

exploring **SOLUTIONS** for rural drinking water SYSTEMS

A MUNICIPAL SUMMARY
PREPARED BY MNL
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Grenfell Campus - Memorial University - 2014

**A briefing for municipal councils
on a study of rural NL drinking water systems**



Sustainable Drinking Water Report Summary

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October 2014
Municipalities Newfoundland and Labrador

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Project Summary

Beginning in March 2013 Dr. Kelly Vodden of Grenfell Campus' Environmental Policy Institute and her team, coordinated by Sarah Minnes, conducted an eighteen-month study on rural drinking water throughout Newfoundland and Labrador communities with 1000 residents or less. Their research found significant inconsistencies in the quality of water produced from municipal drinking water systems.

Our Four Focuses:

1. Source Water
2. Water Infrastructure and Operations
3. Public Perception, Awareness, and Demand
4. Policy and Governance

This project included case studies, surveys, literature reviews, and consultations. The final report and related reports are available at <http://nlwater.ruralresilience.ca>.

Summary of Findings

Community Concerns:

- Aging, degrading, and/or inappropriate infrastructure
- Health risks of high disinfectant-by products (DBPs)
- Use and misuse of chlorine

Critical Issues:

- Long term boil water advisories
- Use of untreated water sources
- Minimal source water protection
- Lack of capacity to address drinking water challenges

Project Objectives:

- Determine the current conditions of drinking water;
- Identify existing drinking water policies and infrastructure;
- Determine perspectives and practices related to water contamination, environmental management, and sustainable solutions;
- Identify key players and understand their roles and responsibilities;
- Research integrated watershed management and drinking water systems strategies for improving drinking water quality;
- Make recommendations based on the findings for i) policy and practice related to water policies, programs and infrastructure, and ii) future research.



In March 2013 Dr. Kelly Vodden was funded by the Harris Centre-RBC Water Research and Outreach Fund to study the risks and challenges influencing drinking water in rural Newfoundland and Labrador (NL) and to explore potential solutions. The project team included researchers from Memorial University's departments of Environmental Studies, Geography, Environmental Science, Civil Engineering, and Community Health and Humanities, as well as expertise from all levels of government. This report summarizes the findings and recommendations of this project, as well as recommendations for future research. Additional funding support was provided by the Mitacs Accelerate Program.

Report Overview

Prolonged exposure to disinfection by-products (DBPs) such as trihalomethanes (THMs) can cause serious health risks.

Disinfection by-products (DBPs) are known carcinogens that can occur when organics in the water mix with chlorine, which is commonly used in municipal water supplies to disinfect the water to kill viruses and bacteria. There has been links found between long-term exposure to DBPs and certain cancers, particularly cancer of the liver, kidneys, bladder and colon, as well as other health impacts.

Chlorine use and misuse has also been identified as a prominent concern.

The prevalence of long-term boil water advisories (BWAs), compromises residents' access to safe, clean drinking water. While primary research related to public perception was not a focus, we found that a distaste for chlorinated and/or discoloured drinking water, was a serious concern for some residents causing them to turn to untreated water sources such as roadside springs.

Provincial agencies play a lead role in water governance together with local governments. Many of the communities in this study lack the human, financial, technical, institutional and political capacity to address the drinking water challenges identified (e.g. ageing infrastructure, high number of long-term and frequent BWAs, high DBPs, inadequate management of drinking water infrastructure assets and uncertified water operators).

Finding and retaining certified water operators is a significant challenge.

Local governments also struggle with maintaining and upgrading their water infrastructure. In addition, strategic management of drinking water infrastructure, including organized leak detection programs and access to all related blueprints and as-builts, is deficient, especially in communities with uncertified water operators.

Watershed protection is overlooked.

Another objective of this project was to look at watershed management practices and drinking water systems strategies that can improve drinking water quality, such as the protection of source water supplies.

Primarily due to the lack of human capacity at the local level, source water protection efforts are often overlooked. Overall, we found that there is insufficient funding and human resources at both the local and provincial levels in NL to achieve sustainable drinking water systems.

In many small communities, fully implementing their mandate to provide clean and safe drinking water to residents is virtually impossible with existing human and financial resources. Our study also shows that communities are not able to draw the necessary support from the province due to similar issues of dwindling human and financial resources at the provincial level.

Who's Responsible for Drinking Water

The responsibility for ensuring the safety of drinking water supplies is shared by all levels of government. The principal responsibility of ensuring the safety of drinking water generally rests with the province and municipalities ensure the day-to-day operations of supply, treatment and distribution.

Federal Government

Health Canada creates guidelines that set a standard for quality of Canadian drinking water. The provinces may use these guidelines to establish their own standards. NL follows guidelines set by Health Canada.

Provincial Government

Drinking water is primarily a provincial responsibility, with the NL provincial government being responsible for ensuring public access to safe drinking water based on:

- The Municipalities Act, 1999,
- The Municipal Affairs Act, 1995
- The Environmental Protection Act, 2002 and
- The Water Resources Act, 2002.

There are 478 public water sources in NL. The following four provincial government departments share responsibility in managing drinking water services, with local governments.

- The Department of Environment and Conservation
- The Department of Health and Community Services
- The Department of Municipal and Intergovernmental Affairs, and
- Service NL

Local Government

Regular operations of water systems, including daily testing of chlorine residual, and source water protection are the responsibility of local governments. Public drinking water sources can be supplied from both surface water and groundwater. In this province we currently have:

- 299 public surface water supplies and
- 179 public groundwater supplies.

Provincial legislation enables local governments to provide public water supply systems. Municipalities are then able to enact their own by-laws and regulations.

Local Service Districts (LSDs) are allowed to operate their own water supply and determine the time, manner, extent, nature and recipients of the supply. LSDs are able to call a water ban, but they do not have the authority to make bylaws with respect to conservation efforts.

In situations such as remote, fly-in communities, activities that are normally a provincial responsibility such as the collection of bacteriological samples are taken on by community staff, with samples being sent to the nearest Regional Government Service Centre office by scheduled flights.

Permits to Operate fall under the provincial Department of Environment and Conservation. These permits regulate public drinking water systems. These permits inspect:

- Source protection;
- Treatment system;
- Water quality and quantity monitoring;
- Waste and quantity monitoring;
- Waste and process wastewater;
- Distribution system;
- Operation manuals;
- Logbooks;
- Contingency, emergency and long term planning;
- Security and safety;
- Consumer relations;
- Reporting, notification and corrective actions; and
- Operator certification and training.

According to a 2013 annual report only seven communities have been inspected for compliance with their Permits to Operate. However, the Department of Environment and Conservation's Water Resources Management Division aims to inspect all public drinking water systems serving a population of 500 people or more within the next five years.

Indigenous Government

Water systems in Indigenous communities are overseen and managed by the provincial government with their Indigenous and local community governments including:

- Nunatsiavut Government,
- Inuit Community Governments,
- Innu Nation,
- NunatuKavut Community Council,
- Qalipu Mi'Kmaq First Nation Band Council,
- Miawpukek First Nation Band Council.

Measuring the Quality of Drinking Water

Drinking Water Quality Index (DWQI)

Drinking Water Quality Index (DWQI) examines the quality of water coming from a drinking water supply and is one tool the province uses to measure water quality.

The DWQI measures:

- scope,
- frequency and,
- amplitude of water quality exceedances.

Rather than being given an exact number, the DWQI combines the three measures into a score between 0 and 100. The higher the score the better the quality of water.

1. **Excellent: (WQI Value 95-100)** - Water quality is protected with a virtual absence of impairment; conditions are very close to pristine levels. These index values can only be obtained if all measurements meet recommended guidelines virtually all of the time.
2. **Very Good: (WQI Value 89-94)** - Water quality is protected with a slight presence of impairment; conditions are close to pristine levels.
3. **Good: (WQI Value 80-88)** - Water quality is protected with only a minor degree of impairment; conditions rarely depart from desirable levels.
4. **Fair: (WQI Value 65-79)** - Water quality is usually protected but occasionally impaired; conditions sometimes depart from desirable levels.
5. **Marginal: (WQI Value 45-64)** - Water quality is frequently impaired; conditions often depart from desirable levels.
6. **Poor: (WQI Value 0-44)** - Water quality is almost always impaired; conditions usually depart from desirable levels.

However if a public water supply system is on a Boil Water Advisory, or it has a current contaminant exceedance, or has a THMs average above the drinking water quality guideline a DWQI score is not computed.

Also, this index presents a falsely - or unrealistically positive rating of drinking water quality because only 28% of communities are actually ranked. It is important to note that 72% of communities are not reported on and therefore their appropriate ranking is unknown. Within the 28% of reporting communities, 80% are achieving a score of Excellent.

Boil Water Advisory (BWA)

Boil water advisories (BWAs) are implemented by local governments to protect the public when there is reason to believe that contaminants may be in their water supply.

BWAs can also be issued if water quality is threatened by operational deficiencies, such as:

- Inadequate chlorine residual,
- No disinfection system,
- The water in a community's water system is contaminated with bacteriological indicators such as total coliforms.

While BWAs do not measure drinking water quality, their presence is an indicator of a possible concern related to a drinking water system. This research project has found that BWAs are more likely to occur in communities of less than 1,000 residents. The most common reasons for BWAs are:

- Lack of chlorine residual in the system,
- Absence of a disinfection system,
- Disinfection system that was not operating due to maintenance or mechanical failure.

BWAs also last for longer periods of time in smaller communities. As of July 29, 2013, there were 256 BWAs affecting 184 NL communities. All but 7 were in communities of less than 1000 residents and over half of them had been on a BWA for five years or more resulting in a Long-Term Drinking Water Advisories.

Health Canada states that a "Long-Term Drinking Water Advisory" is a drinking water advisory that has been in place for more than one year. Our findings indicate that LSDs are more likely than municipalities to experience Long-Term Drinking Water Advisories.

