National Assessment of First Nations Water and Wastewater Systems

Atlantic Regional Roll-Up Report
FINAL

Department of Indian Affairs and
Northern Development

January 2011

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Department of Indian and Northern Affairs Canada

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Prepared for:

Department of Indian and Northern Affairs Canada

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Statement of Qualifications and Limitations for Regional Roll-Up Reports

This regional roll-up report has been prepared by Neegan Burnside Ltd. and a team of sub-consultants (Consultant) for the benefit of Indian and Northern Affairs Canada (Client). Regional summary reports have been prepared for the 8 regions, to facilitate planning and budgeting on both a regional and national level to address water and wastewater system deficiencies and needs.

The material contained in this Regional Roll-Up report is:

- preliminary in nature, to allow for high level budgetary and risk planning to be completed by the Client on a national level.
- based on a compilation of the data and findings from the individual community reports prepared and issued for a specific region.
- not proposing to identify the preferred solution to address deficiencies for each community. Rather this report will identify possible solution(s) and probable preliminary costs associated with solution(s) presented in greater detail in the community reports. Community specific studies including more detailed evaluation will be required to identify both preferred solutions and final costs.
- based on existing conditions observed by, or reported to the Consultant. This assessment does not wholly eliminate uncertainty regarding the potential for costs, hazards or losses in connection with a facility. Conditions existing but not recorded were not apparent given the level of study undertaken.
- to be read in the context of its entirety.
- not to be used for any purpose other than that agreed to with the Client. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Any other user specifically denies any right to claims against the Consultant, Sub-Consultants, their Officers, Agents and Employees.

Risk as it pertains to health and safety issues and building code compliance is based upon hazards readily identifiable during a simple walk through of the water and wastewater facilities, and does not constitute a comprehensive assessment with regard to health and safety regulations and or building code regulations.

The Consultant accepts no responsibility for any decisions made or actions taken as a result of this report.

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1.0 Introduction

The Government of Canada is committed to providing safe, clean drinking water in all First Nations communities, and to ensuring that wastewater services in all First Nations communities meet acceptable effluent quality standards. As part of this commitment, the Government announced the First Nations Water and Wastewater Action Plan (FNWWAP). The plan funds the construction and renovation of water and wastewater facilities, operator training, and public health activities related to water and wastewater on reserves. It also provided for a national, independent assessment – *The National Assessment of First Nations Water and Wastewater Systems* – which will inform the Government's future, long-term investment strategy. This assessment was also recommended by the Senate Standing Committee on Aboriginal Peoples.

The purpose of the *National Assessment* is to define the current deficiencies and the operational needs of water and wastewater systems, identify the long-term water and wastewater needs of each community and recommend sustainable, long-term infrastructure development strategies.

The objectives of the *National Assessment* are to:

- Identify which upgrades will be required for existing public systems to meet INAC's *Level of Service Standards*; INAC's *Protocol for Safe Drinking Water in First Nations Communities*; INAC's *Protocol for Wastewater Treatment and Disposal in First Nations Communities*; and applicable provincial regulations, codes, and standards

- Complete the Annual Inspection, Risk Assessment and Asset Condition Reporting Systems (ACRS) assessment for water and wastewater assets

- Conduct an overall community serviceability assessment of private, on-site communal and/or central systems

- Prepare Class "D" cost estimates for each of the communities visited. Class "D" estimates are preliminary, and are based on available site information. They indicate the approximate magnitude of the cost of the recommended actions, and they may be used to develop long-term capital plans. In addition, these estimates may be used in preliminary discussions of proposed capital projects.

This assessment involved collecting background data and information about each community, undertaking a site visit, and preparing individual community reports for each participating First Nation. Neegan Burnside Ltd. and its sub-consultants conducted an assessment for each of the eight regions. This report summarizes the findings for the Atlantic region.

1.1 Site Visits

Site visits in the Atlantic Region were undertaken by personnel from Neegan Burnside Ltd. and sub-consultants, R.J. Burnside & Associates Limited and XCG Consultants Ltd. during September and October of 2009 and May, June and July of 2010. Each visit included at least two team members. In addition to the consultant staff, additional participants including the Circuit Rider Trainer (CRT), INAC Representative, Environmental Health Officer (EHO) from Health Canada and Tribal Council Representative were invited to attend the site visits. The additional participants that were able to attend are identified in each community report.

After confirming the various components that the First Nation uses to provide water and wastewater services to the community (i.e. number and types of systems, piping, individual systems, etc.) along with population and future servicing needs (planned development and population growth), an assessment was carried out of the water and wastewater systems, as well as 5% of the individual systems.

1.2 Reporting

Individual Community Reports have been prepared for each First Nation. In cases where the First Nation consisted of more than one community located in geographically distinct areas, a separate report was prepared for each community. In the Atlantic Region, there was 100% participation from the 33 First Nations, which resulted in the preparation of 35 individual community reports. Figure 1.1 indicates the location of each First Nation visited as a part of this study.

The reports include an assessment of existing communal and individual systems, identification of required upgrades to meet Departmental, Federal and Provincial protocols and guidelines, and an assessment of existing servicing of the community along with projections of population and water and wastewater flows for future servicing for the 10 year period. Each report includes the projected costs for the recommendations to meet departmental protocol, federal and provincial guidelines, and an evaluation of servicing alternatives along with life cycle costing for each feasible alternative.

The appendices of each report also include an annual water inspection, a risk evaluation, and an Asset Condition Reporting System inspection for each system.

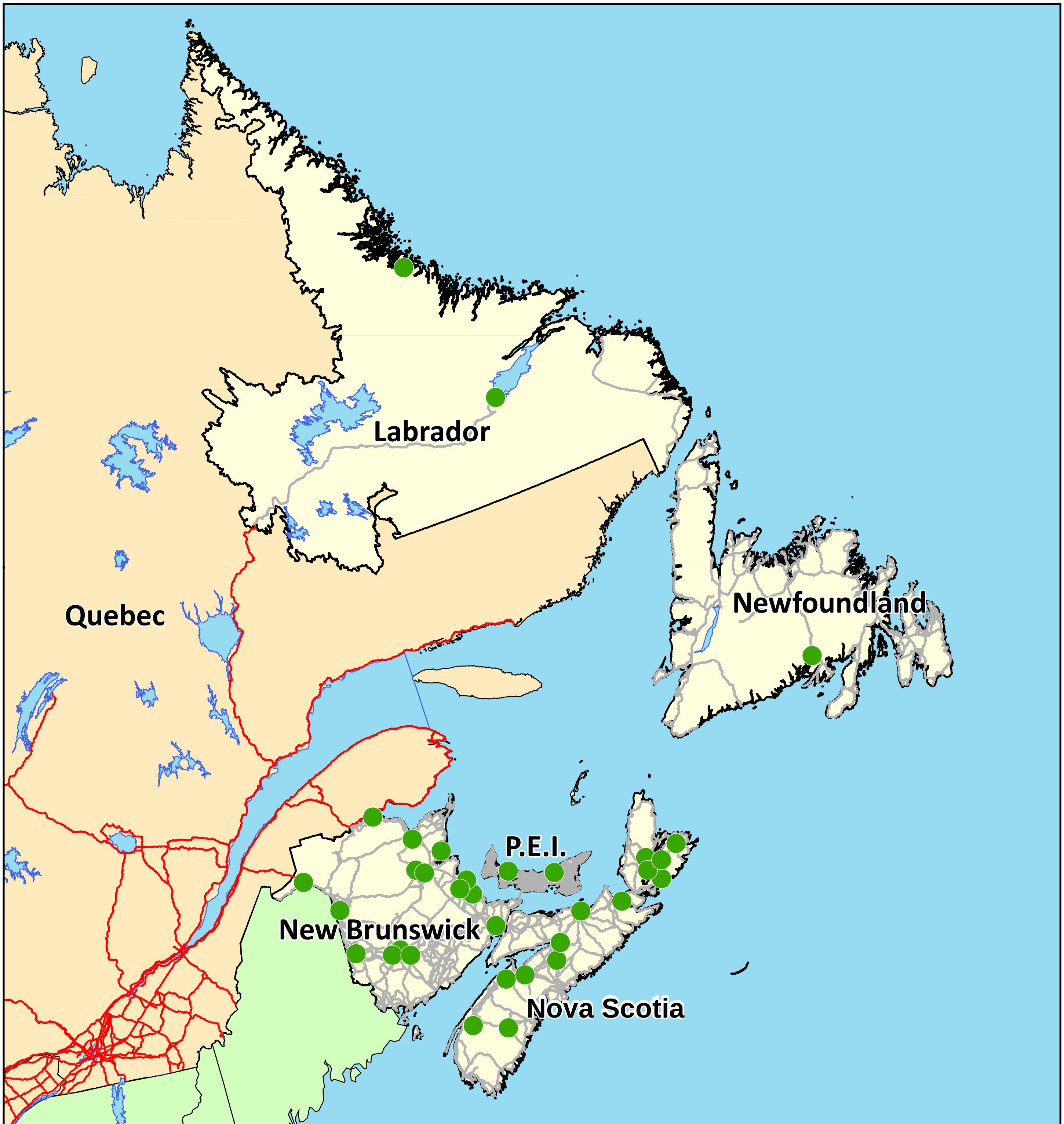

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Figure 1.1 - Atlantic First Nations Visited

- Atlantic First Nations (Visited)
- Atlantic Roads
- Major National Roads
- Major Lakes

N

0 50 100 150 200 250
Kilometers

NOTES

This map has been compiled with data of varying scale and accuracy.This is not a plan of survey.

SOURCES

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2.0 Regional Overview

The Atlantic region includes 33 First Nations in four provinces: 15 First Nations are in New Brunswick, 13 are in Nova Scotia, 2 are in Prince Edward Island, and 3 are in Newfoundland and Labrador. There are 35 water systems, including 26 First Nations and 9 Municipal Type Agreements. There are 28 wastewater systems, including 19 First Nations and 9 Municipal Type Agreements.

A water or wastewater system considered a First Nation system, consists of INAC-funded assets, and serves five or more residences or public facilities. A Municipal Type Agreement (MTA), on the other hand, is when First Nations are supplied with treated water from or send their wastewater to a nearby municipality or neighbouring First Nation or corporate entity as outlined in a formal agreement between the two parties.

The First Nation communities' population ranges from 35 to 3,700 people, and household sizes range from 1.6 to 6.0 people per unit (ppu). The total number of homes is 6,838, and the average household size in the Atlantic region is 3.5 ppu.

2.1 Water Servicing

There are a total of 35 water systems serving 31 of the 33 First Nations communities. The remaining two First Nations are serviced solely by individual wells. Of the 31 First Nations with water systems, 9 receive their water supply through a Municipal Type Agreement (MTA). The remaining 22 First Nations are serviced by 26 water systems, including 20 groundwater systems, 3 GUDI (groundwater under the direct influence of surface water) water systems, and 3 surface water systems.

For water distribution, 94% of the homes (6,415) are piped and 6% (423) are serviced by individual wells. None of the communities within the Atlantic region rely on truck haul for the distribution of potable water. The majority of the homes serviced by individual wells are located within two communities.

Table 2.1, below, provides an overview of the water systems by system classification, source type, treatment type and storage type.

In general, the treatment system classification reflects the complexity of the treatment. Those labeled as "Small System" and "None" represent groundwater systems with disinfection only. The system classification follows the regulations of the appropriate province; the classification definitions for small systems are not the same for every province within the Atlantic region. The distribution classification depends on the population serviced.

Table 2.1 - Water Overview

System Classification	No.	% of Total
None	18	51%
Small System	1	3%
Level I	2	6%
Level II	5	14%
MTA	9	26%

Source Type	No.	% of Total
Groundwater	20	56%
Surface Water	3	9%
Groundwater GUDI	3	9%
MTA	9	26%

Storage	No.	% of Total
None	15	43%
Elevated	5	14%
Standpipe	5	14%
Grade level	4	11%
Underground	6	18%

Treatment Type	No.	% of Total
None - Direct Use	2	6%
Disinfection Only	16	45%
Greensand Filtration	4	11%
Conventional	1	3%
Slow Sand	1	3%
Membrane Filtration	2	6%
MTA	9	26%

2.2 Wastewater Servicing

There are a total of 28 wastewater systems that serve 26 of the 33 First Nations. The remaining 7 First Nations are serviced solely by individual septics. Of the 26 First Nations with wastewater systems, 9 are connected to a nearby municipality, which receives and treats the wastewater from the First Nation under a Municipal Type Agreement. The remaining 17 First Nations are serviced by 19 wastewater systems: 13 systems use either facultative or aerated lagoons, 5 systems use a mechanical plant, and 1 system uses a communal septic system.

For wastewater collection, 90% of the homes (6,132) are piped and 10% (703) are serviced by individual systems. A total of three homes rely on truck haul for sewage collection.

The following table provides an overview of the wastewater systems by system classification and treatment type.

Table 2.2 - Wastewater Overview

System Classification	No.	% of Total
Small System	1	4%
Level I	10	35%
Level II	7	25%
Level III	1	4%
MTA	9	32%

Treatment Type	No.	% of Total
Aerated Lagoon	7	25%
Facultative Lagoon	6	21%
Mechanical Treatment	5	18%
MTA	9	32%
Septic System	1	4%

3.0 Preliminary Results and Trends

3.1 Per Capita Consumption and Plant Capacity

For the 10 communal water systems that provided historical flow data, the average per capita demand ranged from 159 L/p/d to 753 L/p/d, with an average per capita demand of approximately 290 L/p/d.[1]

Historical flow records for water systems were not available for the nine First Nations serviced by a Municipal Type Agreement or for 16 of the First Nations with communal water systems. For these First Nations, an average per capita flow rate of 325 L/p/d was used to evaluate the water systems.

The distribution of per capita flow is outlined in Table 3.1. The distribution includes the 25 systems with an assumed per capita demand of 325 L/p/d.

Table 3.1 - Range of Per Capita Water Usage Rates

	No. of systems 2009
Less than 250 L/c/d	1
250 L/c/d to 375 L/c/d	32
Greater than 375 L/c/d	2

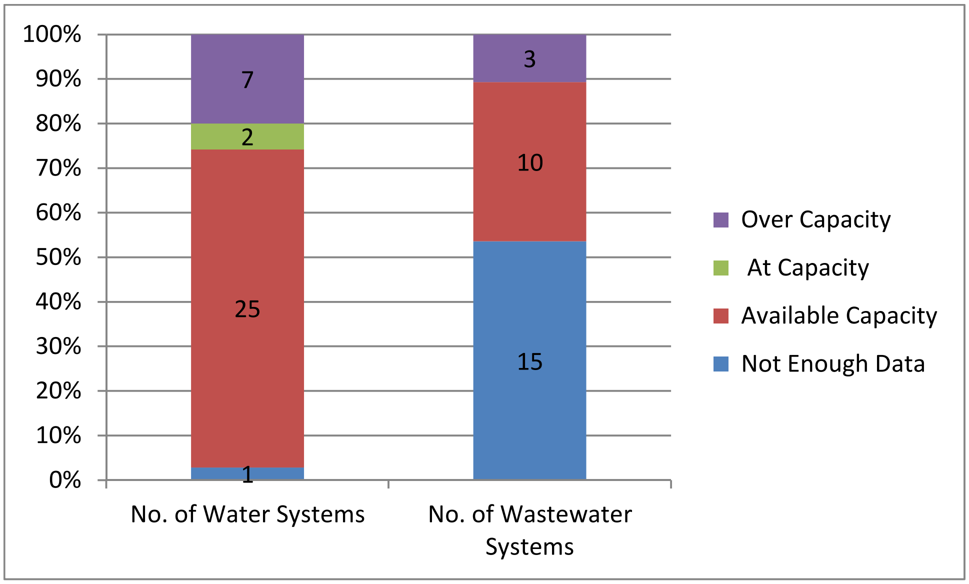
Historical flow data for wastewater was not available for most of the sewage systems. Therefore, to evaluate the ability of the existing infrastructure to meet the current and projected need, the average daily flow was calculated based on the actual or assumed per capita water consumption, plus an infiltration allowance of 90 L/p/d.

The following figure provides a summary of the water and wastewater treatment capacities for the 33 First Nations:

- over capacity: The existing system is unable to meet the current needs
- at capacity: The existing system is able to meet the current needs
- available capacity: The existing system has sufficient capacity to meet more than the current needs
- not enough data: There is insufficient data to determine the actual system capacity.

[1] By comparison, according to Environment Canada (2004), the average per capita consumption across Canada is 329 L/c/d.

Figure 3.1 - Water and Wastewater Treatment Capacities



The data collected shows that 9 water systems and 3 wastewater systems are operating at or beyond their estimated capacities. For the plants identified as over capacity, the per capita demand is within typical values for the region, according to available records.

3.2 Distribution and Collection

The household size for the 33 First Nations ranges from 1.6 to 6.0 people per unit (ppu), with an average size of 3.5 people per unit.[2] The total number of piped connections in the region is 6,415 for water and 6,132 for wastewater. The average length per connection of watermain is approximately 33 m while average length per connection of sewer main is 26 m.

For communities with a population over approximately 1,200 people, the average length per connection is 30 m, while communities with less than 1,200 people have an average length per connection ranging between 15 m and 130 m for water, and 15 m to 100 m for wastewater. In some cases, the average length includes dedicated transmission main lengths with no service connections and non-distribution mains (i.e. intake pipes, raw water pipes). As a result, the average length per connection in these cases would be inflated, particularly for smaller communities where the additional pipe length is spread over a smaller number of connections.

The table below indicates the number of water and wastewater systems that have pipe lengths above and below 30 m/connection. It should be noted that this information was not available for all of the systems.

[2] By comparison, the average Canadian household size in 2009 was 2.5 people per unit according to Statistics Canada.

