

2021 Year End Report: Bracebridge Wastewater Treatment Plant (WWTP)



Environmental Compliance Approval: #3237-BDGQDG

Engineering and Public Works Department

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Introduction

The Bracebridge Wastewater Treatment Plant (WWTP), which services the Town of Bracebridge, is owned and operated by the District Municipality of Muskoka. The plant is located at 1000 Lagoon Lane, and was commissioned in 2011. It services a population of approximately 8,600 people. The treatment facility consists of 60 acres of facultative lagoons and a membrane bio-reactor (MBR) treatment plant. The first two lagoons were constructed in 1959. They were 23 acres in size. By 1976, additional capacity was required to meet the needs of the town. At that time, an additional 37 acres of lagoon were constructed, bringing the total to 60 acres.

In 1983, an extended aeration treatment plant was commissioned to provide additional capacity for the growing town.

During the 2010-11, a new membrane filtration (MBR) plant was constructed to replace the extended aeration facility. Alum is used as the coagulant and disinfection is by ultra-violet lights. The final effluent is discharged to the Muskoka River by way of a diffuser.

The Plant operates under the MECP Environmental Compliance Approval (Sewage) # 3237-BDGQDG, issued July, 2019. Under the terms of the Approval, the plant is permitted to treat an average daily flow of 8,000 meters cubed per day peak flow rating of 18,000 meters per day. Additionally, effluent limit criteria are as follows.

Table 1 Effluent Limit Criteria

Effluent Parameter	Concentration
CBOD	10 mg/l
Total Suspended Solids	10 mg/l
Total Phosphorous	0.4 mg/l
Total Ammonia Nitrogen Summer (May 15 to September 30)	5.0 mg/l
Total Ammonia Nitrogen Winter (October 01 to May 14)	10.0 mg/L
E. coli	80 counts/100ml (Monthly Geometric Mean Density)

The membrane equipment, with the latter performing the critical solids/liquid separation function that is traditionally accomplished using secondary clarifiers as in most other Muskoka wastewater treatment plants.

MBRs rely upon membrane equipment for liquids/solids separation prior to discharge of the effluent. The membrane equipment installed at the Lagoon Lane WWTP is an immersed system, i.e. a system that is designed for installation within membrane tanks, which utilizes hollow fibre membranes.

Waste sludge from the MBR process is sent to one of the three primary facultative lagoons.

General Information

A review of the District of Muskoka's infrastructure needs is conducted annually by the Director of Water and Sewer Services, Area Manager and Chief Operator, and recommendations for maintenance, rehabilitation and renewal programs are considered.

Efforts to eliminate the discharge of untreated or partially treated wastewater to receiving waters are being accomplished by a long term financial commitment to correct excessive infiltration into the wastewater collection system by means of sewer main rehabilitation / replacement, manhole rehabilitation and pumping station rehabilitation programs.

The treatment facility is capable of effective operation during emergencies; maintenance shut downs, and power failures. This is achieved through such measures as preventive maintenance of duty / standby units, the duplication of major treatment components, the provision of standby power sources and extensive use of the SCADA systems. All pumping stations and treatment control systems use SCADA (Supervisor control and Data Acquisition), in combination with Data Highway Plus, and programmable logic controllers.

All operators are qualified to operate the systems efficiently and effectively in order to achieve the highest level of treatment at all times. A commitment to provide Operator training and certification is being sustained.

Regulatory sampling is carried out to meet the requirements outlined in the ECA, and additional in house operational sampling beyond these regulatory requirements is being performed on a routine basis. These efforts have resulted in an effective treatment process which ensures that effluent discharges consistently meet effluent objectives and are environmentally safe. All final effluent sample results for the MBR facilities met their effluent limits.

All data in this report is a compilation of test results received from SGS Canada and their accredited laboratory, Lakefield Research. All in-plant sampling, analysis and recording of results conforms, in order of precedence, to the following 3 standards: Ministry's Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works", Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" and the American Water Works Association/Water Environment Federation (AWWA/WEF) publication "Standard Methods for the Examination of Water and Wastewater"

Executive Summary

In all respects, test results of the treated effluent for the parameters of CBOD5, suspended solids, ammonia, total phosphorous, and E. Coli are in compliance with the limits outlined in the Certificate of Approval regarding monthly allowable concentrations and total effluent loading throughout the entire year.

