Annual Report

For the 2020 Operating Year

Lucknow Sewage Treatment Works
2020 Operation and Maintenance

PREPARED BY:
Veolia Water Canada
100 Cove Road
Goderich, ON
N7A 3Z2
Author: Nancy Mayhew

TO:
Township of Huron-Kinloss
Box 130
21 Queen Street
Ripley, ON, N0G 2R0

Resourcing the world

EXECUTIVE SUMMARY:

This report is a summary of the Lucknow Sewage Treatment Works performance in accordance with the Ministry of the Environment, Conservation and Parks (MECP) Amended Environmental Compliance Approval (ECA) No. 35667-999KAF, Issued: August 6, 2013 for the 2020 operating year.

DESCRIPTION OF FACILITIES: **Works Number: 110002764**

Component	**Location**
Sewage Pumping Station	432 Inglis Street - Northeast of the Ackert Drain
Aerated Ponds (Lagoons)	65 Washington St - Lots 53 and 54, Conc. 1
Winter/Emergency Storage Lagoon	65 Washington St - Lots 54 and 55, Conc. 1
Infiltration Basin System	65 Washington St - Lot 54, Conc. 1
Groundwater Seepage to Swale	65 Washington St - Lot 55, Conc. 1
Collection System	Village of Lucknow

SEWAGE PUMPING STATION

- Wet well structure (4.70 m x 2.10 m x 10.83 m deep)
- One (1) raw sewage pump (15 hp), 8.68 L/s
- Two (2) raw sewage pumps (40 hp each), 32.5 L/s each
- Milltronics level sensor
- Volume totalizer (magnetic flow meter)
- Endress + Hauser data logger for flows
- Standby generator (100 hp), 935 L diesel fuel tank and containment
- Force Main: 2,600 m x 200 mm diameter
- Bypass Pipe: 150 mm diameter, 0.6096 m long, 0.4064 m high

STABILIZATION PONDS (LAGOONS)

- Aluminum sulphate storage tank (27,000 L) and containment
- Alum metering pumps, max. 44 L/hour (one duty, one standby)
- Cell No. 1, 2, and 3: 10,700 m^3 each cell
- 4.0 m liquid depth, 0.9 m freeboard each cell
- Aerators (Cell No. 1 and 2): Flygt submersible pumps, self-aspiring Oxyjet (2 per cell)

WINTER STORAGE LAGOON (EMERGENCY STORAGE)

- Total operating volume: 67,500 m³
- 3.0 m liquid depth, 0.6 m freeboard

INFILTRATION BASIN SYSTEM

- Infiltration basin pumping station
  - 2.4 m precast concrete wet well structure
  - Two (2) submersible sewage pumps, 16.5 L/s (each)
- Splitter box structure
- Six (6) infiltration basins
- Bottom dimensions: 10.0 m x 7.0 m (each)
- Top-of-Berm dimensions: 16.0 m x 13.0 m (each)
- Total depth: 1.0 m (each)

EFFLUENT-GROUNDWATER REGIME

- Groundwater discharge/seepage conduit
- Maximum daily flow rate: 1,000 m³/day
- Sampling location: 100 mm diameter tile

UNIT PROCESS:

In 2020, the sewage treatment works was operated as follows:

Raw sewage from the Inglis Street Sewage Pumping Station was pumped to Lagoon Cell # 1, where aluminum sulfate is added to aid in phosphorus removal. From Cell # 1 the sewage was fed into Cell # 2, and then finally into Cell # 3 in series configuration. The treated effluent from Cell # 3 was continually discharged to the Infiltration Basin Pumping Station, then on to the Rapid Infiltration Basins (RIBs). The Splitter Box at the Infiltration Basin Pumping Station was manually controlled to distribute the effluent across the Rapid Infiltration Basin, each of which are interconnected with overflow pipes. A schematic of the Sewage Pumping Station is shown in Figure 2.

The Lucknow Sewage Treatment Works has been approved to treat sewage at a rated capacity of 750 m³ per day, based on the arithmetic mean of 366 consecutive days flow (leap year). During 2020, the Lucknow Sewage Treatment Works was consistently below the Non-Compliance Limits as set forth in the Environmental Compliance Approval.