Boil water advisories are issued when water sampling and testing detects higher than accepted amounts of coliforms (bacteria) or if there are deficiencies with regard to chlorination or other forms of disinfection. In such cases, the results are immediately communicated to affected communities for appropriate action. The information is also passed along to regional Medical Officers of Health to advise that action has been taken with the community, and for any follow up that may be necessary by the public health system.

*Department of Environment and Conservation
Government of Newfoundland and Labrador*

SOURCE WATER - Disinfectant By-Products

Source water refers to the lakes, ponds, rivers, and underground aquifers that are used to supply drinking water to a residence or community. We examined these four key areas related to source water:

1. Disinfectant by-products,
2. Aesthetics,
3. Quantity issues,
4. Source water protection.

It should be noted while our research found other source water contaminants such as arsenic in wells, E. coli and tailings from mines, this report is a summary of the most common issues identified in our research and not all the issues are represented.

Disinfectant By-Products

Prolonged exposure to disinfection by-products (DBPs) such as trihalomethanes (THMs) can lead to serious health risks. These by-products are known carcinogens that can occur when organics in the water mix with chlorine, which is commonly used in municipal water supplies to disinfect the water to kill viruses and bacteria.

Communities that rely on surface water have higher concentrations of DBPs in their water supply. More organics can be found in surface water than ground water. In NL surface water supplies are more prevalent, with 299 communities relying on surface water supplies compared to 179 groundwater supplies.

Experts indicated that this problem is exacerbated by climate change due to increased precipitation and extreme weather events, resulting in increased delivery of dissolved organics.

Dissolved organic content in water can be especially challenging for small communities in NL, as it requires more costly and sophisticated filtration systems to remove organic matter prior to disinfection. Currently, filtration is not mandatory in NL.

Chlorine is the most commonly used disinfectant not only in NL but also across Canada. The Government of NL stresses that the risks of consuming untreated drinking water outweigh the possible risks associated with DBPs.

The current policy on public drinking water systems states that using alternatives without chlorine to treat water is not

an option for public water systems with the exception of PWDUs. However, this is decided on a case by case basis. If a community had adequate primary and secondary disinfection then no chlorine could be an option and allowed by the Province.

Solutions and Future Directions

Disinfectant By-Products (DBPs)

- Alternatives to chlorine (for disinfection) in public water systems should be examined further.
- More research is also needed into the necessity of using chlorine in combination with these technologies.
- More research is also needed on the long-term health impacts of DBPs in drinking water in NL communities. These carcinogens have garnered much concern, and proactive research is needed to track possible correlations between cancer rates and/or reproductive issues and high DBP levels.
- Communicate the potential health-related impacts, and both municipal and household treatment options with the public. Consideration must be given to household treatment options and increasing education efforts for residents about what they can do at home to decrease DBPs. Home treatment options for eliminating THMs and HAAs including filtration water purification systems and UV water disinfection systems, should be communicated to the public in communities where DBPs are found to be over the Canadian guidelines.

Aesthetics - SOURCE WATER

Aesthetics

Poor aesthetics of the water supply is a concern for many municipalities. Individuals often judge the safety of their drinking water based on the colour, clarity, odour, and taste. Our research suggests many residents will only accept a water supply as safe to drink if the appearance or smell of the water is pleasant. Though aesthetic issues often do not mean that the water supply is contaminated, it is often used as an unofficial indicator of poor water quality and safety.

For example, a high iron count in a water supply will discolour the water. Residents are cautious to consume brown water, believing contaminants may be present. To avoid this “contaminated” water residents often turn to alternative water sources, such as roadside springs or bottled water. Roadside springs are a concern because these are unmonitored sources and could put users at risk.

Aesthetics are perceived as the “proof” of water quality and solutions to these issues are often expensive. Residents may choose to install in-home filters at their own expense to ensure their own personal safety.

Technically safe water should be a priority for municipalities, however aesthetics cannot be overlooked. If residents are not drinking from their monitored water sources, then the sizeable monetary investment in municipal water treatment is not being maximized. In fact residents may be putting themselves at serious health risk by using unmonitored sources because they haven't been properly briefed on their town's water quality.

Solutions and Future Directions

Aesthetics

- Inform residents on the risks of using unmonitored or un-chlorinated water supplies, as well as on why aesthetics do not always indicate the actual safety of drinking water.
- Educate the public on simple things they can do at home to reduce chlorine taste such as:
 - Refrigerating water, letting water sit to allow the chlorine taste to dissipate,
 - Use of Brita or other activated carbon and ion exchange resin filters.



SOURCE WATER - Quantity

Quantity

Water quantity is also an issue for some rural communities in NL. Low water levels from unusually dry weather have been a reoccurring threat to municipal drinking water systems, causing the implementation of water bans. In some cases low water levels for extended periods have had a negative impact on residential and local economic development.

"We've had communities run out of water because their ponds just don't have the capacity. They're not recharging at a quicker rate than the water's being used. Any extreme in weather is really going to (have an) effect in a surface water supply."

-NL Provincial government representative

Recent climate change projections show that NL is at a low risk for droughts. However data collected for this project indicate that some communities have experienced periods of water shortage. This may be largely due to the:

- Location of water sources
- Leakages within the infrastructure
- Capacity of the water systems

Solutions and Future Directions

Quantity

- The most common solution to low water level issues has been to find a new water source. Other useful tools would be education and conservation.
- The majority of "high water users" were institutions such as schools and hospitals; therefore, it may be wise for the provincial government to consider implementing water conservation strategies in those provincially funded buildings.



Protection - SOURCE WATER

Protection

In NL, source water and water supply areas, while not mandatory may be protected under the Water Resources Act. Development within these designated areas is regulated using several different monitoring tools including:

- Referrals from the Interdepartmental Land Use Committee, Crowns Lands, Natural Resources, MIGA and other agencies;
- Permits for development;
- Watershed sensitivity classification system;
- Watershed management plans; and
- Watershed management committees.

Once a municipal water supply is designated as a protected public water supply area (PPWSA), local governments can erect signage that bans unpermitted activities such as swimming, boating and fishing within their drinking water supplies. It is important to note that not all municipal water supplies have this designation.

Source Water Threats

According to municipal leaders the most common land use activity threats to municipal water supplies were:

- Hunting and fishing;
- Domestic woodcutting; and
- Recreational vehicle usage.

It was reported to us that some communities often do not actually monitor their water supplies, even if they are designated as PPWSAs, largely due to insufficient human resource capacity. This is despite the fact that, under the PPWSA regulations, operators of the water systems in municipalities and LSDs are responsible for monitoring their water supply.

Other findings from this project indicated that many local governments do not prohibit any of the banned activities under the PPWSA regulations in their drinking water supply area. From this, we have learned that leaving source water protection monitoring solely at the discretion of local governments may be inappropriate given the current lack of capacity of many small communities, as well as conflicting values and cultural uses within source water areas.

In many cases the only source water protection actively enforced is the permitting process, whereby individuals and organizations wishing to develop within these protected areas must seek approval from the local government.

It is alarming to find that while the provincial government strongly encourages communities to protect their water supplies, it is not mandatory. This poses various problems:

- Not all water supplies have a formal mechanism for protection,
- The onus is on individual municipalities to apply for PPWSA designation,
- The designation costs \$100.

Leaving this important aspect of drinking water protection up to the discretion of the local government is inappropriate. Although the program was seemingly designed in this fashion to ensure a community driven process, it seems that even when communities have PPWSAs, protection and enforcement does not always occur. Without sufficient monitoring and active implementation of the PPWSA, the usefulness of PPWSAs in achieving source water protection is questionable.

Lack of capacity and understanding of the importance of source water protection can contribute to weak adherence to PPWSA regulations, especially when human and financial resources are limited.

Watershed planning has been employed as a source water protection tool in other jurisdictions, but this is not a common practice in NL. According to the 2013 Drinking Water Safety in Newfoundland and Labrador: Annual Report there are only five watershed committees in the province, and only three watershed plans have resulted from these committees. Of these, only one community with less than 1000 residents has a watershed plan/committee.

None of these watershed plans are inter-community or regional agreements, meaning they may reflect political rather than watershed boundaries with the exception of the Gander Watershed Management Plan. This is problematic for managing drinking water, as what happens upstream, impacts downstream communities but may be outside of their planning boundaries. Participants in the expert policy workshop explained, there is currently insufficient capacity at both the local and provincial levels for many NL communities to develop watershed management plans.

SOURCE WATER - Protection (continued)

Protection

The lack of mandatory and enforceable source water protection regulations puts NL communities at risk.

Researchers have identified source water contamination as a threat to drinking water in NL. Even though source water protection is stated as an important part of the Provincial Government's "Multi-Barrier Strategic Action Plan" to ensure safe drinking water, little research has been done in the province on current and alternative source water management structures. Furthermore, in a 2009 report, it was stated that there is a, "...lack of information regarding the connectivity between landscape attributes, hydrology, water use and water quality".

The findings of this study suggest that further research is needed on how to increase source water protection, as well as compliance with PPWSA regulations. Even if the PPWSA regulations are not enforced, making the designation of a PPWSA mandatory for all public drinking water systems may help to stress their importance.

Furthermore, source water protection should be context appropriate, and not a cookie cutter regulation. Though community driven regulations like the PPWSA process are often considered a best practice, our findings indicate they are not always being effectively executed in rural NL.

One example of a context appropriate source water protection measure that does currently occur in some areas is setting watershed specific buffer zones in PPWSAs, depending on the pressures or threats in the area. Considering the often limited monitoring and enforcement capacity of small municipalities, alternatives such as community based education, stewardship and monitoring programs should also be explored, as well as the potential role of non-governmental organizations and public groups.

