Uxbridge Brook Water Pollution Control Plant

2019 Annual Performance Report

The Regional Municipality of Durham
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Environmental Compliance Approval (ECA): 8357-8CTQ5V Dated June 28, 2012
Environmental Compliance Approval (Air): 6581-67GRPR Dated December 10, 2004

The Uxbridge Brook Water Pollution Control Plant (WPCP) 2019 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Uxbridge Brook WPCP in 2019. 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 Uxbridge Brook WPCP located in the Township of Uxbridge is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECA. This MECP Class 3 wastewater treatment plant utilizes an extended aeration process with tertiary treatment and is designed to treat wastewater at a rated capacity of 5,221 cubic metres per day (m^3/d). The Uxbridge Brook WPCP has a service population of 11,686 residents. Uxbridge Brook WPCP treats wastewater from the Uxbridge service area utilizing the following processes;

- raw influent pumping,
- preliminary treatment,
- phosphorus removal,
- secondary treatment,
- tertiary filtration,
- disinfection, and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 50.7 kilometres of sanitary sewers in Uxbridge and is conveyed to the WPCP by gravity and the Sandy Hook sanitary sewage pumping station (SSPS).

Preliminary Treatment

Screening: There are two bar screens in the screening room for the removal of paper products and large material that could harm pumps and process equipment. One channel contains an automatic, mechanically raked bar screen and the other is equipped with a manually raked bar screen to provide

screening on an emergency basis. Screenings are removed in this process and transported to landfill for disposal.

Grit Removal: Vortex grit removal is provided to remove sand and small stones (grit) for the protection of mechanical equipment from unnecessary wear and to reduce formation of heavy deposits in pipelines, channels and process tanks. The vortex grit removal chamber uses centrifugal force to separate the grit from the wastewater. Grit is collected in the lower portion of the grit tank and is pumped to a grit classifier for dewatering. The dewatered grit is conveyed to the grit/screenings bin for landfill disposal.

Phosphorus Removal

The phosphorous removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant, aluminum sulphate, as part of the treatment process. Aluminum sulphate can be added at multiple locations throughout the plant.

Secondary Treatment

Aeration Tanks: Preliminary effluent flow is directed to two aeration tanks. Fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics and nutrients.

Secondary Clarifiers: The effluent from the aeration tanks is directed to three secondary clarifiers where solids settle quickly as activated sludge leaving a clear effluent. A portion of the activated sludge collected on the bottom of the clarifiers is pumped back to the front of the aeration tanks and any excess activated sludge is sent to the aerobic digester.

Tertiary Treatment

Tertiary Sand Filter: Effluent from the secondary clarifiers is filtered through two automatic self-cleaning sand filters. The automatic backwash is initiated by an increase in head pressure or on a programmed timer. The backwash water is returned to the front of the plant for further treatment.

Disinfection

Ultra Violet (UV) Irradiation: The effluent flow from the sand filter is then directed to the UV channel for disinfection. The effluent passes two banks of UV lamps connected in series. The treated final effluent is discharged to the Uxbridge Brook.

Solids Treatment

Aerobic Digester: Waste activated sludge from the secondary clarifiers is pumped to a two-stage aerobic digester for stabilization. A coarse bubble diffuser provides oxygen for the microorganisms. The diffusers are turned off to allow solids to settle for removal and the supernatant is returned to the front of the plant for further treatment.

Sludge Management: Stabilized biosolids from the digester are transported to Duffin Creek WPCP for further treatment and incineration.

Environmental Compliance Approval

Under Condition 9.(5) of ECA #8357-8CTQ5V the Region must produce an annual performance report that must contain 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 Uxbridge Brook WPCP effluent was compliant with the approval limits during the reporting period. The plant operated at 72.6% of its rated capacity and received a maximum daily flow of 6,828 m^3/d on April 20.

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

There were no operating issues encountered in 2019.

c) Summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works;

- replaced the alum tank level sensor, and
- repaired the ventilation system to filter number 2 building.

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 plant flow meter was conducted on May 28 and October 21.
- Calibration of the in-house laboratory equipment was conducted on August 27.
- Verification of the pH meter is conducted regularly.

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

The Region strives to achieve the best effluent quality at all times and produce results below the ECA compliance limits.

- The effluent objective for total suspended solids was exceeded in 2 of 311 samples (0.6%)
- The effluent objective for total phosphorus was exceeded in 24 of 311 samples (7.7%).

