Newcastle Water Pollution Control Plant

2018 Annual Performance Report

The Regional Municipality of Durham

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Environmental Compliance Approval (ECA): 3-2189-87-946 Dated July 26, 1994
Amendments; Dated June 21, 2006
May 10, 1998
June 11, 1996

Environmental Compliance Approval (Air): 8-3083-93-006 Dated March 22, 1993

The Newcastle Water Pollution Control Plant (WPCP) 2018 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Newcastle 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 Newcastle WPCP is located in the Municipality of Clarington (Newcastle) and is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECAs.

The plant treats wastewater from the Newcastle service area in the Region, servicing approximately 11,047 residents.

The Newcastle WPCP is designed to treat wastewater at an average flow rate of 4,086 cubic metres per day (m^3/d) with a peak flow rate of 12,300 m^3/d. The plant is an MECP class three 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 treatment.

Raw Influent Pumping

Wastewater collected through approximately 40 km of sanitary sewers in Newcastle is conveyed to the Newcastle WPCP by gravity and by two sanitary sewage pumping stations located in the collection system.

Preliminary Treatment

Screening: One automatic, mechanically cleaned screen and one emergency manual screen remove paper products and large material that could harm pumps and process equipment. Screenings removed in this process are transported to landfill.

Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the aerated grit tank. The velocity of the wastewater rolling in the tanks is controlled by the quantity of air added to produce conditions that 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 primary clarifier utilizes 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 sweep arm mechanism which pushes the sludge into a hopper. The sludge is then pumped to the sludge holding tank for transportation to the Courtice WPCP or the Port Darlington WPCP. Any material floating on the surface of the clarifier (scum) is also removed to the sludge holding tank.

Secondary Treatment

Aeration Tank: The two aeration tanks are each 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 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 clarifier.

Phosphorus Removal

The phosphorous removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant (aluminum sulphate). Aluminum sulphate can be added at various locations within the plant.

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 900 mm diameter outfall extending 130 m to a 600 mm diameter pipe which extends 800 m into Lake Ontario.

Solids Treatment

All sludge produced at the Newcastle WPCP is stored in a sludge holding tank. The sludge is shipped to the Courtice WPCP or the Port Darlington WPCP for anaerobic digestion.

Environmental Compliance Approval

Under Condition 17 (1) of ECA #3-2189-87-946 the Region must produce an annual 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 Newcastle WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at an average of 77% of its annual average rated flow capacity and received a maximum daily flow of 13,694 m^3/d on April 17, 2018. See tables 3 and 4 for effluent results.

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

No operating problems were encountered at the Newcastle WPCP in 2018.

c) Maintenance of major equipment

Major maintenance items in 2018 included:

- Rebuilt bar screen,
- Replaced three unidirectional waste activated sludge (WAS) valves with bidirectional valves,
- Replaced motor on sodium hypochlorite pump #2, and
- Replaced mechanical seal and housing on raw sewage 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. All results were found to be within a comparable range.
- Online instrumentation is verified by WPCP operators using field or laboratory test equipment.

e) Summary of the calibration and maintenance carried out

- Calibration of the raw influent flow meter was conducted on June 13 and August 29, 2018.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted on August 1, 2018.
- Calibration of the in-house lab pH meter was conducted regularly.

f) Effluent Objectives

The Region continually strives to achieve the best effluent quality at all times, remaining below the ECA compliance limits.

- The average daily rated flow capacity of 4,086m^3/d was not exceeded. The maximum rated flow rate of 12,300 m^3/d was exceeded on April 17, 2018 due to a significant precipitation event.
- The total chlorine residual monthly average objective was exceeded on two of 12 occasions (17%). Sodium bisulphite dosing is monitored and increased as necessary to ensure low total chlorine residual.

Best efforts and process adjustments will continue to be applied to maintain results below objectives.

g) Sludge Production:

Tabulation of Volume of Sludge Generated:

The volume of sludge removed from Newcastle WPCP in 2018 was 7,931 m^3 at an average concentration of 3.4% total solids. See table 5 Sludge Quality and Disposal.

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 is Disposed:

All sludge produced at the Newcastle WPCP is stored in a sludge holding tank. The plant sludge volume of 5,488 m^3 (69%) was transferred to the Courtice WPCP for anaerobic digestion and 2,443 m^3 (31%) was shipped to the Port Darlington WPCP for anaerobic digestion.

h) Summary of Complaints and Steps Taken to Address the Complaints:

There were no documented complaints received about the Newcastle WPCP in 2018.

i) By-passes and Spills

- MECP approved by-passes of the chlorine contact chamber were conducted on April 19 and November 8, 2018 for cleaning. The MECP York Durham District Office supervisor was notified once the by-pass was complete.

