



The Corporation of the Township of Perth East
2024 Annual Operations Report
Shakespeare Water Pollution Control Plant

3976B Galt Street
Shakespeare, Ontario
N0B 2P0

February 6, 2025



Ministry of the Environment, Conservation and Parks

London Regional Office
733 Exeter Road
London, Ontario
N6E 1L3

February 6, 2025

ATTN: Mr. Pierre Adrien, London District Manager

**Re: The Corporation of the Township of Perth East
Shakespeare Water Pollution Control Plant, Annual Report 2024**

Please find enclosed the Township of Perth East's Shakespeare Wastewater Treatment Facility Annual Operations Report for the year 2024. The report is prepared in accordance with the annual report criteria as part of the Certificate of Approval # 3152-7X2TW2, issued October 28, 2009 which contains the following:

- a) A summary and interpretation of all monitoring data and a comparison to the effluent limits outlined in condition 7, including an overview of the success and adequacy of the Works;
- b) A description of any operating problems encountered and corrective actions taken;
- c) A summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works;
- d) A summary of any effluent quality assurance or control measures undertaken in the reporting period;
- e) A summary of the calibration and maintenance carried out on all effluent monitoring equipment;
- f) A description of efforts made and results achieved in meeting the Effluent Objectives of Condition 6;
- 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;
- h) A summary of any complaints received during the reporting period and any steps taken to address the complaints;
- i) A summary of all By-pass, spills or abnormal discharge events;
- j) Any other information the District Manager requires from time to time.

We trust that the information provided herein is satisfactory to the requirements of the above referenced Certificate of Approval. Should there be any questions or comments regarding the contents of this report, please feel free to contact the undersigned.

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cc:// Neville Rising (MECP), Inspector
Matt Gabel, Water/Wastewater Supervisor
Michael Givens, CAO



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INTRODUCTION

The Shakespeare Water Pollution Control Plant (WPCP) is located at 3976B Galt Street in Shakespeare, ON. The WPCP operates under ECA number 3152-7X2TW2, and is rated as a Class 2 Facility. The plant is comprised of two continuous inflow extended aeration sequencing batch reactors. Raw wastewater flows from the village of Shakespeare are directed to the treatment plant via a gravity collection system. The raw sewage is processed through the plant in accordance with all applicable laws, certificates and regulations. Final effluent from the plant is treated by UV disinfection before discharging into the Shakespeare Drain and eventually the Thames River. The plant services a population of approximately 830 people.

The following is a list of the main treatment components:

- An inlet works consisting of a heavy bar screen (manual), and a raw sewage high lift station equipped with two (2) submersible pumps (operated alternately)
- Raw sewage equalization tank, equipped with two (2) submersible pumps (operated alternately)
- Two (2) continuous inflow extended aeration sequencing batch reactors (SBR) equipped with fine bubbling system, two (2) blowers (operated alternately), two (2) effluent decanters (one for each SBR) discharging into the effluent equalization tank, two (2) submersible waste pumps (one for each)
- One (1) 57.7m³ effluent equalization tank, with two (2) submersible pumps (operated alternately)
- One (1) 1,000L Alum storage tote with chemical feed pumps, and standby alum totes
- One (1) tertiary sand filter
- One (1) UV disinfectant channel
- Grassed outlet channel
- One (1) 150kW standby diesel engine generator

The sewage works, including both the collection and treatment systems are owned and operated by the Township of Perth East.

The following information corresponds with the reporting parameters set forth under Subsection 6 of Section 10 of the aforementioned ECA (3152-7X2TW2).



A) SUMMARY & INTERPRETATION OF MONITORING DATA

Table 1 - Effluent Quality Monitoring Data and Regulatory Compliance Parameters													
Year	Week	Month	CBOD ₅ (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorus (mg/L)	Total Ammonia Nitrogen (mg/L)	E.coli (CFU/100mL)	pH	Temperature °C				
			Limit: 10.0	Limit: 10.0	Limit: 0.3 (04/16 - 10/15)	Limit: 3.0	Limit: 100	Limit: 6.0 - 9.5					
			Objective: 5.0	Objective: 5.0	Limit: 0.5 (10/16 - 04/15)	Objective: 1.0	Objective: 80	Objective: 6.5 - 8.5					
					Objective: 0.25								
2024	1	January	3.2	5.4	0.19	0.6	151	8.0	7.1				
	2							8.0					
	3							7.8					
	4							7.7					
	5							8.1					
	6	February	2.0	4.6	0.13	0.7	1	7.8	7.0				
	7							7.9					
	8							7.8					
	9							8.1					
	10	March	2.0	4.1	0.18	1.0	14	7.9	7.5				
	11							8.0					
	12							8.3					
	13							6.7					
	14	April	1 - 15	2.1	8.2	1.0	13	8.0	9.0				
	15							7.9					
	16		16 - 30		2.1			8.2		0.23	1.0	13	7.8
	17												7.9
	18	May	3.2	6.6	0.48	4.7	48	8.0	8.9				
	19							7.9					
	20							8.0					
	21							8.1					
	22	June	2.5	6.5	0.19	3.1	6	7.9	17.7				
	23							8.0					
	24							8.1					
	25							7.8					
	26	July	4.2	4.0	0.21	0.7	102	8.0	22.1				
	27							8.4					
	28							8.2					
	29							8.0					
	30							8.1					
	31							8.2					
	32	August	4.0	3.5	0.19	0.2	6	8.3	22.3				
	33							8.3					
	34							8.0					
	35							8.5					
	36	September	4.0	3.0	0.49	0.3	18	8.7	21.4				
	37							9.3					
	38							8.3					
	39							8.2					
	40							8.4					
	41	October	1 - 15	4.0	4.3	0.30	0.8	5	8.2	20.6			
	42								8.1				
	43		16 - 30						4.0		4.3	0.22	0.8
	44	8.2											
	45	November	5.5	7.3	0.42	1.8	95	7.4	17.0				
	46							8.1					
	47							7.5					
	48	December	4.0	4.2	0.26	0.5	10	8.3	17.0				
	49							8.5					
	50							8.2					
	51							8.1					
	52							8.2					
	53	8.2											



