

ARNPRIOR WATER POLLUTION CONTROL CENTER SUMMARY REPORT 2016

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PRELIMINARY TREATMENT

Screen Units

There are two screening units, the automatic mechanical screen and the standby manual screen. Both screens have openings of 13 mm between bars and are enclosed with an odour enclosure where the air is discharged to the exterior atmosphere through a carbon filter.

The screenings are then transferred onto a conveyer that empties into a container for disposal at the Arnprior landfill.

Grit Removal

Grit removal is achieved by a pair of rectangular aerated spiral roll 90 m³ tanks. Each tank has a grit screw conveyer which pushes settled grit into the grit hoppers. Grit is then pumped into a grit dewatering classifier unit where dense grit particles are separated from light organic solids.

PRIMARY TREATMENT

Primary Sedimentation

There are four rectangular primary clarifiers at the WPCC: two with a surface overflow area of 142 m² and two with an overflow area of 154 m². All units are equipped with chain and flight sludge collection and manual scum removal.

Raw sludge is pumped from the primary clarifiers to Anaerobic Digesters using plunger type positive displacement pumps.

SECONDARY TREATMENT

Activated Sludge Treatment

The activated sludge treatment process includes two rectangular aeration tank and three separate rectangular secondary clarifiers, each made up of two units in parallel.

The aeration tank volumes are 1,303 m³ each, and are equipped with four inlet gates and one outlet slide plate for isolation. The secondary clarifiers have a surface area of 310 m² each. They are equipped with longitudinal and cross chain and flight collector mechanisms, which collect the activated sludge into a sump where it is returned to the aeration tank.

Phosphorous Removal

The phosphorous control system consist of two 12,100 Litre indoor ferric chloride chemical storage tanks and two chemical feed pumps complete with calibration cylinders. The ferric chloride is added to either the aeration tank or preliminary discharge depending on operational requirements.

Chlorination System

Disinfection of the plant discharge is done through the addition of Sodium Hypochlorite (NaOCl). The NaOCl is stored in a pair of 12,100 Litre tanks, and a bank of three variable speed metering pumps are used to deliver the chlorine to the chlorine contact chamber.

De-chlorination System

The chlorinated water must be de-chlorinated before discharge into the Ottawa River. This is achieved through the addition of sodium bisulfate. The sodium bisulfate system is made up of one 1,336 Litre storage tank and a pair of feed pumps.

Sludge Dewatering

A Centrifuge capable of processing 7 Litres of sludge per second is used for dewatering anaerobically digested sludge. The sludge from this unit is loaded onto a dump truck and delivered to the Arnprior landfill.

Auxiliary Power

The Arnprior WPCP is equipped with a 400 Kw diesel generator and automatic transfer switch. This generator will automatically start when a power outage occurs, and can supply power to run the entire plant.

Plant Performance Summary (4.3- a)

The following table indicates the effluent criteria for the Arnprior pollution control plant, criteria is based on an annual average although the new Certificate of Approval for the upgraded plant will be based on a monthly average. The effluent results for 2016 were within these parameters.

Effluent Criteria		
Parameter	Effluent Limit	Effluent Loading
CBOD ₅ (mg/L) *	25	243 kg/day
Suspended Solids (mg/L) *	25	243 kg/day
Total Phosphorus (mg/L) *	1.0	9.7 kg/day
Total Ammonia as Nitrogen (mg/L)	Non-Acutely Lethal to Rainbow Trout and Daphnia Magna	n/a
E.coli CFU/100 mL	200	n/a
Total Residual Chlorine (mg/L)	0.10	n/a
pH	6.0 to 9.5	n/a

*NOTE: Monthly average concentrations.