Lucknow Sewage Treatment Plant Map

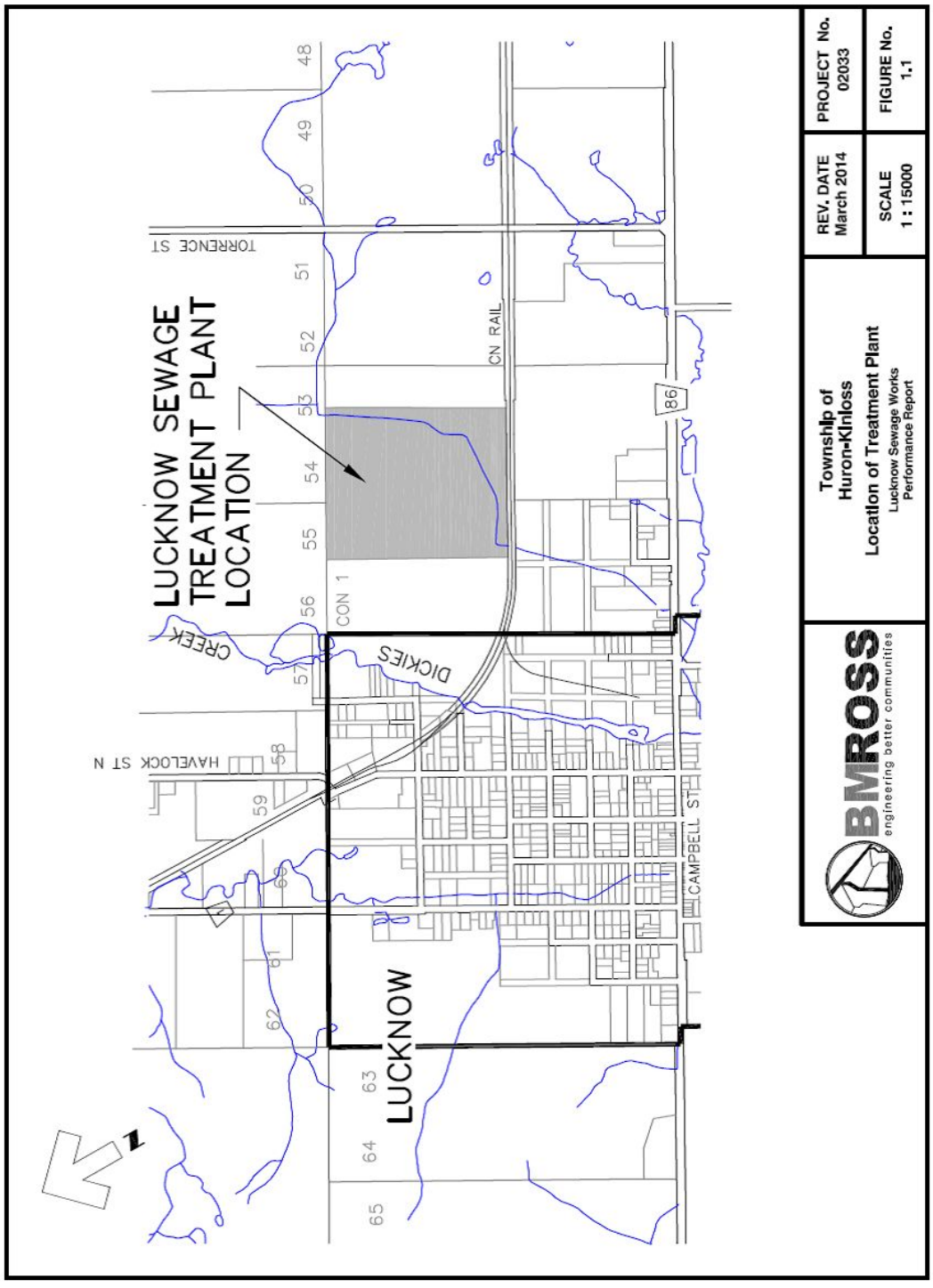


Figure 1

Lucknow Sewage Pumping Station Schematic

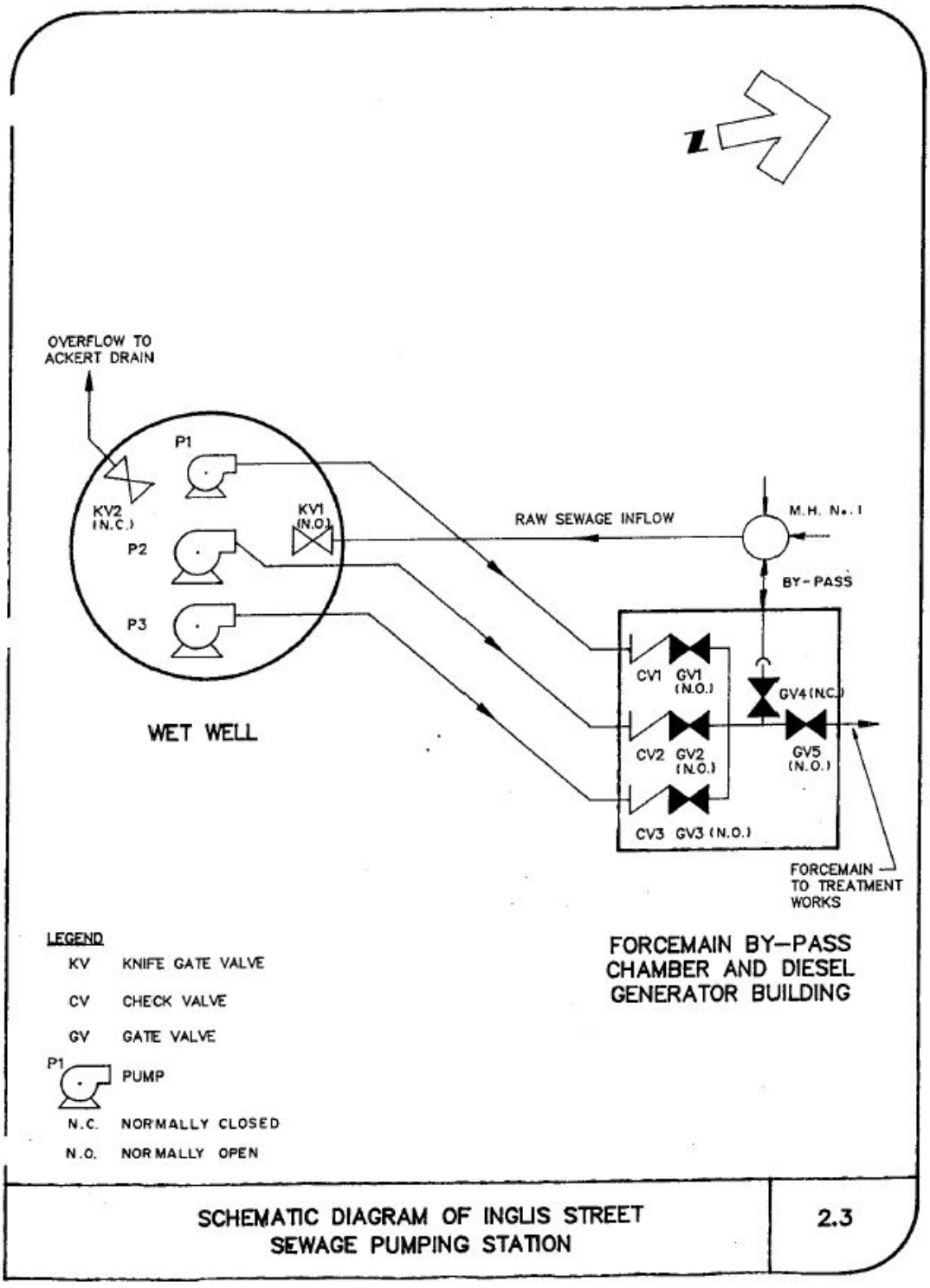


Figure 2

Lucknow Sewage Lagoon Schematic

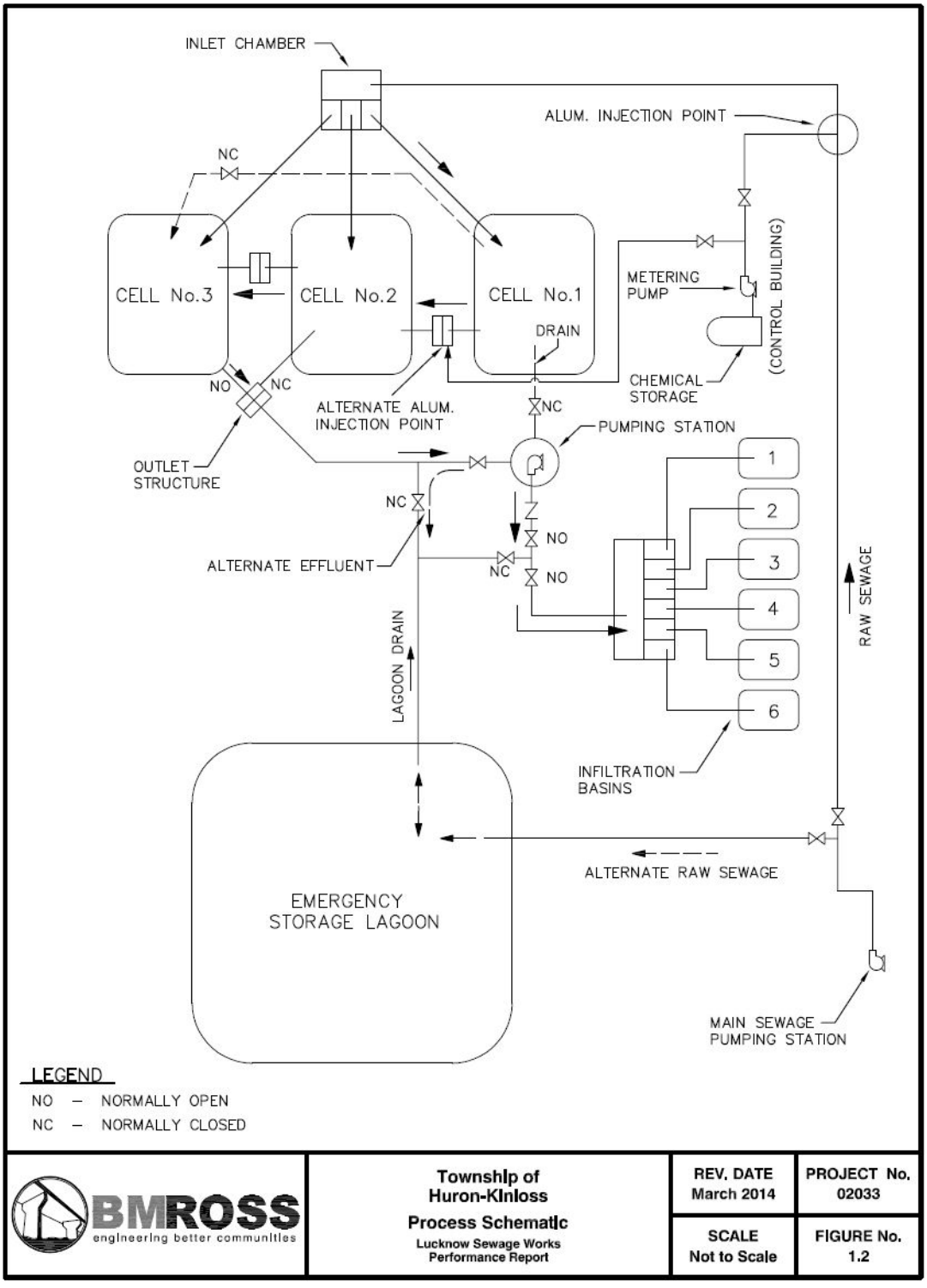


Figure 3

Ripley Sewage Lagoon Aeration Cell Schematic

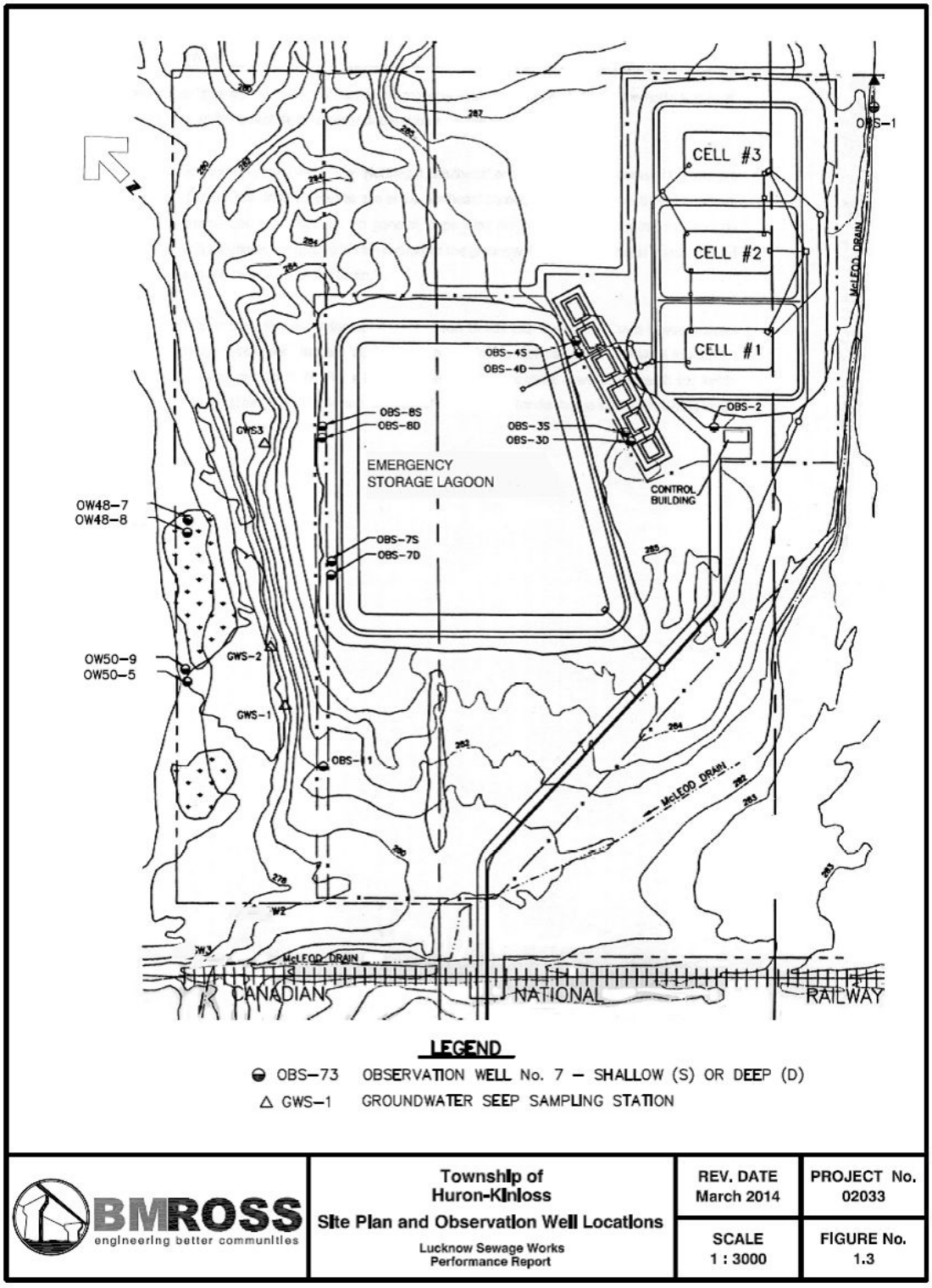


Figure 4

BY-PASSES:

There were no By-passes or Plant Overflows at the Lucknow Sewage Treatment Works in 2020.

RAW INFLUENT:

Flow data for the reporting period was obtained from the utility monitoring system records maintained by Veolia, the operator of the works. The flows are recorded from a magnetic flow meter located in the Sewage Pumping Station at 432 Inglis Street. The flow meter was calibrated on June 30, 2020.

All of the influent flow from the Village of Lucknow is pumped to the Sewage Treatment Facility via the Sewage Pumping Station. Below is a summary of the 2020 monthly flows as reported by Veolia. The annual average daily flow during 2020 was 530 m^3/day, which is in compliance with the rated capacity of 750 m^3/day stated in the ECA.

Influent Flow: Rated Capacity: 750 m^3/day

Date	Volume, m^3	Daily Max, m^3	Daily Min, m^3	Average, m^3	Capacity, %
January	22,915	1,765	360	739	98.6
February	14,760	793	313	509	67.9
March	26,803	2,282	460	865	115.3
April	16,589	919	346	553	73.7
May	14,614	808	298	471	62.9
June	14,046	606	250	468	62.4
July	12,258	574	250	395	52.7
August	12,478	616	200	402	53.7