Table 2 - Influent and Effluent Flow Data

FLOW DATA (m ³)							
Year	Month	EFFLUENT			INFLUENT		
		Average Daily Flow	Total Monthly Flow	Maximum Daily Flow	Average Daily Flow	Total Monthly Flow	Maximum Daily Flow
2024	January	254.22	7880.84	599.39	312.77	9695.73	1199.08
	February	188.36	5462.46	237.24	218.87	6347.13	266.21
	March	216.32	6705.86	369.36	255.55	7922.12	527.70
	April	231.18	6935.26	420.98	261.71	7851.15	486.02
	May	220.52	6836.21	423.62	163.76	5076.53	383.45
	June	185.86	5575.74	264.40	214.50	6435.07	321.16
	July	219.81	6814.08	559.28	296.89	9203.56	1578.49
	August	244.55	7580.96	574.30	291.11	9024.34	753.45
	September	216.66	6499.76	494.62	258.79	7763.68	608.63
	October	174.18	5399.55	267.36	204.08	6326.46	329.23
	November	209.76	6292.80	249.97	215.19	6455.73	267.10
	December	233.56	7240.41	570.74	249.23	7726.13	588.84

Table 3 - Influent Quality Monitoring Data

Year	Month	CBOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorus (mg/L)	Total Kjeldahl Nitrogen (TKN)
2024	January	152	77.3	5.0	57.0
	February	194	113.0	4.8	46.0
	March	139	80.2	5.8	63.0
	April	142	105.0	6.0	52.6
	May	130	54.1	5.1	44.3
	June	139	163.0	4.7	39.5
	July	138	60.2	5.8	57.2
	August	134	120.0	4.6	40.4
	September	181	160.0	4.7	45.5
	October	165	144.0	4.9	47.3
	November	259	213.0	4.8	43.4
	December	134	93.0	4.7	43.5



Table 4 - Monthly Average Annual Waste Loadings

Table 4 - Monthly Average Annual Waste Loadings					
Year	WASTE LOADING				
	Month	CBOD ₅ (kg/day)	Total Suspended Solids (kg/day)	Total Phosphorus (kg/day)	Total Ammonium Nitrogen (kg/day)
2024	January	47.5	24.2	1.6	17.8
	February	42.5	24.7	1.0	10.1
	March	35.5	20.5	1.5	16.1
	April	37.2	27.5	1.6	13.8
	May	21.3	8.9	0.8	7.3
	June	29.8	35.0	1.0	8.5
	July	41.0	17.9	1.7	17.0
	August	39.0	34.9	1.3	11.8
	September	46.8	41.4	1.2	11.8
	October	33.7	29.4	1.0	9.7
	November	55.7	45.8	1.0	9.3
	December	33.4	23.2	1.2	10.8

Table 5 – Percent (%) Removal

Year	Month	CBOD ₅	Total Suspended Solids	Total Phosphorus	Total Kjeldahl Nitrogen (TKN)
2024	January	97.92%	92.96%	96.13%	99.01%
	February	98.96%	95.97%	97.32%	98.55%
	March	98.54%	94.95%	96.88%	98.44%
	April	98.42%	92.76%	96.06%	98.12%
	May	97.54%	87.85%	90.66%	89.29%
	June	98.20%	96.01%	95.91%	92.19%
	July	96.96%	93.36%	96.33%	98.81%
	August	97.01%	97.08%	96.00%	99.50%
	September	97.79%	98.13%	89.70%	99.25%
	October	97.58%	97.05%	94.77%	98.41%
	November	97.88%	96.60%	91.16%	95.85%
	December	97.01%	95.48%	94.40%	98.76%



I. Carbonaceous Biological Oxygen Demand (CBOD₅)

Throughout the reporting period, the monthly average Carbonaceous Oxygen Demand concentration did not exceed the effluent limit of 10.0 mg/L. With the exception of the month of November, the effluent objective of 5mg/L was additionally achieved. The average for the reporting year was 3.4 mg/L, which indicates the treatment was effective for CBOD₅. Figure 1 below details the CBOD₅ concentrations in relation to the compliance parameters and objectives.