Table 3.2 - Average Water Distribution and Wastewater Collection Pipe Lengths

	Watermain	Sewer
Average m/connection	33	26
No. of systems with pipe lengths above 30 m/connection	21	9
No. of systems with pipe lengths below 30 m/connection	13	17

Figure 3.2 - Water Distribution - Average Pipe Length per Connection

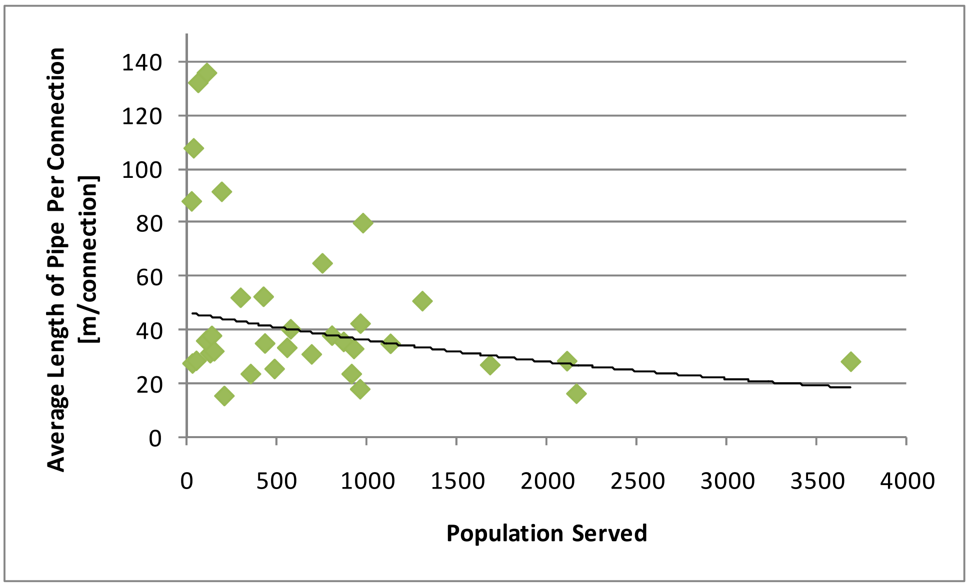
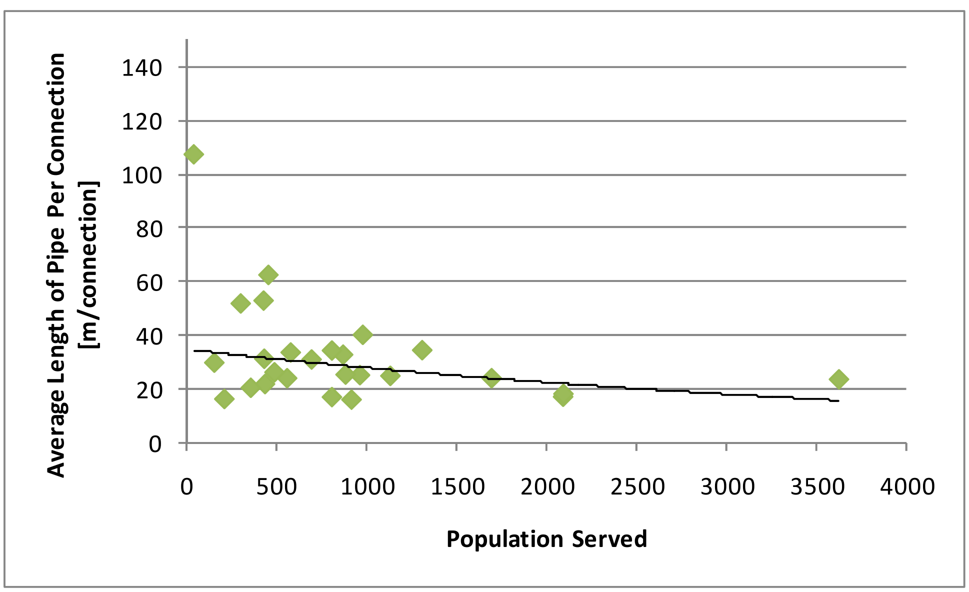


Figure 3.3 - Wastewater Collection - Average Pipe Length per Connection



3.3 Water Risk Evaluation

A risk assessment has been completed for each water system according to the INAC *Risk Level Evaluation Guidelines*. Each facility is ranked in risk according to the following categories: Water Source, Design, Operation (and Maintenance), Reporting and Operators. The risk levels of all five categories are then used to determine the overall risk for the system.

Each of the five risk categories, as well as the overall risk level of the entire system, is ranked numerically from 1 to 10. Low, medium and high risks are defined as follows:

- **Low Risk (1.0 to 4.0):** These are systems that operate with minor deficiencies. Low-risk systems usually meet the water quality parameters that are specified by the appropriate Canadian Guidelines for drinking water (in particular, the *Guidelines for Canadian Drinking Water Quality* (GCDWQ)).
- **Medium Risk (4.1 to 7.0):** These are systems with deficiencies, which—individually or combined— pose a medium risk to the quality of water and to human health. These systems do not generally require immediate action, but the deficiencies should be corrected to avoid future problems.
- **High Risk (7.1 to 10.0):** These are systems with major deficiencies, which—individually or combined— pose a high risk to the quality of water. These deficiencies may lead to potential health and safety or environmental concerns. They could also result in water quality advisories against drinking the water (such as, but not limited to, boil water advisories), repetitive non-compliance with guidelines, and inadequate water supplies. Once systems are classified under this category, regions and First Nations must take immediate corrective action to minimize or eliminate deficiencies.

Regional Risk Summary:

Of the 35 water systems inspected:

- 6 are categorized as high overall risk
- 19 are categorized as medium overall risk
- 10 are categorized as low overall risk.

The 10 low-risk systems include eight Municipal Type Agreement systems and two groundwater systems.

Neighbouring municipalities operate and maintain seven of the nine Municipal Type Agreement systems. The First Nations operate and maintain the distribution system of the remaining two Municipal Type Agreement systems.

The table in Appendix E.1 summarizes the correlation between component risk and overall risk. In general, Municipal Type Agreement systems have the lowest risk, followed by systems with a groundwater source, a groundwater under the direct influence of surface water (GUDI) source and, finally, systems with a surface water source.

Figure 3.4 provides a geographical representation of the final risk for the water systems that were inspected.

3.3.1 Overall System Risk by Source

The following table summarizes the overall system risk by water source. In general, it is assumed that Municipal Type Agreement systems have low-risk water supplies because the municipalities operate their systems in compliance with provincial legislation. For the Atlantic region, due to the small number of systems, no conclusions could be drawn from this data regarding the relationship between the overall risk and the water source.

Table 3.3 - Summary of Overall Risk Levels by Water Source

Overall Risk Level	Groundwater	GUDI	Surface Water	MTA	Total
High	4	1	1	0	**6**
Medium	14	2	2	1	**19**
Low	2	0	0	8	**10**
Total	**20**	**3**	**3**	**9**	**35**

3.3.2 Overall System Risk by Treatment Classification

The following table summarizes the overall system risk by the classification level of the treatment system. The system classification is based on a number of factors, such as size and complexity of treatment. There is no clear pattern between the system classification level and the overall system risk.

As previously discussed, Municipal Type Agreement systems have a low overall risk.

Table 3.4 - Summary of Overall Risk Levels by Treatment System Classification

Overall Risk Level	None	Small System	Level I	Level II	MTA	Total
High	3	1	1	1	0	**6**
Medium	13	0	1	4	1	**19**
Low	2	0	0	0	8	**10**
Total	**18**	**1**	**2**	**5**	**9**	**35**

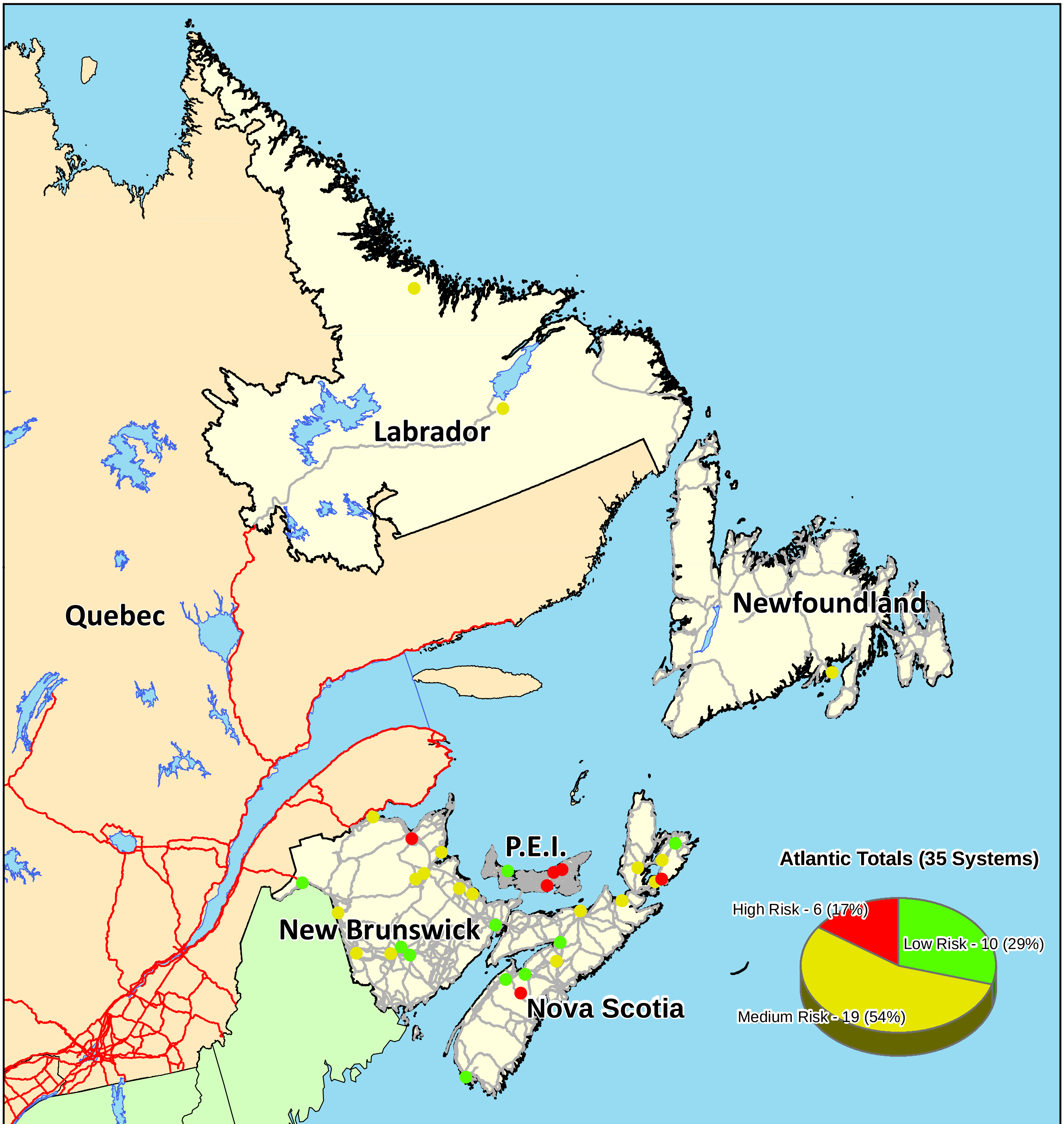


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Figure 3.4 - Atlantic Water System Risk

Water System Risk Level

- High
- Medium
- Low
- Atlantic Roads
- Major National Roads
- Major Lakes

N

0 50 100 150 200 250

Kilometers

NOTES

This map has been compiled with data of varying scale and accuracy.This is not a plan of survey.

SOURCES

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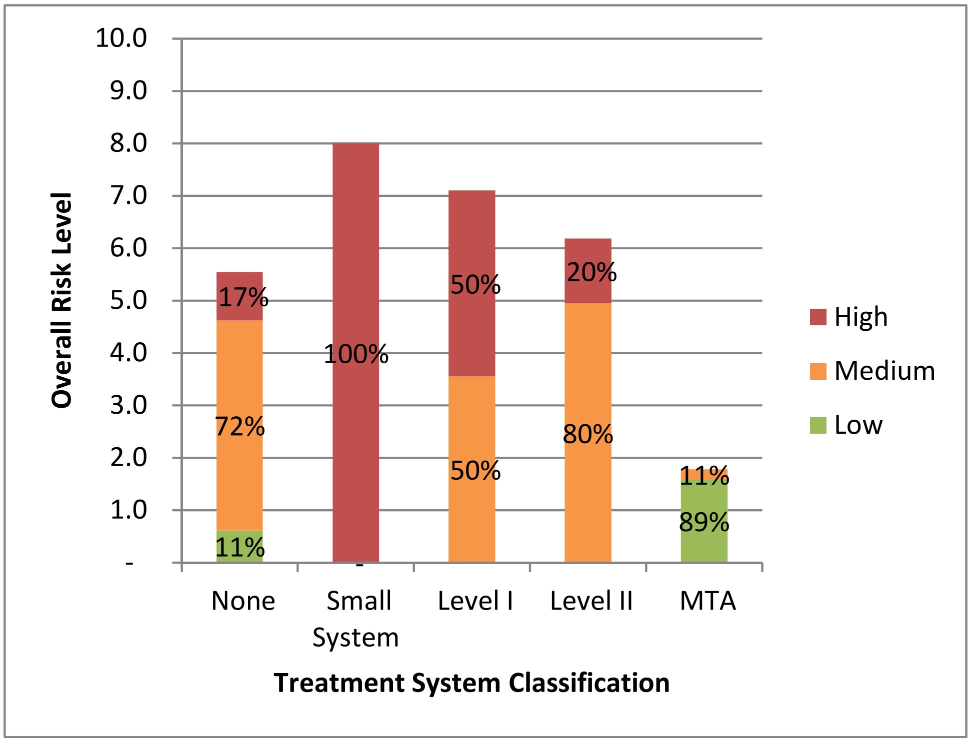
Figure 3.5 - Risk Profile Based on Water Treatment System Classification



3.3.3 Overall Risk by Number of Connections

For the Atlantic region, systems serving more than 100 connections tend to have a medium overall risk (with one exception), while systems serving less than 100 connections are fairly evenly split between having a medium overall risk and a high overall risk. All, but one, of the Municipal Type Agreement systems are low risk, regardless of the number of connections.

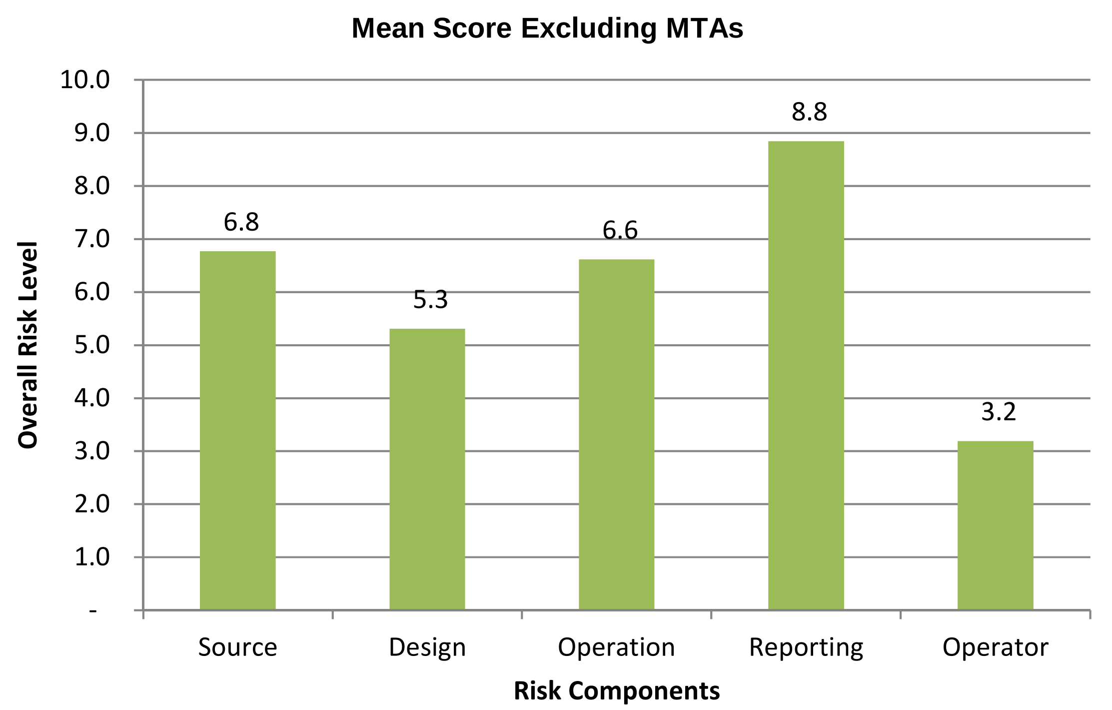
The reasons for the higher risk rating for smaller systems include:

- inadequate treatment of the source water
- untrained operators
- no backup operators
- poor reporting practices.

3.3.4 Component Risks: Water

The overall risk is comprised of five component risks: water source, design, operation, reporting and operator. Each of these component risk factors are discussed below.

Figure 3.6 - Water: Risk Profile Based on Risk Components (with MTA's excluded)



	Source	Design	Operation	Reporting	Operator
Risk	6.8	5.3	6.6	8.8	3.2
Minimum	4.0	1.0	4.0	2.0	1.0
Maximum	10.0	10.0	10.0	10.0	10.0
Std. Dev.	2.0	2.4	1.7	2.3	3.5

3.3.5 Component Risk - Water: Source

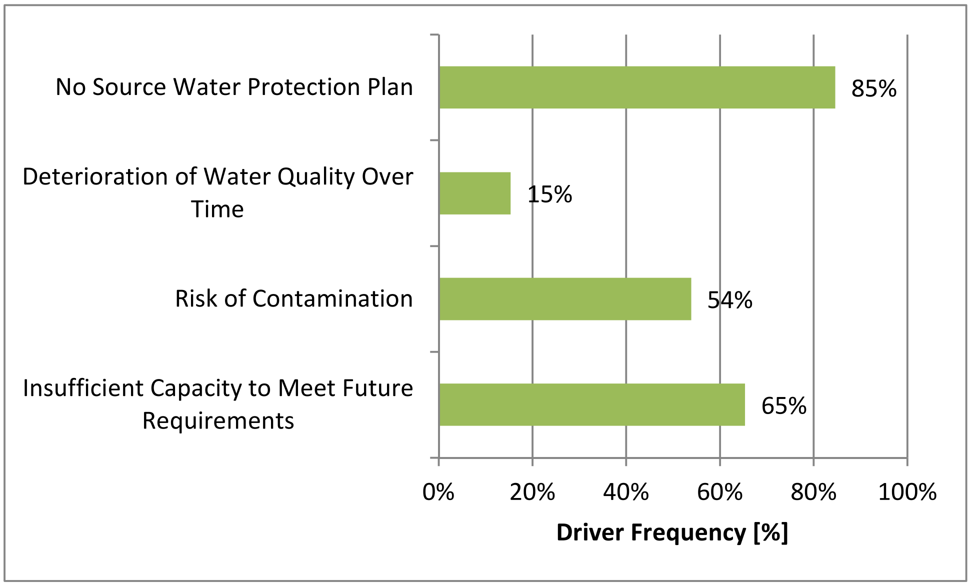
The risk associated with the water source has a mean score of 6.8, excluding MTA's. The mean source risk score by type of source is:

- groundwater at 6.0
- ground water under the direct influence of surface water (GUDI) at 9.3
- surface water at 9.0
- Municipal Type Agreement (MTA) at 1.0.

Systems that rely on surface water, or on groundwater under the direct influence (GUDI) of surface water, typically have a higher water-source component risk score than systems that rely on groundwater. The risk formula automatically assigns a higher base risk to these types of systems.

The following figure identifies drivers contributing to water source risk scores.

Figure 3.7 - Source Risk Drivers



3.3.6 Component Risk - Water: Design

The risk associated with the design has a mean score of 5.3, excluding MTA's. The mean design risk score by type of source is:

- groundwater at 5.2
- groundwater under the direct influence of surface water (GUDI) at 6.7
- surface water at 4.7
- Municipal Type Agreement (MTA) at 1.8.

