

Annual Report 2018/2019

Submission: October 4, 2021



Hamlet of Fort Providence

Water Licence MV2016L3-0001

Municipal Water Licence Annual Report

Village of Fort Providence
Licence #: MV2016L3-0001
Reporting year: 2018/2019
Expires: July 6, 2026

*Part B, item 4: The Licensee shall file an Annual Water Licence Report with the Board not later than **June 30th** of the year following the calendar year reported (April 1 – March 31), which shall contain the following information (as set out in Schedule 1):*

a) Water Use

Licensed Water Volume Withdrawal: not to exceed 60,000 m³ annually

Approximate total yearly volume of water used: 27,490.10 m³

Table 1: Monthly and annual water quantities obtained from all sources

Month	Volume from main source: Raw Water intake at Water Supply Facilities (m ³)	Volume from any other source (m ³)	TOTAL Volume (m ³)
April	2193.85	-	2193.85
May	2426.97	-	2426.97
June	2418.14	-	2418.14
July	2321.55	-	2321.55
August	2432.43	-	2432.43
September	2025.48	-	2025.48
October	2387.64	-	2387.64
November	2292.76	-	2292.76
December	2283.86	-	2283.86
January	2200.47	-	2200.47
February	2258.02	-	2258.02
March	2248.90	-	2248.90
TOTALS	27,490.06	-	27,490.06
% Increase / decrease from previous year	-2.74% 2017/2018: 28263.32 m ³	-	-2.74% 2017/2018: 28263.32 m ³

Reasons for increase/decrease in water withdrawn:

Between the 2017/2018 and 2018/2019 fiscal years there was a net decrease in water consumption of 2.74%. No significant events or changes within the Hamlet's population or operations occurred within the 2018/2019 fiscal year that could have affected the trucked water supply to residents and businesses. The 2.74% decrease is considered to a part of the nominal fluctuations within annual water usage.

Reasons for exceeding licensed withdrawal volumes (if applicable):

Not Applicable

Name and location of other water source used (if any), and reason for its use:

Not Applicable

General information (e.g. information regarding any modifications to the water withdrawal procedure or facilities) should be included here. If necessary, please attach any relevant reports as an appendix to this report.

No modifications or operational changes took place in 2018-2019 year to the water withdrawal facilities or process. In the 2018/2019 year Stantec completed a Constructability Study outlining potential solutions for upgrades to the WTP. A Water Treatment Plant Upgrades & Water Supply Constructability Study was completed on June 20, 2018 and can be made available upon request. In addition, in March of 2019 Stantec was retained as the design consultant to provide a detailed design for upgrades to the Water Treatment Plant and a new reservoir. The Engineering Services Agreement can be made available upon request. **Appendix D** contains a Review of Community Water Management and Water System Infrastructure completed by the GNWT Department of Municipal and Community Affairs (MACA).

b) Waste Disposal

i) Solid Waste

Approximate total yearly volume of solid waste deposited: 3914.63 m³

*GNWT – MACA has provided a standard formula for estimating the amount of solid waste deposited into a Solid Waste Facility in the absence of a metered Garbage Truck. The following can be used: **Volume per person per day X number of days X population***

*e.g. **0.015 m³** X 30 days X 860 people = 387 m³ of domestic trash
deposited into Solid Waste Facility in a 30 day month*

Table 2: Monthly and annual quantities of solid waste deposited at the Fort Providence Solid Waste Disposal Facilities

Month	Volume of solid waste deposited (m ³)	Volume of sludge from the Water Supply Facility (m ³)
April	321.75	-
May	332.48	-
June	321.75	-
July	332.48	-
August	332.48	-
September	321.75	-
October	332.48	-
November	321.75	-
December	332.48	-
January	332.48	-
February	300.30	-
March	332.48	-
TOTALS	3,914.63	-
% Increase / decrease from previous year	56.59 - 30.49%* 2017-2018: 2,500-3,000m ³	-

*See below for the rationale explaining the range of percentages

Reasons for increase / decrease: (e.g. an industrial project close to the Hamlet of Fort Providence, or a large influx of people into town)

Through the 2018/2019 fiscal year no significant changes to the Hamlet's population or solid waste facilities (SWF) occurred. The 2018/2019 quantities calculated above were based on the above recommended equation and the 2018 estimated population of 715 residents (From the NWT Bureau of Statistics July 1, 2020 Population Estimate).

The 56.59 – 30.49% increase from 2017/2018 noted above reflects the difference in estimation methods, as no significant population or operational changes occurred through the 2018/2019 year. In the 2017/2018 fiscal year the total estimated solid waste deposited for a 30-year period was calculated to be 67,000 - 88,500 m³, or the equivalent of 2,500 – 3,000 m³ per year. This method, utilizing a population growth rate of 0.5% (NWT Bureau of Statistics projects a declining population), estimated the solid waste quantities for the 30-year period and then averaged over the 30-year period. The significant estimate increase for 2018-2019 when compared to 2017/2018 can be attributed to this difference in estimation methods.

The volume of sludge from the Water Treatment Plant deposited at the Solid Waste Disposal Facilities is not currently being recorded. The Board has previously requested the development of a sludge monitoring process, as defined in Part 7 of the *Water Treatment Plan O&M Plan – Version 3* to provide information on sludge composition, estimated monthly quantities of sludge

disposal, and information about how sludge is disposed of. The Hamlet has not been recording this information. Recommended practices are outlined within the Part 10 of the *Water Treatment Plan O&M Plan – Version 3*.

ii) Sewage

Table 3: Monthly and annual quantities of sewage deposited at Fort Providence Sewage Disposal Facilities

Month	Volume of sewage waste deposited (m ³)
April	1931.32
May	2552.12
June	2328.79
July	2466.95
August	2211.25
September	1720.85
October	2074.03
November	2021.03
December	1887.41
January	2058.51
February	1801.48
March	2021.79
TOTALS	25,075.51
Is this an estimated volume? (yes/no)	Yes
% Increase / decrease from previous year	2.11% 2017-2018: 24,557m ³

To calculate monthly sewage waste deposited to the Sewage Disposal Facilities, please provide the above information if metered information is available. If metered information is not available, please fill in the table using the corresponding TOTAL water volumes from Table 1. This provides estimation only and equals water in/sewage out.

Reasons for increase / decrease: (e.g.: an industrial project close to the Hamlet of Fort Providence, or a large influx of people into town)

Between the 2017/2018 and 2018/2019 fiscal years there was a net increase in sewage waste deposited of 2.11%. No significant events or changes within the Hamlet's population or operations occurred within the 2018/2019 fiscal year that could have affected the sewage volumes. The 2.11% increase is considered to a part of the nominal fluctuations within annual water usage.

iii) Other Waste Sources

Are there any other types or sources of waste that are being deposited at the Hamlet of Fort Providence's Waste Disposal Facilities? Please list the type/source, where it is being deposited, and monthly/annual volumes for each waste.

No other waste sources of waste were deposited into the Hamlet of Fort Providence's Waste Disposal Facilities.

c) Waste Removed from Waste Disposal Facilities

Please list in the table below wastes removed from Waste Disposal Facilities (e.g. recyclables, tires, household hazardous waste, scrap metal, and other wastes that are periodically shipped out.). Add additional columns to Table 4 if necessary.

Table 4: Monthly and annual quantities of waste removed from the Waste Disposal Facilities by Type

Month	Waste type 1 (m ³) (fill in type)	Waste type 2 (m ³) (fill in type)	Waste type 3 (m ³) (fill in type)
April	0	0	0
May	0	0	0
June	0	0	0
July	0	0	0
August	0	0	0
September	0	0	0
October	0	0	0
November	0	0	0
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
TOTALS			
Is this an estimated volume? (yes/no)	No	No	No
% Increase / decrease from previous year	0	0	0

No solid waste was removed from the Waste Disposal Facility in 2018/2019.

d) Waste Volume

Table 5: Monthly waste volumes deposited by commercial and industrial operators working outside the boundaries of Fort Providence

Month	Solid Waste Disposal Facility (m ³)	Sewage Disposal Facility (m ³)	TOTAL (m ³)
April	0	0	0
May	0	0	0
June	0	0	0

July	0	0	0
August	0	0	0
September	0	0	0
October	0	0	0
November	0	0	0
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
TOTALS			
Is this an estimated volume? (yes/no)	No	No	No
% Increase / decrease from previous year	-	-	-

General information:

Information regarding any agreements with outside organizations to be a waste receiving facility should be outlined here along with estimates of the amounts and types of waste to be received.

No major changes were made to the Solid Waste Disposal Facility and no wastes were deposited by commercial or industrial operators working outside of the Hamlet boundaries.

e) Tabular summaries of data generated under the Surveillance Network Program

Tabular summaries of all data generated under the Surveillance Network Program should be included using the tables in Appendix A (attached).

Summaries of all data generated under the Surveillance Network Program are found in Appendix A.

f) Laboratory reports for all samples collected for the Surveillance Network Program

All laboratory reports should be attached as Appendix B to this report.

Laboratory reports for the Surveillance Network Program are found in Appendix B.

g) Geographic Coordinates for all Surveillance Network Program stations, and a map showing station locations

Table 6: SNP station details

Station Number	Geographic Coordinates (approximate)	Effective date	Signage install date
2016-1	61.3499 N; -117.6373 W	2016	June 2018
2016-2	61.3524 N; 117.6185 W	2016	June 2018
2016-3	61.3520 N;	2016	June 2018

	117.6166 W		
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A map showing the approximate proposed Surveillance Network Program station locations are found in Appendix C. The map has not been formally finalized and has various proposed locations. A proposal finalizing the SNP locations to be registered within the Water Licence has been submitted and is currently being reviewed for approval by the MVLWB. The Hamlet will ground truth the SNP locations to obtain accurate geographic coordinates.

h) Activities to install and maintain fencing at the Waste Disposal Facilities

Include a summary of any and all activities undertaken to install and maintain fencing at the Solid Waste Disposal Facilities and Sewage Disposal Facilities.

Regular maintenance of fencing took place during 2018/2019 to the Solid Waste Disposal Facility and Sewage Disposal Facilities. Damage to fencing was caused by wildlife.

i) Activities to install and maintain signage at the Waste Disposal Facilities and SNP stations

Include a summary of any and all activities undertaken to install and maintain signage at the:

- Solid Waste Disposal Facilities,
- Sewage Disposal Facilities, and
- Surveillance Network Program stations.

Signage has been installed at the Solid Waste Disposal Facilities and the Sewage Disposal Facilities. Please see **Appendix C** for the Map of the proposed SNP locations and municipal facilities.



Signage installed during 2018/2019



Signage at the Solid Waste Facility



Signage was installed in the Solid Waste Facility.



Signage was installed in the Solid Waste Facility.

Signage was also installed at the Surveillance Network Program stations during 2018/2019.



Image of signage installed at SNP 1412-2 (decommissioned).



Signage installed at SNP 2016-1



Signage installed at SNP 2016-2



Image of signage installed at SNP 2016-3.



Image of SNP 2016-3

j) Sludge Management Activities

Include a summary of sludge management activities, including results of depth and volume measurements, sludge removal and treatment.

No desludging activities took place in the 2018/2019 fiscal year. Please refer to the updated Sludge Management Plan appended to the Operation and Maintenance Plan: Sewage Disposal Facility – Version 3.

k) Construction activities

Include a summary of construction activities conducted in accordance with Part F of this Licence. If there were no construction activities, please make note of that. If required, please attach any as-built drawings or reports as an appendix to this report.

No construction activities took place during 2018/2019.

l) Modifications and major maintenance

Include a summary of Modification activities and major maintenance work conducted on the Water Supply and Waste Disposal Facilities, including all associated structures, in accordance with Part G of the Licence. This includes any changes, repairs and modifications. If any problems occurred during the year, please note them here. If there are no changes, make note of that. If required please attach any as-built drawings or reports as an appendix to this report.

No modifications or major maintenance took place during 2018/2019. Following the Hamlets Solid Waste Facilities O&M Plan from October 2018 the community will continue to maintain the sites and contain the solid waste items to better manage the site.

m) Unauthorized Discharges

List and describe all unauthorized discharges that occurred during the previous calendar year, including the date, NWT spill number, volume, location, and summary of the circumstances and follow-up actions

taken, and the status (i.e. open or closed), in accordance with the reporting requirements referred to in Part H, item 4 of the Licence. Please attach copies of spill reports, correspondence with the GNWT Water Resources Officer (Inspector) or any other pertinent documentation as an appendix to this report.

No unauthorized discharges took place during 2018/2019.

n) Spill Training and Communications Exercises

List any spill training and communications exercises that have been carried out during the previous calendar year including courses on spills prevention, waste management, SNP sampling, etc.

No spill training or communication exercises took place within the 2018/2019 year, the Hamlet is planning to do spill training in the near future.

o) Closure and Reclamation Activities

Summarize any closure and reclamation work completed during the year, and an outline of any work anticipated for the next year. Attach any relevant as-built drawings or reports as an appendix to this report.

No closure or reclamation activities took place during 2018/2019.

p) Studies requested by the Board

If the Board has requested that specific studies related to Waste disposal, Water Use or Reclamation be completed, include details of the studies in this section with a summary of the outcome. Also include a brief description of any future studies planned. Include any studies or reports as appendices to the Annual Report.

No studies were requested by the Board related to waste disposal, water use or reclamation during 2018/2019.

q) Actions taken to address concerns, non-conformances, or deficiencies identified by an Inspector

Include any non-compliance items identified in GNWT Water Licence Inspection reports and detail how the Hamlet of Fort Providence is addressing them.

No inspection reports under the Water Licence for the 2018/2019 fiscal year have been filed within the MVLWB public registry to date.

On September 6, 2018 there was correspondence with Wendy Bidwell on exceedances that occurred at SNP locations 2016-2 - Landfill Leachate, 1412-2 – Lagoon Outflow, and 2016-3 – Large Construction waste Area Leachate. No correspondence was found to comment further on the Hamlets response to these exceedances that occurred in the Fall of 2018.

r) Updates to Plans

Summarize any updates or revisions to the Spill Contingency Plan, Management Plans and Operations and Maintenance Plans. Add rows to the table if necessary.

Updates to the Water Treatment Plant, Spill Contingency Plan and Sewage Disposal Facilities Operation and Maintenance Plans were requested by the Board on December 4, 2017 and are updated and have been submitted to MVLWB with this annual report. The updated Sludge Management Plan was also updated and

appended to the Sewage Disposal Facilities Operation and Maintenance Plan.

Table 7: Updates to Plans

Plan	Summary of revisions made	Effective date
Water Treatment Plant	Updates made based on the December 4, 2017 letter from MVLWB	Version 2 – December 2018 Version 3 – October 2021
Spill Contingency Plan	Updates made based on the December 4, 2017 letter from MVLWB	Version 2 – December 2018 Version 3 – June 2 2021
Sewage Disposal Facilities	Updates made based on the December 4, 2017 letter from MVLWB The Sludge Management Plan was also updated based on March 2021 correspondence with the MVLWB and appended to the Sewage Disposal Facilities Plan.	Version 2 – December 2018 Version 3 – September 29 2021

s) Other Details Requested by the Board

If the Board has requested any other details on Water use, operating procedures, Modifications, maintenance work, or other topics, include details in this section with a summary of the outcome(s). Include any attachments as appendices to the Annual Report.

No other updates were requested by the Board.

Other Information

- Include a summary of correspondence with the Inspector, including inspection dates and identification of any issues of non-compliance. The MVLWB is interested in this information in order to facilitate discussions to resolve any issues.
- Include any other information here that may be valuable to the MVLWB.
- Include details on upcoming studies that will be completed.
- If there are any contaminated soil piles currently in use (land farming), please list the details of containment, remediation and progress in this section.

Inspection Correspondence

No inspection reports under the Water Licence for the 2018/2019 fiscal year have been filed within the MVLWB public registry to date.

Date (mm/dd/yr)	Inspection Correspondence	Hamlet Response
11/6/2018 10/10/2018 10/2/2018 9/6/2018 8/10/2018 8/8/2018 7/19/2018 6/26/2018	Taiga Analytical Report(s) shared	-
6/1/2018	Submission Status Table shared with Hamlet, information for June 12, 2018 meeting	-
6/20/2018	Follow-up from June 12 Meeting	-
6/22/2018	Discussion on inadequate freeboard levels, expected lab results, and to follow-up if an emergency decant is required.	Provided photos of Lagoon levels
7/3/2018	Requirements for emergency decant outlined.	Decant commenced as instructed.
9/6/2018	The Inspector and MVLWB notified the Hamlet that several parameters from the August 14, 2018 samples exceeded licenced levels. Although, it was noted that the previous analysis of samples collected in June 2018 showed no exceedances. The Inspector inquired if the Hamlet knew any rationale as to why the exceeded occurred and that an inspection on September 11, 2018 will take place. This correspondence has been appended within Appendix B.	No correspondence was found to comment further on the Hamlets response to these exceedances that occurred in the Fall of 2018.
10/10/2018	Approval received to commence Fall decant of Cell #5 of the Sewage Disposal Facilities.	Decant commenced as instructed.

Studies and Design

In the 2018/2019 year Stantec completed a Constructability Study outlining potential solutions for upgrades to the WTP. A Water Treatment Plant Upgrades & Water Supply Constructability Study was completed on June 20, 2018 and can be made available upon request. In addition, in March of 2019 Stantec was retained as the design consultant to provide a detailed design for upgrades to the Water Treatment Plant and a new reservoir. The Engineering Services Agreement can be made available upon request. **Appendix D** contains a Review of Community Water Management and Water System Infrastructure completed by the GNWT Department of Municipal and Community Affairs (MACA).

