



# Drinking Water Forum

Lion's Community Centre

Sunnyside, NL

May 12, 2015

# Welcome



**Facilitator**

**Colin Holloway, Office of Public  
Engagement**

# Agenda

- ❧ Session purpose
- ❧ Why this Keeps Me Up at Night- Mayor Robert Snook
- ❧ Is Our Water Safe: Monitoring and Management – Phil Smith, Town Manager
- ❧ The Provincial Picture - Dr. Kelly Vodden, Memorial University of Newfoundland- Grenfell Campus
- ❧ Survey Results and Chlorinated Disinfectant By-products: potential health impacts and solutions/alternatives – Jen Daniels, MA Geography
- ❧ Discussion
- ❧ Moving Forward and Adjournment



# Purpose of Session

- ❧ To provide information about the current status of the Town's water supply system
- ❧ To provide an overview of recent provincial water research
- ❧ To provide results from the Water Survey
- ❧ To provide information on DBPs, health impacts and treatments options
- ❧ To seek input and feedback from residents
- ❧ To identify a strategy for moving forward

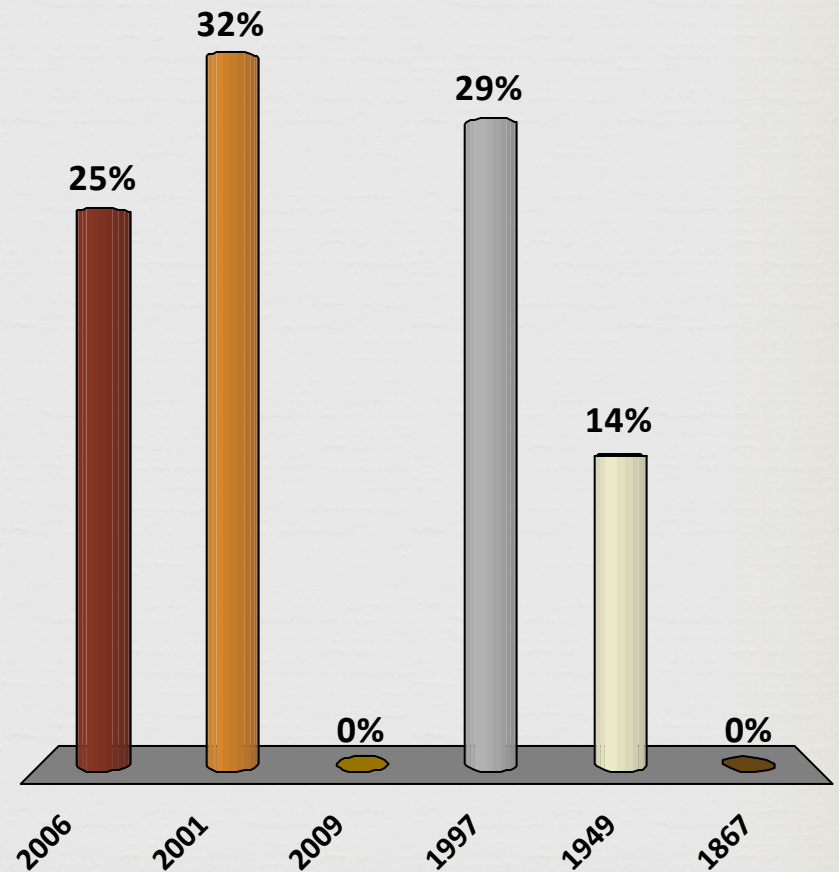


# Polling



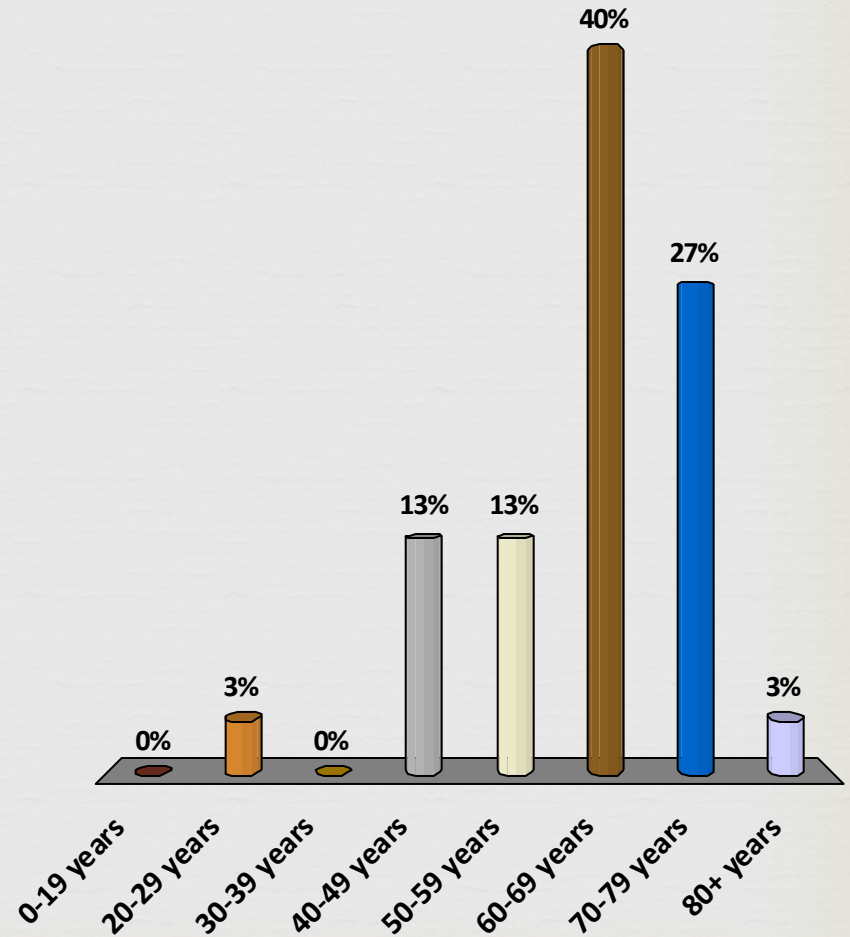
# In what year did this Province change its name to Newfoundland and Labrador?

- A. 2006
- ★ B. 2001
- C. 2009
- D. 1997
- E. 1949
- F. 1867



# I fit into the following age group.

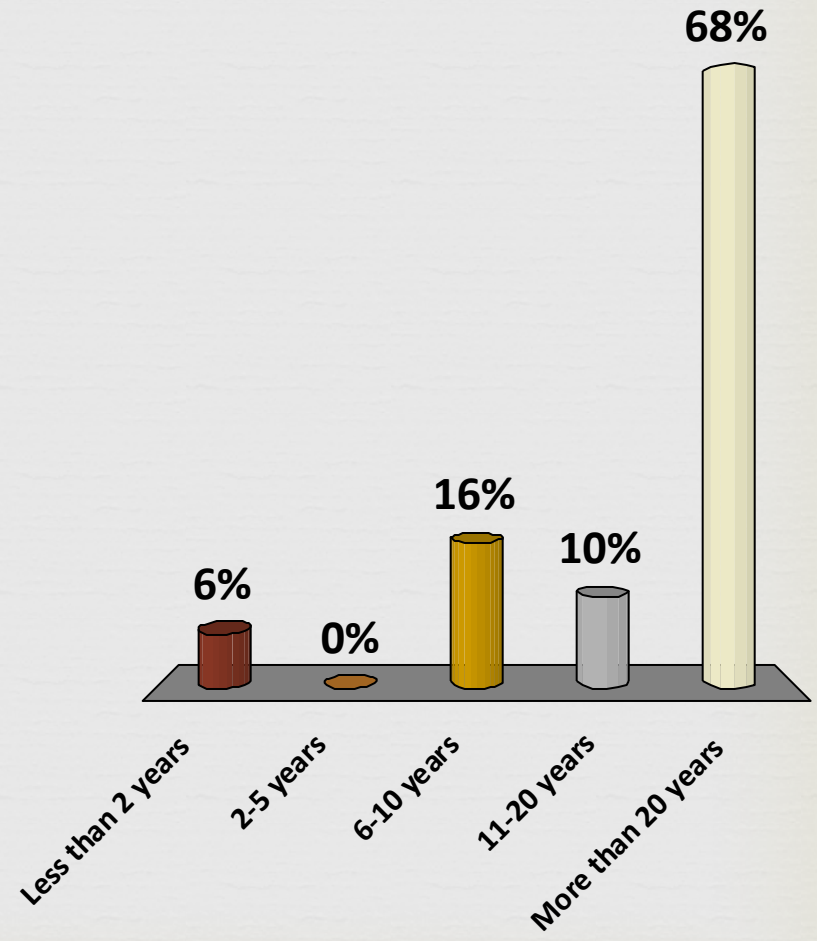
- A. 0-19 years
- B. 20-29 years
- C. 30-39 years
- D. 40-49 years
- E. 50-59 years
- F. 60-69 years
- G. 70-79 years
- H. 80+ years





I have lived in Sunnyside for \_\_\_\_\_ years.

- A. Less than 2 years
- B. 2-5 years
- C. 6-10 years
- D. 11-20 years
- E. More than 20 years



# PRESENTATION

Why this keeps me  
up at night.



Robert Snook  
Mayor



## **Sunnyside's Water System:**

- Sunnyside's water history.
- Disinfectant by-Products
- Historical overview of DBPs in Sunnyside's Water
- What causes these High readings?
- What have we done?
- Where are we now?





- THMs .....100ug/l(100 micrograms per liter)which is the same as parts per billion.
- HAAs....80ug/l (80 micrograms per liter) which is the same as parts per billion.

### **History of THMs and HAAs....Sunnyside**

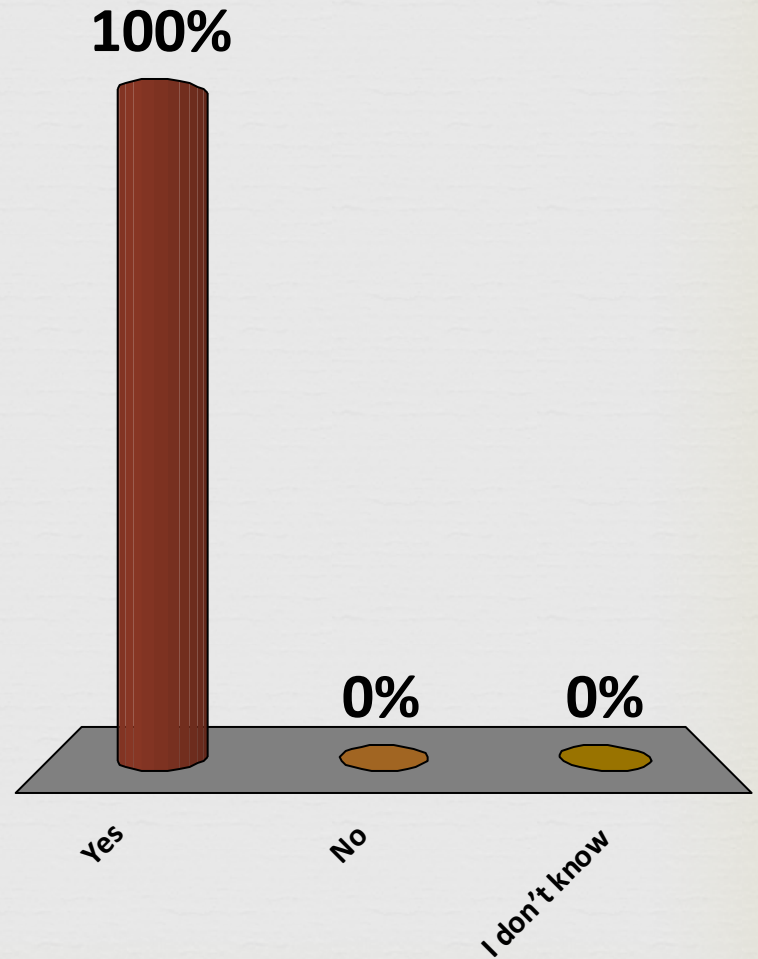
	<b>THM</b>	<b>HAA</b>
2005	214.00	202.25
2006	123.75	
2007	95.82	
2008	112.25	220.50
2009	144.00	170.13
2010	321.50	288.71
2011	333.22	264.1
2012	307.75	359.3
2013	305.25	351.6
2014	302.00	394.2



Community Name	Population (Year)	HAAs Average (µg/L)	NO. of HAA Samples	THM Average (µg/L)	NO. of HAA Samples	Last Season Samples
New Wes Valley	500 (2006)	865.10	35	245.25	69	Summer 2014
Keels	61 (2011)	835.70	62	497.20	62	Spring 2014
Salvage	174 (2006)	751.10	33	411.25	64	Summer 2014
Cartwright	516 (2012)	716.50	31	389.25	38	Summer 2014
St. Pauls	309 (2006)	645.30	57	361.25	67	Summer 2014
Point May	260 (2006)	526.70	31	310.45	62	Spring 2014
Sunnyside	260 (2006)	416.80	59	306.00	45	Spring 2014