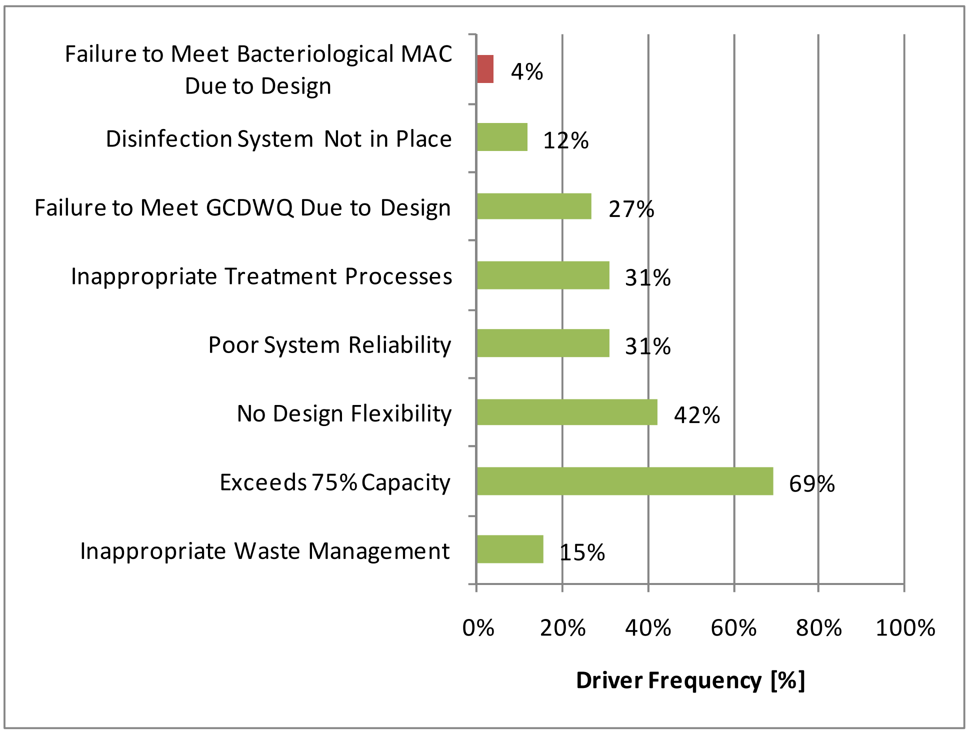
The higher design risk for systems with a GUDI source is associated with the relatively recent requirement for GUDI sources to meet treatment levels equivalent to those required for surface water. Prior to this change, the source would have been considered as a groundwater source, and the level of treatment would not meet the minimum level of treatment requirements. The three systems identified as GUDI provide only disinfection and therefore are considered to have a high design risk.

As part of the multi-barrier approach to water treatment, chlorination is now required for all water systems. Typically, a groundwater system has an increased design risk if it has no disinfection systems in place, or if there is insufficient contact time to ensure that the chlorination process is adequate.

There are several key drivers of the region's design risk scores, including:

- failure to meet the *Guidelines for Canadian Drinking Water Quality* (GCDWQ)
- exceeding the GCDWQ Maximum Acceptable Concentration (MAC) for bacteria
- no disinfection system in place or a disinfection system that is not being used
- no appropriate treatment in place to meet INAC's Protocol requirements
- problems with system reliability
- systems approaching or exceeding design capacity.

Figure 3.8 - Design Risk Drivers



It should be noted that the design risk drivers in red result in the entire water system being given a high risk score, regardless of all of the other component risk scores.

3.3.7 Component Risk - Water: Operation

The risk associated with operation has a mean score of 6.6, excluding MTA's. The mean operation risk score by type of source is:

- groundwater at 6.6
- groundwater under the direct influence of surface water (GUDI) at 6.7
- surface water at 6.7
- Municipal Type Agreement (MTA) at 2.0.

Areas that increased risk included not maintaining records, not having or not using approved O&M manuals and not scheduling and performing maintenance activities. Increased effort focused on these areas would result in lowering both the component and overall risk scores.

There are several key drivers of the region's operation risk scores, including:

- failure to meet the *Guidelines for Canadian Drinking Water Quality* (GCDWQ)
- exceeding the GCDWQ Maximum Acceptable Concentration (MAC) for bacteria
- maintenance logs being inadequately maintained
- lack of general system maintenance
- Emergency Response Plan not in place or not in use
- Operation & Maintenance manual not available or not in use.

Figure 3.9 - Operation Risk Drivers

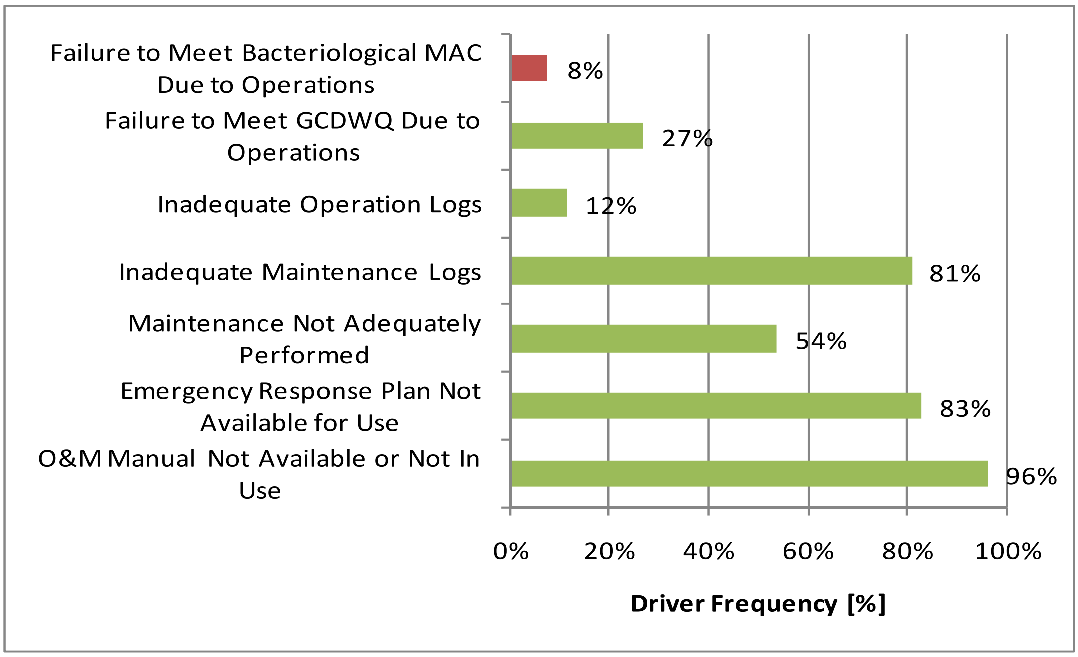
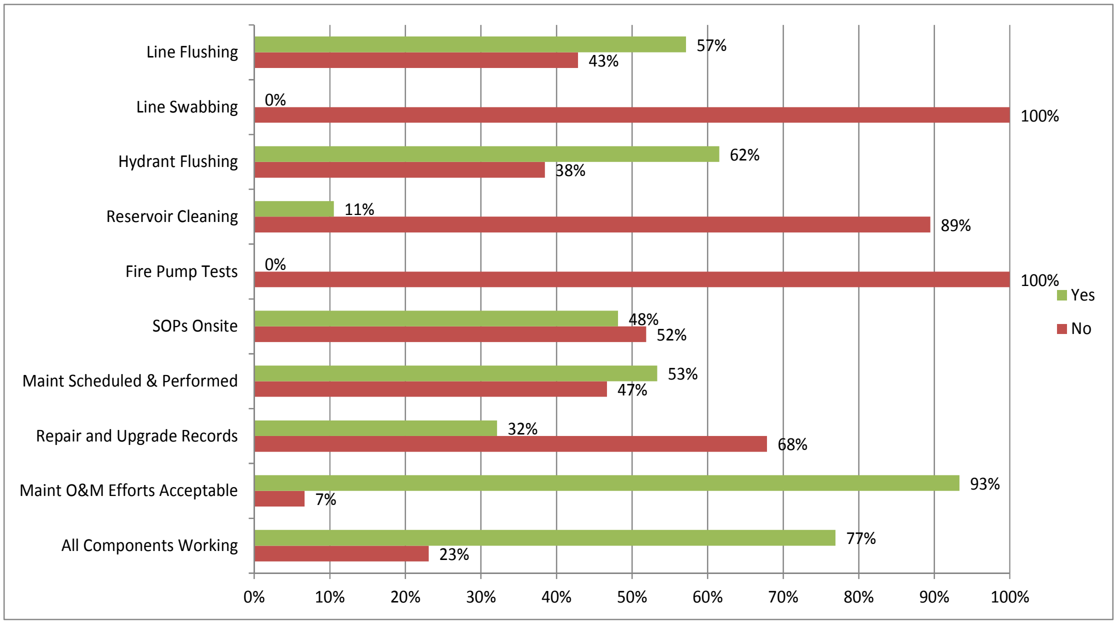


Figure 3.10 - Summary of Findings: Water Systems Operational Practices



Approximately 57% of the operators practice line and hydrant flushing, however, line swabbing is currently not practiced. Reservoir cleaning and fire pump tests appear not to be undertaken on a regular basis. Records of system repairs and upgrades were available for only 32% of the systems. One or more major components were not working for 23% of the systems.

3.3.8 Component Risk - Water: Reporting

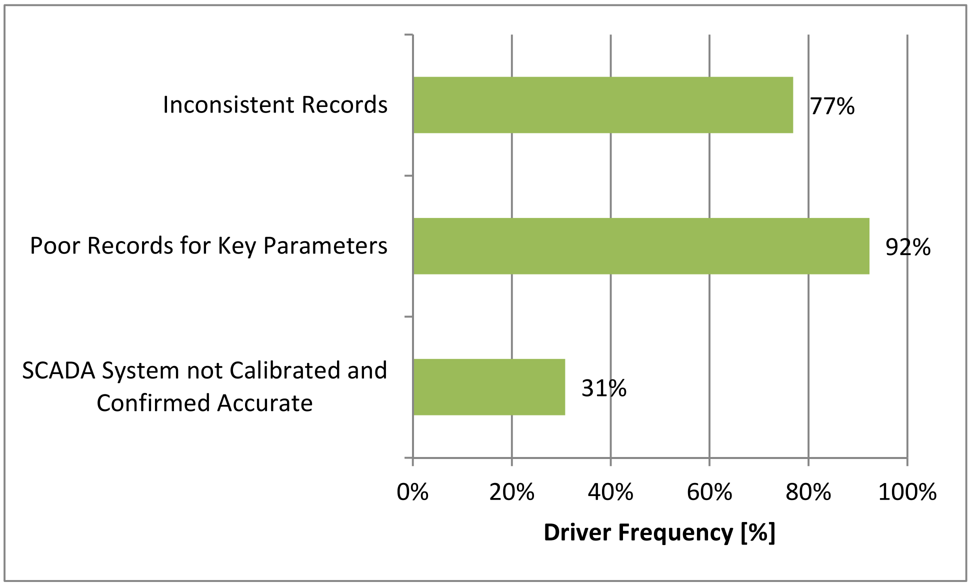
The risk associated with reporting has a mean score of 8.8, excluding MTA's. The risk score of 1.4 for Municipal Type Agreement systems reflects the minimal reporting required for these types of systems. The mean reporting risk score by type of source is:

- groundwater at 9.1
- groundwater under the direct influence of surface water (GUDI) at 10.0
- surface water at 6.3
- Municipal Type Agreement (MTA) at 1.4.

Poor record keeping and inconsistent records are the main risk drivers for all systems (77% and 92%). For systems with a Supervisory Control and Data Acquisition (SCADA) system in place, an additional driver is that the instruments are not being calibrated to ensure that the information being recorded is accurate (31%).

An important consideration is that the systems were evaluated based on the requirements for monitoring and reporting as set out in INAC's Protocol. Typically, the monitoring and reporting being undertaken by the operators does not meet these requirements. Operator awareness and training could have a significant impact on these risk scores.

Figure 3.11 - Reporting Risk Drivers



3.3.9 Component Risk - Water: Operator

The risk associated with the operator(s) has a mean score of 3.2, excluding MTA's. It should be noted that a more complicated system (based on treatment classification) requires an operator with a higher level of training. Because systems with higher classifications are less likely to have suitably certified staff, the risk associated with the operator is higher for more complicated systems in the region than for less complicated systems. The mean operator risk score by type of source is:

- groundwater at 2.5
- groundwater under the direct influence of surface water (GUDI) at 4.0
- surface water at 7.0
- Municipal Type Agreement (MTA) at 2.0.

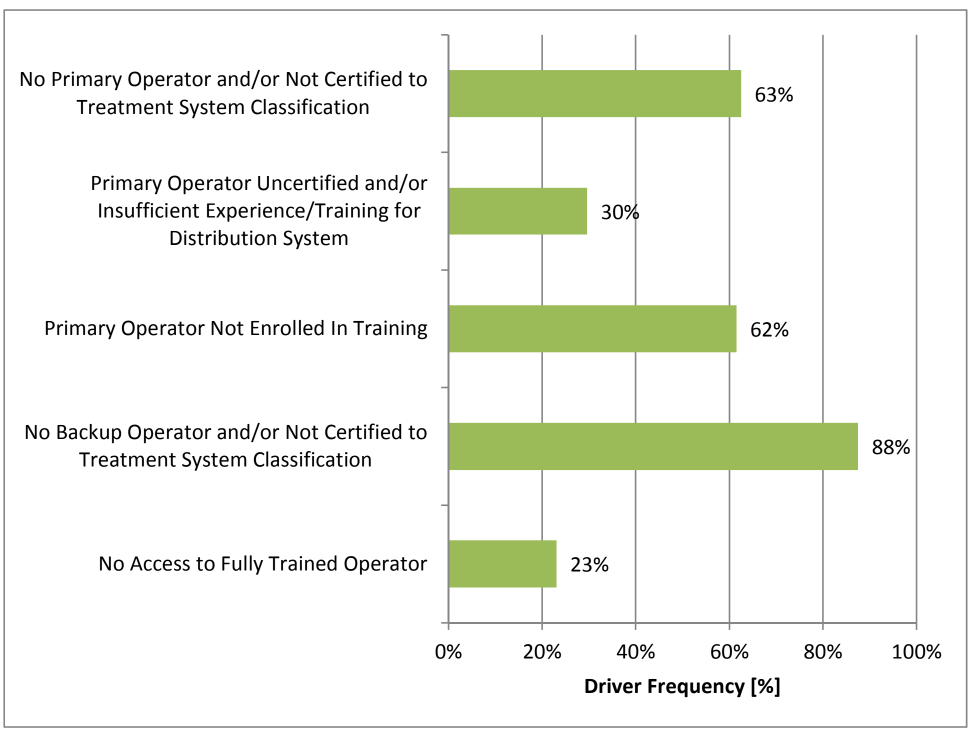
The extent to which existing systems have fully certified primary and backup operators is presented in Table 3.5. Of the 8 systems that require a certified operator for the water treatment system, 63% did not have a fully certified primary operator and 88% did not have a fully certified backup operator. Of the 27 systems that require a certified operator for the distribution system, 41% did not have a fully certified primary operator and 93% did not have a fully certified backup operator.

Table 3.5 – Water: Operator Status for Atlantic Region

	Primary Operator		Backup Operator	
	Treatment	**Distribution**	**Treatment**	**Distribution**
No. of Systems Currently Without an Operator	0	3	2	10
No. of Systems with Operator with No Certification	4	5	5	15
No. of Systems with Operator Certified but not to the Required Level of the System	1	3	0	0
No. of Systems with Operator with Adequate Certification	3	16	1	2
No. of Systems Not Requiring Operators with Certification	27	8	27	8
Total No. of Systems	**35**	**35**	**35**	**35**

Those factors which frequently contribute to increased operator risk are identified in Figure 3.12. A lack of certification, lack of training and the lack of primary or backup operator are common drivers that increase operator risk.

Figure 3.12 - Operator Risk Drivers



3.4 Wastewater Risk Evaluation

A risk assessment was completed for each wastewater system according to INAC's *Risk Level Evaluation Guidelines*. The risk of each wastewater facility is ranked according to the following categories: effluent receiver, design, operation and maintenance, reporting, and operator. The risk levels of all five categories are used to determine the overall risk for the system. The overall risk score is a weighted average of the component risk scores.

Each of the five risk categories, as well as the overall risk level of the entire system, is ranked numerically from 1 to 10. A risk ranking of 1.0 to 4.0 represents a low risk, a risk ranking of 4.1 to 7.0 represents a medium risk, and a risk ranking of 7.1 to 10.0 represents a high risk.

Of the 28 wastewater systems inspected:

- 7 are categorized as high overall risk
- 12 are categorized as medium overall risk
- 9 systems are categorized as low risk.

All of the low risk systems are Municipal Type Agreements.

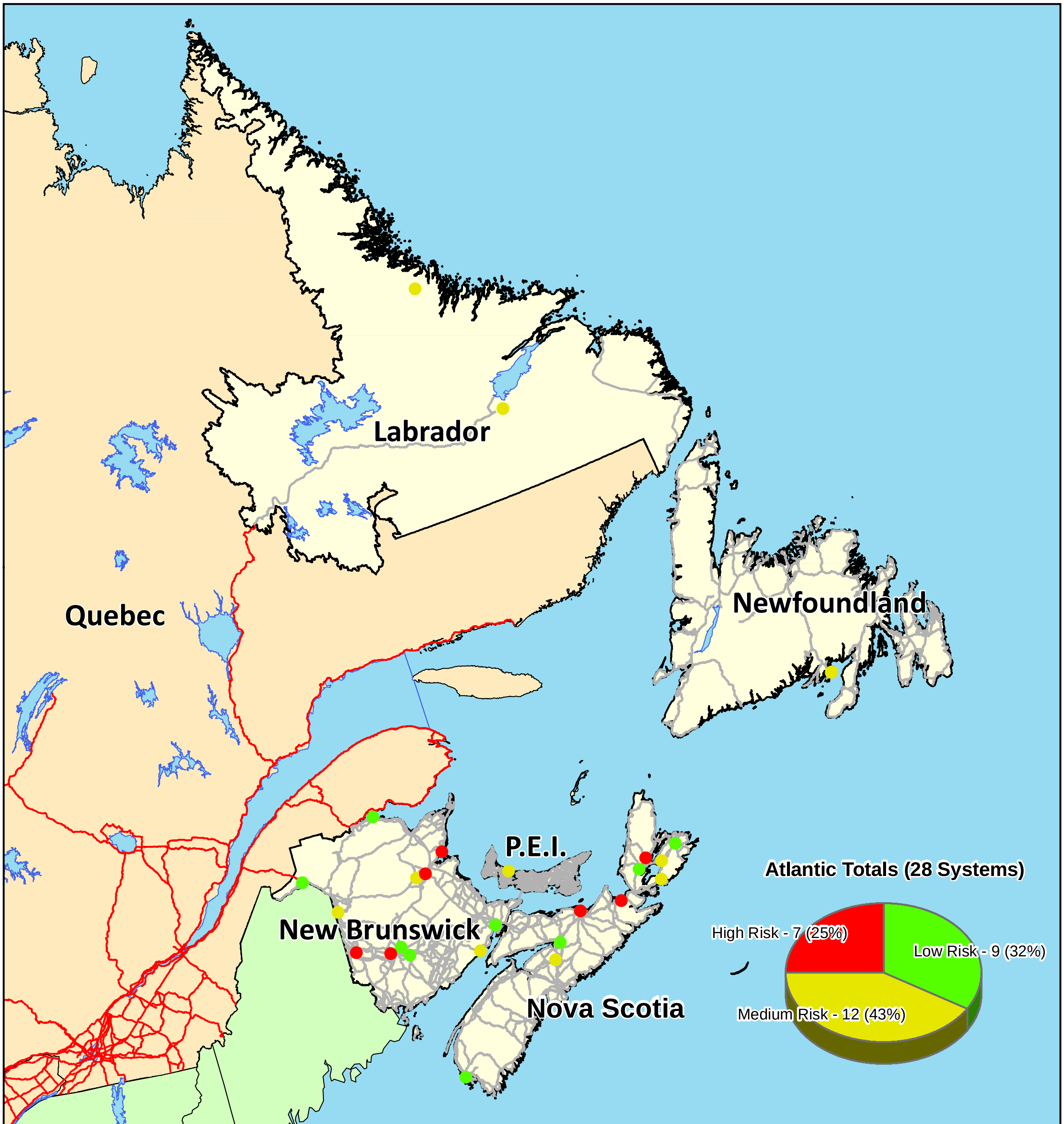
Appendix E.2 provides a table that summarizes the correlation between the component risk and the overall risk.

3.4.1 Overall System Risk by Treatment Classification

The following figure demonstrates the correlation between the mean overall system risk and the classification level of the treatment system. For MTA's, it was assumed that the municipality was operating their system in accordance with provincial legislation and therefore resulted in a low risk sewage receiver.