Furthermore, watershed management plans should be created on a physical/ecological watershed basis, including inter-municipal agreements where water sources and watersheds are shared between communities. This is especially important for communities that share PPWSAs. These communities need greater support from the provincial government and/or organizations such as MNL to create regional water committees and to discuss source water protection and other drinking water related issues. However, no plans or committee decisions can work unless they are implemented.

Solutions and Future Directions

Protection

- Further research is needed on how source water protection is being done in other rural areas and how NL can improve the implementation of current policies.
- New policies or governance arrangements must be accompanied by efforts to improve awareness of source water protection and potential threats to community water supplies.
- Increase the number of communities engaging in source water monitoring and protection.
- Involve other provincial wide organizations such as MNL and PMA to increase awareness of the importance of source water protection.



Safe Drinking Water Starts at the Source!

INFRASTRUCTURE AND OPERATIONS

Ageing and Degrading Infrastructure

In this report, “infrastructure” refers to all infrastructure related to public drinking water systems, including water intakes and treatment plants, pump houses, and distribution lines. “Operations” refers to the operations and maintenance of drinking water systems, including daily procedures, operator training and certification, and proactive maintenance such as leak detection. The sub-headings below outline the project’s main findings pertaining to water infrastructure and operations.

- Ageing and Degrading Infrastructure
- Operator Education, Training and Certification
- Potable Water Dispensing Units

Ageing & Degrading Infrastructure

Ageing and degrading drinking water infrastructure was identified as the most common challenge faced by communities. More than 80% of LSDs and 65% of the municipalities studied said they require repairs or upgrades to at least parts of their drinking water infrastructure. Of these identified communities, 80% indicated that they couldn’t make required repairs or upgrades due to a lack of financial resources.

It was found that in terms of addressing local drinking water issues, 16% of LSDs and 25% of municipalities with a population of less than 1000 had implemented new or innovative solutions locally to address issues. In terms of how often these measures succeeded, some administrators indicated that there had been past actions undertaken by their community in an attempt to address their water challenges that had either failed, or had not worked well. They described, in particular, a lack of local capacity to manage new technologies.

It was noted by administrators in our survey that new drinking water treatment technologies installed are often inappropriate for the community. For example, in some cases there was no one in the community with the necessary expertise to operate or repair the infrastructure. This resulted in expensive new infrastructure that was either unusable or unsuitable. It was communicated to our researchers by municipal administrative staff that outside engineers are required to consult on what new infrastructure is needed when communities are applying for federal or provincial funding. It was noted that these engineers often do not take into account the scale and human and financial ca-

acity of the communities or may be unwilling to recommend solutions beyond standard approaches, resulting in the adoption of inappropriate technologies.

However, provincial officials refuted this claim during interviews, indicating that Municipal and Intergovernmental Affairs does not fund any projects without assurance that someone in the community can operate the system. How they do this was not explained. The Province has also expressed a commitment to providing rural NL communities with context appropriate solutions. In 2008, former Minister of Environment and Conservation, Charlene Johnson, further spoke to the Province’s commitment to context-specific drinking water solutions:

“The geography and various environmental factors of some of the smaller communities throughout Newfoundland and Labrador do not permit a ‘one size fits all’ approach to dealing with water quality matters...Through phase one and the subsequent phases of our initiative, we will continue to reaffirm our commitment to safe and reliable drinking water for all residents, determining the appropriate solution for communities”

A commitment to drinking water from the provincial government is evident. Between 2008 and 2014 MIGA has provided \$234,983,015 (an average of just over \$39M per year) to specifically drinking water infrastructure projects and \$132,037,213 (an average of just over \$22M per year) to water and sewer joint projects (a total of \$367,020,228). Out of the total funding for 2008-2014, \$95,067,253 (40% of total funding and approximately \$15.8M per year) was given to communities of 1000 residents or less for drinking water infrastructure projects, and 22,813,840 (17% of total funding and approximately \$3.8M per year) was given to communities of 1000 residents or less for water and sewer joint projects. A recent survey by MNL indicated that communities of 1000 residents or less anticipate spending over \$280M (approximately \$28M per year) over the next ten years on water related capital costs. Thus previous levels of expenditure will need to increase to meet anticipated needs of these communities. This will also place financial demands on local governments. It was mentioned by provincial and local government officials that even contributing 10% of a project’s cost, a requirement for small communities under the Capital Works program, can be challenging for many communities, especially ones in which residents are on fixed incomes and/or populations are declining.

INFRASTRUCTURE AND OPERATIONS

Ageing and Degrading Infrastructure (continued)

Solutions and Future Directions

Ageing & Degrading Infrastructure

- Physical and human asset management is needed to improve the lifespan and overall knowledge of a community's water infrastructure.
- Need succession planning for water operators
- Local governments must effectively charge for water consumption.
- Promote and use capital works funding for asset management activities.
- Regional approaches and sharing infrastructure and tools with neighbours to make operations and maintenance more affordable should be considered more often.
- Address the issue of infrastructure deficit in rural NL communities through funding and better asset management.

Asset Management

Asset management could be improved in rural NL. Better asset management could in turn improve the lifespan of water infrastructure and result in less funding being needed for ageing and degrading infrastructure.

The findings on ageing and degrading infrastructure in NL are not surprising. Dr. Tom Cooper's report (2013) on municipal infrastructure risk stated that approximately, 43% of Water and Sewer infrastructure is amortized and near the end of its expected life. Cooper's report recommended asset management as a useful tool to reduce known

infrastructure risks. Furthermore, Cooper also found that more than 80% of all municipalities have water and sewer systems that are more than 20 years old. The life span of drinking water infrastructure varies greatly depending on the type, make, and the operation and maintenance it has received.

Asset management was consistently found to be an issue at the local level. About 30% the water operators indicated that a lack of maps, as-builts, and digitized mapping of community infrastructure was one of the biggest challenges preventing them from effectively do their job. Meanwhile, many small communities are unlikely to have maps of their distribution infrastructure. Knowledge gaps regarding fundamental infrastructure considerations, such as where it is in the ground and how long it has been there, represent serious barriers to effective management of water systems.

One feature of proactive asset management is having organized leak detection programs to reduce water leakage or loss, which reduces chlorine usage and results in fewer emergency repair-induced BWAs. Of the water operators in our study only 12% said they had an organized leak detection program, while 23% had five or more leaks in 2012 that required repairs. This suggests that there is much room for improvement in proactive leak detection practices.

In addition to physical asset management, issues with human resources management, specifically around succession planning (or lack thereof) for experienced water operators, have to be addressed. It was noted that when water operators leave, essential system knowledge, as well as critical administrative information are often lost).

Both physical and human asset management are relatively ubiquitous challenges among rural communities in NL.

Regarding future management of drinking water assets, it appears many communities have little in the way of future plans to address community water assets:

Replies from Local Service Districts:

- 31% indicated there were no plans to do so in their existing capital works plan, and
- 23% indicated that their community did not have a capital works plan.

INFRASTRUCTURE AND OPERATIONS

Ageing and Degrading Infrastructure (continued)

Replied from Municipalities:

- 22% of smaller municipalities of under 1000 indicated that there were no plans to improve or expand upon their water system as part of their existing capital works plan,
- 2% of municipalities with over 1,000 residents did not include water infrastructure in their existing capital works plans.

One promising policy change was the reporting of Tangible Capital Assets (TCA). Starting in 2008, municipalities across Canada were required to account for their TCA in annual financial reporting, with the order from the Public Sector Accounting Board (PSAB). This requires that municipalities pay closer attention to the value of their infrastructure over the course of these materials' useful life than in the past.

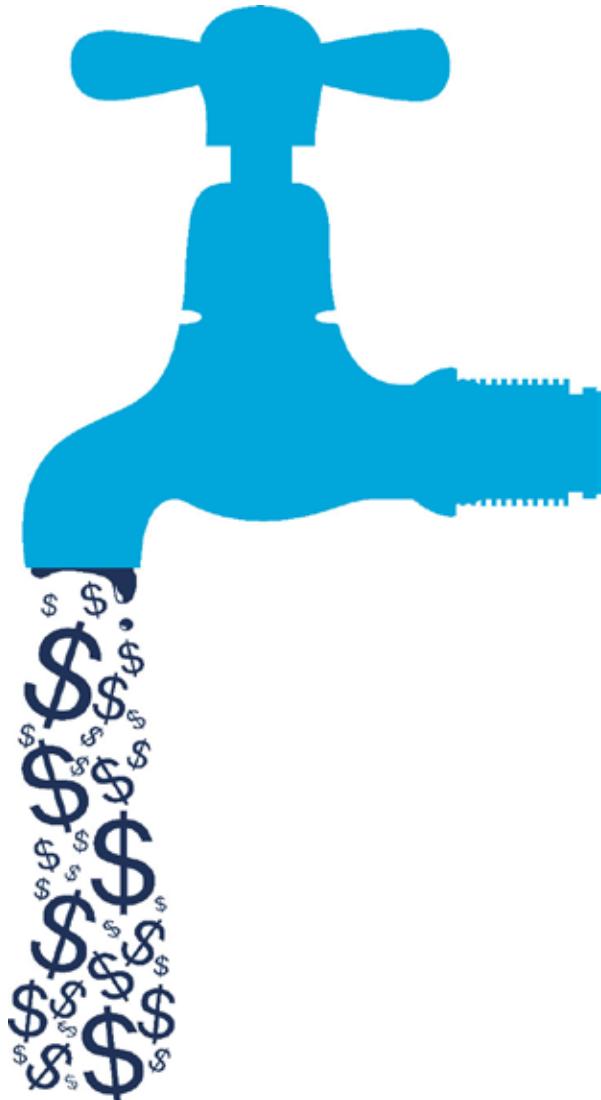
Effectively charging for water consumption

Studies have shown that households on water meters use less water than households who are not. A recent study found that the average water rate charged to NL residents was not fully recovering the municipality's cost for treating water. Also, smaller communities have higher per household costs for treating water.