There were no spills during the reporting period.

j) Proposed Alterations, Extensions or Replacements

There are no proposed alterations, extensions or replacements for this plant.

k) Information Required by MECP Water Supervisor

Table 7 provides a bacterial analysis of the Newcastle Water Supply Plant raw water for 2018.

MECP Inspection

This plant was last inspected by the MECP on November 16, 2017.

Table 1 Raw Influent Flows

Month	Total Flow to Plant -metered at the raw influent cubic metre	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	94,620	3,052	4,850
February	96,162	3,434	6,286
March	96,049	3,098	4,106
April	151,931	5,064	13,694
May	105,059	3,389	4,989
June	77,603	2,587	3,122
July	73,941	2,385	2,903
August	76,575	2,470	3,013
September	75,427	2,514	3,420
October	82,161	2,650	3,316
November	107,309	3,577	6,003
December	105,546	3,405	4,656
Total	1,142,383		
Average	95,199	3,130*	
Minimum	73,941		
Maximum	151,931		13,694
ECA Limit		4,086	12,300
Met Compliance		Yes	No

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading kilogram per day (kg/d)	Biochemical Oxygen Demand avg. conc. mg/L	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d
January	142	433	187	214	654
February	99	340	145	177	609
March	120	371	162	193	597
April	91	461	112	145	735
May	143	486	166	191	647
June	152	394	192	223	578
July	145	346	185	226	538
August	143	353	188	197	487
September	106	267	152	204	514
October	125	332	156	181	478
November	89	319	118	151	541
December	123	418	169	198	674
Average	123	386	161	192	600
Minimum	89	267	112	145	478
Maximum	152	486	192	226	735

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	Total Phosphorous (TP) avg. conc. mg/L	TP loading kilograms per day
January	36.16	22.1	7.0	8.2	4.3	13
February	33.15	21.0	6.7	8.1	3.8	13
March	37.20	23.8	7.3	7.9	4.2	13
April	25.72	16.2	7.1	8.0	2.8	14
May	38.90	21.6	6.8	8.2	4.5	15
June	46.30	31.0	7.2	8.4	5.7	15
July	45.12	31.7	7.1	7.9	5.3	13
August	44.50	29.1	7.2	7.8	5.3	13
September	40.25	26.0	6.9	8.3	4.8	12
October	40.24	25.7	7.2	8.0	4.8	13
November	28.63	19.2	7.2	7.9	3.5	12
December	36.15	22.4	6.8	7.9	4.0	14
Average	37.69	24.1			4.4	14
Minimum	25.72	16.2	6.7		2.8	12
Maximum	46.30	31.7		8.4	5.7	15

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand (CBOD5) average (avg.) concentration (conc.) milligram per litre (mg/L)	CBOD5 loading kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d	Total Phosphorous (TP) avg. conc. mg/L	TP loading kilograms per day	Total Ammonia Nitrogen (TAN) avg. conc. mg/L summer	TAN avg. conc. mg/L winter
January	2.5	8	5.6	17	0.19	0.6		0.41
February	2.2	7	4.5	15	0.21	0.7		2.07
March	3.3	10	5.8	18	0.48	1.5		1.37
April	3.3	17	5.9	30	0.41	2.1	0.25	
May	2.3	8	6.1	21	0.57	1.9	0.56	
June	2.1	5	4.1	10	0.46	1.2	0.06	
July	2.2	5	3.4	8	0.26	0.6	0.63	
August	2.0	5	3.0	7	0.23	0.6	0.86	
September	2.3	6	3.4	8	0.19	0.5	1.69	
October	2.4	6	5.6	15	0.28	0.7	0.80	
November	2.4	8	6.0	21	0.25	0.9	0.11	
December	2.1	7	7.0	24	0.26	0.9		0.48
Average	2.4	8	5.0	16	0.31	1.0	0.62	1.08
Minimum	2.0	5	3.0	7	0.19	0.5	0.06	0.41
Maximum	3.3	17	7.0	30	0.57	2.1	1.69	2.07
ECA Limit	25.0	102	25.0	102			15	20
ECA Objective	15.0	61.29	15.0	61.29	1.0	4.1	10	15
Within Compliance	Yes	Yes	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	Nitrate plus Nitrite avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.00	1.67	0.00	14.6	6.5	7.0	10
February	0.00	3.86	0.00	11.4	6.5	6.9	10
March	0.00	2.94	0.00	13.0	6.7	7.2	10
April	0.00	1.71	0.00	11.4	6.9	7.5	10
May	0.00	1.42	0.00	13.3	6.7	7.3	13
June	0.00	1.35	0.00	17.2	6.6	7.2	16
July	0.00	2.29	0.00	17.3	6.6	7.1	18
August	0.00	1.90	0.00	16.8	6.5	7.1	19
September	0.00	3.47	0.01	15.3	6.1	7.0	20
October	0.00	2.02	0.01	15.4	6.4	7.1	17
November	0.00	1.63	0.00	11.3	6.7	7.3	14
December	0.00	1.77	0.00	12.3	6.3	7.6	12
Average	0.00	2.17	0.00	14.1			14
Minimum	0.00	1.35	0.00	11.3	6.1		10
Maximum	0.00	3.86	0.01	17.3		7.6	20
ECA Limit			0.04				
ECA Objective			0				
Within Compliance			Yes				
Sampling Frequency Requirement Met		Yes	Yes	Yes	Yes	Yes	Yes

