



Water Infrastructure and Well-being: What Does the Data Tell Us?

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Water Rights and An Economic Perspective

- We know there is a legal basis – also likely the case that there is an economic basis for such infrastructure.
- Economic analysis is needed to confront government and public apathy towards the issue.
→ Economic counter-argument may persuade the government to act sooner.
- Economics first comes to mind when we consider the costs of water infrastructure and indoor plumbing.
 - \$4.7 billion! (Neegan Burnside Ltd. (2011))
 - Economics can also be used to quantify the benefits of providing them.



What are the economic benefits of improved water infrastructure?

- Improved health, including reduced incidence of water- and sanitation-related illness (such as respiratory tract, skin and gastrointestinal tract infections)
 - **Averted health care costs**
- Fewer absences from work - and increased labour earnings - due to illness.
- Children's attendance at and performance in school
- Environmental benefits of proper sanitation infrastructure, including reduced groundwater contamination, improved soil quality and improved health of aquatic life
- Inherent value of access to safe drinking water

Documenting Health impacts of a lack of water infrastructure

- We investigate the relationship between access to safe water and general health conditions in First Nations communities in Canada using 3 datasets:
- The Aboriginal Peoples Survey (2001, 2006) – off-reserve data (n=621,000)
- The Regional Health Survey (2008) – on reserve data (n=11,000)
- St. Theresa Point First Nation data (2016)
(n=142)

The Model

$$H_i = \alpha + \beta X_i + \delta W + \varepsilon$$

- H_i represents a number of health indicators for individual i
- $W = 1$ if household consider water safe to drink, 0 otherwise
- X_i includes age, sex, household's income, province, education, employment, alcohol, smoking

On Reserve Analysis

- On-reserve data – from the Regional Health Survey
- Survey administered by First Nations Information Governance Centre (FNIGC) and Regional Partners
- Information for 2002 and 2008

Summary Statistics for Dependent Variables

	2002	2008
Proportion in excellent, very good or good health	79.90%	77.20%
Proportion having stomach and intestinal problems	7.70%	9.90%
Proportion reporting that they feel depressed (2002) /distressed (2008)	29.90%	50.80%

Impact of Water Source on Self-rated Health

Odds of good health – relative to having water delivered by truck (2008 data)

Including explanatory variables:	Age* and Gender*	Age*, Gender* and Defence*	Age*, Gender*, Defence* + Res. School*	Age*, Gender*, Defence* + Res. School*, Good Community Progress*
Piped	1.102	1.088	1.107	1.109
Well	0.830	0.833	0.58	0.862

Impact of Water Source on Gastrointestinal Problems

Odds of being told you have a stomach problem – relative to having water delivered by truck (2008 data)

Including explanatory variables:	Age*, Gender*	Age*, Gender*, Defence*, Remote	Age*, Gender*, Defence*, Remote*, Res School*
Piped	0.688	0.816	0.807
Well	1.021	0.996	0.983

* Independent variables are statistically significant at the 1%, 5% or 10% levels.

Impact of water infrastructure on health costs

- Piped water associated with a roughly 20% decrease in stomach/intestinal problems relative to trucked water.
- The cost of infectious and parasitic diseases in 2008 was estimated at \$2.92 billion (Economic Burden of Illness in Canada (2014)).
 - Includes the costs of hospitalization and physician care, drug costs, mortality and morbidity costs
- Benefit of piped water on reserve could be estimated at \$583 million for 2008.

Impact of Sanitation on Self-rated Health

Odds of good health for those with sanitation relative to those without sanitation (2008 data)

Including explanatory variables:

Age* and Gender*

Sanitation

1.383

* Independent variable is statistically significant at the 1%, 5% or 10% level.



