Uxbridge Brook Water Pollution Control Plant

2022 Annual Performance Report

The Regional Municipality of Durham
Uxbridge Brook Water Pollution Control Plant 2022 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) 2022 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Uxbridge Brook WPCP in 2022. 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 12,120 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 50.9 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 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 66.9% of its rated capacity and received a maximum daily flow of 5,576 cubic metres per day (m^3/d) on February 17, 2022.

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

No operating problems were encountered in 2022.

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:

- Replaced soft start on aeration blower 1,
- Replaced aeration blower 2,
- Replaced main breaker on aeration blower 3,
- Installed new raw influent and final effluent composite samplers,
- Performed diesel generator fuel and exhaust upgrades.

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 June 15 and November 23, 2022.
Calibration of the in-house laboratory equipment was conducted on October 20, 2022.
New balance scale in 2022, factory calibrated.
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 7 of 363 samples (1.9%)
- The total phosphorus objective of 0.1 mg/L was exceeded in 20 of 363 samples (5.5%)
- The summer total ammonia nitrogen objective of 2.0 mg/L was exceeded in 1 of 363 samples (0.3%)
- The winter total ammonia nitrogen objective of 5.0 mg/L was exceeded in 4 of 363 samples (1.1%)
- The minimum effluent pH objective of 6.5 was exceeded in 15 of 259 samples (5.8%). 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 2022 was 17,688 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 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;

All complaints received from the public are administered and tracked through a central database. No complaints were received in 2022.

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	97,695	3,151	3,473
February	94,060	3,359	5,576
March	126,316	4,075	5,016
April	126,525	4,218	4,581
May	125,128	4,036	5,039
June	120,855	4,029	5,118
July	107,252	3,460	3,835
August	96,865	3,125	3,482
September	93,825	3,128	3,428
October	95,677	3,086	3,315
November	92,401	3,080	3,312
December	98,182	3,167	4,761
Total	1,274,781		
Average	106,232	3,493**	
Minimum	92,401		
Maximum	126,525		5,576
ECA Limit		5,221	15,110
Met Compliance		Yes	Yes

*Metered at the Final Effluent

**Annual average

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	232	271	5.5	2.7
February	206	437	4.9	2.4
March	161	244	3.7	1.8
April	120	145	3.7	1.3
May	133	189	3.9	1.8
June	169	253	4.5	2.0
July	231	264	5.9	2.9
August	185	278	5.3	2.6
September	141	174	5.0	2.5
October	250	266	6.5	3.9
November	185	214	5.2	2.9
December	193	304	4.4	2.2
Average	184	253	4.9	2.4
Minimum	120	145	3.7	1.3
Maximum	250	437	6.5	3.9
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	Temp. Degree Celsius avg.
January	51.79	29.4	371	7.1	8.4	12.9
February	42.43	25.2	354	7.1	8.1	12.6
March	35.19	20.4	355	6.9	8.2	12.7
April	36.66	19.7	363	7.4	8.4	12.9
May	39.86	22.1	336	7.5	8.4	15.4
June	47.61	21.9	349	7.1	7.9	17.0
July	50.38	24.7	373	7.1	8.3	17.8
August	45.94	27.8	346	6.8	8.5	18.9
September	45.54	28.8	361	7.8	8.5	19.2
October	58.40	29.6	373	7.5	8.5	17.4
November	46.50	27.3	344	7.3	8.4	16.6
December	45.36	27.7	346	7.3	8.4	14.5
Average	45.47	25.4	356			
Minimum	35.19	19.7	336	6.8		12.6
Maximum	58.40	29.6	373		8.5	19.2
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	1.1	3.5	2	7.2
February	1.0	3.4	3	8.1
March	1.0	3.7	1	7.5
April	1.0	3.8	2	7.5
May	1.2	4.0	2	7.7
June	1.0	4.0	2	7.6
July	1.0	3.9	2	7.4
August	1.0	3.8	2	7.1
September	1.0	3.7	1	6.5
October	1.0	3.7	1	6.1
November	1.0	3.6	1	5.7
December	1.0	3.6	1	5.5
Annual Loading		3.6**		5.5**
Average	1.0		2	
Minimum	1.0	3.4	1	5.5
Maximum	1.2	4.0	3	8.1
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	0.04	0.10	4
February	0.06	0.20	10
March	0.05	0.20	16
April	0.05	0.20	22
May	0.08	0.30	32
June	0.05	0.20	38
July	0.05	0.20	43
August	0.04	0.10	47
September	0.03	0.10	49
October	0.03	0.10	52
November	0.03	0.10	55
December	0.03	0.10	57
Annual Loading			57***
Average	0.05	0.16	
Minimum	0.03	0.10	4
Maximum	0.08	0.30	57
ECA Limit	0.15*	0.78**	286***
ECA Objective	0.1		
Lake Simcoe Phosphorus Reduction Strategy	0.15****		286***
Within Compliance	Yes	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	0.1			0.0
February	0.01	0	0.1			0.0
March	0.01	0	0.4			0.0
April	0.01	0	0.5			0.0
May	0.01			0	0.6	0.0
June	0.01			0	0.2	0.0
July	0.02			0	0.1	0.0
August	0.02			0	0.1	0.0
September	0.01			0	0.1	0.0
October	0.01			0	0.1	0.0
November	0.02			0	0.1	0.0
December	0.01	2	5.4			0.0
Average	0.01	0	1.4	0	0.2	0.0
Minimum	0.01	0	0.1	0	0.1	0.0
Maximum	0.02	2	5.4	0	0.6	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

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	30.0	111	6.3	7.2	10.9
February	27.9	121	6.4	7.3	11.9
March	24.1	135	6.3	7.3	11.9
April	21.9	131	6.5	7.4	12.7
May	24.0	129	6.3	7.3	15.3
June	25.9	132	6.4	7.0	17.5
July	30.2	118	6.2	7.0	19.1
August	32.9	82	6.6	7.0	20.1
September	35.5	84	6.7	7.5	19.5
October	32.4	89	6.4	7.1	17.4
November	33.8	89	6.3	7.6	15.6
December	24.5	120	6.5	7.0	13.4
Average	28.6	112			15.4
Minimum	21.9	82	6.2		10.9
Maximum	35.5	135		7.6	20.1
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	9	1
February	8	1
March	9	1
April	8	1
May	9	1
June	9	1
July	8	1
August	10	1
September	8	1
October	9	1
November	9	1
December	8	1
ECA Objective		200 organisms/100ml
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Aluminum Sulphate litres	Hydro kilowatt hours	Natural Gas cubic metres
January	18,244	154,264	1,600
February	16,883	142,758	3,135
March	21,484	149,039	4,927
April	19,032	130,023	1,658
May	24,257	136,378	265
June	19,764	147,090	4,856
July	16,715	152,359	116
August	14,411	149,962	282
September	15,277	144,272	103
October	15,698	147,837	585
November	16,246	146,217	5,870
December	18,311	149,469	3,558
Total	216,322	1,749,668	26,955