- Results were monitored and adjustments were made to the treatment process.
- The effluent pH was below the minimum effluent objective of 6.5 in 3 of 236 samples (1.3%). Maintenance and cleaning of the pH electrode probe is performed regularly.
- On September 4, a raw grab sample was used as part of a weekly sampling requirement in place of a composite sample. In all future instances staff resampled on the following day to obtain a composite sample if the automatic sampler malfunctioned.
- Between September 3 and 20, total phosphorus on the raw influent and final effluent was read as orthophosphate instead of orthophosphate-phosphorus. Values were corrected by multiplying orthophosphate values by 0.3261 as recommended by the laboratory equipment supplier, Hach. Staff will ensure the spectrophotometer is reading the correct chemical formula after each calibration.

Best efforts 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 Uxbridge Brook WPCP in 2019 was 16,884 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 was transported to Duffin Creek WPCP for incineration.

h) Summary of any complaints received during the reporting period and any steps taken to address the complaints;

A summary of complaints received from the public is administered through a central database. An odour complaint from an Uxbridge resident was received and investigated on December 9. Staff found no unusual odours at the plant and there were no process abnormalities at that time frame. The odour could not be confirmed as emanating from the plant. The resident did acknowledge the odour had dissipated during a follow up call on the same day.

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

No by-passes, spills or abnormal discharges occurred during the reporting period.

j) Status Update of the Initial Effluent Characterization;

The initial effluent characterization report was submitted to MECP in 2016**.**

k) Information Required by Ministry of the Environment, Conservation and Parks (MECP) District Manager;

No additional information was requested**.**

Ministry of the Environment, Conservation and Parks (MECP) Inspection

The plant was inspected by the MECP on March 7, 2019. No compliance items were identified in the report. The MECP did however, recommend that the Region continue to use best efforts to ensure the effluent of the WPCP meets the objectives outlined in the ECA. The ventilation system to filter number 2 building was repaired as recommended to ensure the facility was maintained in a good state of repair.

Table 1 Final Effluent Flows

Month	Total Plant Flow metered at the Final Effluent cubic metre (m^3)	Average Daily Flow In cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	105,835	3,414	3,913
February	92,290	3,296	4,513
March	113,369	3,657	5,294
April	143,967	4,799	6,828
May	155,727	5,023	6,449
June	125,927	4,198	4,890
July	116,958	3,773	4,471
August	101,039	3,259	3,668
September	99,289	3,310	3,771
October	100,675	3,248	4,222
November	106,606	3,554	3,897
December	120,927	3,901	4,516
Total	1,382,609		
Average	115,217	3,788*	
Minimum	92,290		
Maximum	155,727		6,828
ECA Limit		5,221	15,110
Met Compliance		Yes	Yes

*Annual average

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand (BOD_5) average (avg.) concentration (conc.) milligram per litre (mg/L)	BOD_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	Dissolved Phosphorus avg. conc. mg/L
January	148	506	168	575	4.6	16	2.8
February	163	537	181	596	4.0	13	2.5
March	160	586	178	649	5.1	19	3.3
April	113	540	142	681	3.4	16	1.7
May	131	660	181	908	3.5	17	2.0
June	126	528	172	720	3.7	16	2.2
July	188	709	278	1,049	3.8	14	2.1
August	157	512	169	550	4.3	14	2.7
September	172	568	233	770	5.1	17	6.3
October	165	537	191	621	4.7	15	2.5
November	143	507	211	750	4.3	15	2.8
December	161	627	200	782	3.8	15	2.4
Average	152	576	192	727	4.2	16	2.8
Minimum	113	506	142	550	3.4	13	1.7
Maximum	188	709	278	1,049	5.1	19	6.3
Sampling Frequency Requirement Met	Yes		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	Alkalinity Calcium Carbonate mg/L	pH minimum	pH maximum	Temp. Degrees Celsius avg.
January	33.86	24.0	82	298	6.9	8.6	12.1
February	33.40	23.9	79	355	7.5	8.4	12.1
March	36.75	23.7	87	309	6.9	8.4	12.4
April	25.38	18.7	90	318	7.5	8.2	12.3
May	27.12	16.8	84	406	7.3	8.3	14.1
June	28.65	20.8	87	337	7.2	8.1	16.2
July	34.92	23.0	87	312	7.7	8.3	18.5
August	34.85	23.7	77	348	6.9	8.2	20.3
September	47.50	26.3	87	332	7.1	8.6	18.2
October	36.00	24.7	80	346	7.1	8.6	17.1
November	34.23	23.5	84	361	7.6	8.5	15.0
December	32.56	21.9	85	321	7.4	8.5	13.2
Average	33.77	22.6	86	337			
Minimum	25.38	16.8	77	298	6.9		12.1
Maximum	47.50	26.3	90	406		8.6	20.3
Sampling Frequency Requirement Met	Yes	Yes		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 monthly avg. kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading monthly avg. kg/d	Total Phosphorus (TP) avg. conc. mg/L	TP loading avg. kg/d	TP loading kilogram per month
January	1.2	4	2.1	7	0.09	0	9
February	1.0	3	2.3	8	0.07	0	6
March	1.0	4	1.3	5	0.07	0	7
April	1.0	5	1.6	8	0.04	0	5
May	1.0	5	1.8	9	0.05	0	8
June	1.0	4	1.6	7	0.06	0	7
July	1.0	4	1.9	7	0.07	0	9
August	1.0	3	0.9	3	0.06	0	6
September	1.0	3	0.9	3	0.08	0	8
October	1.0	3	0.5	2	0.05	0	5
November	1.0	4	0.7	3	0.04	0	4
December	1.4	5	1.2	5	0.07	0	9
Total							83***
Average	1.0	4	1.4	5	0.06	0	7
Minimum	1.0	3	0.5	2	0.04	0	4
Maximum	1.4	5	2.3	9	0.09	0	9
ECA Limit	8.5*	30.9**	10*	36.3**	0.15*	0.78**	286***
ECA Objective	5		5		0.1		
Lake Simcoe Phosphorus Reduction Strategy					0.15****		286***
Within Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes		