There does not appear to be a correlation between the overall risk and the level of treatment classification in the Atlantic region. Although the treatment complexity increases from "Small System" to "Level III Systems," this increase does not appear to be a driver for the overall system risk.

Figure 3.13 provides a geographical representation of the final risk for the wastewater systems that were inspected.



NATIONAL ASSESSMENT OF FIRST NATION WATER AND WASTEWATER SYSTEMS

Figure 3.13 - Atlantic Wastewater System Risk

Wastewater System Risk Level

- High
- Medium
- Low
- Atlantic Roads
- Major National Roads
- Major Lakes

N

0 50 100 150 200 250
Kilometers

NOTES

This map has been compiled with data of varying scale and accuracy.This is not a plan of survey.

SOURCES

Geobase® Aboriginal Lands (First Nations) - Accessed from http://geobase.ca.

DISCLAIMER

Neegan Burnside Ltd. and the above mentioned sources and agencies are not responsible for the accuracy of the spatial, temporal, or other aspects of the data represented on this map. It is recommended that users confirm the accuracy of the information represented.

Project: FGY16308
Drawn By: B. Goll

Projection: Geographic, Canada LCC

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

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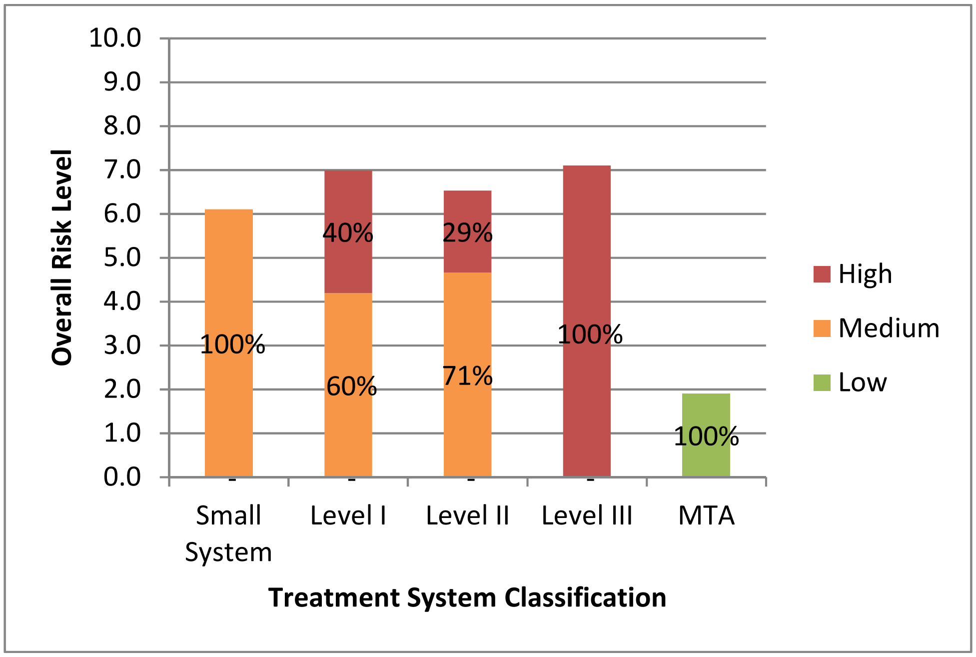
Figure 3.14 - Risk Profile Based on Wastewater Treatment System Classification



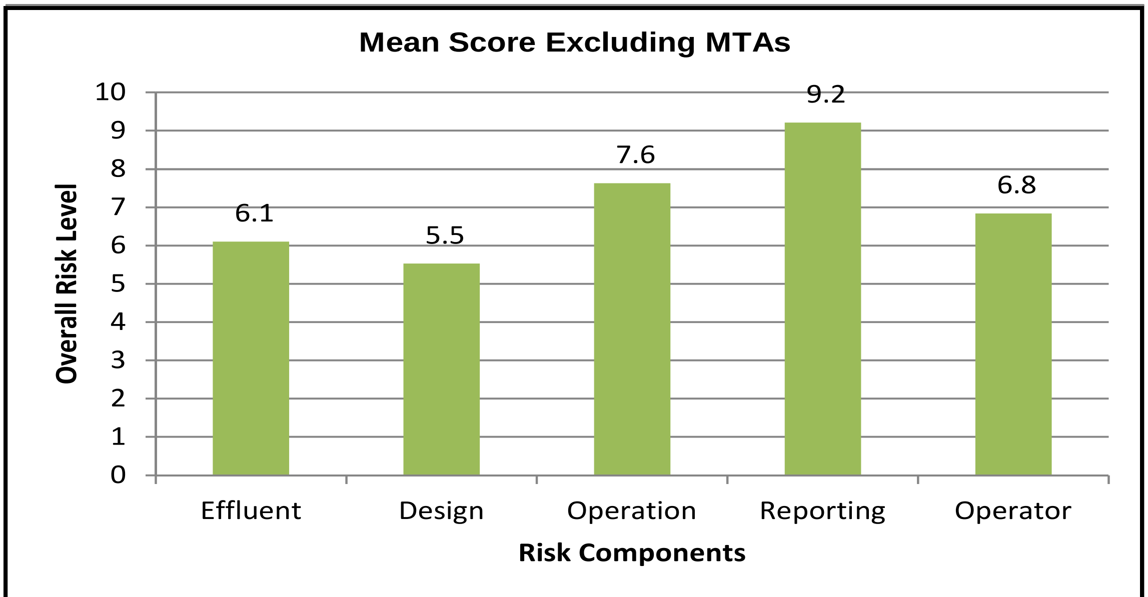
3.4.2 Overall System Risk by Number of Connections

For the Atlantic region, excluding Municipal Type Agreements, there is no clear pattern between the overall system risk and the number of connections.

3.4.3 Component Risks: Wastewater

The overall risk is comprised of five component risks: effluent receiver, design, operation, reporting and operators. Each of these component risk factors is discussed below. Municipal Type Agreements are excluded from the component risk sections because they are all low-risk systems.

Figure 3.15 - Wastewater: Mean Risk Scores by Risk Component



	Effluent	Design	Operation	Reporting	Operator
Risk	6.1	5.5	7.6	9.2	6.8
Minimum	2.0	2.0	5.0	1.0	1.0
Maximum	10.0	8.0	10.0	10.0	10.0
Std. Dev.	2.4	2.1	1.9	2.4	3.3

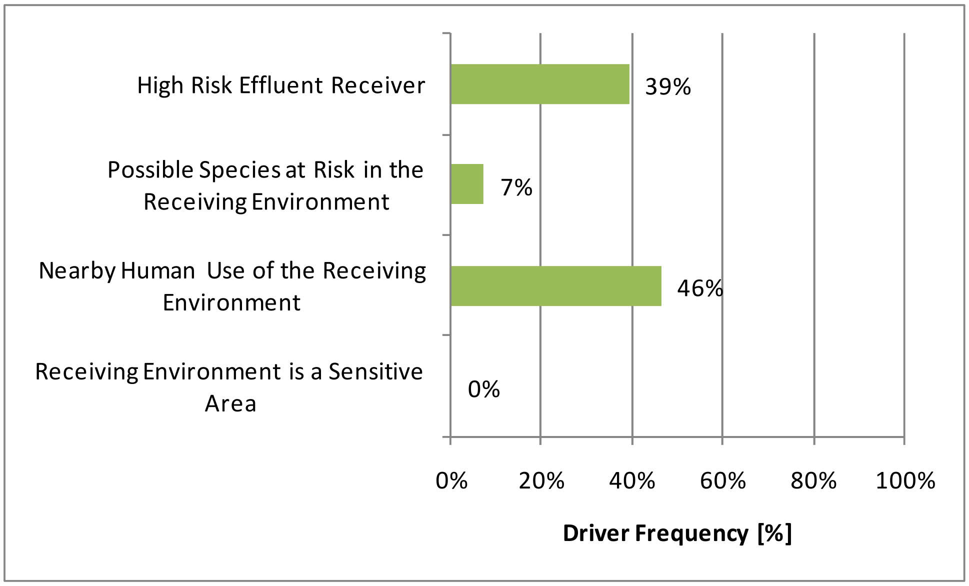
3.4.4 Component Risk - Wastewater: Effluent Receiver

The effluent receiver has a mean risk score of 6.1 excluding MTA's, and a fairly even distribution of the risk scores.

There are two key drivers of this risk component:

- the receiving environment
- the extent to which the receiver is required for other human uses, such as fishing, recreation, or drinking water.

Figure 3.16 - Effluent Receiver Risk Drivers



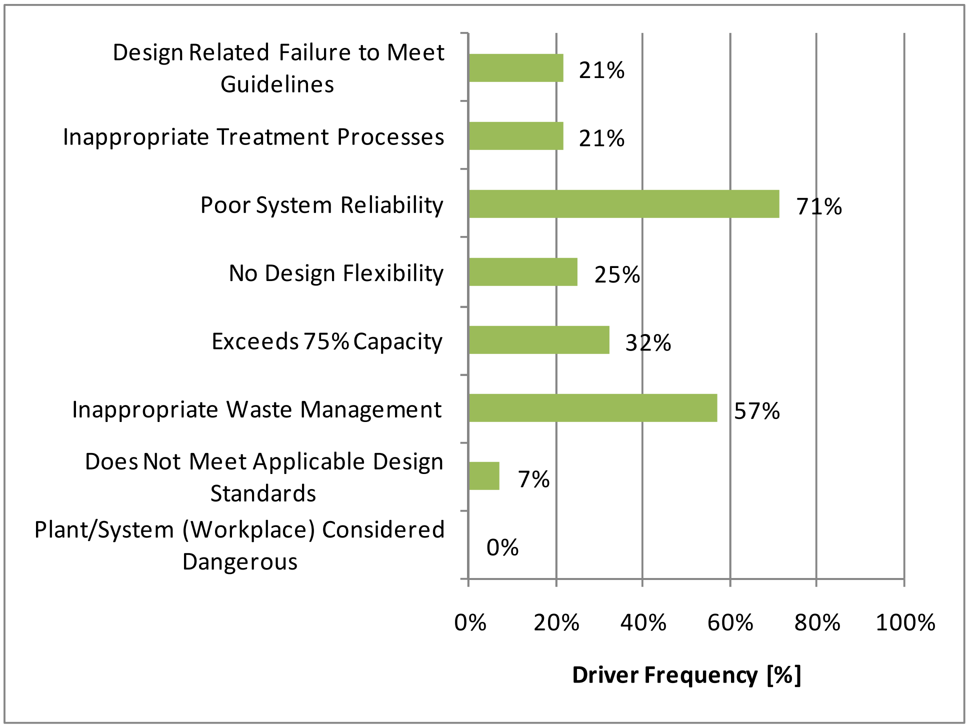
3.4.5 Component Risk - Wastewater: Design

The risk associated with design has a mean score of 5.5 excluding MTA's. The design component risk has the lowest mean component score. When systems with Municipal Type Agreements are excluded, the remaining systems were evenly split between high, medium and low, design component risk. In addition, two thirds of the overall high-risk systems also have a high design risk.

There are several key drivers of the design component risk scores in the region, including:

- failure to meet Federal *Effluent Quality Guidelines*
- inappropriate treatment processes
- poor system reliability
- inappropriate waste management.

Figure 3.17 - Design Risk Drivers



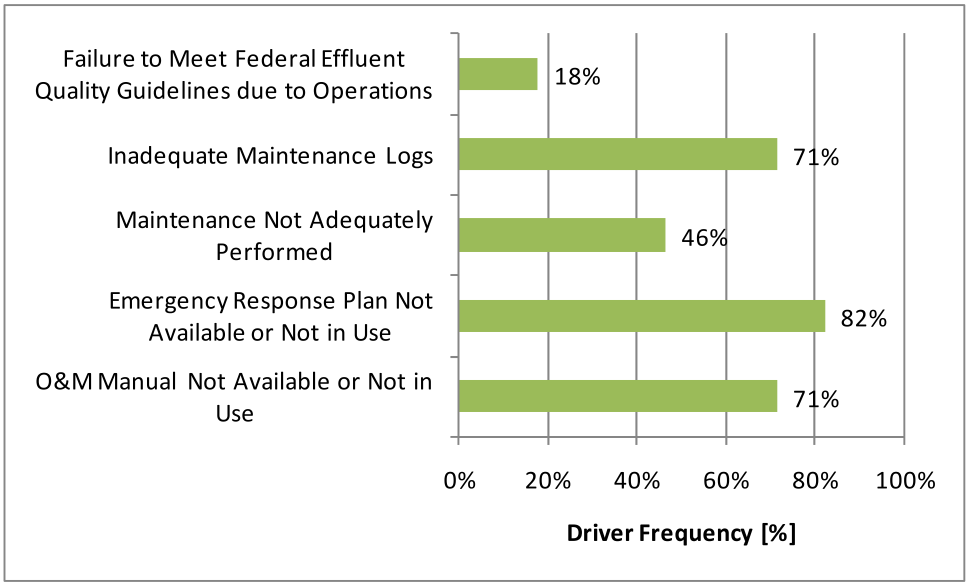
3.4.6 Component Risk - Wastewater: Operation

The risk associated with the operation has a mean score of 7.6 excluding MTA's. All of the wastewater systems have a medium- or high-risk score. This is identified as an area of opportunity for increased risk mitigation efforts.

There are several key drivers of the operation risk in the region, including:

- failure to meet Federal *Effluent Guidelines*
- inadequate maintenance logs
- lack of general system maintenance
- Emergency Response Plans not in place or not being used
- Operations & Maintenance manuals not available or not being used.

Figure 3.18 - Operation Risk Drivers



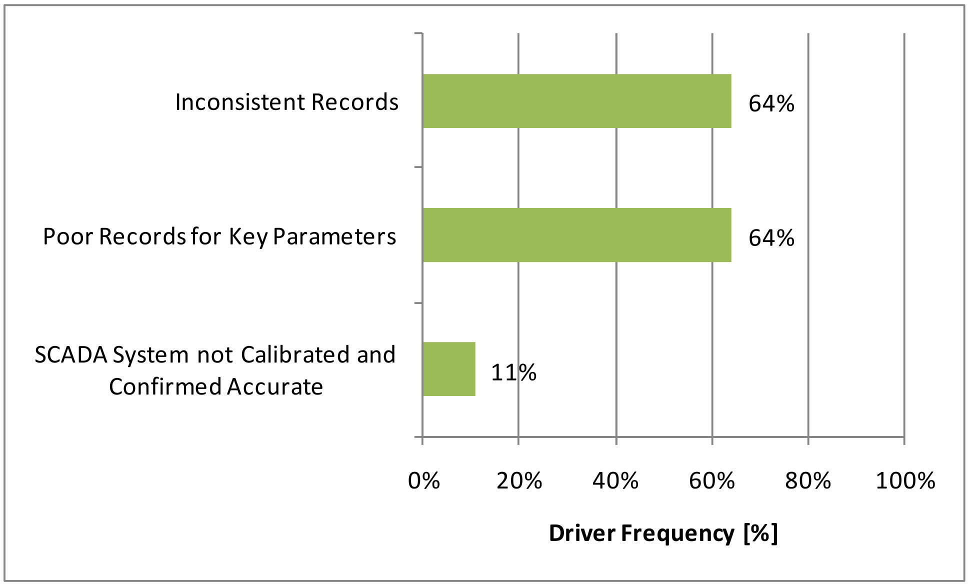
3.4.7 Component Risk - Wastewater: Reporting

The risk associated with reporting has a mean score of 9.2 excluding MTA's. The reporting risk component assesses whether operators maintain effluent-testing and system-monitoring records. Poor record keeping is a significant factor in raising the overall risk ranking for many communities in this region.

There are several key drivers of the reporting risk in the region, including:

- inconsistent record keeping
- inconsistent records for key parameters
- instruments not being calibrated.

Figure 3.19 - Reporting Risk Drivers



3.4.8 Component Risk - Wastewater: Operator

The risk associated with the operator has a mean score 6.8 excluding MTA's. Operator risk is determined by whether or not the operators have adequate certification.

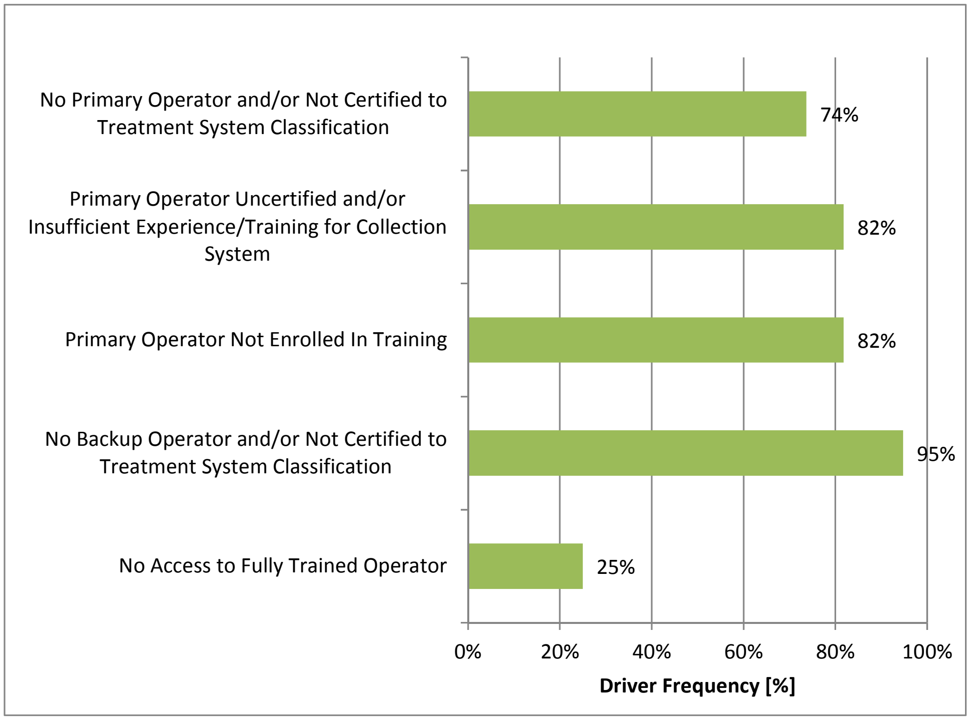
The extent to which existing wastewater systems have fully certified primary and backup operators is presented in Table 3.6. Of the 19 systems which require a certified operator for the wastewater treatment system, 74% did not have a fully certified primary operator and 100% did not have a fully certified backup operator. Of the 22 systems which require a certified operator for the collection system, 82% did not have a fully certified primary operator and 100% did not have a fully certified backup operator.

Table 3.6 - Wastewater: Operator Status for Atlantic Region

	Primary Operator		Backup Operator	
	Treatment	Collection	Treatment	Collection
No. of Systems Currently Without an Operator	0	0	7	9
No. of Systems with Operator with No Certification	14	18	11	13
No. of Systems with Operator Certified but not to the Required Level of the System	0	0	1	0
No. of Systems with Operator with Adequate Certification	5	4	0	0
No. of Systems Not Requiring Operators with Certification	9	6	9	6
Total No. of Systems	**28**	**28**	**28**	**28**

Those factors which frequently contribute to increased wastewater operator risk are identified in Figure 3.20. A lack of certification, lack of training and the lack of primary or backup operator are common drivers that increase operator risk.

Figure 3.20 - Operator Risk Drivers



3.5 Plans

Information was collected regarding the availability of various documents, including Source Water Protection Plans (SWPP), Maintenance Management Plans (MMP), and Emergency Response Plans (ERP).