Overall, the plant treatment processes performed satisfactorily and are deemed to be adequate. All sample test results of the final effluent were within levels outlined in the plant ECA (#3237-BDGQDG)

Quantity of Flow Summary.

The plant has a daily average flow design capacity of 8,000 m³/day. The actual average daily flow for the year was 3,871 meters cubed per day, however, the 3-year average is 3,894 meters cubed per day, which represents 49% of the plant capacity. None of the individual system components exceeded the design flow rating.

Plant Operational Upsets, Process Failures and Bypasses

There were no plant operational process problems in 2021. There was a bypass from plant lagoon cell #2 in March. A leak in the concrete Outlet Lagoon Structure (OLS) resulted in a bypass of partially treated effluent. The concrete wall separating the lagoon valving area used to divert the lagoon discharge to cell #4 was leaking through a crack in the concrete to a basically abandoned, with the pipe capped and closed, discharge structure. The abandoned discharge structure was filled with

concrete, this work was also completed to other lagoon outlet structures at the facility to prevent this was from occurring in the future. The lagoon discharge was to the Muskoka River through the plant outfall pipe. The combined MBR plant and lagoon discharge effluent was sampled with these results included in the plant effluent quality summaries.

Summary of Maintenance

- There were significant plant upgrades continuing in 2021 with the construction of the headworks to include new raw sewage screening, grit removal, flow measurement, emergency standby power and pumping facilities
- All equipment information at this plant is entered into a computer database. From this information, a scheduled preventive maintenance programme has been established. The maintenance programme includes (and not limited to)
 - Monthly testing of emergency testing (under load) of the standby generators
 - Annual servicing of emergency standby generators
 - Annual replacement of U.V. bulbs
 - Annual calibration of flow metering devices
 - Annual cleaning of all sewage pumping stations
 - Marine inspection of effluent outfall and diffuser completed in 2017. (5 year cycle)

Evaluation of the Need for Improvement Works

The treatment facility is operating at a plant capacity of 49% and is in compliance with specified effluent parameter criteria. In addition, there has been no significant treatment process upsets and plant bypasses. As a result, there is no need for improvements to the existing works

Interpretation of Analytical Results

All sample results for Raw Sewage and Final Effluent are reported in this section. Other tables in this report include Chemical Usage, Biosolids Quality, and Biosolids Quantity

Raw Sewage

The information reported in the Raw Sewage sample results summary table consists of test results of analysis conducted on composite samples of the plant influent flow as required by the plant ECA. Samples are sent for analysis to Lakefield Research, as well as analysis conducted on site using Standard Methods or equivalent. Weekly analysis has been performed and reported as specified under the terms outline in the ECA

Influent Analysis

Table 2 Influent Analysis

Influent Parameter	Minimum	4 Week Average Maximum	Annual Average	Average loading kg/day
BOD5 (mg/L)	44	600	259.1	1,046
Suspended Solids (mg/L)	56	2505	442	1,946
Total Phosphorus (mg/L)	2.9	9.5	5.2	22.7
Ammonia (mg/L)	15	45.4	26.5	107

Effluent Analysis

The information reported in the Final Effluent sample results summary tables 14-19 consists of test results of analysis conducted on final effluent composite samples. Bacteriological samples, however, consisted of grab samples. Weekly analysis has been performed and reported as specified under the terms outlined in the ECA.

Effluent Objective Analysis

The effluent objectives were met during all sample periods.

