Newcastle Water Pollution Control Plant

2024 Annual Performance Report

The Regional Municipality of Durham
Newcastle Water Pollution Control Plant 2024 Annual Performance Report

Environmental Compliance Approval (ECA): A-500-5222303834 Dated June 13, 2024
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) 2024 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 12,998 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). 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)
- Solids management

Raw Influent Pumping

Wastewater collected through approximately 47 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 2024, 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 11(4) of ECA A-500-5222303834 the Region must produce an annual performance report that contains the following information:

a) A summary and interpretation of all Influent monitoring data, and a review of the historical trend of the sewage characteristics and flow rates

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 and Figures 1-5 summarize the raw wastewater characteristics during the reporting period.

b) A summary and interpretation of all Final Effluent monitoring data, including concentration, flow rates, loading and a comparison to the design objectives and compliance limits in this Approval, including an overview of the success and adequacy of the Works

The Newcastle WPCP effluent was determined to be compliant with the ECA approval limits in Schedules 2, 3 and 4 during the reporting period.

The plant operated at an average of 80% of its annual average daily flow rated capacity.

Newcastle WPCP experienced two maximum daily flow rates which exceeded the maximum daily flow rate limit of 12,300m3/day:

- 12,355 cubic metres per day (m3/d) on April 4, 2024
- 13,695 m3/d on April 12, 2024

These exceedances were caused by extreme precipitation events where plant staff were able to effectively treat the wastewater without bypassing. The instantaneous peak flow rates were reported to the Ministry of the Environment Conservation and Parks. See tables 3 and 4 for effluent results.

c) A summary of all operating issues encountered, and corrective actions taken

Sodium hypochlorite chemical was declining in strength rapidly after delivery. This required frequent dosing adjustments to be made at the Newcastle WPCP, and adequate disinfection was able to be maintained. Investigations into the integrity of the chemical storage tank and

associated pumps and equipment were undertaken. The issue was resolved when the supplier was changed in September of 2024, and no internal issues were identified.

d) A summary of all normal and emergency repairs and maintenance activities carried out on any major structure, equipment, apparatus or mechanism forming part of the Works

Major maintenance items in 2024 included:

- Rebuilt secondary 2 corner sweeps with springs and squeegees
- Replaced motor for jet aeration 2
- Replaced grit classifier cyclone
- Cleaned out contact chamber in Spring and Fall

e) 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.

f) A summary of the calibration and maintenance carried out on all Influent and Final Effluent monitoring equipment to ensure that the accuracy is within the tolerance of that equipment as required in this Approval or recommended by the manufacturer

Calibration of the raw influent flow meter was conducted on November 26, 2024.
Calibration of in-house laboratory equipment was conducted on July 25, 2024.

Calibration of the pH meter is conducted regularly.

g) A summary of efforts made to achieve the design objectives in this Approval, including an assessment of the issues and recommendations for pro-active actions if any are required under the following situations

a. when any of the design objectives is not achieved more than 50% of the time in a year, or there is an increasing trend in deterioration of Final Effluent quality;

b. when the Annual Average Daily Influent Flow reaches 80% of the Rated Capacity

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 (m^3/d) was not exceeded.
- The pH objective of less than 6.5 was exceeded in 8 out of 366 samples (2.19%).

- The average daily flow reached 80 percent of the plant capacity. The WPCP is currently undergoing an expansion which upon completion, will increase the rated capacity to 7,200 m3/d. The expected completion date is April of 2027.

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

h) A tabulation of the volume of sludge generated, 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 2024 was 9,856 cubic metres (m^3). 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:
Duffin Creek WPCP – 8,076 m^3 or 81.9%
Courtice WPCP – 1,780 m^3 or 18.1%

i) 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 2024.

j) A summary of all Bypasses, Overflows, other situations outside Normal Operating Conditions and spills within the meaning of Part X of EPA and 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 18 and November 19 for cleaning. The MECP York Durham District Office supervisor was notified at the completion of each by-pass.

k) Summary of all Notice of Modifications to Sewage Works completed under Paragraph 1.d. of Condition 10, including a report on status of implementation of all modification

No notice of modifications were submitted in 2024.

l) A summary of efforts made to achieve conformance with Procedure F-5-1 including but not limited to projects undertaken and completed in the sanitary sewer system that result in overall Bypass/Overflow elimination including expenditures and

proposed projects to eliminate Bypass/Overflows with estimated budget forecast for the year following that for which the report is submitted