September	12,738	598	315	425	56.6
October	14,436	614	292	466	62.1
November	14,405	700	283	480	64.0
December	17,850	1,100	339	576	76.8
Total	193,892				70.6%
Maximum	26,803	2,282			
Minimum	12,258		200		
Average	16,158			530	

Raw Sewage Sample Results (collected Quarterly):

Date	BOD_5	Total Kjeldahl Nitrogen	Total Phosphorus	Total Suspended Solids
January	228	29.7	4.14	187
April	180	27.5	3.75	163
July	347	48.9	6.67	700
September	208	38.6	0.40	7
Average	241	36.2	3.74	264
Total # Samples	4	4	4	4

Aluminum Sulfate Liquid (48.5%) Usage

Aluminum Sulphate (alum) is added to the raw water at the Luckow Lagoon facility. Alum acts as a coagulant and flocculant that adsorbs and precipitates soluble phosphorus and other compounds such as organic matter, forming clumps that settle to the bottom of the lagoon. Typical alum dosages for wastewater treatment are between 50 - 200 mg/L.

Month	Volume, L	kg	Dosage, mg/L
January	1,785	1,155.7	50.4
February	1,407	911.0	61.7
March	1,764	1,142.2	42.6
April	1,575	1,019.8	61.5
May	1,932	1,250.9	85.6
June	1,743	1,128.6	80.4
July	1,878	1,216.0	99.2
August	1,827	1,182.9	94.8
September	1,806	1,169.3	91.8
October	2,016	1,305.3	90.4
November	1,827	1,182.9	82.1
December	1,829	1,184.2	66.3
Total	21,389	13,848.8	---
Average	1,782	1,154.1	75.6

EFFLUENT OBJECTIVES:

The *Owner* shall use best efforts to design, construct and operate the *Works* with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from the aerated lagoon system (Cell # 3):