Final Effluent Analysis Summary

All final effluent samples tested for CBOD5, suspended solids, ammonia, E. Coli, and total phosphorous were below non-compliance limits outlined in the ECA

Table 3 Final Effluent Analysis Summary

Parameter	Minimum	4 Week Average Maximum	Annual Average	Average Loading kg/day
COBD5 (mg/L)	2	4	2.2	8.38
Suspended Solids (mg/L)	2	2.5	2.1	8.03
Total Phosphorus (mg/L)	0.03	0.11	0.04	0.17
Ammonia (mg/L)	0.1	2.2	0.54	1.97
E. Coli (#/100 mL)	0	0	0.03	N/A
pH	6.6 - Min	7.83 - Max	7.3	N/A

Final Effluent Sampling Summary

Average daily flow comparisons by day of week ensure ECA requirements for scheduled sampling are taken at a time, and in a location characteristic of the quality and quantity of the sewage stream over the time period being monitored. Average daily flow rates by day of the week compare the flow to the average daily flow for the entire year. This data is used to determine if a particular day of the week is best to ensure samples are taken to meet the requirements of scheduled monitoring sections of the ECA's. Sampling plans are reviewed and updated yearly based on the previous yearly flow data. Wednesday was the sample day for 2021 as indicated in the flow chart

Table 4 Average Influent Flow by Day of the Week

Day	2021 Average Flow by Day	% of ADFR
Monday	4012.80	97%
Tuesday	4002.75	97%
Wednesday	4114.08	100%
Thursday	4143.84	100%
Friday	4328.82	105%
Saturday	4174.85	101%

Sunday	4087.65	99%
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For 2022 the sample collection day will be Wednesday

Biosolids Generation

The quality and volume of biosolids both generated and hauled from the facility for disposal is outlined in the table provided. Waste activated sludge is pumped from the Bracebridge WWTP to the Lagoon Cell number 3. The lagoon provides storage and stabilization for the waste activated sludge.

In 2021, no stabilized biosolids in Plant Lagoon Cell number 3 were removed for disposal

It is not anticipated that there will be a significant increase in the total volume of biosolids produced in 2022

Co-Treatment Flow Summary

The treatment plant has the capability to co-treat additional wastes through the Septage Receiving Facility, which located on site at the Septage Lagoons. Septage and holding tank waste are hauled in by vacuum trucks, and dumped into the receiving cell, which is then blended into the plant influent flow. In addition, leachate from the District owned Rosewarne Landfill are trucked to the Septage Receiving Facility on a scheduled basis.

The plant ECA (Sewage) #3237-BDGQDG, states that the average quantity of partially treated septage lagoon effluent shall not exceed 180 meters cubed per day. The highest monthly average for partially treated septage lagoon effluent was 163.5 meters cubed per day in July 2021 with no problems observed by this volume.

In 2021, 6,589 meters cubed of hauled septage was received at Lagoon Lane septage lagoon and an additional 19,527 meters cubed of District Rosewarne Landfill leachate was hauled for disposal. There was transfer of wastewater from the treatment lagoons 1 and 2 to the MBR plant in March of 2021. All septage, leachate and wastewater disposed of into the Lagoon Lane septage lagoon was processed through the lagoon system and the supernatant from septage lagoon cell #3 was pumped to the MBR plant. Septage cell number 3 transfers are summarized in the following table:

Table 5 Septage Cell 3 Transfer Summary

Month	Minimum Daily Flow (m ³)	Maximum Daily Flow (m ³)	Total Monthly Flow (m ³)
January	45.28	279.42	3,525
February	0.00	79.96	980
March	0.00	281.94	3,730
April	50.94	398.81	4,343
May	14.30	305.72	3,262
June	11.32	455.94	3,619
July	10.85	396.70	5,039
August	72.64	113.21	3,419
September	24.69	113.20	3,126
October	56.61	158.50	3,338
November	94.33	142.42	3,399
December	11.32	113.21	2,106

Summary of Complaints received throughout the reporting period

There were no complaints received in the reporting period.

Bracebridge Wastewater Collection Summary

New Sewer Services

A total of 77 customers connected to existing sewer laterals in 2021.

New Sewer Mains

A total of 810 meters of 250 millimeter gravity sewer was installed in 2021 as well as 15 new Manholes in the Clearbrook and Kestrel Glen Subdivisions.

Sewer Main Replacements

There were no sewer main replacements in 2021

Low Pressure Sewer Breaks

There were no low pressure sewer breaks in 2021

Sewer Force Main Breaks

There were no sewer force main breaks in 2021

Sewer Force Main Replacement

There were no sewer forcemain replacements in 2021

Main Line Sewer Blockage

There were no sewer main blockages in 2021

Sewer Lateral blockage

The District of Muskoka had 4 sewer lateral issues in 2021 for residential customers, all of which were excavated and repaired.

