



Newcastle Water Pollution Control Plant 2023 Annual Performance Report





The Regional Municipality of Durham

Newcastle Water Pollution Control Plant 2023 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) 2023 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 12,170 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 46 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 (alum), into various locations within the plant. In 2023, alum 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 83% of its annual average rated flow capacity and received a maximum daily flow of 10,109 cubic metres per day (m³/d) on February 10, 2023. 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 2023 included:

- Replaced mechanical seal assembly on raw sludge pump 2,
- Installed new effluent gate valve,
- Replaced all corner sweep springs in secondary 2,
- Replaced impeller, cutter bars, and mechanical seal on raw sludge pump 3,
- Replaced casing on raw sludge pump 3,
- Replaced sheave on grit pump 1,
- Replaced expansion joint on blower 2,
- Cleaned out wet well,
- Replaced air shut off valve,
- Emptied, cleaned, and repaired sodium hypochlorite tank.



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.

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 July 31, 2023.

Calibration of in-house laboratory equipment was conducted on August 8, 2023.

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 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 (m³/d) was not exceeded.

The maximum rated flow rate of 12,300 m³/d was not exceeded.

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

g) A tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed;

The volume of sludge removed from Newcastle Water Pollution Control Plant (WPCP) in 2023 was 8,860 cubic metres (m³) at an average concentration of 2.89% total solids. Table 5 summarizes sludge quality and disposal results during the 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.

The sludge produced at this facility was transferred to Duffin Creek Water Pollution Control Plant (WPCP) for incineration, or Courtice WPCP for anaerobic digestion.

Receiving facilities included:

Courtice WPCP – 8,728 m³ or 98.5%

Duffin Creek WPCP – 132 m³ or 1.5%

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 2023.

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



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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 16 for cleaning. The MECP York Durham District Office supervisor was notified at the completion of each by-pass.

The MECP was notified (incident number 1-3ST3ZP) that on September 1, 2023 a blockage of the bar screen at Sunset Boulevard Sanitary Sewage Pumping Station caused an upstream surcharge of the sewer. Sewage spilled through the lid of the maintenance access hole, flowed through a chain-link fence, and down a forested slope to a nearby creek. Durham Region staff cleared the blockage and performed cleanup. There were no visible impacts to the creek, which was investigated the next morning during daylight hours. As a result of this incident the number of station checks was increased to mitigate the risk of reoccurrence.

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 odor 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 the detailed design stage and construction is planned to be completed in 2025.

k) Information Required by MECP Water Supervisor;

Table 7 provides a bacterial analysis of the Newcastle Water Supply Plant raw water for 2023.

MECP Inspection

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



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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	122,878	3,964	8,474
February	117,428	4,194	10,109
March	146,889	4,738	9,093
April	139,065	4,636	9,574
May	117,926	3,804	8,481
June	99,759	3,325	5,698
July	90,720	2,926	3,362
August	83,669	2,699	3,049
September	74,292	2,476	2,854
October	75,321	2,430	2,713
November	76,383	2,546	2,876
December	91,789	2,961	3,886
Total	1,236,119		
Average	103,010	3,387**	
Minimum	74,292		
Maximum	146,889		10,109
ECA Limit		4,086	12,300
Met Compliance		Yes	Yes

*Metered at the raw influent

**Annual Average Daily Flow



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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	163	188	5.2	38.70
February	130	147	4.5	34.20
March	199	238	6.2	36.80
April	193	233	6.1	35.13
May	234	232	6.4	32.68
June	205	268	6.7	38.25
July	315	383	10.7	52.52
August	338	372	9.2	52.08
September	379	503	13.6	63.95
October	365	398	12.0	64.60
November	288	288	8.0	55.15
December	271	265	9.5	60.40
Average	257	293	8.2	47.04
Minimum	130	147	4.5	32.68
Maximum	379	503	13.6	64.60