Appendix A: Tabular summaries of all data generated under the Surveillance Network Program for Fort Providence (MV2016L3-0001)

Surveillance Network Program Lab Results Summary

Surveillance Network Program (SNP) information is to be summarized in a tabular format and shall indicate date of testing, parameters tested for and any other information requested by the GNWT Water Licence Inspector or the MVLWB. Summary tables have been provided below for your convenience. Laboratory analysis results should be appended in Appendix B.

1) SNP Lab Results Summary – Station number 1412-1 (Raw water from the Water Supply Facilities)

This station monitors the monthly and annual quantities of Water withdrawn for municipal purposes. This information is reported in Table 1 of the Annual Report.

2) SNP Lab Results Summary – Station number 1412-2 (Sewage effluent from Sewage Disposal Facilities)

This station is the site of compliance, and monitors final effluent quality prior to discharge to the Receiving Environment.

2018-2019

Water Licence Parameters	Effluent Quality Criteria	June	June 13 (Pre- decant)	July 11	July 18	July 5	August	August 14	September	October
pH	Above 6	8.34	8.48	10.3	10.3	9.55	8.98	9.09	8.22	8.88
CBOD ₅	330mg/L	22	13	10	22	17	44	74	31	8
Total Suspended Solids	300mg/L	24	22	98	166	94	75	90	18	46
Ammonia	mg/L	13.9	11.8	0.388	0.113	0.718	8.69	1.84	8.40	15.4
Total Phosphorus	mg/L	5.78	6.21	1.24	1.25	3.41	7.02	3.83	0.374	5.84
Nitrate	mg/L	0.16	0.61	0.57	0.50	1.35	0.37	0.35	0.51	0.57
Nitrite	mg/L	0.28	0.96	1.92	1.22	3.24	0.01	0.18	<0.01	0.30

Fecal Coliforms	1x10 ⁵ CFU/100ml	18	80	#1	<10	20	10	10	28	2
Oil and Grease	5mg/L	2.1	<2.0	2.3	3.2	< 2.0	3.5	20.0	< 2.0	< 2.0

Notes:

#1 Holding time exceeded before receipt of sample.

Highlighted values within the above table were noted by the Inspector on September 6, 2018 to be exceedances from Part D Item 7 of the Water Licence MV2016L3-0001.

3) SNP Lab Results Summary – Station number 1412-3 (Raw sewage from pump out truck)

This station has been discontinued.

4) SNP Lab Results Summary – Station number 2016-1 (Sewage effluent flowing through ponded area of wetland)

At issuance, this station's exact location was to be determined with the Inspector. It monitors the quality of effluent discharged from the Sewage Disposal Facilities and determines effectiveness of wetland treatment before final discharge to the Mackenzie River. Sampling frequency is at the beginning (one week following freshet) and end (before freeze-up) of the open water season.

Parameter	Sample 1 (one week following freshet) June 13, 2018	July 18, 2018	August 14, 2018	Sample 2 (before freeze-up) Sept 13, 2018
pH	7.12	6.91	6.95	7.11
CBOD₅ (mg/L)	7	5	21*	33
Total Suspended Solids (mg/L)	18	6	306	176
Ammonia (mg/L)	0.033	0.065	0.030	0.014
Total Phosphorus (mg/L)	0.289	0.425	0.677	0.270
Nitrate (mg/L)		0.23	0.21	0.32
Nitrite (mg/L)		<0.01	<0.01	<0.01
Nitrate+Nitrite (mg/L)	0.31			

Fecal Coliforms (CFU/100mL)	<1	<1	<10	1
Oil and Grease (mg/L)	<2.0	8.4	<2.0	3.4

*BOD result is inconclusive; residual DO was less than 1mg/L. For evaluation purposes only.

5) SNP Lab Results Summary – Station number 2016-2 (Ponded water within or adjacent to domestic waste cells at Solid Waste Disposal Facilities)

At issuance, this station's exact location was to be determined with the Inspector. This station monitors potential impacts of the Solid Waste Disposal Facilities on groundwater and surface Water, and water quality and quantity prior to discharge. Sampling frequency is twice per year in June and September, and prior to discharge of accumulated water. Add additional columns to table if necessary.

	Sample 1 (June) June 13, 2018	Sample 2 (September) September 13, 2018	August 14, 2018
Volume of water discharged (m³)			
Total Suspended Solids	473 mg/L	220 mg/L	11600 mg/L
Total Cadmium	0.2 µg/L	0.3 µg/L	0.7 µg/L
Total Chromium	28.7 µg/L	24.7 µg/L	51.8 µg/L
Total Cobalt	7.7 µg/L	13.7 µg/L	20.2 µg/L
Total Copper	20.4 µg/L	14.5 µg/L	36.2 µg/L
Total Iron	16200 µg/L	97000 µg/L	90200 µg/L
Total Lead	4.6 µg/L	5.5 µg/L	20.3 µg/L
Magnesium	169 mg/L	60.5 mg/L	59.1 mg/L
Total Manganese	332 µg/L	3070 µg/L	3650 µg/L
Total Mercury	-	0.04 µg/L	0.07 µg/L
Total Nickel	65.9 µg/L	38.3 µg/L	59.1 µg/L
Oil and Grease	<2.0 mg/L	6.3 mg/L	5.4 mg/L
Total Petroleum Hydrocarbons	-	-	-
Benzene	< 0.00050 mg/L	< 0.002 mg/L	<0.00050 mg/L
Ethylbenzene	< 0.00050 mg/L	< 0.002 mg/L	<0.00050 mg/L
Toluene	0.00330 mg/L	0.093 mg/L	0.3260 mg/L
Xylenes	0.00058 mg/L	< 0.002 mg/L	0.000140 mg/L
Total Phenols	0.0430 mg/L	0.0987 mg/L	0.0047 mg/L

Total Phosphate	-	0.223 mg/L	0.066 mg/L
Calcium	161 mg/L	513 mg/L	580 mg/L
Potassium	295 mg/L	365 mg/L	275 mg/L
Sodium	717 mg/L	742 mg/L	564 mg/L
Sulphate	196 mg/L	1 mg/L	12 mg/L
Total Zinc	234 µg/L	680 µg/L	712 µg/L
pH	7.82	6.99	6.98
Conductivity	5500 µS/cm	6160 µS/cm	5780 µS/cm

Highlighted values within the above table were noted by the Inspector on September 6, 2018 to be elevated levels.

6) SNP Lab Results Summary – Station number 2016-3 (Ponded Water within or adjacent to the construction waste cell at the Solid Waste Disposal Facilities)

At issuance, this station's exact location was to be determined with the Inspector. This station monitors potential impacts of the Solid Waste Disposal Facilities on groundwater and surface Water, and monitors water quality and quantity prior to discharge. Sampling frequency is twice per year in June and September, and prior to discharge of accumulated water. Add additional columns to table if necessary.

	Sample 1 (June) June 13, 2018	July 18, 2018	Sample 2 (September) August 14, 2018
Volume of water discharged (m³)			
Total Suspended Solids (mg/L)	10	6	110
Total Cadmium (µg/L)	<0.1	<0.1	<0.1
Total Chromium (µg/L)	2.0	0.1	0.1
Total Cobalt (µg/L)	0.1	0.1	0.1
Total Copper (µg/L)	0.6	0.2	0.4
Total Iron (µg/L)	179	142	178
Total Lead (µg/L)	<0.1	<0.1	0.1
Magnesium (mg/L)	25.0	28.5	29.5

Total Manganese (µg/L)	73.9	73.1	118
Total Mercury (µg/L)		<0.01	<0.01
Total Nickel (µg/L)	1.1	1.0	1.0
Oil and Grease (mg/L)	<2.0	<2.0	33.5
Total Petroleum Hydrocarbons	-	-	-
Benzene (mg/L)	< 0.002	<0.002	< 0.00050
Ethylbenzene (mg/L)	< 0.002	<0.002	< 0.00050
Toluene (mg/L)	< 0.002	<0.002	< 0.00450
Xylenes (mg/L)	< 0.002	<0.002	< 0.00050
Total Phenols (mg/L)		<0.0010	0.0039
Total Phosphate	-	-	-
Calcium (mg/L)	71.6	68.1	84.4
Potassium (mg/L)	22.4	18.3	19.9
Sodium (mg/L)	38.9	43.3	44.1
Sulphate (mg/L)	66	60	51
Total Zinc (µg/L)	< 5.0	< 5.0	< 5.0
pH	7.83	7.67	7.65
Conductivity (µS/cm)	772	799	871

Highlighted values within the above table were noted by the Inspector on September 6, 2018 to be elevated levels.

**Appendix B: Laboratory reports for all samples collected for the Surveillance
Network Program for Fort Providence (MV2016L3-0001)**

From: [Erica Janes](#)
To: [Permits](#)
Subject: FW: Emailing: 180943 - 1819 - FINAL REPORT.xls, 180943 - 1819 - FINAL REPORT.pdf
Date: October 3, 2018 1:33:38 PM
Attachments: [180943 - 1819 - FINAL REPORT.pdf](#)

Please post email and attachment to MV2016L3-0001 - Ft Providence - 5 Reports and Studies / SNP Reports - Analytical results for SNP 2016-1 on September 13 2018 - Oct2-18

-----Original Message-----

From: Judy Mah <Judy_Mah@gov.nt.ca> On Behalf Of taiga
Sent: Tuesday, October 2, 2018 3:51 PM
To: provwork@ssimicro.com; Wendy Bidwell <Wendy_Bidwell@gov.nt.ca>; Erica Janes <ejanes@mvlwb.com>
Subject: Emailing: 180943 - 1819 - FINAL REPORT.xls, 180943 - 1819 - FINAL REPORT.pdf

Hello,

Please see attached for final report 180943.

Have a good afternoon,
Judy

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi

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Main Phone: 867-767-9230 Ext. 53151
Fax: 867-920-8740

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Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180943

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Judy Mah
Client Service Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Tuesday, October 02, 2018

Print Date: *Tuesday, October 02, 2018*

Page 1 of 3



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180943

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-1**

Taiga Sample ID: **001**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 13-Sep-18

Sampling Date: 13-Sep-18

Sampling Time: 8:45

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	0.014	0.005	mg/L	15-Sep-18	SM4500-NH3:G	
CBOD	33	2	mg/L	13-Sep-18	SM5210:B	
Phosphorous, Total	0.270	0.002	mg/L	25-Sep-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	7.11		pH units	13-Sep-18	SM4500-H:B	
Solids, Total Suspended	176	3	mg/L	17-Sep-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.32	0.01	mg/L	16-Sep-18	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	16-Sep-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	1	1	CFU/100mL	13-Sep-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	3.4	2.0	mg/L	19-Sep-18	EPA1664A	

ReportDate: Tuesday, October 02, 2018

Print Date: **Tuesday, October 02, 2018**

Page 2 of 3



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180943

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-1**

Taiga Sample ID: **001**

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Tuesday, October 02, 2018

Print Date: *Tuesday, October 02, 2018*

Page 3 of 3

From: Glen Hudy
To: [Susan Christie](#); [Erica Janes](#); [Wendy Bidwell](#)
Subject: Emailing: 180740 - 1819 - FINAL REPORT, 180740 - 1819 - FINAL REPORT
Date: Thursday, September 6, 2018 10:37:04 AM
Attachments: [180740 - 1819 - FINAL REPORT.pdf](#)
[180740 - 1819 - FINAL REPORT.xls](#)

Susan,

Please see attached for final report 180740.

Have a good day.

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi
Glen Hudy
Chemist, Quality Assurance
Water Resources
Environment and Natural Resources
Government of the Northwest Territories

Taiga Environmental Laboratory
PO Box 1320
Yellowknife, NT X1A 2L9

Phone: 867-767-9235 Ext. 53154
Fax: 867-920-8740
www.enr.gov.nt.ca

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Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
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 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 1 of 10



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-2**

Taiga Sample ID: **001**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ortho-Phosphate as Phosphorus	0.066	0.002	mg/L	17-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
Conductivity, Specific (@25C)	5780	0.4	µS/cm	15-Aug-18	SM2510:B	
pH	6.98		pH units	15-Aug-18	SM4500-H:B	
Solids, Total Suspended	11600	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Calcium	580	0.1	mg/L	15-Aug-18	SM4110:B	
Magnesium	59.1	0.1	mg/L	15-Aug-18	SM4110:B	
Potassium	275	0.1	mg/L	15-Aug-18	SM4110:B	
Sodium	564	0.1	mg/L	15-Aug-18	SM4110:B	
Sulphate	12	1	mg/L	15-Aug-18	SM4110:B	
<u>Organics</u>						
Hexane Extractable Material	5.4	2.0	mg/L	22-Aug-18	EPA1664A	
<u>Subcontracted Organics</u>						
Benzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021	

ReportDate: Thursday, September 06, 2018

Print Date: **Thursday, September 06, 2018**

Page 2 of 10



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-2**

Taiga Sample ID: **001**

Ethylbenzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021
F1: C6-C10	0.12	0.1	mg/L	29-Aug-18	CCME CWS PHC
F2: C10-C16	0.85	0.30	mg/L	31-Aug-18	EPA3510
F3: C16-C34	1.24	0.30	mg/L	31-Aug-18	EPA3510
F4: C34-C50	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
Phenols, Total	0.0047	0.001	mg/L	21-Aug-18	AB ENV.06537
Toluene	0.03260	0.0045	mg/L	28-Aug-18	EPA 5021
Xylenes	0.00140	0.0005	mg/L	28-Aug-18	EPA 5021

Trace Metals, Total

Aluminum	15700	5	µg/L	24-Aug-18	EPA200.8
Antimony	4.8	0.1	µg/L	24-Aug-18	EPA200.8
Arsenic	16.8	0.2	µg/L	24-Aug-18	EPA200.8
Barium	1070	0.1	µg/L	24-Aug-18	EPA200.8
Beryllium	0.7	0.1	µg/L	24-Aug-18	EPA200.8
Bismuth	0.7	0.2	µg/L	24-Aug-18	EPA200.8
Boron	1650	0.9	µg/L	24-Aug-18	EPA200.8
Cadmium	0.7	0.1	µg/L	24-Aug-18	EPA200.8
Cesium	1.7	0.1	µg/L	24-Aug-18	EPA200.8
Chromium	51.8	0.1	µg/L	24-Aug-18	EPA200.8
Cobalt	20.2	0.1	µg/L	24-Aug-18	EPA200.8
Copper	36.2	0.2	µg/L	24-Aug-18	EPA200.8
Iron	90200	5	µg/L	24-Aug-18	EPA200.8
Lead	20.3	0.1	µg/L	24-Aug-18	EPA200.8
Lithium	128	0.2	µg/L	24-Aug-18	EPA200.8
Manganese	3650	0.1	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*



Taiga Environmental Laboratory
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Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-2

Taiga Sample ID: 001

Mercury	0.07	0.01	µg/L	24-Aug-18	EPA200.8
Molybdenum	3.7	0.1	µg/L	24-Aug-18	EPA200.8
Nickel	59.1	0.1	µg/L	24-Aug-18	EPA200.8
Rubidium	123	0.1	µg/L	24-Aug-18	EPA200.8
Selenium	1.8	0.5	µg/L	24-Aug-18	EPA200.8
Silver	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Strontium	1790	0.1	µg/L	24-Aug-18	EPA200.8
Thallium	0.3	0.1	µg/L	24-Aug-18	EPA200.8
Tin	4.3	0.1	µg/L	24-Aug-18	EPA200.8
Titanium	664	0.1	µg/L	24-Aug-18	EPA200.8
Uranium	1.5	0.1	µg/L	24-Aug-18	EPA200.8
Vanadium	38.2	0.1	µg/L	24-Aug-18	EPA200.8
Zinc	712	5	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018
Print Date: *Thursday, September 06, 2018*

Page 4 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-3**

Taiga Sample ID: **002**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ortho-Phosphate as Phosphorus	0.004	0.002	mg/L	17-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
Conductivity, Specific (@25C)	871	0.4	µS/cm	15-Aug-18	SM2510:B	
pH	7.65		pH units	15-Aug-18	SM4500-H:B	
Solids, Total Suspended	110	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Calcium	84.4	0.1	mg/L	15-Aug-18	SM4110:B	
Magnesium	29.5	0.1	mg/L	15-Aug-18	SM4110:B	
Potassium	19.9	0.1	mg/L	15-Aug-18	SM4110:B	
Sodium	44.1	0.1	mg/L	15-Aug-18	SM4110:B	
Sulphate	51	1	mg/L	15-Aug-18	SM4110:B	
<u>Organics</u>						
Hexane Extractable Material	33.5	2.0	mg/L	22-Aug-18	EPA1664A	
<u>Subcontracted Organics</u>						
Benzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021	
Ethylbenzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021	

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 5 of 10



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-3**

Taiga Sample ID: **002**

F1: C6-C10	< 0.10	0.1	mg/L	29-Aug-18	CCME CWS PHC
F2: C10-C16	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
F3: C16-C34	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
F4: C34-C50	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
Phenols, Total	0.0039	0.001	mg/L	21-Aug-18	AB ENV.06537
Toluene	< 0.00450	0.0045	mg/L	28-Aug-18	EPA 5021
Xylenes	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021

Trace Metals, Total

Aluminum	36.9	5	µg/L	24-Aug-18	EPA200.8
Antimony	0.2	0.1	µg/L	24-Aug-18	EPA200.8
Arsenic	1.4	0.2	µg/L	24-Aug-18	EPA200.8
Barium	104	0.1	µg/L	24-Aug-18	EPA200.8
Beryllium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Bismuth	< 0.2	0.2	µg/L	24-Aug-18	EPA200.8
Boron	205	0.9	µg/L	24-Aug-18	EPA200.8
Cadmium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Cesium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Chromium	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Cobalt	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Copper	0.4	0.2	µg/L	24-Aug-18	EPA200.8
Iron	178	5	µg/L	24-Aug-18	EPA200.8
Lead	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Lithium	12.3	0.2	µg/L	24-Aug-18	EPA200.8
Manganese	118	0.1	µg/L	24-Aug-18	EPA200.8
Mercury	< 0.01	0.01	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 6 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-3