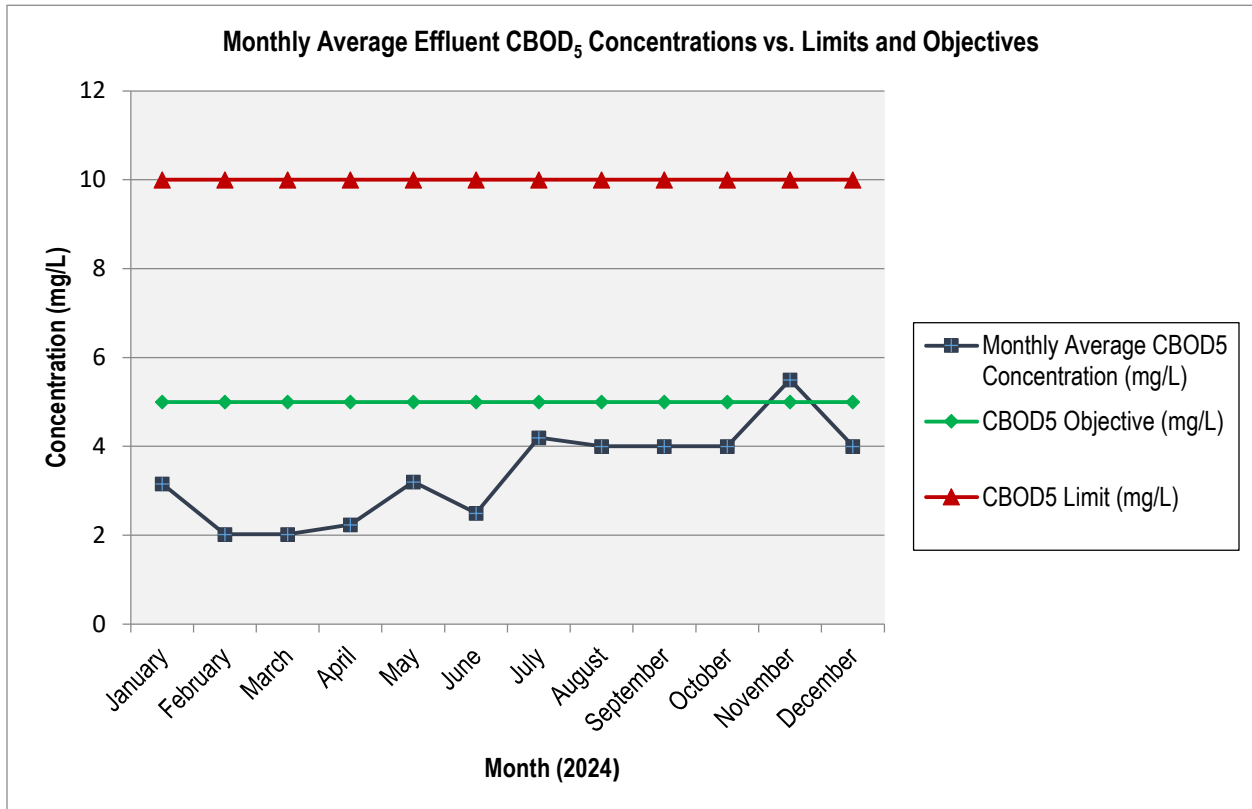


Figure 1 – Monthly Average Effluent CBOD5 Concentration vs. CoA Limits & Objectives



II. Total Suspended Solids (TSS)

Throughout the reporting period, the monthly average Total Suspended Solids concentration did not exceed the effluent limit of 10.0 mg/L. With the exception of the months of January, April and November, the effluent objective of 5mg/L was additionally achieved. The average for the reporting year was 5.1 mg/L, which indicates the treatment was generally effective for TSS, being marginally above the objective. Figure 2 below illustrates the monthly effluent Total Suspended Solids concentrations in relation to the compliance parameter limits and objectives.