The following tables provide a summary of the percentages of First Nations that have plans in place:

Table 3.7 - Plans Summary: Water

Source	*Percentage of Water Systems that have a (an)...*		
	Source Water Protection Plan	**Maintenance Management Plan**	**Emergency Response Plan**
Groundwater	15%	0%	15%
Groundwater GUDI	0%	0%	0%
MTA	N/A	11%	22%
Surface Water	33%	0%	33%
Overall	**15%**	**3%**	**17%**

Table 3.8 - Plans Summary: Wastewater

Percentage of Wastewater Systems that have a (an)…	
Maintenance Management Plan	**Emergency Response Plan**
4%	18%

3.5.1 Source Water Protection Plans

Source water protection planning is one component of a multi-barrier approach to providing safe drinking water. Source Water Protection Plans seek to identify threats to the water source. They also establish policies and practices to prevent contamination of the water source and to ensure that the water service provider is equipped to take corrective action in the event of water contamination. Source water protection is appropriate for groundwater and surface water sources.

Only 15% of the water systems inspected have a Source Water Protection Plan in place.

3.5.2 Maintenance Management Plans

Maintenance Management Plans are intended to improve the effectiveness of maintenance activities. MMP's focus on planning, scheduling and documenting preventative maintenance activities and unscheduled maintenance efforts to be documented by the operator(s). The plans represent a change from reactive to proactive thinking, and—when executed properly—help the operator optimize maintenance spending, minimize service disruption, and extend asset life.

Only 3% of the water systems and 4% of the wastewater systems have completed a Maintenance Management Plan in place.

3.5.3 Emergency Response Plans

Emergency Response Plans (ERPs) are intended to be a quick reference to assist operators and other stakeholders in managing and in responding to emergency situations. Emergency Response Plans should be in place for both water and wastewater systems. They include key contact information for those who should be notified and who may be of assistance in case of emergency (agencies, contractors, suppliers, etc.), and they provide standard communication and response protocols. Emergency Response Plans identify recommended corrective actions for “foreseeable” emergencies, and they establish methodologies for addressing unforeseen situations. They are essentially the last potential “barrier” in a multi-barrier approach to protecting the drinking water supply and the natural environment, and they provide the last opportunity to mitigate damages.

17% of the water systems and 18% of the wastewater systems have an Emergency Response Plan in place.

4.0 Cost Analysis

4.1 Upgrades to Meet INAC Protocols: Water

In 2006, INAC began to develop a series of Protocol documents for centralised and decentralised water and wastewater systems in First Nations communities. The Protocols contain standards for the design, construction, operation, maintenance, and monitoring of these systems.

One of the objectives of this study was to review the existing water and wastewater infrastructure and to identify the potential upgrade costs to meet INAC's Protocols, and federal and provincial guidelines, standards and regulations. The total estimated construction cost for water system upgrades to meet the INAC Protocol is $28M.

Table 4.1 provides a breakdown of the estimated total capital costs. A separate line item is included for engineering and contigency. Figure 4.1 provides a comparison graph of each of the categories. Note that treatment upgrades and storage and pumping upgrades make up approximately half of the estimated costs.

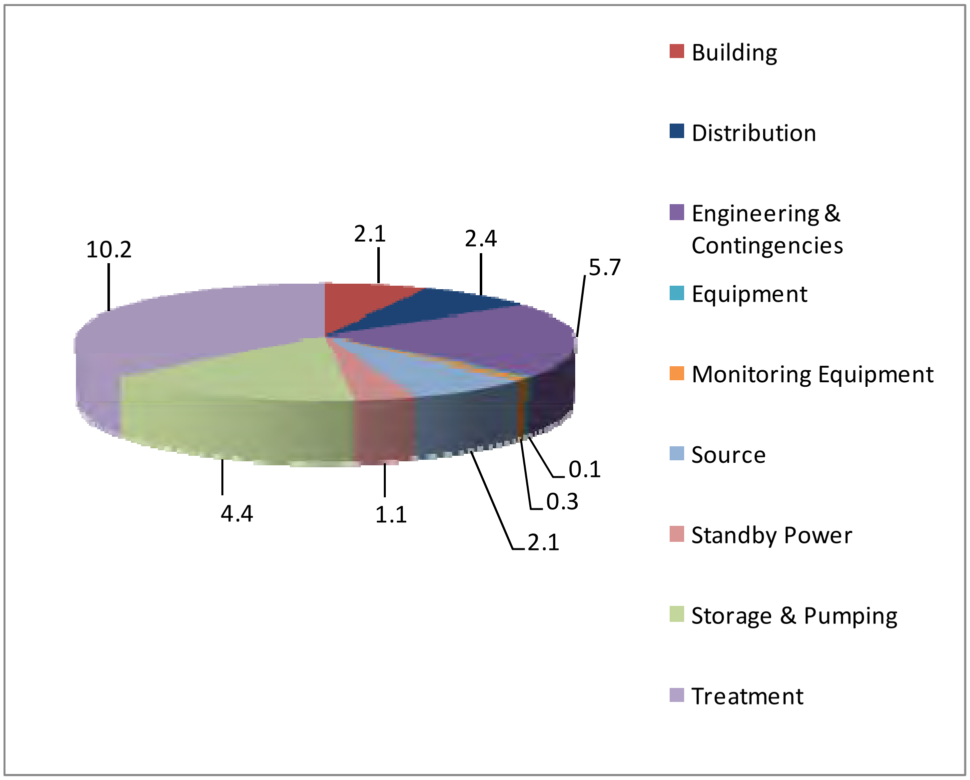
Table 4.1 - Estimated Total Construction Costs: Water

Description	Protocol - Estimated Cost	Federal - Estimated Cost	Provincial - Estimated Cost
Building	$2,106,000	$104,500	$1,341,000
Distribution	$2,395,500	$2,050,000	$2,395,500
Equipment	$140,500	$135,500	$141,950
Monitoring Equipment	$295,500	$218,500	$295,500
Source	$2,067,450	$230,000	$2,067,450
Storage & Pumping	$4,440,000	$4,329,500	$4,440,000
Treatment	$10,242,500	$10,123,500	$10,242,500
Standby Power	$1,055,000	$250,000	$1,055,000
Engineering & Contingencies	$5,685,500	$4,368,900	$5,497,500
Construction Total Estimate	**$28,427,950**	**$21,810,400**	**$27,476,400**

There are 13 water systems that may have groundwater under the direct influence (GUDI) of surface water supplies. Upgrade costs for these systems are estimated assuming that they will prove to be secure groundwater supplies and recommendations for GUDI studies are identified to confirm this.

If the GUDI studies indicate that these supplies should be considered to be surface water *rather than* groundwater, then additional upgrade requirements will be necessary for these systems to meet INAC's Protocols. It is estimated that, depending on system capacity and site indices, an additional $1.0 to 2.5 million will be required for each system that needs to be upgraded to surface-water treatment.

Figure 4.1 - Breakdown of the Estimated Construction Costs to Meet INAC's Protocols: Water ($ - M)



The following lists provide a summary of the Protocol items for the two categories with the highest cumulative Protocol costs that are listed above.

Treatment:

- Provide spare chemical feed equipment.
- Provide spare disinfection equipment.
- Provide additional filter trains.
- Provide secondary containment for treatment chemicals.
- Provide specific treatment equipment (i.e. arsenic, manganese, etc.).
- Provide Supervisory Control and Data Acquisition systems (SCADA).
- Provide conventional treatment systems for groundwater-under-the-direct-influence-of-surface-water sources.
- Provide contact piping.
- Provide surge suppression/uninterruptible power supplies for critical electronic equipment.
- Remove cross connections.
- Upgrade capacity of existing water treatment plants.

Storage & Pumping:

- Expand to provide adequate storage for fire protection and domestic flows.
- Provide screened reservoir vents.
- Provide secondary containment liners for onsite fuel storage.
- Provide storage and pumping.
- Repair reservoirs.
- Retrofit existing reservoirs to include baffling (concrete and/or curtain).

Table 4.2 - Estimated Total Non- Construction Costs to Meet INAC's Protocols, and Federal and Provincial Guidelines, Standards and Regulations: Water

Description	Protocol - Estimated Cost	Federal - Estimated Cost	Provincial - Estimated Cost
Training	$230,000	$230,000	$230,000
GUDI Studies	$535,000	$45,000	$535,000
Plans/Documentation	$1,952,500	$1,312,500	$1,952,500
Non-Construction Total Estimate	**$2,717,500**	**$1,587,500**	**$2,717,500**

Plans/Documentation costs include:

- Develop and/or update Emergency Response Plans.
- Develop and/or update Maintenance Management Systems.
- Develop and/or update Operation & Maintenance manuals.
- Develop and/or update Source Water Protection Plans.
- Develop Standard Operating Procedures (SOPs)/Operational Plans (OP).
- Develop wellhead protection plans, including wellhead integrity recommendations.
- Provide as-built/record drawings for facility records.

Additional annual operations and maintenance costs include costs that occur annually for items that are not currently being completed to meet protocols, such as calibrating monitoring equipment, additional sampling, cleaning the reservoir, and backup operator's salary.

Table 4.3 - Estimated Additional Annual Operations & Maintenance Costs: Water

Description	Estimated Cost
Sampling	$555,000
Operations	$155,000
Operator	$339,000
Water O&M Total Estimated Cost	**$1,049,000**

The total estimated cost, including construction and non-construction costs, for water system upgrades to meet the INAC Protocol is $31M. This excludes costs associated with potentially GUDI systems, which prove to be GUDI systems as discussed previously.

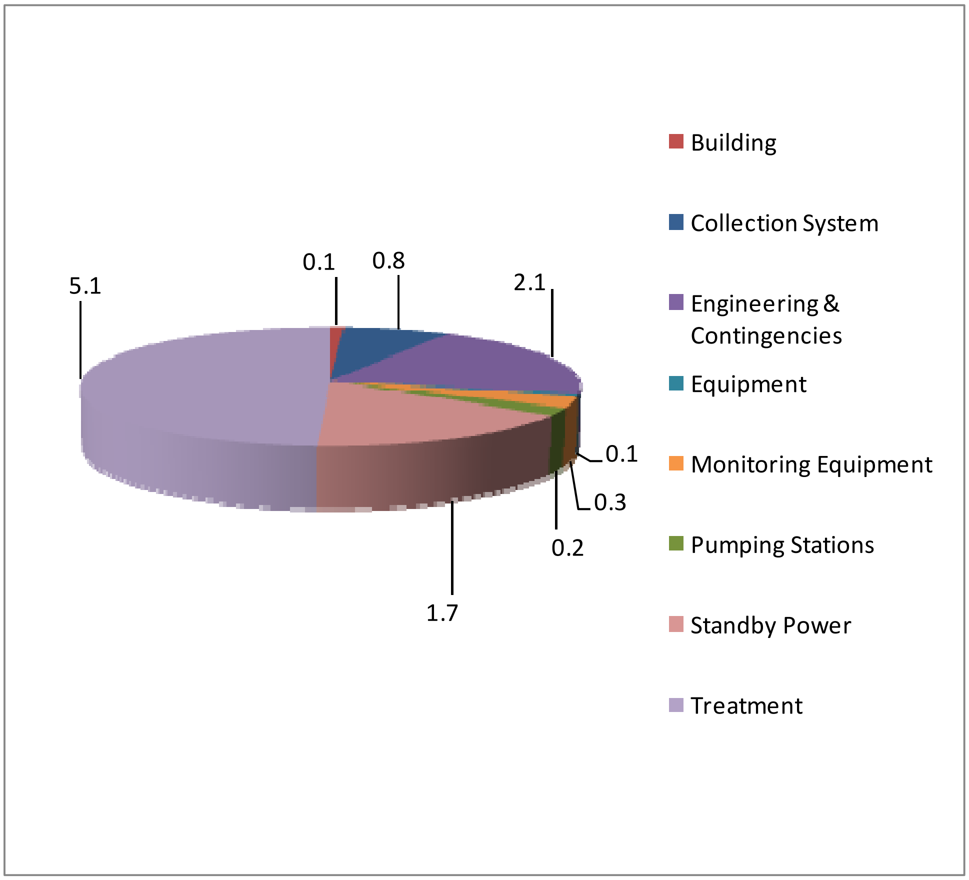
4.2 Upgrades to Meet Protocols: Wastewater

The total estimated construction cost for wastewater system upgrades to meet INAC Protocol is $10.4M. Increasing treatment capacity and providing standby power accounts for over 66% of the projected cost of meeting INAC's Protocol. Only two systems require an increase in capacity, but increasing a system's capacity requires high-cost upgrades. Providing standby power is a widespread necessity, but the upgrades required to provide standby power cost less than those required to increase capacity.

Table 4.4 - Estimated Total Construction and Related Costs to Meet INAC Protocols, Federal Guidelines, and Provincial Standards and Regulations: Wastewater

Description	Protocol - Estimated Cost	Federal - Estimated Cost	Provincial - Estimated Cost
Building	$100,000	$0	$0
Collection System	$780,000	$780,000	$780,000
Equipment	$59,500	$59,500	$59,500
Monitoring Equipment	$325,000	$5,000	$325,000
Pumping Stations	$215,000	$215,000	$215,000
Treatment	$5,101,000	$5,101,000	$5,101,000
Standby Power	$1,720,000	$1,660,000	$1,720,000
Engineering & Contingencies	$2,068,500	$1,956,500	$2,043,500
Construction Total Estimate	**$10,369,000**	**$9,777,000**	**$10,244,000**

Figure 4.2 - Breakdown of the Estimated Construction Costs to Meet INAC's Protocol: Wastewater ($ - M)



Treatment is the major construction-cost category for wastewater system upgrades.

Treatment costs include:

- Installing rodent screens on wastewater outfall.
- Constructing new Rotating Biological Contactor (RBC) sewage treatment facility to meet existing demands.
- Providing additional sewage pumps.
- Providing tertiary treatment (i.e. sand filter).
- Providing treatment for sludge wastes.
- Providing UV disinfection.
- Providing nutrient removal systems.

Table 4.5 - Estimated Total Non-Construction and Related Costs: Wastewater

Description	Protocol - Estimated Cost	Federal - Estimated Cost	Provincial - Estimated Cost
Training	$160,000	$160,000	$160,000
Plans/Documentation	$525,000	$405,000	$525,000
Studies	$55,000	$30,000	$55,000
Non-Construction Total Estimate	**$740,000**	**$595,000**	**$740,000**

Additional annual operations and maintenance costs include costs that occur annually for items that are not currently being completed to meet protocols, such as calibrating monitoring equipment, sampling and backup operator's salary. The largest cost item was sampling which is consistent with the fact that most First Nations do not currently monitor effluent quality as required by the Protocol.

Table 4.6 - Estimated Additional Annual O&M Costs: Wastewater

Description	Estimated Cost
Calibration	$6,000
Operator - Back-up	$45,000
Sampling	$289,000
Wastewater O&M Total Estimated Cost	**$340,000**

The total estimated cost, including construction and non-construction costs, for wastewater system upgrades is $11M.

4.3 Upgrade Cost Summary

Table 4.7 provides a summary of the upgrade costs to meet INAC's Protocols, and federal and provincial standards, guidelines and regulations.

Table 4.7 - Summary and Comparison of Upgrade Costs

	Total Estimated Cost	
	Water	Wastewater
Upgrade to meet Protocol	$31,145,450	$11,109,000
Upgrade to meet Federal Guidelines	$23,397,900	$10,372,000
Upgrade to meet Provincial Guidelines	$30,193,900	$10,984,000

The following tables present a breakdown of the estimated upgrade costs to meet INAC's Protocols by overall risk level.

Table 4.8 - Breakdown of Protocol Estimated Costs by Risk Level: Water

Risk Level	Short Term	Long Term	Total
High	$2,691,285	$0	**$2,691,285**
Medium	$27,801,528	$0	**$27,801,528**
Low	$652,637	$0	**$652,637**
Total	**$31,145,450**	**$0**	**$31,145,450**

Table 4.9 - Breakdown of Protocol Estimated Costs by Risk Level: Wastewater

Risk Level	Short Term	Long Term	Total
High	$6,326,496	$0	**$6,326,496**
Medium	$4,401,575	$122,880	**$4,524,455**
Low	$258,049	$0	**$258,049**
Total	**$10,986,120**	**$122,880**	**$11,109,000**

4.4 Asset Condition and Reporting System Needs

ACRS (Asset Condition and Reporting System) inspections were completed for all water and wastewater related assets. For the purposes of this assessment, ACRS needs were limited to required repairs of existing facilities, and did not include any upgrade costs, in order to avoid duplication with the Upgrade to Protocol needs identified. The following two tables (Tables 4.10 and 4.11) provide a summary of the required operation & maintenance repairs broken down by the type of asset for both water and wastewater systems.

Table 4.10 - Asset Condition and Reporting System Identified Operation & Maintenance Costs: Water

Asset Code	Description	Estimated Cost
A5A	Buildings	$167,775
B1B	Watermains	$446,000
B1C/B1D	Treatment	$71,500
B1E	Reservoirs	$769,750
B1F	Community Wells	$693,650
B1H	High Lift Pumping	$64,500
	Water ACRS Total Estimated Cost	**$2,213,175**

Table 4.11 - Asset Condition and Reporting System Identified Operation & Maintenance Costs: Wastewater

Asset Code	Description	Estimated Cost
A5B	Buildings	$37,050
B2A	Sewers	$315,000
B2H	Lift Stations & Forcemains	$1,038,350
B2C/B2D	Treatment	$59,750
B2E/B2I	Lagoons	$399,000
B2F	Septic Systems	$17,500
	Wastewater ACRS Total Estimated Cost	**$1,866,650**

4.5 Community Servicing

An analysis was completed to evaluate future servicing alternatives for a 10-year design period. The analysis considers a variety of alternatives, including expanding existing systems, developing new systems, establishing local Municipal Type Agreements (if applicable), and using individual systems.

A theoretical operation and maintenance cost was developed for each alternative, along with a 30-year life-cycle cost. The cost of the upgrades that are necessary for systems to meet INAC's Protocol is included in the new servicing cost, if appropriate (i.e. for new servicing alternatives that include continued use of the existing system).

The following table summarizes the capital cost and the total estimated operation & maintenance cost of the recommended servicing alternatives.

Table 4.12 - Future Servicing Costs

	Total Estimated Cost		Cost Per Connection	
	Water	Wastewater	Water	Wastewater
Future Servicing Cost	$110,000,000	$100,000,000	$11,900	$10,700
Annual O&M to service future growth	$9,000,000	$8,800,000	$1,000	$900

The majority of communities in the Atlantic Region are serviced by piped water and sewer. In most cases, extension of the existing piped systems was found to be the most viable servicing option.

5.0 Regional Summary

Neegan Burnside Ltd. and its sub-consultants visited all of the 33 First Nations in the Atlantic region during the completion of this project. Nine of the First Nations are serviced by Municipal Type Agreements with neighbouring municipalities. The majority of First Nations are serviced by piped distribution systems; only two First Nations are serviced entirely by individual wells and septic systems. The percentage of Municipal Type Agreements appears to be higher in the Atlantic region than in other regions of Canada. The proximity of Atlantic First Nations to adjacent municipalities may explain this difference.

In the Atlantic region, six water systems and seven wastewater systems were identified as high-risk systems. High-risk systems in the region typically require system upgrades or improved operational procedures to meet the applicable guidelines, regulations, and protocols for treated water quality or sewage effluent quality. Although there are many factors that contribute to risk, the analysis suggests that INAC, Health Canada, and Band Councils should give design and operational concerns the most weight, particularly when the concern is related to the protection of public health or to the environment.