COMPLIANCE DATA 2016							
MONTH	SUSPENDED SOLIDS		PHOSPHOROUS		B.O.D / CBOD		E.COLI Geo-Mean
	Influent. mg/L	Effluent. mg/L	Influent. mg/L	Effluent. mg/L	Influent. mg/L	Effluent. mg/L	
JAN.	378.67	6.15	6.62	0.11	212.00	5.75	2.4
FEB.	187.80	6.60	3.80	0.13	181.75	3.50	2.0
MAR.	234.00	5.69	2.54	0.10	138.40	3.40	3.6
APR.	344.09	7.45	2.33	0.13	122.25	9.75	17.2
MAY	1,881.83	4.82	5.00	0.17	281.20	5.00	34.7
JUN.	1,695.60	6.38	0.34	0.34	206.34	5.25	43.6
JUL.	308.00	6.15	3.74	0.21	204.25	3.25	41.0
AUG.	281.60	5.20	5.09	0.21	220.60	4.20	50.0
SEPT.	471.20	7.44	4.69	0.24	276.00	4.50	111.8
OCT.	1,100.00	15.00	6.09	0.33	16.40	8.00	2.8
NOV.	773.00	9.25	6.43	0.27	315.40	6.20	2.0
DEC.	492.75	9.63	4.23	0.23	231.75	4.00	6.5
AVG	679.05	7.48	4.24	0.20	200.53	5.23	26.5
MAX	1,881.83	15.00	6.62	0.34	315.40	9.75	111.8
MIN	187.80	4.82	0.34	0.10	16.40	3.25	2.0

Monitoring Data Interpretation (4.3 b & c)

The Total Suspended Solids (TSS) in the raw and effluent wastewater is usually measured 3 times per week from a composite sample. The effluent reporting criteria is 25 mg/l and the plant target is 15 mg/l. The average monthly effluent TSS in 2016 was 7.48 mg/l and the monthly maximum average level was 15.00 mg/l in October. The TSS removal efficiency at the WPCC was 99% in 2016. Non-compliance with respect to plant effluent loading of Suspended Solids is 243 kg/d. The WPCC had an average daily effluent loading of 45 kg/d in 2016.

The Total Phosphorous (TP) in the raw and effluent wastewater is sampled and tested each week from composite samples. The reporting criteria is 1.0 mg/l and the plant target is 0.5 mg/l. The average monthly TP levels in 2016 was 0.20 mg/l with a monthly high average of 0.34 mg/l in June. The Total Phosphorous non-compliance loading rate is 9.7 kg/d and in 2016 the average daily TP loading rate was 1.22 kg/d.

Five day Biological Oxygen Demand (CBOD₅) is sampled once per week from a composite sample. The effluent reporting criteria is 25 mg/l and the plant target is 15 mg/l. The average monthly CBOD₅ in 2016 was 5.23 mg/l with a monthly average high of 9.75 mg/l in April. The CBOD₅ removal efficiency at the WPCC was 97 %. The CBOD₅ non-compliance loading rate is 243 kg/d, and in 2016 the plant averaged an effluent loading rate of 32 kg/d.

Total Kjeldahl Nitrogen (TKN) is the sum of organic nitrogen, ammonia (NH_3), and ammonium (NH_4^+) in the chemical analysis of soil, water, or wastewater (e.g. sewage treatment plant effluent). To calculate Total Nitrogen (TN), the concentrations of nitrate-N and nitrite-N are determined and added to TKN. There is no effluent limit criteria for TKN, The average monthly TKN levels in 2016 was 9.48 mg/l with a monthly high of 20.33 mg/l in December.

Chloride is common in human diet and passes through unchanged through the digestive system. It can also be increased by industrial processes. There are no effluent limit criteria for Chloride, the average monthly chloride level was 1.64 mg/l with a monthly high of 305.25 mg/l in December.

Conductivity is a measure of the ability of water to carry an electric current. If the wastewater has too many molecules of organic compounds it cannot conduct a current as well. There are no effluent limit criteria for Conductivity, the average monthly Conductivity in 2016 was 901.55 $\mu\text{mho/cm}$ with a monthly high of 1,442 $\mu\text{mho/cm}$ in April.

Ammonia is present naturally in wastewater, the effluent target for Ammonia is 10 mg/l. The toxicity limit for Ammonia is tested using a lethality test with Rainbow Trout and Daphnia Magna. The average monthly Ammonia concentration was 6.54 mg/l, the monthly high was 17.33 mg/l in December. All toxicity samples taken in 2016 passed.