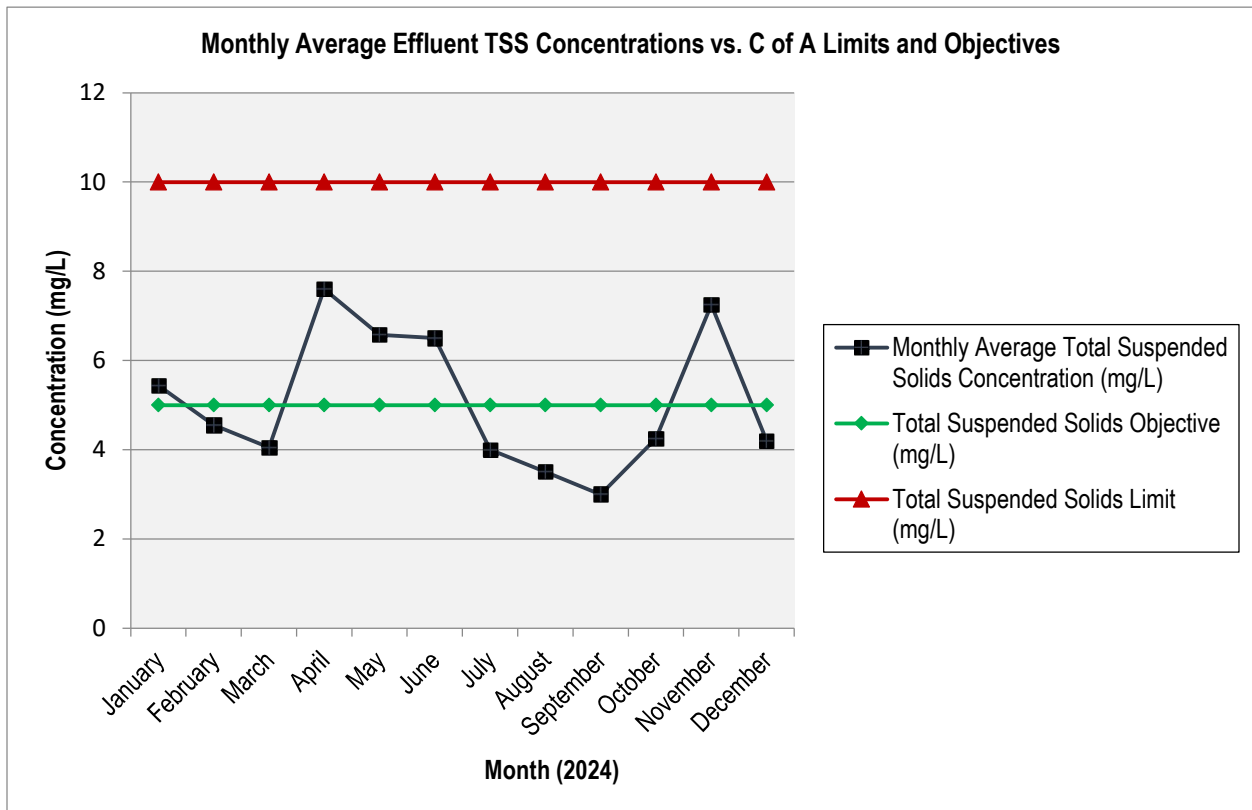


Figure 2 – Monthly Average Effluent TSS Concentration vs. CoA Limits & Objectives



III. Total Phosphorus (TP)

Throughout the reporting period, the monthly average Total Phosphorus concentration generally did not exceed the effluent limit. Effluent limits for this parameter are seasonal in nature having a reduced limit of 0.3 mg/L between April 16th and November 15th, while being 0.5 mg/L otherwise. In the months of May and September the average concentration of TP did exceed the effluent limit, which staff feel can be attributed to excessive sludge digester supernatant concentrations.

The effluent objective of 0.25 mg/L was achieved in seven out of the twelve months. The average for the reporting year was 0.27 mg/L, which indicates the treatment was generally effective for TP. Figure 3 below illustrates the monthly effluent Total Phosphorus concentrations in relation to the compliance parameter limits and objectives.

