

“It’s about quantity not quality”

*Drinking Water
Successes and Struggles
in Port au Port East, NL*



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A community case-study report for the *Exploring
Solutions for Sustainable Rural Drinking Water
Systems* project

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List of acronyms

BWA	Boil water advisory/boil order
DBP	Disinfectant by-product
DOEC	Department of Environment and Conservation
DOHCS	Department of Health and Community Services
DWQI	Drinking Water Quality Index
GCDWQ	Guidelines for Canadian Drinking Water Quality
HAA	Haloacetic acids
ICSP	Integrated Community Sustainability Plan
LI	Langelier Index
MBSAP	Multi- Barrier Strategic Action Plan
MIGA	Municipal and Intergovernmental Affairs
MNL	Municipalities Newfoundland and Labrador
MUN	Memorial University of Newfoundland
NL	Newfoundland and Labrador
OETC	Operator Education, Training, and Certification
PI	Principal Investigator
PMA	Professional Municipal Administrators of NL
THM	Trihalomethane

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Introduction

1.1 Project overview

In rural Newfoundland and Labrador (NL), watersheds provide drinking water supplies, while also supporting other resources and activities that form our culture, identity, and economy. Healthy drinking water supplies are dependent on healthy watersheds as well as on supporting water policies, practices, and infrastructure. The *Exploring Solutions for Sustainable Rural Drinking Water Systems* study, led by Dr. Kelly Vodden, aims to identify the types of risks and challenges influencing drinking water quality and availability in rural areas, with a particular emphasis on communities of 1,000 residents or less in NL. Factors for success and possible solutions are also being examined. This project is in partnership with Memorial University of Newfoundland (MUN), Municipalities Newfoundland and Labrador (MNL) and the Professional Municipal Administrators of NL (PMA).

This interdisciplinary research addresses knowledge gaps related to drinking water systems in NL by providing a current and comprehensive picture of drinking water issues in small communities from a multitude of angles. This has been accomplished by drawing from current and past research and existing sources at federal, provincial and municipal levels, as well as research from other jurisdictions. Dialogue with stakeholders has also been a key method for understanding the issues and solutions for drinking water systems in rural NL.

One component of the project is the completion of case studies; at least one for each of the six MNL regions.¹ The objective of this case study research is to profile key issues, challenges and solutions related to public drinking water systems in rural NL. The method of inquiry consists of semi-structured key informant interviews using an interview guide (see Appendix B) and the review of key documents.

This particular case study's interviews were conducted on two trips to the community of Port au Port East. The interviews for this case study were conducted with the mayor, town clerk, members of town council, the water operator, and a focus group of residents from the town.² Although each interview was recorded, it was requested that the audio be deleted once transcripts were complete (except for one participant). For further information about the case study methodology, please see Appendix A.

1.2 Community description

The town of Port au Port East was originally incorporated in 1952. Geographically located on the West Coast of Newfoundland, it was settled around the "late 1800s" (Home page - Port Au Port East, n.d.). Port au Port East has "spectacular scenery as the scenic loop, called the French Ancestors Route, follows the coast and skirts along the edge of the sea cliffs that,

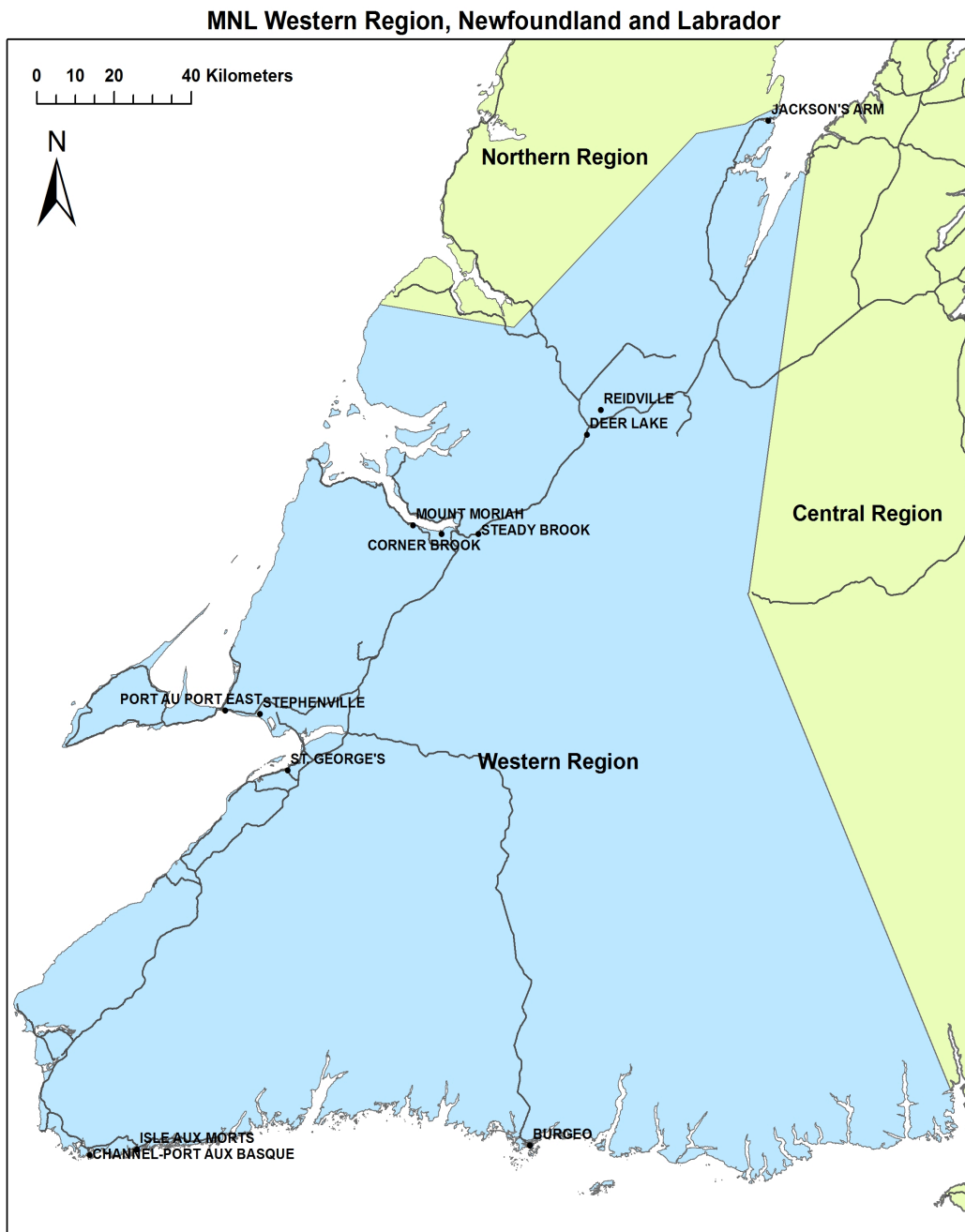
¹ To see all MNL regional boundaries please visit the project website:
http://nlwater.ruralresilience.ca/?page_id=17

² There were 8 participants included in the focus study, as well as one observer.

in some places, plunge 500 meters into the ocean” (Town of Port au Port East et al., 2010, p. 4). The rural region consists of an estimated population of approximately 595 people as of 2012 (NL Statistics Agency, 2013). Community Accounts Information anticipates that, moving forward, this population is set to decline (NL Statistics Agency, 2013). Although Port au Port East is considered to be “rural,” many residents believe that it does not have the same “small town feeling” as many other rural communities due to its proximity to larger population areas such as Stephenville and Kippens.

Another reason that the community may be perceived as larger than its actual population would suggest is the number of facilities within the community, such as a town hall, church, community centre, school, tourist shop, and social club (the last of which was recently shut down). Symbolically, this sense of the town seeming larger than it actually is seems to represent the larger picture of what is happening in Port au Port East. While the community is primarily comprised of retired individuals, there is still a desire to develop and expand the community through new businesses and housing. However, as will be discussed in greater detail, although the water quality in the community has been consistently rated as “excellent” on the *Drinking Water Quality Index* (DWQI) reports issued by the provincial government’s Department of Environment and Conservation (DOEC) (Government of Newfoundland and Labrador DOEC, 2014), water availability (i.e. quantity) in the community has been a hindrance to such growth.

Figure 1. MNL Western region, Newfoundland and Labrador.



Data Sources:
Government of Newfoundland and Labrador,
Department of Municipal and Intergovernmental Affairs
Geobase National Road Network, Government of Canada,
Natural Resources Canada, Centre for Topographic Information

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1.3 Community water system

Source water supply

The community of Port au Port East secures its drinking water from two main sources. The primary drinking water source for the municipality is a protected reservoir that is backed up by a drilled artesian well. The reservoir is situated on top of a large hill, which is above most of the town. Two brooks feed this reservoir. It was mentioned that some houses are within the area, yet no new development is allowed. The reservoir's protected area has a buffer zone of at least 500 meters.