Low Pressure Sewer Blockages

No low pressure sewer blockages in 2021

Frozen Sewer Force Mains

There were no frozen sewers Mains in 2021

Frozen Sewer Service Laterals

No sewer service laterals froze in 2021

Frozen Low Pressure Sewer Services

No low pressure sewer services froze in 2021

Sewer Flushing/Video

Approximately of 5,800 meters of sewer main was flushed and video inspected and another 2,300 meters was flushed only in 2021

Sewer locates

The District, either in-house or with contracted staff, completed 914 buried utility locate requests in 2021 to comply with Ontario OneCall requests.

Table 6 Effluent Flow Summary - 2021

Month	Plant Total Monthly (m ³)	Average Day Flow (m ³ /d)	Maximum Day Flow (m ³ /d)	Minimum Day Flow (m ³ /d)	Lagoons Monthly Flow (m ³)	Facility Total Monthly Flow (m ³)
January	93,590	3,019	3,540	2,715	3,525	93,590
February	77,647	2,773	2,954	2,563	980	77,647
March	145,821	4,704	8,279	2,680	3,730	145,924
April	154,491	5,150	6,883	3,757	4,343	154,491
May	108,810	3,510	4,841	1,605	3,262	108,810
June	91,322	3,044	5,492	1,810	3,619	91,322
July	139,143	4,488	6,801	3,315	5,039	139,143
August	105,716	3,410	4,047	2,604	3,419	105,716
September	134,817	4,494	7,115	2,965	3,126	134,817
October	118,510	3,823	5,452	2,947	3,338	118,510
November	112,054	3,735	4,612	2,970	3,399	112,054
December	130,988	4,225	5,433	2,563	2,106	130,988

Total Flow: 1,412,908 m³

Average Day: 3,871 m³

Maximum Day: 8,279 m³

Minimum Day: 1,605 m³

Table 7 Influent Quarterly Analysis Summary – Weekly 24 Hour Composite Sample Part 1

Sample Date	mg/L	Alkalinity (Total as CaCO3) mg/L	pH	Total Phosphorus mg/L	Suspended Solids mg/L
Feb 10	168	197	7.42	3.08	56
May 12	211	181	7.28	3.97	295
Aug 18	421	263	7.26	12.6	1310
Nov 10	113	240	7.55	3.26	157
Yearly Average	228.3	220.3	7.4	5.7	454.5
Maximum	421.0	263.0	7.6	12.6	1310.0
Minimum	113.0	181.0	7.3	3.1	56.0

Table 8 Influent Quarterly Analysis Summary – Weekly 24 Hour Composite Sample Part 2

Sample Date	Total Kjeldahl Nitrogen mg/L	Nitrate Nitrogen mg/L	Nitrite Nitrogen mg/L	Total Ammonia Nitrogen mg/L
Feb 10	34.6	<0.06	<0.03	28.1
May 12	26.6	<0.06	<0.03	18.5
Aug 18	83.2	<0.06	<0.03	34.6
Nov 10	29.2	<0.06	<0.03	24.3
Yearly Average	43.4	<0.06	<0.03	26.4
Maximum	83.2	<0.06	<0.03	34.6
Minimum	26.6	<0.06	<0.03	18.5

Table 9 Chemical Usage Summary: Alum

Month	Average Dosage mg/L	Total kg (dry)
January	31.3	4,964.0
February	26.7	4,904.2
March	20.4	11,643.8
April	26.1	9,741.6
May	31.8	5,713.3
June	34.2	4,546.8
July	30.1	7,418.7
August	31.9	5,509.2
September	27.9	7,781.4
October	38.4	5,171.1
November	38.7	4,869.5
December	30.4	7,131.0
Average	30.6	79,395

Total Yearly Kilograms: 79,395

Table 10 Chemical Usage Summary: Soda Ash

Month	Average Dosage mg/L	Total kg (dry)
January	4.3	400.0
February	5.2	400.0
March	3.4	500.0
April	3.2	500.0
May	4.6	500.0
June	4.4	400.0
July	2.9	400.0
August	4.7	500.0
September	3.7	500.0
October	6.8	800.0
November	12.5	1,400.0
December	6.1	800.0
Average	5.1	591.7