# Do you have access to the Town's water supply?

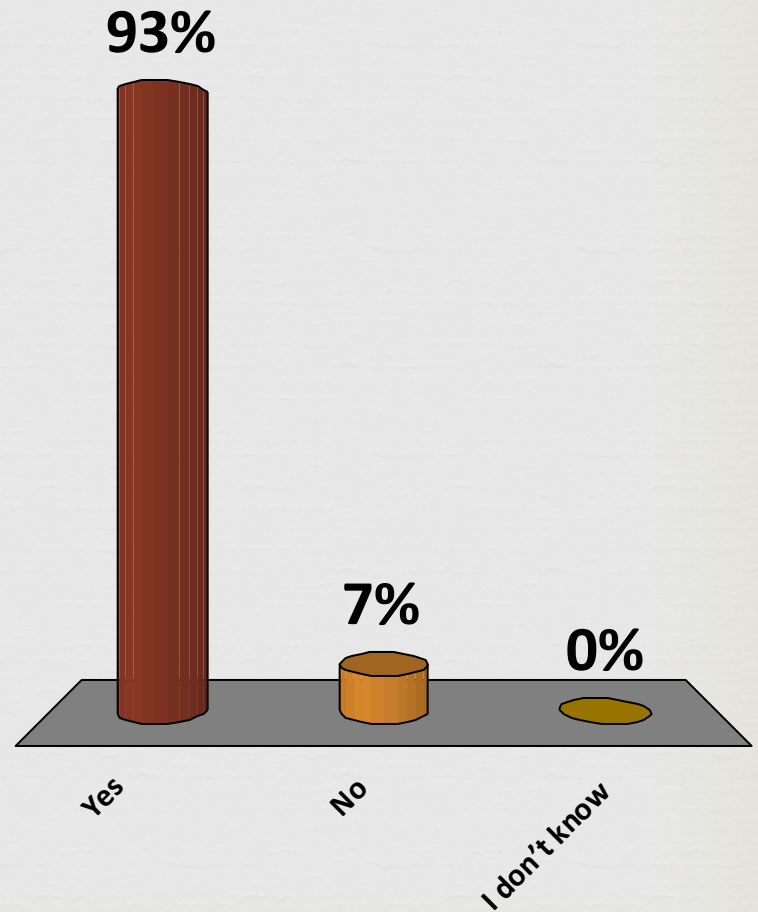
1. Yes
2. No
3. I don't know





# Is your home connected to the Town's water supply system?

1. Yes
2. No
3. I don't know



# PRESENTATION

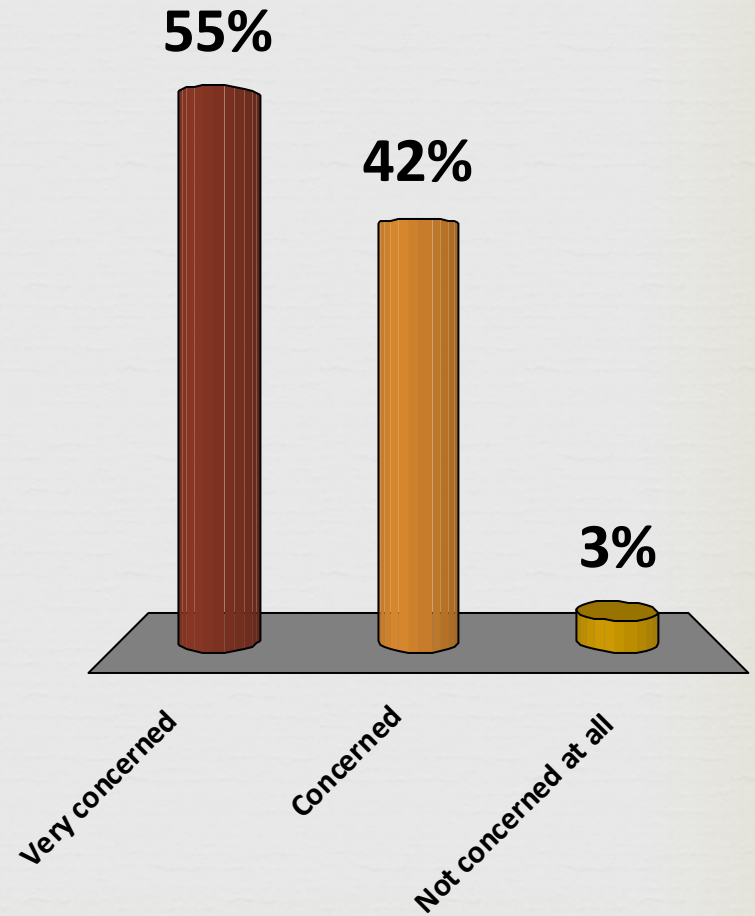
## Is Our Water Safe? Monitoring and Management



Phil Smith  
Town Manager

# How concerned are you about the Town's Water Quality and Treatment?

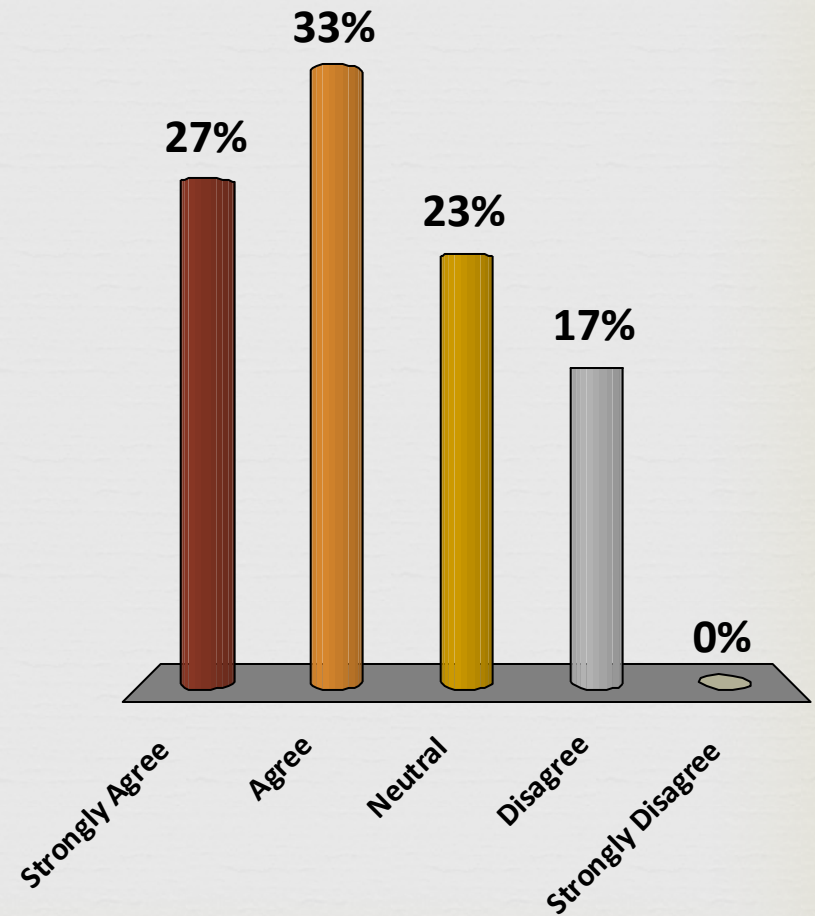
1. Very concerned
2. Concerned
3. Not concerned at all





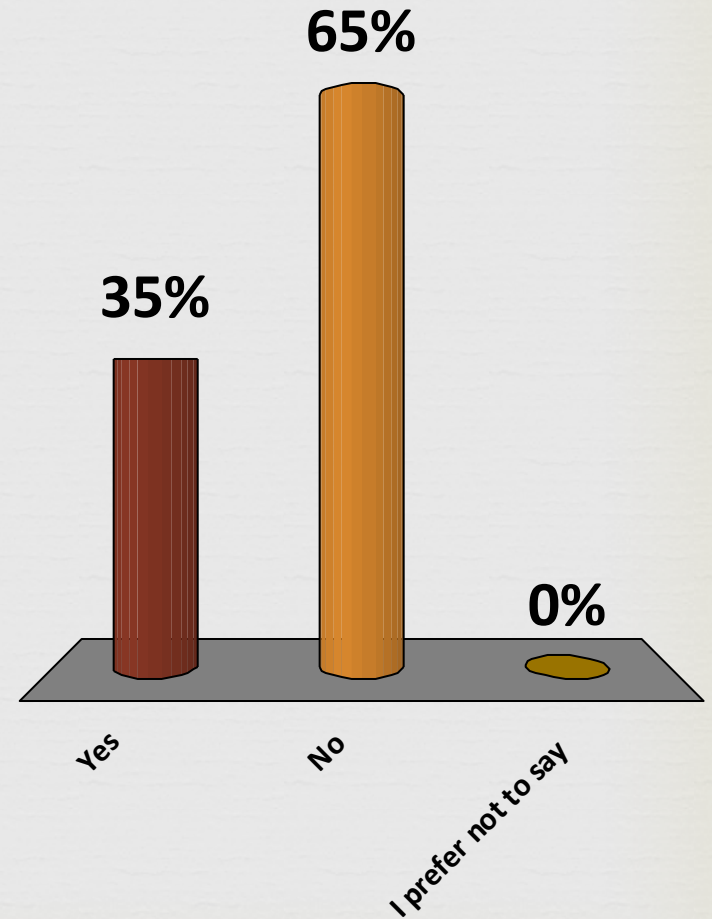
“I have a good understanding about water based bacteria and chlorination processes.”

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree



# Do you drink water from the Town's supply system?

1. Yes
2. No
3. I prefer not to say



# PRESENTATION

## The Provincial Picture



Dr. Kelly Vodden  
Environmental Policy Institute  
Grenfell Campus, Memorial University of  
Newfoundland



# The Provincial Picture

Presented by: Kelly Vodden  
Environmental Policy Institute  
Grenfell Campus, Memorial University





**nlwater.ruralresilience.ca**



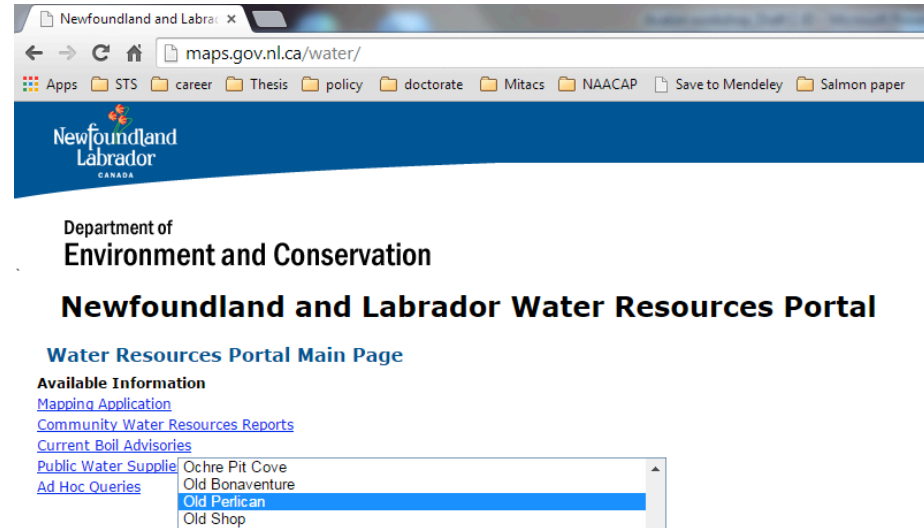
**GRENFELL**  
CAMPUS



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exploring **SOLUTIONS** for rural  
**drinking water SYSTEMS**

**Literature/  
secondary data  
Surveys  
Consultations  
Case studies**



<http://maps.gov.nl.ca/water/>



exploring **SOLUTIONS** for rural  
**drinking water SYSTEMS**



## Drinking Water Responsibility

Federal: Sets guidelines, \$

Provincial: Overall responsibility

Municipal: Infrastructure and day-to-day operation

# Concerns

- ☒ Aging Infrastructure
- ☒ Little Physical Asset Knowledge
- ☒ Poor Maintenance Planning
- ☒ Limited Human Resources
- ☒ Lack of Succession Planning
- ☒ High # of BWAs
- ☒ Source Water Protection



# Solutions:



- ☒ **Effectively Charge for Service**
- ☒ **Develop Leak Detection Plan**
- ☒ **Improve Overall Knowledge**
- ☒ **Explore Regional Approaches**
- ☒ **Maintenance Assurance Manuals**





# Concerns:

- ☒ Contamination
- ☒ Health Risks
- ☒ Communication





**Organics (in the raw water) +  
chlorine + time = DBPs**



- **197 communities** in NL displayed averages that exceeded the Health Canada guidelines at least once according to **HAAs Summary** sampling reports from 2011 to Winter 2014; 152 communities with population of 1,000 or less.

- **174 communities** in NL had running averages that exceeded the Health Canada guidelines at least once according to the **THMs sampling reports** from 2011 to Spring 2014; 140 were communities with population of 1,000 or less.



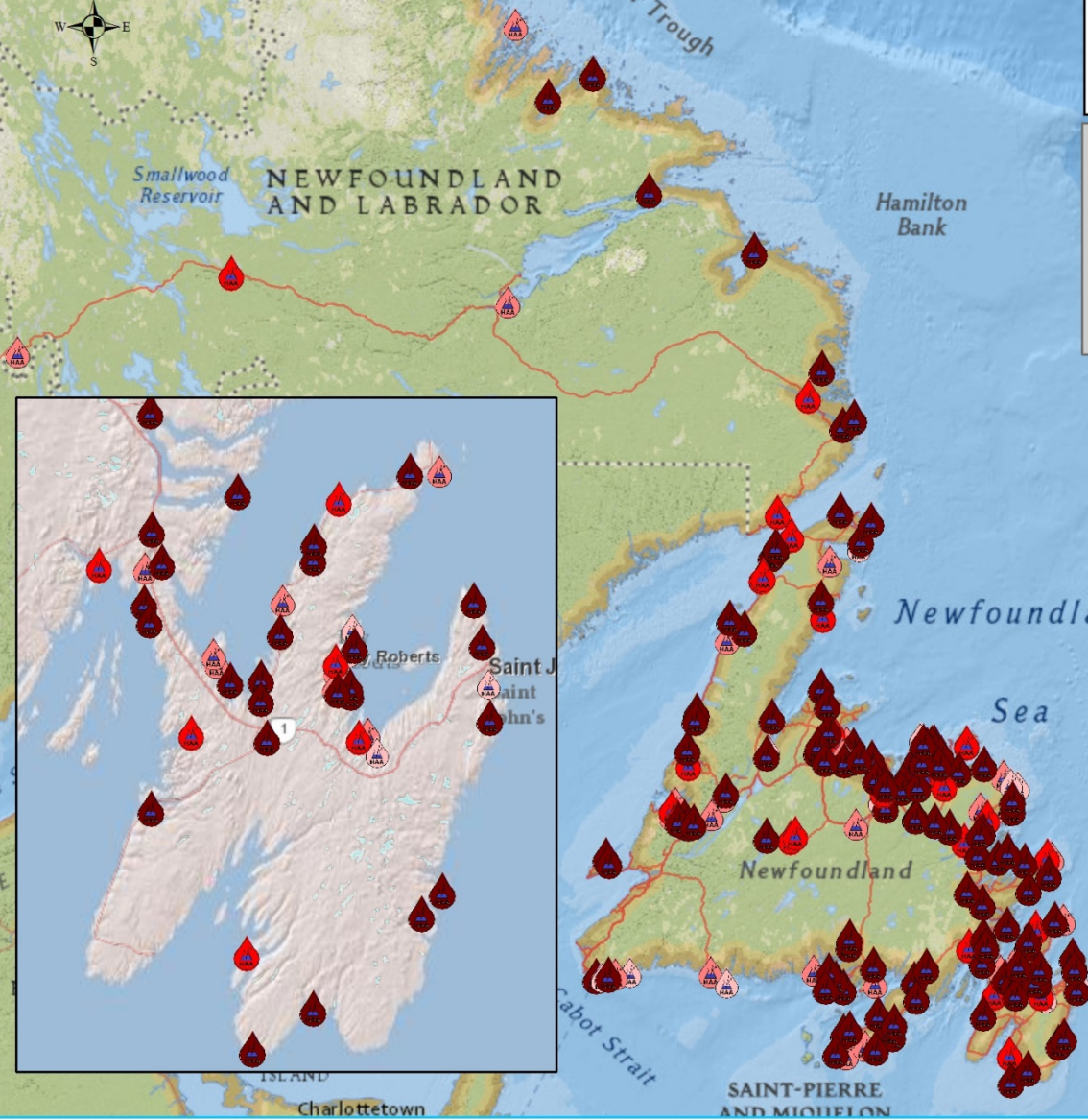
# Sunnyside

THM: 306.00 Running Avg. Spring 2014

HAA: 416.75 Running Avg. Spring 2014

[http://maps.gov.nl.ca/water/reports/viewreport.aspx?  
COMMUNITY\\_NAME=Sunnyside+\(T.B.\)](http://maps.gov.nl.ca/water/reports/viewreport.aspx?COMMUNITY_NAME=Sunnyside+(T.B.))