Taiga Sample ID: 002

Molybdenum	0.3	0.1	µg/L	24-Aug-18	EPA200.8
Nickel	1.0	0.1	µg/L	24-Aug-18	EPA200.8
Rubidium	3.3	0.1	µg/L	24-Aug-18	EPA200.8
Selenium	< 0.5	0.5	µg/L	24-Aug-18	EPA200.8
Silver	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Strontium	428	0.1	µg/L	24-Aug-18	EPA200.8
Thallium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Tin	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Titanium	1.4	0.1	µg/L	24-Aug-18	EPA200.8
Uranium	0.3	0.1	µg/L	24-Aug-18	EPA200.8
Vanadium	0.4	0.1	µg/L	24-Aug-18	EPA200.8
Zinc	< 5.0	5	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018
Print Date: *Thursday, September 06, 2018*

Page 7 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-1**

Taiga Sample ID: **003**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	0.030	0.005	mg/L	21-Aug-18	SM4500-NH3:G	
CBOD	21	2	mg/L	16-Aug-18	SM5210:B	55
Phosphorous, Total	0.677	0.002	mg/L	23-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	6.95		pH units	15-Aug-18	SM4500-H:B	
Solids, Total Suspended	306	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.21	0.01	mg/L	15-Aug-18	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	15-Aug-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	< 10	10	CFU/100mL	15-Aug-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	< 2.0	2.0	mg/L	22-Aug-18	EPA1664A	

ReportDate: Thursday, September 06, 2018

Print Date: Thursday, September 06, 2018

Page 8 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **004**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	1.84	0.005	mg/L	21-Aug-18	SM4500-NH3:G	
COD	74	2	mg/L	16-Aug-18	SM5210:B	
Phosphorous, Total	3.83	0.002	mg/L	23-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	9.09		pH units	16-Aug-18	SM4500-H:B	
Solids, Total Suspended	90	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.35	0.01	mg/L	15-Aug-18	SM4110:B	
Nitrite as Nitrogen	0.18	0.01	mg/L	15-Aug-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	10	10	CFU/100mL	15-Aug-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	20.0	2.0	mg/L	22-Aug-18	EPA1664A	

ReportDate: Thursday, September 06, 2018

Print Date: Thursday, September 06, 2018

Page 9 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **004**

- DATA QUALIFIERS -

Data Qualifier Descriptions:

55 *BOD result is inconclusive; residual DO was less than 1 mg/L. For evaluation purposes only.*

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 10 of 10

From: [Erica Janes](#)
To: [Permits](#)
Cc: [Heather Scott](#)
Subject: FW: Emailing: 180576 - 1819 - FINAL REPORT, 180576 - 1819 - FINAL REPORT
Date: August 10, 2018 2:07:44 PM
Attachments: [180576 - 1819 - FINAL REPORT.pdf](#)

Please post email and attachment to MV2016L3-0001 - Ft Providence - 5 Reports and Studies / SNP Reports - Analytical results for SNP 2016-1, 2016-3 and 1412-2 on July 18 2018 - Aug10-18

-----Original Message-----

From: Glen Hudy <Glen_Hudy@gov.nt.ca> On Behalf Of taiga
Sent: Friday, August 10, 2018 10:59 AM
To: Susan Christie <sao@fortprovidence.ca>; Erica Janes <ejanes@mvlwb.com>; Wendy Bidwell <Wendy_Bidwell@gov.nt.ca>
Subject: Emailing: 180576 - 1819 - FINAL REPORT, 180576 - 1819 - FINAL REPORT

Susan,

Please see attached for final report 180576.

Have a good day.

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi Glen
Hudy Chemist, Quality Assurance Water Resources Environment and Natural Resources Government of the
Northwest Territories

Taiga Environmental Laboratory
PO Box 1320
Yellowknife, NT X1A 2L9

Phone: 867-767-9235 Ext. 53154
Fax: 867-920-8740
www.enr.gov.nt.ca

Your message is ready to be sent with the following file or link attachments:

180576 - 1819 - FINAL REPORT
180576 - 1819 - FINAL REPORT

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Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180576

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

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 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Friday, August 10, 2018

Print Date: *Friday, August 10, 2018*

Page 1 of 7



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180576

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-1

Taiga Sample ID: 001

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 19-Jul-18

Sampling Date: 18-Jul-18

Sampling Time:

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	0.065	0.005	mg/L	20-Jul-18	SM4500-NH3:G	
CBOD	5	2	mg/L	19-Jul-18	SM5210:B	
Phosphorous, Total	0.425	0.002	mg/L	24-Jul-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	6.91		pH units	19-Jul-18	SM4500-H:B	
Solids, Total Suspended	6	3	mg/L	23-Jul-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.23	0.01	mg/L	19-Jul-18	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	19-Jul-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	< 1	1	CFU/100mL	19-Jul-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	8.4	2.0	mg/L	27-Jul-18	EPA1664A	

ReportDate: Friday, August 10, 2018

Print Date: Friday, August 10, 2018

Page 2 of 7



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180576

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **002**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 19-Jul-18

Sampling Date: 18-Jul-18

Sampling Time:

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	0.113	0.005	mg/L	20-Jul-18	SM4500-NH3:G	
CBOD	22	2	mg/L	19-Jul-18	SM5210:B	
Phosphorous, Total	1.25	0.002	mg/L	24-Jul-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	10.3		pH units	19-Jul-18	SM4500-H:B	
Solids, Total Suspended	166	3	mg/L	23-Jul-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.50	0.01	mg/L	19-Jul-18	SM4110:B	
Nitrite as Nitrogen	1.22	0.01	mg/L	19-Jul-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	< 10	10	CFU/100mL	19-Jul-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	3.2	2.0	mg/L	27-Jul-18	EPA1664A	

ReportDate: Friday, August 10, 2018

Print Date: Friday, August 10, 2018

Page 3 of 7



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180576

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-3**

Taiga Sample ID: **003**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 19-Jul-18

Sampling Date: 18-Jul-18

Sampling Time:

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ortho-Phosphate as Phosphorus	< 0.002	0.002	mg/L	24-Jul-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
Conductivity, Specific (@25C)	799	0.4	µS/cm	19-Jul-18	SM2510:B	
pH	7.67		pH units	19-Jul-18	SM4500-H:B	
Solids, Total Suspended	6	3	mg/L	23-Jul-18	SM2540:D	
<u>Major Ions</u>						
Calcium	68.1	0.1	mg/L	19-Jul-18	SM4110:B	
Magnesium	28.5	0.1	mg/L	19-Jul-18	SM4110:B	
Potassium	18.3	0.1	mg/L	19-Jul-18	SM4110:B	
Sodium	43.3	0.1	mg/L	19-Jul-18	SM4110:B	
Sulphate	60	1	mg/L	19-Jul-18	SM4110:B	
<u>Organics</u>						
Benzene	< 0.002	0.002	mg/L	20-Jul-18	EPA8260B	
Ethylbenzene	< 0.002	0.002	mg/L	20-Jul-18	EPA8260B	
F2: C10-C16	< 0.2	0.2	mg/L	30-Jul-18	EPA8015B	
F3: C16-C34	< 0.2	0.2	mg/L	30-Jul-18	EPA8015B	

ReportDate: Friday, August 10, 2018

Print Date: *Friday, August 10, 2018*

Page 4 of 7



Taiga Environmental Laboratory

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Taiga Batch No.:

180576

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-3**

Taiga Sample ID: **003**

F4: C34-C50	< 0.2	0.2	mg/L	30-Jul-18	EPA8015B
Hexane Extractable Material	< 2.0	2.0	mg/L	27-Jul-18	EPA1664A
Hydrocarbons, Total Extractable	< 0.2	0.2	mg/L	30-Jul-18	EPA8015B
Toluene	< 0.002	0.002	mg/L	20-Jul-18	EPA8260B
Xylenes	< 0.002	0.002	mg/L	20-Jul-18	EPA8260B
<u>Subcontracted Organics</u>					
Phenols, Total	< 0.0010	0.001	mg/L	27-Jul-18	AB ENV.06537
<u>Trace Metals, Total</u>					
Aluminum	19.1	5	µg/L	26-Jul-18	EPA200.8
Antimony	0.2	0.1	µg/L	26-Jul-18	EPA200.8
Arsenic	1.4	0.2	µg/L	26-Jul-18	EPA200.8
Barium	99.1	0.1	µg/L	26-Jul-18	EPA200.8
Beryllium	< 0.1	0.1	µg/L	26-Jul-18	EPA200.8
Bismuth	< 0.2	0.2	µg/L	26-Jul-18	EPA200.8
Boron	173	0.9	µg/L	26-Jul-18	EPA200.8
Cadmium	< 0.1	0.1	µg/L	26-Jul-18	EPA200.8
Cesium	< 0.1	0.1	µg/L	26-Jul-18	EPA200.8
Chromium	0.1	0.1	µg/L	26-Jul-18	EPA200.8
Cobalt	0.1	0.1	µg/L	26-Jul-18	EPA200.8
Copper	0.2	0.2	µg/L	26-Jul-18	EPA200.8
Iron	142	5	µg/L	26-Jul-18	EPA200.8
Lead	< 0.1	0.1	µg/L	26-Jul-18	EPA200.8
Lithium	10.6	0.2	µg/L	26-Jul-18	EPA200.8
Manganese	73.1	0.1	µg/L	26-Jul-18	EPA200.8
Mercury	< 0.01	0.01	µg/L	26-Jul-18	EPA200.8

ReportDate: Friday, August 10, 2018

Print Date: *Friday, August 10, 2018*

Page 5 of 7



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180576

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-3

Taiga Sample ID: 003

Molybdenum	0.4	0.1	µg/L	26-Jul-18	EPA200.8
Nickel	1.0	0.1	µg/L	26-Jul-18	EPA200.8
Rubidium	3.0	0.1	µg/L	26-Jul-18	EPA200.8
Selenium	< 0.5	0.5	µg/L	26-Jul-18	EPA200.8
Silver	< 0.1	0.1	µg/L	26-Jul-18	EPA200.8
Strontium	369	0.1	µg/L	26-Jul-18	EPA200.8
Thallium	< 0.1	0.1	µg/L	26-Jul-18	EPA200.8
Tin	< 0.1	0.1	µg/L	26-Jul-18	EPA200.8
Titanium	0.6	0.1	µg/L	26-Jul-18	EPA200.8
Uranium	0.4	0.1	µg/L	26-Jul-18	EPA200.8
Vanadium	0.3	0.1	µg/L	26-Jul-18	EPA200.8
Zinc	< 5.0	5	µg/L	26-Jul-18	EPA200.8

ReportDate: Friday, August 10, 2018
Print Date: *Friday, August 10, 2018*

Page 6 of 7



Taiga Environmental Laboratory

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Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180576

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-3

Taiga Sample ID: 003

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Friday, August 10, 2018

Print Date: Friday, August 10, 2018

Page 7 of 7

From: Wendy Bidwell
To: sao@fortprovidence.ca
Cc: [Erica Janes](mailto:Erica.Janes@provwork@ssimicro.com); provwork@ssimicro.com
Subject: FW: Emailing: 180740 - 1819 - FINAL REPORT, 180740 - 1819 - FINAL REPORT (SNP Sampling Licence EQC Exceedences)
Date: Thursday, September 6, 2018 11:20:19 AM
Attachments: [180740 - 1819 - FINAL REPORT_Fort Providence SNP Sampling August 2018.pdf](#)
[180740 - 1819 - FINAL REPORT.PDF](#)
[180740 - 1819 - FINAL REPORT.XLS](#)
Importance: High

Good morning Susan,

Both Erica and I have reviewed the most recent SNP sampling results for the Hamlet (see attached), and noted a number of exceedences with respect to Organics, like Hexane Extractable Materials (i.e. Hydrocarbons/Oil & Grease). I have highlighted the exceedences and elevated levels in the attached results in yellow. I looked back at the sampling I did in June 2018 and there were no exceedences at any of the SNP stations sampled. Can you wager a guess as to why we are seeing elevated HEM levels at these SNP locations (i.e. 2016-2-Landfill Leachate, 1412-2-Lagoon Outflow, 2016-3-Large Construction Waste Area Leachate)? Does Clifford have any insight? I would like to discuss this issue with you both, so please call me back when you return to the Office.

I'll be in Providence next Tuesday (11th) for the fall WL inspection. We can discuss this then too, if you're not available this week.

Regards,

Wendy

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi
Wendy Bidwell
Water Resource Officer
South Slave Region
Department of Environment and Natural Resources
Government of the Northwest Territories

Highway #5
PO Box 900
Fort Smith, NT X0E 0P0

Phone: 867-872-6421
Cell: 867-446-3775
Fax: 867-872-4250
www.gov.nt.ca

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-----Original Message-----

From: Glen Hudy On Behalf Of taiga
Sent: Thursday, September 06, 2018 10:37 AM
To: Susan Christie; ejanes@mvlwb.com; Wendy Bidwell
Subject: Emailing: 180740 - 1819 - FINAL REPORT, 180740 - 1819 - FINAL REPORT

Susan,

Please see attached for final report 180740.

Have a good day.

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi Glen
Hudy Chemist, Quality Assurance Water Resources Environment and Natural Resources Government of the
Northwest Territories

Taiga Environmental Laboratory
PO Box 1320
Yellowknife, NT X1A 2L9

Phone: 867-767-9235 Ext. 53154
Fax: 867-920-8740
www.enr.gov.nt.ca

Your message is ready to be sent with the following file or link attachments:

180740 - 1819 - FINAL REPORT
180740 - 1819 - FINAL REPORT

Note: To protect against computer viruses, e-mail programs may prevent sending or receiving certain types of file attachments. Check your e-mail security settings to determine how attachments are handled.



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 1 of 10



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-2**

Taiga Sample ID: **001**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ortho-Phosphate as Phosphorus	0.066	0.002	mg/L	17-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
Conductivity, Specific (@25C)	5780	0.4	µS/cm	15-Aug-18	SM2510:B	
pH	6.98		pH units	15-Aug-18	SM4500-H:B	
Solids, Total Suspended	11600	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Calcium	580	0.1	mg/L	15-Aug-18	SM4110:B	
Magnesium	59.1	0.1	mg/L	15-Aug-18	SM4110:B	
Potassium	275	0.1	mg/L	15-Aug-18	SM4110:B	
Sodium	564	0.1	mg/L	15-Aug-18	SM4110:B	
Sulphate	12	1	mg/L	15-Aug-18	SM4110:B	
<u>Organics</u>						
Hexane Extractable Material	5.4	2.0	mg/L	22-Aug-18	EPA1664A	
<u>Subcontracted Organics</u>						
Benzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021	

ReportDate: Thursday, September 06, 2018

Print Date: **Thursday, September 06, 2018**

Page 2 of 10



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-2**

Taiga Sample ID: **001**

Ethylbenzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021
F1: C6-C10	0.12	0.1	mg/L	29-Aug-18	CCME CWS PHC
F2: C10-C16	0.85	0.30	mg/L	31-Aug-18	EPA3510
F3: C16-C34	1.24	0.30	mg/L	31-Aug-18	EPA3510
F4: C34-C50	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
Phenols, Total	0.0047	0.001	mg/L	21-Aug-18	AB ENV.06537
Toluene	0.03260	0.0045	mg/L	28-Aug-18	EPA 5021
Xylenes	0.00140	0.0005	mg/L	28-Aug-18	EPA 5021

Trace Metals, Total

Aluminum	15700	5	µg/L	24-Aug-18	EPA200.8
Antimony	4.8	0.1	µg/L	24-Aug-18	EPA200.8
Arsenic	16.8	0.2	µg/L	24-Aug-18	EPA200.8
Barium	1070	0.1	µg/L	24-Aug-18	EPA200.8
Beryllium	0.7	0.1	µg/L	24-Aug-18	EPA200.8
Bismuth	0.7	0.2	µg/L	24-Aug-18	EPA200.8
Boron	1650	0.9	µg/L	24-Aug-18	EPA200.8
Cadmium	0.7	0.1	µg/L	24-Aug-18	EPA200.8
Cesium	1.7	0.1	µg/L	24-Aug-18	EPA200.8
Chromium	51.8	0.1	µg/L	24-Aug-18	EPA200.8
Cobalt	20.2	0.1	µg/L	24-Aug-18	EPA200.8
Copper	36.2	0.2	µg/L	24-Aug-18	EPA200.8
Iron	90200	5	µg/L	24-Aug-18	EPA200.8
Lead	20.3	0.1	µg/L	24-Aug-18	EPA200.8
Lithium	128	0.2	µg/L	24-Aug-18	EPA200.8
Manganese	3650	0.1	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 3 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-2

Taiga Sample ID: 001

Mercury	0.07	0.01	µg/L	24-Aug-18	EPA200.8
Molybdenum	3.7	0.1	µg/L	24-Aug-18	EPA200.8
Nickel	59.1	0.1	µg/L	24-Aug-18	EPA200.8
Rubidium	123	0.1	µg/L	24-Aug-18	EPA200.8
Selenium	1.8	0.5	µg/L	24-Aug-18	EPA200.8
Silver	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Strontium	1790	0.1	µg/L	24-Aug-18	EPA200.8
Thallium	0.3	0.1	µg/L	24-Aug-18	EPA200.8
Tin	4.3	0.1	µg/L	24-Aug-18	EPA200.8
Titanium	664	0.1	µg/L	24-Aug-18	EPA200.8
Uranium	1.5	0.1	µg/L	24-Aug-18	EPA200.8
Vanadium	38.2	0.1	µg/L	24-Aug-18	EPA200.8
Zinc	712	5	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018
Print Date: *Thursday, September 06, 2018*