The data indicates that risk could be significantly reduced if all systems were operated and maintained by trained and certified operators, and if operators completed monitoring and record keeping in accordance with INAC's Protocols.

Another area that INAC, Health Canada and Band Councils need to address is the lack of planning tools, including Source Water Protection Plans (SWPPs), Operations and Maintenance Manuals (O & Ms), Maintenance Management Plans (MMPs), and Emergency Response Plans (ERPs).

Various individual First Nations commented that current Operations & Maintenance budgets are often insufficient to retain operators, to provide ongoing component replacement and to perform all of the monitoring and recording requirements of the Protocol.

Wastewater sampling prior to effluent discharge appears to be another area that INAC, Health Canada and Band Councils could address in order to reduce the overall risk significantly. Sampling, testing and recording the effluent quality prior to discharge would reduce the reporting risk for these systems.

To address the reporting risk component for wastewater systems, INAC—in conjunction with Band Councils, Health Canada, and/or Environment Canada—could develop a protocol for sampling, testing, reporting and monitoring.

Appendix A

Glossary

Appendix A: Glossary of Terms and Acronyms

Aeration (see also lagoon): The process of bringing air into contact with a liquid (typically water), usually by bubbling air through the liquid, spraying the liquid into the air, allowing the liquid to cascade down a waterfall, or by mechanical agitation. Aeration serves to (1) strip dissolved gases from solution, and/or (2) oxygenate the liquid. (Gowen Environmental)

Aesthetic Objective (AO): Aesthetic objectives are set for drinking water quality parameters such as colour or odour, where exceeding the objective may make the water less pleasant, but not unsafe. (INAC *Protocol for Decentralised Water and Wastewater*)

Ammonia (See also: Potable water; Effluent quality requirements): A pungent colorless gaseous alkaline compound of nitrogen and hydrogen (NH_3) that is very soluble in water and can easily be condensed to a liquid by cold and pressure (*Merriam-Webster*). Ammonia is used in several areas of water and wastewater treatment, such as pH control. It is also used in conjunction with chlorine to produce potable water. The existence of ammonia in wastewater is common in industrial sectors as a by-product of cleaning agents. This chemical impacts both human and environmental conditions. Treatment of ammonia can be completed in lagoon systems and mechanical plants.
(R.M. Technologies)

Arsenic: A metallic element that forms a number of compounds. It is found in nature at low levels, mostly in compounds with oxygen, chlorine, and sulphur; these are called inorganic arsenic compounds. Organic arsenic in plants and animals combines with carbon and hydrogen. Inorganic arsenic is a human poison. Organic arsenic is less harmful. High levels of inorganic arsenic in food or water can be fatal.
(Medicinenet.com)

Aquifer (confined): A layer of soil or rock below the land surface that is saturated with water. There are layers of impermeable material both above and below it, and it is under pressure so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer. (INAC *Protocol for Decentralised Water and Wastewater Systems*)

Aquifer (unconfined): An unconfined aquifer is one whose upper water surface (water table) is at atmospheric pressure, and thus is able to rise and fall. (INAC *Protocol for Decentralised Water and Wastewater Systems*)

As-built/record drawings: Revised set of drawing submitted by a contractor upon completion of a project or a particular job. They reflect all changes made in the specifications and working drawings during the construction process, and show the exact dimensions, geometry, and location of all elements of the work completed under the contract. Also called as-built drawings or just as-builts.

ACRS Inspection (Asset Condition Reporting System Inspection): For centralised water and wastewater systems, an ACRS (asset condition reporting system) inspection of the system is to be performed once every three (3) years by a qualified person (consulting engineer, Tribal Council engineer), who is not from the First Nation involved, to assess the condition of the asset, adequacy of maintenance efforts, and need for additional maintenance work. The ACRS inspection report will be discussed with, and submitted to, the First Nation council and the INAC regional office. Inspections will be conducted in accordance with the ACRS Manual, a copy of which can be obtained from the INAC regional office.

Bacteria (plural) bacterium (singular): Microscopic living organisms usually consisting of a single cell. Bacteria can aid in pollution control by consuming or breaking down organic matter in sewage and/or other water pollutants. Some bacteria may also cause human, animal, and plant health problems. Bacteria are predominantly found in the intestines and feces of humans and animals. The presence of *coliform* bacteria in water indicates the contamination of water by raw or partially treated sewage. (INAC *Protocol for Decentralised Water and Wastewater Systems*)

Baffle (concrete and/or curtain): Vertical/horizontal impermeable barriers in a pond or reservoir. Baffles direct the flow of water into the longest possible path through the reservoir in order to eliminate short-circuiting in the water treatment system. In potable water treatment, short-circuiting can reduce the effectiveness of disinfectants. In effluent treatment, short-circuiting may result in an increase of pollutants at the outlet. Short-circuiting occurs when water flows directly from the inlet to the outlet across a pond or reservoir. (Layfield)

BOD_5 (Biochemical Oxygen Demand): The most widely used parameter of organic pollution applied to both wastewater and surface water is the 5-day BOD (BOD_5). This determination involves the measurement of the dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter. BOD test results are used to: determine the approximate quantity of oxygen that will be required to biologically stabilize the organic matter present; to determine the size of waste treatment facilities; to measure the efficiency of some treatment processes; and to determine compliance with wastewater discharge permits. (Metcalf & Eddy)

Capacity (actual vs. design): Refers to the capacity of the treatment system, with the “design capacity” being the flow rate proposed by the designer or manufacturer. If the system is not operating to design levels, the “actual capacity” could be limited by failing pumps, clogged filters or not meeting the Protocol (i.e. Protocol requires two filter trains such that one could operate while another is being cleaned/repaired and this was previously not explicitly required; therefore, the actual capacity is half of the design capacity).

Chemical feed equipment: All equipment associated with introducing chemicals to the raw water as part of the treatment process including coagulants, coagulant aids, disinfectants, etc.

Chlorine: A disinfectant used in either gas or liquid from gas that is added to water to protect the consumer from bacteria and other micro-organisms. It is widely used because it is inexpensive and easily injected into water. Because of its concentration, a gallon can treat a large amount of water. However, chlorine use does have drawbacks: when chlorine is used as a disinfectant it combines with naturally occurring decaying organic matter to form Trihalomethanes (THMs). (Vital Life Systems)

Chlorination: The application of chlorine to water, sewage or industrial wastes for disinfection (reduction of pathogens) or to oxidize undesirable compounds. (City of Toronto)

Chlorine Residual: The chlorine level in potable water immediately after it has been treated. (Ontario Ministry of the Environment)

Circuit Rider (see also Circuit Rider Training Program): Under the department's Circuit Rider Trainer Program (CRTP) INAC provides funds to engage circuit riders (third party water and wastewater system experts who provide water and wastewater system operators with on-site, mentoring, training, and emergency assistance). The third-party service providers that provide circuit rider services also provide operators with a 24/7 emergency hotline. (INAC *Protocol for Centralised Wastewater Systems in First Nations Communities*)

Circuit Rider Training Program: The main vehicle by which most First Nations operators receive the required training to operate their systems. This program provides qualified experts who rotate through a circuit of communities, providing hands-on training for the operators on their own system. Circuit rider trainers also help the First Nations with minor troubles and issues of operation and maintenance of their systems. (INAC *Plan of Action*)

Cistern: A tank for storing potable water or other liquids, usually placed above the ground. (Bow River Basin Council, cited in Alberta Environment *Glossary*)

Class "D" Cost Estimates: A preliminary estimate, for each community visited, based on available site information, which indicates the approximate magnitude (+/- 40%) of the cost of the actions recommended in the report, and which may be used in developing long-term capital plans and for a preliminary discussion of proposed capital projects.

Collection piping: Sanitary sewer collecting wastewater from individual buildings and homes, for treatment and disposal at a public facility.

Component risk / component risk factors: The overall risk is determined by five component risks: water source/effluent, design, operation, reporting, and operator.

Community Health Representatives (CHRs): Health Canada's local health representatives. They undertake bacteriological and chlorine residual sampling of distributed water within most First Nation communities.

Contact piping: Dedicated watermain to provide chlorine contact time before potable water is distributed to the first user.

Containment liners (for on-site fuel storage): A form of secondary containment used for diesel driven generators or fire pumps.

Continuous discharge to a receiving body: The release of treated wastewater effluent to a lake, river, stream, etc. where the rate of release is continuous (i.e. not batch discharge).

Conventional Wastewater Treatment: Consists of preliminary processes, primary settling to remove heavy solids and floatable materials, secondary biological aeration to metabolize and flocculate colloidal and dissolved organics, and secondary settling to remove additional solids. Tertiary treatment such as disinfection or filtration to further treat the wastewater depending on the level of treatment required for discharge. Waste sludge drawn from these operations is thickened and processed for ultimate disposal, usually either land application or landfilling. Preliminary treatment processes include coarse screening, medium screening, shredding of solids, flow measuring, pumping, grit removal, and pre-aeration. Chlorination of raw wastewater sometimes is used for odor control and to improve settling characteristics of the solids.

Conventional Water Treatment: Consists of a combination of coagulation (adding chemicals called coagulants), flocculation (particles binding together with coagulants) and sedimentation (settling of particles) to remove a large amount of organic compounds and suspended particles, filtration (water passing through porous media) to remove bacteria protozoa and viruses (slow sand filtration) or suspended particles (rapid sand filtration), and disinfection to ensure all the bacteria protozoa and viruses are removed, and provide safe drinking water.

Cross connections: A cross connection is a link between a possible source of pollution and a potable water supply. A pollutant may enter the potable water system when a) the pressure of the pollution source exceeds the pressure of the potable water source or b) when a sudden loss of pressure occurs in the water system and "backflow" occurs. The flow through a water treatment plant should have no instances of treated water coming into contact with raw or wastewater. Backflow preventers should be tested regularly and any actual physical links should be removed.

Decentralized System: A group or groups of communal (as opposed to private) on-site water or wastewater systems. (INAC *Protocol for Decentralised Water and Wastewater Systems*)

Dedicated transmission main: A length of watermain which has no service connections or hydrants; can refer to the length of raw watermain from a raw water source to the water treatment plant or in the distribution system where there are larger distances between homes.

Discharge Frequency: The frequency in which treated wastewater is discharged; could be continuous, seasonal, annual, etc.

Discharge quality data: Data acquired through the completion of a laboratory analysis of treated wastewater effluent prior to obtaining permission to discharge. Relevant parameters for testing include: 5 day Biochemical Oxygen Demand, Suspended Solids, Fecal Coliforms, pH, Phenols, Oils & Greases, Phosphorus and Temperature.

Disinfectant: A disinfectant is a chemical (commonly chlorine, chloramines, or ozone) or physical process (e.g., ultraviolet light) that inactivates or kills microorganisms such as bacteria, viruses, and protozoa. (INAC *Protocol for Decentralised Water and Wastewater Systems*)

Disinfection: A process that has as its objective destroying or inactivating pathogenic micro-organisms in water. (Government of Alberta, *Environmental Protection and Enhancement Act*, cited in Alberta Environment *Glossary*)

Disinfection By-products: Disinfection by-products are chemical, organic and inorganic substances that can form during a reaction of a disinfectant with naturally present organic or anthropogenic matter in the water. (Lenntech)

Distribution Classification > piped / trucked: Refers to the classification of the delivery of potable water leaving the water treatment plant. This can be either piped (via watermain) or trucked (via truck delivery to individual homes/cisterns). The level of classification involves the number of house connections (population served).

Domestic flows: All demands in the water system excluding fire flows.

Drinking Water: Water of sufficiently high quality that can be consumed or used without risk of immediate or long term harm.

Drinking Water Advisory (DWA): Drinking Water Advisories (DWAs) are preventive measures that are regularly issued in municipalities and communities across Canada; they protect public health from waterborne contaminants that can be present in drinking water. A DWA can be issued in any community and may include *boil water advisories, do not consume advisories* and *do not use advisories.* (INAC “Fact Sheet”)

Effluent: 1. The liquid waste of municipalities/communities, industries, or agricultural operations. Usually the term refers to a treated liquid released from a wastewater treatment process. (Bow River) 2. The discharge from any *on-site sewage* treatment component. (Alberta Municipal Affairs; cited in Alberta Environment *Glossary*)

Effluent quality data: Any test results or monitoring data that describes the condition of treated wastewater effluent.

Effluent Quality Requirements: All effluents from wastewater systems in Canada must comply with all applicable federal legislation including the *Canadian Environmental Protection Act, 1999* and the *Fisheries Act,* as well as any other applicable legislation, including provincial, depending on the geographical location of the system.
In addition, all discharges from First Nations wastewater systems shall meet the quality requirements found in the *Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments* - EPS 1-EC-76-1 (1976 Guidelines).

For the purposes of determining effluent quality related to ammonia and chlorine, the *Notice Requiring the Preparation and Implementation of Pollution Prevention Plans for Inorganic Chloramines and Chlorinated Wastewater Effluents* and the *Guideline for the Release of Ammonia Dissolved in Water Found in Wastewater Effluents* contain additional and/or updated information to the requirements provided in the 1976 Guidelines.

A copy of the *Guideline for the Release of Ammonia Dissolved in Water Found in Wastewater Effluents* can be found at Environment Canada's website. (INAC *Protocol for Centralised Wastewater Systems in First Nations Communities*)

Effluent Receiver (also referred to as the receiving body; the receiving environment; the receiver) (see also Effluent and Component risks): The environment that receives treated wastewater, including lakes, rivers, wetlands, sub-surfaces, title fields, open marines, and enclosed bays. It may also refer to a community's method for dealing with wastewater (e.g. Municipal Type Agreements or evaporation).

Elevated Storage: A water tower, which is a reservoir or storage tank mounted on a tower-like structure at the summit of an area of high ground in a place where the water pressure would otherwise be inadequate for distribution at a uniform pressure. (Collins)

Emergency Response Plan (ERP): Emergency response plans for water and wastewater systems are intended to be a quick reference to assist operators and other stakeholders in managing and responding to emergency situations. They include key contact information for persons to be notified and for persons who may be of assistance (e.g. agencies, contractors, suppliers, etc.), as well as standard communication and response protocols. Emergency response plans identify recommended action for "foreseeable" emergencies, and provide methodologies for unforeseen situations.

Facultative Lagoon: The most common type of wastewater treatment lagoon used by small communities and individual households. Facultative lagoons rely on both aerobic and anaerobic decomposition of waste, can be adapted for use in most climates and require no machinery to treat wastewater.

Filter: A device used to remove solids from a mixture or to separate materials. Materials are frequently separated from water using filters. (Edwards Aquifier)

Filter train equipment: Includes all components that form part of the water filtration process from where the raw water enters the filter process to where the filtered water leaves the treatment unit. This does not refer to the disinfection equipment.

Filtration: The mechanical process which removes particulate matter by separating water from solid material, usually by passing it through sand. (Edwards Aquifier)

Fire pump tests: A monthly test for the basic operation and functionality of the fire pump.

Grade Level Storage: A treated water storage reservoir that is constructed at grade, typically with earth mounded on top to provide some frost protection.

GPS: Global Positioning System (GPS) - A navigational system involving satellites and computers that can determine the latitude and longitude of a receiver on Earth by computing the time difference for signals from different satellites to reach the receiver.

Groundwater: Groundwater is any water that is obtained from a subsurface water-bearing soil unit (called an aquifer). 1) Water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper surface of the saturate zone is called the water table. 2) Water stored underground in rock crevices and in the pores of geologic materials that make up the Earth's crust. (INAC, *Protocol for Decentralised Water and Wastewater Systems*)

Groundwater, confined: Groundwater that is under pressure significantly greater than atmospheric, with its upper limit the bottom of a bed with hydraulic conductivity distinctly lower than that of the material in which the confined water occurs. (INAC, *Protocol for Decentralised Water and Wastewater Systems*)

Groundwater, unconfined: Water in an aquifer that has a water table that is exposed to the atmosphere. (INAC *Protocol for Decentralised Water and Wastewater Systems*)

Groundwater under the direct influence of surface water (GUDI): This term refers to groundwater sources (e.g., wells, springs, infiltration galleries, etc.) where microbial pathogens are able to travel from nearby surface water to the groundwater source. (Government of Nova Scotia)

Guidelines: Guidelines as referred to in this Assessment include all federal and provincial water and wastewater guidelines for domestic potable water and household sanitary waste. These guidelines include the “Guidelines for Canadian Drinking Water Quality” and all its recommended health and aesthetic guidelines for water quality.

Guidelines for Canadian Drinking Water Quality (GCDWQ): Water quality guidelines developed by the Federal-Provincial-Territorial Committee on Drinking Water and have been published by Health Canada since 1968.

Canadian drinking water supplies are generally of excellent quality. However, water in nature is never "pure." It picks up traces of everything it comes into contact with, including minerals, silt, vegetation, fertilizers, and agricultural run-off. While most of these substances are harmless, some may pose a health risk. To address this risk, Health Canada works with the provincial and territorial governments to develop guidelines that set out the maximum acceptable concentrations of these substances in drinking water. These drinking water guidelines are designed to protect the health of the most vulnerable members of society, such as children and the elderly. The guidelines set out the basic parameters that every water system should strive to achieve in order to provide the cleanest, safest and most reliable drinking water possible.

The Guidelines for Canadian Drinking Water Quality deal with microbiological, chemical and radiological contaminants. They also address concerns with physical and aesthetic characteristics of water, such as taste and odour. (Health Canada)

Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments, April 1976: The purpose of these guidelines is to indicate the degree of treatment and effluent quality that will be applicable to all wastewater discharged from existing and proposed Federal installations. Use of these guidelines is intended to promote a consistent wastewater approach towards the cleanup and prevention of water pollution and ensure that the best practicable control technologies used. (Government of Canada)

Highlift Pumping: Refers to pumps installed that provide treated water into the water distribution system at pressure; either directly or via water tower.

Hydrant Flushing (see line flushing and swabbing)

Influent: Water, wastewater, or other liquid flowing into a reservoir, basin or treatment plant. (Gowen)

Lagoon: A shallow pond where sunlight, bacterial action, and oxygen work to purify wastewater. Lagoons are typically used for the storage of wastewaters, sludges, liquid wastes, or spent nuclear fuel. (Edwards Aquifier)

Lagoon, aerated: See Aeration

Lagoon, facultative: See Facultative Lagoon.

L/c/d: Measurement of daily water usage as Litres per capita, per day.

Level of Service Standards (INAC): The Level of Service Standards (LOSS), determined on a national basis, are the levels of service that the Department of Indian Affairs and Northern Development (DIAND) is prepared to financially support to assist First Nations in providing community services comparable to the levels of service that would generally be available in non-native communities of similar size and circumstances.

The Level of Service Standards provide a description of criteria which will be used to establish the level of funding for safe, cost-effective, domestic water supply and wastewater disposal systems for on-reserve housing units and administrative, operative, institutional and recreational buildings. (INAC "Water and Sewage Systems")

Lift Station (also Pumping Station): A point in the sewer system where the wastewater needs to be pumped (lifted) to a higher elevation so that gravity can be used to bring the wastewater to the treatment plant. (Hailey City Hall Public Works)

Line flushing and swabbing (also referred to as watermain swabbing and flushing): Watermain swabbing entails inserting a soft material shaped like a bullet into the watermain through a fire hydrant. The diameter is slightly larger than the watermain and the bullet (swab) is pushed along the watermain by water pressure. As it passes through the watermain, the swab executes a scouring action on the sediment inside the watermain.

During watermain flushing, high velocity water flowing from hydrants is used to remove loose sediment from watermains. (City of Guelph)

L/p/d: Measurement of daily water usage as Litres per person, per day.