# Disinfectant By-Products (DBPs) (THMs and HAAs)

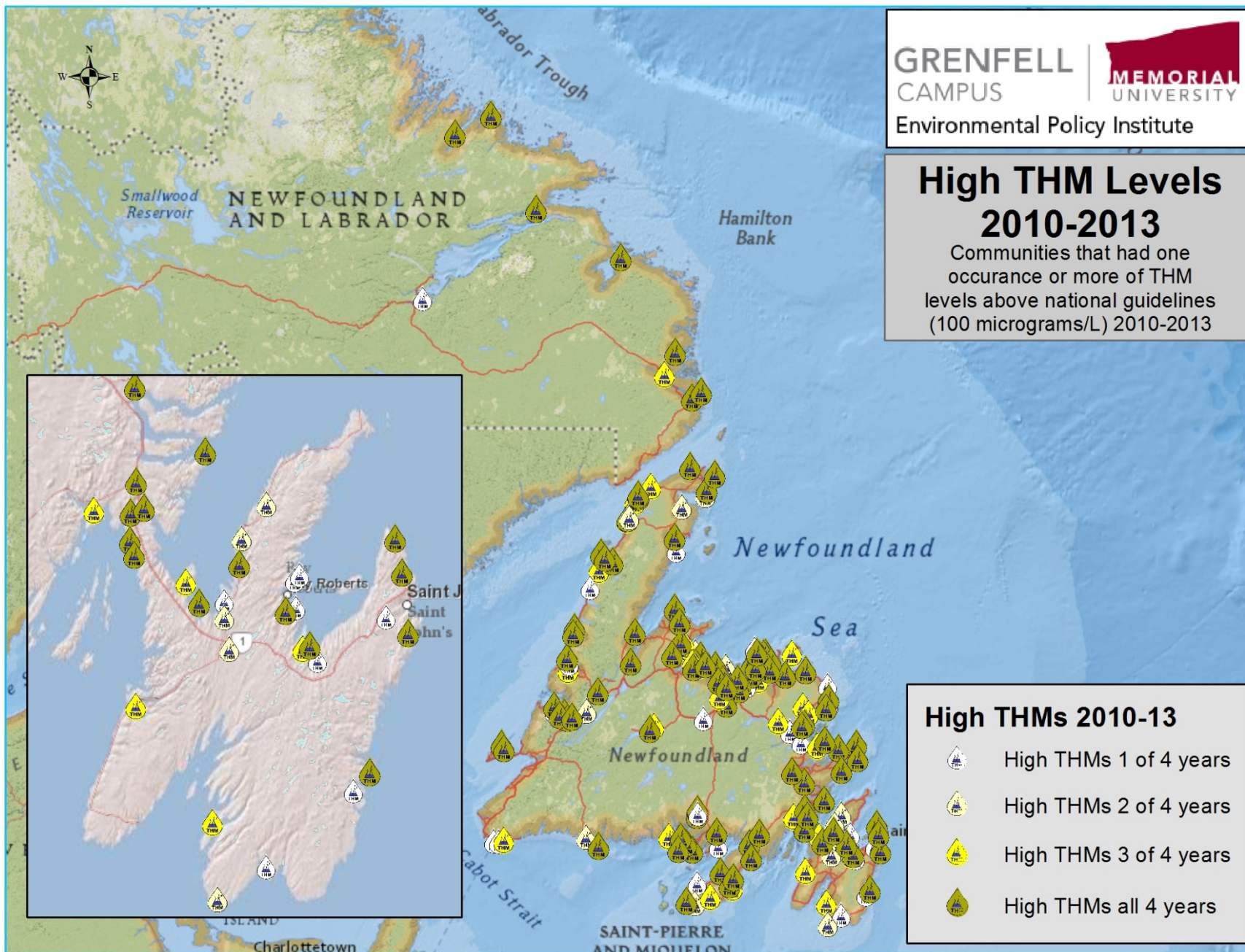


**High HAA Levels  
2010-2013**

Communities that had one occurrence or more of HAA levels above national guidelines (80 micrograms/L) 2010-2013

- High HAAs 2010-13**
- High HAAs 1 of 4 years
  - High HAAs 2 of 4 years
  - High HAAs 3 of 4 years
  - High HAAs all 4 years

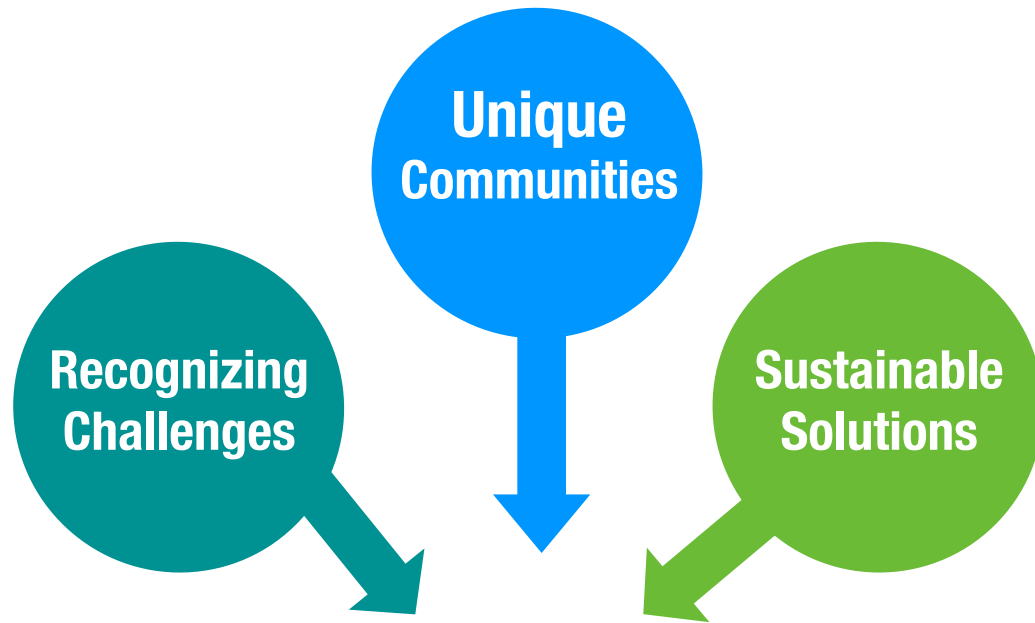




# Solutions:



- ☒ **Household Treatments**
- ☒ **Filtration and Alternative Disinfectants**
- ☒ **More Research**
- ☒ **Public Education**



