



Corbett Creek Water Pollution Control Plant 2023 Annual Performance Report





The Regional Municipality of Durham

Corbett Creek Water Pollution Control Plant 2023 Annual Performance Report

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) 2023 Annual Performance Report provides staff, stakeholders, and customers a performance overview of the plant for the 2023 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 168,775 residents.

The Corbett Creek WPCP is designed to treat wastewater at an average daily flow rate of 84,350 cubic metres per day (m³/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 555 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 sulfide. 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 7560-9PPRJ 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 67% of its annual average rated flow capacity and received a maximum daily flow of 106,314 cubic metres per day on February 10, 2023.

- The total phosphorus (TP) average concentration limit of 1.0 mg/L was exceeded in 2 of 12 months (16.7%),
- The total phosphorus average waste loading limit of 84 kg/d was exceeded in 1 of 12 months (8.3%),
- The total suspended solids (TSS) average concentration limit of 25.0 mg/L was exceeded in 2 of 12 months (16.7%),
- The total suspended solids average waste loading limit of 2,108 kg/d was exceeded in 1 of 12 months (8.3%),
- The E. coli limit of 200 CFU/100mL was exceeded in 3 of 12 months (25%),

A large industrial site close to the Corbett Creek WPCP began commissioning their wastewater treatment system in 2023. This led to uncharacteristic influent loadings. As a result, Corbett Creek exceeded the effluent limits for TP and TSS for the months of November and December. Regional staff met with Ministry of the Environment, Conservation and Parks (MECP) staff to discuss a resolution to the issues in January 2024. Numerous in-house solutions are being examined by staff and a third-party consultant is being engaged to assist the Region. A final report detailing the compliance issues and corrective actions will be provided to the MECP.

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

Operating problems encountered and corrective actions taken in 2023 included:

- Corbett Creek experienced high influent chemical oxygen demand and total phosphorus loadings in the second half of 2023. Operating parameters and conditions such as chemical dosage and dissolved oxygen were reviewed and changed regularly to accommodate the fluctuation in influent loadings,



Corbett Creek Water Pollution Control Plant 2023 Annual Performance Report

- Heating issues were encountered with digester 2. The 3-way valve regulating the hot water to the heat exchanger was not operating properly, resulting in the digester temperature becoming too low. The valve was operated manually by operations staff until it could be replaced,
- Foaming issues were encountered in digester 2. Raw sludge pumping was decreased and mixing was stopped except when sludge was being transferred out of the digester,
- The digester pumps became plugged regularly during the end of the year. This was due to foaming issues in the digester causing inaccurate level readings. The digester would be pumped lower than anticipated because of the inaccurate readings, and debris from the top of the tank would be pulled into the pumps. Pumps were cleaned out as needed,
- The monthly average effluent E. coli results exceeded the Environmental Compliance Approval (ECA) limit of 200 CFU/100mL in the months of June, July and August. Operators closely monitored chlorine residual and installed baffles in the plant 2/3 chlorine contact chambers to improve chlorine mixing and contact time,
- The monthly average total suspended solids results exceeded the ECA limit of 25 mg/L in November and December. Numerous in-house solutions are being examined by staff and a third-party consultant is being engaged to assist with this complicated matter,
- The monthly average total phosphorus results exceeded the ECA limit of 1.0 mg/L in November and December. Numerous in-house solutions are being examined by staff and a third-party consultant is being engaged to assist with this complicated matter,
- Multiple high flow events due to heavy precipitation occurred throughout the year. Operations staff monitored the plant and made adjustments as necessary,
- Ferrous chloride lines routinely became plugged due to the quality of ferrous received. The chemical supplier has been contacted and is reviewing the quality of the product,
- The plant experienced low dissolved oxygen in aeration tanks caused by plugged stone diffusers. Diffusers will be cleaned or replaced in 2024,
- A programming issue occurred after upgrading the programmable logic controller (PLC) controlling the return activated sludge from trains 5 and 6. Operators manually ran the system until the PLC was fixed.