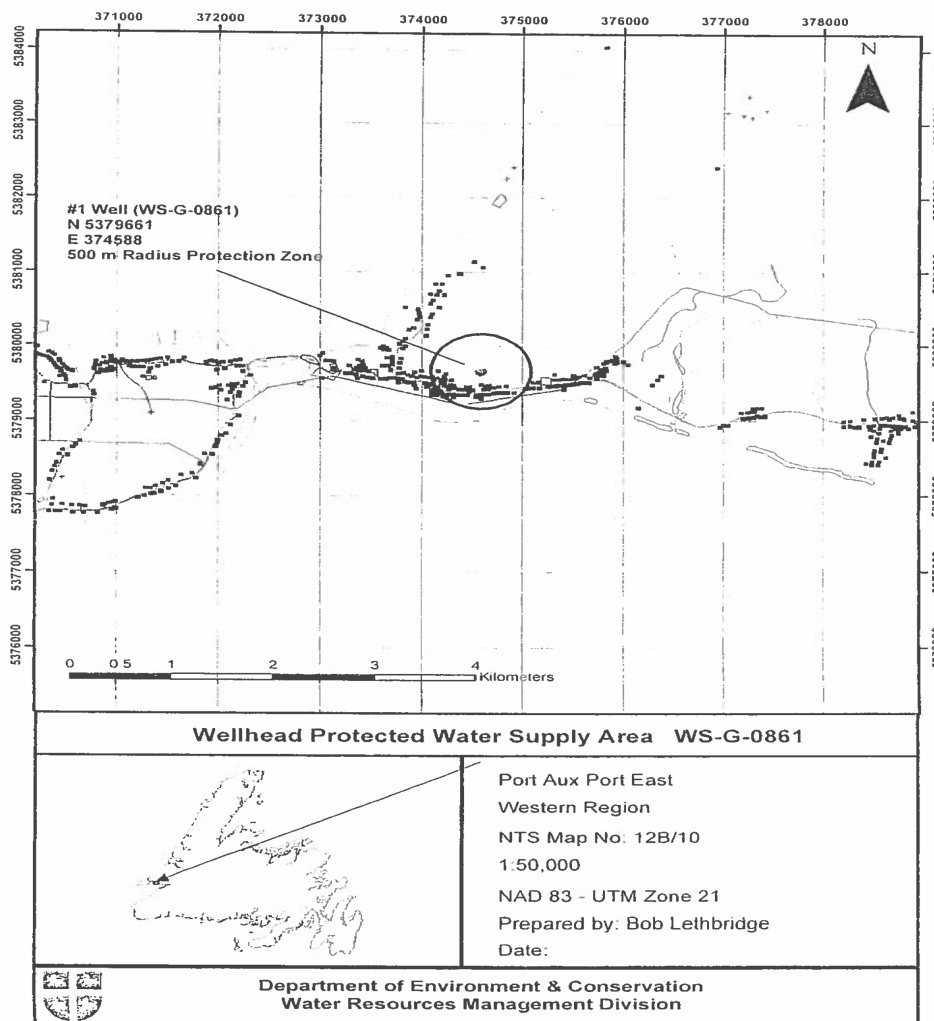


Figure 2. Wellhead Protected Water Supply Area

Infrastructure

Each home in Port au Port East has piped drinking water that is connected to the town's reservoir and an artesian well. Each house also has its own septic system. This water system currently operates with a water pressure of 50 pounds throughout town. When the town was originally incorporated in 1952, drinking water service was not available by pipe until the 1960s. Around this time, a brook also ran through the community and provided drinking water to residents, but it has since been rerouted and is no longer used. Piped service, however, did not extend into the western part of the community until the 1970s. Port au Port East's drinking water system is now centred on its own pump house that contains usage meters, user manuals, and is secured by lock and key. In this system, water is treated with liquid chlorine exclusively. Currently many of the pipes and shut-off valves in the community have been replaced. Although much of the water system is relatively new, steps have been taken in order to reduce water usage to address the occasional instances of scarcity that have occurred in recent years. Furthermore, the municipality undertook testing in order to prepare the next steps to secure a new artesian well. The municipality is hopeful that obtaining a new well will help avoid water shortage issues in the future.

Local Governance

The community of Port au Port East is governed by a mayor, deputy mayor, town clerk and town council. The town council is comprised of a group of volunteers who are elected as councillors by residents. Similarly, Port au Port East's Mayor is a voluntary position held by an elected official. The town office itself is run with the assistance of the town clerk, which is a paid full time position. It is the town clerk that also works with the Water Operator who is a part-time paid position.

Research findings

The following four sections outline issues in Port au Port East related to:

- Source water quality and quantity
- Infrastructure and operations
- Policy and governance
- Public perception, awareness and demand

2.1 Source water quality and quantity

One of the main focuses of this research was to identify rural communities' successes and struggles regarding their drinking water situations. The municipality of Port au Port East can be seen as a good example of both. As mentioned previously, Port au Port East received multiple DWQI reports with a rating of "excellent." In fact, the town has received this rating on every sample date currently listed on these reports since 2009 (Government of Newfoundland and Labrador DOEC, 2014). Monthly bacteriological testing conducted by NL Services has also revealed consistent testing results with no concerns for bacteria

levels. Consequently, few boil water advisories (BWAs) have been implemented, and when they have been, they were self-imposed as a precautionary measure due to maintenance on the water system or related infrastructure. Additionally, the drinking water is clear and is not odorous. Tourists visiting the area have also made positive comments about the drinking water taste and quality, saying that they prefer it to other communities' drinking water.

What the community is facing, however, are periods of water scarcity. While the problem is not considered to be a chronic one, it is frequent enough to cause some concern among residents and town council. Flooding and drinking water shortages can arise when too much or too little rain falls and affects the water levels of the brooks that feed into the water reservoir. Periods of low water levels have been attributed to about a month of no rainfall. These concerns appear to be correlated with season-specific climatic conditions, and tend to be most prevalent during winter and summer. While flooding is raised as a concern in general, it was not specifically mentioned as an issue for the drinking water quality.

Key informant perspectives

"We're running out. We've stopped issuing new building permits until such a time as supply is increased, which is detrimental to the town. You don't want to stop growth. And you can't bring in residences and open new businesses either without water." – Municipal staff

To be sure, the community does have an artesian well to help mitigate some of the stresses of only having surface water (a reservoir) as their drinking water source. However, when periods of low water quantity arise, the well is only used sparingly. Periods of conservation do not typically have a timeline available to explain how long this period may last, thus posing a risk of the well running dry. There are physical measurements that the water operator keeps track of at the well that are used to assure the water level does not fall below an unrecoverable point. Even though this has not happened yet and the community is taking steps to ensure it does not, it remains a potential concern for the municipal staff. Previous efforts to help deal with these periods of water shortage include turning the water system off in order to allow the reservoir to replenish. Once the measured water levels have been replenished, the water is turned back on. To date, the water shut-off measures have not been implemented for any longer than six hours at a time. As a result of these pressures on water quantity, the town council's number one priority is to achieve drinking water security with an emphasis on measures to increase drinking water conservation.

Water conservation

The Town of Port au Port East has been fairly proactive at identifying large water users and strategies to reduce the community's overall water consumption levels. For example, as previously mentioned, water leak detection testing has been conducted, and faulty shut-off valves have been replaced. It was also identified that other public buildings had been consuming large quantities of water, such as the school, the social club (now shut down), and the community centre. These key buildings were experiencing problems because they were each equipped with about three continually flowing urinals. Although these building

only contained a few urinals each, the cumulative continuous water flow strained the system. To address this issue, some of the urinals have had flushes installed so that they no longer run all the time. However, one building has yet to install the new flush system. It is hoped that awareness about water scarcity will continue to be raised in the municipality, and that more people will become involved in trying to reduce their water usage.

Physical parameters and major ions

The DOEC's online *Water Resources Portal* is an important source of data regarding drinking water in NL. This source provides results for physical parameters and major ions in source water and tap water, based on the listed maximum acceptable concentrations in the *Guidelines for Canadian Drinking Water Quality* (see Table 1).

Table 1. List of physical parameters and ions tested in drinking water by DOEC

<i>Physical parameters</i>	<i>Ions</i>
- Alkalinity	- Boron
- Colour	- Bromide
- Conductivity	- Calcium
- Hardness	- Chloride
- pH	- Fluoride
- TDS	- Potassium
- TSS	- Sodium
- Turbidity	- Sulfate

(Daniels, 2014-Forthcoming)

The results of sampling for Port au Port East show that colour of the water remained below the provincial standards and generally appears clear/without colour. The pH levels of 8.2 also fall within the acceptable range (since the first recorded date of 2006) (Government of Newfoundland and Labrador DOEC, 2014). This is consistent with the findings that drinking water quality levels are acceptable for drinking water in Port au Port East (Government of Newfoundland and Labrador DOEC, 2014).

Nutrients and metals

Table 2 contains data about the nutrients and metals tested in drinking water in NL .

Table 2. List of nutrients and metals tested in drinking water by Department of Conservation and Environment

<i>Nutrients</i>	<i>Metals</i>
- Ammonia	- Zinc
- Dissolved Organic Carbon	- Aluminum

-
- | | |
|---------------------|-------------|
| - Nitrate(ite) | - Antimony |
| - Total phosphorous | - Arsenic |
| - Kjeldahl nitrogen | - Barium |
| | - Cadmium |
| | - Chromium |
| | - Copper |
| | - Iron |
| | - Lead |
| | - Magnesium |
| | - Manganese |
| | - Mercury |
| | - Nickel |
| | - Selenium |
| | - Uranium |
-

(Daniels, 2014-Forthcoming)

From September 2006 to August 2012, testing results for nutrients and metals in drinking water have all been below the recommended guidelines for Port au Port East (Government of Newfoundland and Labrador DOEC, 2014).

Chlorination disinfection by-products (DBPs)

Disinfectant by-products (DBPs) are an unintended consequence of treating drinking water with chlorine. “DBPs are chemical compounds that form when water containing natural organic matter (the decay products of living things such as leaves, human and animal wastes, etc.) is chlorinated” (Government of Newfoundland and Labrador DOEC, 2013). These compounds pose a potential risk to safe drinking water because they are a “possible human carcinogen” (Health Canada, 2006, p. 3). However chlorination has also been commonly referred to as a ‘necessary evil’ given Health Canada’s assertion that,

The health risks from [DBPs], including trihalomethanes, are much less than the risks from consuming water that has not been disinfected. Utilities should make every effort to maintain concentrations of all disinfection by-products as low as reasonably achievable without compromising the effectiveness of disinfection (Health Canada, 2006, p. 1).

