Uxbridge Brook Water Pollution Control Plant

2024 Annual Performance Report

The Regional Municipality of Durham
Uxbridge Brook Water Pollution Control Plant 2024 Annual Performance Report

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) 2024 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Uxbridge Brook WPCP in 2024. 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 12,240 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
- Solids management

Raw Influent Pumping

Wastewater is collected through approximately 51.1 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 chamber 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 Filtration

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

Ultraviolet (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 Management

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 Raw Influent Analyses 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 76% of its rated capacity and received a maximum daily flow of 6,385 cubic metres per day (m^3/d) on April 12, 2024.

The monthly total phosphorus limit of 0.15 mg/L was exceeded in December. Aluminum sulphate dosing and mixed liquor suspended solids were increased to help decrease final total phosphorus.

The total ammonia nitrogen monthly loading limit of 10.9 kg/d was exceeded in August. Aeration tank 2 was taken out of commission for some repairs which reduced the nitrifying capacity for the plant. After aeration tank 2 was back in service, ammonia levels returned to their normal levels.

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

No operating problems were encountered in 2024.

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 2024 included:

- Replaced impeller for return activated sludge pump 1
- Replaced air header section for aeration intake
- Cleaned and replaced diffusers for aeration 2
- Replaced aeration blower 1
- Replaced chains on bar screen

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 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 final effluent flow meter was conducted on June 11, 2024.
Calibration of the Hach equipment was conducted on November 24, 2024.
Calibration and 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 milligrams per litre (mg/L) was exceeded in 52 of 360 samples (14.4%). Total suspended solids results are monitored daily, and adjustments are made to the process as required.
- The total phosphorus objective of 0.1 mg/L was exceeded in 60 of 363 samples (16.5%). Total phosphorus results are monitored daily, and adjustments are made to the process as required.
- The total ammonia nitrogen objective of 2 mg/L (summer season) was exceeded in 26 of 362 samples (7.2%). Total ammonia results are monitored daily, and adjustments are made to the process as required.
- The minimum effluent pH objective of 6.5 was exceeded in 2 of 260 samples (0.8%). Alkalinity is monitored twice per week to ensure there is enough buffering capacity to maintain pH compliance.

g) A 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 Uxbridge Brook WPCP in 2024 was 19,204 cubic metres (m^3). The sludge produced was transported to Duffin Creek WPCP for further treatment and incineration. 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.

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

All complaints received from the public are administered and tracked through a central database. No complaints were received in 2024.

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* cubic metre (m^3)	Average Daily Flow In cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	120,347	3,882	4,773
February	116,416	4,014	4,286
March	131,107	4,229	4,646
April	153,306	5,110	6,385
May	149,059	4,808	5,802
June	118,575	3,953	4,503
July	117,239	3,782	4,304
August	120,073	3,873	5,096
September	109,882	3,663	3,840
October	105,806	3,413	3,664
November	101,783	3,393	3,601
December	102,198	3,297	3,963
Total	1,445,791		
Average	120,483	3,950**	
Minimum	101,783		
Maximum	153,306		6,385
ECA Limit		5,221**	15,110
Met Compliance		Yes	Yes

*Metered at the Final Effluent

**Annual average daily flow

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand (BOD_5) average (avg.) concentration (conc.) milligrams 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	183	3.5	1.3
February	156	156	3.4	1.4
March	141	248	3.3	1.4
April	158	260	2.9	1.2
May	134	134	2.9	1.0
June	159	299	4.2	1.5
July	149	199	3.7	1.5
August	143	200	3.7	1.5
September	152	211	4.0	2.1
October	151	212	3.7	2.0
November	151	213	4.5	2.1
December	155	186	3.8	2.2
Average	148	208	3.6	1.6
Minimum	124	134	2.9	1.0
Maximum	159	299	4.5	2.2
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen (TKN) average (avg.) concentration (conc.) milligrams per litre (mg/L)	Total ammonia nitrogen (TAN) avg. conc. mg/L	Alkalinity Calcium Carbonate mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	31.91	20.0	320	7.0	8.0	12.9
February	30.66	20.8	320	7.3	8.0	12.5
March	29.13	19.8	344	7.1	7.7	12.3
April	25.35	16.6	321	7.1	7.9	13.1
May	23.27	15.1	329	7.3	8.0	14.8
June	32.48	21.9	349	7.3	8.0	16.7
July	31.25	22.2	327	7.2	8.0	17.5
August	30.20	21.1	322	7.6	8.1	18.3
September	34.59	23.4	342	7.8	8.4	18.2
October	37.66	27.5	329	7.6	8.5	17.4
November	41.63	28.2	334	7.9	8.5	16.3
December	37.88	27.7	330	7.8	8.4	13.7
Average	32.17	22.0	331			15.3
Minimum	23.27	15.1	320	7.0		12.3
Maximum	41.63	28.2	349		8.5	18.3
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.) milligrams per litre (mg/L)	$CBOD_5$ kilograms per day (kg/d) year to date avg.	Total Suspended Solids (TSS) avg. conc. mg/L	TSS kg/d year to date avg.
January	1.0	3.9	4	14.5
February	1.0	4.0	2	11.5
March	1.2	4.3	2	10.6
April	1.0	4.5	2	10.5
May	1.0	4.6	1	9.7
June	1.3	4.7	2	9.5
July	1.2	4.7	1	8.8
August	1.6	4.9	4	9.8
September	1.4	5.0	3	10.0
October	1.3	4.9	2	9.6
November	1.3	4.9	2	9.3
December	1.0	4.7	7	10.6
Annual Loading		4.7**		10.6**
Average	1.2		3	
Minimum	1.0		1	
Maximum	1.6		7	
ECA Limit	8.5*	30.9**	10*	36.3**
ECA Objective	5		5	
Within Compliance	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	

