Port Darlington Water Pollution Control Plant

2019 Annual Performance Report

The Regional Municipality of Durham
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Environmental Compliance Approval (ECA): 0114-8S8RTA Dated April 24, 2012
Environmental Compliance Approval (Air): 2242-8TFNN3 Dated June 19, 2012

The Port Darlington Water Pollution Control Plant (WPCP) 2019 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Port Darlington WPCP. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the 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 Port Darlington WPCP is located in the Municipality of Clarington (Bowmanville) and is owned and operated by the Regional Municipality of Durham (Region). The plant operates in accordance with the terms and conditions of the ECAs.

Port Darlington WPCP treats wastewater from the Bowmanville service area. Two process trains were added in November 2015 and are treating all incoming wastewater. The four existing trains have been removed from service for refurbishment. The Port Darlington WPCP services approximately 45,815 residents.

The Port Darlington WPCP is designed to treat wastewater at an average daily flow rate of 27,276 cubic metres per day (m^3/d). The plant is an MECP Class 3 conventional activated sludge treatment plant that utilizes the following processes to treat wastewater;

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- secondary treatment,
- phosphorus removal,
- disinfection (chlorination/dechlorination), and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 157 kilometres of sanitary sewers in Bowmanville and is conveyed to the Port Darlington WPCP by gravity to a sanitary sewage pumping station located at the WPCP.

Preliminary Treatment

Screening: Two automatic, mechanically cleaned screens remove paper products and large material that could harm pumps and process equipment. Screenings removed in this process are compacted for landfill disposal.
Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the two vortex grit tanks. The velocity of the wastewater swirling in the tanks is controlled by the velocity of influent flow to 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 two 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 flight and chain 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 digester.

Secondary Treatment

Aeration Tanks: The aeration tanks are comprised of two distinct sections. The first section is an anoxic zone, where no oxygen is introduced and allows for potential denitrification. Subsequently, the flow leaves the anoxic zone and enters the aerated zone where fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics, and nutrients. Biological activity is controlled to assimilate the organic material.
Secondary Clarifier: The effluent from the aeration tanks is directed to the two 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.

Phosphorus Removal

The phosphorous removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant, ferrous chloride, into various locations throughout the WPCP.

Disinfection (chlorination/dechlorination)

Chlorine in the form of liquid sodium hypochlorite is metered into the secondary effluent stream for pathogen control. Adequate contact time is provided by the single chlorine contact chamber. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged through a 1,350 millimetre (mm) diameter land section of effluent sewer extending 525 metres (m) to a 1,200 mm diameter marine section of effluent outfall which extends 1,055 m into Lake Ontario.

Solids Treatment

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 a more stabilized sludge, water, carbon dioxide, methane, and hydrogen sulphide. The supernatant is returned to the head of the plant for further treatment.
Sludge Management: All stabilized sludge produced at the Port Darlington WPCP is hauled to the Duffin Creek WPCP for incineration.

Environmental Compliance Approval

Under Condition 10.(6) of ECA #0114-8S8RTA 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 Port Darlington WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at 48% of its annual average rated flow capacity and received a maximum daily flow of 26,621 m^3/d on April 21, 2019. See tables 3 and 4 for effluent results.

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

There were no operating problems encountered in 2019.

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 2019 included:

- rebuilt primary digester recirculation pump 201,
- replaced belts on digester mixer pump,
- rebuilt final effluent sampler, and
- installed air relief valves on raw sewage pumps #1 and #2.

d) Summary of any effluent quality assurance or control measures undertaken in the reporting period;

- In-house lab test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy. Elevated in-house total suspended solids results in June and July was due to the use of filter paper with 1.2 micron pore space instead of the standard 1.5 micron pore space. All other results were found to be within a comparable 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;

- The raw influent flow meter was calibrated on July 12.
- Calibration of in-house laboratory equipment was conducted on August 28.
- Calibration of the in-house lab pH meter is conducted regularly.

f) A 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, remaining below the ECA compliance limits.