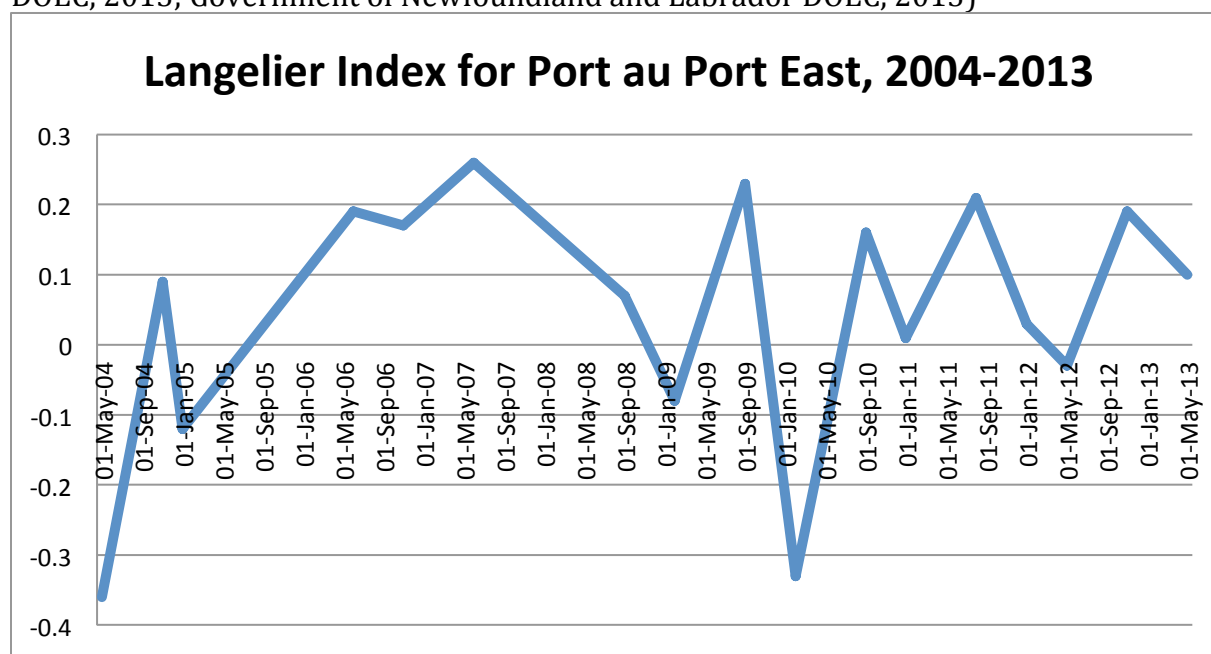
While it appears that the overall number of communities experiencing higher than recommended THM levels has increased from 126 (in 2010) to 132 (in 2012-2013) (Government of Newfoundland and Labrador DOEC, 2013, p. 11) this is not the case for Port au Port East. Since 2008, each report on the drinking water has indicated that THM and HAA concentrations are well below the *GCDWQ* recommended level of 100 µg/L and 80 µg/L, respectively (Health Canada, 2006).

Langelier Index (LI)

The LI is an approximate indicator of a water source's calcium carbonate saturation. The LI indicates the following (Government of Newfoundland and Labrador DOEC, 2014):

- If the LI is negative, then the water is under saturated with calcium carbonate and will tend to be corrosive in the distribution system
- If the LI is positive, then the water is over saturated with calcium carbonate and will tend to deposit calcium carbonate forming scales in the distribution system
- If the LI is close to zero, then the water is just saturated with calcium carbonate and will neither be strongly corrosive or scale forming.

Figure 3. Shows the trend in the LI report for the municipality (Government of Newfoundland and Labrador DOEC, 2014; Government of Newfoundland and Labrador DOEC, 2013; Government of Newfoundland and Labrador DOEC, 2013)



Port au Port East's testing report shows that the general trend has been for the tests to come back positive since 2010 (with one negative report in May 2012). If this trend continues, calcium carbonate could build up in the system's pipes and reduce the area available to carry water, which, over time, could lead to a number of water flow related issues.

2.2 Infrastructure and operations

Existing infrastructure

Drinking water infrastructure is made up of fixed capital assets for public use and includes water treatment, storage, and distribution systems (Gov. of NL 2005; Government of Canada, 2006). The water system in Port au Port East is much like the rest of NL in that it

gets its drinking water from surface water like 61% of the other public water sources in NL (Government of Newfoundland and Labrador DOEC, 2009, p. 4) As previously mentioned, Port au Port East's drinking water comes from protected sources: a reservoir and an artesian well. This system has a pump house that is secured and maintained daily with records that are also updated daily. The system uses liquid chlorine and is also filtered by a set of nine screens, which are cleaned often using a pressure washer. Although the filtration system is new, the town has made it a priority to improve its water system in an effort to address its water shortage problems.

The municipality has been proactive and has taken a multipronged approach on both the demand and supply sides to comprehensively address its water shortage issues. Some demand-side infrastructure solutions that have been implemented include initiatives like replacing shut-off valves for about 75% of the town. Further steps have also been taken to improve some public buildings' water consumption by providing flushes on urinals, and plans have also been discussed to procure more shut-off valves and flushes for other public toilets that are continually running. This is not the only work being done to address the municipality's water shortages.. On the supply side, the town has put forth a proposal to secure a new artesian well. The town hopes that multiple sites will be drilled in order to secure a reliable source.

Key informant perspective

We're in the process like I said of trying to obtain funding for a new artesian well, and uh, once we get that we figure our water quantity will be higher and we fixed all the leaks so that (well the ones they could find) to improve the amount of water we have. Other than that, our water is our number one priority. – Municipal staff

Challenges

The municipality of Port au Port East has been fortunate in that their community has high-quality drinking water; however, there are a few problems. The largest of these problems seems to be periods of water scarcity. Other issues with the water system include the ability to retain a water operator, physical security of the reservoir, and securing funding opportunities for infrastructure.

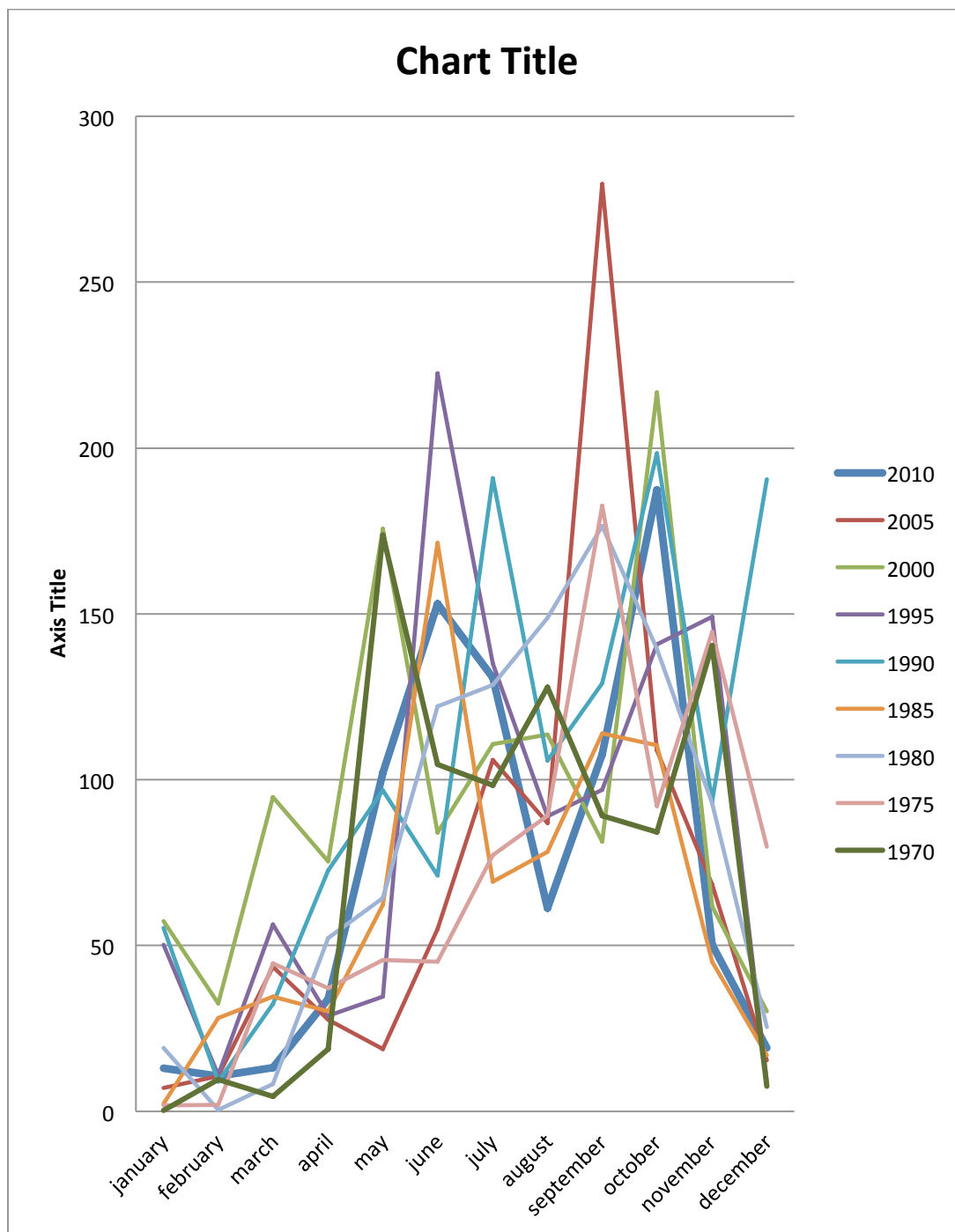
- **Water scarcity**

Although Port au Port East usually has enough water to meet the regular demand of its residents, water conservation measures have been enacted approximately 3-4 times over the past fifteen years according to the towns water operator. This generally happens when the water level of the reservoir falls below a certain threshold, which is observed by the water operator. This typically happens due to low rainfall, which they experience around winter and summer. Figure 4. Shows monthly rainfall patterns from 1970-2010 in five year increments. This data is from the Stephenville station, however it is the closest observation station for the area. The data supports the same information conveyed by the

water operator that rainfall levels are low during winter and summer. The data shows that levels below 50mm of rainfall have become more frequent since 2005.

Figure 4.

Monthly rainfall data Stephenville station



(Government of Canada, 1970-2010)

Key informant perspective

The quality is good, the quantity in the dry season is where we get in trouble. We sometimes shut it off at night. It's probably happened three to four times in the last 15 years...we can take a month with no water. Then the reservoir starts to go low and we have to put out to conserve water. – Water Operator

These conservation measures are carried out at night and typically run for six hours. Because a few brooks feed the reservoir, this has been enough time to sufficiently replenish its water levels and allow water services to be resumed in the morning. As the system exists currently, the existing artesian well can be used as backup in times when there has been a notable lack of rain; however, it is preferred that the well is not used for risk of running it dry and diminishing its capacity. This has caused a few concerns for residents, especially with regard to emergency situations. For example, if a fire were to occur, would they have the capacity to fight it? These issues have been behind the drive to secure other drinking water sources.

- **Water lines and filtration system**

Port au Port East has been fairly proactive when it comes to the upkeep and maintenance of its waterlines and filtration system. The town has conducted several tests to determine which water lines have leaked, and it has also reviewed the system and replaced 75% of its faulty shut-off valves. Through the process of replacing aging pipes and installing new shut-off valves, the town learned that the parts delivered to them were faulty. Upon discovering this, the town council fixed the problem right away. However, because there are about 25% remaining (original valves) made from the same manufacturer it is assumed that these valves will also have to be replaced at a later date. The screens for the filtration are all cleaned regularly and have not needed to be replaced.