Aerated Lagoon Effluent Objectives (Cell # 3)	
Effluent Parameter	**Average Concentration (mg/L)**
$CBOD_5$	20.0
Total Suspended Solids	20.0
Total Phosphorus	1.0

The *Owner* shall use best efforts to:

(a) maintain the pH of the effluent from the *Works* within the range of 6.5 - 8.5, inclusive, at all times;
(b) operate the *Works* within the *Rated Capacity* of the *Works*;
(c) ensure that the effluent from the *Works* is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film or sheen or foam or discolouration on the receiving waters.

Aerated Lagoon Effluent (Cell # 3) Sample Results (collected Monthly)

Date	Total Ammonia	Free Ammonia	$CBOD_5$	E. Coli	TP	TSS	Field DO	Field pH	Field Temp. °C
January	13.2	0.0603	<4	180	0.24	4	6.02	7.46	6.1
February	13.7	0.0338	<4	1100	0.25	4	6.35	7.45	7.4
March	14.6	0.0682	<4	700	0.22	4	8.81	7.58	8.5
April	11.0	0.1080	<4	10	0.16	6	5.53	7.66	13.4
May	12.3	0.1720	<4	10	0.28	2	4.11	7.71	16.4
June	15.1	0.1160	<4	390	0.28	6	3.41	7.29	20.5
July	18.8	0.1030	4.6	500	0.43	15	3.34	7.15	24.0
August	17.6	0.2940	5.8	1800	0.45	20	2.05	7.23	22.8
September	11.6	0.0944	<4	2000	0.34	7	3.05	6.98	18.2
October	13.0	0.1170	4.8	1700	0.40	7	3.83	7.16	13.5
November	11.7	0.0272	4.0	700	0.24	6	8.89	7.20	10.9
December	9.7	0.0287	5.0	62	0.23	5	7.25	7.43	8.3
Average	13.5	0.1019	4.4	308*	0.29	7	5.22	7.36	14.2
Objectives	--	--	20.0	--	1.0	20.0	--	6.5-8.5	--
Compliant	--	--	**YES**	--	**YES**	**YES**	--	**YES**	--