MAC (Maximum acceptable concentration): In the Guidelines for Canadian Drinking Water Quality (GCDWQ), Maximum Acceptable Concentrations (MACs) have been established for certain physical, chemical, radiological and microbiological parameters or substances that are known or suspected to cause adverse effects on health. For some parameters, Interim Maximum Acceptable Concentrations (IMACs) are also recommended in the guidelines.

Drinking water that continually has a substance at a greater concentration than the specified MACs will contribute significantly to consumer exposure to the substance and may, in some instances, produce harmful health effects. However, the short-term presence of substances above the MAC levels does not necessarily mean the water constitutes a risk to health. (INAC, *National Assessment Summary Report*)

Maintenance Management Plan (MMP): Maintenance management plans apply to both water and wastewater systems. They are intended to improve the effectiveness of maintenance activities and are focused on planning, scheduling, and documenting preventative maintenance activities and on documenting unscheduled maintenance.

Manganese: Manganese is a mineral that naturally occurs in rocks and soil and is a normal constituent of the human diet. In some places, it exists in well water as a naturally occurring groundwater mineral, but may also be present due to underground pollution sources. Manganese may become noticeable in tap water at concentrations greater than 0.05 milligrams per liter (mg/L) of water by imparting a colour, odour, or taste to the water. However, health effects from manganese are not a concern until concentrations are approximately 10 times higher. (Conneticut Dept. of Health)

Mechanical Plant/ Mechanical Treatment: Refers to any type of wastewater treatment plant including treatments systems consisting of rotating biological contactors (RBC), sequencing batch reactors (SBR), extended aeration (EA), etc. It does not include natural forms of wastewater treatment like lagoons or septic systems.

Metals Scan (Full): A full metal scan refers to what laboratories call Inductively Coupled Plasma Mass Spectrometry (ICP-MS) analysis for the evaluation of trace metals in water samples. This test covers a complete scan of over 20 trace metals in a single analysis.

Municipal Type Agreement (MTA): The situation where First Nations are supplied with treated water from or send their wastewater to a nearby municipality, as outlined in a formal agreement between the two parties. The term is also used in this report to describe a system where the First Nation is supplied with treated water or wastewater treatment services by another First Nation or other independent body such as a corporate entity such as a Casino etc.

Multi-Barrier Approach: Approach used to ensure that drinking water is safe. In the past, the term „multi-barrier' referred only to the barriers involved in the actual treatment of raw water to provide quality drinking water. This approach has now been expanded to include a number of key elements that are an integral part of a drinking water program to ensure delivery of safe, secure supplies of drinking water. Barriers may be physical (eg: filter) or administrative (eg: planning) in nature. (Alberta Environment, *Glossary & Alberta's Drinking Water Program*)

None: Indicates that the treatment and/or distribution/collection system has not been classified.

O & M: Operation and Maintenance.

Operational Plan (OP): An Operational Plan is the primary instrument for communicating the Community's quality management system (QMS) from the public works departments (water and wastewater) to Chief and Council, and from Council to INAC, Health Canada and the community members.

Phosphorus: A non-metallic element of the nitrogen family that occurs widely especially as phosphates (*Merriam-Webster*). Phosphorus occurs naturally in rocks, soil, animal waste, plant material, and even the atmosphere. In addition to these natural sources, phosphorus comes from human activities such as agriculture, discharge of industrial and municipal waste, and surface water runoff from residential and urban areas. Nutrients held in soil can be dissolved in water and carried off by leaching, tile drainage or surface runoff.

Phosphorus does not pose a direct threat to human health; it is an essential component of all cells and is present in bones and teeth. It does, however, pose an indirect threat to both aesthetics and to human health by affecting source waters used for drinking and recreation. For example, excessive nutrients can promote the growth of algal blooms, which can contribute to a wide range of water quality problems by affecting the potability, taste, odour, and colour of the water. (Canadian Council of Ministers of the Environment)

Piped Distribution System: A water distribution system which relies on pipes to convey water through pumping or elevated storage to the end user. Different from trucked distribution in that a trucked distribution system delivers water to end users in batch quantities to individual holding tanks (cisterns).

Potable water: Potable water is water that is destined for human consumption.
For the purposes of the *Protocol for Centralised Drinking Water Systems in First Nations Communities*, water destined for human consumption is water that is consumed directly as drinking water, water that is used in cooking, water that is used to wash food, and water that is used for bathing infants (individuals under 1 year in age). (INAC, *Protocol for Centralised Drinking Water Systems in First Nations Communities*)

PPU: People per unit. Measurement to describe housing density.

Primary Operator: The main operator of a water or wastewater system. The primary operator must be certified to the level of the treatment and distribution/collection system.

Primary Wastewater Treatment: Removal of particulate materials from domestic wastewater, usually done by allowing the solid materials to settle as a result of gravity. Typically, the first major stage of treatment encountered by domestic wastewater as it enters a treatment facility. Primary treatment plants generally remove 25 to 35 percent of the *Biological Oxygen Demand (BOD)* and 45 to 65 percent of the total suspended matter. Also, any process used for the decomposition, stabilization, or disposal of sludges produced by settling. (North American Lake Management Society; cited in Alberta Environment *Glossary*)

Protocol for Safe Drinking Water in First Nations Communities: Standards for design, construction, operation, maintenance, and monitoring of drinking water systems and is intended for use by First Nations staff responsible for water systems. It is also intended for use by Indian and Northern Affairs Canada (INAC) staff, Public Works and Government Services Canada (PWGSC) for INAC staff, and all others involved in providing advice or assistance to First Nations in the design, construction, operation, maintenance, and monitoring of their drinking water systems in their communities, in accordance with established federal or provincial standards, whichever are the most stringent.

Any water system that produces drinking water destined for human consumption, that is funded in whole or in part by INAC, and that serves five or more households or a public facility, must comply with the requirements of this protocol. (INAC *Protocol*)

Quality Assurance/Quality Control (QA/QC): A quality management system that focuses on fulfilling quality requirements and providing confidence that quality requirements will be fulfilled.

Reporting Risk: The Reporting risk level is the risk inherent with the operational method of recording data and providing the required reports. This would include both manual and automatic methods of record keeping. The reporting risk ranking is based on the adequacy of the operational records and the number of reports submitted during the year compared to the total number of records and reports required according to the appropriate legislation, standards, and operation procedures of the system in question.

Reservoir: A man-made lake that collects and stores water for future use. During periods of low river flow, reservoirs can release additional flow if water is available. (Government of Alberta, *Water for Life*, cited in Alberta *Glossary*)

Reservoir Cleaning: This involves the pump-down, clean-out, removal of settled material, disinfection and refill of a water storage reservoir. This activity requires confined space entry equipment and training.

Retrofit: 1. To furnish with new or modified parts or equipment not available or considered necessary at the time of manufacture; 2. To install (new or modified parts or equipment) in something previously manufactured or constructed; 3. To adapt to a new purpose or need: modify. (*Merriam-Webster*)

Rotating Biological Contactor (RBC): A technology used to treat wastewater classified as mechanical treatment.

Risk (Management Risk Level/Management Risk Score): Risk is defined in INAC's *Management Risk Level Evaluation Guidelines for Water and Wastewater Systems in First Nations Communities* (Revised 2010). These guidelines follow the Multi-Barrier Approach for water management. This approach, developed by the Federal-Provincial-Territorial Committee on Drinking Water and the Canadian Council of Ministers of the Environment (CCME) Water Quality Task Group, is intended to prevent the presence of water-borne contaminants in drinking water by ensuring effective safeguards are in place at each stage of a drinking water system.

Following that approach, INAC assesses five main components of a system to determine an overall system management risk score:
-Source Water (drinking water systems) or Effluent Receiver (wastewater systems)
-System Design
-Operation and Maintenance
-Records and Reporting
-Operator Training and Experience

Each of these components is assigned a risk score, which are then weighed to determine the overall management risk score of a system. The resulting score will then result in the management of the system as being classified as either high risk, medium risk, or low risk.

-High Risk: Major deficiencies in most of the components. Should a problem arise, the system and management as a whole is unlikely to be able to compensate, thus there is a high probability that any problem could result in unsafe water. Issues should be addressed as soon as possible.

-Medium Risk: Minor deficiencies in several components, or major deficiencies in one or two components. Should a problem arise, the system and management can probably compensate for the problem, but the noted deficiencies makes this uncertain, thus there is a medium probability that any problem could result in unsafe water. Issues need to be addressed.

-Low Risk: Minor or no deficiencies with the system or management. Should a problem occur, it is likely that the system and management as a whole will be able to compensate and continue to provide safe water while the issue is being resolved.

It is important to distinguish between INAC's system management risk level and drinking water quality. The actual quality of the water produced by a system is but one part of determining the overall system management risk level.

Unsafe drinking water is noted through the implementation of Drinking Water Advisories (DWA), not by the management risk level of the system. DWA come in multiple forms, the most common being the boil water advisory.

A system with a high-risk ranking under INAC's management evaluation is, because of its multiple deficiencies, likely to be unable to cope with problems that may occur in the system that result in a DWA. This means that DWA are likely to occur more frequently and to have a longer-term duration on a high-risk system. On the other hand, while problems can and do occur in low-risk systems, because of better overall risk management, these systems are more likely to address the problem in the short term, resulting in the rapid removal of problems and DWA.

This means that a high-risk drinking system can still produce perfectly safe and potable water. Deficiencies should be addressed as quickly as possible, however, before any issues arise with the water quality. (INAC, *Management Risk Level Evaluation Guidelines*)

SCADA (Supervisory Control and Data Acquisition) system: Refers to a control and/or computer system that can monitor, record and control infrastructure, or facility-based processes.

Screened reservoir vents: Reservoir vents should be screened to allow air movement and to prevent vermin from entering.

Seasonal discharge: Discharge of wastewater at times of maximum or substantial stream flow. This may vary from location to location.

Secondary containment for treatment chemicals: Secondary containment is required for the storage of all regulated hazardous materials. Secondary containment must be constructed using materials capable of containing a spill or leak for at least as long as the period between monitoring inspections. A means of providing overfill protection for any primary container may be required. This may be an overfill prevention device and/or an attention getting high level alarm. Materials that in combination may cause a fire or explosion, the production of a flammable, toxic, poisonous gas, or the deterioration of a primary or secondary container will be separated in both the primary and secondary treatment containment so as to avoid intermixing.

Secondary Treatment: involving the biological process of reducing suspended, colloidal, and dissolved organic/inorganic matter in effluent from primary treatment systems and which generally removes 80 to 95 percent of the *Biochemical Oxygen Demand (BOD)* and suspended matter. Secondary wastewater treatment may be accomplished by biological or chemical-physical methods. Activated sludge and trickling filters are two of the most common means of secondary treatment. (North American Lake Management Society, cited in Alberta *Glossary*)

Septic tank: A tank used to detain domestic wastes to allow the settling of solids prior to distribution to a leach field for soil absorption. Septic tanks are used when a piped wastewater collection system is not available to carry them to a treatment plant. A settling tank in which settled sludge is in immediate contact with sewage flowing through the tank, and wherein solids are decomposed by anaerobic bacterial action. (INAC *Protocol for Centralised Wastewater*)

Septic system: A combination of underground pipe(s) and holding tank(s) which are used to hold, decompose, and clean wastewater for subsurface disposal. (Bow River, cited in Alberta *Glossary*)

Sequencing Batch Reactor (SBR): A treatment technology used to treat wastewater classified as mechanical treatment.

Sewage treatment plant (STP) (also known as Wastewater Treatment Plant (WWTP) or Water Pollution Control Plant (WPCP)): Facility designed to treat wastewater (sewage) by removing materials that may damage water quality and threaten public health. (Ontario Ministry of Environment)

Sewage treatment systems: Facility or system designed to treat wastewater (sewage) by removing materials that may damage water quality and threaten public health. (Ontario Ministry of Environment)

Shoot-out: A septic system consisting of a septic tank with untreated wastewater effluent being discharged to the surface; this poses a health risk.

Sludge: The accumulated wet or dry solids that are separated from wastewater during treatment. This includes precipitates resulting from the chemical or biological treatment of wastewater. (Government of Alberta, *Activities*, cited in Alberta *Glossary*)

Source Classification: The determination of the water source classification in this assessment includes the options of: surface water, groundwater, GUDI or MTA. Surface water includes water from lakes or rivers; groundwater includes any well water that is not influenced by surface water infiltration; GUDI is any groundwater source under the direct influence of surface water; MTA as a source refers to the community acquiring the treated water from a municipality.

Source risk: The risk inherent in the quality and quantity of the raw source water prior to treatment.

Source Water Protection: 1. The prevention of pollution of the lakes, reservoirs, rivers, streams, and groundwater that serve as sources of drinking water. Wellhead protection would be an example of a source water protection approach that protects groundwater sources, whereas management of land around a lake or reservoir used for drinking water would be an example for surface water supplies. Source water protection programs typically include: delineating source water protection areas; identifying sources of contamination; implementing measures to manage these changes; and planning for the future. (North American Lake Management Society, cited in Alberta *Glossary*)

2. Action taken to control or minimize the potential for introduction of chemicals or contaminants in source waters, including water used as a source of drinking water (Alberta Environment, *Standards and Guidelines*, cited in Alberta *Glossary*).

SPS: An abbreviation of the term sewage pumping station.

Standard Operating Procedures (SOPs): An SOP is a written document or instruction detailing all steps and activities of a process or procedure. This would include all procedures used in water/wastewater treatment processes that could affect the quality.

Standpipe Storage: An above-grade storage facility where the storage volume is contained within the entirety of the structure. This type of storage is most feasible for use where there is sufficient change in the topography to allow for maximum usable volume in the standpipe.

Storage Type: Refers to whether the community water storage is via grade-level, below-grade or elevated storage (including standpipes and towers). In some cases there is no storage thus the storage type would be considered "direct pump."

Surface water: Surface water is any water that is obtained from sources, such as lakes, rivers, and reservoirs that are open to the atmosphere. (INAC, *Protocol for Centralised Drinking Water*)

System Designer: A system designer is a person, such as a professional engineer, who is qualified to design a water or wastewater systems. (INAC, *Protocol for Centralised Drinking Water*)

System Operator: A system operator is a First Nation employee or third party under contract to a First Nation who is tasked with managing a water or wastewater system. (INAC, *Protocol for Centralised Drinking Water*)

System Manager: A system manager is a First Nation employee or third party under contract to a First Nation who is tasked with managing a water or wastewater system. (INAC, *Protocol for Centralised Drinking Water*)

Tertiary Treatment: Selected biological, physical, and chemical separation processes to remove organic and inorganic substances that resist conventional treatment practices. *Tertiary Treatment* processes may consist of flocculation basins, clarifiers, filters, and chlorine basins or ozone or ultraviolet radiation processes. Tertiary techniques may also involve the application of wastewater to land to allow the growth of plants to remove plant nutrients. Can include advanced nutrient removal processes. (North American Lake Management Society, cited in Alberta *Glossary*)

Trihalomethanes (THMs): Chemical compounds that can be formed when water is disinfected using chlorine or bromine as the chemical disinfection agent. These chemical compounds are formed when organic material present in the raw source water reacts with chlorine or bromine. Therefore, THMs are classified as disinfection by-products (DBPs). The primary source of organic material comes from decaying vegetation found in lakes, rivers and streams and for this reason, THMs are more commonly observed in water systems that use a surface water source. The four chemical compounds that are measured and used to calculate total THMs are: chloroform, bromoform, bromodichloromethane (BDCM) and chlorodibromomethane (CDBM). THMs are a concern in potable water because there is scientific evidence that they may pose a risk in the development of cancer.

Treatment Certification: The treatment level to which an operator is certified for water treatment and distribution and wastewater treatment and collection systems (see Treatment Classification).

Treatment Classification: The size (flow) and complexity of a water or wastewater system is used to determine the Class of a system using a point template. The knowledge and experience it takes to operate a system is closely related to its classification and is reflected in the level of certification of the operator. Systems that are small and relatively simple, are classified as Small Water or Wastewater Systems. Larger or more complex systems are ranked as Class I, II, III, and IV with the highest being Class IV. Systems should be operated under the supervision of an operator certified to at least the same level of the facility.

TSS (Total Suspended Solids): Measure of the amount of non-dissolved solid material present in water or wastewater. Total suspended solids (TSS) can cause: a) interference with light penetration (in UV applications), b) build-up of sediment and c) can carry nutrients and other toxic pollutants that cause algal blooms and potential reduction in aquatic habitat (wastewater).

Underground Storage: A water storage facility (reservoir/clearwell) which is located 100% below-grade. Often located below the water treatment plant.

Waste: Any solid or liquid material, product, or combination of them that is intended to be treated or disposed of or that is intended to be stored and then treated or disposed. This does not include recyclables. (Government of Alberta, Activities Designation Regulation, cited in Alberta *Glossary*)

Waste management plan: A Waste Management Plan identifies and describes types of waste generated during operations and how they are managed and disposed of.

Wastewater (*Industrial Wastewater, Domestic Wastewater)*: A combination of liquid and water-carried pollutants from homes, businesses, industries, or farms; a mixture of water and dissolved or suspended solids. (North American Lake Management Society, cited in Alberta *Glossary*)

Wastewater System: an organized process and associated structures for collecting, treating, and disposing of wastewater. For the purposes of this report, it is a system serving five or more houses. It includes any or all of the following:
1. Sewers and pumping stations that make up a wastewater collection system.
2. Sewers and pumping stations that transport untreated wastewater from a wastewater collection system to a wastewater treatment plant.
3. Wastewater treatment plants.
4. Facilities that provide storage for treated wastewater.
5. Wastewater sludge treatment and disposal facilities.
6. Sewers that transport treated wastewater from a wastewater treatment plant to the place where it is disposed of.
7. Treated wastewater outfall facilities, including the outfall structures to a watercourse or any structures for disposal of treated wastewater to land or to wetlands. (Government of Alberta, *Environmental Protection and Enhancement Act*, cited in Alberta *Glossary*)

Wastewater Treatment: Any of the mechanical, chemical or biological processes used to modify the quality of wastewater (sewage) in order to make it more compatible or acceptable to man and his/her environment. (North American Lake Management System, cited in Alberta *Glossary*)

Wastewater Treatment Plant: Any structure, thing, or process used for the physical, chemical, biological, or radiological treatment of wastewater before it is returned to the environment. The term also includes any structure, thing, or process used for wastewater storage or disposal, or sludge treatment, storage, or disposal. (Government of Alberta, *Activities*, cited in Alberta *Glossary*)

Watermain: A principal pipe in a system of pipes for conveying water, especially one installed underground. (*American Heritage Dictionary*)

Water quality: The term used to describe the chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose. (INAC, *Protocol for Centralised Drinking Water*)

Water use: The term water use refers to water that is used for a specific purpose, such as for domestic use, irrigation, or industrial processing. Water use pertains to human interaction with and influence on the hydrolic cycle, and includes elements, such as water withdrawal from surface- and ground-water sources, water delivery to homes and businesses, consumptive use of water, water released from wastewater-treatment plans, water returned to the environment, and in-stream uses, such as using water to produce hydroelectric power. (INAC, *Protocol for Centralised Drinking Water*)

Water Well: An opening in the ground, whether drilled or altered from its natural state, that is used for the production of groundwater, obtaining data on groundwater, or recharging an underground formation from which groundwater can be recovered. By definition in the provincial Water Act, a water well also includes any related equipment, buildings, and structures. (Government of Alberta, *Water for Life*, cited in Alberta, *Glossary*)

Wellhead Protection Area: A protected surface and subsurface zone surrounding a well or well field supplying a public water system to keep contaminants from reaching the well water. (Edwards Aquifier)

Wellhead Protection Plan: A wellhead protection plan defines the wellhead protection area, identifies potential sources of contamination, manages the potential contaminant sources including properly decommissioning abandoned wells, identifies emergency and contingency plans (i.e. what to do if the well becomes contaminated or requires additional capacity) and provides overall public awareness.