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 2023 included:

- Replaced ferrous chloride pump lines, heads, and motors,
- Installed baffles in plant 2/3 chlorine contact chambers to improve mixing,
- Rebuilt two return activated sludge pumps and two waste activated pumps in plant 4,
- Rebuilt one return activated sludge pump in plant 2/3,
- Replaced two gearboxes in grit classifiers and screen packer system,



Corbett Creek Water Pollution Control Plant 2023 Annual Performance Report

- Second gas booster was brought online. This conveys digester gas to the boilers that heat the hot water system,
- Refurbished two secondary clarifiers and one primary clarifier with new wheels and springs,
- Replaced hot water 3-way valve on heat exchanger,
- Repaired main chlorine holding tank for plant 4; replaced gaskets and piping,
- Cleaned ferrous tanks and replaced gaskets,
- Installed new alarm auto callout system.

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.

On-line instrumentation is verified by water pollution control plant (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 August 1, 2023.

Calibration of in-house laboratory equipment was conducted on July 13, 2023.

Calibration of the in-house lab 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 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 (m³/d),
- The total suspended solids (TSS) objective of 15.0 mg/L was exceeded in 157 of 486 samples (32.3%). This was likely due to the high influent TSS loadings the plant received. 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 109 of 344 samples (31.7%). This was likely due to the high total phosphorus loadings the plant received. 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 56 of 359 samples (15.6.%). The ECA states an objective concentration of “non-detect”, however, the instrumentation has a detection limit of 0.005 mg/L. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals,



Corbett Creek Water Pollution Control Plant 2023 Annual Performance Report

- The E.coli objective was exceeded in 3 of 12 samples (25%). Chlorine residuals are monitored daily, and adjustments are made to the process as required. Baffles were installed to increase chlorine mixing and contact time between the chlorine and effluent.

Best efforts will continue to be applied to maintain results below the objectives.

g) Tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed;

The volume of sludge removed from Corbett Creek Water Pollution Control Plant (WPCP) in 2023 was 62,855 cubic meters (m³).

Even with the increase in population on a year-to-year basis, no significant changes to flows or processing are anticipated. Therefore, no significant changes in sludge generation are expected for the next year.

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

Receiving facilities included:

Agricultural Fields – 45,959 m³ or 73.1%

Duffin Creek WPCP – 16,896 m³ or 26.8%

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 2023.

i) Summary of all Bypass, spill or abnormal discharge;

- On January 4, approximately 199 cubic meters (m³) of wastewater bypassed primary treatment facilities during a 2 hour and 50-minute event resulting from heavy precipitation. Bypassed flow was disinfected before being mixed with plant effluent and being discharged to Lake Ontario. Ministry of the Environment, Conservation and Parks (MECP) Incident Report #1-2FW08T,
- On June 24, approximately 2,500 m³ of wastewater bypassed primary treatment during the 4 hour and 45-minute bypass event resulting from heavy precipitation. Bypassed flow was directed to the bypass channel where it was disinfected before mixing with plant effluent. MECP Incident Report #1-3KP4WV.

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.



**Corbett Creek Water Pollution Control Plant
2023 Annual Performance Report**

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.



**Corbett Creek Water Pollution Control Plant
2023 Annual Performance Report**

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	1,937,755	62,508	100,687
February	1,795,160	64,113	106,314
March	2,146,907	69,255	96,176
April	1,931,610	64,387	101,629
May	1,770,373	57,109	75,018
June	1,792,948	59,765	102,116
July	1,721,277	55,525	60,632
August	1,604,122	51,746	61,648
September	1,470,844	49,028	51,896
October	1,512,881	48,803	53,281
November	1,460,913	48,697	51,827
December	1,662,030	53,614	63,389
Total	20,806,820		
Average	1,733,902	57,005**	
Maximum	2,146,907		106,314
ECA Limit		84,350	
Met Compliance		Yes	

