## Newcastle Water Pollution Control Plant

# 2021 Annual Performance Report

# The Regional Municipality of Durham
# Newcastle Water Pollution Control Plant 2021 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) 2021 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 11,647 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 storage.

### Raw Influent Pumping

Wastewater collected through approximately 42 kilometres 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. The Rudell Sanitary Sewage Pumping Station was taken out of service August

2021. The flow has been diverted to a new trunk sewer line that has been constructed under Highway 401 and the Canadian National Railway.

### 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), the Port Darlington 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 2021 aluminum sulphate was dosed only in the channel between the aeration tanks and the secondary clarifiers.

### 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.

**Sludge 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 76% of its annual average rated flow capacity and received a maximum daily flow of 9,409 cubic metres per day ($m^3$/d) on September 23, 2021. See tables 3 and 4 for effluent results.

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

Foaming issues occurred in the aeration tank which travelled into the center ring of the secondary clarifier. Higher than normal sludge volumes were discovered in the primary clarifier. A combination of both increased wasting and sludge haulage resolved the issue.

**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 2021 included:

- Replaced bearings and chains on the bar screen
- Replaced ware strip on the grit auger
- Replaced sludge pump for sludge loading station
- Replaced raw sewage pump 3 mechanical seal.
- Replaced sodium hypochlorite pump 2 pressure valve
- Repaired jet aeration pump 2 in grit tank 101
- Replaced motor on sodium bisulphite 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 December 1, 2021.
- Calibration of in-house lab equipment was conducted on July 22, 2021.
- 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 at all times 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 2021 was 9,048 cubic metres ($m^3$) at an average concentration of 3.1% 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 3,900 $m^3$ (43%) was hauled to the Duffin Creek WPCP for incineration and 5,148 $m^3$ (57%) 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 2021.

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

Ministry of the Environment, Conservation and Parks (MECP) approved by-passes of the chlorine contact chamber were conducted on April 7 and November 4 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;**

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 end of 2023.

**k) Information Required by MECP Water Supervisor;**

Table 7 provides a bacterial analysis of the Newcastle Water Supply Plant raw water for 2021.

## 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 | 93,713 | 3,023 | 4,019 |
| February | 72,918 | 2,604 | 3,208 |
| March | 91,129 | 2,940 | 4,194 |
| April | 113,596 | 3,787 | 7,689 |
| May | 95942 | 3095 | 4085 |
| June | 77,396 | 2,580 | 3,165 |
| July | 84,909 | 2,739 | 3,303 |
| August | 79,922 | 2,578 | 3,026 |
| September | 98,146 | 3,272 | 9,409 |
| October | 106,342 | 3,430 | 4,546 |
| November | 99,867 | 3,329 | 4,396 |
| December | 113,071 | 3,647 | 5,802 |
| Total | 1,126,951 | | |
| Average | 93,913 | 3,088* | |
| Minimum | 72,918 | | |
| Maximum | 113,596 | | 9,409 |
| ECA Limit | | 4,086 | 12,300 |
| Met Compliance | | Yes | Yes |

*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 | 180 | 183 | 4.6 | 39.98 |
| February | 316 | 281 | 6.5 | 57.40 |
| March | 319 | 302 | 7.6 | 51.42 |
| April | 267 | 262 | 5.3 | 39.18 |
| May | 311 | 272 | 7.6 | 51.5 |
| June | 550 | 549 | 15.9 | 82.08 |
| July | 454 | 407 | 9.1 | 60.55 |
| August | 327 | 326 | 8.3 | 55.58 |
| September | 395 | 347 | 7.2 | 54.70 |
| October | 362 | 330 | 8.0 | 49.40 |
| November | 281 | 231 | 6.4 | 41.98 |
| December | 259 | 268 | 7.1 | 42.63 |
| Average | 335 | 313 | 7.8 | 52.20 |
| Minimum | 180 | 183 | 4.6 | 39.18 |
| Maximum | 550 | 549 | 15.9 | 82.08 |

