THE CORPORATION OF THE TOWN OF ST. MARYS

2016 SUMMARY REPORT FOR THE WASTEWATER SYSTEM

WASTEWATER TREATMENT AND COLLECTION

Report Prepared for the:
Reporting Period of January 1, 2016 through December 31, 2016

Report Prepared By:
Renee Hornick, Operations Manager
Ontario Clean Water Agency on behalf of the Town of St. Marys

Date: March 2017

Table of Contents

PLANT FACTS

Facility:	Anoxic/Oxic Biological Nutrient Removal (A/O BNR) System with Integrated Sludge Management
Design Capacity:	5,560 m3/day - rated capacity 14,250 m3/day - Peak Flow Rate
Receiving Water:	Thames River
Certificate of Approval:	7828-9VLLLP (issued April 22, 2015)
Plant Classification:	Wastewater Treatment 2 (WWT2) Wastewater Collection 2 (WWC2)

Section 1: Overview of System

The St. Marys Wastewater Treatment Plant completed a Sludge Management Upgrade in 2010. The upgrade included conversion of the existing extended aeration activated sludge type system to anoxic/oxic biological nutrient removal system with integrated sludge management. The system consists of the following:

Raw Sewage Pumping Station:

Raw sewage typically flows by gravity throughout the system to the wastewater treatment plant. Where gravity flow is not possible due to elevation restrictions, raw sewage flows by gravity to each of the three pump stations that service the Town of St, Marys and from there is pumped to the wastewater treatment plant. The three pump stations are located as follows:

Emily Street Pump Station consisting of 2 30 HP pumps controlled by floats with high level float alarm.

Robinson Street Pump Station consisting of 2 7.5 HP pumps controlled by milltronics with high level float alarm and an emergency back-up generator.

Queen Street Pump Station consisting of 2 10 HP pumps controlled by milltronics with high level float alarm and an emergency back-up generator.

Inlet Works:

Sewage flows from the collection system and the three pump stations into the wet well through automatic bar screens then through a grit tank and communitor, the grit is conveyed to a bin sent to landfill. Sewage then flows by sewer piping to the anoxic tanks.

Anoxic Tanks:

Sewage is split between two round tanks with submersible mixers.

Aeration Tanks:

Sewage enters an inlet chamber where flows are split to three distribution chambers which feed three aeration basins operating in parallel. In 2015 there was a 150 hp turbo blower installed to provide a minimum 2,506 m3 of air/hour to replace one of the centrifugal blowers.

Aeration Tanks

Secondary Clarifiers:

Sewage is split in to four centre feed round clarifiers, two of which are presently in operation. During high flow conditions the other two clarifiers are put into service. Return activated sludge collected here can be transferred from the clarifiers to the aeration or waste activated equalization tanks which are the holding tanks for the sludge thickening process.

Disinfection and Discharge:

Effluent passes through two ultraviolet lamp arrays containing a total of 112 lamps. A sodium hypochlorite liquid feed system is provided for backup chlorination in the event of UV failure.

Final effluent is discharged via pipe to the outfall on the bank of the Thames River.

Sludge Handling

Waste activated sludge is pumped from the WASEQ tanks (waste activated sludge equalization) into two sludge storage tanks that were previously used as digesters. Supernate is taken off the top of the storage tanks to thicken the sludge. The sludge from these storage tanks is then dosed with polymer and then processed through the centrifuge. The dewatered sludge produced by the centrifuge is then run through the Lystek process. Sludge is mixed with potassium hydroxide in a heated mixing tank and processed.

Product from the mixing tank is pumped to a mixed storage tank equipped with an activated carbon odour control system. Sludge is loaded to the tanker from an overhead hose. The loading area is equipped with curbing and graded to catch basins tied into the Works.

Lystek Process

Lystek Chemical Feed System

Phosphorus Removal:

One phosphorus removal system capable of processing internal recycle streams consisting of one polymerized aluminum sulphate feed system consisting of two chemical feed pumps discharging into the channel of the outlet of the aeration tanks.

Standby Power

The wastewater treatment plant has an automatic standby generator which will operate the plant when there is a power failure. This allows for manual running of the plant when power outages occur.

Section 2: Summary of Monitoring Data

The St. Marys Wastewater Treatment Plant was monitored as per the Environmental Compliance Approval #7828-9VLLLP.

Detailed monitoring data is supplied in Appendix A.

Wastewater Monitoring

The raw wastewater is monitored for BOD_5, total suspended solids, total phosphorus, total ammonia nitrogen, alkalinity and total kjeldahl nitrogen weekly by composite sample. E-coli is monitored weekly by a grab sample. Dissolved oxygen, PH and temperature are monitored daily Monday to Friday. The plant was designed based on typical raw water characteristics.

Effluent is sampled on a weekly basis and tested for CBOD5, suspended solids, total phosphorus and total ammonia nitrogen as a composite sample. A grab sample is taken weekly and tested for E. coli. Unionized ammonia is calculated weekly. These parameters specified in the ECA were analyzed by SGS Lakefield; which is an accredited laboratory in Ontario.