Table 4(a) *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	2
February	4	4
March	4	4
April	4	14
May	5	5
June	4	5
July	5	6
August	4	6
September	4	3
October	5	9
November	4	14
December	4	4
ECA Limit		
ECA Objective		200
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 4(b) Summary of Faecal Streptococcus and Total Coliform Monitoring

Month	Number of Samples	Faecal Streptococcus Monthly Geometric Mean Density	Total Coliform Monthly Geometric Mean Density
January	3	27	1,162
February	2	24	276
March	2	36	416
April	2	46	1,165
May	3	42	2,169
June	2	2	100
July	3	4	105
August	2	4	104
September	2	84	52
October	3	73	129
November	2	37	197
December	2	15	62
Sampling Frequency Requirement Met	Yes		

Table 5 Sludge Quality and Disposal

Month	Average Sludge Total Solids Percentage	Total Volume Removed cubic metre (m^3)	Total Volume Hauled to Courtice WPCP (m^3)	Total Volume Hauled to Port Darlington WPCP (m^3)
January	2.87	660	660	0
February	2.97	659	659	0
March	5.34	572	572	0
April	4.09	616	616	0
May	3.77	613	613	0
June	3.87	608	608	0
July	2.98	572	572	0
August	2.63	645	484	161
September	3.28	704	0	704
October	3.33	698	0	698
November	2.87	792	704	88
December	3.04	792	0	792
Total		7,931	5,488	2,443
Average	3.42	661		

Table 6 Energy and Chemical Usage

Month	Total Plant Flow cubic metre	Alum litre	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite litre	Hydro kilowatt hour	Natural Gas cubic metre
January	94,620	7,781	334	1,716	85,559	24,926
February	96,162	6,372	282	1,684	96,509	15,947
March	96,049	6,496	308	1,860	107,713	10,503
April	151,931	6,815	473	2,220	95,235	8,074
May	105,059	6,332	444	1,904	94,471	6,762
June	77,603	6,286	457	1,748	89,888	769
July	73,941	5,792	434	2,628	98,291	769
August	76,575	6,840	509	2,772	92,180	891
September	75,427	7,466	637	3,444	101,092	757
October	82,161	7,722	478	5,460	91,161	8,761
November	107,309	7,825	360	3,104	98,291	8,188
December	105,546	7,806	356	2,776	65,188	15,247
Total	1,142,383	83,531	5,071	31,316	1,115,578	101,594

Table 7 Summary of the Raw Water Bacteriological Analyses at the Newcastle Water Supply Plant

Month	*Escherichia coli* (*E. coli*) Colony Forming Units per 100ml (CFU/100ml) Range (minimum to maximum result)	*E. coli* (number of samples)	Total Coliform CFU/100ml Range (minimum to maximum result)	Total Coliform (number of samples)
January	<1	18	<1-160	18
February	<1-1	15	<1-900	15
March	<1-1	17	<1- 170	17
April	<1-1	16	<1-16	16
May	<1-8	18	<1-230	18
June	<1-1	16	<1-35	16
July	<1-1	17	<1-11	17
August	<1-16	17	<1-220	17
September	<1-7	15	<1-68	15
October	<1-2	18	<1-22	18
November	<1-16	16	<1-140	16
December	<1-1	14	<1-53	14