

Chapleau Sewage Treatment Lagoon

Annual Performance Report

Prepared by Ontario Clean Water Agency, Northeastern Ontario Hub
January 1, 2016 to December 31, 2016



Ontario Clean Water Agency
Agence Ontarienne Des Eaux

Annual Sewage Performance Report

Reporting Period	January 1, 2016 to December 31, 2016
Sewage System Name	Chapleau Sewage Treatment Lagoon
Sewage System Address	300 Strathcona Street, Chapleau, ON P0M 1K0
Sewage System Owner	Corporation of the Township of Chapleau
Sewage System Number	110002149
Environmental Compliance Approval No.	6830-5SQK4C, issued October 30, 2003

Facility Description

Capacity of Works	4550 m ³ /day
Service Area	Township of Chapleau, District of Sudbury
Service Population	2300
Effluent Receiver	Nebskwashi River
Major Process	Two Cell Aerated Lagoon

The Chapleau sewage treatment lagoon consists of a grit removal channel where heavier inorganic wastes are settled and manually removed before entering a two cell aerated lagoon. There are two blowers supplying air to a fine bubble tubular aeration system with separate distribution grids located in each cell. Cell 1 is 96 m x 72 m and Cell 2 is 112 m x 65 m, with a combined storage capacity of approximately 28,000 m³/day. The lagoons service the Township of Chapleau and are continuously discharged into the Nebskwashi River. The system is designed to operate at a rated capacity of 4550 m³/day.

The sewage effluent is disinfected on a seasonal basis from May 1 to October 31 with gaseous chlorine. An open channel flow meter to measure the treated chlorinated effluent is located in the chlorine contact chamber.

1.0 Monitoring Data**1.1 Monitoring Program as Outlined in the Environmental Compliance Approval**

BOD ₅ = Five-day biochemical oxygen demand measured in an unfiltered sample <i>E. coli</i> = <i>Escherichia coli</i> TSS = Total Suspended Solids TP = Total Phosphorus TKN = Total Kjeldahl Nitrogen TCR = Total Chlorine Residual

1.1.1 Raw Sewage (Influent)

Parameter	Type of Sample	Minimum Frequency
BOD ₅	composite*	monthly
Total Suspended Solids	composite*	monthly
Total Phosphorous	composite*	monthly
TKN	composite*	monthly

*Historically grab samples have been taken, for both influent and effluent testing, as the system is not equipped with a 24hr automatic sampler and therefore not capable of collecting a composite sample as required by the ECA.

1.1.2 Final Effluent

Parameter	Type of Sample	Minimum Frequency
BOD ₅	composite*	monthly
Total Suspended Solids	composite*	monthly
Total Phosphorous	composite*	monthly
<i>E. coli</i>	grab	monthly
pH	grab	weekly
Temperature	grab	weekly

*Historically grab samples have been taken, for both influent and effluent testing, as the system is not equipped with a 24hr automatic sampler and therefore not capable of collecting a composite sample as required by the ECA.

Note: *E. coli* samples are collected May 1 to October 31.

1.2 Data

1.2.1 Influent Flow Data

Month	Average Flow (m ³ /day)	Maximum Flow (m ³ /day)	Total Volume (m ³)
January	1,500	2,998	46,500
February	1,733	3,649	50,267
March	1,516	2,026	46,985
April	1,721	2,376	51,637
May	1,383	1,721	42,861
June	1,241	1,677	37,251
July	1,237	1,783	38,357
August	1,022	1,810	31,688

Month	Average Flow (m ³ /day)	Maximum Flow (m ³ /day)	Total Volume (m ³)
September	1,461	2,274	43,838
October	1,428	2,421	44,258
November	1,220	1,592	36,600
December	1,141	1,421	35,359

1.2.2 Summary of Influent Flow

	Flow (m ³ /day)	Rated Capacity (m ³ /day)	% Capacity	Exceedance
Average	1,384	4,550	30	No
Maximum	3,649	4,550	80	No

1.2.3 Raw Sewage (Influent)

Parameter (mg/L)	Average	Maximum
Total Phosphorous	1.47	2.29
TKN	14	20.8
BOD ₅	79	142
Total Suspended Solids	134	675

1.2.4 Effluent

Parameter (mg/L)	Annual Average	Range of Results (min – max)	Compliance Limit
BOD ₅	11.1	1.3 – 20.6	Limit - annual average 30 Objective - maximum 25
Total Suspended Solids	17	3.5 – 47	Limit - annual average 40 Objective - maximum 30
Total Phosphorous	0.563	0.274 – 1.42	N/A
Temperature (°C)	11.0	0.5 – 24.5	N/A
pH (units)	7.1	5.9 – 8.5	6.0 – 9.5
<i>E. coli</i> (cfu/100 mL)	15 (geometric mean)	<5 – 235	monthly geometric mean 200

Note: *E. coli* results are from the disinfection period (May 1 – October 31).

1.3 Sewage Treatment Program Success and Adequacy

The Performance Summary details results and efficiency of the plant's performance demonstrating pollutant removal rates from raw sewage concentrations through to final effluent for BOD₅, suspended solids and total phosphorus.