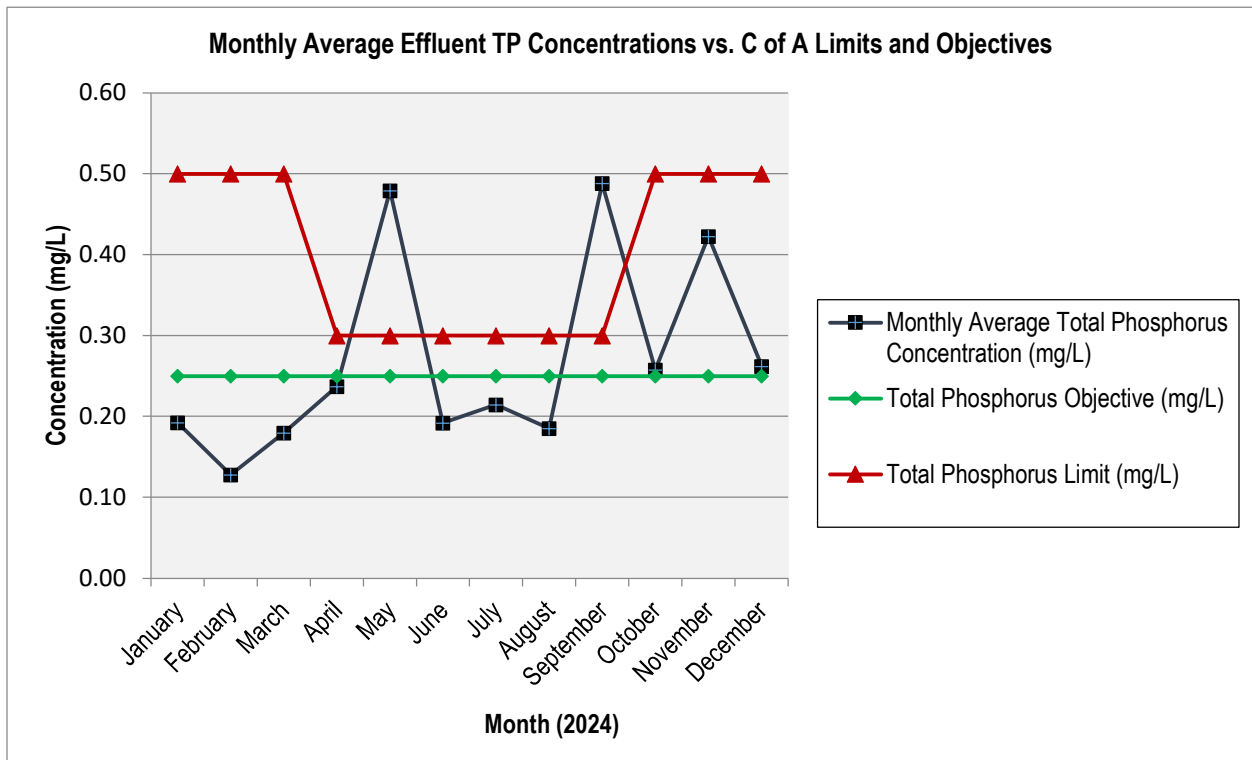


Figure 3 – Monthly Average Effluent TP Concentration vs. CoA Limits & Objectives



IV. Total Ammonia Nitrogen (TAN)

Throughout the reporting period, the monthly average Total Ammonia Nitrogen concentration did not exceed the effluent limit of 3.0 mg/L with the exception of the months May and June. Relative to the effluent objective of 1.0 mg/L, the average monthly concentration generally met the target. The effluent concentration remained under the objective concentration for all months with the exception of May, June and November. The average for the reporting year however was 1.2 mg/L; marginally over the objective concentration, which indicates the treatment was generally effective for TAN. Figure 2 below illustrates the monthly effluent Total Suspended Solids concentrations in relation to the compliance parameter limits and objectives.

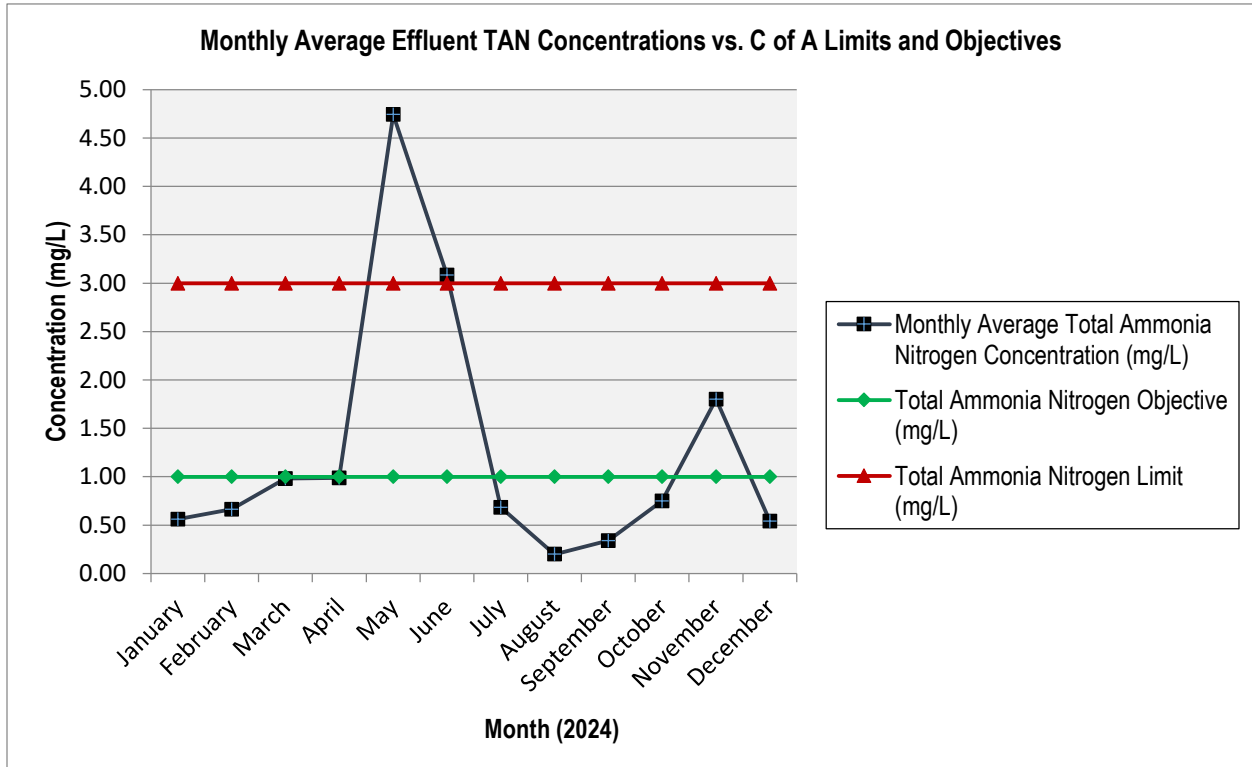


Figure 4 – Monthly Average Effluent TAN Concentration vs. CoA Limits & Objectives



V. E. coli

Throughout the reporting period, the monthly geometric mean density E. coli concentration generally did not exceed the effluent limit of 100 CFU/100mL. In the months of January and July, the limit was exceeded due to short term operational issues with the Ultraviolet (UV) system leading to outlier concentrations within those months. The objective of 80 CFU/100mL was met 9 out of 12 months in 2024. The geometric mean density for the reporting year was 17 CFU/100mL, which indicates the treatment was generally effective for E. coli. Figure 5 below details the E. coli concentrations in relation to the compliance parameter limits and objectives.