Page 4 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-3**

Taiga Sample ID: **002**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ortho-Phosphate as Phosphorus	0.004	0.002	mg/L	17-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
Conductivity, Specific (@25C)	871	0.4	µS/cm	15-Aug-18	SM2510:B	
pH	7.65		pH units	15-Aug-18	SM4500-H:B	
Solids, Total Suspended	110	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Calcium	84.4	0.1	mg/L	15-Aug-18	SM4110:B	
Magnesium	29.5	0.1	mg/L	15-Aug-18	SM4110:B	
Potassium	19.9	0.1	mg/L	15-Aug-18	SM4110:B	
Sodium	44.1	0.1	mg/L	15-Aug-18	SM4110:B	
Sulphate	51	1	mg/L	15-Aug-18	SM4110:B	
<u>Organics</u>						
Hexane Extractable Material	33.5	2.0	mg/L	22-Aug-18	EPA1664A	
<u>Subcontracted Organics</u>						
Benzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021	
Ethylbenzene	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021	

ReportDate: Thursday, September 06, 2018

Print Date: Thursday, September 06, 2018

Page 5 of 10



Taiga Environmental Laboratory

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Taiga Batch No.:

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- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-3**

Taiga Sample ID: **002**

F1: C6-C10	< 0.10	0.1	mg/L	29-Aug-18	CCME CWS PHC
F2: C10-C16	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
F3: C16-C34	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
F4: C34-C50	< 0.30	0.30	mg/L	31-Aug-18	EPA3510
Phenols, Total	0.0039	0.001	mg/L	21-Aug-18	AB ENV.06537
Toluene	< 0.00450	0.0045	mg/L	28-Aug-18	EPA 5021
Xylenes	< 0.00050	0.0005	mg/L	28-Aug-18	EPA 5021

Trace Metals, Total

Aluminum	36.9	5	µg/L	24-Aug-18	EPA200.8
Antimony	0.2	0.1	µg/L	24-Aug-18	EPA200.8
Arsenic	1.4	0.2	µg/L	24-Aug-18	EPA200.8
Barium	104	0.1	µg/L	24-Aug-18	EPA200.8
Beryllium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Bismuth	< 0.2	0.2	µg/L	24-Aug-18	EPA200.8
Boron	205	0.9	µg/L	24-Aug-18	EPA200.8
Cadmium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Cesium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Chromium	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Cobalt	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Copper	0.4	0.2	µg/L	24-Aug-18	EPA200.8
Iron	178	5	µg/L	24-Aug-18	EPA200.8
Lead	0.1	0.1	µg/L	24-Aug-18	EPA200.8
Lithium	12.3	0.2	µg/L	24-Aug-18	EPA200.8
Manganese	118	0.1	µg/L	24-Aug-18	EPA200.8
Mercury	< 0.01	0.01	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 6 of 10



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Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-3

Taiga Sample ID: 002

Molybdenum	0.3	0.1	µg/L	24-Aug-18	EPA200.8
Nickel	1.0	0.1	µg/L	24-Aug-18	EPA200.8
Rubidium	3.3	0.1	µg/L	24-Aug-18	EPA200.8
Selenium	< 0.5	0.5	µg/L	24-Aug-18	EPA200.8
Silver	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Strontium	428	0.1	µg/L	24-Aug-18	EPA200.8
Thallium	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Tin	< 0.1	0.1	µg/L	24-Aug-18	EPA200.8
Titanium	1.4	0.1	µg/L	24-Aug-18	EPA200.8
Uranium	0.3	0.1	µg/L	24-Aug-18	EPA200.8
Vanadium	0.4	0.1	µg/L	24-Aug-18	EPA200.8
Zinc	< 5.0	5	µg/L	24-Aug-18	EPA200.8

ReportDate: Thursday, September 06, 2018
Print Date: *Thursday, September 06, 2018*

Page 7 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-1**

Taiga Sample ID: **003**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	0.030	0.005	mg/L	21-Aug-18	SM4500-NH3:G	
CBOD	21	2	mg/L	16-Aug-18	SM5210:B	55
Phosphorous, Total	0.677	0.002	mg/L	23-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	6.95		pH units	15-Aug-18	SM4500-H:B	
Solids, Total Suspended	306	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.21	0.01	mg/L	15-Aug-18	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	15-Aug-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	< 10	10	CFU/100mL	15-Aug-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	< 2.0	2.0	mg/L	22-Aug-18	EPA1664A	

ReportDate: Thursday, September 06, 2018

Print Date: Thursday, September 06, 2018

Page 8 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **004**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 15-Aug-18

Sampling Date: 14-Aug-18

Sampling Time: 14:30

Location:

Report Status: Final

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	1.84	0.005	mg/L	21-Aug-18	SM4500-NH3:G	
COD	74	2	mg/L	16-Aug-18	SM5210:B	
Phosphorous, Total	3.83	0.002	mg/L	23-Aug-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	9.09		pH units	16-Aug-18	SM4500-H:B	
Solids, Total Suspended	90	3	mg/L	16-Aug-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.35	0.01	mg/L	15-Aug-18	SM4110:B	
Nitrite as Nitrogen	0.18	0.01	mg/L	15-Aug-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	10	10	CFU/100mL	15-Aug-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	20.0	2.0	mg/L	22-Aug-18	EPA1664A	

ReportDate: Thursday, September 06, 2018

Print Date: Thursday, September 06, 2018

Page 9 of 10



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180740

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **004**

- DATA QUALIFIERS -

Data Qualifier Descriptions:

55 *BOD result is inconclusive; residual DO was less than 1 mg/L. For evaluation purposes only.*

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Thursday, September 06, 2018

Print Date: *Thursday, September 06, 2018*

Page 10 of 10

From: [Erica Janes](#)
To: [Permits](#)
Subject: FW: Emailing: 181166 - 1819 - FINAL REPORT, 181166 - 1819 - FINAL REPORT
Date: November 6, 2018 11:29:28 AM
Attachments: [181166 - 1819 - FINAL REPORT.pdf](#)

Please post email and attachment to MV2016L3-0001 - Ft Providence - 5 Reports and Studies / SNP Reports - Analytical results for SNP 1412-2 on October 19 2018 - Nov6-18

-----Original Message-----

From: Glen Hudy <Glen_Hudy@gov.nt.ca>
Sent: Tuesday, November 6, 2018 9:25 AM
To: sao@fortprovidence.ca; Erica Janes <ejanes@mvlwb.com>; Wendy Bidwell <Wendy_Bidwell@gov.nt.ca>
Subject: Emailing: 181166 - 1819 - FINAL REPORT, 181166 - 1819 - FINAL REPORT

Susan,

Please see attached for final report 181166.

Have a good day.

Mársi | Kinanaskomitin | Thank you | Merci | Haï' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi Glen
Hudy Chemist, Quality Assurance Water Resources Environment and Natural Resources Government of the
Northwest Territories

Taiga Environmental Laboratory
PO Box 1320
Yellowknife, NT X1A 2L9

Phone: 867-767-9235 Ext. 53154
Fax: 867-920-8740
www.enr.gov.nt.ca

Your message is ready to be sent with the following file or link attachments:

181166 - 1819 - FINAL REPORT
181166 - 1819 - FINAL REPORT

Note: To protect against computer viruses, e-mail programs may prevent sending or receiving certain types of file attachments. Check your e-mail security settings to determine how attachments are handled.



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
181166

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Monday, November 05, 2018

Print Date: *Monday, November 05, 2018*

Page 1 of 3



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
181166

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **001**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 19-Oct-18

Sampling Date: 19-Oct-18

Sampling Time:

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	15.4	0.005	mg/L	02-Nov-18	SM4500-NH3:G	
CBOD	8	2	mg/L	19-Oct-18	SM5210:B	
Phosphorous, Total	5.84	0.002	mg/L	23-Oct-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	8.88		pH units	19-Oct-18	SM4500-H:B	
Solids, Total Suspended	46	3	mg/L	19-Oct-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.57	0.01	mg/L	20-Oct-18	SM4110:B	
Nitrite as Nitrogen	0.30	0.01	mg/L	20-Oct-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	2	1	CFU/100mL	19-Oct-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	< 2.0	2.0	mg/L	31-Oct-18	EPA1664A	

ReportDate: Monday, November 05, 2018

Print Date: *Monday, November 05, 2018*

Page 2 of 3



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

181166

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **001**

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Monday, November 05, 2018

Print Date: *Monday, November 05, 2018*

Page 3 of 3

From: [Erica Janes](#)
To: [Permits](#)
Subject: FW: Emailing: 180494 - 1819 - FINAL REPORT, 180494 - 1819 - FINAL REPORT
Date: July 30, 2018 9:16:29 AM
Attachments: [180494 - 1819 - FINAL REPORT.pdf](#)

Please post email and attachment to MV2016L3-0001 - Ft Providence - 5 Reports & Studies / SNP Reports - Analytical results from SNP 1412-2 on July 5 2018 - Jul19-18

-----Original Message-----

From: Glen Hudy <Glen_Hudy@gov.nt.ca> On Behalf Of taiga
Sent: Thursday, July 19, 2018 3:46 PM
To: Susan Christie <sao@fortprovidence.ca>; Erica Janes <ejanes@mvlwb.com>; Wendy Bidwell <Wendy_Bidwell@gov.nt.ca>
Subject: Emailing: 180494 - 1819 - FINAL REPORT, 180494 - 1819 - FINAL REPORT

Susan,

Please see attached for final report 180494.

Have a good day.

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi Glen Hudy Chemist, Quality Assurance Water Resources Environment and Natural Resources Government of the Northwest Territories

Taiga Environmental Laboratory
PO Box 1320
Yellowknife, NT X1A 2L9

Phone: 867-767-9235 Ext. 53154
Fax: 867-920-8740
www.enr.gov.nt.ca

Your message is ready to be sent with the following file or link attachments:

180494 - 1819 - FINAL REPORT
180494 - 1819 - FINAL REPORT

Note: To protect against computer viruses, e-mail programs may prevent sending or receiving certain types of file attachments. Check your e-mail security settings to determine how attachments are handled.



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180494

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Thursday, July 19, 2018

Print Date: *Thursday, July 19, 2018*

Page 1 of 3



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180494

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **001**

Client Project: WL#: MV2016L3-0001

Sample Type: Water

Received Date: 05-Jul-18

Sampling Date: 05-Jul-18

Sampling Time:

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	0.718	0.005	mg/L	10-Jul-18	SM4500-NH3:G	
CBOD	17	2	mg/L	05-Jul-18	SM5210:B	
Phosphorous, Total	3.41	0.002	mg/L	19-Jul-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	9.55		pH units	05-Jul-18	SM4500-H:B	
Solids, Total Suspended	94	3	mg/L	06-Jul-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	1.35	0.01	mg/L	06-Jul-18	SM4110:B	
Nitrite as Nitrogen	3.24	0.01	mg/L	06-Jul-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	20	10	CFU/100mL	05-Jul-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	< 2.0	2.0	mg/L	16-Jul-18	EPA1664A	

ReportDate: Thursday, July 19, 2018

Print Date: **Thursday, July 19, 2018**

Page 2 of 3



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180494

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 1412-2

Taiga Sample ID: 001

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Thursday, July 19, 2018

Print Date: *Thursday, July 19, 2018*

Page 3 of 3

From: [Erica Janes](#)
To: [Permits](#)
Subject: FW: Emailing: 180541 - 1819 - FINAL REPORT, 180541 - 1819 - FINAL REPORT
Date: August 9, 2018 8:57:22 AM
Attachments: [180541 - 1819 - FINAL REPORT.pdf](#)

Please post email and pdf to MV2016L3-0001 - Ft Providence - 5 Reports and Studies / SNP Reports - Analytical results from SNP 1412-2 on July 11 2018 - Aug8-18

-----Original Message-----

From: Glen Hudy <Glen_Hudy@gov.nt.ca> On Behalf Of taiga
Sent: Wednesday, August 8, 2018 2:56 PM
To: Susan Christie <sao@fortprovidence.ca>; Erica Janes <ejanes@mvlwb.com>; Wendy Bidwell <Wendy_Bidwell@gov.nt.ca>
Subject: Emailing: 180541 - 1819 - FINAL REPORT, 180541 - 1819 - FINAL REPORT

Susan,

Please see attached for final report 180541.

Have a good day.

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi Glen
Hudy Chemist, Quality Assurance Water Resources Environment and Natural Resources Government of the
Northwest Territories

Taiga Environmental Laboratory
PO Box 1320
Yellowknife, NT X1A 2L9

Phone: 867-767-9235 Ext. 53154
Fax: 867-920-8740
www.enr.gov.nt.ca

Your message is ready to be sent with the following file or link attachments:

180541 - 1819 - FINAL REPORT
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Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180541

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Wednesday, August 08, 2018

Print Date: *Wednesday, August 08, 2018*

Page 1 of 3



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180541

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **001**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 12-Jul-18

Sampling Date: 11-Jul-18

Sampling Time: 8:35

Location: 1412-2

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	0.388	0.005	mg/L	20-Jul-18	SM4500-NH3:G	
CBOD	10	2	mg/L	13-Jul-18	SM5210:B	
Phosphorous, Total	1.24	0.002	mg/L	13-Jul-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	10.3		pH units	12-Jul-18	SM4500-H:B	
Solids, Total Suspended	98	3	mg/L	17-Jul-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.57	0.01	mg/L	13-Jul-18	SM4110:B	
Nitrite as Nitrogen	1.92	0.01	mg/L	13-Jul-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal		1	CFU/100mL		SM9222:D	3
<u>Organics</u>						
Hexane Extractable Material	2.3	2.0	mg/L	16-Jul-18	EPA1664A	

ReportDate: Wednesday, August 08, 2018

Print Date: **Wednesday, August 08, 2018**

Page 2 of 3



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180541

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **001**

- DATA QUALIFIERS -

Data Qualifier Descriptions:

3 *Holding time exceeded before receipt of sample*

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Wednesday, August 08, 2018

Print Date: **Wednesday, August 08, 2018**

Page 3 of 3

From: Judy Mah
To: [Susan Christie](#)
Cc: [Erica Janes](#); [Wendy Bidwell](#)
Subject: Emailing: 180382 - 1819 - FINAL REPORT.pdf, 180382 - 1819 - FINAL REPORT.xls
Date: Tuesday, June 26, 2018 4:35:48 PM
Attachments: [180382 - 1819 - FINAL REPORT.pdf](#)
[180382 - 1819 - FINAL REPORT.xls](#)

Hello,

Please see attached for final report 180362.

Have a good afternoon,
Judy

Mársi | Kinanaskomitin | Thank you | Merci | Hai' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi

Taiga Environmental Laboratory
Environment and Natural Resources
Government of the Northwest Territories

Mailing Address
4601 – 52 Avenue
PO Box 1320
Yellowknife, NT X1A 2L9

Shipping Address:
4601 – 52 Avenue
Yellowknife, NT X1A 2L9

Main Phone: 867-767-9230 Ext. 53151
Fax: 867-920-8740

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Your message is ready to be sent with the following file or link attachments:

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180382 - 1819 - FINAL REPORT.xls

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Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180382

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Judy Mah
Client Service Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Tuesday, June 26, 2018
Print Date: *Tuesday, June 26, 2018*

Page 1 of 3



Taiga Environmental Laboratory

4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9

Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180382

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **001**

Client Project: MV2016L3-0001

Sample Type: Water

Received Date: 13-Jun-18

Sampling Date: 13-Jun-18

Sampling Time:

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	11.8	0.005	mg/L	20-Jun-18	SM4500-NH3:G	
CBOD	13	2	mg/L	13-Jun-18	SM5210:B	
Phosphorous, Total	6.21	0.002	mg/L	18-Jun-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	8.48		pH units	13-Jun-18	SM4500-H:B	
Solids, Total Suspended	22	3	mg/L	18-Jun-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.61	0.01	mg/L	15-Jun-18	SM4110:B	
Nitrite as Nitrogen	0.96	0.01	mg/L	15-Jun-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	80	10	CFU/100mL	13-Jun-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	< 2.0	2.0	mg/L	25-Jun-18	EPA1664A	

ReportDate: Tuesday, June 26, 2018

Print Date: **Tuesday, June 26, 2018**

Page 2 of 3



Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180382

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 1412-2

Taiga Sample ID: 001

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Tuesday, June 26, 2018

Print Date: *Tuesday, June 26, 2018*

Page 3 of 3

From: [Erica Janes](#)
To: [Permits](#)
Subject: FW: Emailing: 180944 - 1819 - FINAL REPORT, 180944 - 1819 - FINAL REPORT
Date: October 11, 2018 9:00:51 AM
Attachments: [180944 - 1819 - FINAL REPORT.pdf](#)

Please post email and pdf to MV2016L3-0001 - Ft Providence - 5 Reports and Studies / SNP Reports - Analytical results for SNP 1412-2 and 2016-2 on September 13 2018 - Oct 10-18

-----Original Message-----

From: Glen Hudy <Glen_Hudy@gov.nt.ca> On Behalf Of taiga
Sent: Wednesday, October 10, 2018 2:14 PM
To: sao@fortprovidence.ca; Erica Janes <ejanes@mvlwb.com>; Wendy Bidwell <Wendy_Bidwell@gov.nt.ca>
Subject: Emailing: 180944 - 1819 - FINAL REPORT, 180944 - 1819 - FINAL REPORT

Susan,

Please see attached for final report 180944.

Have a good day.