Industrial Wastes

Durham Region's Sewer Use By-Law (55-2013) outlines concentration limits for discharge into land drainage works or the sanitary sewer system. Violations of the by-law can result in fines of up to $100,000 for personal or corporate offences. Durham Region may establish a Compliance Program that will permit an industrial user to discharge non-complying sewage upon such terms and conditions deemed appropriate by the Durham Region Commissioner of Works. The compliance program allows industry to not be prosecuted for violating the concentration limits outlined in the by-law. The compliance program outlines the length of time necessary to plan, design, construct or install facilities to eliminate the non-compliance. A Sewage Surcharge Agreement is an agreement between Durham Region and a company, that permits the discharge of overstrength sewage to the Region's sanitary sewer collection system. Companies are billed for the overstrength sewage to pay for the additional cost of treatment and collection. The eligible parameters for a sewage Surcharge Agreement are Biochemical Oxygen Demand, Total Suspended Solids, Total Phosphorus, Total Kjeldahl Nitrogen, Animal/Vegetable Oil & Grease, and Sulphates. Sewer use by-law office staff routinely monitor and sample the wastewater collection system to ensure compliance with the by-law.

m) Any changes or updates to the schedule for the completion of construction and commissioning operation of major process(es) / equipment groups in the Proposed Works

Contract Number	Project Description	Original Projected Completion Date	Updated Projection Completion Date
D2024-58	Newcastle WPCP Capacity Re-Rating Upgrades	June 1, 2023	April, 2027

n) A summary of any deviation from the monitoring schedule and reasons for the current reporting year and a schedule for the next reporting year

There were no deviations from the monitoring schedule in 2024.

The following table demonstrates the 2025 sample schedule with the following definitions:

- SIM1 – Carbonaceous biochemical oxygen demand (CBOD5), suspended solids
- SIM2 – Biochemical oxygen demand (BOD5), suspended solids, Total Kjeldahl Nitrogen (TKN), Total Phosphorous (TP)
- SIM3M - BOD5, suspended solids, TKN, TP, Total Ammonia Nitrogen (TAN), Nitrite (NO2), Nitrite + Nitrate (NO2+NO3), dissolved phosphorous, Aluminum (Al), Arsenic (As),

Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Lead (Pb), Antimony (Sb), Selenium (Se), Zinc (Zn)

- SIM3C - CBOD5, suspended solids, TKN, TP, TAN, NO2, NO2+NO3, dissolved phosphorous
- SIM3MC - CBOD5, suspended solids, TKN, TP, TAN, NO2, NO2+NO3, dissolved phosphorous, Al, As, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Zn
- SLU2 - Total solids, ashed total solids, volatile total solids, TKN, TP, TAN, NO2+NO3, Mercury (Hg), As, Cd, Co, Cr, Cu, Potassium (K), Mo, Ni, Pb, Se, Zn
- MFECS – E.coli
- MFEC-WW – E.coli

Sample Location	Tuesday	Thursday
Raw	SIM3M (Monthly) SIM2	SIM2
Primary Effluent	SIM1 (Monthly)	Not Applicable (N/A)
Return Activated Sludge	SLU2 (Bi-weekly) MFECS (Bi-weekly)	N/A
Final Effluent Contact Chamber	SIM3C SIM3MC MFEC-WW	SIM3C MFEC-WW