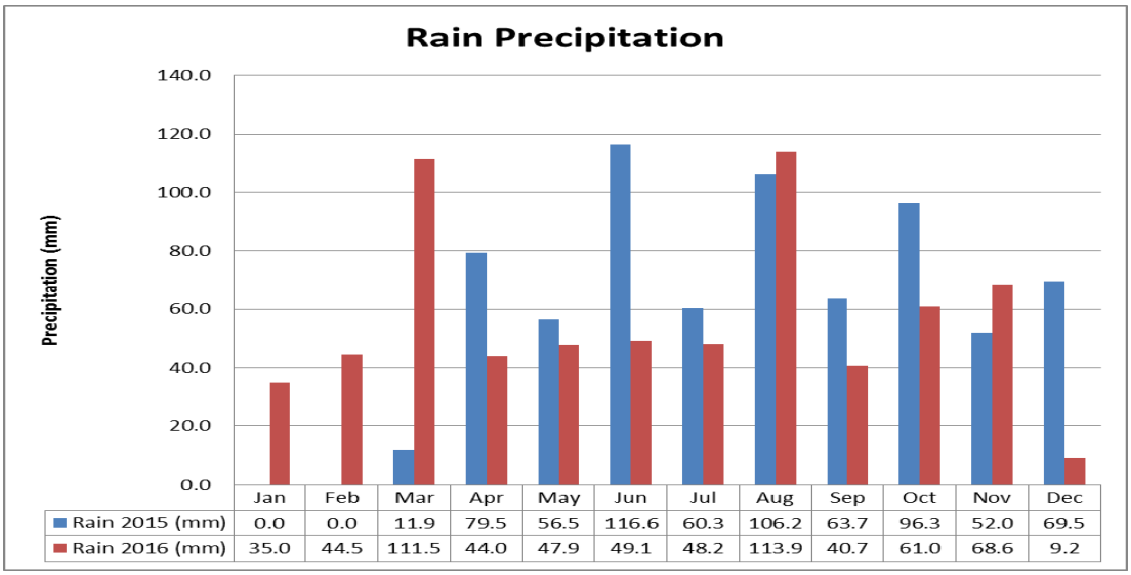
In-house tests are conducted by licensed operators for monitoring purposes using Standard Methods and the data generated from these tests is used to determine the treatment efficiency while maintaining process control; these include pH, temperature and DO which is mandatory Monday to Friday as well as phosphorus, ammonia, total suspended solids and settling tests.

Refer to Appendix A for more detailed monthly results.

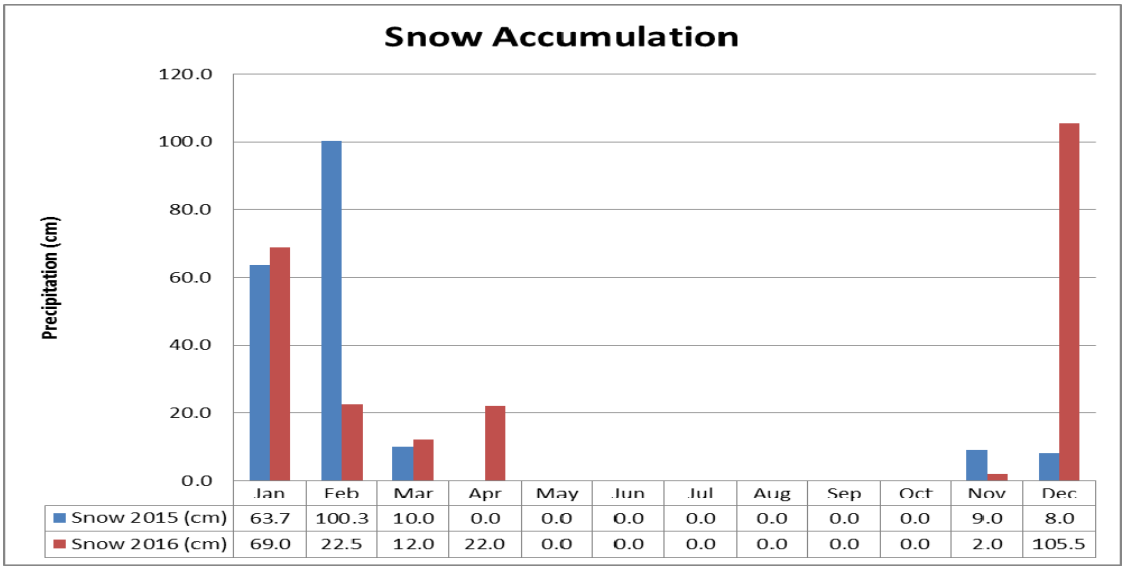
The total flow treated at the treatment plant was 1,459,176 m^3. The average daily flow for raw wastewater was 3,994.84 m^3/d. This represents 72% of the design capacity of 5,560 m^3/d. The maximum daily flow was 10,812 m^3 which occurred on April 8, 2016.

There were 27 instances where the rated capacity of 5,560 m3/day was exceeded, these occurred in the months of February, March and April and were related to wet weather conditions. The peak flow rate of 14,250 m3 was not exceeded in 2016.

According to the Stratford weather station in 2016, there was a total of 633.6 mm of rain and 712.5 mm in 2015. Total snow in 2016 was 233 cm and 191 cm in 2015.



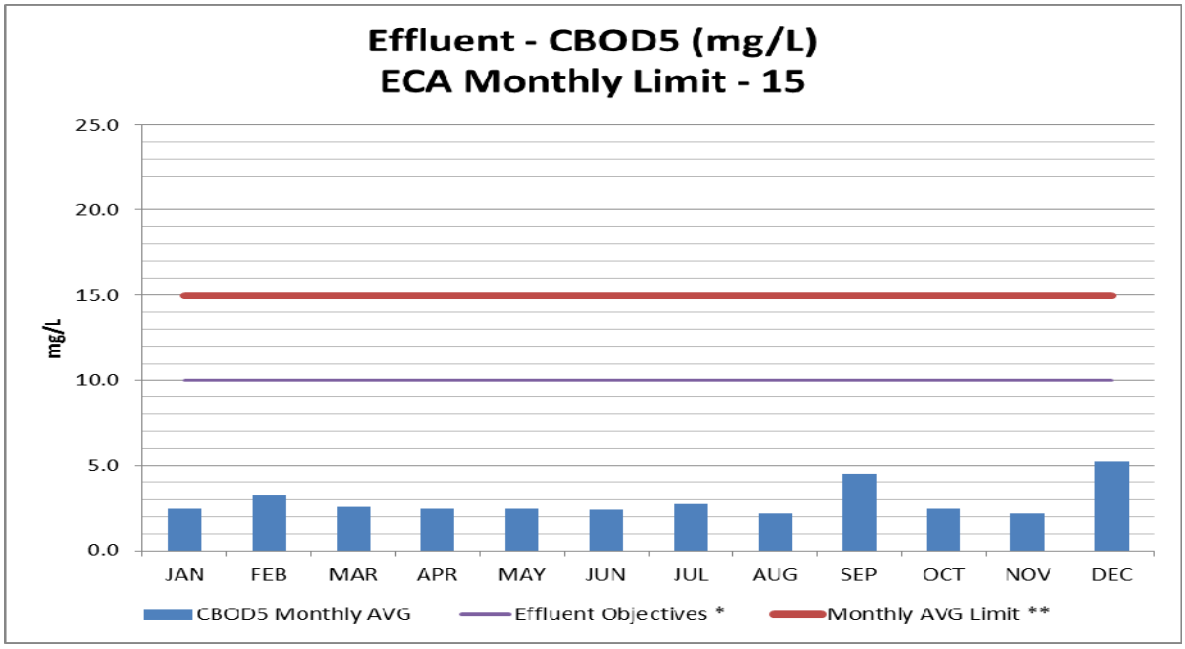
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain 2015 (mm)	0.0	0.0	11.9	79.5	56.5	116.6	60.3	106.2	63.7	96.3	52.0	69.5
Rain 2016 (mm)	35.0	44.5	111.5	44.0	47.9	49.1	48.2	113.9	40.7	61.0	68.6	9.2