Mársi | Kinanaskomitin | Thank you | Merci | Hąı' | Quana | Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsi Glen
Hudy Chemist, Quality Assurance Water Resources Environment and Natural Resources Government of the
Northwest Territories

Taiga Environmental Laboratory
PO Box 1320
Yellowknife, NT X1A 2L9

Phone: 867-767-9235 Ext. 53154
Fax: 867-920-8740
www.enr.gov.nt.ca

Your message is ready to be sent with the following file or link attachments:

180944 - 1819 - FINAL REPORT
180944 - 1819 - FINAL REPORT

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Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180944

- FINAL REPORT -

Prepared For: Hamlet of Fort Providence

Address: General Delivery
Fort Providence, NT
X0E 0L0

Attn: Susan Christie

Facsimile: (867) 699-4624

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
 - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
 - Environment Canada
 - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Wednesday, October 10, 2018

Print Date: *Wednesday, October 10, 2018*

Page 1 of 6



Taiga Environmental Laboratory

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Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180944

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **1412-2**

Taiga Sample ID: **001**

Client Project: MV2016L3-0001

Sample Type: Sewage Lagoon

Received Date: 13-Sep-18

Sampling Date: 13-Sep-18

Sampling Time: 8:45

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ammonia as Nitrogen	8.40	0.005	mg/L	15-Sep-18	SM4500-NH3:G	
CBOD	31	2	mg/L	13-Sep-18	SM5210:B	
Phosphorous, Total	0.374	0.002	mg/L	25-Sep-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
pH	8.22		pH units	13-Sep-18	SM4500-H:B	
Solids, Total Suspended	18	3	mg/L	18-Sep-18	SM2540:D	
<u>Major Ions</u>						
Nitrate as Nitrogen	0.51	0.01	mg/L	16-Sep-18	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	16-Sep-18	SM4110:B	
<u>Microbiology</u>						
Coliforms, Fecal	28	1	CFU/100mL	13-Sep-18	SM9222:D	
<u>Organics</u>						
Hexane Extractable Material	< 2.0	2.0	mg/L	24-Sep-18	EPA1664A	

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Page 2 of 6



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Taiga Batch No.:

180944

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-2**

Taiga Sample ID: **002**

Client Project: MV2016L3-0001

Sample Type: Ponded Leachate

Received Date: 13-Sep-18

Sampling Date: 13-Sep-18

Sampling Time: 8:45

Location:

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifier
<u>Inorganics - Nutrients</u>						
Ortho-Phosphate as Phosphorus	0.223	0.002	mg/L	24-Sep-18	SM4500-P:D	
<u>Inorganics - Physicals</u>						
Conductivity, Specific (@25C)	6160	0.4	µS/cm	20-Sep-18	SM2510:B	
pH	6.99		pH units	13-Sep-18	SM4500-H:B	
Solids, Total Suspended	220	3	mg/L	18-Sep-18	SM2540:D	
<u>Major Ions</u>						
Calcium	513	0.1	mg/L	16-Sep-18	SM4110:B	
Magnesium	60.5	0.1	mg/L	16-Sep-18	SM4110:B	
Potassium	365	0.1	mg/L	16-Sep-18	SM4110:B	
Sodium	742	0.1	mg/L	16-Sep-18	SM4110:B	
Sulphate	1	1	mg/L	16-Sep-18	SM4110:B	
<u>Organics</u>						
Benzene	< 0.002	0.002	mg/L	15-Sep-18	EPA8260B	
Ethylbenzene	< 0.002	0.002	mg/L	15-Sep-18	EPA8260B	
F2: C10-C16	< 0.2	0.2	mg/L	18-Sep-18	EPA8015B	
F3: C16-C34	0.4	0.2	mg/L	18-Sep-18	EPA8015B	

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Page 3 of 6



Taiga Environmental Laboratory

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Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180944

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **2016-2**

Taiga Sample ID: **002**

F4: C34-C50	< 0.2	0.2	mg/L	18-Sep-18	EPA8015B
Hexane Extractable Material	6.3	2.0	mg/L	24-Sep-18	EPA1664A
Hydrocarbons, Total Extractable	0.4	0.2	mg/L	18-Sep-18	EPA8015B
Hydrocarbons, Total Purgeable	0.4	0.3	mg/L	15-Sep-18	EPA8015
Toluene	0.093	0.002	mg/L	15-Sep-18	EPA8260B
Xylenes	< 0.002	0.002	mg/L	15-Sep-18	EPA8260B
<u>Subcontracted Organics</u>					
Phenols, Total	0.0987	0.001	mg/L	21-Sep-18	AB ENV.06537
<u>Trace Metals, Total</u>					
Aluminum	1720	5	µg/L	04-Oct-18	EPA200.8
Antimony	4.5	0.1	µg/L	04-Oct-18	EPA200.8
Arsenic	13.7	0.2	µg/L	04-Oct-18	EPA200.8
Barium	741	0.1	µg/L	04-Oct-18	EPA200.8
Beryllium	0.1	0.1	µg/L	04-Oct-18	EPA200.8
Bismuth	< 0.2	0.2	µg/L	04-Oct-18	EPA200.8
Boron	1890	0.9	µg/L	04-Oct-18	EPA200.8
Cadmium	0.3	0.1	µg/L	04-Oct-18	EPA200.8
Cesium	0.4	0.1	µg/L	04-Oct-18	EPA200.8
Chromium	24.7	0.1	µg/L	04-Oct-18	EPA200.8
Cobalt	13.7	0.1	µg/L	04-Oct-18	EPA200.8
Copper	14.5	0.2	µg/L	04-Oct-18	EPA200.8
Iron	97000	5	µg/L	04-Oct-18	EPA200.8
Lead	5.5	0.1	µg/L	04-Oct-18	EPA200.8
Lithium	149	0.2	µg/L	04-Oct-18	EPA200.8
Manganese	3070	0.1	µg/L	04-Oct-18	EPA200.8

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Page 4 of 6



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Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:
180944

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-2

Taiga Sample ID: 002

Mercury	0.04	0.01	µg/L	04-Oct-18	EPA200.8
Molybdenum	2.7	0.1	µg/L	04-Oct-18	EPA200.8
Nickel	38.3	0.1	µg/L	04-Oct-18	EPA200.8
Rubidium	112	0.1	µg/L	04-Oct-18	EPA200.8
Selenium	1.4	0.5	µg/L	04-Oct-18	EPA200.8
Silver	< 0.1	0.1	µg/L	04-Oct-18	EPA200.8
Strontium	1820	0.1	µg/L	04-Oct-18	EPA200.8
Thallium	< 0.1	0.1	µg/L	04-Oct-18	EPA200.8
Tin	1.2	0.1	µg/L	04-Oct-18	EPA200.8
Titanium	42.8	0.1	µg/L	04-Oct-18	EPA200.8
Uranium	0.6	0.1	µg/L	04-Oct-18	EPA200.8
Vanadium	8.1	0.1	µg/L	04-Oct-18	EPA200.8
Zinc	680	5	µg/L	04-Oct-18	EPA200.8

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Page 5 of 6



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Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.:

180944

- CERTIFICATE OF ANALYSIS -

Client Sample ID: 2016-2

Taiga Sample ID: 002

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

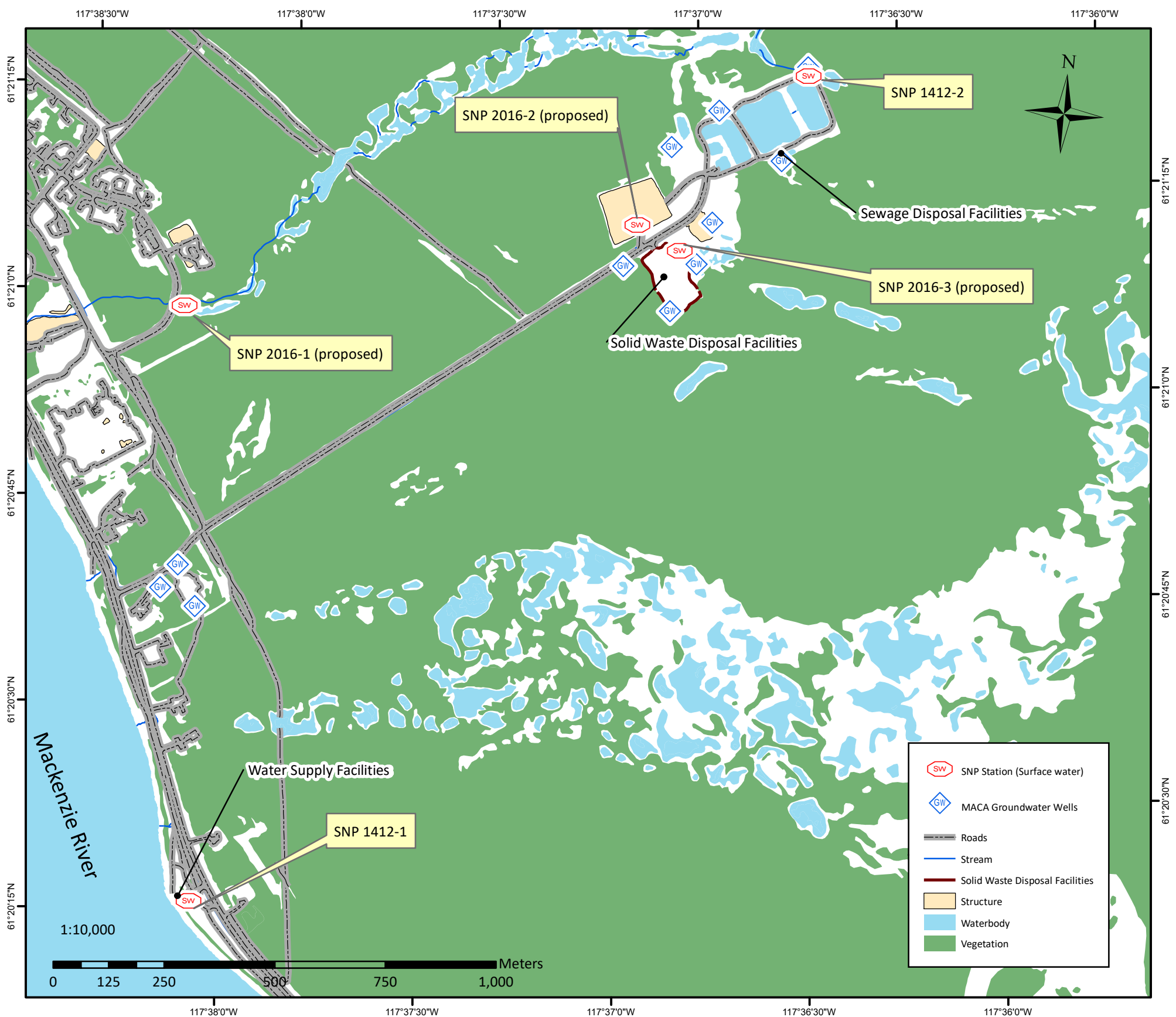
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Page 6 of 6

**Appendix C: Map showing Surveillance Network Program stations for Fort
Providence (MV2016L3-0001)**

Hamlet of Fort Providence Surveillance Network Program (SNP) MV2016L3-0001



ID	Taiga Lab Colour Codes	SNP1412-1	SNP1412-2	SNP2016-1 (TBD)	SNP2016-2 (TBD)	SNP2016-3 (TBD)
Frequency		Monthly	Prior to discharge and weekly during discharge	Beginning and end of open water season, (i.e. one week following freshnet, and before freeze-up)	Twice per year: (1) during the months of June and September; and (2) prior to discharge of accumulated water	Twice per year: (1) during the months of June and September; and (2) prior to discharge of accumulated water
Volume in m ³		Water withdrawn			Water discharged	Water discharged
Effluent Quality Criteria (EQC)			Part D, item 7			
Parameters						
CBOD ₅			✓	✓		
Ammonia (Nitrogen)			✓	✓		
Total Phosphorous (P)			✓	✓		
Total Suspended Solids			✓	✓	✓	✓
Faecal Coliform	STERILE		✓	✓		
Calcium (Ca)					✓	✓
Conductivity					✓	✓
pH			✓	✓	✓	✓
Nitrate (NO ₃)			✓	✓		
Nitrite (NO ₂)			✓	✓		
Total Phosphate					✓	✓
Potassium (K)					✓	✓
Sodium (Na)					✓	✓
Sulphate (SO ₄)					✓	✓
Oil and grease (O+G)			✓	✓	✓	✓
Total Petroleum Hydrocarbons					✓	✓
BTEX					✓	✓
Total Phenols					✓	✓
Total Cadmium (Cd)					✓	✓
Total Chromium (Cr)					✓	✓
Total Cobalt (Co)					✓	✓
Total Copper (Cu)					✓	✓
Total Iron (Fe)					✓	✓
Total Lead (Pb)					✓	✓
Magnesium (Mg)					✓	✓
Total Manganese (Mn)					✓	✓
Total Mercury (Hg)					✓	✓
Total Nickel (Ni)					✓	✓
Total Zinc (Zn)					✓	✓

Map Description:

This map demonstrates the Surveillance Network Program (SNP) stations for the Hamlet of Fort Providence Municipal Water Licence MV2016L3-0001.

This map is for illustrative purposes only. This is not a legal document and should not be treated as such.

Coordinate System: NAD 1983 Northwest Territories Lambert

Projection: Lambert Conformal Conic

Datum: North American 1983

False Easting: 0.0000

False Northing: 0.0000

Central Meridian: -112.0000

Standard Parallel 1: 62.0000

Standard Parallel 2: 70.0000

Latitude Of Origin: 0.0000

Units: Meter

This map is created by the Mackenzie Valley Land and Water Board. For mapping related questions, please contact:

Jacqueline Ho
Regulatory Specialist
Mackenzie Valley Land and Water Board
jho@mvlwb.com
1 867 766 7455

For any file related questions, please contact:

Erica Janes
Regulatory Specialist
Mackenzie Valley Land and Water Board
ejanes@mvlwb.com
1 867 766 7466

Map Produced: December 19, 2018

Data Source: MACA (accessed June 19, 2017);

MV2016L3-0001 Current to: December 4, 2017

Appendix D: Review of Community Water Management and Water System Infrastructure – Municipal and Community Affairs – January 2019

REVIEW OF COMMUNITY WATER MANAGEMENT AND WATER SYSTEM INFRASTRUCTURE



FORT PROVIDENCE, NT

JANUARY 2019

*Prepared by:
Water and Sanitation
Department of Municipal and Community Affairs*



TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Community and Water System.....	1
1.2	Roles and Responsibilities.....	3
2.0	WATER SUPPLY SYSTEM.....	7
2.1	Flow Process and Instrumentation.....	7
2.2	Water Source and Intake	7
2.3	Water Treatment.....	8
2.4	Treated and Fire Water Storage.....	12
2.5	Truckfill.....	13
2.6	Potable Water Distribution.....	13
2.6.1	Trucked Delivery	13
2.6.2	Household Water Tanks.....	13
2.7	Water Treatment Plant Building.....	13
3.0	OPERATIONS AND MAINTENANCE REVIEW	15
3.1	Staffing and Training Certification.....	15
3.2	Regulatory Compliance	15
3.3	Sampling and Testing.....	16
3.4	Record Keeping	18
3.5	System Performance.....	19
3.6	Preventive Maintenance and Spare Parts.....	20
3.7	Emergency Planning.....	22
3.8	Safety.....	22
3.9	Treatment System Review.....	24
3.9.1	Condition Assessment.....	24
3.9.2	WTP Capability (Treatment).....	24
3.9.3	WTP Capability (Quantity)	24
3.10	Guidelines for Canadian Drinking Water Quality Compliance	24
3.11	Operational Issues.....	26
3.12	Operator-Identified Issues.....	27
4.0	RECOMMENDATIONS	28
4.1	Meeting Expectations (Successes)	28
4.2	Areas Requiring Improvement	28
4.3	Action Plan and Resources.....	29

APPENDICES

APPENDIX A: Photos	1
APPENDIX B: Chemical Disposal Information	7
APPENDIX C: Batch Chlorination Procedures	8
APPENDIX D: Council Briefing and Quote.....	9

TABLES

Table 1: Agency and Department Contacts	3
Table 2: GNWT Department of Municipal and Community Affairs – Supports Communities and Operators.....	4

Table 3: GNWT Department of Health and Social Services – Regulatory Agency, Public Health	5
Table 4: Community Staff - Management	6
Table 5: Community Staff - Operations.....	6
Table 6: Process Equipment	8
Table 7: Filter Media	9
Table 8: Process Chemicals	10
Table 9: Chemical Feed Equipment	10
Table 10: Building and Additional Equipment	11
Table 11: Building Specifications.....	14
Table 12: Site Detail	14
Table 13: Regulatory Requirements for Sampling	15
Table 14: Routine Sampling	17
Table 15: Water Quality Testing.....	18
Table 16: In-Plant Process Control/Optimization	19
Table 17: Laboratory Equipment.....	20
Table 18: Water Quality Test Kits.....	21
Table 19: Spare Parts Inventory	21
Table 20: PPE and Safety Equipment.....	23
Table 21: GCDWQ Parameters	25
Table 22: Community Action Plan Update.....	29
Table 23: GNWT Action Plan Update.....	30
Table 24: Upgrades Needed to Keep Plant Operational	30

FIGURES

Figure 1: Fort Providence Water Treatment Plant.....	1
Figure 2: Flow Process Diagram	7

EXECUTIVE SUMMARY

The Hamlet of Fort Providence operates a Class II Water Treatment Plant and trucked delivery system to provide potable water to the community. The plant has been in operation for 26 years and the Hamlet is looking to determine what upgrades are needed. MACA has reviewed the background data and visited to plant to determine the current condition of the infrastructure.