1.3.1 Performance Summary

Parameter (mg/L)	Influent	Effluent	% Removal
Total Phosphorous	1.47	0.563	62
BOD ₅	79	11.1	86
Total Suspended Solids	134	17	88

Note: calculations are based on the annual averages

1.4 Interpretation of Monitoring and Analytical Data

The Chapleau sewage treatment lagoon operated within its required capacity. Table 1.2.1 *Influent Flow Data* summarizes the flow data for 2015. The average and maximum daily flows are presented for each month. The Environmental Compliance Approval outlines that the owner shall use best effort to operate the works within the rated capacity of 4550 m³/day. Average flows from the plant were measured at 1,348 m³/day; which represents approximately 30 % of the total design capacity of the system. This is a continual discharge lagoon system, thus flow control is not possible.

The effluent quality is based on the biochemical oxygen demand, total suspended solids, *E. coli* and pH levels. The annual averages for all parameters are listed in table 1.2.4 *Effluent*.

Biological Oxygen Demand (BOD₅) is the amount of oxygen used by micro-organisms as they decompose organic matter in the effluent sample for five days. High BOD₅ in effluent means a large quantity of oxygen was needed to break down the organic matter and identifies a large amount of organic matter in the effluent indicating inadequate treatment. In 2016, the average BOD₅ of 11.1 mg/L complied with the limit of 30 mg/L and the maximum result of 20.6 mg/L was well below the effluent objective of 25 mg/L.

Total Suspended Solids (TSS) in effluent are composed of settleable solids and non-settleable solids depending on the size, shape and weight of the solid particles. Settable solids are large sized particles that tend to settle more rapidly in a given period of time. In 2016, the average TSS of 17 mg/L complied with the limit of 40 mg/L. The effluent objective of 30 mg/L was exceeded as the maximum result was 47 mg/L. This result was artificially inflated due to the large number of *Daphnia magna* (water fleas) that were present in the lagoons.

Escherichia coli (*E. coli*) is a common bacterium that lives in human and animal intestines, where it is present in large numbers. There are hundreds of *E. coli* strains and most are relatively harmless, however a notorious exception is *E. coli* strain 0157:H7, an emerging pathogen that produces a powerful toxin and can cause severe illness. *E. coli* is used as the most widely adopted indicator of faecal pollution in water and wastewater. The compliance limit for *E. coli* is a monthly geometric mean limit of 200 cfu/100 mL during the disinfection period (May 1-October 31). In 2016, the *E. coli* the monthly geometric mean was exceeded in August - the lab ran a duplicate *E. coli* analysis on the sample and the results were 155 cfu/100 mL and 235 cfu/100 mL.

The pH of a solution is an indication of its acidic and basic properties and measured on a scale ranging between 0 and 14. Very high or very low pH levels can be corrosive to pipes, screening equipment and pumps, can damage biological processes and form undesirable toxic gases or heavy metals. The ECA outlines the compliance criteria for effluent pH to be maintained within the limits of 6.0 and 9.5, inclusive, at all times. In 2016, the pH ranged from 5.9 – 8.5. The low pH was reported to MOE SAC.

Refer to Appendix A for the Monthly Process Data Report, which summarizes the monitoring and sampling analysis conducted at the facility.

2.0 Operating Problems and Corrective Actions

There were no significant operating problems or corrective actions during the reporting period. Preventative maintenance was performed on a regular basis to help identify problems before they occur.

However, the following non-compliances were noted:

AUGUST *E. coli* sample result was 235 cfu/100 mL
Compliance limit is monthly geometric mean of 200 cfu / 100 mL

The sample was collected on August 30 thus there was no time to collect an alternate sample. The lab ran a duplicate *E. coli* analysis on the sample and the results were 155 cfu/100 mL and 235 cfu/100 mL. Due to a misunderstanding of the monthly geometric mean with seasonal geometric mean the exceedance was not reported immediately.

Going forward, the samples will be earlier in the month and the compliance limits are going to be entered into Testmark's Laboratory Information System so we can be alerted to high results sooner.

NOVEMBER 24 pH reading was 5.89 (Ref: 3767-AHXNA9)
Compliance range is 6.0 – 9.5 inclusive

The pH meter calibration tends to drift. Upon further investigation it is

suspected that the analyzer was not calibrated before testing was done.

Corrective Actions: pH meter calibration frequency has been increased from weekly to 'before use' and a reminder that anomalous pH readings need to be investigated and/or reported immediately

Reported on January 25, 2017 to MOE SAC

3.0 Maintenance Procedures Performed on the Works

Routine maintenance is done as per OCWA's Work Management System software program. This is a comprehensive maintenance program that is based on a pro-active, preventive approach. This program includes but not limited to running checks weekly, monthly, and annually as required or as recommended by manufacturer's instructions.

