Newcastle Water Pollution Control Plant

2017 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) 2017 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Newcastle WPCP in 2017. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). 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 10,923 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 MOECC 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 removes 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. Any material floating on the surface of the clarifier (scum) is also removed to the 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 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.

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 is intended to lower the total phosphorous level in the final effluent by adding a chemical coagulant (aluminum chloride). Aluminum chloride 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 pipe extending 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 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 78% of its annual average rated flow capacity and received a maximum daily flow of 12,160 m^3/d on May 6th, 2017. See tables for effluent results.

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

No operating problems were encountered at the Newcastle WPCP in 2017.

c) Maintenance of major equipment

Major maintenance items in 2017 included:

- Replaced mechanical seal on raw sewage pump #3,
- Replaced breaker for raw sewage pump #2,
- Rebuilt return activated sludge pump #1, and
- Replaced process water pump #1.

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 in May and October 2017.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted in July 2017.
- 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 not exceeded.

The total chlorine residual monthly average objective was exceeded on three of 12 occasions (25%). 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 2017 was 7,114 m^3 at an average concentration of 2.9% 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:

Courtice WPCP -100%

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

There were no documented complaints received about the Newcastle WPCP in 2017.

i) By-passes and Spills

MOECC approved by-passes of the chlorine contact chamber were conducted on April 19th and November 9th, 2017 for cleaning. The MOECC supervisor was notified once the bypass 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 MOECC Water Supervisor

Table 7 provides a bacterial analysis of the Newcastle Water Supply Plant raw water for 2017.

MOECC Inspection

This plant was inspected on November 16th, 2017. The final report is pending from the MOECC.

Table 1 Raw Influent Flows

Month	Total Flow to Plant -metered at the raw influent m^3	Average Day Flow m^3/d	Maximum Day Flow m^3/d
January	95,166	3,070	4,022
February	80,441	2,873	4,972
March	100,718	3,249	6,013
April	119,151	3,972	6,980
May	144,721	4,668	12,160
June	109,882	3,663	12,109
July	111,288	3,590	5,403
August	83,160	2,683	3,127
September	72,172	2,406	2,940
October	79,836	2,575	3,268
November	84,023	2,801	3,397
December	84,780	2,735	3,230
Total	1,165,338		
Average	97,112	3,193*	
Minimum	72,172		
Maximum	144,721		12,160
ECA Limit		4,086	12,300
Met Compliance		Yes	Yes

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	$CBOD_5$ avg. conc. mg/L	$CBOD_5$ loading kg/d	BOD_5 avg. conc. mg/L	TSS avg. conc. mg/L	TSS loading kg/d
January	132	407	164	197	604
February	86	248	156	207	595
March	114	371	142	179	582
April	92	364	134	187	743
May	95	443	128	174	810
June	104	380	149	191	701
July	114	407	152	227	815
August	116	312	167	232	623
September	116	279	170	224	540
October	116	299	157	209	538
November	100	279	144	252	705
December	119	326	173	224	614
Average	109	347	153	209	666
Minimum	86	248	128	174	538
Maximum	132	443	173	252	815

Table 2 Raw Influent Analyses continued

Month	TKN avg. conc. mg/L	TAN avg. conc. mg/L	pH min.	pH max.	TP avg. conc. mg/L	TP loading kg/d
January	38.24	23.4	6.5	7.8	4.2	13
February	32.83	23.6	7.0	7.8	4.4	13
March	33.55	21.7	6.5	7.6	3.8	12
April	26.70	17.9	6.4	7.5	3.6	14
May	25.54	15.9	6.5	7.7	3.1	14
June	30.13	19.9	7.1	7.7	3.8	14
July	30.85	21.2	6.7	7.6	4.5	16
August	39.50	25.3	6.5	7.4	5.4	15
September	43.03	28.8	6.9	7.3	6.2	15
October	42.78	27.9	6.9	7.6	5.1	13
November	37.03	25.3	6.9	7.7	4.7	13
December	39.33	25.7	6.7	7.7	4.9	14
Average	34.96	23.0			4.5	14
Minimum	25.54	15.9	6.4		3.1	12
Maximum	43.03	28.8		7.8	6.2	16