In fact, MNL's study on ten-year capital and operational cost estimates found that over one third of all capital expenditures expected for towns under 500 will be water related expenditures.

Rural NL could benefit from pilot metering programs aimed at promoting conservation and more appropriate pricing that have been used in the larger centers of Corner Brook, Mount Pearl, and St. John's. Full cost accounting and better estimates of the true cost of drinking water systems' operations could be included in fiscal framework discussions between the provincial and local governments.

Water programs aimed at helping communities evaluate and monitor leaks in the infrastructure can raise awareness of water use in communities and demonstrate that preventative leak detection measures can reduce system demand and preserve community infrastructure.



Providing communities with more funding for water infrastructure will help mitigate ageing and degrading infrastructure, but this on its own is not an economically or fiscally sustainable solution. It has been found that better maintenance and operations could improve the state of infrastructure in rural NL and extend the life of both existing and new infrastructure investments. To realize this potential, communities must focus on keeping better records including infrastructure maps and blueprints, conducting preventative maintenance, charging appropriate fees for water services, and considering regional programs.

INFRASTRUCTURE AND OPERATIONS

Operator Education, Training and Certification

Operator Education, Training and Certification

In 2001, the Operator Education, Training and Certification program was initiated here by the provincial Department of Environment and Conservation. As of the 2012-13 fiscal year, there were 376 certified water and/or wastewater system operators in the province. While this may seem like an encouraging statistic, we have found that uncertified water operators are still prevalent in small rural communities. In fact approximately 25% of the communities involved in this study have uncertified water operators, meaning that they are not certified or enrolled in the Operator Education, Training and Certification program. Even though water operator certification is stipulated in the Permits to Operate it is evident that this clause is not always followed or enforced.

Our findings indicate that even if mandatory certification was enforced for water operators in small rural communities, it is already difficult enough for these local governments to find and retain a water operator at all, let alone anyone with certification.

Researchers also explored the differences between certified and uncertified water operators. Findings indicated that certified operators were more likely to be in paid, full time positions, as opposed to volunteer positions. As larger communities are more likely to have the tax base to hire a full time employee they are also more likely to have a certified operator. We also discovered that smaller rural communities face significant human and financial resource shortages that make it difficult to find and retain certified water operators.

Researchers also found a relationship between water operator certification and the prevalence of asset management, substantiating the aforementioned lack of asset management in small communities. Communities with certified

water operators were found to be more likely to have a Capital Works Plan that focused on expanding, improving, repairing, or replacing the municipal water system. Furthermore, certified water operators are more likely to report that they had complete maps of pipe infrastructure, and were also more likely to report having a specific office or filing area for drinking water system information. While certified and non-certified operators were equally likely to have a written formal maintenance plan for water distribution infrastructure, certified water operators were more likely to have a maintenance plan for the water treatment system/plant operations than non-certified operators.

Another difference between certified and non-certified operators from the water operators survey was the frequency with which chlorine residual was checked. This is important, as during interviews with provincial officials, it was stated that chlorine residual should be checked once daily in two locations, as per best practices to ensure that no bacteriological contaminants enter the drinking water system. Certified operators were more likely to check for chlorine residual daily in two different locations, while non-certified operators were more likely to check only once a week.

Chlorine related issues contribute to 44% of boil water advisories. An inquiry was commissioned following the Walkerton tragedy in Ontario, where seven people died and many became seriously ill. In this inquiry it was stated,

-Provincial Government Representative

“...you've got to have realistic expectations. Say you're going to have a mandatory certified operator of your town of 50 people, then there's got to be something else in place for them to say hire an operator or pay him some money. Because that's the thing, the problem is with the volunteer organizations in the LSDs. That's where the biggest risk would be.”

“Perhaps the most significant recommendations in this report address the need for quality management through mandatory accreditation and operational planning. Sound management and operating systems help prevent, not simply react to, the contamination of drinking water. In this vein, I recommend requiring all operating agencies to become accredited in accordance with a quality management standard – a standard that will be developed by the industry and others knowledgeable in the area and mandated by the [Ministry of Environment]. Accreditation is designed to ensure that

INFRASTRUCTURE AND OPERATIONS

Operator Education, Training and Certification

operating agencies have systems in place at the organizational level that will enable them to deliver safe water. Also, as part of the quality management approach, I recommend that each municipality be required to have an operational plan for its water system. I anticipate that the accreditation standard and the requirement for operational plans can be tailored to accommodate systems of different sizes and complexity".

Mandatory certification for all public water systems water operators is an admirable, if somewhat unrealistic, goal. Oftentimes in small communities, water operators are volunteers who are giving their time to do basic maintenance and operations work for their community's water system. But to what extent can, or should, these volunteers be relied upon to do the preventative maintenance and the technical operational tasks needed to keep these systems running? Indeed, many operators are nearing retirement or are already retired. Furthermore, especially with volunteer operators, there is little succession planning for who will take over these positions when the current water operator leaves.

Provincial officials suggest that uncertified operators are often the cause of operational and infrastructure problems.

Solutions and Future Directions

Operator Education, Training and Certification

- Regional water operators would help to alleviate burdens and initiate asset management activities.
- Water operators must have training and certification.
- Research into remote technologies should be applied where feasible.
- More education and awareness is needed about the province's Mobile Training Unit.
- Back up water operators and plans for succession of water operators should be in place.

This research team concludes that uncertified water operators are more prevalent in communities with less than 1000 residents, and that uncertified operators pose more of a health risk.

INFRASTRUCTURE AND OPERATIONS

Potable Water Dispensing Units

Potable Water Dispensing Units

Potable Water Dispensing Units (PWDUs) have been promoted as a solution to rural drinking water problems in NL. PWDUs are small-scale water systems that treat water for drinking water purposes only (i.e. not for other household purposes such as showering or laundry), with water stored at a central location and manually collected by users. Residents must go to the PWDU location with water containers and transport the water back to their homes. PWDUs use a combination of different water treatment processes that are also used in large-scale water treatment plants, but at a smaller scale.

The most common reasons for installing a PWDU are:

- Chronic boil water advisories on the existing drinking water system,
- A lack of financial resources for household hook-ups,
- Health concerns surrounding drinking water.

Research reveals mixed opinions regarding the success of PWDUs. The majority of communities that have installed PWDUs indicate they are working properly and felt they are a viable solution to the town's drinking water problem.

It is important that consideration be given the location of the PWDU and that all residents can conveniently access it. PWDUs can also impose a physical difficulty. Residents must carry the water containers from the PWDU location to a vehicle and from vehicles to homes. This can be especially challenging for elderly residents. Furthermore, possible contamination of water storage containers due to containers not being cleaned properly has been noted as a health risk.

Municipal and Intergovernmental Affairs have actively encouraged PWDUs in small communities due to their ease of use and effectiveness in delivering clean and safe drinking water. In 2013, the provincial government paid for or contributed to the cost of six new PWDUs throughout the province. Provincial officials and some communities have noted PWDUs as an appropriate solution for small, rural communities because they require operators to have limited technical expertise, and are inexpensive compared to

treating water for household distribution. However, PWDUs do not address the issue of DBPs being absorbed through skin contact when bathing or showering.

Serious consideration should be given to PWDUs as a permanent solution to poor drinking water quality versus as an expensive temporary solution while waiting upon funding and/or appropriate technology for a better treatment and water distribution system.

Further research and public education on the benefits and costs of PWDUs is needed. PWDUs could very well be the answer to some rural NL community's water system problems, yet not all communities have reached this conclusion. A credible and trusted organization, such as MNL or PMA, would be an appropriate entity to commission research into the successes and challenges of PWDUs thus far in rural NL communities. Furthermore, comprehensive studies on optimizing the design and improving the performance of PWDUs under different environmental and operational conditions as well as more demonstrational tests in the field could be beneficial.

Challenges:

Potable Water Dispensing Units

- Physical demand to carry water from the central location to your home.
- Does not address the health risks of absorbing Disinfectant By-Products through skin contact when bathing.

MNL firmly believes that PWDUs are a step backwards in terms of water systems, and are only a “band-aid” solution. Further discussion is needed on the rising costs of the units and of the costs of operations.