The water system consists of a gravity-fed wetwell intake in the Mackenzie River, a treatment train including coagulation, upflow settling tubes, a multi-media (anthracite and sand) filter, and chlorine disinfection, underground storage cells, and trucked water delivery. The main operator, Clifford McLeod, is certified as a Class I water plant operator. The backup operator, Dale Vendell, is certified as a Small Systems operator. In addition to the operators, there are two water truck drivers who do not hold any operator certifications. The operators are working on upgrading their certifications to meet the level of the plant.

A number of issues were noted onsite:

- The plant is currently not meeting the Guidelines for Canadian Drinking Water Quality for turbidity. Repairs to the filter are needed immediately.
- Fuel from the generator has leaked into the clearwell in the past. The concrete floor of the generator room should be sealed with epoxy flooring to prevent a recurrence.
- The operators noted a water hammer issue when the truckfill pump is run at the design rate of 1000 L/min. The flow is currently throttled to 850 L/min. 1000 L/min is recommended for fire flow, and this problem should be investigated.
- A recent WSCC inspection identified several safety issues including PPE use and ventilation.
- On some days, there was an insufficient number of chlorine and turbidity samples recorded. Sampling should be done throughout the day to ensure guidelines continue to be met.
- Mineral oil leak from truckfill pump.

Several successes were also noted:

- The majority of regulatory requirements for sampling are being met. Proper sampling techniques are being used.
- Record keeping is excellent.
- Operators are knowledgeable about the plant operations.
- Operators keep in contact with the Environmental Health Officer when issues arise.

In order to keep the plant operational over the next few years, additional repairs and upgrades to the building and the process equipment will be needed. This may include repairs to the paint, siding, flashing,

and generator room floor, upgrades to inline monitoring and control systems, and process equipment refurbishment.

The immediate highest priority items are consistent use of PPE for operator safety, and filter repairs to return the turbidity to a level that meets the Guidelines for Canadian Drinking Water Quality. Additional actions are identified within the report.

1.0 INTRODUCTION

The Hamlet of Fort Providence operates a Class II water treatment plant (WTP) to supply potable water to the community via trucked delivery service. The plant has been in operation for 26 years and the Hamlet would like to determine what upgrades and repairs will be needed in the next few years.

Upgrades to the raw water intake are currently in the planning stages and there is potential for a new WTP to be constructed concurrently with these upgrades, particularly if a new site is selected. There is also some possibility that major intake changes, such as the addition of a reservoir, could cause changes to the raw water quality and therefore the treatment requirements.

The Department of Municipal and Community Affairs (MACA) has reviewed the available background data on the WTP and conducted a site visit to determine the current condition of the infrastructure.

1.1 Community and Water System



Figure 1: Fort Providence Water Treatment Plant

Community Government

Name:	Hamlet of Fort Providence
Status:	Hamlet
Population:	est. 770 as of July 1, 2017 (NWT Bureau of Statistics)
Role/Responsibility:	Maintain and operate WTP, truckfill, trucked delivery services, and sewer truck services.

Raw Water Source

Name: Mackenzie River
Type: Surface Water

Water Licence

Licence Number: MV2016L3-0001
Licence Type: Type B
Effective Dates: July 7, 2016 – July 6, 2026

Operator Certification

Number of Operators Certified to the Level of the WTP: None

Water Quality (Appendix E)

Parameter	Description
Raw Water Quality Description:	The Mackenzie River can be expected to have turbidity ranging from less than 10 to over 2500 NTU. Raw water quality drops during the spring freshet as large quantities of silt and organic material enter the water. Sampling records from the plant during 2015-2018 show raw water turbidity generally between 1 and 16 NTU, with an average around 5 NTU. Aluminum concentrations in the raw water do not exceed the OG. One manganese sample was above the AO. Iron is frequently above the AO. pH levels are within water quality guidelines.
Treated Water Meets GCDWQ (for all parameters tested):	No. The limit for treated water turbidity in conventional water treatment plants is 0.3 NTU in at least 95% of measurements. Turbidity currently exceeds the MAC (see discussion in Section 3.11). Prior to November 2018, the turbidity occasionally exceeded the MAC.
Parameters Outside GCDWQ Health Limits:	Turbidity.
Parameters Outside GCDWQ Aesthetic Limits:	pH, manganese, iron.

Parameter	Description
Parameters Outside GCDWQ Operational Guidelines:	Aluminum

Annual Consumption

WTP Flow Totalizer: 349,027,300 L
 Estimated Annual Consumption: 28,263 m³ (from 2017/2018 annual report)

Boil Water Orders

Date Issued: None reported.

Water Supply System Infrastructure Summary

WTP Classification: Class II
 Raw Water Reservoir: Concrete cell
 Intake or Well System: Wetwell with gravity flow from river through pipes. Two submersible pumps bring water from the wetwell to the WTP.
 Wetwell Pumphouse: None
 Disinfection System: 12% sodium hypochlorite solution
 Treatment Type: Coagulation, flocculation, and multi-media filtration (sand and anthracite) package plant using alum and polymer.
 Treated Water Storage: Two underground concrete reservoirs
 Distribution System: Trucked
 Water Trucks: Three trucks: 2 x 12,000 L and 1 x 9,092 L backup

1.2 Roles and Responsibilities

Table 1: Agency and Department Contacts

Agency or Department	Contact Name	Comments (function/role, frequency of contact, recent work in community, concerns)
Mackenzie Valley Land and Water Board	Erica Janes Regulatory Specialist	Regulate the use of land and water and the deposit of waste throughout the area. Issue Municipal Water Licences.

Agency or Department	Contact Name	Comments (function/role, frequency of contact, recent work in community, concerns)
Environment and Natural Resources (ENR)	Wendy Bidwell Water Resource Officer	Water Resource Officers conduct regular inspections of the Community's water use and waste management systems to ensure compliance with the conditions of the Municipal Water Licence. Water Resource Officers visit the community regularly to enforce the licence and can be a resource for any questions regarding the legal obligations associated with the operation of the Solid Waste Facility, WTP, and Sewage Disposal Facility
Department of Fisheries and Ocean (DFO)	Fisheries and Oceans Canada has changed the way new project proposals (referrals), reports of potential Fisheries Act violations (occurrences) and information requests are managed in Central and Arctic (Alberta, Saskatchewan, Manitoba, Ontario, Nunavut, and the Northwest Territories). Please be advised that general information regarding the management of impacts of fish and fish habitat and self-assessment tools (e.g. Operation Statements) that enable you to determine Fisheries Act requirement are available at DFO's "Working Near Water" website at www.dfo-mpo.gc.ca/habitat . For all occurrence reports, or project proposals where you have determined, following self-assessment, that you cannot avoid impacts to fish and fish habitat, please submit the fisheriesprotection@dfo-mpo.gc.ca . For general inquiries you can also call 1-855-852-8320.	
Community	Ms. Susan Christie Senior Administrative Officer (SAO)	Overall responsible for the operation of all community operations. Directly responsible to Chief and council.

Table 2: GNWT Department of Municipal and Community Affairs – Supports Communities and Operators

Contact Name	Phone/Email	Comments
Justin Hazenberg, P.Eng. Engineering Team Lead, Water & Sanitation	867-767-9164 ext 21078 justin_hazenberg@gov.nt.ca	Provide technical support and training for WTP operators. Perform system reviews.

Contact Name	Phone/Email	Comments
Jaime D. Goddard, P.Eng. Senior Technical Officer, Water & Sanitation	867-767-9164 ext 21079 jaime_goddard@gov.nt.ca	Provide technical support and training for WTP operators. Perform system reviews.
Greg Hamman Water Quality Environmental Specialist	867-767-9164 ext 21077 greg_hamman@gov.nt.ca	Provide technical support and training for WTP operators. Perform system reviews.
Braden Redshaw Intern - Engineering Project Analyst	867-767-9164 ext 21081 braden_redshaw@gov.nt.ca	Provide technical support and training for WTP operators. Perform system reviews.

Table 3: GNWT Department of Health and Social Services – Regulatory Agency, Public Health

Contact Name	Comments
Peter Workman Chief Environmental Health Officer	Oversight of Environmental Health Officers (EHO) Periodic review of water quality standards and ensuring compliance.
Colin Merz Environmental Health Officer (EHO)	Inspect WTP twice per year. Do chemical and THM sampling. Ensure operator is testing and reporting as required by regulations (bacteriological, chemical, chlorine levels, turbidity, etc.) Investigate any possible sources of contaminations (fuel spill, sewage spill, failure of the WTP to operate, unusually high turbidity, etc.) Issue boil water advisories in the event that the quality of the water cannot be assured. Investigate any complaints or outbreaks that might be associated with the local drinking water.

Table 4: Community Staff - Management

Position	Name	Comments
Chief/Mayor	His Worship Mayor Samuel Gargan (still acting) Danny Beaulieu (newly elected)	Elected leader of the community
Senior Administrative Officer (SAO)	Ms. Susan Christie Senior Administrative Officer	Empowered by council to act as council's representative in the administration of Hamlet affairs
Works Foreman	Clifford McLeod Public Works Manager	Reports to SAO. Responsible for the operation of Public Works day to day operations and some future planning
WTP Operator	Clifford McLeod Dale Vendell – Backup	Reports to SAO. Responsible for the operation and maintenance of the WTP and distribution.
Water Truck Drivers	Gilbert Matto Corey Minoza	Reports to SAO and Foreman.
Finance Comptroller	Albertine Canadien	Reports to SAO. Responsible for PO's for WTP chemicals and equipment, and payroll.

Table 5: Community Staff - Operations

Name	Level of Certification	Years of Experience	Reports To	Comments (hr/day on site)
Clifford	Class I	6 years	SAO	5 days a week, 4-5 hours on site
Dale	Small Systems	2 years	SAO	5 days a week, 4-5 hours on site

Name	Level of Certification	Years of Experience	Reports To	Comments (hr/day on site)
Gilbert	None	32 years	SAO	Regular work weeks, rotate weekends every 2 weeks.
Corey	None	2.5 years	SAO	Regular work weeks, rotate weekends every 2 weeks.

2.0 WATER SUPPLY SYSTEM

2.1 Flow Process and Instrumentation

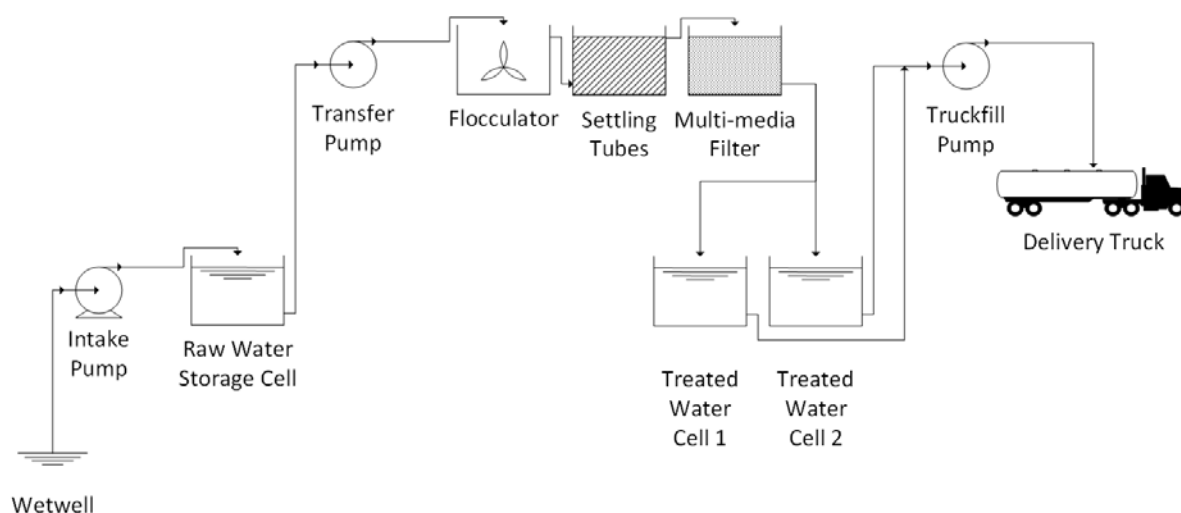


Figure 2: Flow Process Diagram

2.2 Water Source and Intake

The WTP and intake are located on the Mackenzie River, upstream of the Hamlet of Fort Providence as well as the community landfill, lagoon, and former landfill. The WTP and intake are located downstream of the local airport, which is adjacent to the river, but over a kilometer away.

Raw water is drawn from the Mackenzie River. The intake is located in an area where divers have at times refused to work in the river due to safety issues relating to poor visibility and strong currents. Several past intakes have been damaged by ice chunks and boulders entrained by the current.

The current intake consists of a wetwell fed by gravity from the river. In the winter, ice piles up on top of the wetwell, making it completely inaccessible for maintenance for several months. In the event of a pump failure, it is very difficult to access the wetwell in order to conduct repairs or replace the pump before the ice melts in the spring. Work is underway to select and implement a new intake design.

2.3 Water Treatment

The treatment system consists of a Neptune Microfloc (Water Boy) package plant, which includes coagulation and multi-media (sand and anthracite) filtration followed by chlorine disinfection.

Raw water is pumped into the Water Boy by a submersible raw water pump located in the wet well. Aluminum sulphate (alum) and a polymer coagulant aid are added to the water prior to the flocculation chamber. The coagulant combines with any substances in the raw water to form floc. The water passes through an upflow settling tube followed by filtration to remove the floc. The filter consists of layers of gravel, sand, and anthracite media. Upon leaving the Water Boy, chlorine is added to the filtered water to provide disinfection before entering the underground clearwell cells.

The plant initiates an automatic backwash when the filter headloss exceeds the setpoint. Water flows back through the filter and clarifier to clean out the accumulated floc. The backwash water is dosed with Vita-D-Chlor for dechlorination (using a dosing pump) and discharged to waste.

Table 6: Process Equipment

System	Make & Model	Design Flow Rate	Comments
Flocculator Drive	Dayton Split Phase Gearmotor Model#:5K933B	-	Drives flocculator mixing
Flocculation	Neptune MicroFloc Model#: W191WB82	270 L/min	Alum and Polymer mixing
Settling	Neptune MicroFloc Model#: W191WB82	270 L/min	Upflow tube settler

System	Make & Model	Design Flow Rate	Comments
Filtration	Neptune MicroFloc Model#: W191WB82	270 L/min	Sand and anthracite filter, gravity fed
Effluent Pump	Franklin Electric Model#: 3642	7.0 L/s	Filter effluent pump
Backwash Pump	Baldor Reliance Industrial Motor Model#: 36H823Y804	-	Automatic backwash triggered by high headloss.
Headloss Indicator	Ashcroft Duralife Model #: 1009	-	Controls the automatic backwash

Table 7: Filter Media

Media	Diameter	Bed Thickness
Anthracite	0.8 – 0.9 mm	Unknown
Sand	0.35mm	Unknown
Gravel	Unknown	Unknown

Table 8: Process Chemicals

Purpose	Brand/Trade Name or Common Name	Chemical	% Strength	Injection Location
Primary coagulant	Alum	Aluminum Sulphate	45 – 55%	Pipe prior to mixing tank
Coagulant-aid	ClearFloc AP1065	Polyacrylamide	-	Mixing tank inlet weir
Disinfection	Hypochlor-12	Sodium Hypochlorite	12%	Potable water pipe post-filter

Table 9: Chemical Feed Equipment

System	Make/Model of Pump	Design Flow Rate (from O&M manual)	Injection Rate
Primary coagulant	ProMinent Fluid Controls model: CONb0300 NPI000D000	8 L/hr @ 0.3 MPa (2.11 gal/hour @ 43.5 psi)	35mL/hr
Polymer	ProMinent Fluid Controls model: CONb0300 NPI000D000	8 L/hr @ 0.3 MPa (2.11 gal/hour @ 43.5 psi)	70mL/hr
Disinfection	Grundfos DDA	2.2 L/hr	150 mL/hr

System	Make/Model of Pump	Design Flow Rate (from O&M manual)	Injection Rate
Dechlorination	Grundfos DDA	2.2 L/hr	7.5L/hr

Table 10: Building and Additional Equipment

System	Make/Model	Operation
Furnace	Granby Furnaces Oil Fired Warm Air Furnace, manufactured 2017 Model#: CONFORTO – FRONT – H/B 3T PSC	Heats the building
Generator	KHD Deutz Type F3L1011 Motor, manufactured 1993 Model#: 8038459	Provides power to the building
Fuel Tank	Westeel Aboveground Steel Tank - ULC certified, 1,135 L, located indoors in secondary containment, manufactured in 1992	Provides fuel to furnace and generator. A separate outside fuel tank provides heating fuel for the garage and was not inspected during the site visit.
Inline Turbidity Meter	Hach 1720E Low Range Turbidimeter	Monitors effluent turbidity after filter
Automatic Transfer Switch	Simson-Maxwell Auto Trans Switch Model#: ATS3100W	Provides automatic power transfer to generator in the event of a power outage

System	Make/Model	Operation
Fuel Level Switch	Magnetrol International Tag#:41-5001-035	Detects level of fuel in the fuel tank
GenSet Controller	Power Plant Control Model#: CCPX3100/EC200	Control system for generator
Electric Heat Trace	920 Digitrace Heat Trace Controller Assembly Model#: 920*E4FWL*SIS302*SS3202	Maintains temperature in water line to prevent freezing
Jar Tester	Phipps & Bird Stirrer Model#: 7790-400	Testing apparatus for flocculation system

2.4 Treated and Fire Water Storage

Treated water is stored in two 90,000-L underground concrete reservoirs with ultrasonic level sensors. The level switches in the water storage initiate water treatment plant operations when a low water level is detected in the clearwell.