*Average Monthly Geometric Mean Density

EFFLUENT LIMITS

The *Owner* shall operate and maintain the *Works* such that the concentrations of the materials named below as groundwater parameters are not exceeded in the groundwater monitoring well no. GWS-3 (GWSS):

Groundwater Limits	
Effluent Parameter	**Average Concentration (mg/L)**
$CBOD_5$	5.0
Total Suspended Solids	5.0
Total Phosphorus	0.1
Total Ammonia Nitrogen	2.5
Unionized Ammonia	0.1
E. Coli	100 cfu/100 mL (monthly geometric mean density)

For the purposes of determining compliance with and enforcing subsection (1):

(a) The *Monthly Average Concentration* of a parameter shall not exceed the corresponding maximum concentration.

NOTE: Free Ammonia is the same as the provincial Unionized Ammonia calculated from field pH and temperature provided on the Chain of Custody form.

Groundwater Seepage to Swale Sample Results (collected Weekly)

Date	Total Ammonia	Free Ammonia	$CBOD_5$	E. Coli	TP	TSS	DO	pH	Temp. °C
January	0.20	0.0009	<4	<1	0.02	1.8	6.43	7.34	11.8
February	0.09	0.0005	<4	<1	0.02	2.0	6.92	7.37	11.8
March	0.07	0.0003	<4	<1	0.02	2.2	6.96	7.30	12.2
April	0.04	0.0003	<4	<1	<0.02	2.3	6.85	7.45	13.3
May	0.06	0.0005	<4	<1	<0.02	2.3	7.28	7.58	14.8
June	0.06	0.0003	<4	2	<0.02	2.8	7.38	7.20	17.0
July	0.06	0.0004	<4	12	<0.02	1.8	7.84	7.14	19.7
August	0.04	0.0004	<4	1	<0.02	<2.0	8.08	7.35	18.3
September	0.07	0.0005	<4	2	<0.02	2.0	8.05	6.96	15.9
October	0.16	0.0010	<4	<1	<0.02	**5.8**	8.34	7.15	13.3
November	0.20	0.0010	<4	<1	<0.02	<2.0	7.62	7.34	11.8
December	0.72	0.0007	3.6	3	<0.02	<2.0	7.20	7.28	10.5
Average	0.15	0.0006	4.0	1.3	0.02	2.6	7.41	7.29	14.2
Objectives	2.50	0.1000	5.0	100*	0.10	5	---	6.5-8.5	---
Compliant	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	---	**YES**	---

*Average Monthly Geometric Mean Density, cfu/100 mL.

NOTE: One sample result for Total Suspended Solids was 17 mg/L and was related to a rain event and not representative of the actual groundwater seepage to swale. All other weekly samples for October were <3 mg/L. This sample was reported to the Ministry of the Environment, Conservation and Parks (Heather Lovely).

Sludge Accumulation:

Sludge accumulates in the bottom of aerated cells. No sludge was removed from the lagoon. The amount of sludge accumulated for 2020 was estimated based on the average amount of solids processed through treatment. The following calculation is taken from the *US Army Corps and Engineers Cold Region Research & Engineering Laboratory, Special Report 84-8, Accumulation, Characterization, and Stabilization of Sludges for Cold Region Lagoons, April 1984.*

Assumptions:
- 65% of Total Suspended Solids in volatile (35% is the actual Total Solids)
- 80% of solids accumulate in Cell # 1
- 15% of solids accumulate in Cell # 2
- 5% of solids accumulate in Cell # 3
- Concentration of solids is 30% by mass (300 kg/m^3)
- Lagoon Retention Time is 12 days each cell (36 days total)
- Sludge Specific Gravity is 1.3

Known:	Lagoon Cell Count:	3
	RIB Cell Count:	6
	TSS - Raw:	264 mg/L
	TSS - Cell # 3:	7 mg/L
	TSS - GWSS:	2.6 mg/L
	Average Flow:	530 m^3/day
	Density of water:	1,000 kgm^{-3}
	Lagoon Cell Surface Area:	973.75 m^2 each (47.5 m x 20.5 m at bottom)
	RIB Cell Surface Area:	70.0 m^2 each (10.0 m x 7.0 m at bottom)

Calculations:

Annual Accumulated Solids:

$$TS_i = SS_i \times Q \times t(365)\ 10^{-3}$$

Where
- TS_i = total solids into lagoon over operating time, t, (kg)
- SS_i = influent suspended solids concentration, (mg/L)
- Q = average daily inflow, (m^3/day)
- t = operating time of lagoon, (year)

Raw TS_i = 264 mg/L x 530 m^3 x 1(365) 10^{-3}
= 51,071 kg
Subtract 65% volatiles (33,196 kg)
= 17,875 kg Total Raw Solids

Cell # 3 TS_i = 7 mg/L x 530 m^3 x 1(365) 10^{-3}
= 1,610 kg
Subtract 65% volatiles (1,046 kg)
= 564 kg Total Solids at Cell # 3

GWSS TS_i = 2.6 mg/L x 530 m^3 x 1(365) 10^{-3}
= 503 kg
Subtract 65% volatiles (327 kg)
= 176 kg Total Solids Lost in Final Effluent

Solids Removed:

Total Solids Removed = Total Raw Solids - Total Remaining Solids
= 17,875 kg - 564 kg
= 17,311 kg Total Solids Removed by Lagoon Cells

Total Solids to RIBs = Total Solids at Cell # 3 - Total Solids at GWSS
= 564 kg - 176 kg
= 388 kg Total Solids to RIBs

Total Solids Removed (kg) converted to Total Solids Removed (m^3):

Total Solids Removed = 17,311 kg Total Solids Removed ÷ 300 kg/m^3
= 57.7 m^3 Total Solids Removed by Cells
(Assume concentration of solids is 30% by mass)

Annual Accumulation of Sludge:

Sludge Added	= 57.7 m^3 ÷ 973.75 m^2 (Cell surface area) x 1000
At Cells	**= 59.3 mm Annual increase of Sludge**
	= 47.4 mm in Cell # 1 (80%)
	= 8.9 mm in Cell # 2 (15%)
	= 3.0 mm in Cell # 1 (5%)
Sludge Added	= 388 kg Total Solids to RIBs ÷ 300 kg/m^3
At RIBs	= 1.3 m^3 Total Sludge Depth to RIBs
	= 1.3 m^3 ÷ 70.0 m^2 (RIB surface area) x 1000
	= 18.6 mm Annual Increase of Sludge
	= 3.1 mm in each RIB (18.6 ÷ 6 RIBs)

Using this calculation, values were reviewed from 2008 to 2020, and the annual average sludge accumulation is approximately 42 mm total. With this information, it was estimated that the running total accumulation since the sludge was removed in 2004 is approximately 712 mm (Cell # 1: 599 mm, Cell # 2: 113 mm, Cell # 3: 38 mm).