# MOVING FORWARD



# How much water do you drink each day (per 8-ounce glass)?

A. I don't drink water

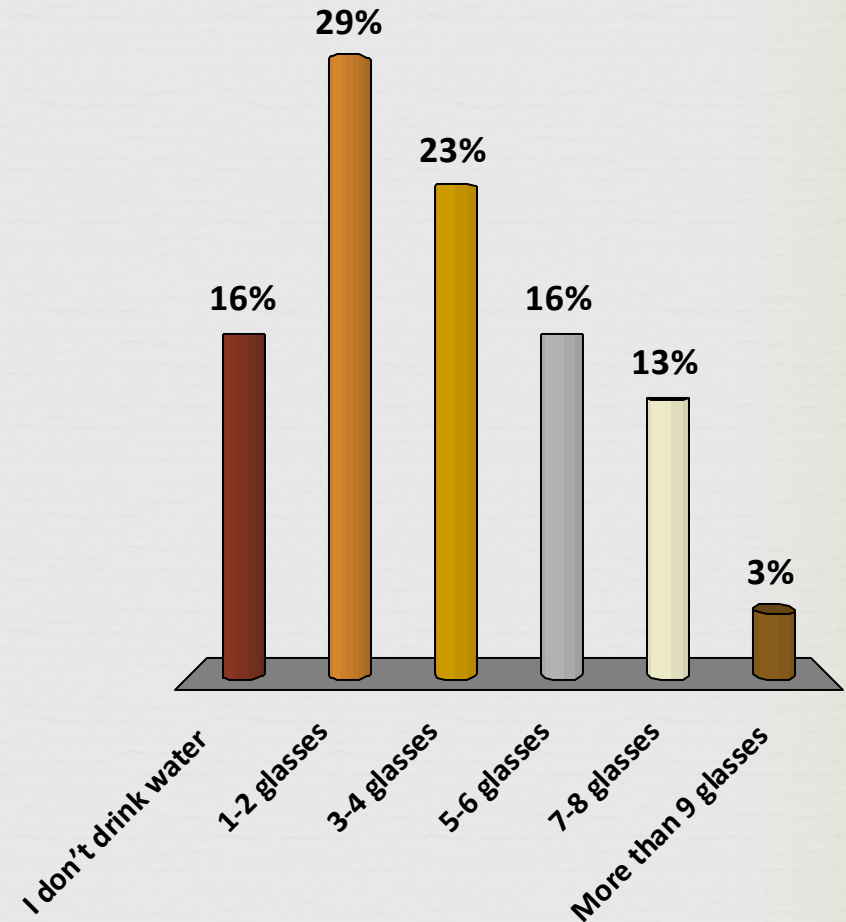
B. 1-2 glasses

C. 3-4 glasses

D. 5-6 glasses

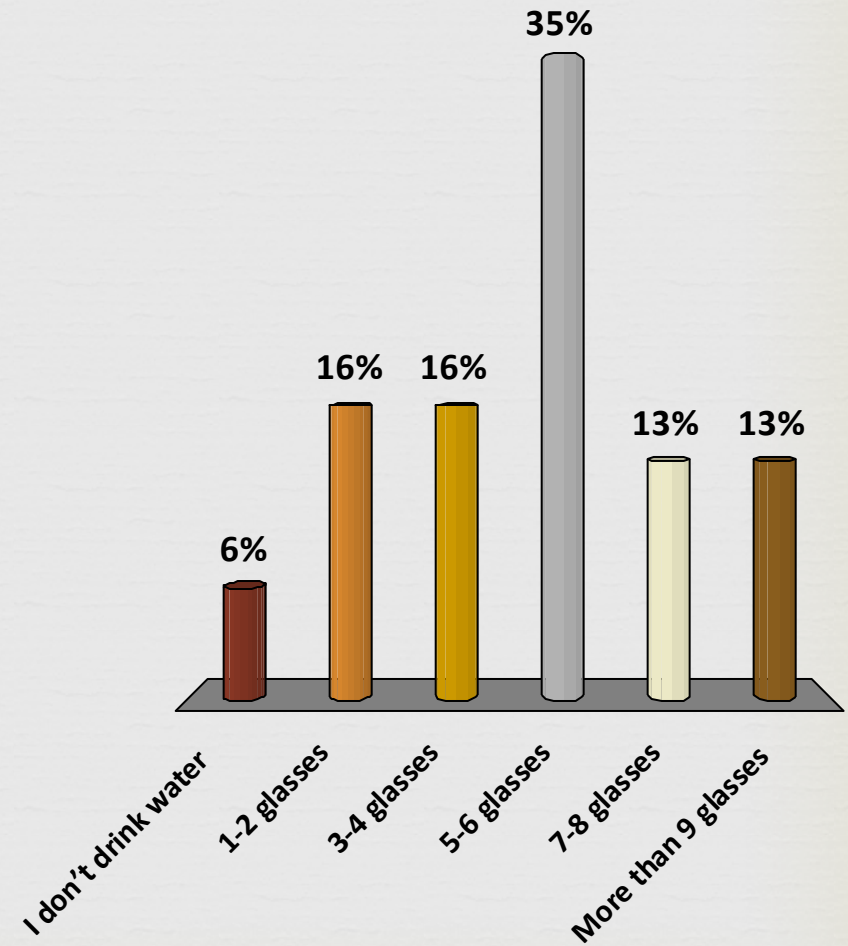
E. 7-8 glasses

F. More than 9 glasses



# How much water do you drink each day (per 8-ounce glass)?

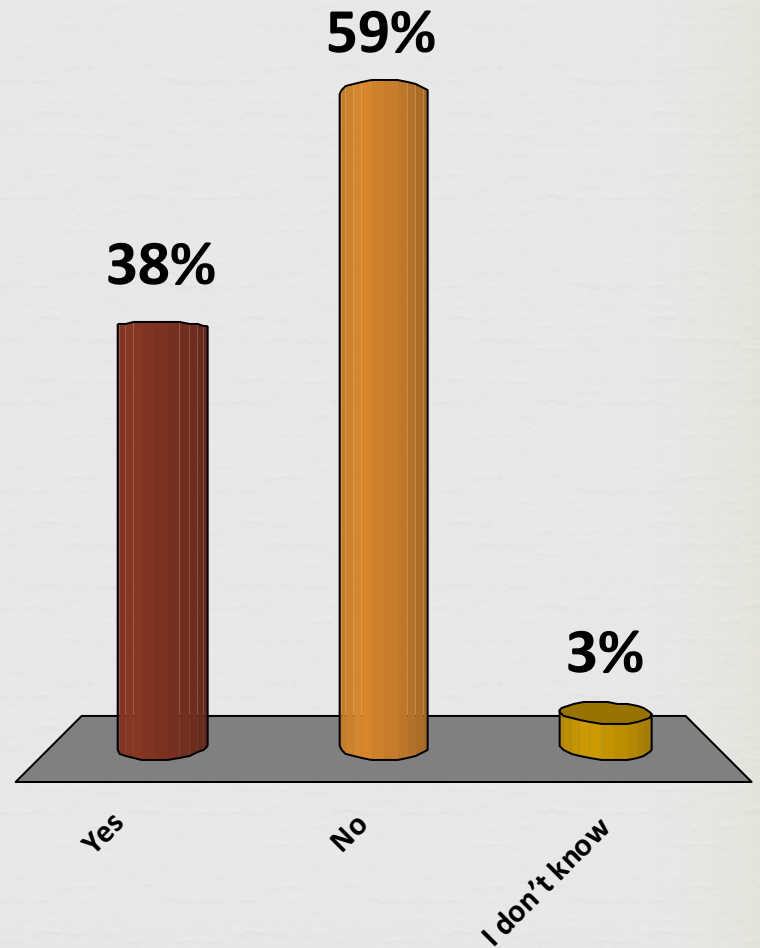
- A. I don't drink water
- B. 1-2 glasses
- C. 3-4 glasses
- D. 5-6 glasses
- E. 7-8 glasses
- F. More than 9 glasses





# Do you filter your drinking water?

1. Yes
2. No
3. I don't know



# PRESENTATION

Public Water Survey Results and  
Chlorinated Disinfectant By-products:  
potential health impacts and solutions/  
alternatives



Jen Daniels  
MA Geography



The background image shows a coastal town nestled on a hillside. The foreground features a rocky shoreline with patches of snow and ice. The town in the middle ground has several buildings, including a prominent white house on the left and a cluster of smaller houses further up the hill. The background shows a body of water and distant mountains under a cloudy sky. The title text is overlaid on a semi-transparent white box in the upper center of the image.

# **Sunnyside Drinking Water Project**

**12 May 2015**

**Jen Daniels, MA Geography**

# Outline

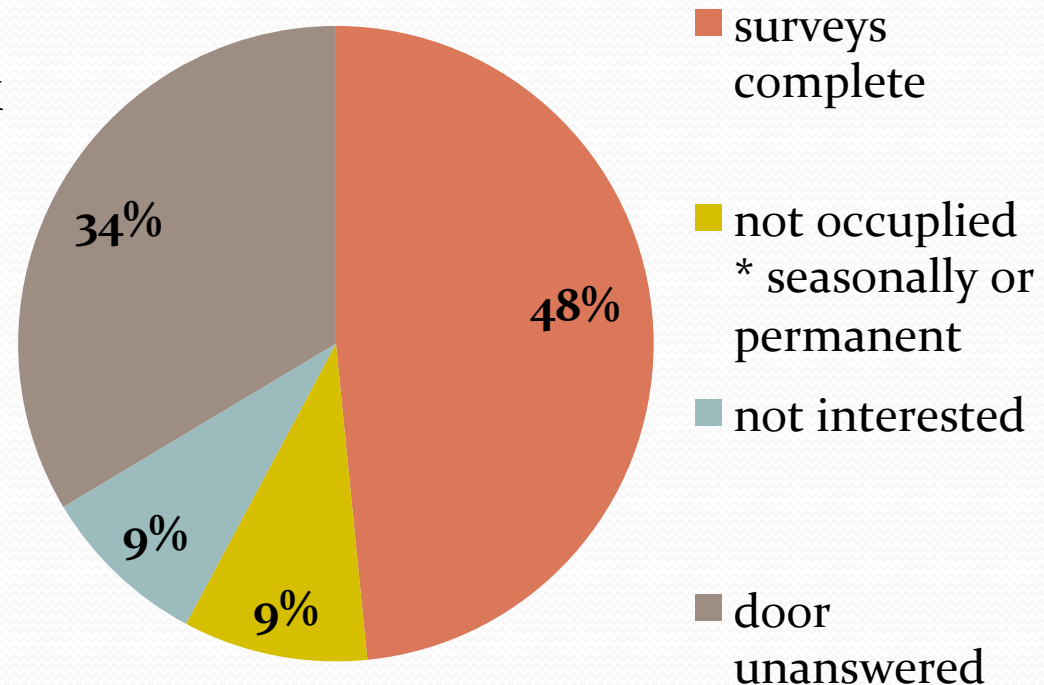
- Part 1. Sunnyside survey results
- Part 2. Chlorinated disinfectant by-products (DBPs)
  - What are the potential health concerns?
  - Technologies and alternatives available





# Part 1. Survey results

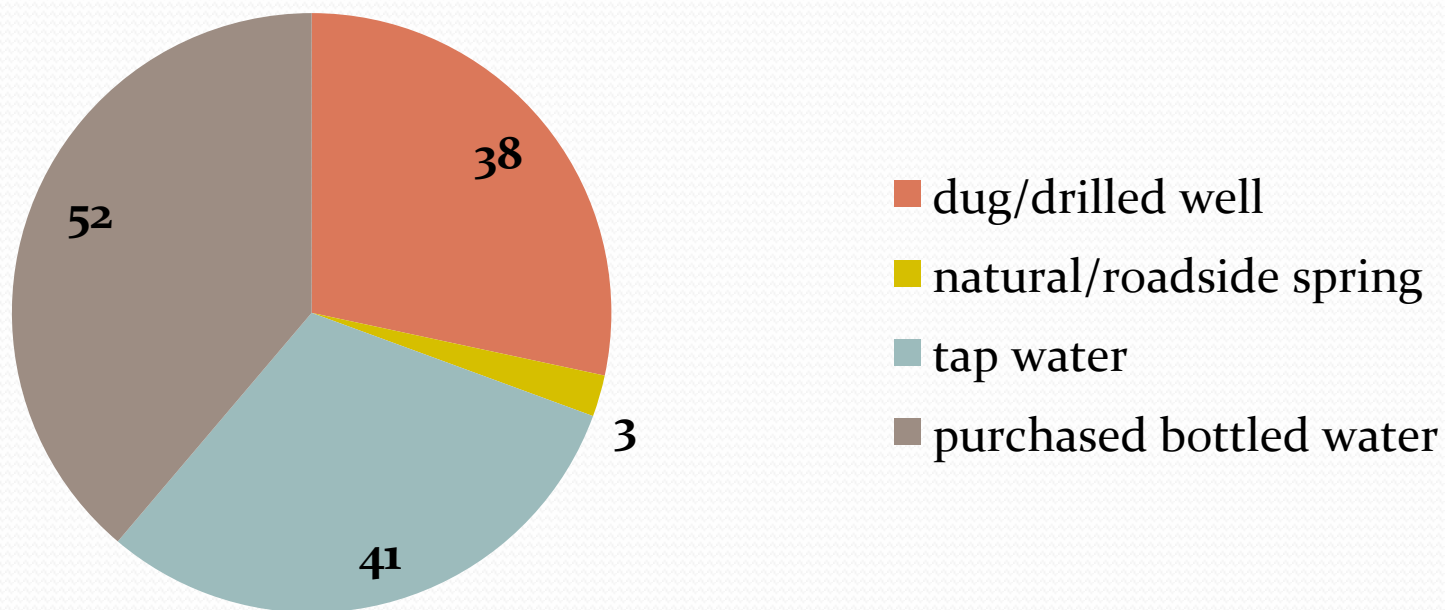
- 48% survey completion rate
- Two rounds of fieldwork
- Report includes six sections:
  - Types of drinking water
  - Municipal taxation
  - Safety concerns
  - Disinfectant by-products
  - Climate change
  - Source water quality and watershed users