PERCEPTION, AWARENESS, DEMAND

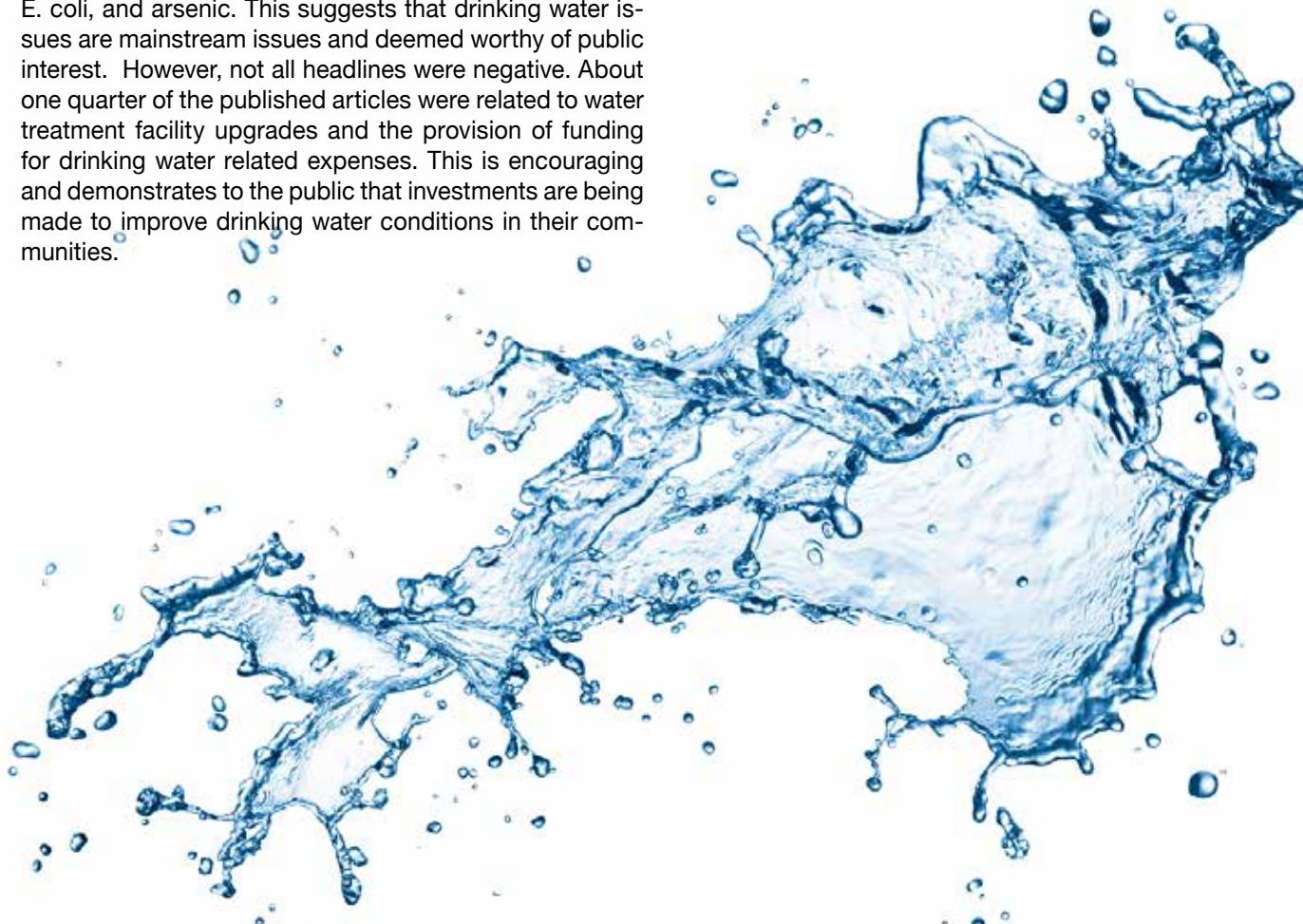
Resident Perception of Drinking Water

Resident Perception of Drinking Water

Residents have strong attitudes towards their drinking water. Though public perceptions of drinking water do not always coincide with data on water quality, it is one indicator of water quality.

While this research project did not collect primary data on the perceptions of residents, it did rely on existing reports pertaining to public perception, a media scan, and municipal opinions to get a general sense of what non-experts were saying about drinking water and what kind of information is exposed to the public. The media scan on rural drinking water found that out of the 94 published articles, 16 related to frequent or long term BWAs, and 10 were about drinking water contaminations such as high DBPs, E. coli, and arsenic. This suggests that drinking water issues are mainstream issues and deemed worthy of public interest. However, not all headlines were negative. About one quarter of the published articles were related to water treatment facility upgrades and the provision of funding for drinking water related expenses. This is encouraging and demonstrates to the public that investments are being made to improve drinking water conditions in their communities.

Researchers surveyed community administrators on their public water systems and 65% said they felt that their public drinking water supply is drinkable directly from the tap. Additionally, very few administrators, 10%, indicated that residents' perceptions of drinking water in their community were either somewhat or very negative. Nevertheless, 16% of administrators revealed they receive complaints about their water systems every 1-7 days. This suggests that community administrators say their water was fine but their reports show otherwise. Again, as with all of the survey results, the research team assumes that those communities with the lowest financial and human capacity were less likely to answer the survey, which further suggests that the results from the community administrator and water operators surveys portray an overly positive picture of drinking water systems in rural NL.



PERCEPTION, AWARENESS, DEMAND

Resident Perception of Drinking Water



Even though many residents may not be aware that their drinking water contains DBPs, concerns about DBPs in NL were raised by the elected officials that were consulted during the MNL regional workshops, as well as in case study communities. Health concerns mainly stem from fears of carcinogen exposure, but government reports also outline other DBP health risks including but not limited to: cancer, kidney damage, reproductive effects, and developmental effects. As a result of one or more of these concerns, residents may feel that roadside springs, which are not chlorinated, are free of THMs and HAAs and are therefore safer.

In consultations with municipalities, as well as in case studies, it was revealed that many residents do not like the taste of chlorine. The clear colour of spring water vs. discoloured surface water in community systems was cited as a factor leading to roadside spring water collection. During the drinking water policy workshop, the issue of chlorination was linked back to operations and management. It was expressed to our researchers that “end of the line” issues are prevalent in rural communities. This refers to situations in which chlorine residual levels meet the minimum level at samples taken halfway through the distribution line, but do not meet the minimum level at houses at the end of the distribution line. To remedy this problem, water operators occasionally use large amounts of chlorine so residual levels meet standards throughout the water distribution line. This results in chlorine taste at the beginning of the line that may be overwhelming for residents, further inducing roadside spring collection or the use of bottled water.

Drinking water from roadside springs is a common practice throughout NL and is not entirely discouraged by many local governments. It is our findings, based on previous studies and after consultation with health officials and provincial representatives, that roadside springs are an unmonitored source of drinking water that pose a risk of contamination. In a study done in 2009 on the use of springs for drinking water in Western and Central Newfoundland, it was found that roadside springs used for drinking water contained E. coli and/or coliforms 43% of the time.

The provincial government considers roadside springs to be an issue. However, very little public education on the dangers of roadside springs has been coordinated as roadside springs fall out of the jurisdiction of the province and local governments. Overall, residents' use of potentially dangerous roadside springs due to mistrust or disaste for the public water system is an important issue in rural NL.

During consultations with municipalities and through the expert policy workshop, it became evident that the public, and even municipal staff and elected officials need more education on drinking water-related concerns. The research team observed that elected officials were hungry

PERCEPTION, AWARENESS, DEMAND

Resident Perception of Drinking Water

for more information and education. For example, during the Northern Regional MNL workshop, a research team member's simple suggestion of refrigerating a water jug overnight to allow the chlorine in the water to dissipate was noted as very useful information by participating municipal officials.

Why haven't we shut down the roadside springs?

Municipalities and the provincial government have taken a non-interventionist approach regarding use of roadside springs, in part due to liability concerns. This is potentially putting the public at risk. It was recommended in a 2003 study that more effort should be put into discouraging the public from using roadside spring water. The report also states that both the province and municipalities should post warning signs at roadside springs warning of potential dangers.

Ultimately, it is residents who must decide what water sources they use; however, when municipalities or the province discover commonly used roadside springs, it would be beneficial to make some attempt to educate the public on the potential risks. Experts at the Drinking Water Policy workshop mentioned that literacy levels should be considered when educating the public. Also a mixed methods approach, using channels such as local newspapers, mail outs or inserts with tax bills, social media, and public service announcements on the television and the Internet should be used. However, the internet should not be relied upon as the sole method for communication, as some areas of rural NL have poor connectivity and residents who do not use the internet regularly.

More education is needed to change public perceptions about drinking water, as well as raise awareness levels on the importance of drinking water treatment and improved chlorine management. To start, the provincial operator certification program needs more emphasis on chlorine management. Though this will not impact those operators who are not certified, operators need to know the importance of chlorine in public systems and how to use it properly. To combat the aforementioned "end of the line issues", greater consultation could also be undertaken with communities regarding chlorine boosters to reduce over chlorination of drinking water.

More information also needs to be communicated to community officials and the general public on the risks

of DBPs. As mentioned previously, more research on the long-term impacts of DBPs would complement the needed public education on the subject in NL. Perpetuating even simple information, such as how to reduce the taste of chlorine or DBPs in water with home filtration and treatment, is needed. Additionally, provincial and municipal governments must take an active role in communicating the potential dangers of roadside springs. As mentioned above, education initiatives should be appropriate for their intended audience.

Solutions and Future Directions

Residents Perception

- Increased education to raise awareness of the importance of treating water.
- Improve public awareness of general public health risks of DBPs
- Communicate easy steps to reduce the taste of chlorine in water that residents can do for free at home or at low cost.
- Take a proactive role in communicating the unknown dangers of roadside springs to the public at large.

PERCEPTION, AWARENESS, DEMAND

Level of Administrator Awareness

Level of Administrator Awareness

Researchers feel it's a fair assessment that local governments and those administrating public water systems were often unfamiliar with the specifics of their drinking water quality data.

The research team compared the answers given in the community administrators survey to data provided on the DOEC's Water Resources Portal (<http://maps.gov.nl.ca/water/mapservices.htm>) to see whether respondents' answers coincided with available provincial data. This comparison found that out of the 40 administrator respondents that indicated they did not have any concerns regarding their municipal/LSD water supply, 85% of those communities had experienced recent issues (as of 2010) with their drinking water system according to provincial data.

For example 27/40 communities that said they had "no concerns with their drinking water system" had no current DWQI ranking in Winter 2014 due to THMs/HAs that exceeded federal guidelines or the presence of a BWA.

It should be noted that rural Newfoundland and Labrador has never experienced a major drinking water crisis like the one that occurred in Walkerton, Ontario in 2000, so water contamination may not seem like a pressing issue for many stakeholders. When interviewed by the research team, town officials suggested that if nothing has happened, then to many, it seems like nothing is wrong. Furthermore, as NL does not have the same level of agricultural or development pressures as other provinces, agricultural threats being a critical element in Walkerton, there is less of a perceived risk to drinking water.

However, that does not mean there are no risks in Newfoundland and Labrador when public water systems are not meeting mandatory requirements (e.g., proper chlorination levels) or when residents are drinking from unmonitored sources.

