Uxbridge Brook Water Pollution Control Plant

2020 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) 2020 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Uxbridge Brook WPCP in 2020. 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 Community of Uxbridge 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 11,704 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 50.4 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: The vortex grit removal removes 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 (ECA)

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 71.1% of its rated capacity and received a maximum daily flow of 8,372 m^3/d on January 12, 2020.

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

A Request for Pandemic Related Temporary Relief (Alternative Arrangement) for Municipal Wastewater Systems was submitted to the MECP 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. Uxbridge 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:

- Repaired chain flights in secondary clarifiers
- Replaced check valve on raw lift pump #2

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 5 and October 6, 2020.
- Calibration of the in-house laboratory equipment was conducted on October 15, 2020.
- Calibration of the balance scale was conducted on March 2, 2020.

- Verification of the pH meter is conducted regularly.

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

The Region continually strives to achieve the best effluent quality at all times and remain below the objectives specified in the ECA.

- The total suspended solids objective of 5.0 mg/L was exceeded in 2 of 318 samples (0.6%)
- The total phosphorus objective of 0.1 mg/L was exceeded in 14 of 354 samples (3.9%)
- The total ammonia nitrogen objective of 2.0 mg/L was exceeded in 2 of 354 samples (0.6%)
- The minimum effluent pH objective of 6.5 was exceeded in 26 of 258 samples (0.8%). Calibration and cleaning of the pH electrode probe is performed regularly.

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 2020 was 18,027 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 further treatment and 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. No complaints were received in 2020.

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 Ministry of the Environment, Conservation and Parks (MECP) in 2016**.**

k) Information Required by 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.

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	150,100	4,842	8,372
February	114,992	3,965	4,528
March	149,174	4,812	5,690
April	135,520	4,517	4,992
May	113,545	3,663	4,352
June	106,766	3,559	3,969
July	100,707	3,249	3,582
August	101,507	3,274	3,697
September	97,456	3,249	3,654
October	93,806	3,026	3,290
November	91,390	3,046	3,339
December	103,789	3,348	3,713
Total	1,358,752		
Average	113,229	3,712*	
Minimum	91,390		
Maximum	150,100		8,372
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)	Total Suspended Solids (TSS) avg. conc. mg/L	Total Phosphorus (TP) avg. conc. mg/L	Dissolved Phosphorus avg. conc. mg/L
January	124	178	3.8	1.6
February	135	217	3.8	1.7
March	187	340	3.0	1.4
April	181	422	3.5	2.0
May	139	335	4.1	2.4
June	196	318	4.4	2.7
July	217	261	4.9	3.0
August	172	275	4.4	2.6
September	188	307	4.9	2.8
October	231	349	5.3	3.3
November	246	427	4.9	2.7
December	288	403	4.7	2.9
Average	192	319	4.3	2.4
Minimum	124	178	3.0	1.4
Maximum	288	427	5.3	3.3
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	Alkalinity Calcium Carbonate mg/L	pH minimum	pH maximum	Temp. Degree Celsius avg.
January	30.1	17.2	321	7.5	9.2	12.4
February	29.5	20.4	337	7.3	8.4	12.7
March	26.6	15.4	323	7.3	8.2	11.9
April	31.4	19.7	320	6.9	8.3	13.5
May	32.7	21.0	308	6.8	8.2	14.6
June	36.3	24.4	335	7.4	8.3	16.7
July	42.0	25.4	338	7.0	8.2	18.5
August	38.6	23.3	337	6.7	8.4	18.8
September	43.0	25.0	354	6.7	8.3	18.0
October	45.0	28.4	362	7.6	8.5	17.5
November	39.3	24.7	340	7.8	8.5	16.1
December	41.0	27.5	350	6.6	8.5	14.1
Average	36.3	22.7	336			
Minimum	26.6	15.4	308	6.6		11.9
Maximum	45.0	28.4	362		9.2	18.8
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)	$CBOD_5$ kilogram per day (kg/d) year to date avg.	Total Suspended Solids (TSS) avg. conc. mg/L	TSS kg/d year to date avg.	Total Phosphorus (TP) avg. conc. mg/L	TP kg/d monthly avg.	TP kilogram per month year to date
January	1.0	4.8	2	9.0	0.06	0.28	9
February	1.0	4.4	1	6.5	0.06	0.23	15
March	1.0	4.6	1	5.3	0.05	0.26	23
April	1.0	4.5	0	4.3	0.05	0.21	30
May	1.0	4.4	0	3.7	0.05	0.20	36
June	1.0	4.2	1	3.4	0.05	0.18	41
July	1.0	4.1	1	3.1	0.04	0.10	44
August	1.0	4.0	1	3.1	0.03	0.10	47
September	1.0	3.9	1	2.9	0.04	0.10	51
October	1.0	3.8	1	3.0	0.08	0.20	59
November	1.0	3.7	1	3.1	0.05	0.20	63
December	1.0	3.7	1	3.3	0.05	0.20	68
Total							68***
Average	1.0	3.7	1	3.3	0.05	0.19	6
Minimum	1.0	3.7	0	2.9	0.03	0.10	9
Maximum	1.0	4.8	2	9.0	0.08	0.28	68
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 Average 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 kilogram per day (kg/d) monthly avg.	TAN Summer avg. conc. mg/L	TAN Summer kg/d monthly avg.	Unionized Ammonia Nitrogen avg. conc. mg/L
January	0.01	0	0.2			0.0
February	0.01	0	0.1			0.0
March	0.01	0	0.2			0.0
April	0.01	0	0.2			0.0
May	0.01			0	0.8	0.0
June	0.01			0	0.5	0.0
July	0.01			0	0.1	0.0
August	0.01			0	0.2	0.0
September	0.01			0	0.2	0.0
October	0.04			0	0.2	0.0
November	0.01			0	0.2	0.0
December	0.01	0	0.1			0.0
Average	0.01	0	0.2	0	0.3	0.0
Minimum	0.01	0	0.1	0	0.1	0.0
Maximum	0.04	0	0.2	0	0.8	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		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. Degree Celsius avg.
January	19.1	150	6.4	7.4	11.3
February	21.0	149	6.3	7.6	11.5
March	18.8	155	6.6	7.2	11.8
April	21.9	146	6.5	7.0	13.0
May	24.7	122	6.4	7.5	15.1
June	27.3	113	6.5	7.0	17.2
July	27.5	102	6.4	6.9	19.5
August	27.2	98	6.2	6.9	19.8
September	27.9	98	6.5	7.4	18.7
October	29.8	117	6.6	7.4	17.4
November	30.3	103	6.5	7.6	15.5
December	29.2	117	6.4	7.4	13.3
Average	25.4	123			15.3
Minimum	18.8	98	6.2		11.3
Maximum	30.3	155		7.6	19.8
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	8	0
February	8	0
March	8	0
April	4	0
May	4	0
June	10	1
July	8	1
August	9	1
September	9	1
October	8	1
November	9	1
December	9	1
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	19,765	135,650	1,792
February	18,939	125,020	7,356
March	24,839	129,083	1,721
April	19,234	122,999	12,045
May	18,408	126,401	1,090
June	16,225	122,802	150
July	16,100	127,595	166
August	17,717	129,784	6,571
September	17,913	120,003	160
October	13,323	126,155	291
November	14,891	125,931	1,199
December	17,549	129,038	1,853
Total	214,903	1,520,461	34,394