"Sludge Judge" Testing

"Sludge Judge" testing was not conducted in 2020. The last testing was performed near the end of the summer in 2016. At that time, all three lagoon cells were probed using a core sampling device to measure the actual depth of biosolids contained in each of the three lagoon cells.

It was observed that in Cell # 1 and Cell # 2, the solids tended to accumulate at the east and west ends of the cells due to the water current action generated by the surface aerators, with very little accumulation in the centre or aerator discharge side. There was negligible accumulation in Cell # 3.
Due to mounding of the biosolids, only an estimate could be used to extrapolate what the overall depth in the cell would be if the accumulation was uniform over the entire lagoon floor. The estimate depth:

Cell # 1: approximate sludge depth	1 m deep x 973.75 m^2	= 23% reduction of treatment volume
Cell # 2: approximate sludge depth	0.5 m x 973.75 m^2	= 11% reduction of treatment volume
Cell # 3: negligible		

Based on these measurements, it is estimated that since the sludge was removed from the lagoons in 2004, annual average sludge accumulation is approximately 107 mm total for all three cells.

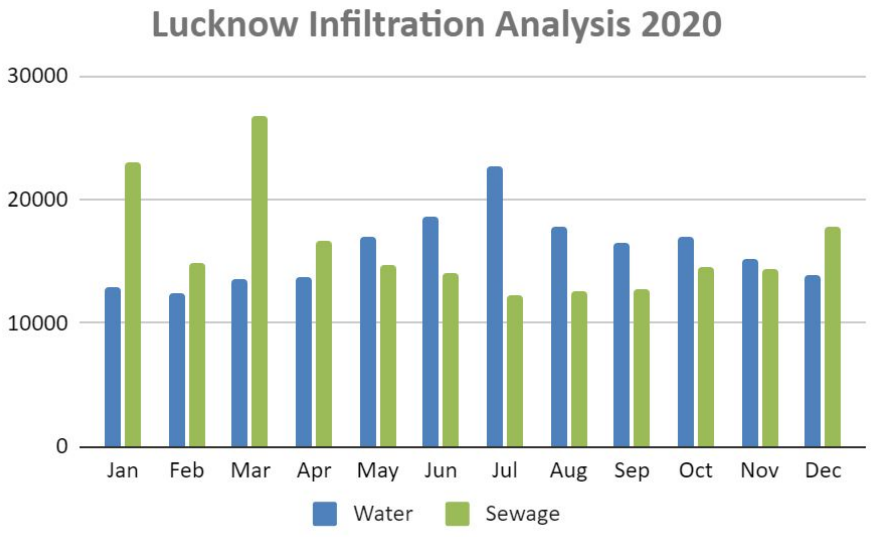
Other Observations:

- No complaints were reported for the period under review
- No sewage bypasses were reported for the period under review
- No modifications to the treatment system were carried out during the period under review
- There were several significant precipitation events in 2020 (>15 mm/24 h):
    - January 11
    - March 29
    - May 18
    - June 10, 23
    - July 9, 10, 19
    - August 2, 4 , 9, 16, 26
    - October 23
    - November 15
    - December 12

Infiltration Analysis:

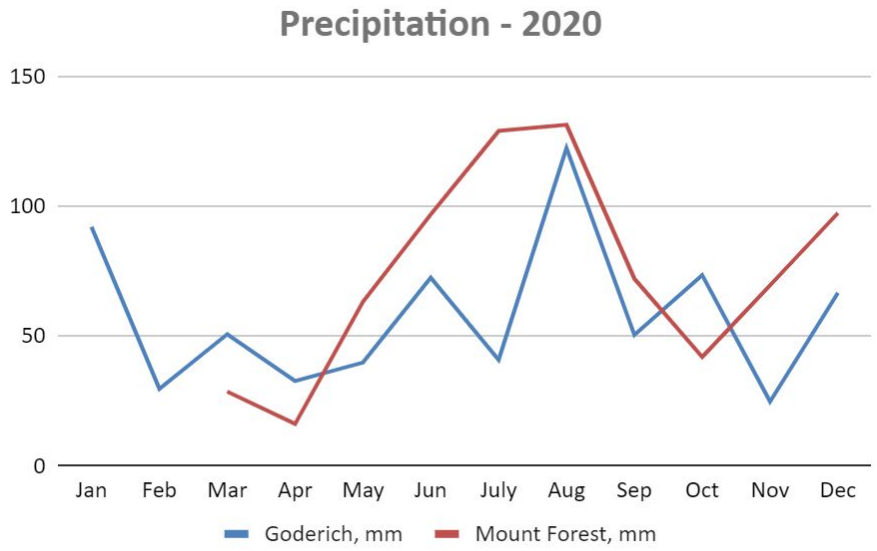
Wastewater flows were compared to the drinking water flows in an effort to estimate the amount of infiltration observed within the sewage collection system. Higher summer drinking water flows are likely related to lawn watering endeavours. Higher sewage flows in January were related to a heavy rain event, and in a spring thaw occurred in March.

Historical maximum day flows for each month provide some indication that direct inflow from storm water is occurring at times. Action should be considered to identify and remove any illegal sanitary connections that exist.