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Appendix B

Water System Summary

NEEGAN BURNSIDE

Appendix B.1

Water System Summary

Regional Roll-Up Summary

Region: ATLANTIC
Total No. of First Nations: 33
Participating No. of First Nations: 33
Participation Level: 100%
No. of Community Reports Issued: 35

Water

	Groundwater	GUDI	Surface	MTA	Totals
Total No. of Systems	**20**	**3**	**3**	**9**	**35**
System Age					
0-5 years (2006 - 2010)	2	0	0	0	**2**
6-10 years (2001 - 2005)	2	0	1	1	**4**
10-15 years (1996 - 2000)	2	0	2	2	**6**
15 -20 years (1991 - 1995)	7	0	0	2	**9**
> 20 years (≤ 1990)	7	3	0	4	**14**
Treatment					
None - Direct Use	2	0	0	0	**2**
Disinfection only	14	2	0	0	**16**
Conventional Filtration	4	1	3	0	**8**
MTA	0	0	0	9	**9**
Classification - Treatment					
Small system	1	0	0	0	**1**
Level I	0	1	1	0	**2**
Level II	3	0	2	0	**5**
MTA	0	0	0	9	**9**
None	16	2	0	0	**18**
Classification - Distribution					
Small system	3	1	0	0	**4**
Level I	13	2	3	1	**19**
Level II	4	0	0	0	**4**
MTA	0	0	0	8	**8**

	Groundwater	GUDI	Surface	MTA	Totals
Total No. of Systems	**20**	**3**	**3**	**9**	**35**
Distribution					
Piped	20	3	3	9	**35**
Water Quality					
Fails Health					
Yes, fails health due to:	5	1	2	1	**9**
Design	2	0	0	1	**3**
Operation	3	0	1	0	**4**
Combination	0	1	0	0	**1**
Unknown	0	0	1	0	**1**
Fails Aesthetic					
Yes, fails aesthetic due to:	5	0	0	0	**5**
Design	4	0	0	0	**4**
Operation	1	0	0	0	**1**
Combination	0	0	0	0	**0**
Unknown	0	0	0	0	**0**
Primary Operator - Treatment					
Not certified	1	1	2	0	**4**
No operator	0	0	0	0	**0**
Not required	16	2	0	9	**27**
Certified to Level	2	0	1	0	**3**
Certified	1	0	0	0	**1**
Back-up Operator - Treatment					
Not certified	3	0	2	0	**5**
No operator	1	1	0	0	**2**
Not required	16	2	0	9	**27**
Certified to Level	0	0	1	0	**1**
Certified	0	0	0	0	**0**

		Groundwater	GUDI	Surface	MTA	Totals	
Total No. of Systems		**20**	**3**	**3**	**9**	**35**	
Primary Operator - Distribution							
	Not certified	1	1	2	1	**5**	
	No operator	3	0	0	0	**3**	
	Not required	0	0	0	8	**8**	
	Certified to Level	13	2	1	0	**16**	
	Certified	3	0	0	0	**3**	
Back-up Operator - Distribution							
	Not certified	12	1	2	0	**15**	
	No operator	7	2	0	1	**10**	
	Not required	0	0	0	8	**8**	
	Certified to Level	1	0	1	0	**2**	
	Certified	0	0	0	0	**0**	
Risk (mean)						**Mean**	**Mean excluding MTA**
	Final	5.7	6.7	6.3	1.8	**4.8**	**5.9**
	Source	6.0	9.3	9.0	1.0	**5.3**	**6.8**
	Design	5.2	6.7	4.7	1.8	**4.4**	**5.3**
	Operations	6.6	6.7	6.7	2.0	**5.4**	**6.6**
	Reporting	9.1	10.0	6.3	1.4	**6.9**	**8.8**
	Operator	2.5	4.0	7.0	2.0	**2.9**	**3.2**

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Appendix B.2

Wastewater System Summary

Regional Roll-Up Summary

Region: ATLANTIC
Total No. of First Nations: 33
Participating No. of First Nations: 33
Participation Level: 100%
No. of Community Reports Issued: 35

Wastewater

		Septic	Aerated Lagoon	Facultative Lagoon	Mechanical	Other	MTA	Totals
Total No. of Systems		**1**	**7**	**6**	**5**	**0**	**9**	**28**
System Age								
	0-5 years (2006 - 2010)	0	0	2	1	0	0	**3**
	6-10 years (2001 - 2005)	0	1	0	0	0	0	**1**
	10-15 years (1996 - 2000)	0	0	2	3	0	0	**5**
	15 -20 years (1991 - 1995)	0	2	1	0	0	3	**6**
	> 20 years (≤ 1990)	1	4	1	1	0	6	**13**
Classification - Treatment								
	Small System	1	0	0	0	0	0	**1**
	MTA	0	0	0	0	0	9	**9**
	Level I	0	5	5	0	0	0	**10**
	Level II	0	2	1	4	0	0	**7**
	Level III	0	0	0	1	0	0	**1**
Classification - Collection								
	Small System	0	0	0	0	0	1	**1**
	Level I	1	7	6	4	0	2	**20**
	Level II	0	0	0	1	0	0	**1**
	MTA	0	0	0	0	0	6	**6**
Collection								
	Piped	1	7	6	4	0	8	**26**
	Trucked	0	0	0	0	0	0	**0**
	Combined	0	0	0	1	0	1	**2**
Effluent Quality								
	No data	0	4	3	3	0	8	**18**
	Meets	0	0	2	0	0	1	**3**
	Does not meet	1	3	1	2	0	0	**7**

		Septic	Aerated Lagoon	Facultative Lagoon	Mechanical	Other	MTA	Totals
Total No. of Systems		**1**	**7**	**6**	**5**	**0**	**9**	**28**
Primary Operator - Treatment								
	Not certified	1	4	4	5	0	0	**14**
	No operator	0	0	0	0	0	0	**0**
	Not required	0	0	0	0	0	9	**9**
	Certified to Level	0	3	2	0	0	0	**5**
	Certified	0	0	0	0	0	0	**0**
Back-Up Operator - Treatment								
	Not certified	1	5	4	1	0	0	**11**
	No operator	0	2	2	3	0	0	**7**
	Not required	0	0	0	0	0	9	**9**
	Certified to Level	0	0	0	0	0	0	**0**
	Certified	0	0	0	1	0	0	**1**
Primary Operator - Collection								
	Not certified	1	6	3	5	0	3	**18**
	No operator	0	0	0	0	0	0	**0**
	Not required	0	0	0	0	0	6	**6**
	Certified to Level	0	1	3	0	0	0	**4**
	Certified	0	0	0	0	0	0	**0**
Back-Up Operator - Collection								
	Not certified	1	5	4	2	0	1	**13**
	No operator	0	2	2	3	0	2	**9**
	Not required	0	0	0	0	0	6	**6**
	Certified to Level	0	0	0	0	0	0	**0**
	Certified	0	0	0	0	0	0	**0**
Receiver								
	Large river	0	0	2	1	0	0	**3**
	Creek	0	3	0	0	0	0	**3**
	Lake, reservoir	0	0	1	2	0	0	**3**
	Open marine, enclosed bay	1	1	1	1	0	0	**4**
	River	0	2	2	1	0	0	**5**
	Wetland	0	1	0	0	0	0	**1**
	MTA	0	0	0	0	0	9	**9**

	Septic	Aerated Lagoon	Facultative Lagoon	Mechanical	Other	MTA	Totals	
Total No. of Systems	**1**	**7**	**6**	**5**	**0**	**9**	**28**	
Risk (mean)							**Mean**	**Mean excluding MTA**
Final	6.1	6.9	6.4	7.3	0.0	1.9	**5.2**	**6.8**
Effluent Receiver	2.0	6.0	6.3	6.8	0.0	1.2	4.5	**6.1**
Design	8.0	5.6	5.3	5.2	0.0	1.6	**4.3**	**5.5**
Operations	7.0	8.4	7.2	7.2	0.0	3.4	**6.3**	**7.6**
Reporting	10.0	9.1	8.5	10.0	0.0	2.0	**6.9**	**9.2**
Operator	5.0	6.4	5.7	9.2	0.0	1.1	**5.0**	**6.8**

NEEGAN BURNSIDE

Appendix C

Site Visit Methodology

Site Visits

Typical Day

Arrive in Community – Lead/Senior Inspector & Technical Support

- Meet with Circuit Rider and/or DIAND representative and First Nation/Tribal Council Representatives to undergo introductions and provide a brief synopsis of the activities to be undertaken for the day. This is based on the assumption that the First Nation has been fully briefed by DIAND on the purpose, process and benefits for the First Nation to cooperate and collaborate with the project.
- Confirm the various components that the First Nation uses to provide water to the entire community (i.e. number and types of distribution systems, source types, private wells, etc.) to help build assessment form for the community.
- Pre-select areas to undertake private system evaluations on community map.
- Confirm any missing background data that may be available allowing the First Nation time during the day to have Public Works Director/Supervisor/Secretary/etc to locate such materials.

Lead/Senior – Inspector

- Meet with Chief/Housing Manager/Band Manager/Finance Manager, to identify:
    - future servicing needs (planned development and population growth)
    - servicing constraints (source availability, soils, groundwater, bedrock, topography, etc.)
    - identify the extent to which non structural solutions or optimization strategies (water conservation, leak reduction, etc) have been previously investigated or implemented
    - confirm current population and housing numbers
    - obtain financial information not previously provided
    - note community concerns related to future servicing.
- Complete a walk through of the water plant from source to storage.
- Prepare a flow schematic (internal use).
- Complete the assessment questionnaire on treatment/storage/operations/operator(s) etc. with Operator/Circuit Rider.
- Take photographs.
- Travel to main sewage pumping station and wastewater treatment facility.
- Complete a walk through of the plant from influent to effluent.
- Prepare a flow schematic (internal use).
- Complete assessment questionnaire.
- Take photographs.
- Complete ACRS update.
- Repeat for additional water or wastewater facilities.
- Review information collected by Technical Support
- Gather all background/operational data gathered by First Nation.
- Complete overall notes.

Technical Support

- Gather any relevant operational data (water and wastewater), if not already provided and arrange with the First Nation to have copied/scanned that day.
- Obtain GPS coordinates of source(s) and treatment.
- Complete the source questions on the assessment questionnaire.
- Undertake sampling of the raw and/or treated water, if necessary.
- Take photographs.
- Complete ACRS update.
- Travel around community with First Nation representative and undertake private system assessments for water and/or septic including GPS coordinates, photographs, assessment forms and sampling.
- Meet back with Lead/Senior Inspector at wastewater location and assist with sampling, if required.

Sampling Requirements

Water Sampling

The terms of reference state, *"The sampling program for public water systems should reflect the requirements of the most stringent regulations applicable in the Province in which the community is located. However, should an adequate sampling program already be in place, then existing data may be used. Bidders should assume sampling and testing will be required for 5% of total wells, septics, and cisterns identified in SW5. Septics and cisterns only require a visual inspection. All bidders are required to carry a $500,000 allowance for this purpose. Any variances should be identified in the Inception Report."*

Health Canada data is anticipated to be available for the majority of the water systems. Where data is not available, sampling will be conducted as part of the inspection.

Minimum existing data required will include:

Community systems	
	- bacteriological – monthly available for previous year
	- general chemistry – annually (treated)
	- full Volatile Organic Compound analysis – within 5 years
Private wells	- bacteriological – one sample within past year
	- basic chemistry – one sample within past year

For public systems where data is not available, treated water samples will be obtained and submitted to a laboratory for testing that would include; Basic Chemistry, Full Metals Scan, Bacteria and Volatile Organic Compounds.

For public systems that include a piped distribution system and where distributed water quality data is not available, a sample will be taken from the most remote point in the distribution system and sampled for Disinfection By-Products.

For individual wells, samples will be obtained from a representative number of wells (5% of total wells) in the community. The testing will include; Basic Chemistry, Full Metals Scan and Bacteria.

Wastewater Sampling

For systems lacking existing discharge quality data, and that will be discharging at the time of the site visit, representative samples will be obtained and submitted to a laboratory for testing. This would include seasonal discharges at the time of the site visit and from plants with continuous discharge to a receiving body. Sewage treatment systems providing an equivalent to secondary treatment (lagoons, and mechanical facilities) for which effluent quality data does not include the parameters of BOD_5, TSS, and E.Coli, will be sampled in the field, if they are in fact discharging at the time of site visit. Similarly, sewage treatment systems providing an equivalent to tertiary treatment for which effluent quality data does not include BOD_5, TSS, Ammonia, Total Phosphorous and E.Coli, will be sampled in the field, if they are in fact discharging at the time of the site visit.

NEEGAN BURNSIDE

Appendix D

First Nation Water Summaries

NEEGAN BURNSIDE

Appendix D.1

Individual First Nation Water Summary

Table D.1 - 1: Water System Regional Summary of Water Treatment, Storage and Distribution Systems

First Nation Information		Water System Information									Storage Information		Distribution System Information						
Band #	Band Name	System #	System Name	Water Source	Treatment Class	Const Year	Design Capacity [m3/d]	Actual Capacity [m3/d]	Max Daily Volume [m3/d]	Disinfection	Storage Type	Storage Capacity	Distribution Class	Population Served	Homes Piped	Homes Trucked	Number of Trucks in Service	Pipe Length	Pipe Length / Connection
1	Abegweit	12499	MORELL NO. 2	Groundwater	None	1992	229	229	27.3	Yes	None		Small System	28	9	0	0	244	27
1	Abegweit	12479	ROCKY POINT NO. 3	Groundwater	None	1992	229	229	38.1	No	None		Small System	50	16	0	0	450	28
1	Abegweit	12459	SCOTCHFORT NO.4, Site #06002	Groundwater	None	1992	916	916	133	No	None		Level I	136	44	0	0	1646	37
18	Acadia		MTA	MTA	MTA	1990				MTA	None	MTA	MTA	205	69	0	0	1036	15
20	Annapolis Valley	6474	CAMBRIDGE NO. 32	Groundwater	None	1984	605	605	287	Yes	Underground	240	Level I	127	57	0	0	1765	30
4	Buctouche	17002	CWS	Groundwater	None	1991	381	381	101	Yes	None	0	Level I	104	37	0	0	1315	35
5	Burnt Church	6467	BURNT CHURCH NO. 14	Groundwater	None	1977	588	588	917	Yes	Elevated	568	Level I	1128	260	0	0	8960	34
22	Chapel Island First Nation	6475	CHAPEL ISLAND NO. 5	Surface Water	Level II	2000	544	305	301	Yes	Elevated	282	Level I	574	145	0	0	5780	39
7	Eel Ground	6468	EEL GROUND NO. 2	Groundwater	None	1998	660	660	561	Yes	Grade level	670	Level I	690	180	0	0	5495	30
8	Eel River Bar First Nation	17003	Eel River 3	MTA	MTA	2000	n/a	n/a	n/a	MTA	None	MTA	Level I	431	155	0	0	5360	34
3	Elsipogtog First Nation	6465	RICHIBUCTO NO. 15	Groundwater	None	1992	1926	1926	1408	Yes	Elevated	950	Level II	2160	600	0	0	9522	15
23	Eskasoni	6476	ESKASONI NO. 3A	Groundwater	None	1987	3168	2420	2279	Yes	Standpipe	1926	Level II	3684	950	0	0	26394	27
9	Fort Folly		FORT FOLLY MTA WATER SYSTEM	MTA	MTA	1991				MTA	None	MTA	MTA	35	22	0	0	2360	107
30	Glooscap First Nation	NEW001	GLOOSCAP MTA WATER SYSTEM	MTA	MTA	2004				MTA	None	MTA	MTA	108	22	0	0	2977	135
11	Kingsclear	6469	KINGSCLEAR NO. 6	Groundwater GUDI	None	1987	1090	1090	718	Yes	Grade level	480	Level I	803	185	0	0	6938	37
2	Lennox Island	NEW001	LENNOX ISLAND WATER SYSTEM	Groundwater	None	2008	1235	1235	523	Yes	Standpipe	1140	Level I	484	120	0	0	3010	25
6	Madawaska Maliseet First Nation	NEW003	WATER MTA	MTA	MTA	1993				MTA	None	MTA	MTA	149	80	0	0	2533	31
26	Membertou	NEW001	MTA WATER SYSTEM	MTA	MTA	1980				MTA		MTA	MTA	959	312	0	0	5474	17
14	Metepenagiag Mikmaq Nation	6470	RED BANK NO. 4	Groundwater	None	2005	976	976	411	Yes	Grade level	455	Level I	423	138	0	0	7173	51
47	Miawpukek	6480	SAMIAJIJ MIAWPUKEK - water treatment system	Surface Water	Level I	2004			781	Yes	Underground		Level I	961	305	0	0	12800	41
27	Millbrook First Nation		MTA	MTA	MTA	1970				MTA	None	MTA	MTA	868	346	0	0	12170	35
32	Mushuau Innu First Nation		MUSHUAU WATER TREATMENT PLANT	Surface Water	Level II	2000	850	850	792	Yes	Underground	410	Level I	975	170	0	0	13500	79
12	Oromocto	17004	CWS	MTA	MTA	2000				MTA	None	MTA	MTA	352	98	0	0	2273	23
13	Pabineau	9816	PABINEAU NO. 11	Groundwater GUDI	Level I	1975	196	95	95	Yes	None		Small System	60	30	0	0	3950	131
19	Paqtnkek First Nation	NEW001	PETOW SUBDIVISION PUMPHOUSE	Groundwater	Level II	2005	136	136	171.9	Yes	Grade level	360	Level I	191	56	0	0	2500	44
19	Paqtnkek First Nation	6473	POMQUET AND AFTON NO. 23 (Pumphouse #1)	Groundwater	None	1980	65	65	86	Yes	Underground	95	Level I	236	69	0	0		
24	Pictou Landing First Nation	6478	FISHER'S GRANT NO. 24	Groundwater	None	1975	290	290	462	Yes	andpipe, Undergrou	900	Level I	554	151	0	0	4978	32
15	Saint Mary's	NEW001	WATER SYSTEM	MTA	MTA	1982				MTA	None	MTA	MTA	912	250	0	0	5800	23
33	Sheshatshiu Innu First Nation	7103	Sheshatshiu Water Treatment Plant	Groundwater	None	1993		1713	1713	Yes	Standpipe	757	Level II	2108	350	0	0	9800	28
25	Shubenacadie	6481	INDIAN BROOK I.R. NO. 14	Groundwater	Level II	1990	862	862	1060	Yes	Elevated	1280	Level I	1305	340	0	0	17116	50
25	Shubenacadie		NEW ROSS PUMPHOUSE	Groundwater	Small System	1995	unknown	unknown	23	No	None		Small System	24	6	0	0	525	87
16	Tobique	6471	TOBIQUE NO. 20	Groundwater	None	1988	1555	1555	1357	Yes	Underground	1220	Level II	1681	356	0	0	9445	26
28	Wagmatcook	6477	WAGMATCOOK NO. 1	Groundwater	Level II	2007	544	544	609	Yes	Standpipe	3,440	Level I	750	147	0	0	9471	64
29	Waycobah First Nation	6479	WHYCOCOMAGH NO. 2	Groundwater	None	1997	458	458	625	Yes	Elevated	418	Level I	925	260	0	0	8464	32
17	Woodstock	6472	WOODSTOCK NO. 23	Groundwater GUDI	None	1955	583	216	143	Yes	Underground	738	Level I	296	80	0	0	4129	51