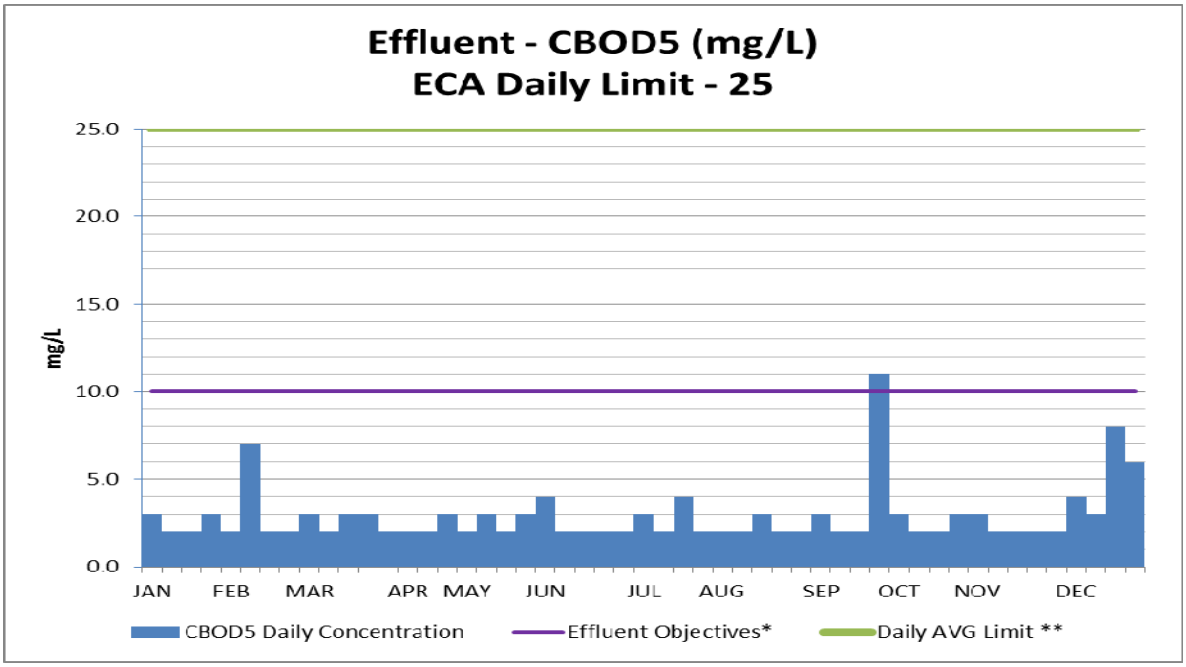


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Snow 2015 (cm)	63.7	100.3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	8.0
Snow 2016 (cm)	69.0	22.5	12.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	105.5

Refer to Appendix A for more detailed monthly results.

The annual average raw sewage BOD_5 concentration to the plant was 334.4 mg/L with a maximum daily concentration of 736 mg/L. The annual average final effluent $CBOD_5$ concentration was 2.93 mg/L with a maximum daily concentration of 11 mg/L.