- The annual average daily flow did not exceed the rated capacity of 27,276 m^3/d during the reporting period.
- The pH objective of not less than 6.5 was exceeded in 3 of 363 samples (1%). The pH meter was calibrated regularly.

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

g) Biosolids Production;

Tabulation of Volume of Sludge Generated;

The volume of sludge removed from Port Darlington WPCP in 2019 was 25,416 cubic metres.

Outline of anticipated volumes to be generated in the next reporting period;

There is no increase in sludge volume expected in the next reporting period.

Summary of locations to where sludge was disposed;

All stabilized sludge produced at the Port Darlington WPCP was hauled to the 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. No complaints were received in 2019.

i) A summary of all By-pass, Spills or Abnormal Discharge events;

There were no by-passes during the reporting period. There are no anticipated by-passes planned during the next reporting period.

There were no spills during the reporting period.

Ministry of the Environment, Conservation and Parks Inspection

This plant was last inspected by the MECP on November 24, 2015.

Table 1 Raw Influent Flows

Month	Total Flow to Plant - metered at the raw influent cubic metre	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	404,842	13,059	18,719
February	337,811	12,065	18,385
March	409,391	13,206	21,405
April	552,375	18,413	26,621
May	519,816	16,768	23,834
June	416,127	13,871	19,794
July	350,512	11,307	23,340
August	324,827	10,478	12,974
September	308,159	10,272	11,587
October	336,059	10,841	20,812
November	389,232	12,974	20,516
December	424,051	13,679	20,952
Total	4,773,202		
Average	397,767	13,077*	
Minimum	308,159		
Maximum	552,375		26,621
ECA Limit		27,276	
Met Compliance		Yes	

*Annual average daily flow

Table 2 Raw Influent Analyses

Month	Carbonaceous Biochemical Oxygen Demand average (avg.) concentration (conc.) milligram per litre (mg/L)	Biochemical Oxygen Demand avg. conc. mg/L	Total Suspended Solids avg. conc. mg/L	Total Phosphorous (TP) avg. conc. mg/L	TP loading kilograms per day
January	113	167	266	6.4	83
February	161	205	280	6.1	74
March	128	145	216	6.0	79
April	65	91	161	3.9	71
May	89	114	168	4.4	73
June	101	126	200	5.1	71
July	144	172	245	5.5	62
August	150	192	259	5.9	62
September	163	186	284	6.9	71
October	171	186	246	5.8	62
November	114	190	239	5.2	67
December	124	183	276	5.1	69
Average	127	163	237	5.5	72
Minimum	65	91	161	3.9	62
Maximum	171	205	284	6.9	83
Sampling Frequency Requirement Met		Yes	Yes	Yes	

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Ammonia Nitrogen avg. conc. mg/L	pH minimum	pH maximum
January	58.58	38.4	7.4	8.8
February	47.75	36.7	8.1	8.8
March	54.88	35.1	7.5	8.8
April	30.42	22.6	7.6	8.5
May	35.28	24.2	7.5	8.4
June	39.75	27.1	7.8	8.3
July	52.93	34.8	7.8	8.4
August	53.73	37.3	7.0	8.2
September	53.48	39.8	7.6	8.5
October	53.40	36.2	7.7	8.4
November	54.23	34.0	7.1	8.2
December	48.20	31.9	6.7	8.0
Average	48.55	33.2		
Minimum	30.42	22.6	6.7	
Maximum	58.58	39.8		8.8
Sampling Frequency Requirement Met	Yes			