**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 | 4.4 | 13.15 | 8.4 | 25.35 | 0.46 | 1.4 | | 2.46 |
| February | 4.9 | 13.01 | 8.2 | 23.46 | 0.40 | 1.1 | | 1.63 |
| March | 3.0 | 11.38 | 5.0 | 20.45 | 0.21 | 0.6 | | 0.77 |
| April | 2.5 | 11.21 | 5.3 | 20.69 | 0.28 | 0.9 | 1.97 | |
| May | 1.4 | 9.78 | 5.3 | 19.82 | 0.39 | 1.2 | 2.13 | |
| June | 1.5 | 8.63 | 4.7 | 18.39 | 0.19 | 0.6 | 2.86 | |
| July | 1.6 | 7.99 | 6.7 | 18.42 | 0.20 | 0.6 | 0.33 | |
| August | 1.4 | 7.38 | 6.0 | 18.04 | 0.21 | 0.6 | 0.45 | |
| September | 1.4 | 7.08 | 5.9 | 18.20 | 0.35 | 1.0 | 0.37 | |
| October | 2.7 | 7.28 | 8.3 | 19.15 | 0.65 | 2.0 | 3.98 | |
| November | 2.1 | 7.25 | 6.1 | 19.27 | 0.25 | 0.8 | 0.68 | |
| December | 3.5 | 7.68 | 8.3 | 20.12 | 0.44 | 1.4 | | 7.77 |
| Average | 2.5 | 7.68 | 6.5 | 20.12 | 0.34 | 1.0 | 1.60 | 3.16 |
| Minimum | 1.4 | 7.08 | 4.7 | 18.04 | 0.19 | 0.6 | 0.33 | 0.77 |
| Maximum | 4.9 | 13.15 | 8.4 | 25.35 | 0.65 | 2.0 | 3.98 | 7.77 |
| 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 | 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 | 4.02 | 0.00 | 13.1 | 6.5 | 7.6 | 11.7 |
| February | 3.78 | 0.00 | 14.7 | 6.5 | 7.8 | 11.1 |
| March | 2.37 | 0.00 | 14.6 | 6.3 | 7.9 | 12.0 |
| April | 3.31 | 0.00 | 11.7 | 6.2 | 7.3 | 13.1 |
| May | 3.97 | 0.00 | 13.9 | 6.5 | 7.9 | 15.1 |
| June | 4.69 | 0.00 | 15.8 | 6.4 | 6.8 | 17.6 |
| July | 1.72 | 0.00 | 15.2 | 6.0 | 6.9 | 19.5 |
| August | 1.91 | 0.00 | 16.5 | 6.5 | 6.9 | 20.8 |
| September | 2.00 | 0.00 | 15.3 | 6.7 | 7.5 | 19.3 |
| October | 6.13 | 0.00 | 11.1 | 6.8 | 7.3 | 18.1 |
| November | 2.11 | 0.00 | 12.9 | 6.5 | 7.3 | 16.2 |
| December | 10.33 | 0.00 | 9.2 | 6.5 | 7.4 | 14.7 |
| Average | 3.86 | 0.00 | 13.7 | | | 15.8 |
| Minimum | 1.72 | 0.00 | 9.2 | 6.0 | | 11.1 |
| Maximum | 10.33 | 0.00 | 16.5 | | 7.9 | 20.8 |
| 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 | 2 | 1 | 1 |
| February | 8 | 2 | 2 | 57 |
| March | 9 | 2 | 2 | 3 |
| April | 9 | 2 | 2 | 2 |
| May | 8 | 8 | 2 | 10 |
| June | 9 | 37 | 2 | 31 |
| July | 9 | 37 | 2 | 41 |
| August | 9 | 53 | 2 | 31 |
| September | 9 | 25 | 2 | 267 |
| October | 8 | 7 | 2 | 31 |
| November | 9 | 47 | 2 | 117 |
| December | 9 | 5 | 2 | 20 |
| ECA Limit | | | | |
| ECA Objective | | 200 | | |
| Within Compliance | | Yes | | |
| 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 Duffin Creek WPCP (m3) | Total Volume Hauled to Courtice WPCP ($m^3$) | Total Volume Hauled to Port Darlington WPCP ($m^3$) |
|---|---|---|---|---|---|
| January | 3.09 | 792 | 792 | | |
| February | 3.22 | 524 | 524 | | |
| March | 3.90 | 608 | 608 | | |
| April | 4.17 | 788 | 788 | | |
| May | 4.05 | 616 | 616 | | |
| June | 2.76 | 792 | 572 | 220 | |
| July | 2.72 | 880 | | 880 | |
| August | 2.30 | 924 | | 924 | |
| September | 2.31 | 748 | | 748 | |
| October | 2.81 | 660 | | 660 | |
| November | 3.22 | 1,056 | | 1,056 | |
| December | 2.48 | 660 | | 660 | |
| Total | | 9,048 | 3,900 | 5,148 | |
| Average | 3.09 | | | | |

**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 | Natural Gas cubic metre |
|---|---|---|---|---|---|---|
| January | 93,713 | 7,932 | 576.8 | 3,787 | 98,176 | 16,360 |
| February | 72,918 | 7,209 | 477.0 | 3,446 | 97,487 | 14,671 |
| March | 91,129 | 7,445 | 542.3 | 3,711 | 95,416 | 10,742 |
| April | 113,596 | 7,577 | 507.3 | 3,778 | 88,661 | 4,476 |
| May | 95942 | 6,997 | 382.5 | 3,747 | 96,312 | 2,910 |
| June | 77,396 | 6,728 | 295.2 | 3,078 | 84,525 | 866 |
| July | 84,909 | 7,466 | 581.7 | 2,975 | 94,109 | 1,105 |
| August | 79,922 | 7,423 | 504.8 | 2,961 | 88,984 | 891 |
| September | 98,146 | 7,048 | 567.2 | 3,220 | 87,398 | 219 |
| October | 106,342 | 6,957 | 476.3 | 2,812 | 101,126 | 7,872 |
| November | 99,867 | 7,677 | 520.8 | 2,889 | 90,062 | 8,135 |
| December | 113,071 | 7,969 | 393.3 | 3,197 | 111,318 | 16,012 |
| Total | 1,126,951 | 88,429 | 5,825 | 39,601 | 1,133,573 | 84,259 |

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

| Month | *Escherichia coli* (*E. coli*) number of samples | *E. coli* Colony Forming Units per 100 millilitres (CFU/100ml) Results Range | Total Coliform number of samples | Total Coliform CFU/100ml Results Range |
|---|---|---|---|---|
| January | 16 | Non-Detect (ND) | 16 | ND - 83 |
| February | 15 | ND | 15 | ND - 5 |
| March | 19 | ND | 19 | ND - 43 |
| April | 16 | ND | 16 | ND - 18 |
| May | 14 | ND | 14 | ND - 22 |
| June | 18 | ND | 18 | ND - 9 |
| July | 16 | ND - 1 | 16 | ND - 16 |
| August | 17 | ND - 1 | 17 | ND - 47 |
| September | 16 | ND | 16 | ND - 11 |
| October | 15 | ND - 1 | 15 | ND - 76 |
| November | 17 | ND - 1 | 17 | ND - 18 |
| December | 16 | ND | 16 | ND - 39 |