Administrators and other key municipal decision makers need to be better educated regarding their drinking water

Solutions and Future Directions

Level of Administrator Awareness

- Training sessions and courses on drinking water management should be mandatory for community leaders and staff.
- Organizations such as MNL could fill this gap through mandatory educations at symposium and regional workshops.
- Regional water committees can play a role in sharing information and best practices.

systems and drinking water-related issues so that they can make more informed decisions. Due to a noted lack of personnel at the provincial government, if the fiscal and human capacity cannot be found within the provincial government to adequately educate administrators and town staff, then professional associations and/or non-governmental groups should be engaged to fill this gap. In either case, partnerships between the Province and associations such as PMA, MNL, and the Atlantic Canada Water and Wastewater Association, could lead to more effective education and awareness-raising efforts.

PERCEPTION, AWARENESS, DEMAND

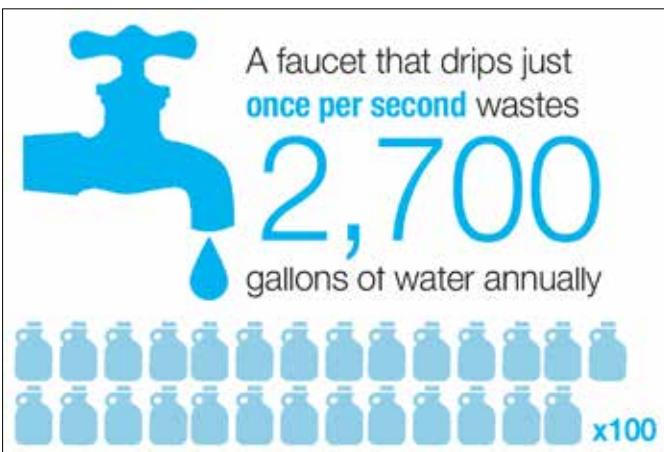
Water Use and Conservation Efforts

Water Use and Conservation Efforts

Water is undervalued in Newfoundland and Labrador. Most likely because of the common perception that it's free and we have lots of it. Because of this, water conservation is not generally given much thought in rural NL, and local governments don't usually enact conservation by-laws. Also local governments are not seeing the connections between conserving water, preserving infrastructure, and saving on the costs associated with having to treat less water. Studies show residential users in rural areas use more water per capita than those in urban areas. Furthermore, NL is estimated to have the second highest per capita water usage rate in Canada.

Usually high water users are charged a lump sum for their water consumption by their local government. This suggests that high water users may not be paying rates that are proportionate with their usage. High users include public buildings like schools and hospitals, as well as commercial/industrial ones like fish plants.

Another water use issue is related to degrading infrastructure. For example, a common practice to prevent water pipes from freezing during the winter months, some residents will continually run their water as a precautionary measure. This is a temporary solution to the larger issue of inadequate infrastructure, and also a misuse of treated water.



Solutions and Future Directions

Water Use & Conservation

- Better metering or at least an understanding of usage, for industrial and commercial users, such as fish plants, is required, as well as for high users of water that are public facilities.
- Municipalities should consider more proactive water usage policies at the local level.
- Clarification of the Municipalities Act, 1999 should be considered regarding giving LSDs the authority to enact bylaws related to conservation of water, as this could have a positive impact on their water supply.
- Both decision makers and the public must understand that distributing water within their communities entails significant costs and that misusing treated water is expensive.
- Financial support could be provided to replace pipes that do not have proper insulation or were not installed deep enough into the ground, resulting in frozen pipes during the winter. This would alleviate residents from running water during the winter months.
- Provincial government departments, including OPE specifically, should be more engaged in public outreach.
- Consideration should be given to how academia and other educational institutions at all levels can help in mobilize knowledge and facilitate public outreach and education.

POLICY AND GOVERNANCE

Concerns Regarding Water Quality Measures

The following discussion on policy and governance includes legislation, programs, or actions taken by local, provincial or federal governments. Not all legislation, policies, or operational guidelines are outlined below; only those that emerged as specific points of interest in the research findings. In this section governance refers to the actors, structures and processes in place to manage drinking water in rural Newfoundland and Labrador, including government and non-government agencies, as well as suggestions on how these management and decision making structures may be improved.

Concerns Regarding Water Quality Measures

The NL Water Resources Portal is an excellent tool managed by the Department of Environment and Conservation, providing the public with important provincially derived drinking water data. Information regarding public water supplies, drinking water reports, boil water advisories, and drinking water quality is provided on the site.

The Drinking Water Quality Index is intended to be a simple tool for reporting on drinking water quality in the province based on the Canadian guidelines. However, the research team found that many communities do not receive index scores. In fact, whenever communities exceed Canadian recommended limits for THMs or HAAs, or are on a boil water advisory, they do not receive a quality index rating.

It was found that between 2009 and 2012 72% of community rankings were not issued a meaningful water quality score. In addition, it was found that there were no scores lower than “Fair” in this period. Therefore, no water sources in NL were ranked either “Marginal” or “Poor”. This was curious to researchers considering the large number of communities on long term boil water advisories, especially given that 7% of small rural communities self reported that the drinking water in their community was “Not suitable for drinking, but suitable for other home uses”.

By all estimates, the Drinking Water Quality Index does not meaningfully rate drinking water quality in over 70% of water sources. In fact, having such an ineffective tool is actually a disservice to the public good. Given that most communities that have a ranking are labelled as excellent or very good, it seems likely that the index misrepresents the drinking water reality in many NL communities. Excluding those communities that are on boil water advisories and have high THMs or HAAs skews the overall picture. Accordingly, communities, researchers, or governments cannot use this index as a baseline metric of drinking water quality or the effectiveness of drinking water systems

in NL, a result the index has limited utility for policy development, implementation, and evaluation. Furthermore, the Index is a poor communication tool that is inherently biased by the way it selects which public water supplies get rankings.

Experts at the Drinking Water Policy Workshop viewed the index as an inappropriate ranking system. It was explained by Policy Workshop attendees that the index is not designed to consider annual averages or adequately incorporate THMs or HAAs. However, simply giving all communities with boil water advisories, or those with high THMs and HAAs, a poor rating would also not accurately reflect the quality of community water supplies. This is because many boil water advisories are issued for precautionary reasons, such as when maintenance is occurring. Therefore, an boil water advisory at the time of ranking may not actually mean that the drinking water quality is poor on average. While the this ranking system is not appropriate, appropriately integrating boil water advisories as well as THM and HAA measurements into this metric is no easy task.



POLICY AND GOVERNANCE

Concerns Regarding Water Quality Measures

Solutions and Future Directions

Water Quality Measures

- The Drinking Water Quality Index (DWQI) should be amended to better serve communities with concerns such as high THM/HAs and BWAs.
- The DWQI should be improved so it can be used as an accurate baseline metric, as well as an easy to understand communication tool. This should include examination of drinking water quality monitoring and reporting in other jurisdictions.
- Performance indicators related not only to drinking water quality, but also to water infrastructure maintenance and operations should be employed in community drinking water reports.



POLICY AND GOVERNANCE

Managing Boil Water Advisories



Often boil water advisories are precautionary in nature and some communities are more cautious than others (e.g. calling a BWA when flushing lines or doing short term maintenance); therefore, it may be wrongly perceived that these communities have lower water quality than others simply because they issue boil water advisories more frequently.

Boil water advisories can cause residents to lose confidence in their water system, leading them to choose other drinking water sources, especially when advisories are in place for long periods of time. Therefore, reducing the number of boil water advisories is seen as necessary to improve residents' perception and use of public drinking water systems.

Overall, clearer guidelines about issuing boil water advisories are needed, as those currently in place are largely subjective and often left at the community's discretion. This sometimes makes it difficult to differentiate between precautionary advisories and ones issued for more serious reasons. Further, reasons for the advisory are not always communicated to residents. Additionally, when there is a long-term (and very long-term) boil water advisory, communities sometimes stop communicating these advisories to residents. Furthermore, residents may not be aware that their water is no longer being chlorinated (or is being chlorinated at inadequate levels) during an advisory. This puts old and new residents at risk, as old residents may believe their water is still being adequately chlorinated and new residents or visitors may not even be aware of the advisory. Better communication with residents is needed about how and why boil water advisories are issued.

The process for terminating boil water advisories also needs to be streamlined, especially in rural areas with limit-

ed access to Service NL labs. Some remote communities are given the responsibility of taking and delivering their own drinking water samples which comes with related cost concerns, while other rural communities often experience time lags between Environment Health Officer visits.

The boil water advisory system in NL was designed to protect the public. Unfortunately, in some ways, it is being used as a temporary, or worse yet a long-term, solution when the funds or expertise are not available to solve a problem. Furthermore, the boil water advisory rationales are not being adequately communicated to residents, making it difficult to determine whether they are issued for precautionary reasons or as a result of a contamination in the system. This is eroding residents' trust in public drinking water systems. While advisories alone should not be used to determine water quality, unfortunately, the public often view boil water advisories as indicating an issue with their water. Due to low compliance with provincial recommendations for safe public water use during BWAs in NL, improved communication and education about these advisories and implications for water use practices are needed.



POLICY AND GOVERNANCE

Managing Boil Water Advisories

Solutions and Future Directions

Boil Water Advisories

- Clearer communication to the public is needed about why a water system is on an advisory, along with better communication about the expected length. Simply advertising a boil water advisory when it is initiated is insufficient.

It should also be clearly communicated when on such an advisory, if towns are no longer chlorinating the water, not chlorinating to adequate levels, or chlorine levels are unknown due to reduced testing – so the public knows the potential consequences of drinking the water may extend beyond the issue that prompted the advisory.

During extended advisories residents should receive regular reminders and updates. In short, more education for residents about boil water advisories is needed.

- Those communities on long-term (and very long-term) advisories should be ranked differently, as long term BWAs and residents' inability to drink the town water for long periods of time should be seen as a more severe problem by provincial and local governments. Long-term advisories reflect a serious breakdown in a public water system and an inability to provide safe drinking water supply to residents.
- Greater attention is needed to examine the causes of long-term boil water advisories and explore solutions to address related deficiencies in the water systems of these communities.