On at least one occasion, fuel lines in the plant have cracked and caused fuel to leak through the concrete floor and into one of the treated water storage cells. The cell had to be isolated, drained, cleaned, and sanitized before being put back in service. A crack in the concrete floor was suspected as the primary pathway for the fuel to travel through the floor. In 2014, there was an attempt to repair the crack. However, incorrect mixing of the sealing product caused it to leak through the crack before curing, contaminating the cell. This exacerbated the problem since the crack had to be widened in order to allow for sealing. The crack has not yet been repaired although solutions for repairing the crack and sealing the floor have been discussed. MACA's recommendation is to install epoxy flooring throughout the generator room, extend the flooring a few inches up the walls, and seal it at the edges.

In a fire flow situation the treatment system is bypassed and raw water is drawn directly from the raw water reservoir. There is no dedicated fire storage.

2.5 Truckfill

Two submersible pumps in the clearwell cells are operated by the truckfill control panel located on the outside wall of the building or by controls on the truckfill arm. Chlorine is injected into the truckfill piping during truck filling. The truckfill system is capable of discharging water at a maximum rate of 1000 L/min, but is currently being run at 850 L/min due to water hammer problems that occur at higher flow rates. At 850 L/min, it takes approximately 15 minutes to fill a water truck.

MACA's *Good Engineering Practice for Northern Water and Sewer Systems* recommends a minimum truckfill rate of 1,000 L/min for fire flow. This is based on a 1993 fire prevention study. If 1,000 L/min flow from the water source cannot be achieved, 60,000 L of dedicated fire storage is recommended.

The generator is only capable of running one of the truckfill pumps at a time and is connected to the pump in Cell 1. In an emergency, or if Cell 1 is nearly empty, the pump is manually moved from Cell 1 to Cell 2. A valve controls the connection between the two cells allowing the operators to connect or isolate them, but is corroded.

2.6 Potable Water Distribution

2.6.1 Trucked Delivery

Treated water is delivered by truck to each building. The hamlet has three water trucks, two with a capacity of 12,000 L (2,800 gallons) each and one with a capacity of 9,092 L (2,000 gallons). Delivery takes place 6 days per week. On weekdays, the two 12,000-L trucks are operating and each takes 6 – 7 truckloads over the course of the day. On Saturdays, deliveries are done for the large buildings, such as the Snowshoe Inn. Chlorine levels are tested 1 - 3 times a day to ensure that the minimum required chlorine residual is being maintained. The 9,092-L truck is used as a back-up when water is in high demand. At the end of the delivery day, all three trucks are left full and prepared for deliveries for the next day. The trucks are cleaned once annually in the fall.

2.6.2 Household Water Tanks

Water is stored in tanks at each building. It is the responsibility of the owner to maintain a clean water tank. Instructions for cleaning the water tanks are sent to residents and building owners yearly with their utility bill. The GNWT Department of Health and Social Services recommends household tanks be cleaned at least once per year.

2.7 Water Treatment Plant Building

The water plant has one large room for process equipment and testing and a small generator room with storage shelves for spare parts. The building is heated by a furnace. There is no ventilation apart from a motorized damper in the generator room. There is an 1,135-L fuel tank in the process room just outside the generator room. The tank was installed in 1992 and has secondary containment. A spill kit was

present. When the tank is replaced, it should be replaced with a double-walled tank, which is the current best practice.

The lab area has counter space, a sink, storage cupboards, and an eyewash station. A jar tester is set up in a far corner of the plant along with polymer mixing equipment.

An adjacent detached garage (the former treatment plant) provides parking for one water truck and storage space for chemical barrels.

Table 11: Building Specifications

Component	Description
Year Built	1992
Envelope	Pre-fabricated building
Exterior	Wood Siding
Interior Walls	Metal Cladding
Doors	Steel Doors
Floors	Concrete Floors
Roof	Shingled
Foundation	Concrete, integrated with clearwells

Table 12: Site Detail

Component	Description
Access Road	No road. Direct access off main road
Turnaround	Drive-through
Site Drainage	Unable to assess due to snow cover

Component	Description
Signage	Sign on building and at road
Fence	None – Guardrails only

3.0 OPERATIONS AND MAINTENANCE REVIEW

3.1 Staffing and Training Certification

Clifford Mcleod is the primary operator of the Fort Providence Water Treatment Plant. He holds a Class I Water Facility Operator certification and has also completed WHMIS, Transportation of Dangerous Goods, Supervisory, Confined Space Entry, and First Aid CPR/AED training. He is waiting to take the Class II certification course when it is offered next. Clifford is also the Public Works Foreman and reports to the SAO Susan Christie. He has been employed by the Hamlet of Fort Providence 17 years and has been the primary water treatment plant operator for 6 years.

Dale Vandell is the backup operator for the Fort Providence Water Treatment Plant. He holds a Small Systems certification and is waiting to take the Class I certification course when it is offered next. He has been the backup water treatment plant operator for 2 years.

3.2 Regulatory Compliance

Table 13: Regulatory Requirements for Sampling

Requirement	Status
One monthly raw water bacteriological sample.	In compliance
Monthly treated water bacteriological samples from each truck in use during the month, plus additional samples taken from different public buildings, for a total of at least four samples per month.	In compliance
Three daily treated water chlorine samples. These can be taken from either the treated water storage or the water truck.	2-3 samples per day – see discussion below
One daily raw water turbidity sample.	In compliance

Requirement	Status
Three daily treated water turbidity samples. These should be taken from the treated water storage.	2-3 samples per day – see discussion below
Quarterly treated water trihalomethane (THM) samples, minimum four per year.	In compliance
One annual raw sample for a full suite of chemical and physical parameters.	In compliance
One annual treated sample for a full suite of chemical and physical parameters.	In compliance

Recently, the chlorine and turbidity sampling routine has been two samples in the morning, one from each clearwell, and one occasionally performed in the afternoon. While this does satisfy the regulation of three samples for each, it does not do a thorough job of ensuring the chlorine residual or the turbidity is maintained throughout the day. Additionally, no chlorine samples were being taken from the water trucks. MACA recommends testing chlorine and turbidity in the afternoon to ensure appropriate levels are maintained, provided this change in the sampling routine is acceptable to the EHO. Water trucks that have been left to sit overnight should be tested in the morning prior to delivery.

3.3 Sampling and Testing

Testing is performed at least once a day with the first test being performed in the morning between 8:30 – 9:00 am. Free and total chlorine, turbidity, colour, pH, aluminum, iron and manganese are tested and the results are recorded in a log book. Raw water sampling for turbidity, pH, and aluminum is performed daily, typically around noon. Additional treated water samples are occasionally taken in the afternoon for turbidity, free chlorine, and total chlorine.

Treated water samples are taken from the clearwell cells using a long-handled metal dipper. Samples from both of the clearwell cells are taken and recorded with each test. Raw water samples are taken from a hose connected to the raw water piping line.

Paper towel is being used for wiping sample cells. MACA recommends the use of lab wipes in place of paper towel for handling and cleaning sample cells. Paper towel has a rough surface and can cause microscopic scratches on the cell surface. These scratches interfere with test results.

PPE including nitrile gloves and safety glasses is being used during sampling. Vinyl gloves have been used in the past but are being replaced with nitrile for better protection.

Guideline values for sampling are posted in the lab area and were updated during the site visit.

Table 14: Routine Sampling

Test Parameter	Frequency	Typical Range	Sampled By	Tested By
FAC (Free Chlorine - mg/L):	1 – 3 times Daily	0.25 – 0.7mg/L	Operator	Operator
TC (Total Chlorine - mg/L):	Once daily	0.4 – 0.8mg/L	Operator	Operator
Turbidity (NTU) – Raw	Once daily	1.5 – 10 NTU	Operator	Operator
Turbidity (NTU) – Prior to Nov 2018:	1 – 3 times daily	0.1 – 0.5 NTU	Operator	Operator
Turbidity (NTU) – Post Nov 2018:	1 – 3 times daily	2 – 4 NTU	Operator	Operator
Aluminum – Raw (mg/L)	Once daily	0.006 – 0.01mg/L	Operator	Operator
Aluminum – Treated (mg/L)	Once daily	0.03 – 0.07mg/L	Operator	Operator
Iron – Raw (mg/L)	Once daily	0.05 – 0.09mg/L	Operator	Operator
Iron – Treated (mg/L)	Once daily	0.01 – 0.03mg/L	Operator	Operator
Manganese – Raw (mg/L)	Once daily	0.02 – 0.03mg/L	Operator	Operator
Manganese – Treated (mg/L)	Once daily	0.008 – 0.017mg/L	Operator	Operator
Bacteriological	Monthly		Operator	Lab

Chemical	Yearly	All parameters within regulation	Operator	Lab
Trihalomethanes (THMs) and Total Organic Carbon	Quarterly	0.02 – 0.03mg/L	Operator	Lab

3.4 Record Keeping

Logbooks are kept at the water treatment plant that the operators use to track activities performed each day. Included in the logbooks are samples taken, tests performed along with test results, correspondence with government officials, and any maintenance activities. All entries in the logbooks include dates and times of day in which each event took place. Additionally, maintenance checklists are kept onsite and completed weekly to ensure the regular upkeep of equipment.

Testing results from all chemical, THM, and bacteriological samples are filed at the Hamlet office. A copy of all sampling results is kept by the operator/foreman at the works garage.

Table 15: Water Quality Testing

Parameter	Test Kit	Procedure Followed Correctly?	Comments
Total Chlorine	DPD 10ml Total Chlorine	Yes	None
Free Chlorine	DPD 10ml Free Chlorine	Yes	None
pH	Hach SensION 1	Yes	None
Aluminum	Vario Aluminum ECR	Yes	None
Manganese	Manganese Testing Supplies	N/A	None
Iron	FerroVer Iron Reagent	N/A	None

3.5 System Performance

Table 16: In-Plant Process Control/Optimization

Parameter	Concentration (mg/L)		Frequency of Testing & Recording	Sample Location	Comments (procedures followed correctly, problems, concerns)
	Raw	Treated			
Turbidity	-	2.98	1 – 3 times daily.	Clearwell Cell 1 & 2, Raw water line.	No problems, procedures followed correctly.
Colour	-	23	Once daily.	Clearwell Cell 1 & 2, Raw water line.	No problems, procedures followed correctly.
Aluminum	0.01	0.056	Once daily.	Clearwell Cell 1, Raw water line.	No problems, procedures followed correctly.
Iron	0.01	-	Once daily.	Raw water line.	No problems, procedures followed correctly.
Manganese	0.06	-	Once daily.	Raw water line.	No problems, procedures followed correctly.
pH	7.84	7.23	1 – 3 times daily.	Clearwell Cell 1 & 2, Raw water line.	No problems, procedures followed correctly.
Free Available Chlorine	-	0.34	1 – 3 times daily.	Clearwell Cell 1 & 2.	No problems, procedures followed correctly.
Total Chlorine	-	0.77	1 – 3 times daily.	Clearwell Cell 1 & 2.	No problems, procedures followed correctly.

3.6 Preventive Maintenance and Spare Parts

Preventative maintenance checklists and plant information sheets are located onsite and are filled out monthly. The preventative maintenance checklist includes:

- Scrubbing process equipment
- Snow and ice removal
- Lawn maintenance
- Pressure gauge checks
- Auto dialer tests
- Emergency light tests
- Heat Trace readings
- Fire extinguisher checks
- Heating fuel checks
- Expanded generator check including oil level, transfer switch testing, battery, engine, operating pressure and temperature tests and pilot light checks.

Table 17: Laboratory Equipment

Type	Quantity	Comments
Graduated cylinder	6	100 ml, 50 ml and 25 ml
Beaker	2	1,000 ml
Flask	3	2 x 50 ml, 1 x 125 ml
Scale	2	Electronic Scales
Turbidity Standard Kit	1	Sample cells, reagents, and standards
Testing Reagents	N/A	Sufficient supply of iron, manganese, and chlorine testing reagents and meters
Plastic Containers	2	1 L and 120 ml

Table 18: Water Quality Test Kits

Type	Make/Model	Condition	Comments
pH	Hach SensION 1	Average	None
Turbidity	Hach 2100N Turbidimeter	Average	None
	Newly Purchased Turbidimeter	Brand New	Newly purchased, verified to be in operational condition
Spectrophotometer	Hach DR2800	Average	None

Table 19: Spare Parts Inventory

Components	Spare Parts Onsite
Flocculator	Spare bottom bearing and steel coupling were used in recent repair, no more spares onsite
Filter Media	Several bags of 35mm sand and 1 bag of 0.8mm anthracite
Chemical Injection Pump	2 x Spare DDA Pumps
Disinfectant	0.5 x 114 kg Sodium Hypochlorite
Primary Coagulant	6 x 114 kg Aluminum Sulphate
Coagulant-aid	1 bag of Polymer
Effluent Pump	2 x Spares
Backwash Pump	2 x Spares
Distribution Pump	4 x Flygt Submersible Pumps

Components	Spare Parts Onsite
Flow Meter/Sensor	1 Flow Indicator Sensor
Gauges	Totalizing Monitor
Valves	3 x 7" Float Valves

3.7 Emergency Planning

Treated water storage is sufficient for one day's deliveries. In a state of emergency, water can be purchased and trucked from Hay River.

3.8 Safety

Public Works personnel including operators and water truck drivers meet daily at 8am to discuss work orders and conduct a tailgate/toolbox meeting. An Occupational Health and Safety Plan is being developed with a Yellowknife contractor and is anticipated to be implemented in 2019.

A report from a recent WSCC inspection dated September 12, 2018 noted five safety points that were not being met:

- 1) The required personal protective equipment is not being used.
- 2) The hatches to the reservoir tanks were open.
- 3) Polymer mix residue was located on the back wall and outlet. It was stated that when there is an air lock in the pump the polymer mix spews out.
- 4) A coffee pot, water pot, and coffee were located on the work desk where polymer was poured and measured.
- 5) There is a ventilation system but it is not currently operational. The report clarifies this refers to ventilation for polymer mixing.

These issues appear to be partially resolved. Proper PPE is onsite. The main operator understands how and when to use it properly. He will provide a refresher to the backup operator on safe handling for chemical mixing. The community has been made aware that if the reservoir hatches remain open a railing must be installed; they are normally kept closed. The polymer mix residue was still visible and while no spewing was observed, there was a plastic cup in place to catch leakages. The coffee pot was still located in the plant, but is not operational and should be discarded. The only ventilation system in the building is the motorized damper in the generator room. Operation of the damper was not confirmed. There is no ventilation system in the process room, so it is unclear what the WSCC inspector wants to see repaired. The SDS sheet for ClearFloc AP1065 states that mechanical ventilation should be provided. The SDS

sheets for aluminum sulphate and sodium hypochlorite recommend ventilation in accordance with fire codes and all other regulatory requirements to limit exposure.

Table 20: PPE and Safety Equipment

Item	Quantity	Comments
Safety Training	N/A	Operator has numerous safety training certifications including supervisor training, confined space entry, WHMIS, and dangerous goods. The operator has completed CPR/AED training but certification has recently expired.
First Aid Kit	2	Unopened
Eye Wash	2	Bottles of eyewash
Eyewash Station	1	Water flowed when tested.
SDS	N/A	SDS sheets for reagents and chemicals are in a binder on the bench. There is no SDS for the polymer. SDS sheets are being updated.
Safety Glasses	1	-
Face Mask	1	Need to ensure this is used when mixing polymer.
Gloves	1 1/2 boxes	Vinyl and nitrile gloves used for sampling. Nitrile gloves are recommended. Operator also has a pair of thick rubber gloves for chemical mixing.
Lab Coat	1	-
Step Ladder	1	-
Hard Hat	2	-
Apron	1	-
Respirator	1	-

Item	Quantity	Comments
Ear Muffs	2	-
Fire Extinguishers	4	Two ABC and two CO ₂ , inspected 2018. Note: ABC extinguishers can react explosively with chlorine and are not recommended in water treatment plants.

3.9 Treatment System Review

3.9.1 Condition Assessment

The treatment equipment is likely beyond its design life. Until recently, water quality has been acceptable. Recently, turbidity has been above guidelines. There is rust on some components and minor issues such as sticking of float valves have been noted. The backwash does not always run automatically, suggesting an issue with the vacuum switch. This could also be connected to the current filter underdrain issues and might be resolved when that repair is completed.

The building appears to be in reasonable condition. Minor repairs are needed to the siding, paint, flashing, and floors. The furnace is new, replaced in 2017. Guard rails or chains are needed around the well hatches if the operators intend to continue leaving the hatches open.

3.9.2 WTP Capability (Treatment)

Until recently, the water treatment plant has been capable of producing water that meets drinking water guidelines. Turbidity has been just below the turbidity guideline of 0.3 NTU, with occasional exceedances. Recently the turbidity has been well over the guideline.

3.9.3 WTP Capability (Quantity)

The plant is capable of producing enough water to keep the community supplied with potable water. The treated storage cells are large enough to hold a one-day supply.

3.10 Guidelines for Canadian Drinking Water Quality Compliance

Parameters of specific concern for the Fort Providence WTP are:

- Turbidity
- Free Available Chlorine
- Aluminum
- Manganese
- Iron

Table 21: GCDWQ Parameters

Parameter	GCDWQ Value	Typical Readings	Comments
Turbidity (Prior to Nov 2018)	Chemically assisted filtration: ≤ 0.3 NTU in at least 95% of a) measurements made or b) the time each calendar month; never to exceed 1.0 NTU	0.1 – 0.5 NTU	Indirect associations: particles can harbour microorganisms, protecting them from disinfection, and can entrap heavy metals and biocides; elevated or fluctuating turbidity in filtered water can indicate a problem with the water treatment process and a potential increased risk of pathogens in treated water.
Turbidity (Post Nov 2018)	Chemically assisted filtration: ≤ 0.3 NTU in at least 95% of a) measurements made or b) the time each calendar month; never to exceed 1.0 NTU	2 – 4 NTU	The filter has been failing to remove floc and sediment from the treated water leading to floc infiltrating the 1720 Turbidimeter post filtration and the clearwells. This has caused high turbidity in the treated water.
Free Chlorine (treated water)	Free chlorine concentrations in most Canadian drinking water distribution systems range from 0.04 to 2.0 mg/L. (Note: 0.2 mg/L required by the NWT HSS)	0.25 – 0.75 mg/L	Chlorine is the disinfectant for treated drinking water and proper chlorination is necessary to safeguard the community against water-borne disease. No testing samples indicate concern for low chlorine.