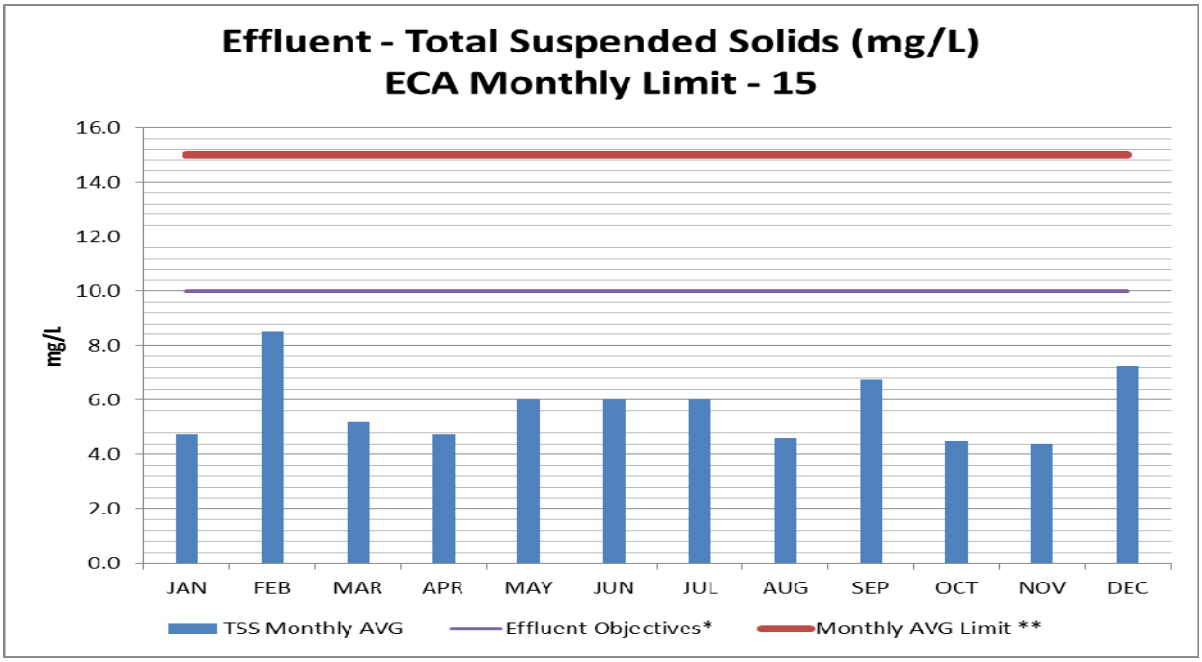


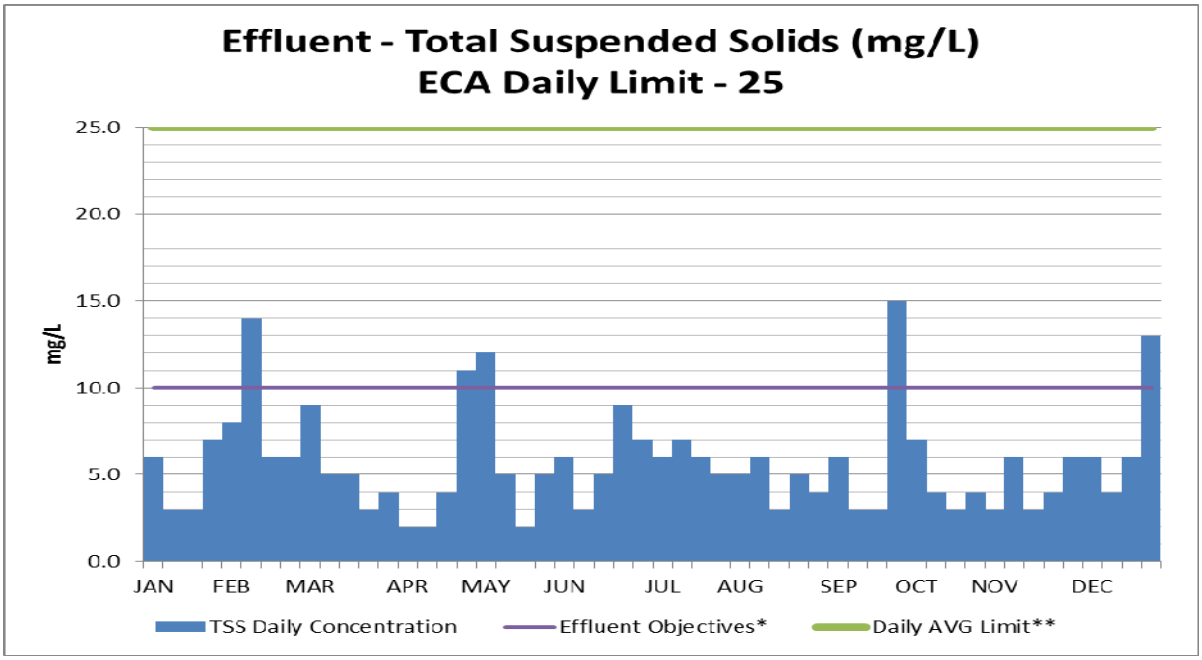
The Wastewater Treatment Plant (WWTP) is designed to handle a soluble BOD of 100 mg/L and a total BOD of 300 mg/L. The BOD loading to the WWTP in 2016 averaged 334.4 mg/l which is more than the designed loading, and can be attributed to the local industry within the Town.

*Objectives – The owner shall use best effort to operate the works with in the objectives

**Limits – The owner shall operate and maintain the works such that the concentrations of the parameters are not exceeded in the effluent

The annual average raw sewage total suspended solids (TSS) concentration to the plant was 230.78 mg/L, with a maximum daily concentration of 529 mg/L. The annual average final effluent TSS concentration was 5.7 mg/L with a maximum concentration of 15 mg/L.