- **Human resources**

Currently, the municipality of Port au Port East has a part time water operator who is also available on call in the event of an emergency. However, this is set to change as the water operator is preparing to retire but has decided to remain as a backup for whomever replaces him. The general outlook for this situation is positive, as the current water operator has been training his replacement and appears to have developed an understanding of the water system. The water system for Port au Port East is fairly straightforward and both water operators have received the appropriate training to operate the system. The current water operator has his water operator certificate class two, and the replacement is in the process of attaining his as well. At one point, sharing water operators with the community of Port au Port West-Aguathuna-Felix Cove was considered as a cost saving measure, but this was eventually deemed unrealistic as the demands of the Port au Port East system are enough to keep someone employed full time if funding was made available. Also, concern was raised in the event that an emergency happened in both communities at the same time the operator would have to choose and

prioritize which community to go to. As the situation would directly affect drinking water, it was agreed that this would be too great a risk to take.

Addressing infrastructure challenges

As recently as within the past five years, the municipality of Port au Port East has applied for funding with Capital Works and other government agencies in order to detect leaks in their system, and to replace faulty valves (which it will be doing again in the near future). Funding was also successfully requested to install flushes in urinals that were constantly flowing, and proposals have been submitted to secure an artesian well. The community is under the impression that the new well is coming, but it is being done under the condition that leaks in the system are addressed first. Due to these periods of water scarcity, it is feared that that development in the town will have to be halted unless more drinking water can be secured. Indeed, under current conditions, no new businesses or housing developments are being approved until the new well comes in. This is due to the fact that the current water infrastructure cannot meet the demands of the community in periods when there is a lack of rain. This could be remedied by securing a new artesian well.

2.3 Policy and governance

Ensuring the safety of drinking water in Canada is a responsibility shared between federal, provincial, territorial, and municipal governments (Health Canada, 2006).

Federal

In Canada, the responsibility for ensuring the safety of drinking water supplies is shared by the various levels of government. The principal responsibility of ensuring the safety of drinking water generally rests with the provinces and territories, while municipalities usually ensure the day-to-day operations of treatment facilities and distribution systems. Federally, Health Canada works in collaboration with the provinces and territories, through the Federal-Provincial-Territorial Committee on Drinking Water, to develop the Guidelines for Canadian Drinking Water Quality (GCDWQ). The GCDWQ are published by Health Canada and used by all Canadian jurisdictions (provinces, territories and the federal government) as a basis to establish their own enforceable requirements for drinking water quality.

The responsibility for the water system and its operations in Port au Port East largely falls to the municipality, as they must comply with the provincial guidelines. It is also their duty to uphold the federal government's *GCDWQ* but the federal government does not influence the day-to-day operations in the municipality. It was mentioned under Port au Port East's ICSP that under their feasibility goals and projects, \$500,000 from their budget would go towards upgrades to their water system in order to "explore and develop a new source of groundwater supply" (municipalities of Port au Port East, Port au Port West, Aguathuna, Felix Cove, Lourdes, Cape St. George, 2010, pp. 60-61).

Provincial

In NL, the provincial government is the main body responsible for ensuring public access to safe drinking water based on the provisions of four main legislative acts: the *Municipalities Act* (1999), the *Municipal Affairs Act* (1995) the *Environmental Protection Act* (2002), and the *Water Resources Act* (2002). It must also follow the previously mentioned *GCDWQ*. Currently there are 315 protected public drinking water sources (Government of Newfoundland and Labrador DOEC, 2013) in the province. In NL, the provincial government has four departments that oversee the public water system: the DOEC, the Department of Health and Community Services (DOHCS), the Department of Municipal and Intergovernmental Affairs (MIGA), and Service NL (Government of Newfoundland and Labrador DOEC, 2013). These departments work under the Multi-Barrier Strategic Action Plan (MBSAP) (Government of Newfoundland and Labrador DOEC, 2013; Government of Newfoundland and Labrador DOEC, 2013) As shown in Table 3, the MBSAP has three levels. This plan is then the responsibility of three levels of government. The departments' specific roles are outlined in Table 4 below.

Table 3. Multi- Barrier Strategic Action Plan - Three levels of governance

Level 1	<ul style="list-style-type: none">- Source water protection- Drinking water treatment- Drinking water distribution
Level 2	<ul style="list-style-type: none">- Monitoring- Data management and reporting- Inspection and enforcement- Operator education, training, and certification- Corrective measures
Level 3	<ul style="list-style-type: none">- Legislative and policy frameworks- Public involvement and awareness- Guidelines, standards, and objectives- Research and Development

(Government of NL, 2014) (Daniels, 2014-Forthcoming)

Table 4. Roles and responsibilities of provincial departments managing drinking water in NL

Department of Environment and Conservation (DOEC)- <i>Water Resources Management</i>	<ul style="list-style-type: none">- Acts as the lead department- Regulates development activities within protected public water supplies- Samples and reports on chemical and physical drinking water quality parameters in public water supplies from source to tap- Administers Operator Education, Training, and Certification
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<i>Division</i>	(OETC) program
	- Annual Clean and Safe Drinking Water Workshop
Department of Health and Community Services (DOHCS)	<ul style="list-style-type: none"> - NL Public Health Laboratory and regional drinking water testing locations where municipal and private water supplies are tested for bacteriological indicators <i>E. coli</i> and total coliform bacteria - Conducts drinking water safety initiatives and review guidelines related to water which to enhance health and prevent disease
Municipal and Intergovernmental Affairs (MIGA)	<ul style="list-style-type: none"> - Provides financial support to communities for the provision of drinking water infrastructure - Involved in NL Drinking Water Safety Initiative and installation of Potable Water Dispensing Units
Service NL (or Government Services- GS)	<ul style="list-style-type: none"> - Samples and reports bacteriological water quality parameters in public water supplies from source to tap - Environmental Health Officers contact municipality/LSD <u>immediately</u> if sample tests indicate <i>E. coli</i> and/or total coliform bacteria or if chlorine residual is inadequate to implement BWA
(Daniels, 2014-Forthcoming)	

Provincial public reporting

DOEC releases several public reports relating to drinking water quality (Government of NL, 2014; Table 5.).

Table 5. DOEC public drinking water quality reporting

Seasonal Community Drinking Water Quality Reports	<ul style="list-style-type: none"> - An interpreted report of seasonal drinking water monitoring - Indicates parameters that exceed the <i>Guidelines for Canadian Drinking Water Quality</i> - Provided to all communities with a public water supply
Exceedance Report:	- A report delivered via fax or email to communities immediately after water quality laboratory results exceed the <i>Guidelines for Canadian Drinking Water Quality</i>
Annual Drinking Water Safety in NL Report:	<ul style="list-style-type: none"> - Provincial report released annually - Describes the province's activities under the MBSAP
Drinking Water	- The Water Resource Management Division's website contains

Quality web documents	a regularly updated online tool with information on drinking water quality
	- See: http://www.env.gov.nl.ca/env/waterres/whatsnew/index.html

(Daniels, 2014-Forthcoming)

Municipal

The Town of Port au Port East is governed by the *Municipalities Act* (1999). Therefore it is the responsibility of the municipality to operate its public water supply. Those who own property in the municipality pay taxes in order to contribute to the water services of Port au Port East. The rest of the water system's operation costs and maintenance is much like other communities for projects where the province pays 90% and the municipality pays 10%.

Port au Port East is a fairly small community, and although the town does not have specific water management policies, it does maintain information for the water system, infrastructure, and testing between the town clerk and the water operator. It is important to note that although the town does not have specific regulations they still comply with the provincial standards. The water operator has kept up to date logs at the pump house and the town hall maintains other aspects of the drinking water knowledge base, such as testing results, maps, and plans.

2.4 Public perception, awareness, demand and practice

Perception

Water quality

Case study interviews suggest that the public perception of the drinking water quality is fairly positive. Complaints about the water quality in the municipality tend to come from residents who do not like their water to have a chlorine taste, but since chlorination is recognized as a necessary safety measure, it is not considered a major issue. The general response from residents is that the water in the community is better than some other municipalities. However, residents have expressed that they would like to see more information communicated to them pertaining to the quality of their drinking water.

Key informant perspective

I used to love it (the water). It used to be so cold, that's what I loved, and then a number of years after they changed it and now I won't touch it. – Resident respondent

...it's safe, it's clean, it's clear, our water it doesn't have an odour, it doesn't have any colour like to it. It's good water, I feel very comfortable drinking it and I drink at least 10 glasses a day.– Resident respondent

Our water's perfect. And you know we get compliments from outside areas, 'your water is beautiful'. I'm after hearing that (like from Stephenville and that). – Municipal government respondent

It's better than Stephenville and Kippens. You can't drink the water there. –Resident respondent

There should be new letters sent out, everyone should be informed about the water. More information needs to be given out to residents. – Resident respondent

Government

In Port au Port East, there has been a discrepancy between the provincial government's stated drinking water policy, regulations, and operational guidelines and those that have actually been enacted in the municipality. Because of the community's water shortages, Port au Port East has had to enact its own stricter conservation measures at times to limit water usage. This is also the case for the community when there are BWAs. These advisories have not been caused by a positive reading for bacteria, but rather as a municipal precaution when work is being done on the infrastructure.

Key informant perspective

Usually in wintertime or summertime, in a dry season there are notices put out to conserve water in the summertime. No washing your car, no pools, no watering your lawn kind of thing. That would fall under policies. Those have been in place for a number of years. – Resident respondent

I know they're doing their best but they're under someone too. – Resident respondent (referring to the municipal government)

Threats

While the perceived threats to the drinking water for Port au Port East are few, one of the major threats to the public drinking water in the community is quantity. While there is enough water for the most part, as previously discussed, the community has faced periods where water conservation measures have been enacted. Furthermore, although unconfirmed, there is a general suspicion among residents that Port au Port East's water might possibly become contaminated by water from an abandoned US military radar site that was originally constructed during the 1940s (Higgins, 2006) near the watershed area. Although there is concern about possible contaminants seeping into the water supply, regular and specialized testing has suggested that this is not the case. Finally, a current threat that has presented itself is security of the water reservoir. Multiple residents and municipal government respondents have expressed concern about wildlife entering the water supply. Although the reservoir is fenced off, fences cannot always protect against larger wildlife such as moose, or smaller rodents such as mice and shrews.