Parameter	GCDWQ Value	Typical Readings	Comments
Aluminum (treated water)	< 0.1 mg/L (conventional treatment); Operational Guideline	0.03 – 0.075 mg/L	The guideline for aluminum applies to plants using aluminum based flocculation processes which this plant does. Meeting the guideline ensures the aluminum injected into the water is being filtered out during the process. The plant is meeting the aluminum guideline value and there is no concern.
Manganese (treated water)	< 0.05 mg/L (Aesthetic Objective)	0.001 – 0.02 mg/L	High manganese content in treated water leads to staining of laundry and plumbing fixtures. This guideline is aesthetic. Regular manganese content in the treated water is below guidelines.
Iron (treated water)	< 0.3 mg/L (Aesthetic Objective)	0.01 – 0.03 mg/L	High iron content in treated water leads to staining of laundry and plumbing fixtures. No evidence of dietary iron toxicity exists for the general population so this guideline is aesthetic. Regular iron content in the treated water is below guidelines.

For treated water turbidity the GCDWQ states that turbidity must be measured ≤ 0.3 NTU in at least 95% of measurements made or each calendar month.

Sampling records from 2015-2018 showed an average turbidity of 0.268 NTU prior to the end of October 2018, with a minimum of 0.079 and a maximum of 1.26 NTU. During November, there was an unusual increase in turbidity. The turbidity rose from 0.35 NTU to a maximum of 4.2 NTU through the month. There was no regular sampling in December. Samples tested by MACA during the site visit had turbidity levels of 2.92 and 3.09 NTU in the morning, and 2.35 NTU in the afternoon.

3.11 Operational Issues

Turbidity levels have been higher than usual during November and December. The operators were concerned that the Hach 2100N Turbidimeter was out of calibration due to consistently high turbidity readings. The turbidity readings were compared with a handheld meter owned by MACA and found to

match. The high turbidity therefore indicates an issue with the filter. The community had already ordered a second turbidimeter and now has two operational units.

The presence of floc was noted in the inline turbidity meter after the filter. It is likely that floc is passing through the filter and into the clearwell. The O&M manual advises manual backwashing and increasing the polymer dosage. Dosage adjustments and backwashing as recommended in the O&M manual have been ineffective in solving the issue. During the site visit, jetting of media was noted during backwashing, and a crater was present after backwashing on several occasions. This likely indicates a failure of the filtration system underdrain or lower layers. Based on the available logs, the media has not been completely replaced since 2002. In order to resolve this issue, the media should be replaced by a specialist firm. MACA has agreed to assist the Hamlet in procurement of a specialist consultant with the appropriate expertise. Quotes were sought from several companies, and a separate briefing has been prepared for the Hamlet Council. This work should be completed as soon as possible, as the high turbidity level can interfere with disinfection.

3.12 Operator-Identified Issues

- Mineral oil leaks into the clearwell from the pump and creates a film on top of the water. Water for the truckfill is taken from the bottom of the reservoir so there is no immediate concern, but when there is too much oil it requires pumping out. The EHO has been notified and does not consider this a health concern.
- The floater that controls the process rate gets stuck and causes the process water flowrate to be high.
- The backwash cycle is sometimes not started automatically and a manual backwash has to be run. The top few inches of media are stirred during the manual backwash. This practice should be reviewed with the media specialists.
- The fitting at the bottom of the flocculator wore out and the impeller fell off. A spare was available and the old one was replaced.
- Increasing the truckfill flowrate above 850 L/min causes water hammer.
- Fort Providence would like to be added to MACA's circuit rider program. The plant used to receive more frequent visits prior to Vincent Tam's retirement.

4.0 RECOMMENDATIONS

4.1 Meeting Expectations (Successes)

The operators are doing an excellent job of tracking all work and sample testing they do each day. The operator log books are very thorough and include the times and dates they clean the instruments, update checklists, and they include all data they gather from their daily samples. The operators have stayed in contact with the regional EHO and notify him when issues arise (for example the mineral oil leak) to provide input or ensure operation is still safe.

The operators have an ongoing preventative maintenance check list that they use to ensure they are staying current with cleaning sensors, calibrating equipment, and ensuring the plant remains fully stocked in all essential equipment.

When asked about the operation of the water plant and the trucked distribution systems the operators were able to answer all questions clearly, confidently, and accurately. It is clear they are knowledgeable about their work and have the knowledge and skills to maintain and operate the water treatment system.

The operators' response to the high turbidity situation included notifying the EHO, more frequent backwashing, dosage adjustments, and verification of the turbidimeter. These steps were a very good start towards fixing the problem, and in most cases the turbidity probably would have returned to normal levels after this. In this case, the problem is more serious and the repair requires specialist assistance that is beyond what the operators can be expected to provide. In future, MACA's Water and Sanitation group can also be contacted for technical advice.

Including the water tank cleaning information with the utility bills annually is a great idea and should be continued.

4.2 Areas Requiring Improvement

1. Recently, chlorine tests have only been performed once a day, or occasionally twice. Regulations state that there must be three chlorine tests on treated water daily as well as three turbidity tests.
2. No chlorine tests are being performed on water from the water trucks, which sometimes sit full all weekend. A chlorine sample from the truck would help provide proof that the free chlorine residual is being maintained.
3. Regular use of proper PPE when handling chemicals and performing sample tests is a simple way to prevent workplace injury.
4. Some of the issues in the WSCC report are still present. Tending to these issues will improve workplace safety.

5. The turbidity in the clearwell has been rising steadily and is now consistently above Canadian Drinking Water Quality Guidelines.
6. The process equipment is still operating but may be reaching the end of its life cycle.
7. The generator room floor is not sealed against fuel leakage and provides a constant possibility of clearwell cell contamination.

4.3 Action Plan and Resources

Table 22: Community Action Plan Update

#	Action	Priority	Time Frame	Lead	Status
1	Increase sampling frequency to meet regulations.	Medium	Immediate	Operators	Started
2	Consistent use of PPE.	High	Immediate	Operators	Started
3	Improve turbidity – media replacement and underdrain repairs by specialist firm.	High	Attempt process adjustments in December, proceed with investigations in January if still not in compliance.	Hamlet with MACA assistance.	Council has approved the expenditure. A specialist firm has been procured.
4	Upgrade operator certification.	Medium	Courses normally offered each year	Operators/SAO	When available
5	Repair and seal generator room floor.	Medium	As time/budget permits	Operators/SAO	When plant upgrade work is being done
6	Update SDS sheets (available from manufacturer on request)	Medium	As soon as practical	Operators/SAO	Started
7	Fix issues identified by WSCC.	Medium	As soon as practical	Operators/SAO	Started
8	Fix water hammer problem to return flowrate to 1000 L/min.	Medium	To be determined	Operator/MACA	Waiting on MACA

Table 23: GNWT Action Plan Update

#	Action	Priority	Time Frame	Lead	Status
1	Assist with turbidity investigation and procurement	High	Attempt process adjustments in December, proceed with investigations in January if still not in compliance.	Jaime Goddard	Procurement done.
2	Provide summary for presentation to Council to guide decision-making.	High	Draft provided December 2018, to be updated with quotes early January.	Jaime Goddard	A summary of the issue has been written for presentation to Council.
3	Add Fort Providence to circuit rider program if possible.	Medium	To be determined.	MACA	Not started.
4	Find a solution to the water hammer problem, with the assistance of the Department of Infrastructure Technical Services.	Medium	To be determined.	MACA	Not started.

The WTP process equipment is reaching the end of its service life. If the community wishes to continue using the existing WTP, a number of refurbishments will be required in the next few years. The following list of upgrades should help the community understand what would be required in the coming years to maintain their water treatment plant.

Table 24: Upgrades Needed to Keep Plant Operational

Immediate Upgrades	
1	Repairs to filter and underdrain system
2	Replacement of leaking truckfill pump

3	Replace probe in inline chlorine meter
Short Term Upgrades (within 2 years)	
1	Replacement of problematic valves, switches, and floats
2	Investigation of water hammer issue occurring when truckfill is run at 1000L/min
3	Building exterior repairs (siding, paint, etc)
4	Flooring upgrade in the generator room
Medium Term Upgrades (within 5 years)	
1	Add inline raw water turbidity measurement
2	Tie inline meters into a new PLC system
3	Refurbishment of all process equipment including recoating the inside of the water boy
4	Replace inline chlorine meter
5	Interior painting (floors, piping, etc)

APPENDIX A: PHOTOS



Photo 1: Water Treatment Plant exterior



Photo 2: Water Treatment Plant interior, Waterboy



Photo 3: Waterboy from top



Photo 4: Filter bed after backwashing, crater on right (same as Photo 5, different angle)



Photo 5: Filter bed after backwashing, crater on left (same as Photo 4, different angle)



Photo 6: Floc inside turbidity meter after filter



Photo 7: Jar testing equipment, coffee maker noted in WSCC report



Photo 8: Storage in generator room



Photo 9: Floor crack



Photo 10: Lab area



Photo 11: Exterior paint peeling



Photo 12: Exterior siding missing

APPENDIX B: CHEMICAL DISPOSAL INFORMATION

Reference Guide for the Disposal of Expired Water Treatment Plant Chemicals and Containers

Note: These procedures only apply to chemicals at your local water treatment plant. Do not apply these methods to household chemicals or chemicals located in other facilities in your community.

Cleaning and Disposal of Containers

Check the SDS for the material for safe handling procedures and appropriate cleaning agents. Empty the container as much as possible and rinse three times with the cleaning agent listed in the SDS.

After cleaning, the container can be safely disposed of at the local waste site. DO NOT reuse containers for food or for water collection or storage.

Larger containers, such as chlorine drums, can sometimes be shipped back to the manufacturer.

Disposal of Chemicals

Check the SDS for safe handling procedures.

The disposal of hazardous chemicals is outlined in the Guideline for Hazardous Waste Management in accordance with the GNWT's Environmental Protection Act.

The Guideline for Hazardous Waste Management can be found at the following link:
http://www.enr.gov.nt.ca/sites/enr/files/resources/128-hazardous_waste-interactive_web.pdf

Additional information can be found by contacting the GNWT's Department of Environment and Natural Resources (ENR), or at the following link:
<http://www.enr.gov.nt.ca/en/services/hazardous-waste>.

Chemical	Disposal Method
<u>Turbidity standards</u>	
Stablcal Formazin Standard 0 NTU	Turn on the cold water and slowly pour the chemical down the drain with the water running.
Stablcal Formazin Standard 20 NTU	<p>Step 1: Dilute the chemical by adding 1L (1000mL) of water for every 50ml of reagent. To do this, measure the amount of chemical you have in mL. Divide this number by 50, then multiply by 1000. The answer is the amount of water to add, in mL.</p> <p>Step 2: After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running. Let the cold water run for another 5 minutes to completely flush the pipes.</p>
Stablcal Formazin Standard 1000 NTU	<p>Step 1: Dilute the chemical by adding 1L (1000mL) of water for every 50ml of reagent. To do this, measure the amount of chemical you have in mL. Divide this number by 50, then multiply by 1000. The answer is the amount of water to add, in mL.</p> <p>Step 2: After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running. Let the cold water run for another 5 minutes to completely flush the pipes.</p>
<u>pH standards</u>	
Buffer Solution pH 4.01 (red)	Adjust to a pH between 6 and 9 by mixing with pH 10.01 Buffer Solution. After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running.
Buffer Solution pH 7.00 (yellow)	Turn on the cold water tap and slowly pour the chemical down the drain with the water running.
Buffer Solution pH 10.01 (blue)	Adjust to a pH between 6 and 9 by mixing with pH 4.01 Buffer Solution. After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running.
Aluminum Chlorhydroxide (KLARAID IC1172)	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.

Sodium Hypochlorite (12%) or bleach	<p>Expired chlorine is safe to keep using. Increase the dosage to make sure the target chlorine residual is being met. It can also be used for cleaning the water plant floors, similar to household bleach.</p> <p>If it needs to be disposed of, it can be taken to the local waste site in batches no greater than 5kg (11 lbs) per month.</p>
Citric Acid 50%	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.
Sodium Hydroxide	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.
Vita-D-Chlor	Turn on the cold water tap and slowly pour the chemical down the drain with the water running.
Free Cl Reagent	<p>Step 1: Dilute the chemical by adding 250mL of water for every 50ml of reagent. To do this, measure the amount of chemical you have in mL. Divide this number by 50, then multiply by 250. The answer is the amount of water to add, in mL.</p> <p>Step 2: After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running. Let the cold water run for another 5 minutes to completely flush the pipes.</p>
Total Cl Reagent	<p>Step 1: Dilute the chemical by adding 250mL of water for every 50ml of reagent. To do this, measure the amount of chemical you have in mL. Divide this number by 50, then multiply by 250. The answer is the amount of water to add, in mL.</p> <p>Step 2: After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running. Let the cold water run for another 5 minutes to completely flush the pipes.</p>
Iron Reagent	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.

Manganese Calibration Standard Solution	<p>Step 1: Dilute the chemical by adding 250mL of water for every 50ml of reagent. To do this, measure the amount of chemical you have in mL. Divide this number by 50, then multiply by 250. The answer is the amount of water to add, in mL.</p> <p>Step 2: Neutralize with provided neutralization chemical.</p> <p>Step 3: After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running. Let the cold water run for another 5 minutes to completely flush the pipes.</p>
Aluminum Calibration Standard Solution	<p>Step 1: Dilute the chemical by adding 250mL of water for every 50ml of reagent. To do this, measure the amount of chemical you have in mL. Divide this number by 50, then multiply by 250. The answer is the amount of water to add, in mL.</p> <p>Step 2: Neutralize with provided neutralization chemical.</p> <p>Step 3: After mixing, turn on the cold water tap and slowly pour the diluted chemical down the drain with the water running. Let the cold water run for another 5 minutes to completely flush the pipes.</p>
Coagulant – Aluminum Sulfate	<p>If possible, use up in the treatment process rather than disposing of chemical.</p> <p>If disposal is necessary, chemical must be shipped out to a registered disposal site. Contact ENR for proper disposal instructions.</p>
Coagulant – Poly-Aluminum Chloride	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.
Coagulant Aid	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.
Colilert Reagent	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.
Colilert Comparator	Dispose of at local waste site in batches no greater than 5kg (11 lbs) per month.

APPENDIX C: BATCH CHLORINATION PROCEDURES

MUNICIPAL BATCH CHLORINATION PROCEDURES

'Batch Chlorination' is done with regular unscented household bleach, which contains about 5% chlorine. Always use regular unscented household bleach without fabric softeners. Always check that the label to ensure that the chlorine concentration is about 6.25%. Add the bleach to the top of the truck tank and mix or circulate the water in the tank using the truck recirculation pump. If there is no pump or it is not working, then run the fill hose from the back of the water tank to the top of the tank and use the fill pump to circulate the water. All table amounts are approximate and the amount of bleach you are adding to your water truck tank may be different depending on the:

- Raw water quality (more bleach may be needed during spring run-off for example).
- Size of the water tank on your truck and the level of water in the tank.
- Length of time the water truck has sat (overnight for fire protection for example).
- How clean or dirty your truck is.
- Age of the bleach you are using for treatment.

STEPS FOR BATCH CHLORINATION

- 1) Add recommended amount of bleach for every thousand liters in water truck. (Refer to Table 1).
- 2) Mix or circulate water in the truck for 20 minutes.
- 3) Record the amount of bleach added and the Free Available Chlorine (FAC) reading on the 'Batch Chlorination Log Sheet'.
- 4) If FAC is still too low, repeat Steps 1, 2, 3 and 4.

NORMAL OPERATING PROCEDURES

- **Truck just filled 20 minutes ago and FAC is less than 0.4 mg/L**
After the truck is filled, wait 20 minutes then test the FAC. If FAC is less than 0.4 mg/L, you have to add more bleach. The lower the FAC, the more bleach you will need. Old bleach, a dirty truck, or poor water conditions may require more bleach than used in table 1. Use Table 1 and follow the Steps for Batch Chlorination.
- **Truck sat full overnight for fire protection, and FAC is less than 0.2 mg/L**
Since the truck has already sat for several hours overnight, the chlorine has had lots of time to do its job. An FAC of 0.2 mg/L is fine in this case. If the FAC is below 0.2 mg/L, then further treatment is required. Use Table 1 and follow the Steps for Batch Chlorination.

Table 1: Normal Batch Chlorination Guideline for 1000 L of Water

FAC Level in Water Truck (mg/L)	Volume of Bleach added to every 1000 L of Water in truck capacity (mL - approx.)
Less than 0.05	10
0.05 - 0.10	9
0.10 - 0.15	8
0.15 - 0.20	7
0.20 - 0.25	6
0.25 - 0.30	5
0.30 - 0.35	4
0.35 - 0.40	3

For Example: If your water truck is 3,400L and 20 minutes after fill-up the FAC is 0.12mg/L, 27mL(8mLx3.4) of chlorine is needed for the truck to have a FAC of 0.4mg/L. Once this is added, re-circulate the water and wait 20 minutes before testing of FAC and then deliver the water if it is 0.4 or above.