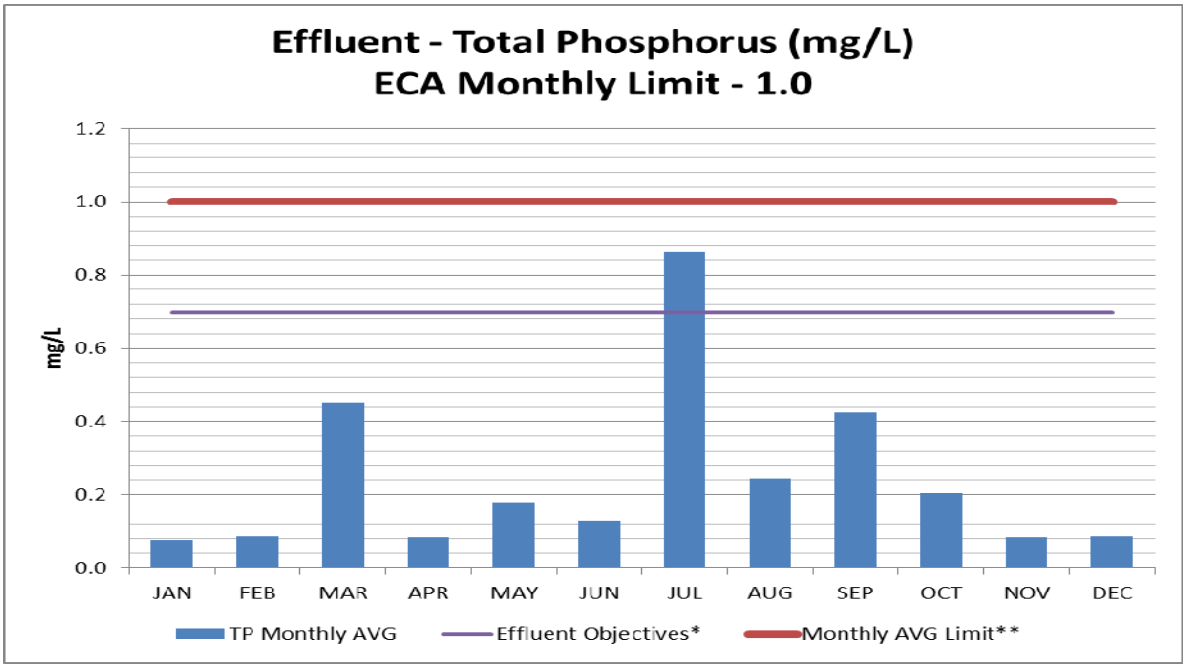


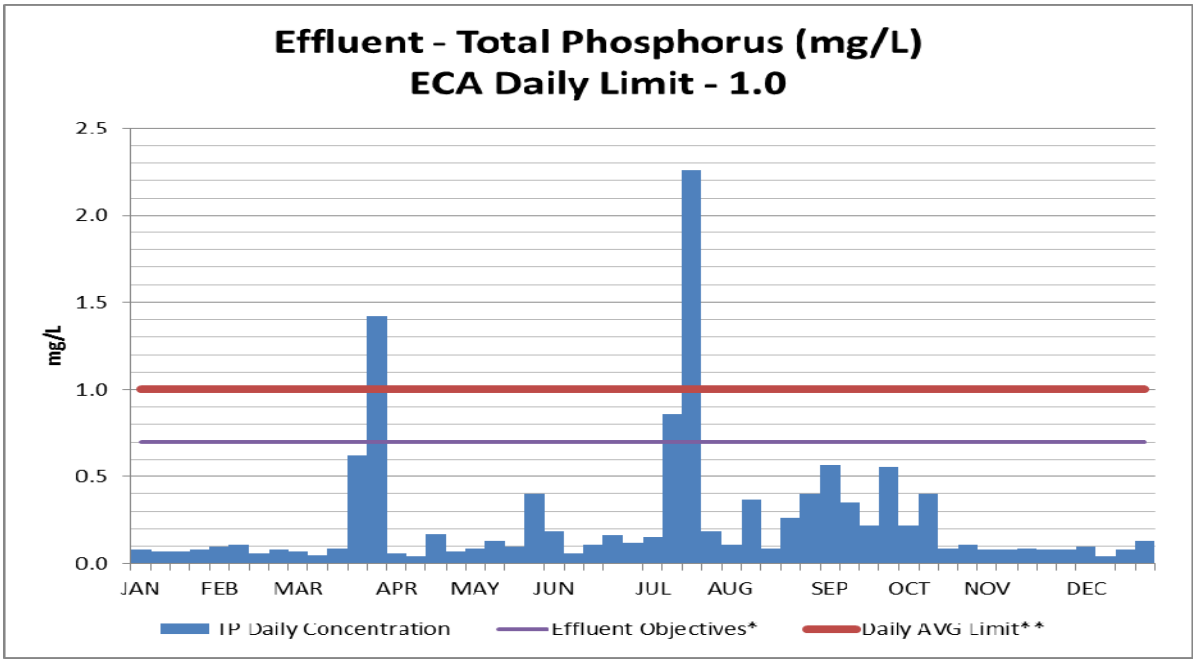


*Objectives – The owner shall use best effort to operate the works with in the objectives

**Limits – The owner shall operate and maintain the works such that the concentrations of the parameters are not exceeded in the effluent

The annual average raw sewage total phosphorus (TP) concentration to the plant was 3.94 mg/L with a maximum daily concentration of 10.4 mg/L. The annual average final effluent TP concentration was 0.24 mg/L with the maximum being 2.26 mg/L.





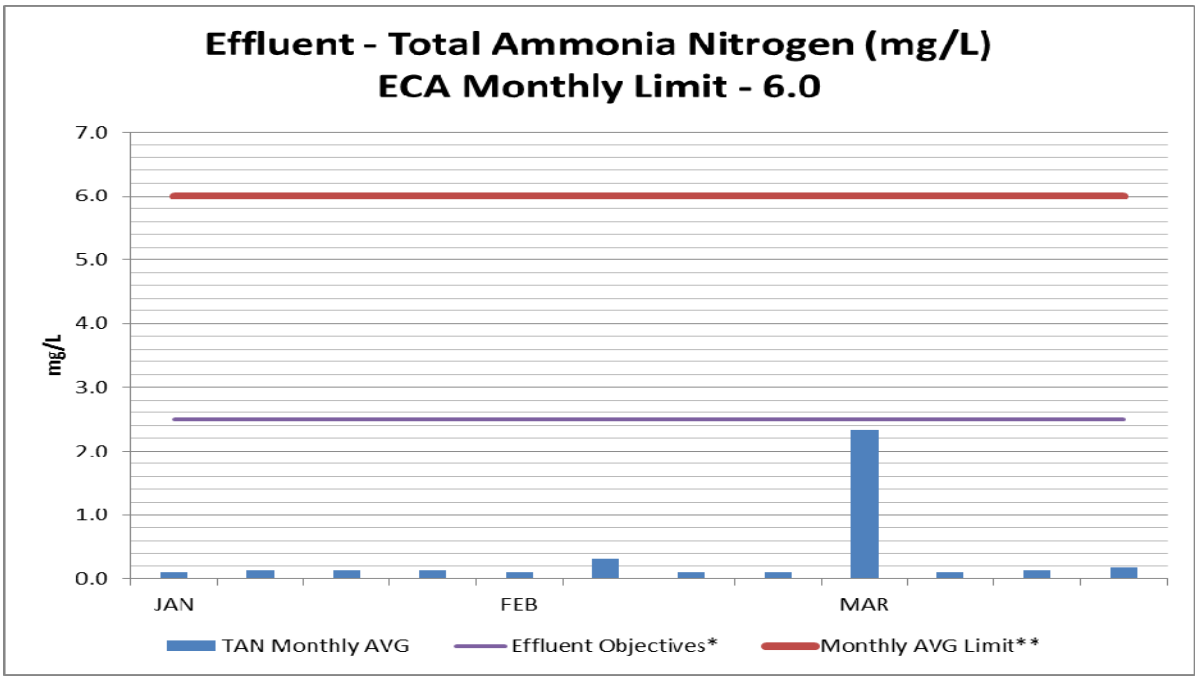
There were two exceedances of the daily Total Phosphorus for the 2016 reporting period. The first was on March 30, 2016 and was 1.42 mg/l and the second was July 28, 2016 and was 2.26 mg/l. The daily ECA limit is 1.0 mg/l.