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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	1.8	7.13	6.2	24.58	0.33	1.3		0.33
February	2.2	8.15	6.3	25.66	0.32	1.3		0.33
March	2.1	8.60	5.5	25.81	0.34	1.5		0.15
April	1.5	8.33	6.2	26.75	0.32	1.4	0.20	
May	1.3	7.68	6.0	25.60	0.29	1.2	0.17	
June	1.6	6.99	6.7	25.07	0.40	1.6	0.11	
July	1.3	6.69	4.3	23.23	0.17	0.7	0.17	
August	1.1	6.05	4.6	21.54	0.17	0.5	0.31	
September	1.9	5.82	5.4	20.73	0.26	0.6	1.27	
October	1.2	5.62	4.3	19.32	0.14	0.3	4.54	
November	2.1	5.48	4.4	18.50	0.22	0.6	3.22	
December	2.6	5.76	4.4	18.29	0.20	0.6		13.60
Average	1.7	5.76	5.4	18.29	0.26	0.9	1.25	3.60
Minimum	1.1	5.48	4.3	18.29	0.14	0.3	0.11	0.15
Maximum	2.6	8.60	6.7	26.75	0.40	1.6	4.54	13.60
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



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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	1.90	0.00	12.3	6.9	7.2	12.6
February	1.46	0.00	13.3	6.5	7.4	11.3
March	1.20	0.00	11.8	6.9	7.3	11.5
April	1.43	0.00	12.1	7.0	7.3	13.0
May	1.96	0.00	13.4	6.6	7.3	14.9
June	1.42	0.00	14.6	6.6	7.1	17.8
July	1.31	0.00	15.8	6.6	7.3	19.6
August	1.46	0.00	16.9	6.5	7.0	19.7
September	2.57	0.00	17.6	6.4	6.8	20.0
October	5.49	0.00	17.5	6.1	7.1	18.2
November	4.47	0.00	17.3	6.4	6.8	15.9
December	15.88	0.00	10.1	6.5	7.0	15.0
Average	3.38	0.00	14.4			15.8
Minimum	1.20	0.00	10.1	6.1		11.3
Maximum	15.88	0.00	17.6		7.4	20.0
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	9	3	2	33
February	8	5	2	28
March	9	11	2	8
April	8	7	2	20
May	9	15	2	36
June	9	28	3	37
July	8	40	2	54
August	10	18	2	12
September	8	15	2	18
October	9	12	2	133
November	9	18	3	131
December	8	3	1	9
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 (m ³)	Total Volume Hauled to Courtice WPCP (m ³)	Total Volume Hauled to Port Darlington WPCP (m ³)
January	4.27	572	0	572	0
February	4.15	528	0	528	0
March	4.98	604	0	604	0
April	2.97	528	0	528	0
May	4.35	616	132	484	0
June	2.77	612	0	612	0
July	2.66	784	0	784	0
August	1.63	968	0	968	0
September	1.01	880	0	880	0
October	1.88	924	0	924	0
November	1.51	964	0	964	0
December	2.51	880	0	880	0
Total		8,860	132	8,728	0
Average	2.89				



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	122,878	7,586	500.2	2,088	92,843	13,416
February	117,428	6,198	473.2	1,890	100,978	14,092
March	146,889	7,165	606.3	1,951	93,717	21,257
April	139,065	7,094	492.4	2,022	101,861	6,952
May	117,926	7,534	441.6	2,099	92,247	7,337
June	99,759	6,139	498.4	1,998	93,343	783
July	90,720	8,122	447.2	2,014	85,686	3,172
August	83,669	7,960	439.5	2,067	87,378	572
September	74,292	9,897	342.1	1,949	80,897	1,945
October	75,321	9,908	282.7	2,020	96,876	7,795
November	76,383	8,062	330.4	1,996	89,074	5,424
December	91,789	6,732	265.7	2,026	109,574	14,555
Total	1,236,119	92,397	5,120	24,120	1,124,474	97,300



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

Month	<i>Escherichia coli</i> (<i>E. coli</i>) number of samples	<i>E. coli</i> Colony Forming Units per 100 millilitres (CFU/100ml) Results Range	Total Coliform number of samples	Total Coliform CFU/100ml Results Range
January	17	Non-Detect (ND) - 1	17	ND - 390
February	15	ND - 2	15	ND - 560
March	18	ND - 1	18	ND - 130
April	15	ND - 1	15	ND - 190
May	18	ND - 1	18	ND - 32
June	17	ND - 1	17	ND - 12
July	17	ND - 1	17	ND - 4
August	18	ND	18	ND - 34
September	15	ND – Overgrown (OG)	15	ND - OG
October	17	ND - 1	17	ND - 21
November	18	ND - 1	18	ND - 22
December	14	ND	14	ND