A strategy is needed to better address long- term and very-long term boil water advisories in Newfoundland and Labrador.

- Rural areas need assistance to get off the boil water advisory designation faster.

We suggest that rural communities, like remote communities, be able to take their own samples when on an advisory for at least one of the two of the required clean samples to remove the boil water advisory. This would result in reduced reliance on provincial inspectors to travel to these communities, and potentially in boil water advisory being removed more quickly. One expert suggested that if an advisory is issued for preventative mechanical reasons (e.g., flushing of lines or small repairs on a water distribution pipe) the community should only need one clean water test to have the boil water advisories designation lifted. This would be a useful step towards separating preventative boil water advisories from those that are issued due to demonstrated risks (e.g. bacteriological contamination) found in the water supply. Another drinking water expert suggested that a rating system to measure the risk posed by different boil water advisories codes (or alternate codes) could be created to help better explain to the public what kind of advisory their water system is on.

POLICY AND GOVERNANCE

Integration and Coordination

Integration and Coordination

There appears to be a lack of integration and coordination amongst the provincial and local governments.

There were many situations where local government believed that the Province could be doing more for local water systems, and vice versa. There was also some confusion on the part of local government officials over the role of local governments in managing drinking water systems. Local governments also sometimes felt there was not enough communication amongst the provincial government departments. Furthermore, it can often be a lengthy process to get provincial and municipal officials to reach mutually acceptable solutions on issues like funding proposals and boil water advisories.

Some communities also felt that the provincial government was not listening or simply has not prioritized drinking water issues. The research has found this perception does need to be clarified, as it has been made clear by several throne speeches as well as speeches from the Environment and Conservation and Municipal and Intergovern-

mental Affairs Ministers that drinking water is very much a priority of the provincial government. Also, through the Multi-Barrier Strategic Action Plan, the province appears to be trying to coordinate efforts amongst various provincial departments.

It seems that when they can, the provincial government, especially the Department of Environment and Conservation, is willing to accommodate communities when requests are made. However, there are few formal channels for local government to voice their concerns to the provincial government or strategically work with the province in a true multi-level governance arrangement. Also, the provincial government often lacks in human resources to properly manage the very large regions they are responsible for. According to the Multi-Barrier Strategic Action Plan, everyone has their role in the water system, including local service districts and municipalities as well as citizens and non-government organizations.

Feedback from our research has shown that there is often some confusion about the responsibilities of municipalities in the Multi-Barrier Strategic Action Plan, especially



POLICY AND GOVERNANCE

Integration and Coordination

concerning source water protection efforts. Furthermore, during consultations, municipal representatives vocalized a sense of mistrust of the provincial government, especially concerning issues such as disinfectant by-products.

"There is a lot of documentation related to our water, from the government, out there, and a lot of it that we don't really know about. And if that could be presented in some way, integrated together, that would be very helpful."

– Councillor, Centreville-Wareham-Trinity

Data management between the provincial and local government requires better integration. All municipalities should readily know about and be familiar with the Water Resources Portal. Furthermore, a more integrated system where municipalities have electronic access to the as-builts and maps of their infrastructure available not only in their own town offices but also at the provincial regional offices, would facilitate discussions between officials from both levels of government, as well as provide back-up copies of key documents.

Though it does seem through the Multi-Barrier Strategic Action Plan that the provincial departments involved in drinking water governance have generally good coordination, there is some miscommunication and room for improvement in terms of multi-level governance related to drinking water management. There is currently an interdepartmental working group at the provincial level that leads work on the development of policy and guidelines relating to drinking water safety; however, despite their critical role, local government and non-governmental organizations are not invited to these meetings. More communication in a formalized venue, such as an inter-governmental working group as well as regional water committees involving provincial officials could provide a venue where communication between levels of government could occur, and better understanding of roles and responsibilities would emerge. Furthermore, where already in place interdepartmental meetings happen on a regional scale, it could be an opportunity for education where provincial government could share the information they have with communities and develop better ways to coordinate and integrate data, as well

as responsibilities. These findings support a 2003 study conducted by the Department of Health and Community Services, "...more frequent discussion between the provincial government and municipal governments is needed to ensure that they recognize their responsibility in delivering information to their residents about their local drinking water supplies, particularly during boil water advisories".

Solutions and Future Directions

Integration and Coordination

- Provide opportunities, that bring together various drinking water stakeholders, including federal, provincial, local government and non-governmental representatives to improve integration and successful policy development and implementation.
- Invite local government representatives to existing provincial interdepartmental working groups to increase communication and coordination on water systems management between municipal and provincial governments.
- Use digitized software programs for shared water system related data, as-builts and maps to integrate and visualize information about water systems at the municipal and provincial levels.

POLICY AND GOVERNANCE

Implementation Gap

Implementation Gap

Overall local governments are largely satisfied with provincial policies. However, there were some findings that suggest implementation of provincial level policies are lacking.

First, each operator (or town) of a public water system receives a permits to operate where stipulations regarding things like mandatory chlorine residual levels and level of operator training/certification are outlined. Performance evaluations are occurring to some extent with the Permit to Operate Drinking Water Inspection Program. However, this program is still in its infancy and had only provided ratings for ten systems in the 2012 - 2014 time span. As discussed in the previous sections, some clauses such as required water operator certification are not being achieved in all communities. Expansion of the Inspection Program should identify these issues.

In regards to the Protected Public Water Supply Area (PPWSA) designation, many communities do not actually enforce the banning of activities in the PPWSA area. As explained earlier in this document source water protection under the PPWSA regulation is up to the municipality to monitor, and is a voluntary designation.

Municipalities do not feel that having the PPWSA designation fosters any more outreach and knowledge, other than signs being posted about the presence of PPWSAs. For example, one community told us that even though there are signs posted indicating that the source water ponds are protected water supplies, residents often skidoo over the source. Town representatives indicated it would be impossible to prevent all recreational use of ponds. There needs to be a mechanism to ensure more involvement of local governments and residents in protecting their drinking water supplies while recognizing the realities of multiple uses in many, particularly larger, rural watersheds.

Experts believe that watershed plans could be a good tool for water resource management; however planning and implementation would be difficult in many cases, as it requires significant resources that towns currently do not have. Furthermore, if every town created a watershed plan, there is insufficient capacity at the provincial level to assist with this venture. Regional approaches to watershed planning and protection provide one possible solution.

Lastly, insufficient financial resources to support provincial programs and policies have been an issue. Our research found that most NL drinking water related policies do not have the financial resources to support them. For example, the operator certification program is said to be an important part of the Multi-Barrier Strategic Action Plan, however, attracting and retaining qualified operators can be a problem as there is often inadequate funding available to make these positions attractive to qualified candidates. One full time regional water operator explained in relation to the water operator job,

"No retirement benefits, there is no medical or benefits of any kind of a way, nothing in that department. That is one thing they could look at is putting some sort of funding in place so that you can use it to make benefits. You go to work with other companies you start with benefits even pension benefits."

-Regional Water Operator

There is a clear need for more provincial support and human capacity to ensure provincial policies are being implemented. There are many provincial policies but few regulations that have meaningful mechanisms for enforcement. Furthermore, there are very few institutions/organizations to help fill the capacity gap. In places such as Ontario, there are conservation authorities that act as the coordinators between the government and the public. However, funding for Conservation Authorities seems unlikely in Newfoundland and Labrador, therefore efforts need to be coordinated better between provincial governments, local governments and even non-governmental organizations in order to enhance compliance with provincial policies and regulations.

An encouraging program that already exists in coordination with Municipal and Intergovernmental Affairs (MIGA) and the Environment and Conservation is the Maintenance Assurance Manual (MAM) designed for local governments. The MAM program supports MIGA's strategic direction of "appropriate infrastructure investment". In the most recent 2012-2013 MIGA Annual report it was said that out of the municipalities that piloted the MAM program from January to December 2011, that better maintenance records and

POLICY AND GOVERNANCE

Implementation Gap

practices improved municipal councils knowledge of their water system operations. MIGA has also committed to creating a MAM program specific to communities of 500 residents or less. This seems like a very promising program that should be expanded and be made mandatory, as it helps to ensure water operators and local government know what is expected of them regarding the maintenance of their water system.



Solutions and Future Directions

Implementation Gap

- More monitoring and mechanisms for enforcement of drinking water policies and regulations are needed.

Local governments are the best candidates for monitoring. However, the local level requires more education about the need for monitoring as well as support for monitoring activities in the form of technical, financial and human capacity.

Greater enforcement by the provincial government is required. This would include expanding the Permit to Operate Drinking Water System Inspection Program so that communities are inspected at least once a year and the results are posted on the Water Resources Portal and in public areas.

To encourage transparency and resident's awareness levels Permits to Operate should be publicly available on the Water Resources Portal.

Expansion of the MAM program to be part of regular operations of water and waste water systems in all NL communities offers promise for increasing the effectiveness and longevity of new and existing water systems.

- Make source water protection mandatory.

POLICY AND GOVERNANCE

Regional Approaches

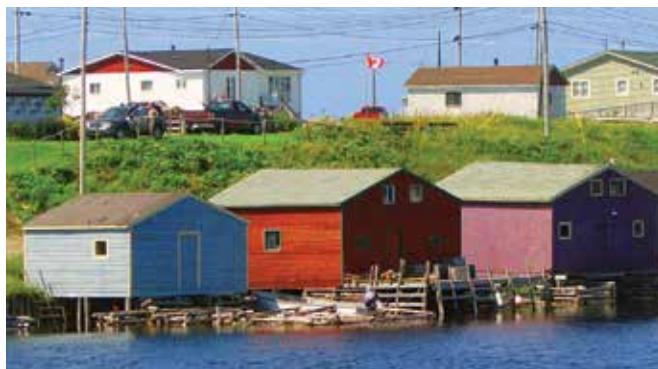
Regional Approaches

In this report regional approaches have been noted as one type of solution to the issues experienced in rural NL related to limited finances and human resource capacity. Many of the proposed solutions coming from this research project will lead to increased financial burdens for local governments.