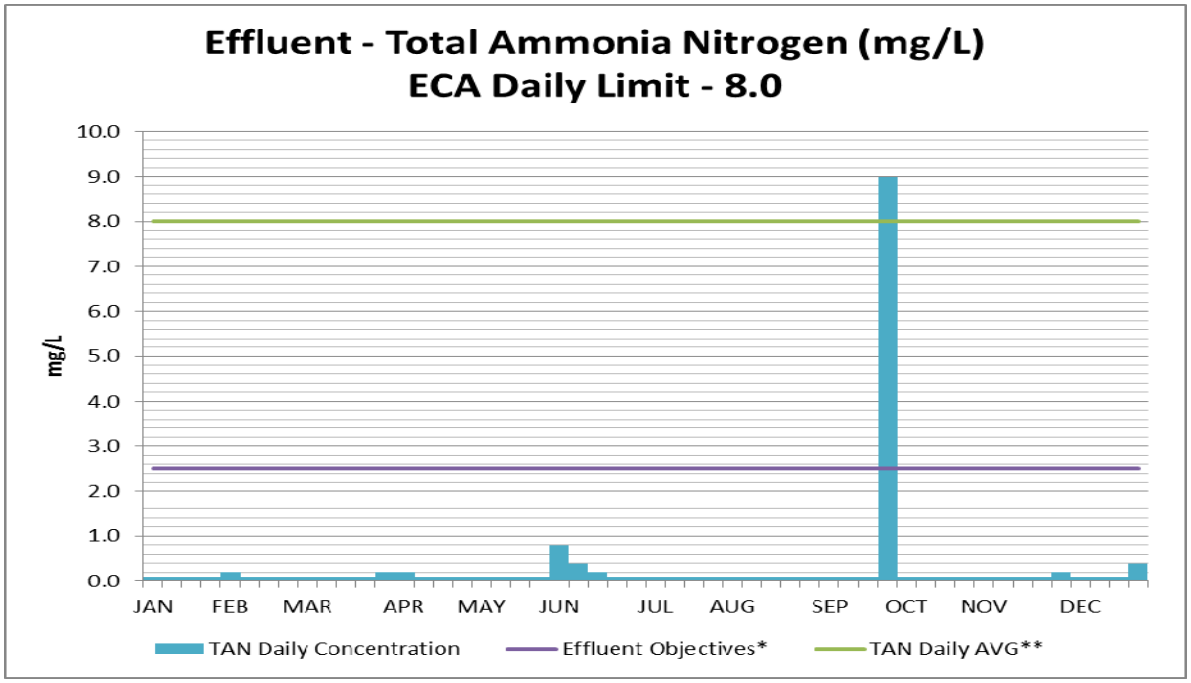
For further information please refer to Section 8 - Summary of all By-Pass, Spill or Abnormal Discharge Events.

*Objectives – The owner shall use best effort to operate the works with in the objectives

**Limits – The owner shall operate and maintain the works such that the concentrations of the parameters are not exceeded in the effluent

The annual average raw sewage total ammonia nitrogen concentration to the plant was 28.4 mg/L with a maximum daily concentration of 31.3 mg/L. The annual final effluent total ammonia nitrogen concentration was 0.32 mg/L with a maximum daily concentration of 9 mg/L.





For a sample taken on September 27, 2016 there was a daily exceedance of 9.0 mg/l for Ammonia+Ammonium. The daily ECA limit is 8 mg/l.

For further information please refer to Section 8 - Summary of all By-Pass, Spill or Abnormal Discharge Events.

*Objectives – The owner shall use best effort to operate the works with in the objectives

**Limits – The owner shall operate and maintain the works such that the concentrations of the parameters are not exceeded in the effluent

There were no odour complaints in 2016 however, the Town of St. Marys is aware of odour issues associated with the WWTP and is currently investigating options to reduce odour sources.

There were no Ministry of Environment and Climate Change Inspections in 2016.

Section 3: Effluent Quality Assurance

Effluent quality assurance is evaluated by monitoring parameters and changes throughout the plant processes. The operators monitor the basins by performing tests on the mixed liquor. These tests include dissolved oxygen, pH, temperature, settling tests, Mixed Liquor Suspended Solids (MLSS). As well, monitoring of the aluminum sulfate dosages and wasting volumes are completed. Data collected from these tests provide valuable information to the operator to make the appropriate adjustments in the treatment process and take corrective actions before the plant reaches its effluent limits.

All in-house monitoring equipment is calibrated based on the manufacturer's recommendations.

Annually a facility sampling schedule calendar is prepared and reviewed with operational staff; the sampling schedule calendar identifies sample collection dates to meet regulatory requirements of the ECA.

Section 4: Maintenance Activities Planned/Unplanned

Regular scheduled monthly preventative maintenance is assigned and monitored using the Workplace Management System (WMS) program. The Work Management System (WMS) provides the framework of how OCWA manages and plans work such as maintenance and operational activities, and is the framework which is supported within our CMMS. (Computerized Maintenance Management System)

A method to prioritize maintenance requests is required to ensure that the top priority work is being pursued at all times. A method has been developed that balances risk, safety, environmental, customer, operations, financial and urgency factors. This method can be used by maintenance request initiators, maintenance planners and workers to ensure that the right work is being completed at the right time.

The result of this maintenance work prioritization is a plan for which resources can be prepared and allocated in an efficient manner.

OCWA's WMS uses data to support how work orders are scheduled. Work orders are prioritized according to the following three classifications:

1. **Emergency work** usually involves safety hazards, environmental concerns or major interruption of service. Repairs are generally initiated without waiting for work orders to be processed.
2. **Routine/Preventive maintenance work** does not require prioritizing, as it is always scheduled.
3. **Breakdown/Corrective maintenance work** is prioritized, planned and scheduled into the regular preventive maintenance program.

The preventive maintenance requirement is built into the regular work schedule and corrective maintenance work requests are added to the schedule according to the priority and workload of staff and availability of outside contractors. The following are the work orders generated and completed in 2016.