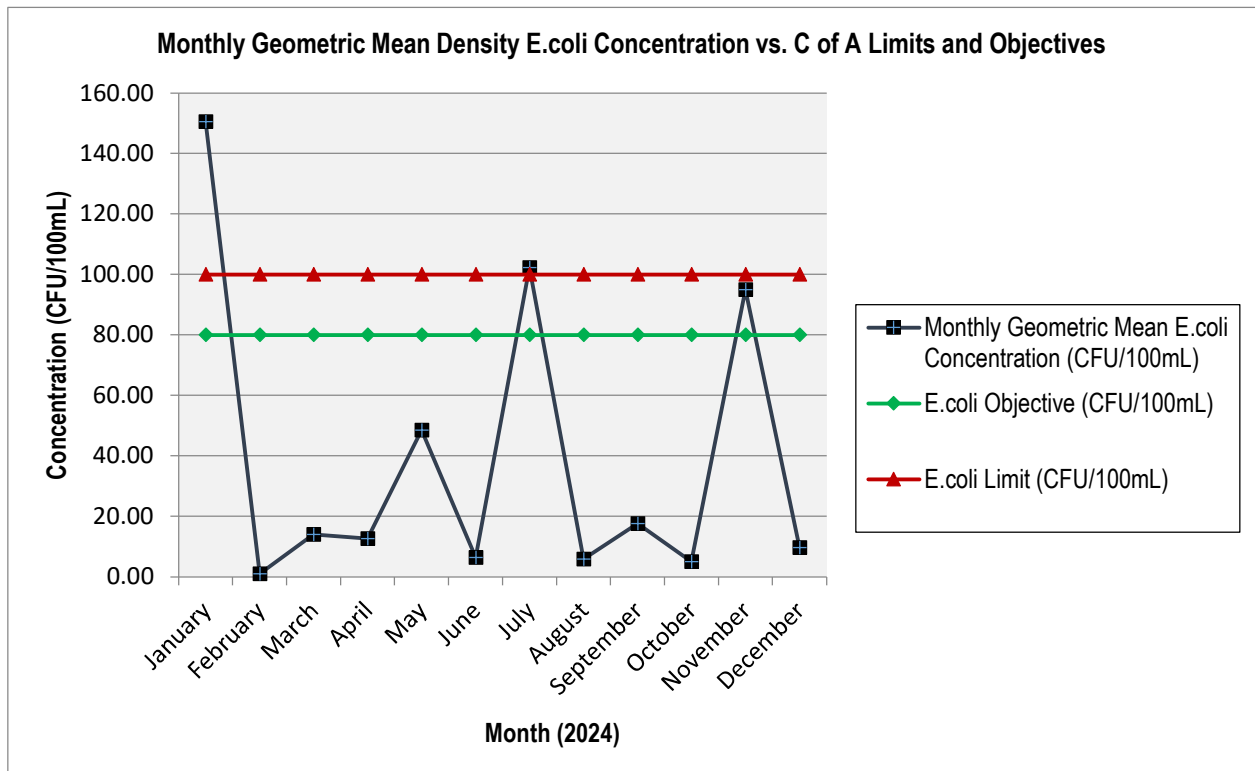


Figure 5 – Geometric Mean Density E. coli Concentration vs. CoA Limits & Objectives



VI. pH

Throughout the reporting period, the pH of the effluent was tested weekly and remained within the effluent limits between 6.0 and 9.5 and further remained within the objective range between 6.5 and 8.5 every week of the year with the exception of two weeks in the month of September indicating the wastewater maintained a relatively neutral pH range, ensuring biological treatment can be successful. Figure 6 below captures the weekly pH concentrations in relation to the compliance parameter limits and objectives.