Nitrate is found in small amounts in wastewater but can be formed during the nitrifying process at biological treatment plants, there are no effluent criteria for Nitrate, and the average monthly nitrate concentration in 2016 was 9.24 mg/l with a monthly high of 28.7 mg/l in October.

Nitrite is formed during the reduction of ammonia and nitrate, there are no effluent criteria for nitrite, the average monthly nitrite concentration in 2016 was 1.32 mg/l and the monthly high was 2.8 mg/l in May.

Total Phosphorus is normally found in wastewater and if discharged to a receiving water can stimulate the growth of plants life in nuisance quantities. The effluent limit for Total Phosphorus is 1.0 mg/l. The average monthly phosphorous concentration in 2016 was 0.2 mg/l with a monthly high of 0.34 mg/l in June.

Plant Flow Summary (4.3 b & c)

The WPCC has a permit under the Certificate of Approval to discharge an effluent of 9,700 m³/d averaged over the year, and a peak hourly flow of 59,200 m³/day. The average daily flow in 2016 was 6,126 m³ per day, or 63% of the C of A permitted flow. As indicated in the table below the average daily flow in March exceeded 9,700 m³/day. There were plant bypasses in July and August, these were due to high rainfall events and were reported to the Ministry of Environment.

A summary of the 2016 plant flow is as follows:

Month	Maximum Daily Flow M ³	Effluent M ³	Secondary Bypass M ³	Plant Bypass M ³	Average Daily Flow M ³
January	9,706	189,277	0	0	6,106
February	8,894	155,277	0	0	5,354
March	16,090	334,783	0	0	10,799
April	13,360	264,753	0	0	8,825
May	9,424	162,341	0	0	5,237
June	11,158	185,842	0	0	6,195
July	10,391	155,325	0	126	5,010
August	14,356	184,161	0	685	5,941
September	9,931	148,609	0	0	4,954
October	9,931	154,761	0	0	4,992
November	8,738	133,020	0	0	4,434
December	9,711	175,586	0	0	5,664
Avg	10,974	186,978	0	68	6,126
Max	16,090	334,783	0	685	10,799
Min	8,738	133,020	0	0	4,434
Total		2,243,735	0	811	

*NOTE: The rise in effluent flow for March is due to melting snow with rain infiltrating into the sanitary sewer system.

Plant Maintenance (4.3 d)

Plant maintenance scheduled and tracked using a computerized maintenance system. A weekly maintenance schedule is printed out and the maintenance personnel initial the schedule as tasks are completed. If any major repairs are required with equipment the operator fills out a work order detailing work required and parts needed.

A summary of major repairs or maintenance carried out in 2016 is as follows:

- Leaks in the roof of the control building were repaired.
- Controllers for the two main boilers were repaired after being damaged due to an electrical storm.
- The Pretreatment Air Blower Variable speed controller was sent away and repaired after being damaged during an electrical storm.
- Substantial repairs were carried out on the Centrifuge after a drive shaft snapped.

Operational Problems (4.3 e)

There are many, day to day adjustments or repairs that the operators must carry out in addition to the major maintenance listed below.

Some operational problems that occurred in 2016 are as follows:

- There were several heavy rainfall events in 2016, causing operational problems such as bypasses and other treatment problems.
- Both boilers were not operational for a 2 month period after the controllers were damaged during a summer electrical storm, the Digesters could not be maintained at their proper operating temperatures resulting in less than optimum sludge digestion.
- The drive shaft of the Centrifuge snapped resulting in the inability of sludge dewatering for a period of a few weeks.

Proposed Alteration (4.3 f)

- The roof of the Blower building is scheduled to be replaced in 2017.