Preventative Maintenance Work Orders Generated											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
59	55	53	57	56	90	55	52	50	56	54	23

The following is a summary of maintenance performed other than WMS work orders:

Electrical repairs to the odour control unit for the sludge storage tank
Re-built anoxic tank mixer
Replaced wet well hatches for Robinson St. Pump Station and Queen St. Pump Station
Replaced ballasts in UV System
Installed guard rail for grit removal unit
Re-built raw sewage pump #1
Replace and/or repaired roofs
Repairs to waste and return activated sludge sink
Repairs to detritor rake arm
Replaced leaking backflow preventer
Installed temporary mixer in sludge tank to assist with pumping thick sludge
Repairs to 8" air pipe in aeration cell
Repairs support beams for anoxic tank walkway
Re-built exhaust fan unit in digester building

Section 5: Future Alterations

The Town of St. Marys, in collaboration with Ontario Clean Water Agency are investigating potential future alterations, such as, but not limited to:

Sludge loading pump replacement
Replace diesel generator to run the sewage plant and administration building
Replace the diesel generator at the Queen Street Pump Station

Section 6: Calibration and Maintenance Procedures

In 2016 calibrations were completed by Pierce Services and Solutions Inc. for the flow meters at the facility. Pierce also calibrated all hand held and laboratory equipment. The backflow preventers were done by Turner Plumbing and Heating. Kone Cranes did the inspection of all lifting equipment/devices. Hetek Solutions Inc. calibrated all gas monitoring equipment. Sommers did the inspection of the emergency generator. Mobile Fire and Safety completed the inspection of all fire extinguishers. In-house meters for pH and dissolved oxygen are calibrated by OCWA operators as per manufacturer's instructions.

Section 7: Sludge Generated

Biosolids produced at the St. Marys WWTP are from the Lystek System. All bio-solids sample analysis was carried out by SGS Lakefield Research Ltd. Bartel Environmental Services has been contracted to haul and land apply all biosolids produced at the WWTP. A total of 3,894 m^3 was land applied or taken to storage facilities.

Based on the information, the hauled bio-solids volume for 2017 is estimated to be in the range 4,000 m^3.

Section 8: Summary of all By-Pass, Spill or Abnormal Discharge Events

Daily Phosphorus Exceedance – March 30, 2016

This can be related to high flows above the average daily rated capacity that had occurred over a 7 day period.

The phosphorus was 1.42 mg/l and the daily limit required as per the ECA is 1.00 mg/l.

Spill of Mixed Liquor – April 4, 2016

A leak was discovered on the bottom of the 250 litre return activated sludge tank. An estimate of less than 1 m3 leaked onto the adjacent ground and covered an approximate area of 20 ft. X 20 ft. The area was cleaned using the pumper truck to vacuum the area. The area of the leak was repaired by welding a patch. This event was report to the MOECC -Spills Action Centre.

Daily Phosphorus Exceedance – July 28, 2016

The source of the exceedance was not able to be determineed. All in-house operations were normal during this time.Locations were sampled and nothing out of the ordinary was found. The operator increased the aluminum sulphate dosage to rectify the issue.

The phosphorus was 2.26 mg/l and the daily limit required as per the ECA is 1.00 mg/l.

Daily Ammonia Exceedance – September 27, 2016

There was a blower failure that did not register on the alarm system due to the fact that it was a very quick power flicker. The blower did not restart automatically. The blowers have now been programmed to start automatically in the event of a failure.

The ammonia was 9.0 mg/l and the daily limit required as per the ECA is 6.0 mg/l.

Section 9: Discussion

Removal rates for $CBOD_5$, TSS, and Total Phosphorus were all 97% or better for 2016.

Removal rates were as follows: $CBOD_5$ (99%), TSS (98.7%) and Total Phosphorus (98%).

REPORT PREPARED BY:

Renee Hornick
Operations Manager
Ontario Clean Water Agency

APPENDIX A
Monitoring Data

Ontario Clean Water Agency
Performance Assessment Report - St. Marys WPCP
January - December 2016

