Newcastle Water Pollution Control Plant

2022 Annual Performance Report

The Regional Municipality of Durham
Newcastle Water Pollution Control Plant 2022 Annual Performance Report

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) 2022 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 approximately 11,853 residents in the Newcastle service area. 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 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 collected through approximately 42 kilometres of sanitary sewers in Newcastle is conveyed to the Newcastle WPCP by gravity and the Sunset sanitary sewage pumping station 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 the 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 Water Pollution Control Plant (WPCP) or the Duffin Creek WPCP. Any material floating on the surface of the clarifier is also removed to the sludge holding tank.

Phosphorus Removal

The phosphorus removal system lowers the total phosphorus level in the final effluent by adding a chemical coagulant, aluminum sulphate, into various locations within the plant. In 2022, aluminum sulphate was dosed post aeration.

Secondary Treatment

Aeration Tanks: 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 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.

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 millimetre (mm) diameter outfall extending 130 metres (m) to a 600 mm diameter pipe which extends another 800 m into Lake Ontario.

Solids Management

All sludge produced at the Newcastle Water Pollution Control Plant (WPCP) is stored in a sludge holding tank. The sludge is shipped to the Courtice WPCP or the Duffin Creek WPCP for anaerobic digestion.

Environmental Compliance Approval (ECA)

Under Condition 17.(1) of ECA #3-2189-87-946 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 Newcastle WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at an average of 75% of its annual average rated flow capacity and received a maximum daily flow of 7,839 cubic metres per day (m^3/d) on March 24, 2022. See tables 3 and 4 for effluent results.

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

There were no operating problems during the reporting period.

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 main electrical feed to administration building,
- Replaced all return activated sludge pickup hangers in secondary clarifier 1,
- Rebuilt variable frequency drive controller on sodium hypochlorite pump 2.

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

In-house laboratory 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 an acceptable range.

Online instrumentation is verified by WPCP operators using field or laboratory (lab) test equipment.

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

Calibration of the raw influent flow meter was conducted on May 17, 2022,

Calibration of in-house laboratory equipment was conducted on August 8, 2022,

Calibration of the in-house lab pH meter was conducted regularly.

f) A description of efforts made and results achieved in meeting the Effluent Objectives;

The Region continually strives to always achieve the best effluent quality and remain below the objectives specified in the Environmental Compliance Approval (ECA).

- The average daily rated flow capacity of 4,086 cubic metres per day (m^3/d) was not exceeded. The maximum rated flow rate of 12,300 m^3/d was not exceeded.

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 Newcastle Water Pollution Control Plant (WPCP) in 2022 was 8,984 cubic metres (m^3) at an average concentration of 8.0% 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 was disposed;

The plant sludge volume of 8,984 m^3 was hauled to the Courtice WPCP for anaerobic digestion.

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

The Ministry of the Environment, Conservation and Parks (MECP) approved two by-passes of the chlorine contact chamber that were conducted on April 20 and November 24 for cleaning. The MECP York Durham District Office supervisor was notified once each by-pass was complete.

There were no spills during the reporting period.

j) Proposed Alterations, Extensions or Replacements;

To meet the needs of Newcastle's growing population, the Region has begun work on the Rerating and Upgrades Project at Newcastle WPCP. This Project will increase the Plant's average daily flow by providing infrastructure upgrades to optimize Newcastle WPCP's operation. These upgrades include new raw sewage pumps, new headworks equipment, new odour control, new blowers, new chemical phosphorous removal (alum) system, replacing the existing chlorination disinfection system with an ultraviolet (UV) disinfection system and outfall modifications. Additionally, this project will reroute the stormwater connection (currently connected to the Plant's outfall pipe) to the adjacent stormwater pond, disconnecting it from the outfall pipe and freeing up capacity for Plant effluent flow. The project is currently in pre-design and construction is planned to be completed by the middle of 2025.

k) Information Required by MECP Water Supervisor;

Table 7 provides a bacterial analysis of the Newcastle Water Supply Plant raw water for 2022.

MECP Inspection

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

Table 1 Raw Influent Flows

Month	Total Flow to Plant* - cubic metre	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	88,906	2,868	3,313
February	100,938	3,605	6,647
March	129,325	4,172	7,839
April	99,999	3,333	3,730
May	96,555	3,115	4,403
June	90,154	3,005	4,193
July	86,778	2,799	4,134
August	83,099	2,681	3,892
September	77,757	2,592	2,853
October	80,179	2,586	2,864
November	76,293	2,543	3,369
December	111,978	3,612	6,792
Total	1,121,961		
Average	93,497	3,074**	
Minimum	76,293		
Maximum	129,325		7,839
ECA Limit		4,086	12,300
Met Compliance		Yes	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	345	326	7.6	58.14
February	347	346	7.8	52.53
March	252	260	7.3	40.70
April	206	263	7.6	50.18
May	293	284	7.7	57.40
June	371	320	7.9	56.45
July	407	370	7.7	52.73
August	339	431	7.3	54.54
September	360	376	11.3	63.20
October	412	453	12.7	66.14
November	399	397	12.4	62.73
December	227	233	6.2	40.18
Average	330	338	8.6	54.58
Minimum	206	233	6.2	40.18
Maximum	412	453	12.7	66.14