Weather and Precipitation: (source: Environment Canada)

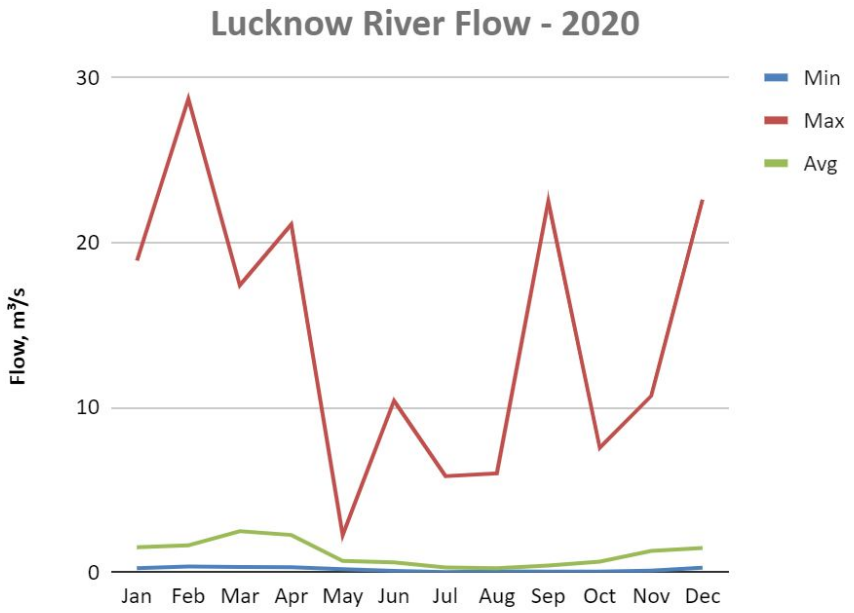
Month	Goderich			Mount Forest		
	Temp, ºC Min	Max	Precip Total, mm	Temp, ºC Min	Max	Precip Total, mm
Jan	-18.9	10.9	92.0	-17.6	9.4	m
Feb	-14.9	8.0	29.7	-25.5	5.4	m
Mar	-9.3	15.5	50.7	-17.9	14.8	28.6
Apr	-7.4	17.3	32.7	-7.2	15.0	16.2
May	-6.0	29.3	39.8	-6.2	30.4	63.2
Jun	4.3	32.3	72.4	3.8	30.7	96.8
Jul	11.2	31.7	40.8	11.7	31.8	128.9
Aug	9.7	29.3	122.3	7.7	29.6	131.2
Sep	-1.5	27.1	50.4	-0.8	26.3	72.1
Oct	-0.2	21.9	73.4	-5.5	18.5	41.9
Nov	-5.0	23.1	24.8	-6.6	22.0	69.5
Dec	-7.9	10.2	66.6	-10.1	8.8	97.3
TOTAL			**695.6**			**745.7**



NOTE: There was no data collected from the Environment Canada Mount Forest location between January and March.

Lucknow River Flows: (source: Government of Canada Real-Time Hydrometric Data)

Summary	m^3/s		
Month	**Min**	**Max**	**Avg**
Jan	0.251	18.9	1.525
Feb	0.360	28.7	1.640
Mar	0.325	17.4	2.496
Apr	0.310	21.1	2.272
May	0.203	2.25	0.695
Jun	0.094	10.4	0.616
Jul	0.026	5.84	0.298
Aug	0.059	6.00	0.263
Sep	0.056	22.50	0.417
Oct	0.056	7.56	0.651
Nov	0.108	10.70	1.306
Dec	0.286	22.60	1.482
Min	0.026		
Max		28.70	
Avg			1.139



Operational Problems, Corrective Actions, and Maintenance:

Date	Site	Comments
January 2	Lagoon	New pH probe installed/calibrated
January 3	Lagoon	New # 7 tube in Stenner alum pump
January 22	Lagoon	Repair to alum line for alum pump # 2
March 19	Sewage Pump Station	Raw sewage pump # 1 removed - sent to Wilsons (wiring issue)
April 28	Lagoon	Alum delivery
April 30	Sewage Pump Station	Raw sewage pump # 1 reinstalled
May 26	Lagoon	Aerator # 4 plugged - reversed and cleared
June 13	Lagoon	Aerator # 4 plugged - reversed and cleared
June 15	Sewage Pump Station	Sommers on-site for generator service
June 23	Lagoon	Aerator # 4 plugged - reversed and cleared
June 30	Sewage Pump Station	Flowmeter calibration
July 9	Lagoon	Aerator # 4 tripped - out of service
September 23	Sewage Pump Station	Hoist inspection
September 23	Lagoon	Hoist inspection
September 24	Lagoon	New # 7 Stenner tube and roller assembly in Stenner alum pump
September 29	Sewage Pump Station	Backflow preventer testing
October 22	Sewage Pump Station	CT on-site for manhole/wet well cleaning
November 5	Lagoon	Stenner alum pump out of service - alum line failure
November 6	Lagoon	Alum line repaired - alum pump back in service
December 9	Sewage Pump Station	Raw sewage pump # 1 out of service
December 9	Lagoon	Alum delivery
December 21	Lagoon	Changed DO probe

Performance Summary Based on Annual Averages:

Below is a summary of the overall effectiveness of the treatment of raw sewage from its entry to the Works though the groundwater regime.

Parameter	Raw Sewage	Cell # 3 Effluent	Design Objective	Groundwater Seepage	Non-Compliance Criteria	% Reduction Plant	% Reduction Groundwater	% Reduction Overall
BOD_5	240.8	7.6	20.0	4.0	5.0	96.8%	1.5%	98.3%
$CBOD_5$	160.3	4.4		4.0		97.2%	0.2%	97.4%
TSS	264	7	20.0	2.4	5.0	97.3%	1.7%	99.0%
Total Ammonia	--	13.53	--	0.15	--	--	--	--
Total Phosphorus	3.74	0.29	1.0	0.02	0.10	92.2%	7.2%	99.4%
E. Coli (CFU/100 mL)	--	308*	--	1.3	100*	--	--	--
Free (Unionized) Ammonia	--	0.1019	--	0.0006	0.10	--	--	--