Total Yearly Kilograms: 7,100 kg

Table 11 Chemical Usage Summary: Sodium Hypochlorite

Month	Average Dosage mg/L	Total litres
January	N/A	1,882.7
February	N/A	1,854.0
March	N/A	5,018.7
April	N/A	4,654.3
May	N/A	3,359.0
June	N/A	1,289.8
July	N/A	1,611.6
August	N/A	3,740.0
September	N/A	979.1
October	N/A	1,561.6
November	N/A	5,897.2
December	N/A	1,254.8
Average	0	2758.6

Total Yearly Litres: 33,103 L

Table 12 Chemical Usage Summary: Citric Acid

Month	Average Dosage L	Total Litres
January	N/A	585.8
February	N/A	633.6
March	N/A	942.4
April	N/A	721.4
May	N/A	790.3
June	N/A	461.1
July	N/A	406.9
August	N/A	1,417.1
September	N/A	573.3
October	N/A	652.4
November	N/A	2,112.4
December	N/A	722.8
Average	0.0	835

Total Yearly Litres: 10,019

Table 13 Effluent Quarterly Analysis Summary – Weekly 24 Hour Composite Sample

Sample Date	CBOD5 mg/L	pH	Total Phosphorus mg/L	Suspended Solids mg/L	Total Kjeldahl Nitrogen mg/L	Nitrate Nitrogen mg/L	Nitrite Nitrogen mg/L	Total Ammonia Nitrogen mg/L
Feb 10	<2	7.38	<0.03	3	1.3	8.14	0.11	0.7
May 12	<2	7.69	<0.03	<2	0.9	1.8	<0.03	<0.1
Aug 18	<2	7.58	<0.03	<2	0.7	2.32	<0.03	0.1
Nov 10	3	7.34	0.23	<2	1.0	8	<0.03	0.3
Yearly Average	2.25	7.50	0.08	2.25	1.0	5.14	0.05	0.3
Maximum	3	7.69	0.23	3	1.3	8.25	0.11	0.7
Minimum	<2	7.34	<0.03	<2	0.7	1.84	<0.03	<0.1

Table 14 Effluent Loading and Concentration Summary 2021: COBD5

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	2.50	7.55	8.85
February	2.00	5.55	5.91
March	2.30	10.82	19.04
April	2.00	10.30	13.77
May	2.00	7.02	9.68
June	3.60	10.96	19.77
July	2.00	8.98	13.60
August	2.00	6.82	8.09
September	2.00	8.99	14.23
October	2.00	7.65	10.90
November	2.00	7.47	9.22
December	2.00	8.45	10.87
Average Monthly	2.20	8.38	11.99
Effluent Objective	5 mg/L		
Non-Compliance	10 mg/L		

Table 15 Effluent Loading and Concentration Summary 2021: Suspended Solids

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	2.00	6.04	7.08
February	2.25	6.24	6.65
March	2.00	9.41	16.56
April	2.00	10.30	13.77
May	2.00	7.02	9.68
June	2.40	7.31	13.18
July	2.00	8.98	13.60
August	2.50	8.53	10.12
September	2.00	8.99	14.23
October	2.00	7.65	10.90
November	2.00	7.47	9.22
December	2.00	8.45	10.87
Average Monthly	2.10	8.03	11.32
Effluent Objective	5 mg/L		
Non-Compliance	10 mg/L		

Table 16 Effluent Loading and Concentration Summary 2021: Total Ammonia Nitrogen Summer

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
May	0.10	0.351001	0.484089
June	0.12	0.365289	0.659047
July	0.10	0.448847	0.68
August	0.13	0.44	0.53
September	0.10	0.449391	0.711463
October	0.10	0.382291	0.545183
Average Monthly	0.11	0.41	0.60
Effluent Objective	2.0 mg/L		
Non-Compliance	5.0 mg/L		

Table 17 Effluent Loading and Concentration Summary 2021: Total Ammonia Nitrogen Winter