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) year to date avg.	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d year to date avg.	Total Phosphorus (TP) avg. conc. mg/L	TP loading kg/d monthly avg.	Total Ammonia Nitrogen (TAN) avg. conc. mg/L summer	TAN avg. conc. mg/L winter
January	4.7	13.48	10.2	29.25	0.42	1.2		3.09
February	4.2	14.48	7.3	28.32	0.35	1.1		4.55
March	4.6	15.96	8.0	30.14	0.46	1.6		8.40
April	2.6	14.32	5.2	26.90	0.28	1.0	0.24	
May	1.9	12.30	4.9	24.25	0.21	0.7	0.34	
June	2.3	11.38	6.0	23.10	0.18	0.6	0.15	
July	2.4	10.46	5.8	22.22	0.18	0.6	0.75	
August	1.9	9.90	6.5	21.39	0.21	0.7	0.60	
September	1.7	9.07	6.0	20.95	0.19	0.6	1.07	
October	2.0	8.60	7.9	20.89	0.30	0.9	4.02	
November	2.2	8.47	9.5	21.17	0.43	1.3	1.14	
December	1.9	8.29	7.8	21.84	0.29	0.9		0.80
Average	2.7	8.29	7.1	21.84	0.29	0.9	1.04	4.21
Minimum	1.7	8.29	4.9	20.89	0.18	0.6	0.15	0.80
Maximum	4.7	15.96	10.2	30.14	0.46	1.6	4.02	8.40
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
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Kjeldahl Nitrogen average (avg.) concentration (conc.) milligram per litre 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	5.56	0.00	13.3	6.3	7.5	11.9
February	6.58	0.00	12.3	6.1	7.3	11.3
March	12.03	0.00	7.9	6.5	7.5	12.5
April	1.90	0.00	14.2	6.7	7.3	14.0
May	1.94	0.00	15.1	6.8	7.3	16.3
June	1.84	0.00	15.7	6.8	7.2	18.3
July	2.49	0.00	14.7	6.6	7.0	20.0
August	2.38	0.00	16.7	6.4	7.0	20.7
September	2.96	0.00	16.2	6.5	7.9	19.8
October	6.82	0.00	15.0	6.7	7.2	17.2
November	3.24	0.00	18.0	6.7	7.6	15.4
December	2.60	0.00	15.0	6.7	7.2	13.2
Average	4.20	0.00	14.5			15.9
Minimum	1.84	0.00	7.9	6.1		11.3
Maximum	12.03	0.00	18.0		7.9	20.7
ECA Limit		0.04				
ECA Objective		0				
Within Compliance		Yes				
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes	Yes

Table 4 Summary of *Escherichia coli* and Faecal Streptococcus Sampling

Month	Escherichia coli Number of Samples	Escherichia coli Monthly Geometric Mean Density	Faecal Streptococcus Number of Samples	Faecal Streptococcus Monthly Geometric Mean Density
January	8	3	2	20
February	8	7	2	78
March	10	6	2	322
April	8	16	2	75
May	9	15	2	23
June	9	83	3	55
July	8	10	2	29
August	9	6	2	37
September	9	16	4	134
October	8	12	2	156
November	9	11	2	32
December	9	3	2	12
ECA Limit				
ECA Objective		200		
Within Compliance		Yes		
Sampling Frequency Requirement Met	Yes		Yes	

Table 5 Sludge Quality and Disposal

Month	Average Sludge Total Solids Percentage	Total Volume Removed cubic metre (m^3)	Total Volume Hauled to Duffin Creek WPCP (m3)	Total Volume Hauled to Courtice WPCP (m^3)	Total Volume Hauled to Port Darlington WPCP (m^3)
January	2.38	788	0	788	0
February	3.45	524	0	524	0
March	2.03	820	0	820	0
April	3.49	784	0	784	0
May	3.04	792	0	792	0
June	3.12	968	0	968	0
July	3.76	704	0	704	0
August	3.88	748	0	748	0
September	26.80	616	0	616	0
October	10.98	792	0	792	0
November	27.80	704	0	704	0
December	5.38	744	0	744	0
Total		8,984	0	8,984	0
Average	8.01				

Table 6 Energy and Chemical Usage

Month	Total Plant Flow cubic metre	Aluminum Sulphate litre	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite litre	Hydro kilowatt hour	Natural Gas cubic metre
January	88,906	7,661	343.0	2,787	92,451	17,621
February	100,938	4,657	271.3	2,997	96,359	15,961
March	129,325	6,051	310.3	3,331	89,682	30,413
April	99,999	5,660	380.6	1,895	99,235	15,235
May	96,555	6,464	496.5	2,049	94,127	4,455
June	90,154	7,731	556.0	1,905	94,857	248
July	86,778	7,810	702.5	1,992	89,093	245
August	83,099	8,150	659.7	2,001	91,004	376
September	77,757	8,470	550.5	1,975	83,743	356
October	80,179	8,380	392.7	2,045	98,601	6,563
November	76,293	7,963	591.3	2,035	84,652	2,713
December	111,978	8,498	598.1	2,021	116,530	15,047
Total	1,121,961	87,494	5,853	27,032	1,130,333	109,233

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

Month	*Escherichia coli* (*E.*	*E. coli* Colony Forming Units per 100 millilitres (CFU/100ml) Results Range	Total Coliform number of samples	Total Coliform CFU/100ml Results Range
January	15	Non-Detect (ND) - 1	15	ND - 22
February	15	ND	15	ND - 230
March	19	ND - 1	19	ND - 46
April	15	ND - 1	15	ND - 3
May	17	ND	17	ND - 3
June	18	ND - 1	18	ND - 1
July	16	ND - 1	16	ND - 10
August	18	ND	18	ND - 180
September	15	ND - 2	15	ND - 33
October	16	ND - 3	16	ND - 17
November	18	ND - 1	18	ND - 12
December	15	ND - 4	15	ND - 52