*Monthly Average Concentration
**Annual Average Loading

Table 3 Final Effluent Analyses continued

Month	Total Phosphorus (TP) average (avg.) concentration (conc.) milligrams per litre (mg/L)*	TP kilograms per day (kg/d) monthly avg.**	TP kilograms per year (kg/yr) year to date avg.
January	0.07	0.27	8
February	0.05	0.20	14
March	0.04	0.17	20
April	0.03	0.15	25
May	0.03	0.14	29
June	0.06	0.24	37
July	0.03	0.11	40
August	0.10	0.39	53
September	0.09	0.33	63
October	0.05	0.17	68
November	0.05	0.17	73
December	0.16	0.53	92
Annual Loading			92***
Average	0.06****	0.25	
Minimum	0.03	0.11**	
Maximum	0.16	0.53**	
ECA Limit	0.15*	0.78**	286***
ECA Objective	0.1		
Lake Simcoe Phosphorus Reduction Strategy	0.15****		286***
Within Compliance	No	Yes	Yes
Sampling Frequency Requirement Met	Yes		

*Monthly Average Concentration
**Monthly Average Loading
***Total Annual Average Loading
****Annual Average Concentration

Table 3 Final Effluent Analyses continued

Month	Dissolved Phosphorus average (avg.) concentration (conc.) milligrams per litre (mg/L)	Total Ammonia Nitrogen (TAN) Winter avg. conc. mg/L	TAN Winter kilograms 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	0.9			0.0
February	0.01	0	0.3			0.0
March	0.01	0	0.1			0.0
April	0.01	0	0.3			0.0
May	0.01			0	0.3	0.0
June	0.01			0	0.5	0.0
July	0.01			0	0.1	0.0
August	0.02			3	13.2	0.0
September	0.01			2	6.6	0.0
October	0.01			1	4.9	0.0
November	0.01			0	0.1	0.0
December	0.01	0	0.2			0.0
Average	0.01	0	0.4	1	3.8	0.0
Minimum	0.01	0	0.1	0	0.1	0.0
Maximum	0.02	0	0.9	3	13.2	0.0
ECA Limit		6*	21.8**	3*	10.9**	0.1*
ECA Objective		5		2		
Within Compliance		Yes	Yes	Yes	No	Yes
Sampling Frequency Requirement Met	Yes	Yes		Yes		Yes

*Monthly Average Concentration

**Monthly Average Loading

Table 3 Final Effluent Analyses continued

Month	Nitrate Nitrogen average (avg.) concentration (conc.) milligrams per litre (mg/L)	Alkalinity calcium carbonate mg/L	pH minimum.	pH maximum.	Temp. Degree Celsius avg.
January	22.0	144	6.5	7.0	12.4
February	23.3	128	6.6	7.1	12.2
March	21.3	157	7.0	7.2	12.3
April	19.9	154	6.8	7.3	13.2
May	19.5	146	6.7	7.6	15.5
June	23.6	140	6.7	7.4	17.9
July	24.5	112	6.3	7.1	19.3
August	15.8	167	6.9	7.2	19.1
September	22.7	113	6.8	7.3	19.0
October	26.3	100	6.3	7.1	17.5
November	31.8	85	6.6	7.1	15.9
December	30.4	97	6.7	7.4	13.3
Average	23.4	129			15.6
Minimum	15.8	85	6.3		12.2
Maximum	31.8	167		7.6	19.3
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	1	10
February	1	8
March	1	8
April	1	9
May	1	8
June	1	8
July	1	10
August	1	8
September	1	8
October	1	9
November	1	8
December	1	8
ECA Objective		200 organisms/100mL
Sampling Frequency Requirement Met	Yes	

Table 5 Chemical and Energy Usage

Month	Aluminum Sulphate litres	Hydro kilowatt hours	Natural Gas cubic metres
January	20,380	144,847	7,509
February	18,058	135,471	3,663
March	20,502	144,361	1,607
April	24,620	139,265	949
May	28,368	143,626	294
June	20,342	116,799	33
July	17,038	112,530	33
August	16,629	108,659	189
September	17,830	103,481	128
October	17,483	104,737	2,055
November	13,671	108,130	551
December	19,134	124,712	4,027
Total	234,055	1,486,617	21,038