Sludge Processing (4.3 g,h)

Combined primary and secondary waste activated sludge is collected from all four primary settling tanks, and pumped into the anaerobic Digesters. From the Digesters sludge is pumped into holding tanks, it is then conditioned and processed in the centrifuge. Sludge is dewatered to approximately 22% and loaded onto a truck and transferred to the Arnprior landfill and landfilled. There were 242 loads of sludge to the Arnprior landfill in 2016, with a total of approximately 123,988 kg dry weight of sludge. Sludge production in 2017 is expected to be slightly higher than 2016. A summary of the sludge processed is as follows:

SUMMARY OF SLUDGE MANAGEMENT					
FILTER OPERATION					
Month	Sludge To Storage m³	Sludge To Filter m³	% Solids Avg.	Dry Solids (kg)	Sludge Hauled Loads
Jan	1,054	170	3.55	6,035	12
Feb	1,211	257	4.46	11,454	19
Mar	972	508	4.00	20,320	32
Apr	951	385	4.37	16,825	21
May	459	209	4.64	9,691	14
Jun	1,021	329	4.64	15,266	24
Jul	633	295	3.99	11,756	22
Aug	785	0	4.08	0	0
Sep	738	171	4.00	6,840	9
Oct	413	78	4.00	3,120	5
Nov	704	87	4.03	3,509	6
Dec	568	412	4.84	19,941	27
Avg	792	242	3.91	10,332	20
Max	1,211	508	4.40	17,640	33
Min	413	0	3.20	2,719	5

Total	9,509	2,901	46.94	123,988		242
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Wastewater Profile

In addition to the above compliance sampling and analysis, the table below outlines the monthly average results of various characteristics of the raw and treated wastewater. These samples are taken with composite samplers and sent to a certified laboratory:

ARNPRIOR EFFLUENT CHARACTERISTICS										
Month	Total Phosphorous mg/l	Ammonia mg/l		TKN mg/l	CBOD ₅ mg/l	Nitrate mg/l	Nitrite mg/l	E. Coli Geomean Density	Chloride	Total Suspended Solids
	Effluent	Un- ionized Ammonia	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent
Jan	0.11	0.0098	7.34	8.40	5.75	6.98	0.90	2.4	206.00	6.15
Feb	0.13	0.0206	12.79	15.08	3.50	1.73	0.80	2.0	201.50	6.60
Mar	0.10	0.0062	6.72	8.23	3.40	2.08	0.48	3.6	288.00	5.69
Apr	0.13	0.0116	4.30	5.42	9.75	1.18	0.35	17.2	229.85	7.45
May	0.17	0.0044	3.58	4.93	5.00	8.62	2.80	34.7	168.80	4.82
Jun	0.34	0.0028	2.02	3.52	5.25	16.80	1.28	43.6	117.90	6.38
Jul	0.21	0.0017	1.27	2.77	3.25	14.23	1.78	41.0	112.70	6.15
Aug	0.21	0.0048	3.46	5.44	4.20	12.10	1.90	50.0	119.14	5.20
Sep	0.24	0.0026	2.87	4.32	4.50	14.45	2.25	111.8	88.90	7.44
Oct	0.33	0.0079	0.40	16.40	8.00	28.70	1.30	2.8	8.00	15.00
Nov	0.27	0.0174	16.48	18.90	6.20	3.50	1.38	2.0	127.06	9.25
Dec	0.23	0.0471	17.33	20.33	4.00	0.50	0.60	6.5	305.25	9.63
Avg	0.20	0.0114	6.54	9.48	5.23	9.24	1.32	26.5	164.43	7.48
Max	0.34	0.0471	17.33	20.33	9.75	28.70	2.80	111.8	305.25	15.00
Min	0.10	0.0017	0.40	2.77	3.25	0.50	0.35	2.0	8.00	4.82

Calibration (4.3 i)

All flow meters were calibrated on site by a service contract given to Endress + Hauser Canada Ltd., the manufacturer of the meters. A company representative applied a number of performance checks to the meters and all meters were accurate within $\pm 1\%$.

Conclusion

The Arnprior WPCP met all MOE sewage effluent criteria in 2016. For inquiries regarding this report, please contact Mike Trumble at 623-4231 Ext. 1834.

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