Key informant perspective

There's a lot of trash up by the old radar site, PCBs are a concern. There was a whole base up there. There's still something up there. That's what they say, lots of trash. – Resident respondent

It's in the backs of a lot of peoples minds, that when the US Air force installation was up on the hill there could be seepage from that but, its been tested, not just the regular water testing but its been sent off to labs. And no traces of anything. But residents [worry] what was up there may get into the water someday. – Municipal staff

It's fenced and inspected daily for beavers or somebody breaking in. Every now and again you get kids and you gotta drive them out. But they can always get underneath the fence somewhere. But it is fenced to keep animals out. Moose have been around...we had moose problems in and around that area and even now you go up and every now and then and see moose tracks. –Municipal Staff

Awareness

Generally, residents and the municipal government did not speak specifically to climate change in their interviews. They did speak to some of the effects of climate change, such as extreme weather events which cause flooding, but did not identify it as such. Although residents raised flooding as a concern, because the water reservoir's physical location is away from the shoreline, it was not presented as a threat to drinking water.

Key informant perspective

*The water might turn like a little shade of brown...like [after] a really torrential rain storm
– Municipal government representative*

90% of the time we have too much water, the water problem is not, you know most of the time the reservoir is on overflow. It takes a good month with no rain. We really have the opposite problem, we have flooding more than which some of it cause from the overflow of the reservoir and the brook that goes down into the town goes into overflow. This is all part of our water, from our reservoir. It doesn't affect quality...that's all down past the water supply. It comes down from the mountains just below it, flooding the water...No salt water intrusion. There's probably about 1000 feet level between the sea and our water supply. Not saying it's 1000, but it's up there. – Municipal government staff



Looking back on the community of Port au Port East-picture shows salt water meeting the land.

Residential demand and practice

The lack of access to more water resources is a concern for both residents and municipal staff. There is a common view that another well needs to be secured so that the community can develop. A few prospective businesses have been denied due to the current water supply being unable to support them. Housing developments have also been halted as there is lack of water to support it. This has made securing another water source a high priority for the municipality. The municipality is also looking into getting a generator so that when the power goes out, the community would still have access to drinking water.

Key informant perspective

Challenges, there is a lady that owns property here, and she wanted to build a subdivision about half a dozen houses or more. And we had to turn her down because of lack of water. So that would be one of the challenges. We don't have enough water to permit it to happen. Also Municipal Affairs would not allow it to go ahead. Department of Environment that is because of the water situation. – Municipal staff

We're working on getting a generator so that when the power goes down we wouldn't lose our water. That's another thing that we would like to have. Which will come up eventually. It actually came about from the last time we lost power for about a day. Now it didn't affect me because I live over here near the water supply so I get gravity feed. So I always have water supply. A dribble of water, but not everyone is that fortunate; the farther away you live the less you get. That time it went for the whole day, no body had any water. –Municipal staff

Industrial, commercial and institutional demand

Currently there is not a large industrial or commercial water demand in the community. Where other communities have larger industrial water users such as fish plants, Port au Port East does not. The only other institutions on their system that could use a large quantity of water are the community's school and community centre. The school, although small in size, does still represent a concern to the community for its level of water consumption. The school has a few urinals that are continually using water.

Key informant perspective

The school, the community center...all have urinals that do not have flushes you know...instead of a urinal running, you know steady, how many gallons [are lost] and I had a friend of mine actually do it up and its actually in the millions he figured a year of water going through one of the buildings
- Municipal government respondent.

See Appendix C for graphs of the average water consumption per day per household. August 2013-January 2014 (graphs provided by Town Council).

Conclusion

The Port au Port East case study is part of the larger *Exploring Solutions for Sustainable Rural Drinking Water Systems* research project. This case study was compiled using information gathered from municipal, provincial, and federal government documents and reports, as well as semi-structured interviews. These interviews were conducted with the help of citizens, town council, the mayor and other municipal employees. It was the goal of these interviews to build a general understanding of challenges and successes the community is experiencing and to place it within a larger understanding of what is going on in NL.

This specific report has examined Port au Port East's source water quality and quantity; infrastructure and operations, policies governing drinking water, government involvement and structure, public perception, and finally, the public's awareness and demand surrounding drinking water in the municipality.

By examining the reports from the DOEC, and considering these along with information relayed by the key respondents, the general picture for drinking water in Port au Port East is a fairly positive one. These reports have come back with numerous consecutive "excellent" ratings on the *DWQI* ranking. They continue to have aesthetically pleasing drinking water, as well as consistent reports of all important indicators such as THMs, HAAs, pH etc. being within the *GCDWQ*. Other than occasional complaints of being able to taste chlorine, residents are fairly pleased with the quality of their drinking water. Furthermore, the community has also had few BWAs in the past 15 years. And generally when these advisories are implemented, it is not due to a bacteria/contaminant problem, but as a precautionary measure when maintenance is done on the water infrastructure.

Drinking water shortages have been identified as the major issue for the community going forward. There is a real sense of a need for a reliable third source of water to supply the town with enough water so that in the dry periods of the year, the community will not have to enact strict conservation measures. In order to accomplish this, more infrastructure and funding is needed for the municipality.

Notwithstanding this need, Port au Port East has also been fairly proactive in the management of their water infrastructure. About 75% of the community's water lines have been replaced, and new shut-off valves have been installed on much of the infrastructure. However, work is still required to ensure that other faulty valves are replaced, which the municipality already has plans to do. These measures have also highlighted a need for better water conservation measures to be taken in the community. Other plans to improve the community's drinking water infrastructure include obtaining a new artesian well (which has been applied for), and there are hopes for a power generator in the event that power fails in the community residents would still have access to water. These projects have been completed and planned projects will be completed with funding from the government on the same type of cost sharing where the provincial government carries 90% of the cost and the municipality assumes the remaining 10%.

As with most communities, the level of knowledge of Port au Port East's drinking water system and situation varies depending on respondent. While there is confidence in the municipal government, and a belief that they are genuinely doing their best to provide clean and safe drinking water to meet the needs of the community, not every citizen is aware of the degree to which this is being done. Consequently, the perceptions are mixed with some citizens drinking bottled water and runoff well water from along the highway (aka roadside springs), while others love and stand by the community's drinking water. These interviews have also spoken specifically to this issue of knowledge variance. Citizens within the municipality have expressed a desire for more feedback and communication with the municipal government about the state of their drinking water. They are interested in the state of infrastructure, water quality reports, the level of provincial government involvement in the community, and information regarding the status of new drinking water sources. They have specifically asked that a newsletter be made available to them on a regular basis to summarize information on: the state of the local water quality, quantity, infrastructure, water infrastructure maintenance, conservation information and tips. This appears to be relatively consistent with the general experience of drinking water quality in the community, everyone has a vested interest in stewardship over the water, with residents generally knowing more than they initially thought.

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Appendices

Appendix A. Case Study Methodology

Objective

In depth profile of key issues, challenges and solutions related to public drinking water systems in rural NL.

Methods

- Semi structured key informant interviews (an interview guide will be used):
 - *Note depending on size and human resources in the community the below informants may not be available
 - Water Operator (at least 1)
 - Town administrator (at least 1)
 - Mayor/Council/LSD Committee rep (at least 1)
 - Business owner/heavy users (~2-3)
 - Include businesses that sell bottled water
 - Environmental or watershed groups (if they present) (at least 1)
 - Health office for community/region
 - Environmental Officer who tests water for that town
 - Residents
 - Best done in a focus group format (possibly by attending another meeting)
 - Seniors groups, family resource centres, youth groups, community groups, etc
- Review of documents
 - Project's administrator/operator survey results
 - DOEC data on community/drinking water supplies
 - Development regulations and by laws related to water
 - Any studies done on drinking water/infrastructure
 - Any other pertinent drinking water related documents
 - Media articles (preliminary database on basecamp)
- At least 3 days' worth of interviews done with 1-3 trips
- At least 1 trip reporting back to the town and requesting feedback at a town council meeting/town hall meeting

Requirement of Case Study Community

- Community of 1000 or less
- At least one per MNL region
- On a public drinking water supply (mix of groundwater, source water and PWDU)
- Willing to be part of study (most likely a town that answered the admin survey)

Possible Topics

- LSDs and Municipalities
- PWDU
- Community trying something new and working (alternatives/solutions)
- Impact of industry/tourism/high water user
- Regional water operators

- Drought issues
- Chronic/long term BWAs
 - How do towns with long term BWAs cope?
- Compliance with BWAs
- Aboriginal communities- Labrador issues→ training for operators, access to water workshops, capacity, infrastructure, sampling
- Roadside springs
- Metering
- Aging infrastructure
- High DBP's
- Chlorination issues
- Real time water quality monitoring
- DWQI/Langlier index
- Use of bottled water/safety of bottles water
- Bacteriological outbreak
- Resident perceptions

Community Contact

*May vary, for example Theresa will require permission from the Nunatsiavut

- Initial informal contact.
- Formal letter of request to Mayor and Council/LSD committee
- Follow up to confirm participation and identification of key contact in community
- Discussion with key contact re methods, available documents, and arranging field visits
- Circulation of report drafts to the town contact and arrangements for feed back visit

Final Reports for Each Case Study

- Each case study community will have an overall community case study outlining the state of the drinking water system, as well as individual topic based reports that are specifically related to drinking water issues or innovations in the community. What will be included in these reports will vary depending on the community and topics identified, however some basic requirements are described below.
- The overall community reports should include:
 - 15-30 pages (1.5 spacing)
 - Title page, table of contents
 - Introduction of community and their water system
 - Source water supply (GW/SW)
 - Types of infrastructure
 - Human resources (e.g. water operator)
 - Summary of findings according to research components (from both the background review and the interviews)
 - Source Water
 - Infrastructure
 - Policy/Governance
 - Public Perception, Awareness and Demand

- Conclusions and Future Directions
- References
- Community summary document
 - 3-5 pages
 - Headings:
 - Introduction
 - Source Water
 - Infrastructure
 - Policy/Governance
 - Public Perception, Awareness and Demand
 - Conclusions and Future Directions
 - Minimum 1 image per page
 - Formatting instructions to come
- The topic based reports should include:
 - 3-5 pages
 - Introduction of topic and significance to drinking water
 - Description of issue/innovation in the community
 - Description of the issue/innovation in the province wide context
 - If an innovation applicability of using the innovation in other parts of the province
 - If an innovation- has this been used in other parts of Canada/the world? Give examples.
 - If an issue- what has other places in Canada/the world done about this?
 - Conclusions
 - Recommendations for future research
 - References

Conducting Key Informant Interviews

1. When contacting key informant interviews start with an e-mail or phone call. If you do not hear back from the possible interviewee within a week then make a follow up phone call. We suggest making 3 attempts in total to contact the potential interviewees.
2. Arrive on time and prepared for your interview. Make sure you have:
 - a. 2 copies of the interview consent form (1 copy for you, 1 copy to be left with interviewee, make sure you and all interviewees sign both copies)
 - b. Tape recorder fully charged- always ask and get on the consent form that this is ok
 - c. Pen and paper
 - d. Copy of the interview guide
3. Before you begin the interview make sure you have the consent form signed and you have asked if you can record the interview, if not takes notes to the best of your ability.