Operational Highlights:

- January
 - Riverside P.S Pump #1 failed (pump Plugged)
- June
 - Riverside SPS. Pump #1 has been taken out for repair. Change level transmitter set-points so that the other two pumps will keep the well at the proper level.
- July
 - Worked at Lagoon pulling Air Lines for Cell #1 Dredging
 - Contractors in to start lagoon work on Cell #1.
- August
 - Operators up to Lagoon to pull old air lines from old aeration system.
 - Town mechanic into Dufferin P.S to replace starter
- September
 - Operators working on new aeration lines at lagoon several days
 - Meeting at Township Office to discuss issues at the lagoon dealing with air lines
 - Val's Equipment was in for the annual generator servicing at Chapleau Lagoon building and pumping stations
 - Operators working on Dufferin P.S Header. Installed 6" Saddle to stop leak.
 - Operators requested to do sludge judging in Cell #1
- October
 - Power Fail Alarm at Lisgar Pumping Station (October 18, 00:30 – 01:45) Received call regarding power fail/high level alarm at Lisgar Pumping Station. Bad weather cause of power bumps. Checked facility, normal power was restored upon arrival and wet well level normal. Checked Dufferin and Riverside Pumping Stations and all was normal

Major maintenance and upgrades that took place during 2016 include:

- Repair pumps
- Repair and/or replace air lines at lagoon
- Pumping station clean outs

4.0 Effluent Quality Assurance and Control Measures Undertaken

The facilities mechanical elements are in good repair. Each member of the operational staff possesses a high level of process knowledge and regulatory competence.

Samples are collected as required and analyzed by Accuracy Environmental Laboratories located in Kirkland Lake, Ontario. Licensed operators conduct in-house tests for monitoring purposes using Standard Methods of Water and Wastewater procedures.

Any bypass or upset events that occur are tested, monitored and reported to the Spills Action Center (SAC).

5.0 Calibration and Maintenance of all Monitoring Equipment

The flow-monitoring program, maintained in the Work Management System (WMS) incorporates a calibration of all monitoring devices once a year. This helps ensure their accuracy within plus or minus 5 % of actual rate of flow from 10 to 100 %.

All monitoring equipment is calibrated based on the manufactures recommendations and conducted by a qualified Instrumentation Technician. Refer to Table 5.1 for a summary of calibrations conducted in 2016.

5.1 Calibration Summary

Date	Instrument	% Accuracy
June 7, 2016	Influent/Effluent Flow Meter	98.2
November 15, 2016	pH meter	99.4 – 100
June 7, 2016	Pocket colorimeter	Within acceptable range

6.0 Sludge Summary

Sludge was removed from the lagoon and pumped into geotubes. It is estimated that the dry quantity sludge volume within the geotubes is 242 BDT (bone dry tonnes) or 242 m³.

7.0 Complaints

No complaints were received during the reporting period.



8.0 Bypass, Spill, and Abnormal Discharge Events

There were no bypasses, spills nor abnormal discharge events for 2016

Appendix A: Monthly Process Data

Raw Sewage	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Total Phosphorus (mg/L)	1.62	1.81	2.29	2.08	0.91	1.45	1.23	1.41	1.11	1.08	1.66	1.04
TKN (mg/L)	16.5	15.9	20.8	15.2	9.7	12.8	13.9	16.4	9.5	11.9	12.8	11.6
BOD5 (mg/L)	117	119	142	81	44	59	38	90	63	65	72	63
Suspended Solids (mg/L)	67	124	166	76	48	87	67	675	58	65	106	73
Effluent												
Total Phosphorus (mg/L)	0.535	0.534	0.39	0.394	0.341	0.963	1.42	0.526	0.337	0.487	0.274	0.554
BOD5 (mg/L)	20.6	19.5	11.6	8.6	3.7	1.3	12	8.1	12	18	5.8	12
cBOD5 (mg/L)	19.9	22.3	9.35	7	6.8	3.4	7	5.8	10	11	5.7	11
Suspended Solids (mg/L)	23	19	9	9.5	8	21.5	47	3.5	20	14	14	12
<i>E. coli</i> (cfu/100 mL)	Only required May 1 to Oct 31				10	< 5	< 5	235 155 Dup	< 5	45	monthly GM of 200	
pH												
	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Min	7.5	6.4	7.5	7.7	7.2	6.8	6.2	6.4	6.4	6.5	5.9	6.0
Max	8.5	8.1	8.3	8.1	7.9	7.4	7.4	7.0	6.9	7.0	6.9	7.2
Cnt	7	9	12	12	18	20	13	15	11	15	13	5
Temperature (C)												
	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Min	0.5	0.9	1.3	4.3	11.6	15.9	20.1	19.8	15.2	6.9	2	1.2
Max	1.9	3.6	6.3	11.2	19.7	23.9	24.5	24.2	20.8	15.8	8.8	4.7
Cnt	7	9	12	12	18	20	13	15	11	15	13	7
Total Chlorine Res. (mg/L)												
	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Min					0.61	0.09	0.36	0.18	0.1	0.1		
Max					1.4	1.51	1.12	1.85	1.07	1.47		
Cnt					20	20	13	15	12	14		