MECP Inspection

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

Table 1 Raw Influent Flows

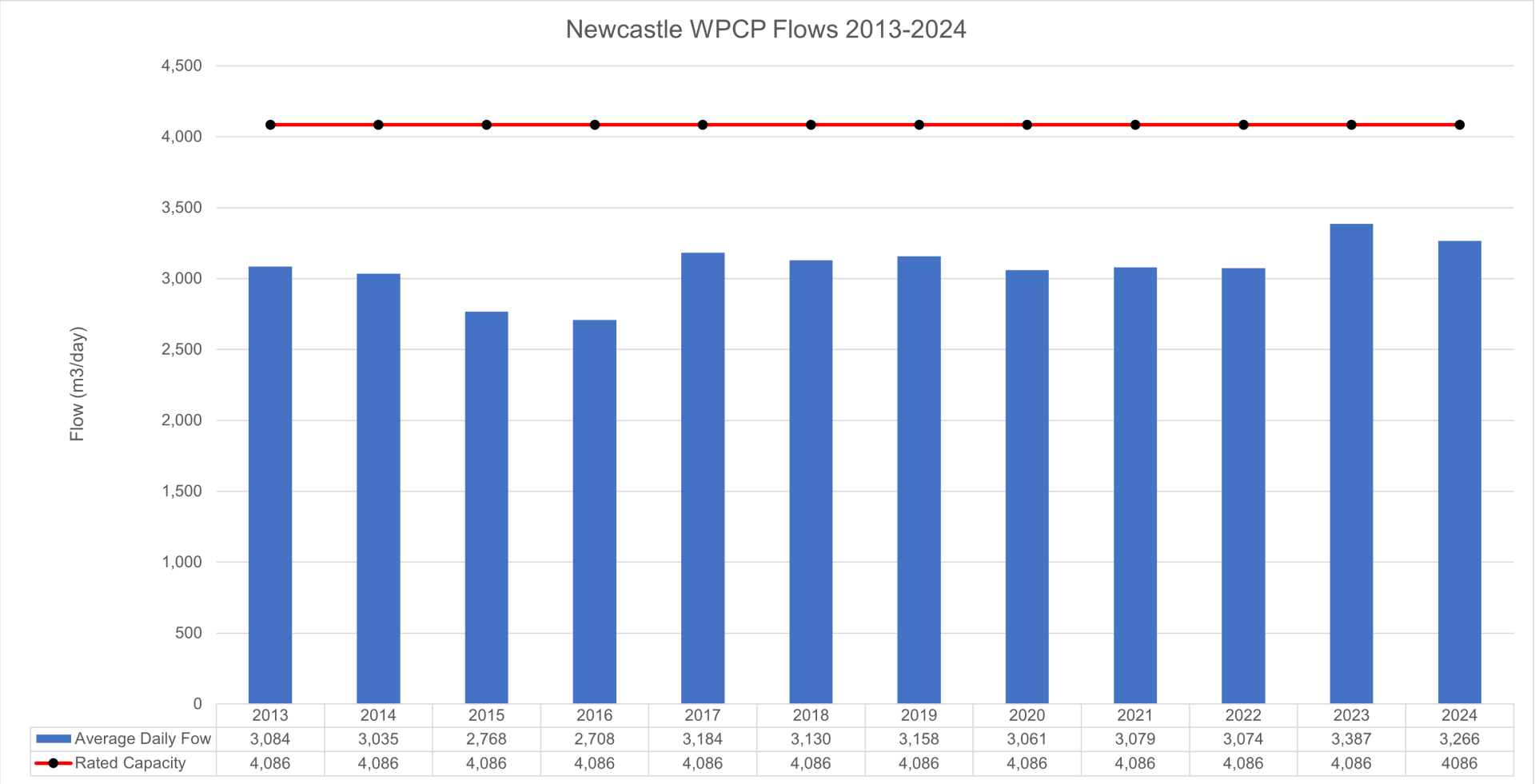
Month	Total Flow to Plant* - cubic metre	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	115,336	3,721	5,551
February	90,137	3,108	3,707
March	112,493	3,629	4,556
April	165,769	5,526	13,695
May	97,624	3,149	3,746
June	91,434	3,048	4,692
July	98,477	3,177	4,944
August	83,360	2,689	3,189
September	82,912	2,764	3,354
October	82,260	2,654	3,036
November	77,903	2,597	2,947
December	97,801	3,155	6,616
Total	1,195,506		
Average	99,626	3,275**	
Minimum	77,903		
Maximum	165,769		13,695
ECA Limit		4,086	12,300
Met Compliance		Yes	No

*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	241	310	8.5	46.50
February	364	329	8.9	48.88
March	250	289	7.9	42.85
April	240	313	7.3	39.76
May	119	383	10.0	62.95
June	215	248	9.0	51.78
July	289	308	8.8	48.28
August	230	310	9.7	54.42
September	199	252	6.5	42.20
October	201	260	7.1	52.22
November	197	293	9.6	56.25
December	262	327	11.0	55.24
Average	234	302	8.7	50.11
Minimum	119	248	6.5	39.76
Maximum	364	383	11.0	62.95



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Average Daily Fow	3,084	3,035	2,768	2,708	3,184	3,130	3,158	3,061	3,079	3,074	3,387	3,266
Rated Capacity	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4086