4. When the interview is over thank them for their time and ask them if they would like a copy of the case study.
5. Make sure to get your interviewees contact information so that you can follow up with them later when outputs of the project are available. Confirm how they would like to be communicated with in the future.

Appendix B. Interview Guide

*It is likely there will be overlap between the questions, be conscious of linking questions together and following up on comments.

*Should prepare questions in addition to the ones below specific to the case study community. These questions should be derived from the administrator/operator survey results and background research.

Section A:

Background Information on Respondent

1. What town do you live in?
 - How long have you lived in your town?
2. What is your profession? What is your role in your community that relates to drinking water?
 - Are you a paid part time/full time position? A volunteer? A user?
3. How long have you been working/associated [with the subject town]?
4. Are you involved in any other organizations in your town not covered above?

Section B:

General Drinking Water Information

***To be collected from all participants**

1. How would you describe the quality and quantity of your local drinking water?
 - Are you content with the drinking water quality in your community?
 - Do you like the taste/appearance?
 - Has your opinion on the drinking water quality changed overtime?
2. In your opinion what is the general resident's perception of the drinking water quality in your community?
 - In your opinion, are there any (widely held) misconceptions?
3. Do you think your town's drinking water is safe?

- Are there any factors that you think may be affecting the safety or quality of drinking water in your community?
4. Have you ever felt that the water system/source in your community as being vulnerable/facing particular threats? (If the respondent struggles with this--e.g. presence of disinfectant bi-products, point or non-point pollution, physical obstructions in water source, aging or inadequate infrastructure...*for a complete list see pgs. 12-24 DPSIR document*)
 - *NB- *It is key here to have a good working knowledge of those risks/threats for community in question based on the community profile at the Water Resources Portal**
 - Under what circumstances did these threats emerge? (e.g. after a particular evident, access to a new information, speaking with a public official etc.)
 - To what extent do any threats apply to you individually as opposed to a risk for the entire community?
 5. How do you determine whether your current water system is safe, or conversely under threat? I.e. What sources of information (people, government, scientific lit..) would you regularly use in determining the safety and quality of your water system/source?
 - Has government been helpful in identifying threats within your water system/water source?
 6. Have your perceptions towards the risks associated with water quality changed over time? If yes, how so?
 7. What are the positive aspects of the publicly supplied water in your town?
 8. Name any negative impacts of the public drinking water on your town? (impacts can be economic, social, environmental etc)
 9. What other sources of drinking water do people in your town use other than the publically supplied drinking water (e.g. spring water, bottled water)?
 10. What have been the challenges your community has faced in the past regarding drinking water?
 - Does the number of Boil Water Advisories in your community concern you?
 11. What would you consider the emerging or more recent challenges for your community's drinking water supply?
 12. What kind of development/land use is there in the vicinity of your community's water suppl(y/ies)?

- In the greater watershed/catchment?
- 13. Is your water source designated as a protected public water supply area?
 - Are there any activities that are prohibited in or around your water supply?
 - If so, do you think these prohibited activities are appropriate?
 - Are they enforced? Are they violated?
 - Are there any activities that should be prohibited in your town's drinking water source that pose a risk to human health?
- 14. Have there been problems with the water supply and/or delivery system(s)? Including source water, the pump house, treatment/ filtration or distribution systems?
 - Have they been addressed/resolved? If so, how? If not, why?
 - Is this problem(s) a reoccurring problem?
- 15. Are you aware of any research that has been done on the local water supply?
 - Has there been an evaluation of the sustainability/capacity of the water supply? Hydrological surveys? Other studies?
- 16. Do changes in weather ever impact your town's drinking water supply?
 - If so, in what ways?
 - Is there a plan to mitigate these impacts? Are there adaptation strategies in place?
 - Describe any changes in water quality/availability that occurs seasonally and/or after extreme weather events.
- 17. In what ways do you think being "rural" affects your community's drinking water quality and supply?

Section C: **Role Specific Questions**

Water Operator

Water System, Maintenance and Operations

1. What is the local source of drinking water?
 - Is it the only one? Is there a back-up supply?

2. If your town is designated as a protected public water supply area:
 - Why did your town choose to designate as a protected public water supply area?
 - How is the water supply managed/protected?
 - Do you think source protection measures are adequate?
 - Has the council tried any new methods of reducing violations of the town's rules/regulations?
3. How long ago was your town's public water supply (source) developed? Can you tell me anything about the historical development of the drinking water suppl(y/ies) locally?
4. How would you describe the level and quality of water infrastructure in your community?
 - Type of infrastructure
 - Scale appropriate for design capacity?
 - What year was it installed? Have upgrades been made since installation?
5. Do you have water treatment?
 - How long have these systems been in place? Is everything currently working?
 - What kind of treatment system do you use?
 - Are you happy with it?
 - Is there sufficient disinfecting agent available? Has the disinfecting agent expired?
6. Do you have water filtration do you use?
 - How long have these systems been in place? Is everything currently working?
 - What kind of filtration is used?
 - Are you happy with it?
7. How is drinking water currently delivered in the community? Do all residents have piped services?
 - What proportion of your community households rely on private wells?
8. Are there any high risk public facilities supplied by the public drinking water system?
 - Daycare facility?

- Hospital?
 - Seniors home, long-term facility?
 - School (K-12)?
9. Are there any high water users using the public supply?
- Fish plants, other industry?
 - Does this impact the quality or quantity of the drinking water?
10. Is there a designated workshop area for drinking water system operation and maintenance?
- Are there appropriate tools in the workshop to perform basic maintenance?
 - Are there operating and maintenance manuals for the treatment equipment, pumps, etc readily available?
 - Do you have spare parts, consumables, maintenance kits, etc?
11. How often do you check for chlorine residual?
12. Do you have a regular system cleaning program?
13. How many (if any) emergency repairs have been required completed in the last 2 years?
- Is any emergency repair kit readily available to keep the system operational in an emergency situation (such as back-up pumps?)
14. Are there any re-occurring operational problems?
15. Do you have a cross-connections control program (Connection to prevent back-siphoning and/or backpressure into the town water mains)?
16. Do you have the resources to prepare and maintain up-to-date water treatment system/plant and distribution systems documentation such as As-Built drawings, Process diagrams, Operations Manuals, Log Books, Lab Results, etc?
- Could you easily locate As-Built for:
 - Water Treatment System/Plant
 - Distribution System
 - Water Storage Tank
17. Do you feel the water treatment facility, water source area, and/or water storage tank have adequate security to prevent unauthorized entry?
18. How is the municipality currently track potential threats to source water (e.g. point pollution, physical obstructions within the watershed, levels of DBPs, cabin development, flooding etc.), if at all?

- Would you be interested in mapping these things to assist in strategic planning and development in the future?

19. What other innovative strategies have you used in attempt to address your water challenges (e.g. the Regional Water Operator)?

- In the case of the Regional Water Operator, how did this come about? Please describe.
 - What were/are the benefits? Drawbacks?
 - How was this funded?
- What are the future plans in terms of regional strategies to manage water infrastructure/source water?

Certification and Training

1. What is your level of water operating training/certification?
 - Years of experience?
2. What are your typical hours of work as operator?
 - How many hours are spent on work/maintenance related to the water treatment system/plant and distribution system, etc?
3. Are you happy with your compensation?
4. Is there only one water operator in your town?
 - Does anyone replace you while on vacation, training or sick?
 - Does this person have the same training as you?
5. Were you trained with the Operator Education, Training and Certification (OETC) Program provided by the DOEC (Department of Environment and Conservation)? If not, proceed to question 8.
 - What were the benefits of this program?
6. Are there any limitations with operator training in NL?
 - Travel costs?
 - No replacement while on training?
 - Other?
7. Do you have any suggestions on how the province can improve the OETC program?
 - Can you suggest any alternative ways of delivering training sessions?

Complaints and Reporting

8. Do you keep record of your daily activities (flows, chlorine residuals, maintenance activities, etc)?
9. Do you receive complaints about the drinking water either directly from residents or from the town office?

- What types of complaints?
- How often?
- What is the range of response times to these complaints?

10. Have there been Boil Water Advisories issued in the past 2 years?

- What protocols are there for notification about a boil water advisory when it is communicated from government services/DOEC to your town?
- What protocols are there for notification at the town level for communicating the advisory to residents?

11. Have you been in contact about water quality issues over the last 12 months with the Department of Environment and Conservation, Municipal Affairs or Government Services?

- What spurred the contact?

Town Administrator/Staff / Councillor
System

1. What is the local source of drinking water? Is it the only one? Is there a back-up supply?
2. How long ago was this supply developed? Can you tell me anything about the historical development of the drinking water suppl(y/ies) locally?
3. How is drinking water currently delivered in the community?
 - Do all residents have piped services?
 - What proportion of community households rely on well and septic systems?
4. How would you describe the level and quality of water infrastructure in your community?
 - Type of infrastructure
 - Scale appropriate for design capacity?
 - What year was it installed? Have upgrades been made since installation?
5. Heading into the future, how do you see the drinking water system developing?
 - Expansion? (Drivers?)
 - Taking on new systems?
 - Replacement? New Approaches?
6. Do you have any comment on private wells in the area?

7. Within your area can you think of any examples of innovative or unique technology?
 - E.g., Point of entry treatment, mobile treatment units
8. Are there any public facilities supplied by the town water system? For example:
 - Daycare facility
 - Hospital
 - Seniors home
 - School (K-12)
9. Are there any high water users using the public water supply?
 - Fish plants, other industry?
 - Does this impact the quality or quantity of water?