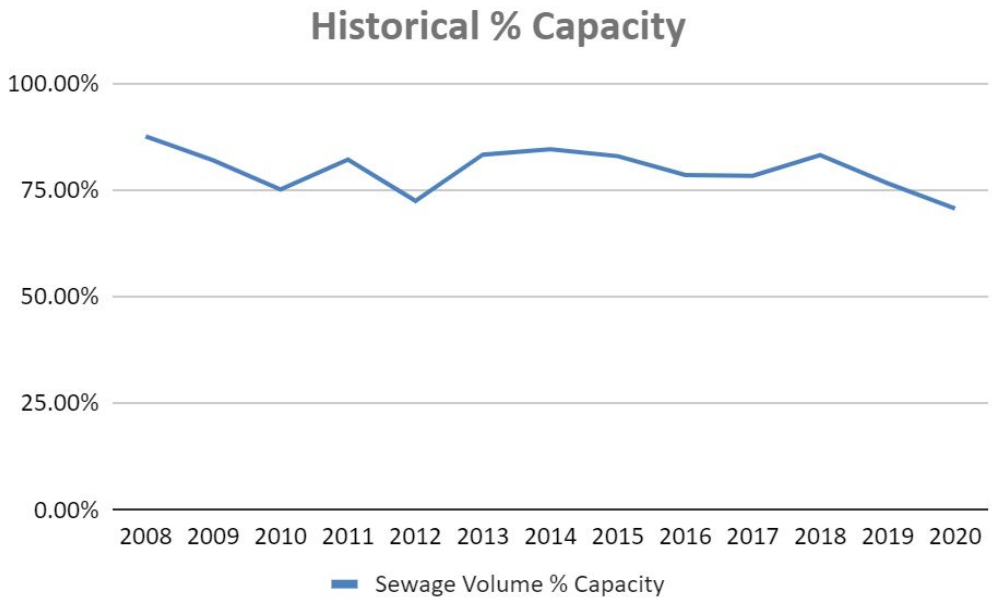
*Average Monthly Geometric Mean Density

CONCLUSIONS AND RECOMMENDATIONS

The following are the conclusions and recommendations resulting from the analysis of operating and monitoring data for the Lucknow Sewage Treatment Facility during 2019:

1. The annual average sewage influent flow was 530 m³/day in 2020, as determined by the flow measuring instrumentation in the Lucknow Sewage Pumping Station. Given that the approved flow to the works is 750 m³/day, the works operated at 70.7% of the design capacity. The 2020 average daily flow is 11.4% lower than the average flow during the previous four years (598 m³/day).

   Historically, maximum day flows will typically be greatest during spring months and be lowest during the summer months. During 2020, the maximum day trend was characteristic, with the maximum day flow of 2,282 m³/day occurring in March. Historical maximum day flows for each month provide some indication that direct inflow from storm water is occurring at times. Action should continue to be taken to identify and remove any illegal connections that exist.



HISTORICAL FLOW SUMMARY (Precipitation source: Environment Canada)

Year	Max Volume	Avg Volume	% Capacity	Total Volume	Mount Forest	Goderich
	m3	m3		m3	Total Precip, mm	Total Precip, mm
2008	2,884	662	87.6%	240,376	1,251.8	1,269.6
2009	2,968	613	82.0%	224,328	990.7	767.7
2010	1,534	563	75.1%	205,574	926.9	736.1
2011	1,698	618	82.1%	224,811	1,102.2	1,018.0
2012	1,056	545	72.4%	198,836	693.4	600.3
2013	2,131	627	83.3%	228,012	1,174.5	944.5
2014	3,195	638	84.6%	231,469	908.6	812.2
2015	1,500	623	82.9%	226,994	773.5	663.5
2016	2,442	597	78.5%	215,455	933.5	895.0
2017	1,949	592	78.3%	214,370	1,044.3	981.2
2018	300	627	83.2%	227,710	912.7	915.6
2019	1,618	575	76.5%	209,540	332.5	777.8
2020	2,282	530	70.6%	193,892	745.7	675.2
4-Year Average	**2,254**	**598**	**79.1%**	**216,769**	**963.5**	**892.4**

2. Raw sewage concentrations and loadings for BOD_5, TKN, TP and TSS have remained relatively consistent since 2016, however, in 2020, loadings were slightly higher than typical domestic sewage loadings on a per capita basis, with the exception of Total Phosphorus:

Parameter	Typical Loadings (mg/L)	2020 Loadings (mg/L)	% Difference
BOD_5	170	240.8	42% higher
TKN	35	36.18	3% higher
TP	7	3.74	46% lower
TSS	200	264	32% higher

3. Effluent quality, as measured at the effluent structure (GWSS), remained excellent throughout 2020, with the exception of one sample collected on October 27th during a rain event. This sample had exceptionally high Total Suspended Solids which is not representative of the groundwater seepage to swale effluent. This sample resulted in an exceedance of the Amended ECA average monthly concentration limits for October and was reported to the Ministry of the Environment, Conservation and Parks.

4. Based on the calculated removal rates of 92.2% to 99.4%, it is concluded that the Lucknow Sewage Treatment Facility provided excellent treatment of sewage in 2020.

Additional Information:

Municipal Utility Monitoring Program Reports (MUMP)

The monthly compilation forms of discharge data are submitted annually to the Ministry. The Ministry uses these forms to publicly report Municipal monitoring data. Please note that the Ministry has revised the format in which this data is uploaded to their website. The Ministry is no longer accepting locally generated reports to be submitted by email. Instead, Operators are required to use the Ministry-provided on-line forms available in the MECP form repository. These forms are populated with appropriate data for submission directly to the Ministry's database.

Infiltration-Inflow Investigations

In the fall of 2019, the Municipality initiated sanitary sewer flow monitoring, as well as a plan for sanitary manhole inspections. In 2020, 149 of the 168 manholes were inspected. Debris was removed from the north quadrant (45 manholes) on November 18, 2020. The sewer flow monitoring is expected to be completed in Spring of 2021. The following observations were made during the inspections:

Observation	# Manholes Affected	Percent of Manholes Affected
Total Manhole Inspections	149	88.7%
• No defect noted	87	51.8%
• Encrustation	15	8.9%
• Infiltration	37	22.0%
• Debris	26	15.5%
• Surface Defects	17	10.1%
• Water Level	1	0.6%
• Obstacles	1	0.6%
• Inaccessible	19	11.3%
• Cleaned	45	26.8%
TOTAL # MANHOLES	**168**	**---**