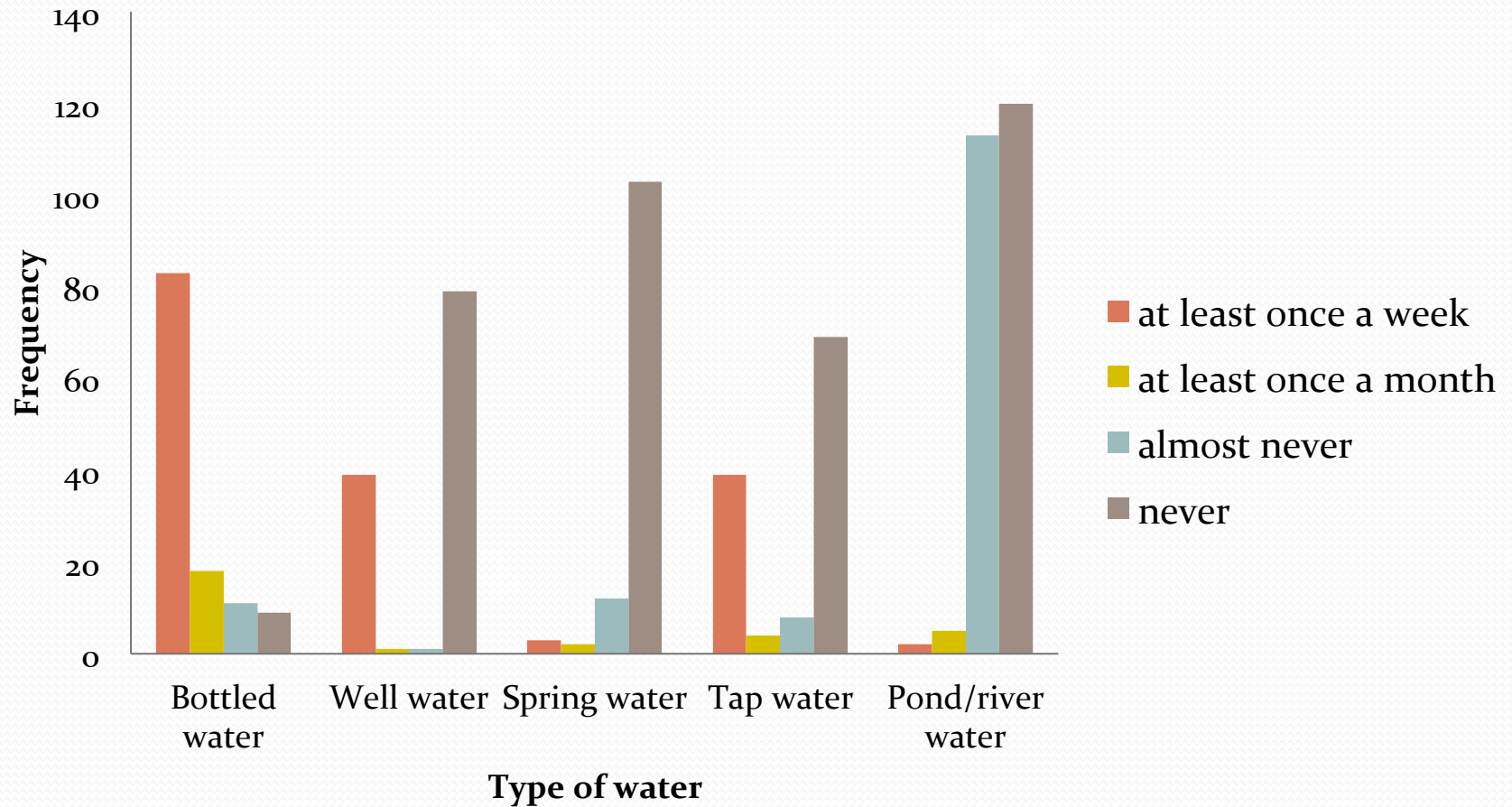


# Types of Drinking Water

**Fig 1. Main household sources of drinking water  
(# cases)**

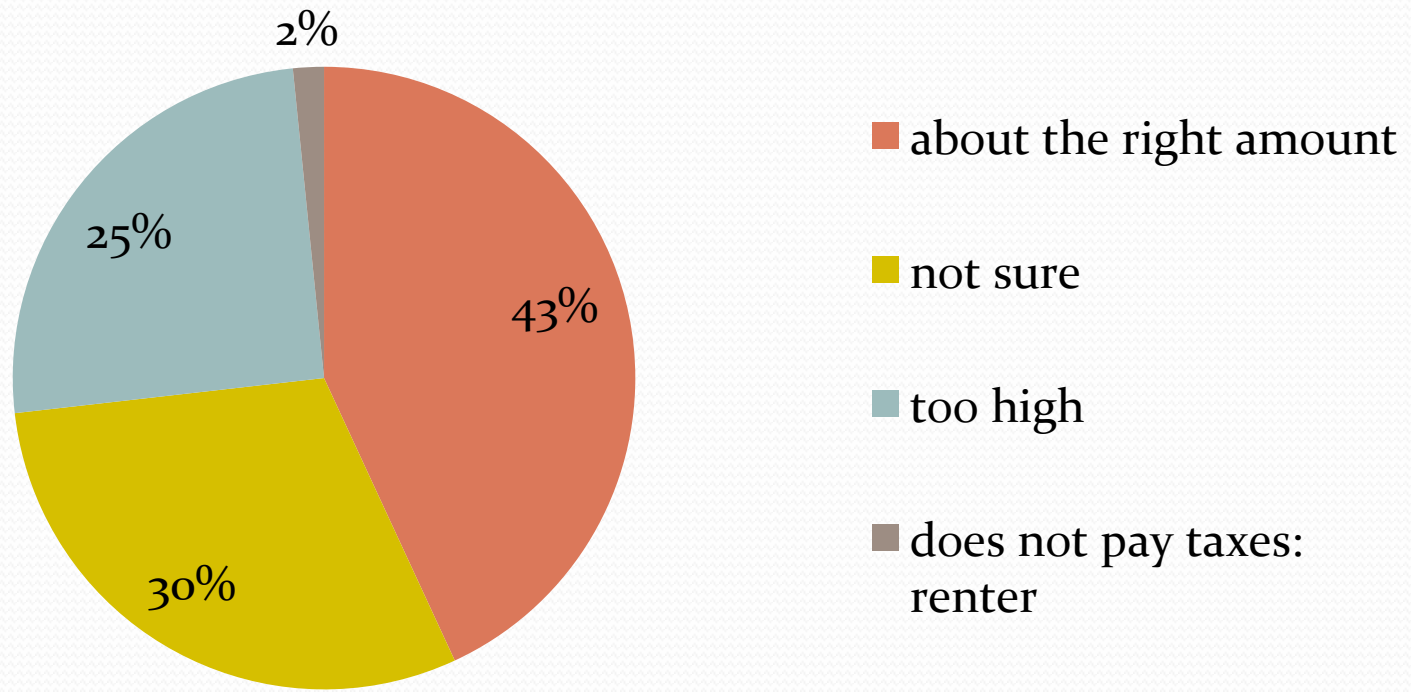


**Fig 2. How often do you drink the following types of water...**

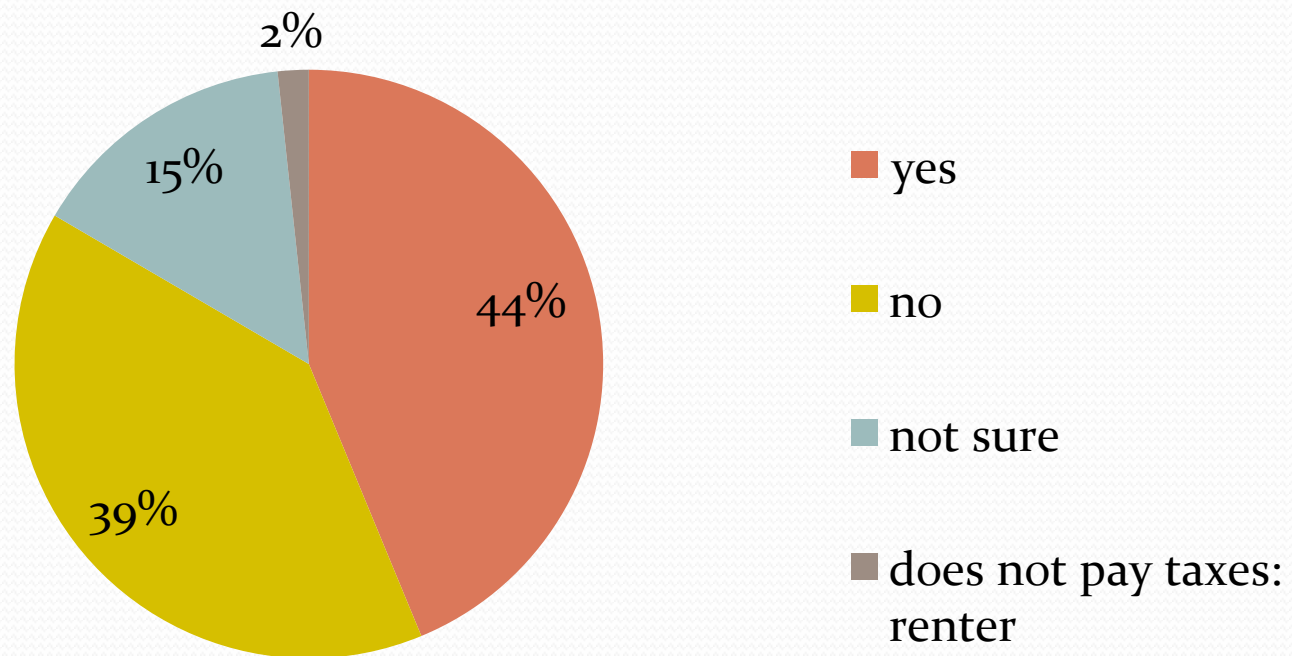


# Municipal taxation and water services

**Fig 3. The water portion of my tax bill is...**

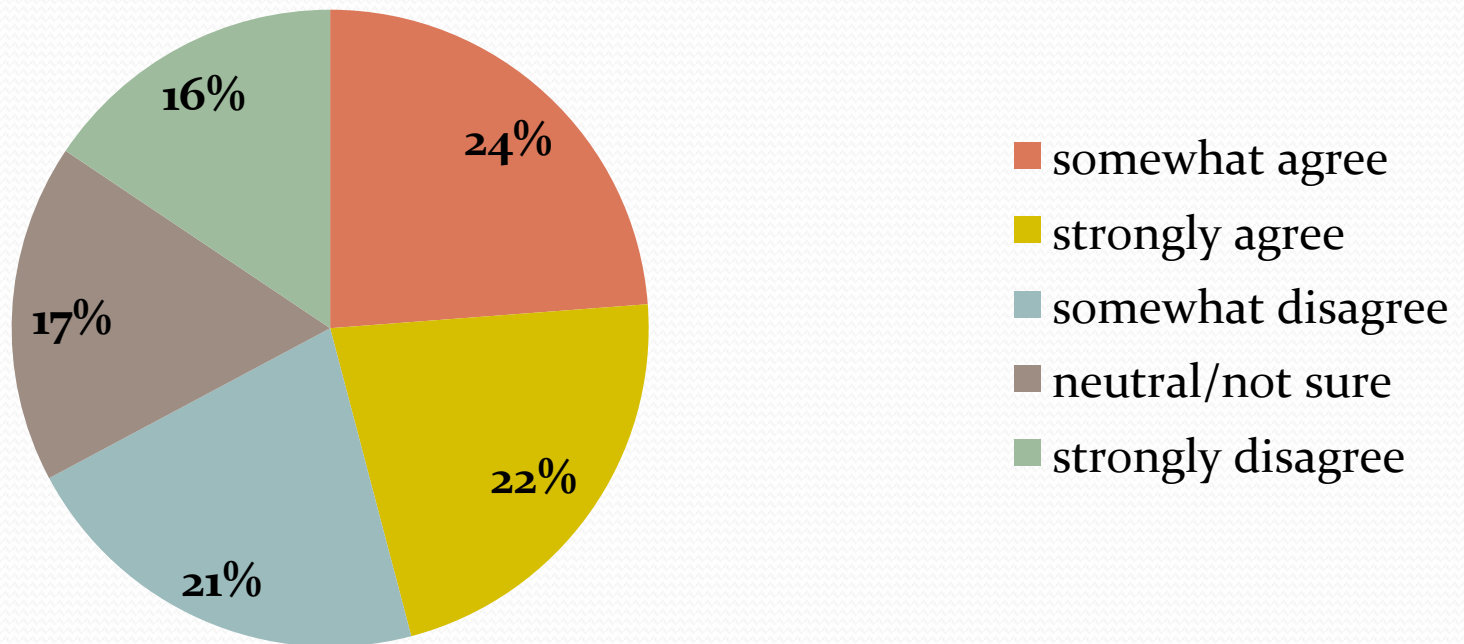


**Fig 4. Would you be willing to pay more in taxes if it resulted in increased water quality?**



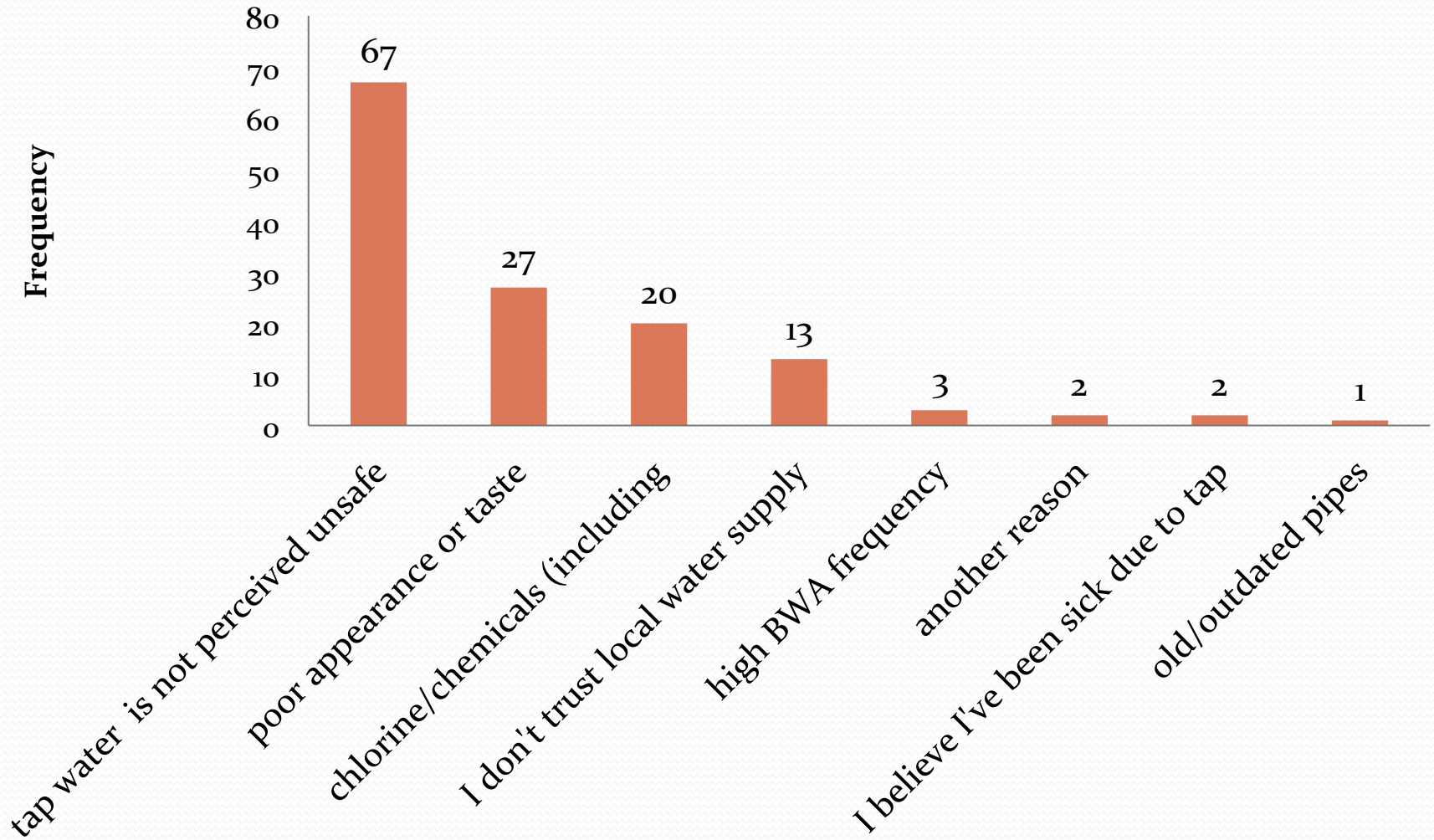
# Drinking Water Safety Concerns

**Fig 5. My tap water is safe to drink...**

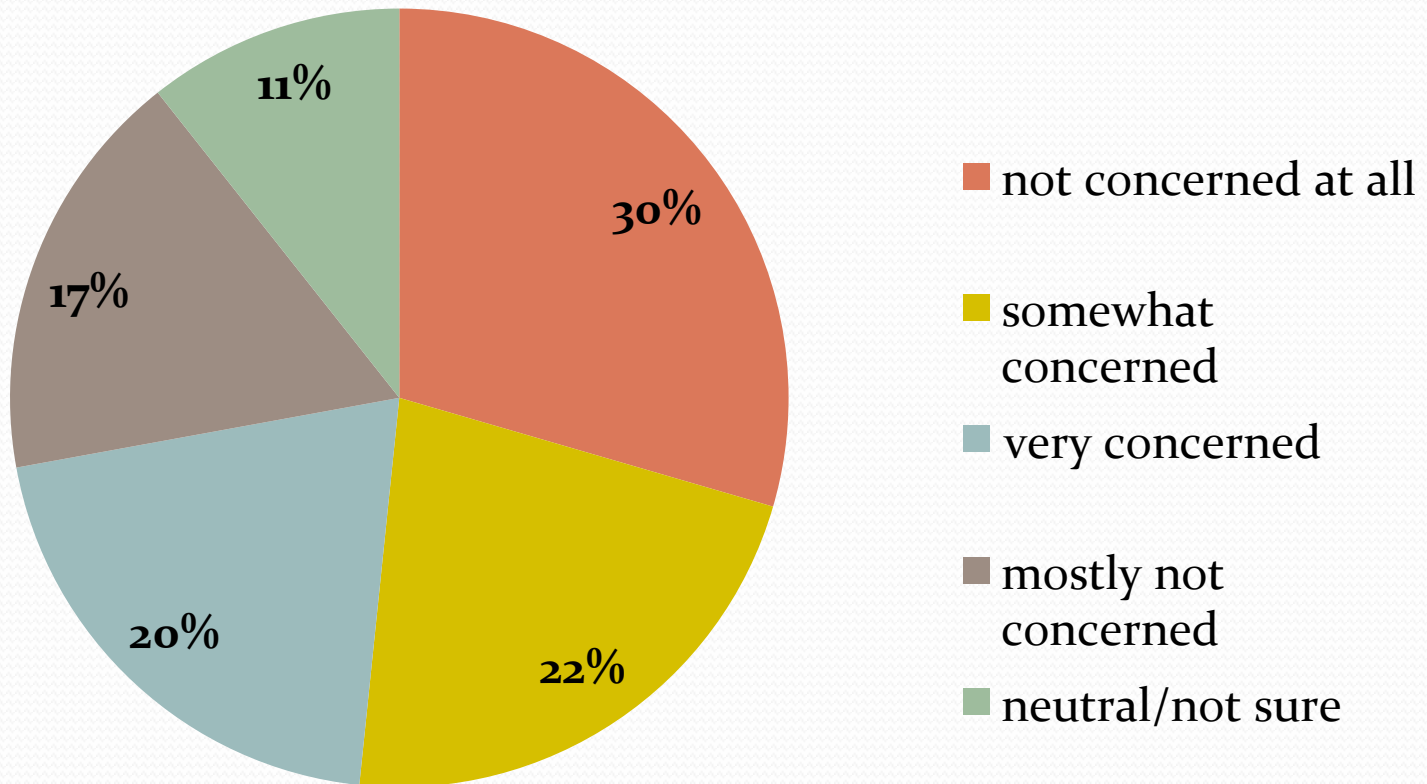