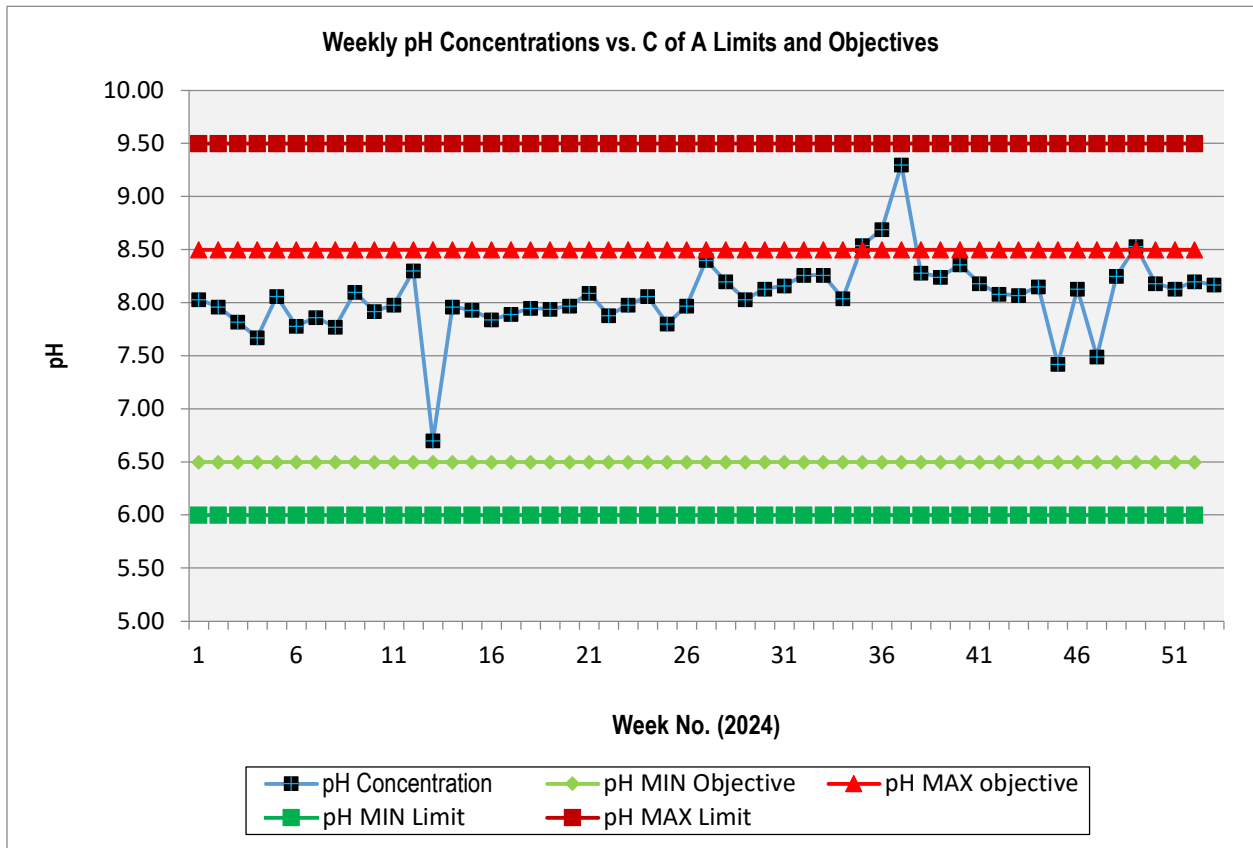


Figure 6 – Weekly pH Concentration vs. CoA Limits & Objectives



VII. Overall Treatment Efficacy

The overall efficacy of the treatment facility can be demonstrated through a comparison of influent and effluent compositions. As outlined in Table 5, the Shakespeare WPCP was able to achieve an average annual removal of 97.8% for CBOD5, 94.9% for Total Suspended Solids (TSS), 94.6% for Total Phosphorus (TP) and 97.2% removal of Total Kjeldahl Nitrogen (TKN). Further, as referenced in Section A (V.), E. coli was calculated to have an effluent geometric mean density of 17 CFU/100mL for the year which is indicative of a well operating filter and disinfection system. The plant effluent was additionally free of floating and settleable solids and there were no signs of oil, discoloration or foam.

VIII. Influent & Effluent Flows

Table 2 above captures influent and effluent flows over the reporting period including average daily flow, total monthly flow and maximum daily flow. In review, the average daily raw sewage influent flow for the Shakespeare WPCP over the reporting period was calculated to be 245.2 m³/day. This average represents approximately 74% of the plant rated capacity of 329 m³ average daily flow. As alluded to in the 2023 Annual Operations Report, both raw flow meters were replaced in 2024.

The maximum daily influent flow over this reporting period occurred on July 16, 2024, with a total of 1578.5 m³ which occurred following a high intensity rain event prior. On July 15 and 16, 2024, precipitation was recorded to be 59.3mm and 44.7mm, respectively. As such, this reinforces the need for an infiltration and inflow (I & I) study, which has been approved for 2025. Staff anticipate that through this process, significant improvements will be able to be realized to minimize the impact of such significant precipitation events. Figure 7 below shows the monthly average influent flow versus the plant rated capacity for the 2024 reporting period.

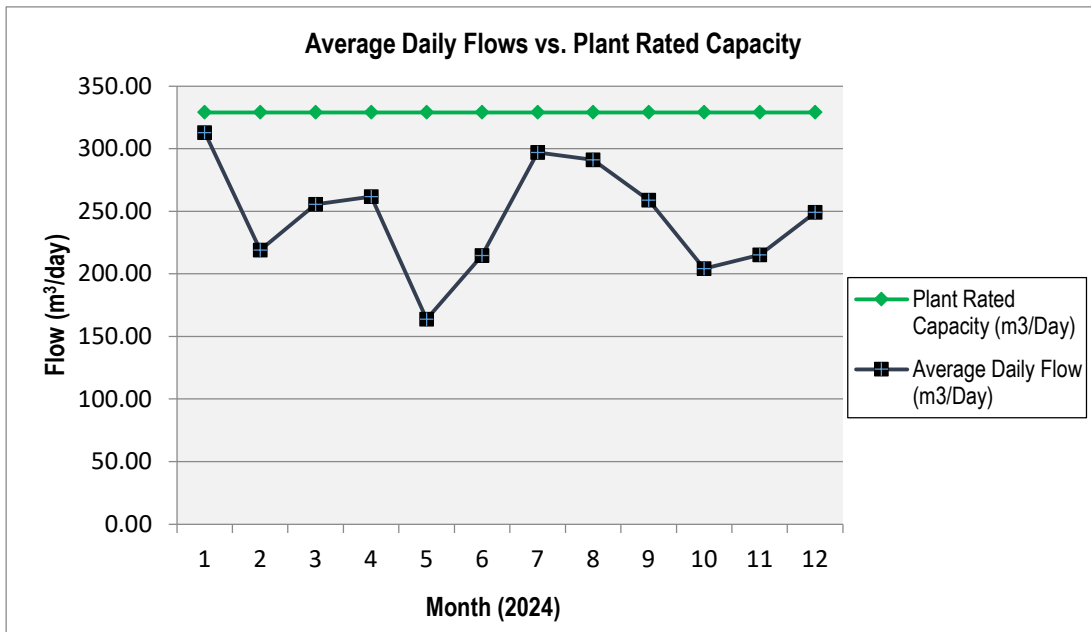


Figure 7 – Average Daily Flows vs Plant Rated & Peak Capacities



B) OPERATING PROBLEMS & CORRECTIVE ACTION

The Township of Perth East operating staff has made every effort to ensure that this wastewater treatment facility operates in accordance with all applicable laws, certificates and regulations. Plant operations were continually monitored and modified in order to improve the treatment process as the nature of the raw sewage changes and the influent flows fluctuate. In the reporting year, operating problems were minimal outside of the challenges with the Ultraviolet Disinfection system, which were resolved quickly in response.