Table 3 Final Effluent Analyses

Month	$CBOD_5$ avg. conc. mg/L	$CBOD_5$ loading kg/d	TSS avg. conc. mg/L	TSS loading kg/d	TP avg. conc. mg/L	TP loading kg/d	TAN avg. conc. mg/L summer	TAN avg. conc. mg/L winter
January	2.1	6	6.5	20	0.25	0.8		0.62
February	1.7	5	5.4	15	0.21	0.6		0.71
March	2.2	7	5.1	17	0.25	0.8		0.30
April	2.0	8	6.0	24	0.32	1.3	1.31	
May	2.1	10	6.2	29	0.41	1.9	0.37	
June	1.6	6	8.1	30	0.71	2.6	0.15	
July	2.2	8	6.3	23	0.47	1.7	0.04	
August	2.0	5	6.2	17	0.34	0.9	0.07	
September	2.0	5	4.8	12	0.25	0.6	0.15	
October	2.4	6	6.6	17	0.37	0.9	0.72	
November	2.1	6	6.0	17	0.34	1.0	0.58	
December	2.4	7	6.0	17	0.30	0.8		0.39
Average	2.1	7	6.1	20	0.35	1.1	0.42	0.51
Minimum	1.6	5	4.8	12	0.21	0.6	0.04	0.30
Maximum	2.4	10	8.1	30	0.71	2.6	1.31	0.71
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 NH3 avg. conc. mg/L	TKN avg. conc. mg/L	TCR avg. conc. mg/L	Nitrate plus Nitrite avg. conc. mg/L	pH min.	pH max.	Temp. avg. °C
January	0.00	1.80	0.00	13.6	6.7	7.4	13
February	0.00	1.82	0.00	13.3	6.6	7.1	12
March	0.00	1.37	0.00	12.0	6.6	7.0	11
April	0.00	2.49	0.00	10.7	6.6	7.0	12
May	0.00	1.74	0.01	11.4	6.8	7.1	13
June	0.00	1.19	0.01	13.7	6.7	7.1	16
July	0.00	1.08	0.01	12.0	6.6	7.4	17
August	0.00	1.26	0.00	16.0	6.5	7.4	19
September	0.00	1.39	0.00	16.2	6.0	6.9	20
October	0.00	2.83	0.00	15.4	6.3	6.9	18
November	0.00	1.38	0.00	14.2	6.3	7.3	15
December	0.00	1.79	0.00	14.9	6.2	7.1	12
Average	0.00	1.68	0.00	13.6			15
Minimum	0.00	1.08	0.00	10.7	6.0		11
Maximum	0.00	2.83	0.01	16.2		7.4	20
ECA Limit			0.04				
ECA Objective			0				
Within Compliance			Yes				
Sampling Frequency Requirement Met		Yes	No*	Yes	Yes	Yes	Yes

*3 of 365 required chlorine residual samples not collected

Table 4(a) Escherichia Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	2
February	4	3
March	4	7
April	4	6
May	5	10
June	4	24
July	4	5
August	5	8
September	4	9
October	5	6
November	4	11
December	4	7
ECA Objective		200
Sampling Frequency Requirement Met	Yes	

Table 4(b) Summary of the Faecal Streptococcus sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	2	70
February	2	69
March	2	36
April	2	228
May	3	49
June	2	15
July	2	1
August	3	7
September	2	22
October	3	21
November	2	31
December	2	25
Sampling Frequency Requirement Met	Yes	

Table 4(c) Summary of the Total Coliform sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	2	302
February	2	445
March	2	330
April	2	930
May	3	61
June	2	420
July	2	44
August	3	98
September	2	143
October	3	169
November	2	526
December	2	236

Table 5 Sludge Quality and Disposal

Month	Avg. Sludge TS (%)	Total Volume Removed (m^3)	Total Volume Hauled to Courtice WPCP (m^3)
January	3.29	596	596
February	2.87	528	528
March	2.26	648	648
April	2.50	572	572
May	2.84	660	660
June	2.17	612	612
July	3.78	554	554
August	3.13	572	572
September	3.05	572	572
October	2.59	660	660
November	2.89	572	572
December	2.87	568	568
Total		7,114	7,114
Average	2.85	593	593

Table 6 Energy and Chemical Usage

Month	Total Plant Flow (cubic metres)	Alum (litres)	Sodium Hypochlorite (kilograms as chlorine)	Sodium Bisulphite (litres)	Hydro (kWh)	Natural Gas (cubic metres)
January	95,166	8,022	389	2,622	88,320	3,955
February	80,441	7,244	343	1,760	85,920	19,007
March	100,718	7,979	421	1,964	87,360	13,612
April	119,151	7,455	467	1,864	95,040	8,721
May	144,721	7,115	1,096	1,736	90,240	7,952
June	109,882	6,410	593	1,548	87,360	2,978
July	111,288	7,660	622	1,640	90,720	991
August	83,160	7,409	487	1,358	84,480	3,997
September	72,172	7,460	473	1,692	95,520	356
October	79,836	7,671	467	1,692	81,840	9,256
November	84,023	7,943	418	1,784	85,440	5,503
December	84,780	8,162	402	1,820	115,200	10,517
Total	1,165,338	90,528	6,178	21,480	1,087,440	86,845

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

Month	E.coli cfu/100ml (min-max result)	E.coli (number of samples)	Total Coliform cfu/100ml (min-max result)	Total Coliform (number of samples)
January	<1-5	17	<1-69	17
February	<1	15	<1-10	15
March	<1	18	<1- 130	18
April	<1	15	<1-8	15
May	<1-1	18	<1-10	18
June	<1-1	17	<1-58	17
July	<1-6	16	<1-52	16
August	<1-1	18	1-32	18
September	<1-1	15	<1-61	15
October	<1-1	17	2-50	17
November	<1-2	17	<1-44	17
December	<1	14	<1-7	14