Management/Financials/Policies

10. If your water source is a designated protected public water supply area:
 - Why did your town choose to designate as a protected public water supply area?
 - How is your water supply managed/protected
 - Do you think source protection measures are adequate?
 - Has the council/town tried any new methods of reducing violations of the town's rules/regulations?
11. Do the household water tax rates cover water operation and maintenance expenses in your town?
12. Is either of the following available for the current water system(s)?
 - Inventory/As-Builts/GIS mapping
 - Infrastructure assessment/evaluation
 - Planning document/SOPS
13. Do you have the resources to prepare and maintain up-to-date water treatment system/plant documentation such as As-Built drawings, Process diagrams, Operations Manuals, Log Books, Lab Results, etc?
14. Do you feel that the current water infrastructure is planned and managed sustainably?
 - If no, is this a future goal?
 - Have you made progress toward sustainable infrastructure goals? Is sustainable infrastructure included in your ICSP(Integrated Community Sustainability Plan) or capital works plan?
15. Have you requested and/or received capital works funding in the last 5 years for a drinking water related project(s)?
 - For what?
 - Was it received?

16. Have you requested and/or received operation and maintenance assistance related to your water treatment system/plant and/or distribution system in the last 5 years?
 - What was requested?
 - Was it received?
17. Do infrastructure funding programs allow for consideration of local context?
 - If yes, how? If no, what challenges does this present? How do you deal with these?
18. Are there any programs, policies, or standards you consider to be critical or influential when it comes to household/drinking water infrastructure?
 - Foundational
 - Last 5 years
 - Last 10?
 - Last 20?
19. Is there a town/regional/provincial water management plan?
 - Is infrastructure included in this?
20. Do you have the ability within the current regulatory framework to accommodate unique local elements/challenges?
 - If yes, how? If no, what challenges does this present? How do you deal with these?
21. Is there a difference between what is mandated and what occurs on the ground in the provincial policies/regulations?
22. Does your town have difficulty with the availability of qualified water operators?
 - How many replacements have you hired in the last 5 years
23. Has your town ever considered a regional water operator?
 - If so, why?
24. Does your office receive complaints about the drinking water?
 - What types of complaints?
 - How often?
 - What is the range of response times to these complaints?

- Are these complaints recorded/logged?
- 25. Have there been Boil Water Advisories issued in the past 2 years?
 - What protocols are there for notification about a boil water advisory when it is communicated from government services/DOEC to your town?
 - What protocols are there for notification at the town level for communicating the advisory to residents?
- 26. Does your town have an emergency response plan and is drinking water considered in this plan? Please explain.
 - Has this been updated in the last 5 years?

Jurisdiction and Integration

- 27. Could you please describe the jurisdiction/level of authority you have?
- 28. Are there other agencies whose jurisdiction overlaps/overrides/conflicts with yours?
 - Do you work with these agencies? If yes, how?
 - Conflicts? Challenges? Please explain.
- 29. Are there recognized connections between household/drinking water infrastructure and other aspects of water management: water stewardship, source water protection, conservation, regional development?
- 30. Do you see an obvious link between household/drinking water infrastructure and regional planning and development?
 - If yes, please describe how state of infrastructure influences development (or vice versa).
 - If no – discuss.
- 31. How is the municipality currently track potential threats to source water (e.g. point pollution, physical obstructions within the watershed, levels of DBPs, cabin development, flooding etc.), if at all?
 - Would you be interested in mapping these things to assist in strategic planning and development in the future?

32. What other innovative strategies have you used in attempt to address your water challenges (e.g. the Regional Water Operator)?
 - In the case of the Regional Water Operator, how did this come about? Please describe.
 - What were/are the benefits? Drawbacks?
 - How was this funded?
 - What are the future plans in terms of regional strategies to manage water infrastructure/source water?
33. Describe your relationship with provincial and federal government departments/agencies, NGOs or private industry regarding drinking water quality? Has the relationship changed over time?
 - Are there any challenges that need to be overcome to ensure effective collaboration/a better relationship? Please explain.

Business Owner

1. Are there any regulations/policies/laws you have to adhere by related to water?
 - Who imposes these policies: federal/provincial/municipal government?
 - Who enforces these policies?
 - Do you feel these policies are appropriate?
2. Is your business ever impacted by the drinking water quality in your town?
 - Please explain.
3. If in food service/food and drink retailer, do you provide patrons with water products other than publicly supplied drinking water? Why or why not?
4. If a food/drink retailer who sells bottled water, is bottled water a common purchase in your town?
5. How would you describe your business' level of water use in your community? (Higher than average, average etc...). Please explain.
6. Describe any attempts within your business and/or with community partners to promote the protection/better management of drinking water.

Environmental and/or Watershed Group

1. What is the mandate of your organization?
 - Are there any mandates specific to drinking water?

- Do you have any drinking water related programs/educational opportunities?
- 2. Describe your relationship with provincial and federal government departments/agencies, other NGOs or private industry regarding drinking water quality?
 - Has the relationship changed over time?
- 3. Is your water source designated as a protected public water supply area?
 - Why did your town choose to designate as a protected public water supply area?
 - How is the water supply managed/protected?
 - Do you think source protection measures are adequate?
 - Has the council tried any new methods of reducing violations of the town's rules/regulations?
- 4. Have you partnered with any groups/organizations regarding water-quality management?

Environmental Health Officer

****Ask intro/general questions as much as they pertain to a regional jurisdiction****

1. Please briefly describe your mandate as an Environmental Health Officer.
 - What communities do you serve?
2. How much interaction do you have with the municipalities in "your region"?
 - Who, at the municipal level, do you interact with the most?
 - Describe the level of interaction your field staff have with water operators/staff in municipalities.
3. What is the greatest health risks associated with the water quality in (subject town)?
 - Are measures being implemented to reduce these risks?
 - What can be done to reduce these risks?
 - Where does your department stand with DBPs and other 'chemical and physical' parameters as far as the potential health risk they represent from a municipal perspective?

4. At what point do you intervene with respect to drinking water safety?
 - Do you monitor the Drinking Water Quality Reports issued by DOEC?
 - Do towns ever approach you to help interpret these reports?
 - To what degree do you help municipalities mitigate their specific environmental health risks/concerns?
5. Describe your relationship with other provincial and federal government departments/agencies, NGOs or private industry regarding drinking water quality? Has the relationship changed over time?

General Resident

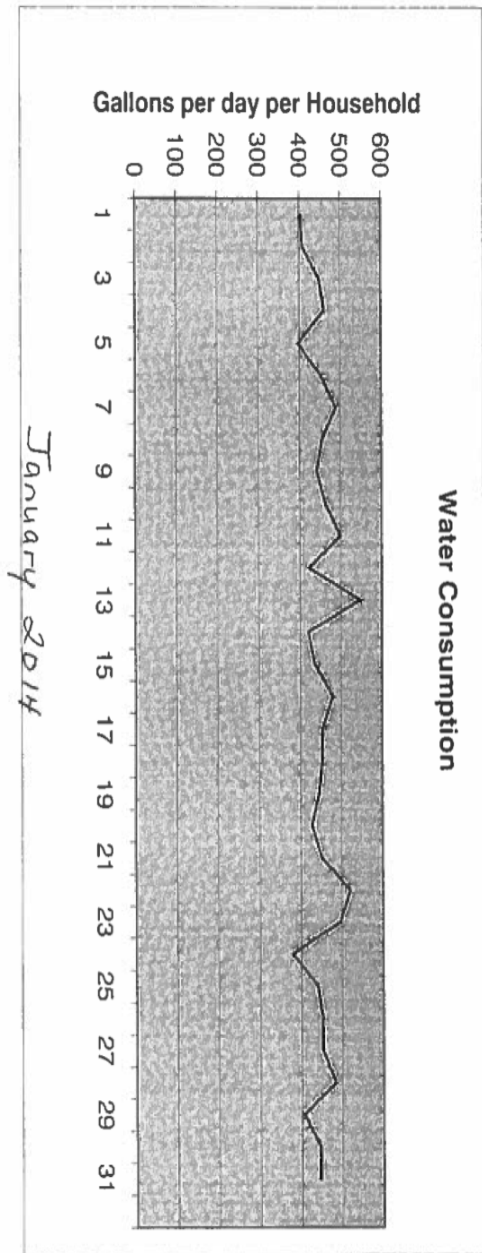
1. Are you aware of any laws/policies surrounding your source water supply?
 - Do you think these laws/policies are adequate/appropriate?
2. As a resident, do you have faith in your government (local, provincial, federal) to provide your town with clean and safe drinking water? Why or why not?

Section D:
Closing Questions for All Respondents

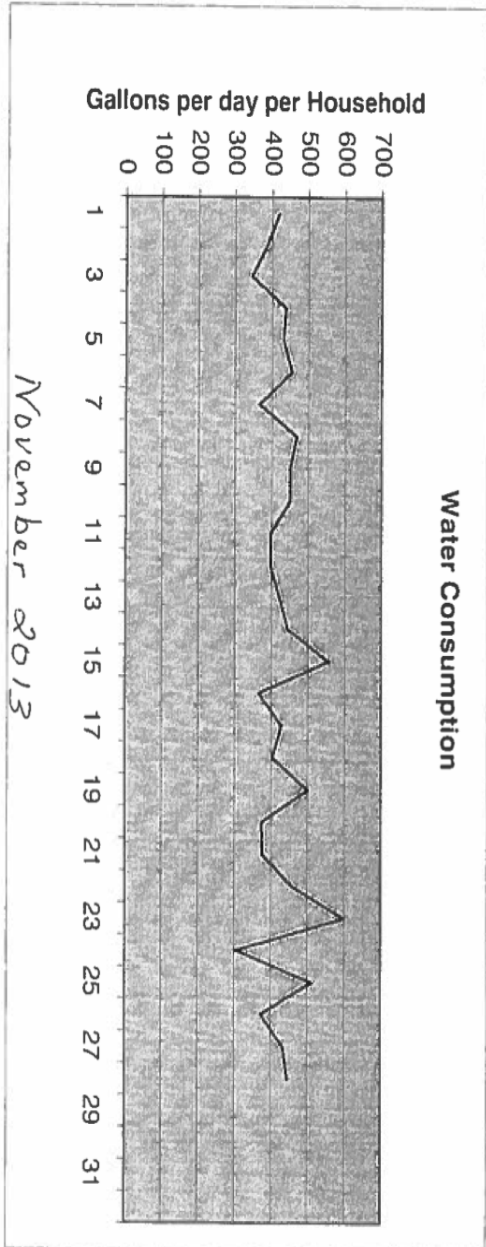
1. How would you like to see the water system in your town develop heading into the future?
 - Future opportunities? Concerns?
 - Links to sustainable development? Climate change?
2. Do you have any other recommendations on how the Department of Environment and Conservation, Water Resources Management Division and/or Department of Municipal Affairs and/or NL Services and/or Department of Health and Community Services can improve their drinking water policies or funding programs?
3. Is there anything else you would like to add? Documents you would like to suggest?
4. Is there anything I can provide back in terms of information that you would be interested in? Get contact information, if not already recorded.