**Fig 6. What makes feel your tap water is not safe?**

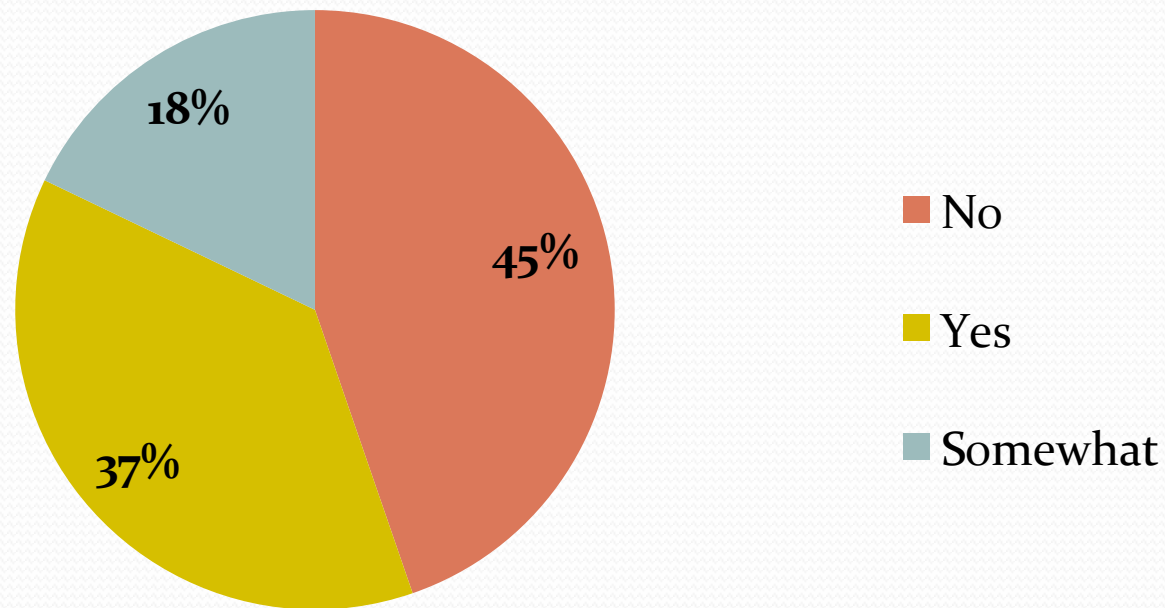


**Fig 7. How concerned are you about water-related illness in your community?**

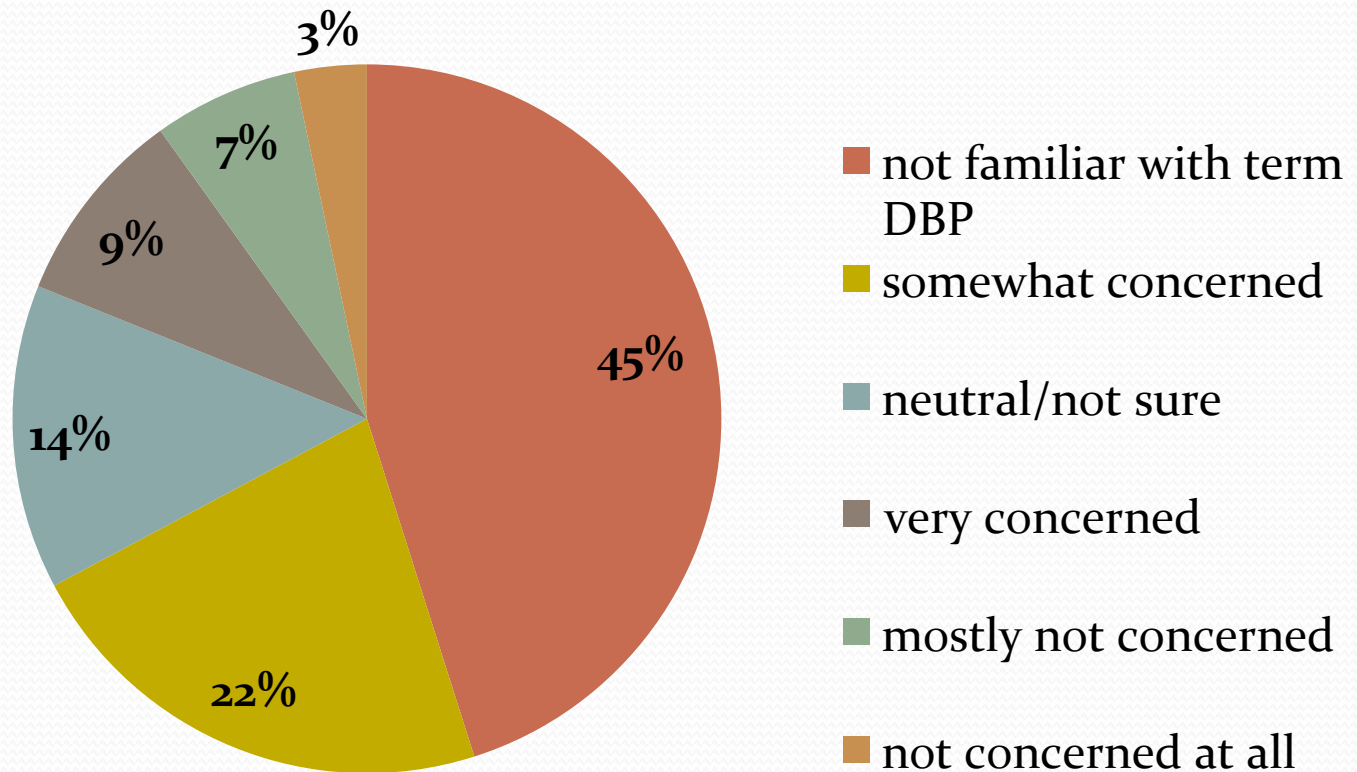


# Chlorinated Disinfectant By-products (DBPs)

**Fig 8. Familiarity with the term Disinfectant by-product (DBP)**



**Fig 9. How concerned are you about DBPs?**





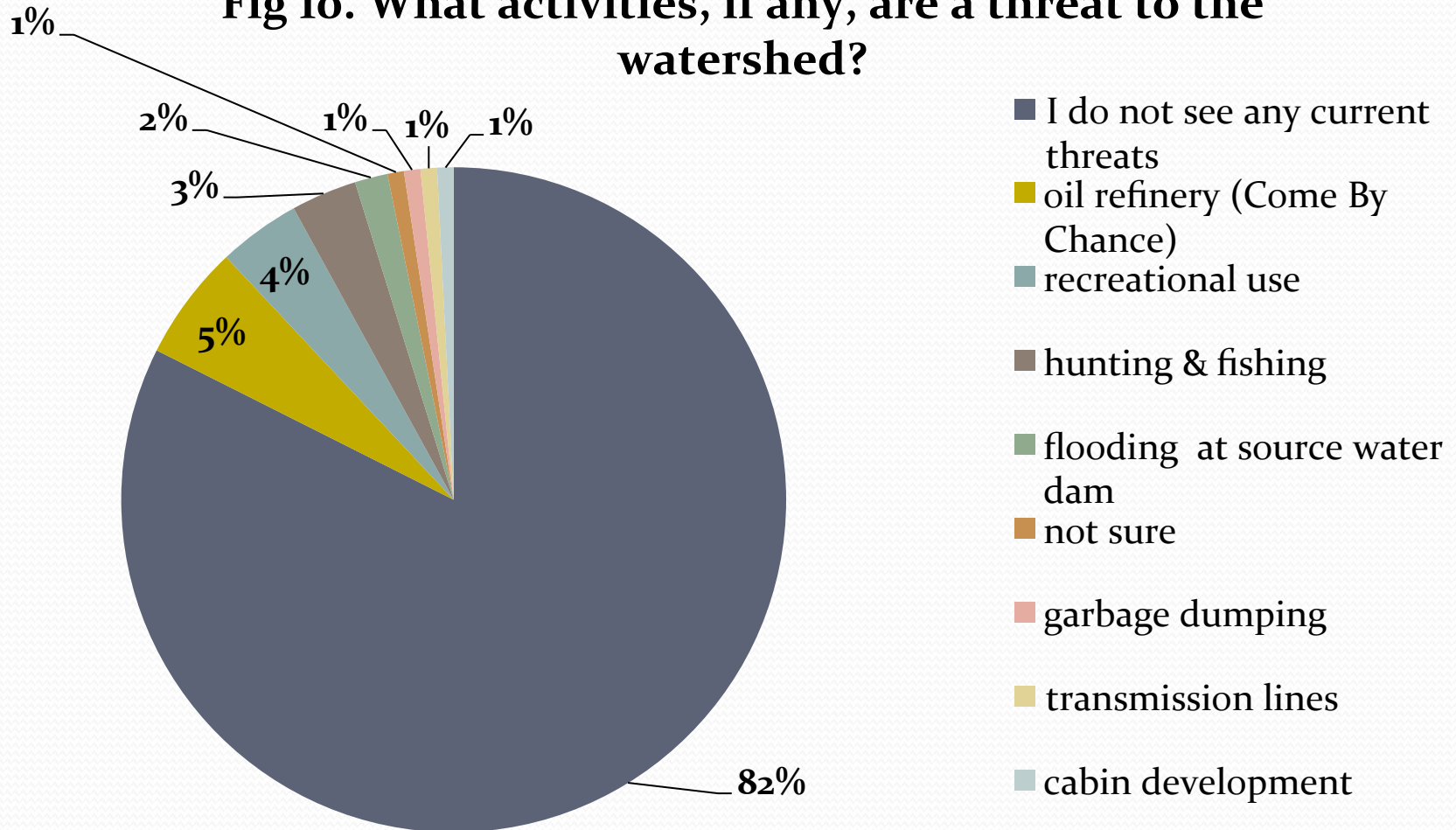
# Climate Change

- Survey respondents indicated that, overall, that climate change was:
  - a) Occurring in Sunnyside (~ 60%)
  - b) Not having significant role in affecting drinking water quality (~30% noting a relationship)