	01/2016	02/2016	03/2016	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	<--Total-->	<--Avg.-->	<--Max.-->
Flows:															
Raw Flow: Total - Raw Sewage (m^3)	137,442.00	159,218.00	173,120.00	190,521.00	119,866.00	102,732.00	93,880.00	101,372.00	90,657.00	90,981.00	93,809.00	105,578.00	1,459,176.00		
Raw Flow: Avg - Raw Sewage (m^3/d)	4,433.61	5,490.28	5,584.52	6,350.70	3,866.65	3,424.40	3,028.39	3,270.06	3,021.90	2,934.87	3,126.97	3,405.74		3,994.84	
Raw Flow: Max - Raw Sewage (m^3/d)	5,446.00	7,690.00	10,318.00	10,812.00	4,370.00	3,808.00	3,652.00	4,228.00	3,383.00	3,301.00	4,132.00	5,395.00			10,812.00
Eff. Flow: Total - Final Effluent (m^3)	156,220.00	175,604.00	177,999.00	182,962.00	133,850.00	147,121.00	140,605.00	117,972.00	115,905.00	108,754.00	108,051.00	120,420.00	1,685,463.00		
Eff. Flow: Avg - Final Effluent (m^3/d)	5,039.35	6,055.31	5,741.90	6,098.73	4,317.74	4,904.03	4,535.65	3,805.55	3,863.50	3,508.19	3,601.70	3,884.52		4,613.02	
Eff. Flow: Max - Final Effluent (m^3/d)	8,352.00	8,063.00	10,201.00	7,647.00	5,075.00	5,569.00	6,050.00	5,021.00	7,520.00	3,761.00	4,373.00	7,349.00			10,201.00
Carbonaceous Biochemical Oxygen Demand: CBOD:															
Eff: Avg cBOD5 - Final Effluent (mg/L)	< 2.50	< 3.25	2.60	< 2.50	< 2.50	< 2.40	< 2.75	< 2.20	< 4.50	< 2.50	< 2.20	5.25		< 2.93	5.25
Eff: # of samples of cBOD5 - Final Effluent (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Loading: cBOD5 - Final Effluent (kg/d)	< 12.60	< 19.68	14.93	< 15.25	< 10.79	< 11.77	< 12.47	< 8.37	< 17.39	< 8.77	< 7.92	20.39		< 13.36	20.39
Biochemical Oxygen Demand: BOD5:															
Raw: Avg BOD5 - Raw Sewage (mg/L)	244.00	213.00	168.60	227.75	271.75	314.00	319.50	> 472.00	462.50	545.00	499.40	275.25		> 334.40	545.00
Raw: # of samples of BOD5 - Raw Sewage (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Eff: Avg BOD5 - Final Effluent (mg/L)	< 3.00	3.75	3.80	3.00	< 2.25	< 3.40	< 3.00	< 2.60	< 4.50	< 2.25	< 2.60	5.25		< 3.28	5.25
Loading: BOD5 - Final Effluent (kg/d)	< 15.12	22.71	21.82	18.30	< 9.72	< 16.67	< 13.61	< 9.89	< 17.39	< 7.89	< 9.36	20.39		< 15.24	22.71
Percent Removal: BOD5 - Raw Sewage (mg/L)	98.77	98.24	97.75	98.68	99.17	98.92	99.06	> 99.45	99.03	99.59	99.48	98.09			99.59
Total Suspended Solids: TSS:															
Raw: Avg TSS - Raw Sewage (mg/L)	158.00	121.75	121.40	179.25	221.50	230.20	177.00	292.40	298.50	352.25	330.80	286.25		230.78	352.25
Raw: # of samples of TSS - Raw Sewage (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Eff: Avg TSS - Final Effluent (mg/L)	4.75	8.50	5.20	< 4.75	6.00	6.00	6.00	4.60	6.75	4.50	4.40	7.25		< 5.73	8.50
Eff: # of samples of TSS - Final Effluent (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Loading: TSS - Final Effluent (kg/d)	23.94	51.47	29.86	< 28.97	25.91	29.42	27.21	17.51	26.08	15.79	15.85	28.16		< 26.68	51.47
Percent Removal: TSS - Raw Sewage (mg/L)	96.99	93.02	95.72	97.35	97.29	97.39	96.61	98.43	97.74	98.72	98.67	97.47			98.72
Total Phosphorus: TP:															
Raw: Avg TP - Raw Sewage (mg/L)	2.93	2.43	2.34	2.37	2.95	3.26	3.75	5.56	5.27	6.57	4.78	5.05		3.94	6.57
Raw: # of samples of TP - Raw Sewage (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Eff: Avg TP - Final Effluent (mg/L)	0.08	0.09	0.45	0.09	0.18	0.13	0.87	0.25	0.43	0.21	0.08	0.09		0.24	0.87
Eff: # of samples of TP - Final Effluent (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Loading: TP - Final Effluent (kg/d)	0.38	0.53	2.58	0.52	0.78	0.63	3.92	0.94	1.64	0.72	0.30	0.34		1.11	3.92
Percent Removal: TP - Raw Sewage (mg/L)	97.44	96.39	80.75	96.42	93.90	96.07	76.92	95.58	91.93	96.88	98.29	98.27			98.29
Nitrogen Series:															
Raw: Avg TKN - Raw Sewage (mg/L)	20.68	18.43	17.06	15.30	25.78	24.34	33.18	36.78	42.63	32.98	38.10	35.40		28.39	42.63
Raw: # of samples of TKN - Raw Sewage (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Eff: Avg TAN - Final Effluent (mg/L)	< 0.10	< 0.13	< 0.12	< 0.13	< 0.10	< 0.32	< 0.10	< 0.10	< 2.33	< 0.10	< 0.12	< 0.18		< 0.32	< 2.33
Eff: # of samples of TAN - Final Effluent (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Loading: TAN - Final Effluent (kg/d)	< 0.50	< 0.76	< 0.69	< 0.76	< 0.43	< 1.57	< 0.45	< 0.38	< 8.98	< 0.35	< 0.43	< 0.68		< 1.33	< 8.98
Eff: Avg NO3-N - Final Effluent (mg/L)	4.51	3.97	4.15	3.59	5.21	4.27	4.00	3.70	3.86	4.47	6.27	5.97		4.50	6.27
Eff: # of samples of NO3-N - Final Effluent (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Eff: Avg NO2-N - Final Effluent (mg/L)	< 0.03	< 0.13	< 0.07	< 0.14	< 0.08	< 0.06	< 0.03	< 0.10	< 0.19	< 0.03	< 0.03	< 0.10		< 0.08	< 0.19
Eff: # of samples of NO2-N - Final Effluent (mg/L)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Disinfection:															
Eff: GMD E. Coli - Final Effluent (cfu/100mL)	11.25	12.71	21.06	20.98	4.90	2.00	2.63	3.03	17.30	3.19	3.84	18.67		10.13	21.06
Eff: # of samples of E. Coli - Final Effluent (cfu/100mL)	4	4	5	4	4	5	4	5	4	4	5	4	52		
Final Effluent / Dissolved Oxygen: DO - mg/L															
Max IH	20.26	16.76	18.99	15.64	16.64	15.48	13.51	13.46	16.62	14.39	14.08	16.75			20.26
Mean IH	16.988	15.038	16.32	8.238	11.088	13.312	11.994	11.667	12.079	12.138	12.674	13.33		12.875	
Min IH	11.08	9.58	12.26	4.01	4.04	9.66	10.34	10.04	7.53	10.57	10.50	9.57			
Final Effluent / Temperature - °C															
Max IH	15.00	16.00	15.00	15.00	19.00	23.00	23.00	24.80	24.00	21.80	18.00	16.90			24.80
Min IH	12	10	10	9.56	13	16	20	21.1	18	16	14	11.1			
Final Effluent / pH															
Max IH	7.93	7.86	7.95	7.69	7.77	7.81	8.65	7.85	7.93	7.81	7.91	8.15			8.65
Mean IH	7.33	7.07	7.33	7.18	7.42	7.41	7.76	7.50	7.39	7.42	7.64	7.54		7.42	
Min IH	6.86	6.56	6.85	6.76	7.15	6.72	7.35	7.08	6.99	6.83	7.41	7.2			