Port Darlington Water Pollution Control Plant

2023 Annual Performance Report

The Regional Municipality of Durham
Port Darlington Water Pollution Control Plant 2023 Annual Performance Report

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) 2023 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 plant treats wastewater from approximately 49,183 residents in the Bowmanville service area. 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,
- phosphorus removal,
- secondary treatment,
- disinfection (chlorination/dechlorination), and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 161 kilometres of sanitary sewers in Bowmanville and is conveyed to the Port Darlington WPCP by gravity to the raw 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 the 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.

Phosphorus Removal

The phosphorus removal system lowers the total phosphorus level in the final effluent by adding a chemical coagulant, ferrous chloride, into various locations throughout the Water Pollution Control Plant. In 2023, ferrous chloride was dosed only in the primary effluent.

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 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.
Secondary Clarifier: The effluent from the aeration tanks is directed to the two secondary clarifiers where the solids settle 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.

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 Management

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 biosolids, 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 Water Pollution Control Plant (WPCP) is hauled to the Duffin Creek WPCP for incineration.

Environmental Compliance Approval (ECA)

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 50% of its annual average rated flow capacity and received a maximum daily flow of 34,215 cubic metres per day (m^3/d) on February 10, 2023. See tables 3 and 4 for effluent results.

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

Operating problems encountered and corrective actions taken in 2023 included:

- Ferrous chloride lines routinely became plugged due to the quality of ferrous chloride received. The tanks were emptied, and new product was requested. The chemical supplier has been contacted and is reviewing the quality of the product.

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 2023 included:

- Replaced liner and cone casting on grit classifier 2,
- Replaced mechanical seals on digester recirculation pump 201,
- Replaced element on aeration 6 ferrous pump.

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

In-house laboratory (lab) test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy.

Online instrumentation is verified by WPCP operators using field or lab test equipment. On-line instrumentation is verified by WPCP operators using various field or lab test equipment.

e) Summary of the calibration and maintenance carried out on all effluent monitoring equipment;

The raw influent flow meter was calibrated on May 31, 2023.

Calibration of in-house laboratory equipment was conducted on December 19, 2023.

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 and remain below the objectives specified in the Environmental Compliance Approval:

- The annual average daily flow did not exceed the rated capacity of 27,276 cubic metres per day (m^3/d) during the reporting period,
- The total ammonia nitrogen objective of 12.0 milligram per litre (mg/L) (November to May) was exceeded in 3 of 12 monthly samples (25%). During this period a series of high rain events combined with low temperatures disrupted the nitrifying bacteria at the plant. Wasting was reduced and operations adjusted to recover the nitrifying population as quickly as possible.

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 Water Pollution Control Plant (WPCP) in 2023 was 27,864 cubic metres.

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

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.

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 further treatment or 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 2023.

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 (MECP) Inspection

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

Table 1 Raw Influent Flows

Month	Total Flow to Plant* - cubic metre	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	493,479	15,919	27,874
February	475,880	16,996	34,215
March	564,128	18,198	29,411
April	511,210	17,040	32,406
May	445,606	14,374	22,715
June	369,381	12,313	16,131
July	368,503	11,887	14,272
August	347,414	11,207	13,025
September	322,590	10,753	12,275
October	328,877	10,609	11,862
November	329,351	10,978	12,291
December	407,794	13,155	18,339
Total	4,964,213		
Average	413,684	13,601**	
Minimum	322,590		
Maximum	564,128		34,215
ECA Limit		27,276	
Met Compliance		Yes	