The largest operating issue at the Shakespeare WPCP continues to be that of high flow events as a result of precipitation and/or melt events. In response to these events, the treatment plant is subject to influent flows which place the sequencing batch reactors into “Storm Mode”, which in turn reduces the treatment timelines and ultimately treatment effectiveness. As recommended in the Township’s Water/ Wastewater Master Plan (2018), the Township intends on conducting an inflow & infiltration (I&I) study in the 2025 operating year. Dependent on the findings of the study, issues can then be addressed as quickly as possible based on the complexity of the problems identified.

C) MAINTENANCE SUMMARY

The following is a list of the maintenance activities carried out during this reporting period on any of the plant’s major structures, equipment, apparatus, or mechanisms which form the integral parts of the treatment process.

- Monthly inspection carried out on backup generator, weekly checks
- Routine service of blowers
- Routine raking of bar screen
- Alum pump foot valves cleaned and serviced
- Primary alum injectors cleaned and serviced
- UV light cleaned; ballast replaced
- Routine greasing of components
- Changed blower air in-take filters
- Generator inspected and load tested by T&T Power Group
- Raw sewage pumps pulled and cleaned
- Raw sewage tanks cleaned by vacuum truck
- Both Raw Water influent flow meters replaced
- Cameras installed for remote monitoring of SBR’s
- Overhead lighting replaced through retrofit program



D) EFFLUENT QUALITY ASSURANCE

All samples are collected and tested as per the requirements of the Certificate of Approval.

Collected samples were delivered to a combination of ALS Global in Waterloo and SGS Canada Inc. in London, both CALA accredited laboratories. Both labs were responsible for performing the quality assurance and control checks.

Effluent quality monitoring is achieved by both composite and grab samples taken weekly as outlined within the plants operational Certificate of Approval. Samples are collected by an automatic composite sampler over a twenty-four-hour period, as well as a grab sample tested for E. coli. Weekly grab samples are collected and tested in house for pH and temperature.

For the purpose of influent quality monitoring, monthly composite samples are collected and sent to the lab for testing. Raw sewage samples are tested for CBOD₅, total suspended solids, total phosphorus and total Kjeldahl nitrogen. Settling tests and TSS are also performed for each of the basins in order to better interpret the state of the activated sludge during checks and better assess the expected performance.

E) CALIBRATION OF EFFLUENT MONITORING EQUIPMENT

Annual calibrations of influent and effluent flow meters for the year 2024 were conducted by SCG Flowmetrix. Calibrations were completed on all meters on May 8, 2024. Calibration of the temperature and pH meters are performed in-house according to manufacturer's instructions. Calibration of the dissolved oxygen (DO) probes, TSS probes, temperature and pH meters are performed in-house according to manufacturer's instructions.

F) EFFORTS MADE IN ACHIEVING EFFLUENT OBJECTIVES

Throughout the reporting period the effluent objectives were met as follows:

EFFLUENT PARAMETER	EFFLUENT OBJECTIVE
Carbonaceous Biological Oxygen Demand (CBOD ₅)	Achieved 11 out of 12 months
Total Suspended Solids (TSS)	Achieved 7 out of 12 months
Total Phosphorus (TP)	Achieved 7 out of 12 months
Total Ammonia Nitrogen (TAN)	Achieved 9 out of 12 months
E.coli	Achieved 9 out of 12 months
pH	Achieved 12 out of 12 months

Over the reporting period, operational staff made every effort to meet effluent objectives. In 2025, the Township plans to undertake an inflow and infiltration (I&I) study which is anticipated to allow for a more consistent and efficient treatment process, which in turn will minimize anomalies in effluent parameter concentrations. Following remediation of identified problems through the I&I study, it is anticipated that this will improve the overall ability for the plant to more consistently meet effluent objectives.



G) SLUDGE GENERATION

Approximately 370m³ of sludge was removed from the plant in 2024 which is similar to the 2023 volume. This equates to a total volume of sludge removed from the plant since the initial treatment operations began in November 2010 of approximately 5650m³.

The generated sludge is transferred to the Township of Perth East's Milverton WPCP (aerated lagoon facility) at Lot 5 Concession 3 Mill Street West, Township of Perth East, Mornington Ward; Certificate of Approval #6264-6EEP9N. The sludge is analyzed annually for the set parameters for not utilized sludge. It is expected that the amount of sludge generated in 2025 will be similar to the volume disposed of in 2024.

H) COMPLIANTS

There were no complaints received regarding the overall operation of the Shakespeare WWTP and collection system during the reporting period.

I) BY-PASSES, SPILLS & ABNORMAL DISCHARGE

There were no abnormal bypasses, spill or discharge events over the reporting period.

J) ADDITIONAL INFORMATION

The District Manager did not request any additional information over the reporting period.