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	1.65	4.98	5.840812
February	0.73	2.02	2.16
March	1.92	9.031477	15.89581
April	0.65	3.347298	4.473996
November	0.33	1.232589	1.522079
December	0.14	0.591559	0.76062
Average Monthly	0.90	3.53	5.11
Effluent Objective	2.0 mg/L		
Non-Compliance	10.0 mg/L		

Table 18 Effluent Loading and Concentration Summary 2021: E.Coli

Month	Geomean (#/100mL)	Maximum Daily (#/100mL)
January	0.00	2.00
February	0.00	0.00
March	0.00	2.00
April	0.00	0.00
May	0.00	0.00
June	0.00	0.00
July	0.00	0.00
August	0.00	0.00
September	0.00	2.00
October	0.00	0.00
November	0.00	2.00
December	0.00	2.00
Average Monthly	0.00	0.83
Effluent Objective	<2	
Non-Compliance	80.00	

Table 19 Effluent Loading and Concentration Summary 2021: Total Phosphorus

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	0.04	0.12	0.141595
February	0.03	0.08	0.09
March	0.03	0.14	0.248372
April	0.03	0.15	0.206492
May	0.03	0.11	0.145227
June	0.03	0.09	0.164762
July	0.04	0.18	0.272043
August	0.03	0.10	0.12
September	0.06	0.27	0.426878
October	0.06	0.23	0.32711
November	0.11	0.41	0.50736
December	0.05	0.21	0.27165
Average Monthly	0.05	0.17	0.24
Effluent Objective	0.3 mg/L		
Non-Compliance	0.4 mg/L		

Table 20 Liquid Sludge Production Summary 2021

Month	Hauler	Shipped to: Location	Shipped to: Volume (m³)
January	Pumped	Sludge Lagoon Cell 3	1952.3
February	Pumped	Sludge Lagoon Cell 3	1431.2
March	Pumped	Sludge Lagoon Cell 3	2436.3
April	Pumped	Sludge Lagoon Cell 3	3647.7
May	Pumped	Sludge Lagoon Cell 3	2082.2
June	Pumped	Sludge Lagoon Cell 3	3769.8
July	Pumped	Sludge Lagoon Cell 3	3337.3
August	Pumped	Sludge Lagoon Cell 3	4534.0
September	Pumped	Sludge Lagoon Cell 3	3218.8
October	Pumped	Sludge Lagoon Cell 3	2755.1
November	Pumped	Sludge Lagoon Cell 3	2082.0
December	Pumped	Sludge Lagoon Cell 3	1820.9

Yearly Total Volume: 33,067 m³
 Yearly Average Volume: 2,756 m³
 Maximum Volume: 4,534 m³
 Minimum Volume: 1,431 m³

Table 21 Sludge Quality Analysis 2021

Parameter Sampled (mg/L)	First Quarter (Feb 10)	Second Quarter (May 12)	Third Quarter (Aug 18)	Fourth Quarter (Nov 10)
Sample ID	BRA-40 WAS	BRA-40 WAS	BRA-40 WAS	BRA-40 WAS
Nitrate	0.8	0.8	0.3	1.3
Mercury	0.001	0.002	0.006	0.002
Chromium	0.07	0.07	0.23	0.11
Cobalt	<0.01	0.01	0.02	0.01
Copper	1.9	1.7	5.5	2.6
Lead	<0.1	<0.1	0.2	<0.1
Molybdenum	<0.05	<0.05	0.07	<0.05
Nickel	0.04	0.05	0.12	0.08
Selenium	<0.1	<0.1	<0.1	<0.1
Arsenic	<0.1	<0.1	<0.1	<0.1
Zinc	1	2	6.0	2
Cadmium	<0.005	<0.005	0.011	<0.005
Ammonia+ Ammonium	6.1	3.2	17.1	6.4
Total Kjeldahl Nitrogen	536	439	328	379
Total Phosphorus	170	150	290	160
Total Solids	6870	6780	11400	6880
Volitile Solids	5040	5030	7920	4670
Nitrite	0.7	1	<0.2	1
Potassium	38	42	65	32
Total Suspended Solids	6960	6130	12000	6400

Bracebridge Certification of Reports

I certify that the information in this document and all attachments are correct, accurate, and complete to the best of my knowledge

Michael Spicer
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