
- Replaced various plug valves with knife gate valves,
- Replaced various aluminum gates with stainless steel slide gates,
- Replaced two return activated sludge pumps in plant 4,
- Installed one new return activated sludge pump in plant 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 WPCP operators using various field or laboratory test equipment.

e) Summary of the calibration and maintenance carried out on all effluent monitoring equipment;

The influent flow meter for plant 4 failed calibration on May 3rd and again on November 14th, 2022. The meter was replaced on January 30th, 2023. Replacement was delayed due to issues obtaining parts as well as technical issues with the installation process.

Calibration of all flow meters was conducted on November 14th, 2022.

All monitoring and laboratory equipment is calibrated and maintained according to the manufacturer's specifications at the Corbett Creek WPCP.

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 (ECA) limits.

- The annual average daily flow did not exceed the rated capacity of 84,350 cubic metres per day (m^3/d),
- The total suspended solids objective of 15.0 mg/L was exceeded in 85 of 506 samples (16.8%). Total suspended solids results are monitored daily, and adjustments are made to the process as required,
- The total phosphorus objective of 0.8 mg/L was exceeded in 25 of 352 samples (7.1%). Total phosphorus results are monitored daily, and adjustments are made to the process as required,
- The total chlorine residual objective of "non-detect" was exceeded in 73 of 358 samples (20.4.%). The ECA states an objective concentration of "non-detect", however, the

instrumentation has a detection limit of 0.0025 mg/L. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals,

- The E.coli objective was exceeded in 1 of 12 monthly samples (8.3%). Chlorine residuals are monitored daily, and 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 2022 was 83,095 cubic metres (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 or transferred to Duffin Creek WPCP for incineration.

Receiving facilities included:

Agricultural Fields – 55,230 m^3 or 66.5%

Duffin Creek WPCP – 27,865 m^3 or 33.5%

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

A summary of complaints received from the public is administered through a central database.

No complaints were received in 2022.

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

There were no by-pass, spill or abnormal discharge events in 2022.

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 (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 effluent objectives.

Table 1 Raw Influent Flows

Month	Total Plant Flow* cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	1,658,972	53,515	56,496
February	1,661,450	59,338	94,864
March	2,053,682	66,248	86,549
April	1,746,612	58,220	65,347
May	1,659,405	53,529	62,503
June	1,544,052	51,468	63,154
July	1,504,157	48,521	58,511
August	1,436,283	46,332	51,728
September	1,389,262	46,309	52,015
October	1,463,450	47,208	52,287
November	1,424,111	47,470	58,056
December	1,684,509	54,339	84,601
Total	19,225,945		
Average	1,602,162	52,674**	
Maximum	2,053,682		94,864
ECA Limit		84,350	
Met Compliance		Yes	

*Metered at the Raw Influent

**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	137	158	4.6	46.00
February	121	114	3.7	39.38
March	98	126	3.0	33.82
April	135	151	3.6	41.28
May	157	143	3.7	42.42
June	164	158	4.1	47.73
July	173	176	4.4	45.28
August	169	157	4.4	46.02
September	167	243	4.9	50.50
October	166	153	4.2	46.54
November	164	168	3.8	44.98
December	157	145	4.0	43.50
Average	151	158	4.0	43.95
Minimum	98	114	3.0	33.82
Maximum	173	243	4.9	50.50
Sampling Frequency Requirement Met	Yes	Yes	Yes	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
January	1.9	102	6.0	321
February	4.1	243	9.2	546
March	2.6	172	5.2	344
April	3.6	210	14.1	821
May	2.6	139	9.1	487
June	3.8	196	17.9	921
July	4.1	199	16.2	786
August	1.9	88	9.0	417
September	1.3	60	9.2	426
October	1.5	71	11.3	533
November	1.4	66	6.1	290
December	2.1	114	8.2	446
Average	2.6	136	10.1	533
Minimum	1.3	60	5.2	290
Maximum	4.1	243	17.9	921
ECA Limit	25.0	2,108	25.0	2,108
ECA Objective	15.0		15.0	
Within Compliance	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	

Table 3 Final Effluent Analyses continued

Month	Total Phosphorus (TP) average (avg.) concentration (conc.) milligram per litre (mg/L)	TP loading kilogram per day (kg/d)	Unionized Ammonia mg/L	Total Ammonia Nitrogen (TAN) avg. conc. mg/L Winter	TAN avg. conc. (mg/L) Summer	TAN Loading kg/day Winter	TAN Loading kg/day Summer
January	0.36	19	0.0	1.11		59	
February	0.38	23	0.0	1.12		66	
March	0.38	25	0.0	0.43		28	
April	0.55	32	0.0	0.46		27	
May	0.42	22	0.0		0.11		6
June	0.58	30	0.0		0.11		6
July	0.72	35	0.0		0.14		7
August	0.63	29	0.0		0.10		5
September	0.45	21	0.0		0.35		16
October	0.46	22	0.0		0.12		6
November	0.39	19	0.0	0.74		35	
December	0.38	21	0.0	0.08		4	
Average	0.48	25	0.0	0.66	0.16	37	7
Minimum	0.36	19	0.0	0.08	0.10	4	5
Maximum	0.72	35	0.0	1.12	0.35	66	16
ECA Limit	1.0	84		24.0	16.0	2,024	1,350
ECA Objective	0.8			18.0	8.0		
Within Compliance	Yes	Yes		Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes		

Table 3 Final Effluent Analyses continued

Month	Total Chlorine Residual average (avg.) concentration milligrams per litre	pH minimum	pH maximum	Temperature avg. Degree Celsius
January	0.00	6.9	7.4	14.0
February	0.00	6.8	7.5	13.0
March	0.00	6.8	7.2	12.6
April	0.00	6.7	7.9	13.6
May	0.00	6.7	7.8	15.9
June	0.00	6.6	7.1	17.7
July	0.00	6.7	7.3	20.3
August	0.00	6.7	7.1	21.6
September	0.00	6.6	7.1	21.5
October	0.00	6.8	7.1	19.6
November	0.00	6.9	7.2	18.2
December	0.00	6.8	7.2	15.7
Average	0.00			17.0
Minimum	0.00	6.6		10.8
Maximum	0.00		7.9	23.2
ECA Limit	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

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	8	129
February	7	23
March	10	6
April	8	10
May	9	151
June	8	31
July	8	63
August	9	106
September	8	54
October	8	66
November	8	99
December	9	63
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	155,073	7,249	8,706	863,112	41,213
February	165,370	8,953	7,881	786,951	17,770
March	143,919	7,555	7,930	864,015	17,611
April	104,618	5,994	11,467	797,895	15,469
May	115,417	6,149	15,920	767,163	7,534
June	107,960	8,051	17,350	755,844	939
July	127,490	8,345	19,897	787,916	4,937
August	148,423	7,865	18,160	779,760	4,288
September	146,640	7,608	15,016	726,939	5,380
October	136,550	5,918	13,514	786,089	13,537
November	128,250	5,235	12,257	819,202	13,474
December	126,100	7,316	14,008	837,078	17,924
Total	1,605,810	86,238	162,106	9,571,964	160,076