Appendix C. Daily Water Consumption

450.6774 Average per day



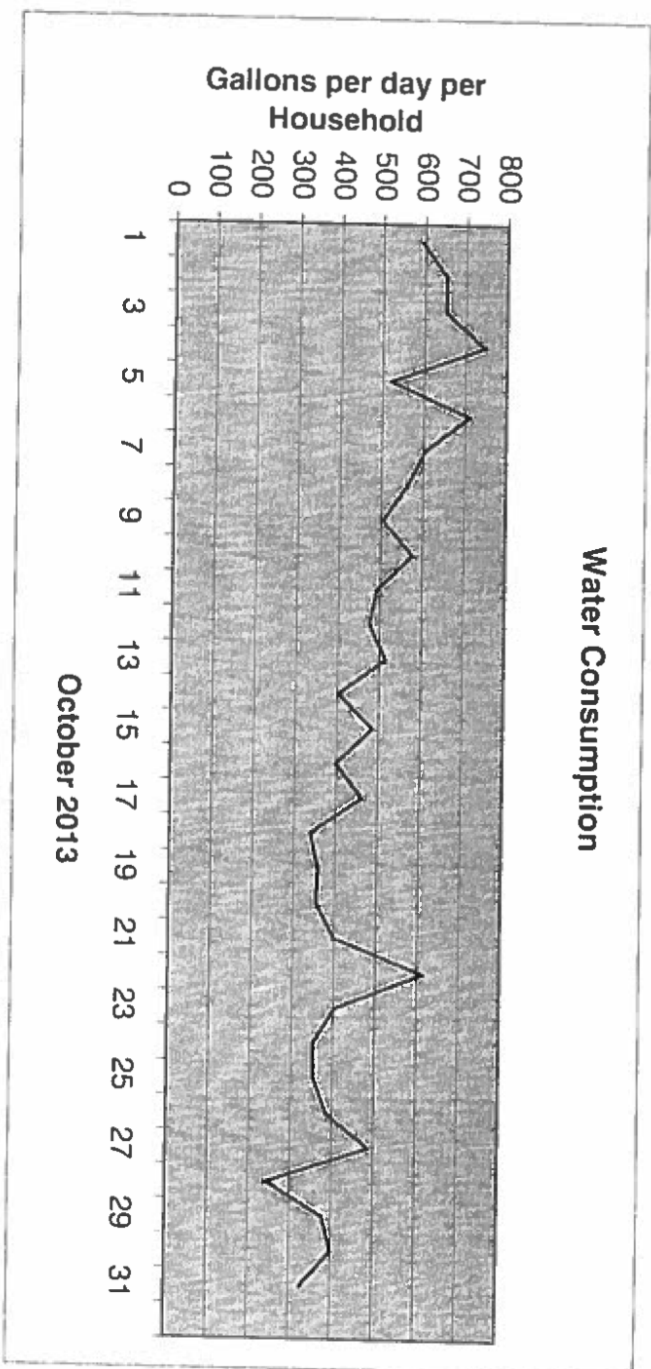
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387
345
438
431
455
366
468
450
451
397
397
421
445
556
365
428
403
499
374
376
458
598
305
511
372
433
445



428,357.1 Average per day

Please Note: On the 23rd, levels were checked at 7 P.M. and on the 24th, they were checked at noon.
Also: Hydro was out on the 29th and 30 due to Blackouts

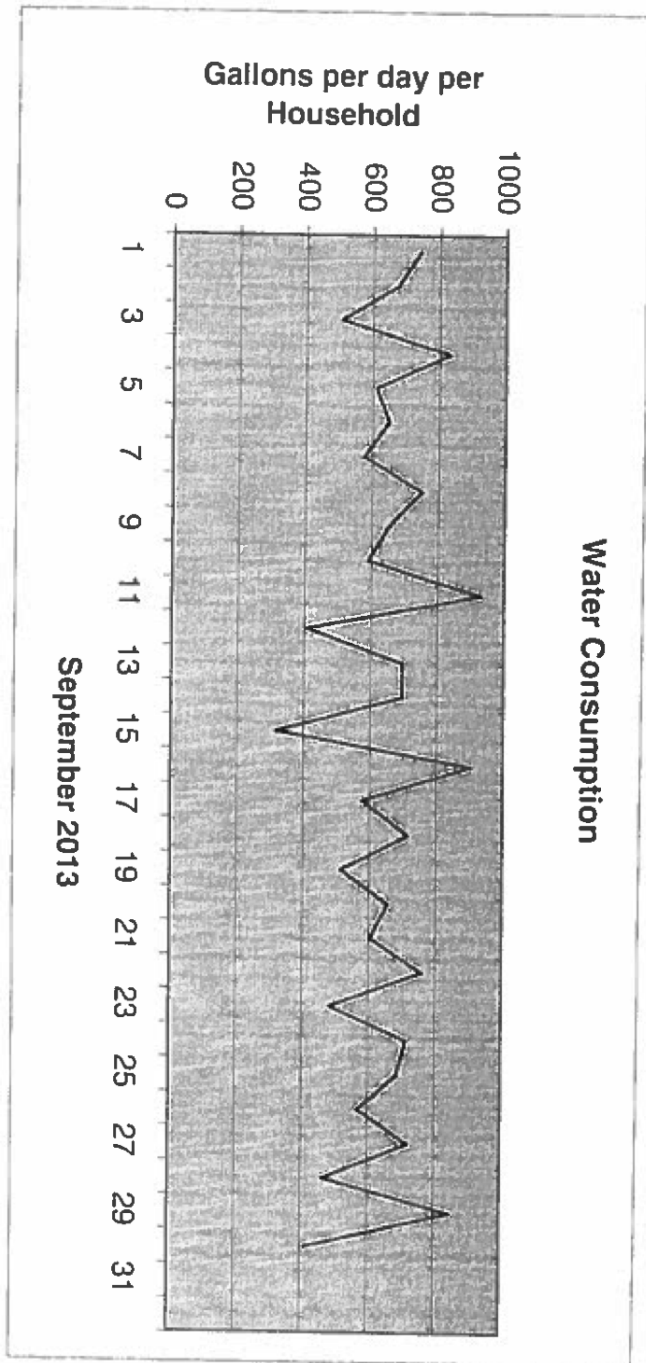
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748
519
711
604
561
504
575
492
474
515
403
485
397
461
338
358
354
398
612
403
351
352
383
486
242
377
399
326



Note: October 27 reading is for 31 hours and October 28 is for 17 hours.

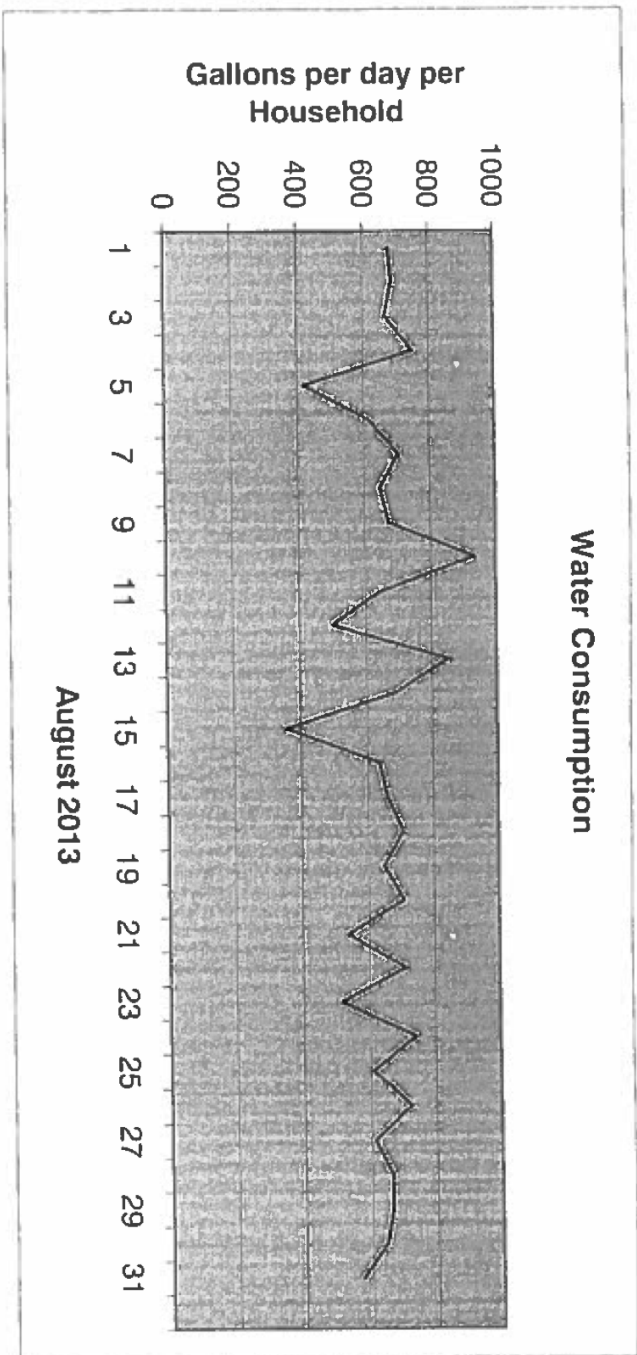
Average per day

832
610
650
576
750
653
590
930
405
697
697
316
903
578
716
515
657
604
759
482
715
686
569
720
464
846
411



641.8333 Average per day

b1s
703
646
671
932
648
498
850
685
355
634
658
704
646
705
534
709
514
738
608
722
610
661
661
642
573



649.0645 Average per day