Figure 1 - Annual Average Flow 2013 - 2024

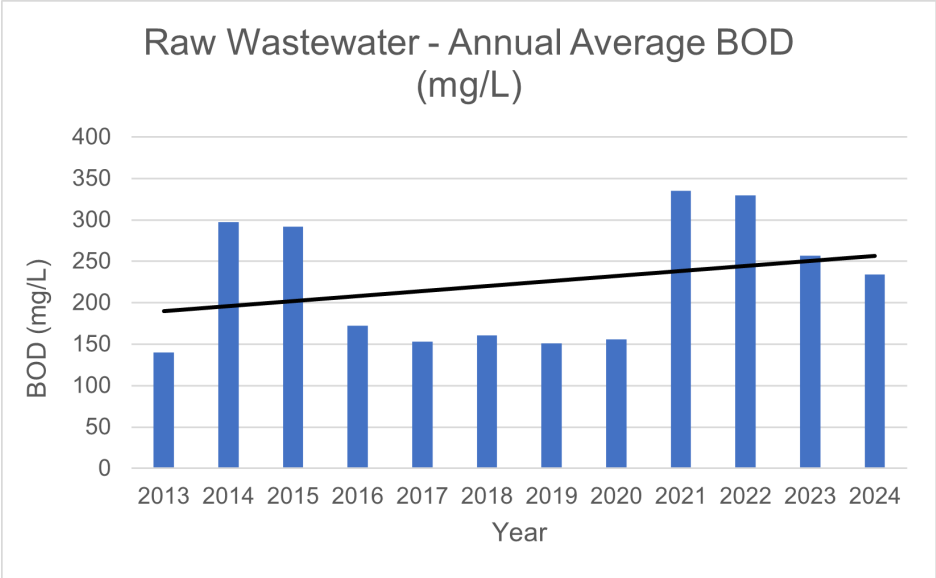


Figure 2 - Raw Influent - Annual Average Biochemical Oxygen Demand (BOD)

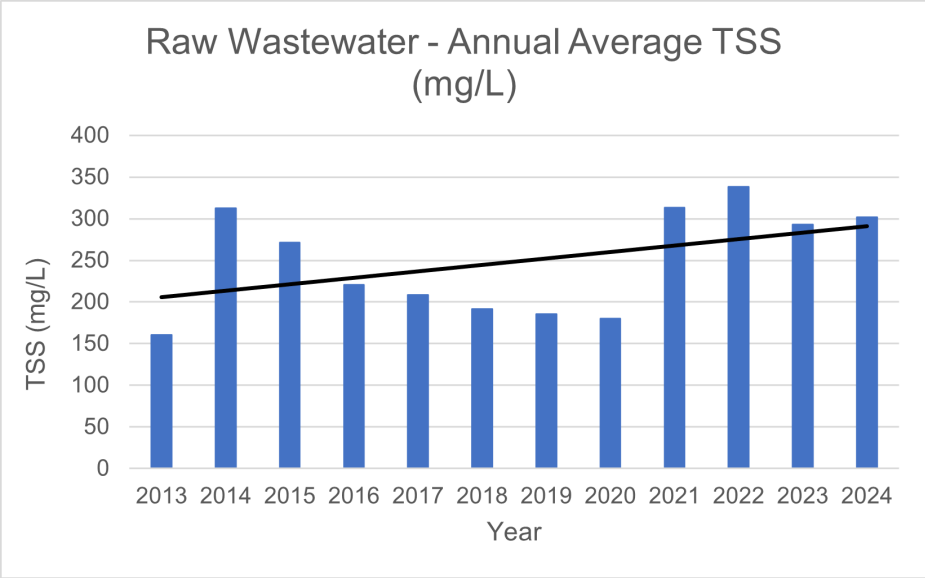


Figure 3 – Raw Influent – Annual Average Total Suspended Solids (TSS)