*Metered at the raw influent

**Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids avg. conc. mg/L	Total Phosphorus avg. conc. mg/L	Total Kjeldahl Nitrogen avg. conc. mg/L
January	147	222	4.8	45.31
February	131	197	4.7	42.44
March	104	159	3.8	32.87
April	97	139	4.4	34.81
May	130	199	4.9	38.65
June	135	201	5.4	45.98
July	128	230	6.4	49.31
August	161	207	5.5	51.39
September	166	233	5.6	53.60
October	200	276	6.0	61.16
November	206	238	5.6	57.33
December	169	235	4.8	47.96
Average	148	211	5.2	46.73
Minimum	97	139	3.8	32.87
Maximum	206	276	6.4	61.16
Sampling Frequency Requirement Met	Yes	Yes	Yes	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 Phosphorus (TP) avg. conc. mg/L	TP loading kilograms per day year to date avg.	Total Ammonia Nitrogen avg. conc. mg/L summer	Total Ammonia Nitrogen avg. conc. mg/L winter
January	3.6	7.6	0.38	6.0		15.30
February	2.8	6.8	0.44	6.7		15.83
March	1.4	5.7	0.30	6.6		11.50
April	2.1	5.2	0.26	6.1		13.66
May	1.3	6.0	0.30	5.8		1.24
June	1.3	5.5	0.26	5.2	0.18	
July	1.2	5.1	0.34	5.0	0.18	
August	1.3	4.2	0.27	4.9	0.34	
September	2.2	6.4	0.38	4.7	2.06	
October	1.7	6.8	0.42	4.7	0.60	
November	3.0	7.0	0.50	4.9		0.66
December	2.7	5.2	0.57	5.0		0.62
Average	2.1	6.0	0.37	5.0	0.67	8.40
Minimum	1.2	4.2	0.26	4.7	0.18	0.62
Maximum	3.6	7.6	0.57	6.7	2.06	15.83
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 Chlorine Residual avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.2	0.00	7.4	7.9	12.6
February	0.2	0.00	7.4	7.9	11.1
March	0.1	0.00	7.3	7.8	10.8
April	0.1	0.00	7.3	7.9	13.5
May	0.0	0.00	6.9	7.6	15.5
June	0.0	0.00	6.7	7.4	17.7
July	0.0	0.00	6.8	7.4	20.2
August	0.0	0.00	6.5	7.4	20.1
September	0.0	0.00	6.5	7.6	19.8
October	0.0	0.00	6.3	7.4	18.0
November	0.0	0.00	6.2	7.4	14.7
December	0.0	0.00	6.7	7.7	14.0
Average	0.1	0.00			15.7
Minimum	0.0	0.00	6.2		10.8
Maximum	0.2	0.00		7.9	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	9	1
February	8	2
March	9	2
April	8	95
May	9	8
June	9	13
July	8	8
August	10	12
September	8	7
October	9	10
November	9	7
December	8	6
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	493,479	19,644	876	5,520	303,992	106,127
February	475,880	7,562	758	5,078	265,655	50,742
March	564,128	23,094	808	5,537	304,716	65,561
April	511,210	26,884	713	5,407	296,197	66,541
May	445,606	51,817	926	5,572	303,273	57,160
June	369,381	37,021	1,175	5,476	289,775	36,187
July	368,503	29,317	1,411	5,566	297,688	27,417
August	347,414	44,193	1,369	5,655	291,145	25,187
September	322,590	42,427	1,354	5,381	290,890	30,439
October	328,877	36,491	1,740	5,538	298,520	33,049
November	329,351	31,424	1,722	5,300	308,956	63,937
December	407,794	36,504	1,980	5,482	343,203	75,691
Total	4,964,213	386,378	14,833	65,512	3,594,010	638,038

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

Month	*Escherichia coli* (*E. coli*) Number of Samples	*E. coli Colony Forming Units per 100 millilitre (CFU/100ml) Results Range*	Total Coliform Number of Samples	Total Coliform Results Range
January	17	Non-Detect (ND) - 3	17	ND - 380
February	15	ND - 1	15	ND - 150
March	18	ND	18	ND - 6
April	14	ND	14	ND - 1
May	17	ND	17	ND - 25
June	17	ND – Overgrown (OG)	17	ND - OG
July	17	ND - OG	17	ND - OG
August	18	ND - 2	18	ND - 23
September	15	ND - OG	15	ND - OG
October	17	ND - 1	17	ND - 72
November	18	ND - OG	18	ND - OG
December	14	ND	14	ND - 5