Impact of Water Source on Mental Health

Odds of distress – relative to having water delivered by truck (2008 data)

Including explanatory variables:	Age*, Gender*, Res. School*	Age*, Gender*, Res. School* and Defence*	Age*, Gender*, Remote + Res. School*	Age*, Gender*, Defence* + Res. School*, Good Community Progress*
Piped	0.581	0.864	0.866	0.862
Well	0.840	0.840	0.823	0.840

* Independent variables that are statistically significant at the 1%, 5% or 10% levels.

Impact of Running Water on Mental Health

Odds of distress relative to having no running water (2008 data)

Including explanatory variables:	Age*, Gender*, Defence	Age*, Gender*, Res. School*	Age*, Gender*, Defence, Small*	Age*, Gender*, Defence, Good Community Progress*
Running water	0.601	0.591	0.581	0.587

* Independent variables that are statistically significant at the 1%, 5% or 10% levels.

Current Situation in Manitoba

- Home to many long standing drinking water advisories
- As of July 31, 2016, there were 132 Drinking Water Advisories in effect in 92 First Nations communities across Canada.

First Nation	Community	System Name	Type of Advisory	Date Set (YYYY/MM/DD)	Date Revoked (YYYY/MM/DD)	Population
Canupawakpa Dakota	Canupawakpa Dakota	Canupawakpa Community Complex/DOCFS/DOPS	BWA	2015/06/03	None	101-500 people
Dakota Tipi	Dakota Tipi	Dakota Tipi Public Water System	BWA	2016/07/22	2016/07/27	101-500 people
Dakota Plains	Dakota Plains	Dakota Plains Public Water System	BWA	2016/07/21	None	101-500 people
God's Lake	God's Lake	God's Lake Austin Nazzie Pump House Public Water System	DNC	2014/04/14	None	0-100 people
Kinonjeoshtegon (Jackhead)	Kinonjeoshtegon (Jackhead)	Kinonjeoshtegon Public Water System	BWA	2016/07/07	None	0-100 people
Lake Manitoba	Lake Manitoba	Lake Manitoba Public Water System	BWA	2016/04/06	None	101-500 people
Long Plain	Long Plain	Long Plain Public Water System	BWA	2016/07/22	2016/07/27	1001-5000 people
Long Plain	Long Plain	Long Plain Public Water System (Cistern)	BWA	2016/07/22	None	101-500 people
Pauingassi	Pauingassi	Pauingassi Public Water System	BWA	2014/09/24	None	501-1000 people
Pinaymootang	Fairford	Pinay Gas Bar Semi-Public Water System (Non-Transient)	DNC	2012/08/24	None	unknown
Pinaymootang	Fairford	Pinaymootang Arena Semi-Public Water System (Non-Transient)	BWA	2015/08/17	None	unknown
Sandy Bay	Sandy Bay	Sandy Bay Public Water System	BWA	2016/07/21	2016/07/22	5001-10000 people
Shamattawa	Shamattawa	Shamattawa Public Water System	BWA	2015/11/06	2016/07/11	1001-5000 people
Wuskwi Sipiik	Indian Birch	Wuskwi Sipiik Public Water System	BWA	2014/04/24	None	0-100 people

St. Theresa Point First Nation

- St. Theresa Point is 610 kilometers Northeast of Winnipeg. The community is accessible by plane and boat in the summer and by winter road in the winter.
- Registered Population: 4187 as of March 2016
- Treaty: Adhesion to Treaty No. 5
- Band No. 298
- Area: Approx. 7,129 Acres
- Chief: Marie A. Wood

(Source: <http://www.stpfirstnation.com>)

Our Study

- To document daily implications of a lack of funding for water infrastructure. We ask:
 - What are the day-to-day impacts of inadequate infrastructure and indoor plumbing?
 - Are there health implications?
 - Is a lack of proper water infrastructure affecting schooling?
 - Are there still homes that need to be retrofitted?
 - How much are people spending on bottled water/filtration systems?
 - Are there any concerns with cisterns?
- This information may assist with acquiring increased Federal funding for infrastructure.