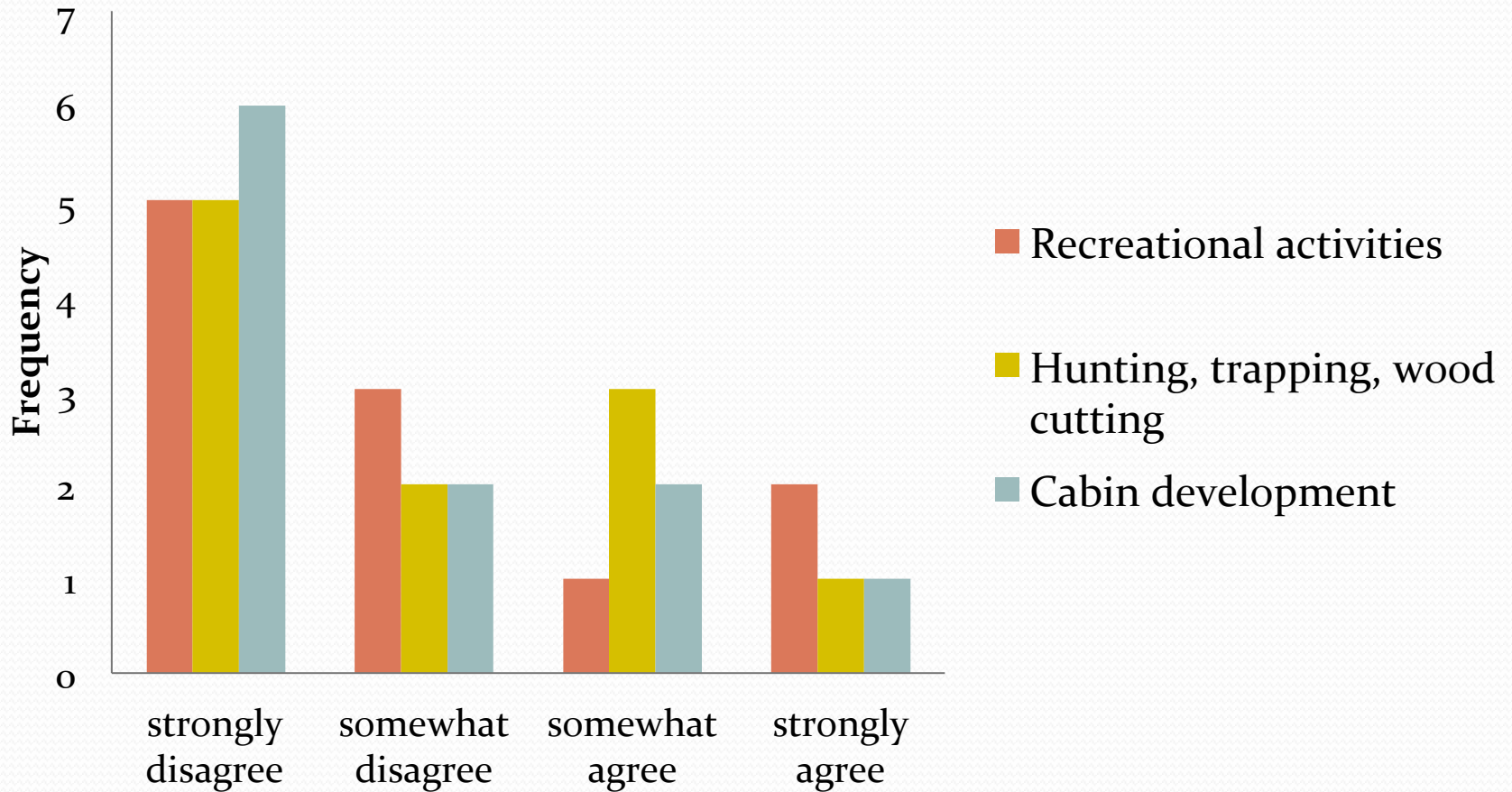


# Source Water Quality and Watershed Users

**Fig 10. What activities, if any, are a threat to the watershed?**

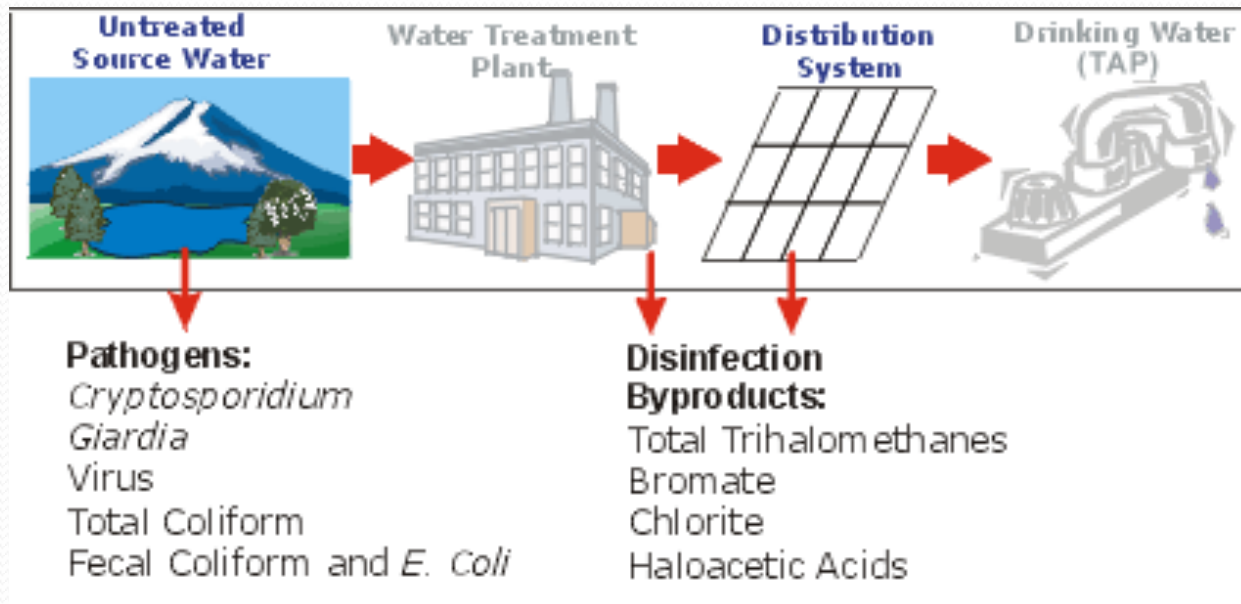


**Fig 12. The following activities are a threat to the watershed**



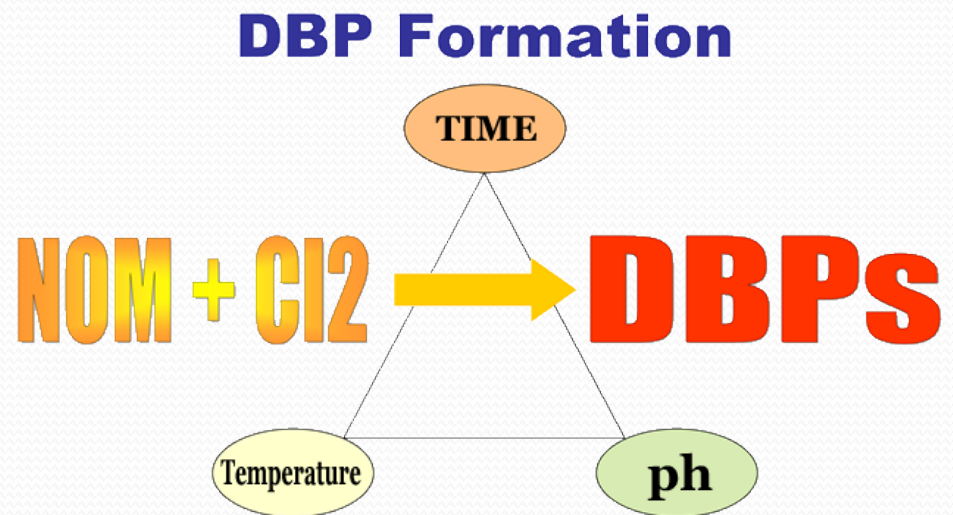
## Part 2. Chlorinated disinfectant by-products (DBPs)

- A. What are the potential health concerns?
- B. Technologies and alternatives available



# DBPs- what are they?

- **Chlorination** *disinfectant by-products* are formed when chlorine used for disinfection reacts with natural organic matter (e.g. decaying vegetation) in the water.



# A. What are the potential health concerns?

## **Why is Drinking Water Disinfected?**

*Infectious diseases caused by pathogenic bacteria, viruses, and protozoa or by parasites are the most common and widespread health risk associated with drinking-water.*

-WHO, Geneva, 1993

*Pathogens pose the greatest and most tangible risk to drinking water safety, making pathogen removal and disinfection the paramount concern.*

-Hrudey, 2004



# How can I be exposed to DBPs?

- Ingestion
  - Drinking water containing DBPs
- Inhalation
  - Breathing DBPs in the air
  - Showering, bathing
  - Boiling water
- Absorption
  - Showering, bathing
  - Swimming

# What are the health guidelines?

- In Canada:
  - HAAs – 80  $\mu\text{g}/\text{L}$
  - THMs- 100  $\mu\text{g}/\text{L}$
- Deemed highly protective by Health Canada, vary across jurisdictions (more conservative than WHO figures)

# What are the possible health impacts?

<u>Type of CDBP</u>	<u>Compound</u>	<u>Rating</u>	<u>Potential Health Effects</u>
THMs	Chloroform	B2	Cancer, liver, kidney and reproductive effects
	Dibromochloromethane	C	Nervous system, liver, kidney and reproductive effects
	Bromodichloromethane	B2	Cancer, liver, kidney and reproductive effects
	Bromoform	B2	Cancer, nervous system, liver and kidney effects
HAAs	Dichloroacetic acid	B2	Cancer, reproductive, developmental effects
	Trichloroacetic acid	C	Liver, kidney, spleen, developmental effects

A: Human carcinogen; B1: Probable human carcinogen (with some epidemiological evidence); B2: Probable human carcinogen (sufficient laboratory evidence); C: Possible human carcinogen; D: Non classifiable<sup>6</sup>.

- See the Canadian Cancer Society web page for more information-- there are other more prominent risk factors for each of the aforementioned cancers in addition to lifestyle guidelines for reducing personal cancer risk

# Measures of risk and health guidelines

- *The Health Canada guidelines are established at a level at which the increased cancer risk is 'essentially negligible' when humans are exposed at that level over a lifetime (70 years).*

*- one new cancer above background per 100,000 people to one new cancer above background per 1 million people (i.e.,  $10^{-5}$  to  $10^{-6}$ ) over a lifetime.*

(Health Canada, 2009)

- assumes 2/L /day for a 60Kg individual, over the course of 70 years
- WHO (2011) figures similar

# What are academic studies finding?

## Cancer associations

- Out of a sample of 10 studies reviewed concerning cancers risks of THMs/HAAAs, 3 studies indicated there was a risk in some geographic locations<sup>7;3;8</sup>. 4 studies said that there may be a risk associated with CDBPs and cancers<sup>9;10;11;12</sup> and 3 studies found there to be a weak association in studies done on humans between CDBPs and certain cancers<sup>13;14;15</sup>.
- All studies agreed that more research is needed.

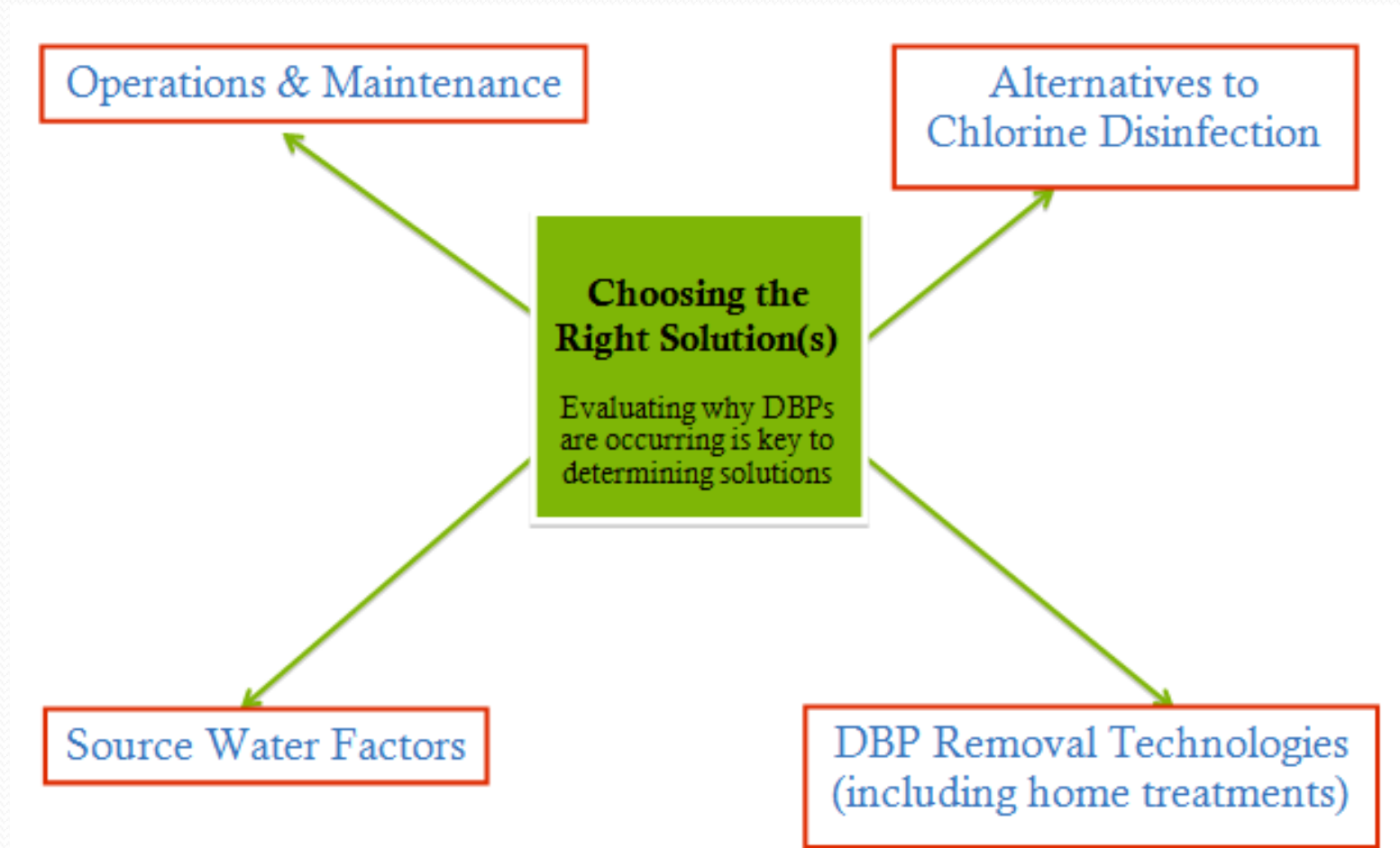
## Reproductive effects

- There have been some toxicological and epidemiological studies that point towards an association between THMs, and (low) birth weight, although the evidence is not conclusive. Some studies have shown associations for DBPs and other outcomes such as spontaneous abortions, stillbirth and birth defects. There is no evidence for an association between THMs and preterm delivery<sup>16</sup>. More research is needed



## B. Technologies and alternatives available

### Multi-tiered approach





## Source water factors

- Where a land area is to be flooded to create a surface water reservoir, vegetation must be removed from the area prior to inundation as per permit requirements.
- Any potential new water source that is to be disinfected with chlorine should have a chlorine decay rate test and THM formation potential test performed at an accredited laboratory prior to the final selection, development and commissioning of the new source

# Operations & Maintenance

- Specific design requirements (i.e., filtration, redundancy, continuous monitoring, log reduction using prescribed treatment processes) and water quality goals (turbidity, coliforms, DBPs) should be written clearly at the beginning of the design guidelines.
- Regularly flushing your system, making use of automatic flushing systems.
- Retention time management (e.g. limit time in storage tank).
- Chlorine management and the use of booster stations.
- Operator training and ensuring you have a certified operator
- Lowering pH value reduces THM concentration, but increases formation of HAAs

# Alternatives to Chlorine Disinfection

- Changing primary disinfectant from chlorine to alternatives such as chloramines, ozone and chlorine dioxide lower disinfectant by-products, and ultraviolet (UV) radiation does not produce any disinfection by-products. Other alternatives include: **mixed oxidants, potassium permanganate, peroxone, and combined disinfectant.**
- For pros and cons of these and other alternatives see:
  - United States EPA and Government of NL websites.
- Monochloramine can be used to provide a secondary disinfectant residual within distribution, in order to reduce THM formation and subsequent development within the distribution system.
- **Chlorine dioxide** can be considered as a potential alternative to both chlorine and ozone disinfection. The main concerns with chlorine dioxide are with the residual concentrations of chlorine dioxide and the by-products chlorite and chlorate.