*Monthly Average Concentration
**Monthly Average Loading, kg/day
***Total Annual Loading, kilogram/year
****Annual Average Concentration

Table 3 Final Effluent Analyses continued

Month	Dissolved Phosphorus average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Ammonia Nitrogen (TAN) Winter avg. conc. mg/L	TAN Winter loading monthly avg. kilogram per day (kg/d)	TAN Summer avg. conc. mg/L	TAN Summer loading monthly avg. kg/d	Total Kjeldahl Nitrogen (TKN) avg. conc. mg/L	Un-ionized Ammonia Nitrogen avg. conc. mg/L
January	0.04	0.02	0			0.72	0.0
February	0.01	0.04	0			0.70	0.0
March	0.01	0.08	0			0.79	0.0
April	0.01	0.09	0			0.62	0.0
May	0.01			0.04	0	0.58	0.0
June	0.01			0.02	0	0.65	0.0
July	0.02			0.03	0	0.66	0.0
August	0.02			0.03	0	0.59	0.0
September	0.03			0.04	0	0.71	0.0
October	0.03			0.02	0	0.61	0.0
November	0.01			0.02	0	0.56	0.0
December	0.02	0.03	0			0.63	0.0
Average	0.02	0.05	0	0.03	0	0.65	0.0
Minimum	0.01	0.02	0	0.02	0	0.56	0.0
Maximum	0.04	0.09	0	0.04	0	0.79	0.0
ECA Limit		6*	21.8**	3*	10.9**		0.1*
ECA Objective		5		2			
Within Compliance		Yes	Yes	Yes	Yes		Yes
Sampling Frequency Requirement Met	Yes	Yes		Yes			

*Monthly Average Concentration

**Monthly Average Loading, kg/day

Table 3 Final Effluent Analyses continued

Month	Nitrate Nitrogen average (avg.) concentration (conc.) milligram per litre (mg/L)	Alkalinity calcium carbonate mg/L	pH minimum.	pH maximum.	Temp. Degrees Celsius avg.
January	25.1	126	6.7	7.4	11.1
February	24.8	91	6.6	7.4	11.3
March	23.7	97	6.7	7.1	11.0
April	19.0	123	6.5	7.2	12.2
May	17.8	172	6.9	7.7	14.0
June	22.1	116	6.7	7.7	16.7
July	25.7	125	6.8	7.3	19.1
August	28.4	100	6.7	8.0	20.8
September	30.4	94	6.5	7.0	18.6
October	29.5	109	6.4	7.1	17.0
November	25.0	125	6.5	7.1	14.2
December	23.0	126	6.6	7.1	12.8
Average	24.5	117			14.9
Minimum	17.8	91	6.4		11.0
Maximum	30.4	172		8.0	20.8
ECA Limit			6.0	9.5	
ECA Objective			6.5	9.0	
Within Compliance			Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	1
February	4	1
March	4	0
April	4	0
May	5	0
June	4	0
July	5	0
August	4	0
September	4	0
October	5	1
November	4	0
December	5	0
ECA Objective		200 organisms/100ml
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Aluminum Sulphate litre	Hydro kilowatt hour	Natural Gas cubic metre
January	18,880	140,197	1,973
February	22,951	125,669	5,189
March	23,069	130,163	2,181
April	26,898	130,229	2,977
May	29,264	131,522	549
June	24,623	126,040	153
July	15,517	115,643	176
August	17,169	119,413	53
September	13,924	115,610	182
October	15,281	120,466	107
November	17,228	122,502	1,396
December	16,902	129,558	4,228
Total	241,706	1,507,012	19,164