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids avg. conc. mg/L	Total Phosphorous (TP) avg. conc. mg/L	TP loading kilograms per day	Total Ammonia Nitrogen avg. conc. mg/L summer	Total Ammonia Nitrogen avg. conc. mg/L winter
January	2.9	5.1	0.39	5		4.73
February	2.3	4.2	0.48	6		3.22
March	3.6	6.6	0.46	6		4.77
April	3.7	5.6	0.30	6		1.53
May	4.1	10.7	0.56	9		1.11
June	3.7	10.9	0.45	6	0.37	
July	2.4	9.5	0.40	5	0.88	
August	3.1	5.1	0.64	7	0.69	
September	2.5	6.7	0.38	4	0.33	
October	2.2	6.6	0.24	3	1.33	
November	1.8	5.5	0.22	3		1.48
December	3.1	5.9	0.24	3		3.62
Average	2.9	6.9	0.40	5	0.72	2.92
Minimum	1.8	4.2	0.22	3	0.33	1.11
Maximum	4.1	10.9	0.64	9	1.33	4.77
ECA Limit	25.0	25.0	0.8		14.0	24.0
ECA Objective	15.0	15.0	0.6	16.4	8.0	12.0
Within Compliance	Yes	Yes	Yes		Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes	Yes		Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Unionized Ammonia average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Kjeldahl Nitrogen avg. conc. mg/L	Total Chlorine Residual avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.0	6.17	0.00	7.3	8.0	10.4
February	0.0	4.04	0.00	7.3	8.3	11.2
March	0.0	6.25	0.00	6.3	8.0	11.9
April	0.0	2.72	0.00	6.8	7.6	11.8
May	0.0	2.59	0.00	6.6	7.2	13.8
June	0.0	1.79	0.00	6.5	7.1	16.6
July	0.0	2.40	0.00	6.5	7.2	19.5
August	0.0	2.43	0.00	6.0	7.4	20.2
September	0.0	1.75	0.00	6.5	7.1	19.4
October	0.0	3.15	0.00	6.5	7.3	16.9
November	0.0	2.94	0.00	6.5	7.3	13.8
December	0.0	5.18	0.00	6.8	7.4	13.6
Average	0.0	3.45	0.00			14.9
Minimum	0.0	1.75	0.00	6.0		10.4
Maximum	0.0	6.25	0.00		8.3	20.2
ECA Limit			0.02	6.0	9.5	
ECA Objective			0.01	6.5	9.0	
Within Compliance			Yes	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	2
February	4	1
March	4	2
April	5	1
May	4	15
June	4	17
July	5	16
August	4	16
September	4	26
October	5	13
November	4	6
December	5	1
ECA Limit		200
ECA Objective		100
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Total Plant Flow cubic metre (m^3)	Ferrous Chloride Litre (L)	Sodium Hypochlorite kilogram as chlorine	Sodium Bisulphite L	Hydro kilowatt hours	Natural Gas m^3
January	404,842	20,383	1,183	6,242	275,971	103,289
February	337,811	16,786	667	4,888	250,856	78,700
March	409,391	17,985	634	4,098	289,841	69,483
April	552,375	20,983	1,075	2,256	284,323	49,847
May	519,816	23,740	1,224	6,016	286,781	41,722
June	416,127	45,202	1,322	6,542	261,653	40,664
July	350,512	33,692	1,269	6,542	265,173	18,995
August	324,827	20,623	989	6,655	256,067	22,244
September	308,159	43,764	1,118	5,527	248,551	22,634
October	336,059	56,029	1,478	5,024	263,523	28,892
November	389,232	54,726	1,702	3,734	262,630	51,348
December	424,051	36,400	1,215	3,147	277,730	65,571
Total	4,773,202	390,312	13,876	60,673	3,223,099	593,389

Table 6 Summary of Raw Water Bacteriological Analyses at the Bowmanville Water Supply Plant

Month	*Escherichia coli* (*E. coli*) Colony Forming Units per 100 millilitre (CFU/100ml) Results Range	*E. coli* (number of samples)	Total Coliform CFU/100ml Results Range	Total Coliform (number of samples)
January	Non-Detect (ND)	18	ND-83	18
February	ND	15	ND-14	15
March	ND-2	16	ND-7	16
April	ND-2	17	ND-5	17
May	ND	17	ND	17
June	ND-2	16	ND-7	16
July	ND-1	18	ND-8	18
August	ND-2	16	ND-120	16
September	ND-1	16	ND-10	16
October	ND-2	18	ND-29	18
November	ND-1	15	ND-16	15
December	ND-1	15	ND-3	15