## DBP Removal Technologies (public systems)

Removing precursors for DBPs would include increasing the removal of total organic carbon. Some options for this include:

- Dissolved air floatation
- Zirconium coagulation
- Regenerative magnetic  $\text{TiO}_2$
- Granular Activated Carbon
- Nano membrane filtration
- Microfiltration/Ultrafiltration
- Ultrasound and quartz sand
- Aluminum Sulphate or PAC Dosing (flocculent)



# DBP Removal Technologies (household options)

Type	Where you can buy it and price	More information
Point of entry systems (aka whole house system) and shower head faucet	There are no systems listed on the NSF site for point of entry systems or shower filter systems that are NSF Standard 53 certified with claims to reduce Total THMs.	
Undersink unit	<ul style="list-style-type: none"> <li>• Rainfresh Twist Undersink System, ~\$135                             <ul style="list-style-type: none"> <li>○ Replacement filters, ~\$33</li> <li>○ Canadian Tire</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <a href="http://www.rainfresh.ca/qsl.php">http://www.rainfresh.ca/qsl.php</a></li> <li>• <a href="http://www.env.gov.nl.ca/env/waterres/training/adww/treatmentalternatives/pres11willarddeonpointofuse.pdf">http://www.env.gov.nl.ca/env/waterres/training/adww/treatmentalternatives/pres11willarddeonpointofuse.pdf</a></li> </ul>
Tap faucet	<ul style="list-style-type: none"> <li>• Brita Faucet Filtration System, ~\$26                             <ul style="list-style-type: none"> <li>○ Replacement filters, ~\$18</li> <li>○ Walmart, Canadian Tire</li> </ul> </li> <li>• PUR MineralClear Advanced Plus Horizontal Faucet Mount, ~\$30                             <ul style="list-style-type: none"> <li>○ Replacement filters, ~\$16</li> <li>○ Walmart, Home Depot, Canadian Tire</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <a href="http://www.hindawi.com/journals/jeph/2013/959480/">http://www.hindawi.com/journals/jeph/2013/959480/</a></li> <li>• <a href="http://www.health.gov.nl.ca/health/publichealth/envhealth/chlorineandthms2009.pdf">http://www.health.gov.nl.ca/health/publichealth/envhealth/chlorineandthms2009.pdf</a></li> <li>• <a href="http://hbg.psu.edu/etc/research/DBPPOU_Fact%20Sheet.pdf">http://hbg.psu.edu/etc/research/DBPPOU_Fact%20Sheet.pdf</a></li> <li>• <a href="http://www.pur.com">http://www.pur.com</a></li> </ul>

# Questions?

The research is supported by the Harris Centre-RBC  
Water Research and Outreach Fund

For more information please contact: Jen Daniels,  
j.daniels@mun.ca  
<http://nlwater.ruralresilience.ca>

# Moving Forward



**Colin Holloway**

**Office of Public Engagement**

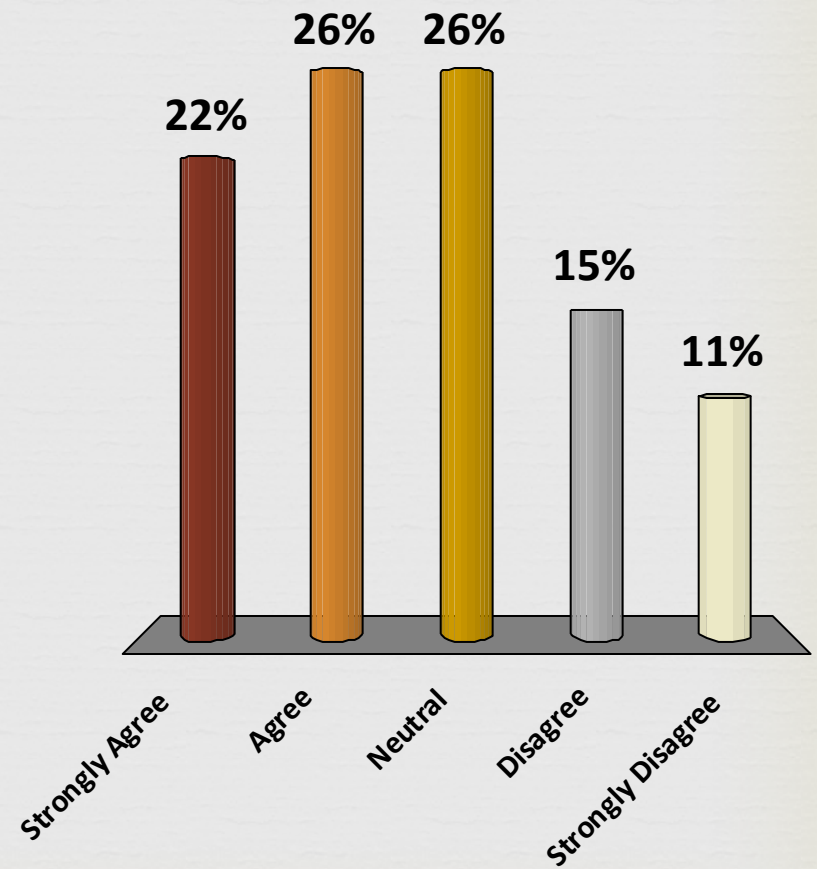
# Municipal Water Rates



- ❧ municipal water rates in Canada amongst the lowest in the world
- ❧ NL among highest water usage rates and lowest prices in the country
- ❧ average annual water tax \$200 per household, max. \$325 in NL (2009) vs. \$500 for all of Canada
- ❧ cost for treating water \$61 - \$1,688 per household, with smaller communities closer to \$1,688 range

“If filtered water costs \$550.00 per year in St. John’s, it is worth \$550.00 per year in Sunnyside”.

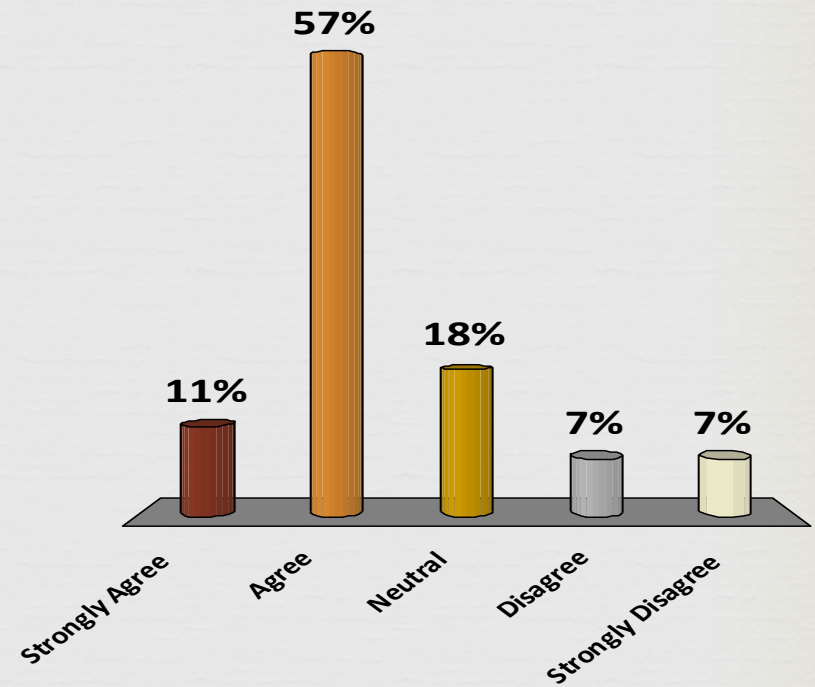
1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree





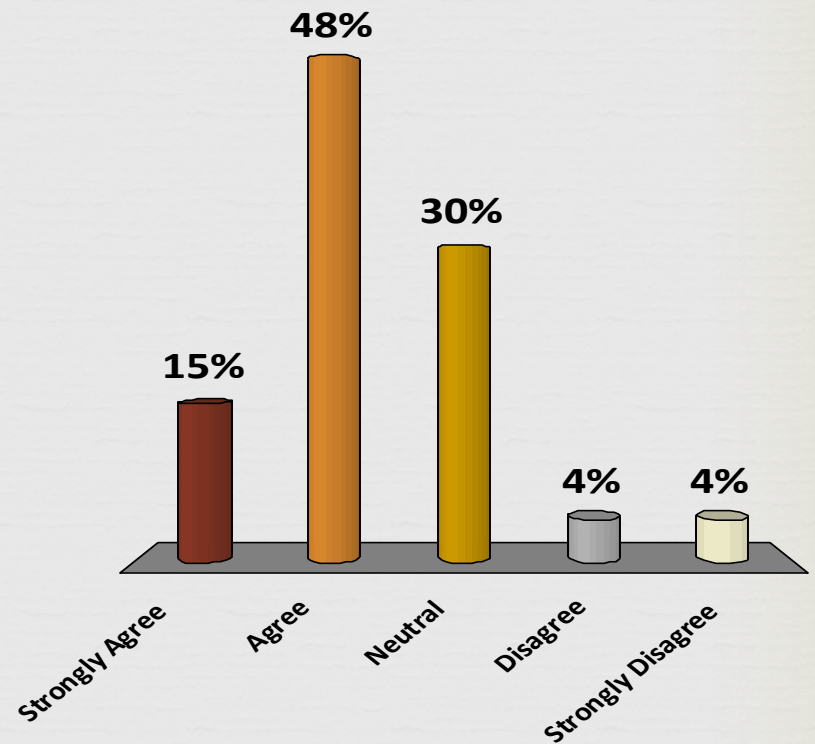
“Since coming to tonight’s Water Forum, my knowledge and understanding about water born bacteria and chlorination issues has changed .”

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree



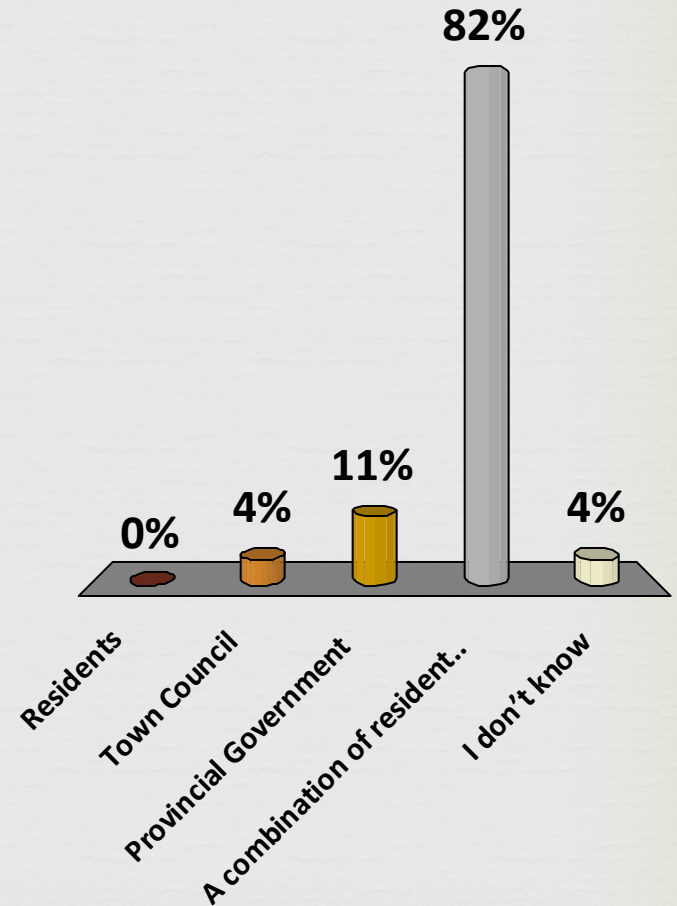
“Since coming to tonight’s Water Forum, my knowledge and understanding about DBPs has changed .”

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree



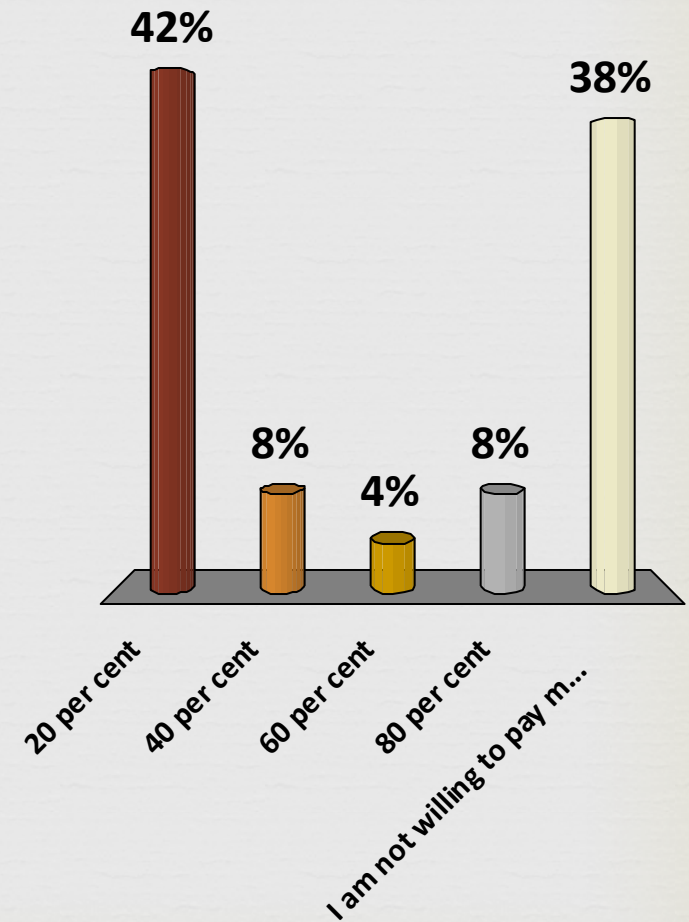
# Who has the responsibility to solve water system issues?

1. Residents
2. Town Council
3. Provincial Government
4. A combination of residents, Town Council and Provincial Government
5. I don't know



# How much more water taxes would you be willing to pay to have a new water treatment process?

1. 20 per cent
2. 40 per cent
3. 60 per cent
4. 80 per cent
5. I am not willing to pay more water taxes





# Discussion



**What additional information do you need  
in order to make an informed decision  
about the Town's Water Supply System?**

**(20 mins)**



# Closing Remarks



**Mayor Robert Snook**

# THANK YOU





# Drinking Water Forum



Lion's Community Centre

Sunnyside, NL

May 12, 2015