Access to Water

- 88% have a working flush toilet
- 4.8% use an outhouse
- 10.5% use a slop pail
- 87% have a working shower
- 74.2% have a septic tank

Water Source	
Pipe (home connected to main water line)	52.1%
Water tank (water delivered by truck)	35.2%
No running water	12.7%

What would you do with the extra time if you weren't hauling water?

- “I would focus on my family, spending time with them”
- “I would clean my home and yard during the summer”
- “I would relax”
- “I would exercise”
- “I would look for a job”
- “I would play video games”
- “I would watch TV or visit friends”
- **Most prominent response – “I would work”**
- It was noted that while hauling water is hard work, it is an important cultural activity

Water and Health

- 30% of individuals say they've missed work or school because they or a family member was sick from a waterborne illness
- 18% say they've missed school or work for another water-related reason
- 33.3% feel chlorine is bad for their health

Self-rated health status	
Excellent	13.5%
Very Good	12.7%
Good	43.7%
Fair	27.0%
Poor	11.9%

Water and Health continued

- Methicillin-resistant Staphylococcus aureus (MRSA)
- Impetigo
- Lice
- Boils



How often is your water monitored?

Every few months	24.8%
Twice a year	5.7%
Once a year	7.6%
Less than once a year	61.9%

Impact on Schooling

“The water situation does make a difference when you’re talking about the quality of life of the students”

- Water pressure – at the school – very unpredictable.
 - It’ll shut off sometimes for an hour or so
 - School is at the end of the line
- Skating rink – can’t flood it – so it’s not functioning
- Some students go to the washroom every hour – they have diarrhea
 - But they’re still managing to come to class
- If water isn’t working, school is shut down – this happens a lot



Impact on Schooling (continued)

- Some students don't come to school because they haven't been able to shower or do laundry
- Eye wash stations don't work – science classes can't do experiments
- If there is a fire – and everyone is using water so water pressure is low – it would be a disaster
- “Water has always been an issue”

What, in your view, is most important for improving the water/sanitation situation in your community?

- Most prominent answer - for all to be directly connected to main water line – 38% of respondents indicated this
- 29% of individuals indicated a general desire for clean water
- 10% of individuals demanded more water trucks
- Other responses:
 - “I would like water to run in pipelines in each home for convenience like washing clothes or daily shower”
 - “Water filtration systems”
 - “Need more trained workers to work at the plant”
 - “Community education on proper water use”

What, in your view, is most important for improving the water/sanitation situation in your community?

- “Improved water pressure”
- “Water that I could trust so I don’t need to boil it”
- “More retrofitting of homes”
- “Hooked to main water line instead of worrying about saving every last drop of water”
- “More frequent testing of water”
- “If everyone got water from the main line – how would things change?”**

The View from Northern Quebec: Different Treaties/ Different Reality

- Reality on the ground is that water infrastructure in Eeyou Istchee is overseen by the Capital Works Department of Cree Nation Government (CNG).
- Three major Agreements: James Bay Northern Quebec Agreement (JBNQA), Les Paix des Braves, and New Relationship Agreement (NRA).
- Water infrastructure is funded through NRA.
- The NRA has a life-span of 50 years and is funded by the Governments of Canada and Quebec.

Eeyous Istchee Water Infrastructure- Modern and Service oriented



Left to right Water Treatment Facilities in Nemaska, Wemindji & Whapmagoostui

\$ spent = H₂O Security

- CNG has spent **\$165,763,703** since 2008 setting up and maintaining healthy water infrastructure.

Conclusions

- Absence of water infrastructure/indoor plumbing shows a statistically significant association with measures of health
 - Gastrointestinal problems, self-rated health, mental health
 - Largest impact appears to be on mental health
- St. Theresa Point case study demonstrates that effects of inadequate water facilities impact more than health
- Success in Northern Quebec indicate there are lessons to be learned!

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