Regional approaches, when geographically feasible, can be a way forward. While there have been successful regional initiatives throughout the province, there is room for improvement. Experts in drinking water policy have expressed a lack of regionalization in the province. Another concern from municipalities was that local service districts often do not pay equitable amounts for water services. Furthermore a great deal of up-front work needs to be in place before regional activities can occur. This includes an arrangement set up to manage regional operations, such as meeting venues, decision-making structures and formal agreements.

Regional operators would also provide an opportunity for highly qualified people to stay in the province. This would also require a commitment from local and provincial governments to provide a reasonable salary for these positions; however in the long term having qualified people looking after the drinking water systems of rural NL would improve the longevity of infrastructure and help to ensure drinking water safety.

Municipal and Intergovernmental Affairs (MIGA) has identified community cooperation as a component of the strategic direction of local government sustainability. MIGA described regional cooperation as activities such as pooling of resources, cost sharing agreements, amalgamation or regionalization.



Evidently, the provincial government is very much in support of, and see the need for, regional approaches. However, at the local level, regional approaches are often equated with fears of amalgamation and losing a sense of individual town identity. More work needs to be done outlining to local governments the benefits of collaborative and regional approaches and how, if done properly, these approaches can result in net benefits for all.

Solutions and Future Directions

Regional Approaches

- MNL and MIGA could play a role in regional approaches. It must be clear to local governments that regional approaches can be a viable option for the sustainable management of their water systems and that regional approaches do not have to mean amalgamation.
- Consideration should be given to:
 - Multi stakeholder regional water committees,
 - Regional water operators/maintenance programs,
 - Source water protection committees when drinking water sources are derived from shared watersheds,
 - Knowledge sharing venues (e.g. regional drinking water workshops), sharing of equipment and supplies and training.
- Support for these regional activities may have to mean restructuring of local government.

CONCLUSIONS AND FUTURE DIRECTIONS

Conclusions and Future Directions

Overall, the state of drinking water systems in rural NL is mixed and feedback from local governments has been contradictory. While many communities claim to be very happy with their drinking water, there is undisputed proof that those same systems have been subject to boil water advisories or have some part of their drinking water systems are in disrepair.

Our research clearly finds that changes are needed when it comes to the management, operations and perception of public drinking water in rural NL. With the lack of any true enforcement of source water protection measures, the prevalence of uncertified operators and the mismanagement of ageing infrastructure, rural NL drinking water

systems cannot be considered sustainable on the whole. At worst many of these systems are at true risk of falling into complete disrepair and exposing the public to serious health risks.

Though this project was focused on four main components of the drinking water systems it has been found that the problems faced by rural communities are not specific to one component and they often overlap. Drinking water problems are complex, connected, and sometimes cumulative. This means solutions must be multifaceted and integrated. As with many other rural sustainability issues, there is no “magic bullet” to address rural NL’s suite of drinking water issues. There are, however, a number of steps that can be taken to move toward a more sustainable situation.

First, capacity needs to be fostered at the local level.

A great deal of responsibility is given to local governments in NL, often times without proper technical, financial, or human capacity to match. Due to a lack of capacity at both the provincial and local level, implementation of policies and programs is not occurring adequately.

- Greater monitoring and enforcement is needed, particularly when it comes to permits to operate and PPWSAs.
- Education programs are needed, first targeting those making decisions in towns such as councillors, mayors and administrators.
 - Especially regarding health concerns such as DBPs, decision makers often felt uneducated on important drinking water related subjects impacting their towns.
 - More informed decision makers make better decisions.
 - More knowledge and technical capacity at the local level could help in informing the general public about drinking water related issues, such as the need for source water protection and conservation of water.

Second, a better system than the current BWA mechanism is needed for communicating the risks associated with drinking water.

- In Newfoundland and Labrador small drinking water systems without certified operators, mostly in LSDs and municipalities of 1,000 or less with low economic capacity, are more likely to be on boil water advisories.
 - A similar program to the British Columbia Interior Health Authority’s (IHA) Boil Water Notice Remediation Program could be used here. This program found similar struggles with human and financial capacity issues.
 - When the IHA investigated further how they could change their management structure to better serve small systems they found that meaningful consultation with stakeholders and public education reduced risks in small drinking water systems.
 - Though meaningful consultation and outreach initiated by the Province is important, the Province also needs to focus energies towards strategic program designed to reduce long-term (and very long-term) boil water advisories in the province.

CONCLUSIONS AND FUTURE DIRECTIONS

Asset Management must be more readily used among local governments.

This could be a useful tool in reducing boil water advisories as well as preserving already degrading infrastructure. For asset management to be successful qualified personnel are required to lead these efforts.

- In rural areas certified regional water operators, when feasible, appear to be a viable option.
 - We recommend that municipalities and LSDs investigate further how regional operations could assist them in addressing their drinking water challenges. Though there will be growing pains and inevitably conflict between communities over shared resources, we suggest that rural NL cannot afford the risk of having uncertified operators managing their drinking water systems.
 - A higher level of oversight of these water systems on a regular basis is needed and regional water operators could provide the expertise that is lacking in rural NL communities.
 - Asset management activities should be increased and strengthened in small communities. Then get into the regional water operators.

Access to safe, acceptable, affordable, and physically accessible water is a basic human right, recognized by the United Nations.

- However, it should be acknowledged that though this is a human right, the service does not come for free. There are significant costs in the distribution of clean drinking water.
- NL is a large province, with many small, spread out communities, often with declining populations and limited tax bases. Many of the recommendations throughout this report outline that more funding is needed for drinking water related solutions.
 - It should be critically examined where this funding can and should come from. Water services must be considered in fiscal framework discussions and the true costs of water supply and distribution should be accounted for in municipal and local service districts budgets, and reflected accurately in water and sewer rates, while keeping in mind equity concerns.
 - An emphasis should be put on investing money strategically and efficiently, with the utilization of regional approaches and investment into long-term planning and asset management activities.

All NL drinking water stakeholders (e.g., local, provincial and federal governments as well as academics, non-governmental organizations, industry and the general public) have a role to play in improving drinking water systems to ensure that this right is satisfied in NL. Everyone involved need to better align and coordinate their efforts in more integrated and multi-level governance collaborations to achieve sustainable rural drinking water systems in NL

RECOMMENDATIONS

Policy, Education and Operations

The following recommendations should be a coordinated effort between all stakeholders involved in the process. Recommendations are intended to be both pragmatic and achievable. However the research team understands that what is ideal may not be feasible given the current political and economic realities of rural Newfoundland and Labrador and due to capacity issues at all levels.

Policy, Regulations and Governance

1. Enhance stewardship of PPWSAs by local governments.
 - 1.1. Include PPWSA monitoring requirements and efforts taken to protect drinking water supplies in local level self-reporting.
 - 1.2. Encourage towns with supplies that are not designated as a PPWSA to do so.
 - 1.3. Provide outreach and education on the importance of and measures for protecting PPWSAs (see also recommendations for Education and Training below). Towns should explore potentials for partnerships with non-governmental groups to undertake these activities.
2. Improve water conservation programs and policies.
3. Develop more functional and user-friendly tools for assessing the state and vulnerability of drinking water systems (e.g. water quality, infrastructure and operations).
4. Create a more effective advisory system for managing and communicating risks than the current BWA approach.
 - 4.1. Develop more descriptive advisories (e.g. a ranking system to differentiate between different types of advisories).
 - 4.2. Develop strategies to remove BWAs in a more timely manner once the issue of concern has been addressed, including considering allowing communities to bring in at least one of the two samples required themselves to a NL Services lab, and only requiring one clean sample for those communities who put a BWA on due to low risk preventative mechanical reasons (e.g. flushing lines, small repairs, etc.).
5. Develop and implement a strategy to address remaining long term and very long term boil water advisories.
6. Foster enhanced compliance with provincial drinking water policies and regulations. For example:

CONCLUSIONS AND FUTURE DIRECTIONS

Policy, Regulations and Governance...continued

- 6.1.** Expand the Permit to Operate Drinking Water Inspection Program and make Permits to Operate publicly available on the Water Resources Portal.
- 6.2.** Provide more capacity (financial, human and technical) and opportunities for capacity building at all levels specific to enhancing compliance with water policies and regulations (see also recommendations for Education and Training below).
- 6.3.** Make self-reporting mandatory for public water system operators, so requirements under policies and regulations are clear.
7. Increase opportunities for multi-level governance and dialogue at the local, regional and provincial scale, bringing together all levels of government as well as representation from other stakeholders such as non-governmental and industry groups. This would involve creating venues for integration, coordination and sharing information concerning water related matters.
8. Provide further incentives and sustained support for regional operators and other regional service sharing and drinking water management initiatives.

Education and Training

9. Offer more (and diverse) public outreach and education opportunities in various mediums concerning all drinking water issues.
10. Provide greater education and capacity building opportunities about the management of drinking water systems for local governments and staff.
11. Include mandatory certification for all water operators as part of the Water Resources Act legislation.
12. Offer more regional training opportunities for water operators.

RECOMMENDATIONS

Policy, Education and Operations

Infrastructure and Operations

1. Enhance succession planning for water operators and designation of back up water operators.
2. Increase funding and support for asset management activities for drinking water systems.
3. Implement Maintenance Assurance Manuals across the province with manuals that consider the particular challenges faced in small drinking water systems.
4. Include full cost accounting and appropriate pricing for water services in fiscal framework discussions.
5. Improve chlorine management and create guidelines.
6. Continue to invest and plan for re-investment to address the infrastructure deficit in rural NL with particular attention to communities experiencing chronic problems such as long term boil water advisories and high disinfectant by-products.



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