*Metered at the Raw Influent

**Annual Average Daily Flow



**Corbett Creek Water Pollution Control Plant
2023 Annual Performance Report**

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	174	3.8	40.18
February	90	81	2.7	31.60
March	103	91	2.5	26.45
April	122	151	3.3	34.88
May	104	140	4.0	32.26
June	140	161	4.5	38.78
July	186	207	4.9	38.92
August	172	206	5.2	44.12
September	177	209	6.9	47.30
October	175	203	6.2	48.96
November	179	163	6.5	50.90
December	172	215	7.2	46.10
Average	146	167	4.8	40.04
Minimum	90	81	2.5	26.45
Maximum	186	215	7.2	50.90
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	2.6	163	15.3	956
February	2.1	135	9.4	603
March	2.0	139	8.2	568
April	2.3	148	11.9	766
May	1.7	97	10.6	605
June	2.8	167	20.6	1,231
July	1.7	94	10.6	589
August	1.3	67	9.9	512
September	1.6	78	14.5	711
October	2.0	98	21.3	1,040
November	4.7	229	32.5	1,583
December	5.7	306	45.9	2,461
Average	2.5	145	17.6	1,001
Minimum	1.3	67	8.2	512
Maximum	5.7	306	45.9	2,461
ECA Limit	25.0	2,108	25.0	2,108
ECA Objective	15.0		15.0	
Within Compliance	Yes	Yes	No	No
Sampling Frequency Requirement Met	Yes		Yes	



**Corbett Creek Water Pollution Control Plant
2023 Annual Performance Report**

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	0.60	38	0.0	0.16		10	
February	0.36	23	0.0	0.17		11	
March	0.27	19	0.0	0.20		14	
April	0.42	27	0.0	0.52		33	
May	0.66	38	0.0		0.41		23
June	0.89	53	0.0		0.32		19
July	0.39	22	0.0		2.35		130
August	0.78	40	0.0		0.59		31
September	0.78	38	0.0		0.59		29
October	1.00	49	0.0		1.31		64
November	1.34	65	0.0	1.02		50	
December	1.85	99	0.0	3.60		193	
Average	0.78	44	0.0	0.95	0.93	52	49
Minimum	0.27	19	0.0	0.16	0.32	10	19
Maximum	1.85	99	0.0	3.60	2.35	193	130
ECA Limit	1.0	84		24.0	16.0	2,024	1,350
ECA Objective	0.8			18.0	8.0		
Within Compliance	No	No		Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes		



**Corbett Creek Water Pollution Control Plant
2023 Annual Performance Report**

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	7.0	7.4	14.7
February	0.00	6.9	7.3	14.4
March	0.00	7.0	7.6	13.5
April	0.00	6.9	7.3	14.4
May	0.00	6.8	7.2	16.5
June	0.00	7.0	7.3	19.9
July	0.00	6.9	7.4	22.1
August	0.00	6.9	7.5	22.8
September	0.00	6.9	7.4	23.0
October	0.00	7.1	7.5	22.7
November	0.00	7.1	8.2	19.9
December	0.00	6.9	7.6	18.4
Average	0.00			18.5
Minimum	0.00	6.8		13.5
Maximum	0.00		8.2	23.0
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	9	21
February	8	17
March	9	59
April	7	56
May	9	51
June	11	628
July	8	287
August	12	273
September	7	131
October	10	145
November	9	107
December	8	40
ECA Requirement		200
ECA Objective		150
Within Compliance		No
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	139,600	9,033	15,813	877,178	23,316
February	129,250	9,406	13,316	780,160	18,927
March	143,290	10,442	13,774	836,076	21,399
April	120,010	9,393	10,439	839,586	13,618
May	131,690	8,274	8,054	841,439	9,479
June	179,030	9,668	11,143	804,866	5,609
July	173,890	9,029	17,629	851,941	3,725
August	171,600	13,454	15,202	845,161	2,183
September	245,430	14,987	15,735	862,885	3,360
October	231,450	14,632	14,582	888,635	4,898
November	254,990	10,790	14,834	873,012	9,524
December	251,840	10,973	15,691	880,705	17,393
Total	2,172,070	130,080	166,212	10,181,642	133,431