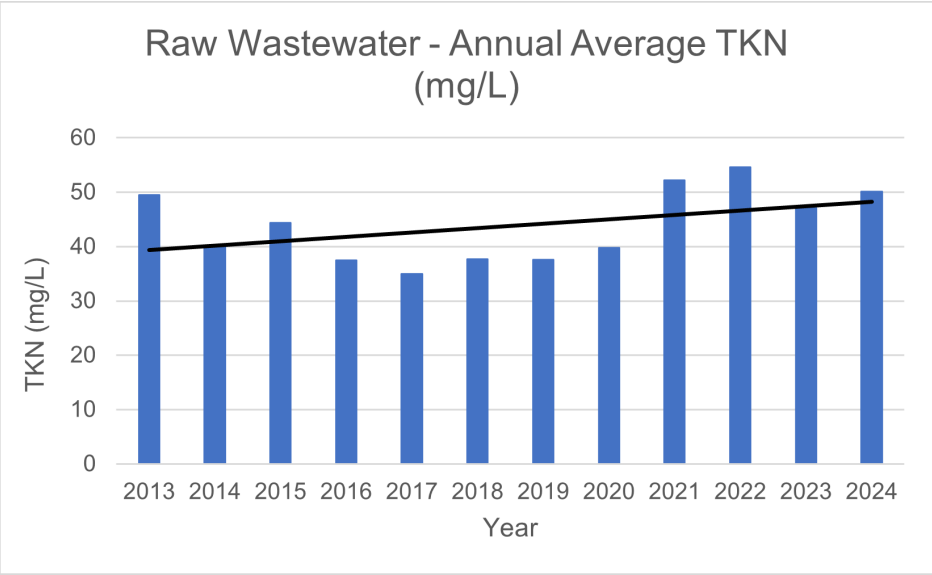


Figure 2 - Raw Influent - Annual Average Total Kjeldahl Nitrogen (TKN)

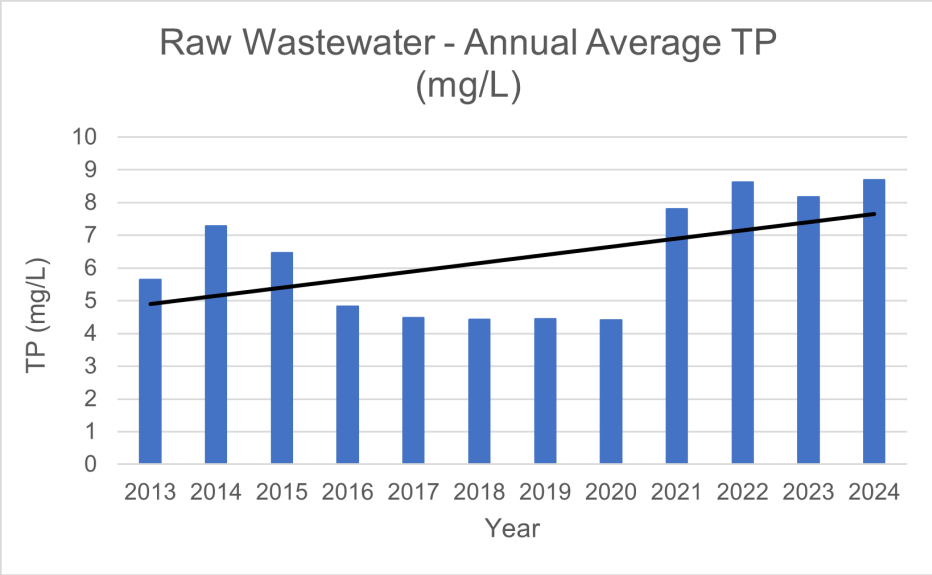


Figure 3 - Raw Influent - Annual Average Total Phosphorous (TP)

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand (CBOD5) average (avg.) concentration (conc.) milligrams per litre (mg/L)	Total Suspended Solids (TSS) avg. conc. mg/L
January	3.5	5.5
February	3.0	4.4
March	1.7	4.3
April	2.0	4.6
May	2.3	3.9
June	2.6	3.7
July	2.3	3.6
August	2.4	4.2
September	2.7	4.4
October	2.1	3.9
November	2.6	5.4
December	2.8	4.1
Average	2.5	4.3
Minimum	1.7	3.6
Maximum	3.5	5.5
ECA Limit	25.0*	25.0*
ECA Objective	15.0	15.0
Annual Conc.	2.50	4.61
Annual Loading	8.16	15.07
Within Compliance	Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes

*Annual Average Concentration

Table 3 Final Effluent Analyses Continued

Month	Total Phosphorus (TP) average (avg.) concentration (conc.) mg/L milligrams per litre (mg/L)	Total Ammonia Nitrogen (TAN) avg. conc. mg/L summer	TAN avg. conc. mg/L winter	Total Kjeldahl Nitrogen avg. conc. milligram per litre mg/L
January	0.23		5.34	6.69
February	0.20		2.65	4.01
March	0.16		1.21	1.90
April	0.18		2.13	3.40
May	0.10	0.44		1.50
June	0.17	0.64		1.73
July	0.21	0.30		1.33
August	0.22	0.94		2.26
September	0.25	1.95		3.18
October	0.18	2.70		3.92
November	0.30		2.74	4.08
December	0.34		0.75	2.04
Average	0.21	1.16	2.49	3.01
Minimum	0.11	0.30	0.75	1.33
Maximum	0.34	2.70	5.34	6.69
ECA Limit		15	20	
ECA Objective	1.0	10	15	
Within Compliance		Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Chlorine Residual maximum concentration (conc.) mg/L	Nitrate plus Nitrite average (avg.) conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	Non-Detect (ND)	10.8	6.3	7.1	12.6
February	ND	13.0	5.9	7.0	12.7
March	ND	13.0	6.6	6.9	13.1
April	ND	11.0	6.6	7.0	13.9
May	ND	15.5	6.5	6.9	16.7
June	ND	14.5	6.5	7.1	18.8
July	ND	15.4	6.4	7.2	20.2
August	ND	18.3	6.6	7.0	21.0
September	ND	18.1	6.6	6.9	20.5
October	ND	18.4	6.4	6.9	18.0
November	ND	18.5	6.4	7.0	16.6
December	ND	16.5	6.6	7.1	14.0
Average	ND	15.3			16.5
Minimum	ND	10.8	5.9		12.6
Maximum	ND	18.5		7.2	21.0
ECA Limit	0.02		6.0	9.5	
ECA Objective	ND*		6.5	8.5	
Within Compliance	Yes		Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes

*Non-detect is any value less than 0.02 mg/L.

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	5	2	3
February	9	2	2	57
March	8	6	1	4
April	9	16	2	237
May	9	29	3	37
June	8	48	No Data (ND)	ND
July	9	42	ND	ND
August	9	22	ND	ND
September	8	8	ND	ND
October	10	7	ND	ND
November	8	55	ND	ND
December	9	24	ND	ND
ECA Limit		200		
ECA Objective		200		
Within Compliance		Yes		
Sampling Frequency Requirement Met	Yes		Yes	

*Faecal Streptococcus only reportable until May of 2024 on former ECA.

Table 5 Sludge Quality and Disposal

Month	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	960	0	960	0
February	612	0	612	0
March	584	376	208	0
April	616	616	0	0
May	660	660	0	0
June	792	792	0	0
July	968	968	0	0
August	924	924	0	0
September	836	836	0	0
October	1,056	1,056	0	0
November	924	924	0	0
December	924	924	0	0
Total	9,856	8,076	1,780	0
Average	821	673	148	

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	115,336	9,931	468	2,137	94,658	17,985
February	90,137	8,997	711	2,053	94,798	13,322
March	112,493	9,394	654	2,231	97,621	24,340
April	165,769	9,295	1038	2,021	86,196	7,408
May	97,624	9,128	654	2,094	88,065	572
June	91,434	9,114	1089	1,932	94,474	538
July	98,477	6,890	823	1,994	86,974	19,790
August	83,360	7,963	1114	2,117	90,583	922
September	82,912	7,604	287	1,968	79,409	1,717
October	82,260	8,288	274	1,812	89,371	10,580
November	77,903	6,473	655	693	85,419	16,858
December	97,801	6,261	504	1,133	111,427	19,124
Total	1,195,506	99,337	8269	22,185	1,098,996	133,156

Table 7 Sludge Analysis

Parameter	Quarter 3 Concentration milligrams/kilogram (mg/L)	Quarter 4 Concentration milligrams/kilogram (mg/L)
Ammonia (total, as N)	180.9	194
Arsenic (total)	0.036	0.061
Cadmium (total)	0.02	0.015
Chromium (total)	0.1	0.141
Cobalt (total)	0.3	0.25
Copper (total)	2.81	4.351
Lead (total)	0.1	0.166
Mercury (total)	2.8	4.86
Molybdenum (total)	0.3	0.25
Nickel (total)	0.1	0.118
Nitrate (total)	0.4	0.4
Phosphorous (total)	421.6	363
Potassium (total)	70.4	72.9
Selenium (total)	0.05	0.060
Total Solids	14,993	25,399
Zinc (total)	7.06	8.87